MINISTRY OF HEALTH
SINGAPORE

National Medication Safety Guidelines Manual

June 2013

MINISTRY OF HEALTH, SINGAPORE

NATIONAL MEDICATION SAFETY GUIDELINES MANUAL

INTRODUCTION AND BACKGROUND

Ensuring medication safety is a global challenge. While much has been done to improve the safety of medication usage in our healthcare system, safety risks due to medications continue to present concerns because of the rapidly aging population and increase in incidences of poly-pharmacy and drug-related interactions and complications. The advent of medication-related technologies to improve safety e.g. Computerized Physician Order Entry (CPOE) systems, "Smart" infusion pumps, automated drug picking and packing systems have also presented challenges due to technology induced errors.

In 2010, a national framework was adopted to reduce the incidence of preventable medication errors by ensuring a holistic and coordinated approach to improving medication safety. The framework aims to enhance safe medication practices and reduce medication errors by:

a) Reducing unnecessary variations in practice
b) Replicating successful medication safety initiatives across all healthcare institutions
c) Encouraging innovation and research in medication safety
d) Educating patients on safe medication process

Under this framework, the National Medication Safety Taskforce (NMST) comprising a multi-disciplinary team of physicians, nurses and pharmacists from restructured hospitals, experts in medical informatics from Ministry of Health Holdings (MOHH), Health Sciences Authority (HSA) and Health Promotion Board (HPB) was formed in June 2010 with the support of the Ministry of Health (MOH). The NMST was tasked to review current gaps in medication safety, advise/formulate a national medication safety strategy and advise on the implementation of the national strategy components and initiatives (refer Appendix 1 for the composition of the committee and workgroups).To assist and to support the NMST to accomplish these tasks, two workgroups were also formed – the Safe Medication Practices Workgroup and the Surveillance, Research and Patient Education Workgroup.

The Safe Medication Practices (SMP) Workgroup comprises representatives from restructured and private hospitals, community hospitals, MOHH, and Agency for Integrated Care (AIC). The role of the SMP workgroup is to advise on guidelines for standardized safe medication practices and to work with institutions to establish best practices and standards according to best available evidence. The SMP Workgroup was also asked to advise on integration of automated medication systems with electronic health and medical record systems.

The Surveillance, Research and Patient Education (SRPE) Workgroup members were drawn from restructured hospitals, HPB, NUS, PSS and HSA. The role of this workgroup is to advise on measurement strategies against medication error and harm, identify areas for research and system improvement, and to develop patient education materials.

NATIONAL MEDICATION SAFETY STRATEGY

1. Defining the gaps in Medication Management

The NMST initiated a review of the existing practices in medication management and medication safety practices amongst local public and private healthcare institutions. A listing of evidence-based best practices was also gathered from literature search and references from patient safety organizations such as Institute of Safe Medication Practices (ISMP) and International Medication Safety Network (IMSN).

Using the ISMP Survey, a formal gap analysis was performed in 17 public and private hospitals. This was conducted in 2010 through a voluntary survey using the ISMP self-assessment tool for hospitals. The results from this self-administered survey were anonymised and aggregated at the national level by ISMP and the data analyzed and report was returned to NMST. The respective institutions that took part in the survey were able to use their own responses to benchmark against both the Singapore average score and the US hospitals score (2004).

The top 5 gaps through the ISMP survey identified correlated well with a preliminary review done by the NMST and these were:

S/N	Gaps identified
1	Lack of standardization of medication devices
2	Incomplete patient information (lack of data on height and weight to tabulate correct dosage)
3	Unreliable drug information (especially on drug allergies)
4	Poor communication of drug information to patients and care givers
5	Lack of a concerted and coordinated patient education program

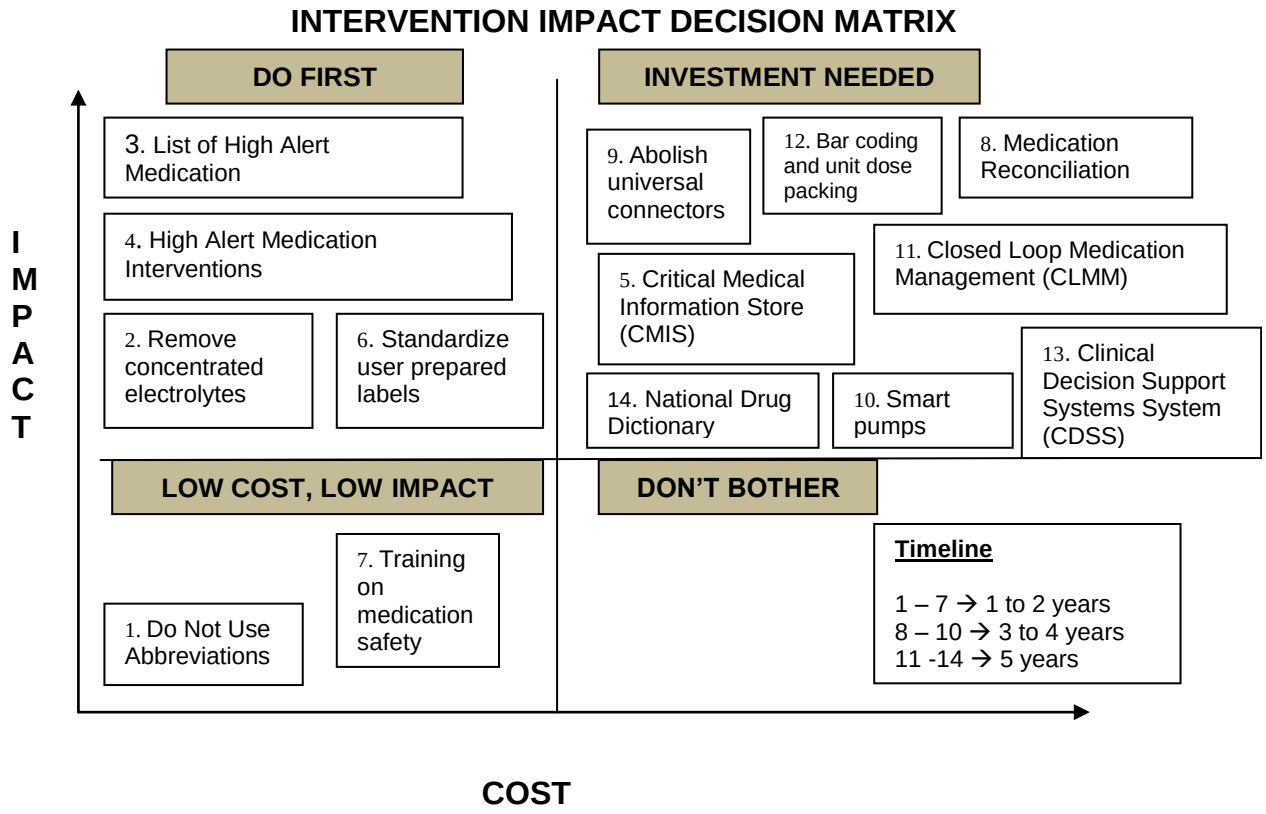
The NMST also noted from its review that there is currently inadequate information on baseline medication error rates in Singapore hospitals, as well as a lack of sharing of best practices (such as practices around High-Alert Medications) amongst hospitals. In addition, it was noted that there was a lack of standardization and coordination in the development and deployment of technologies and electronic support and documentation systems across the various restructured institutions and clusters.

2. Prioritization of Best Practices within the National Medication Safety Strategy

The medication safety strategy aims to ensure a coordinated and systems approach to enhance medication safety nationally. Four key focus areas were identified:

a) Standardization of medication related practices
b) Enhancing safety of medication delivery systems
c) Build awareness of medication safety in patients
d) Promote medication safety culture among healthcare providers

The SMP workgroup listed a total of 14 interventions as part of the National Medication Safety strategy to improve systems, processes and clinical practices on the ground to meet the objectives of improving medication safety. These were targeted mainly at standardization of practices and enhancing systems. These interventions involve both IT and non-IT related changes. A 2 x 2 matrix was developed to guide recommendation of a timeline for deployment, taking into consideration the expected impact on improving safety and the cost or resources required to implement, as well as dependencies between some of the proposed IT support systems.



3. Methodology for Development of the National Medication Safety Guidelines

The SMP decided to develop National Medication Safety Guidelines in the following areas to support the implementation of best practices:

a) Standardization of High- Alert Medication (HAM) list
b) Standardization of "Do Not Use" abbreviations
c) Standardization of concentrated electrolytes list
d) Guidelines on safe use of infusion pumps and devices

In the development of national medication safety guidelines in these 5 areas, inputs were sought by SMP from as many stakeholders as possible. These included those hospitals, institutions and bodies represented on the NMST and the 2 workgroups. The workgroup also reached out to professional bodies such as Singapore Medical Association (SMA), Singapore Nursing Board (SNB), Pharmaceutical Society of Singapore (PSS), Singapore Dental Association (SDA), and College of Family Physicians, Singapore (CFPS). This was to ensure that due consideration be given to any concerns, feedback or suggestions from all parties that would be involved in the processes of medication management.

In other instances, initiatives have already been adopted by several hospitals or institutions, but with variances in implementation practices. In these cases, the essential policies and practices were requested from the institutions, and the members of the SMP workgroup aggregated the information and attempted to create minimum medication safety practice guidelines that would be applicable to all institutions and organizations. These guidelines were then circulated back to institutions and other stakeholders for their feedback and further inputs before they were confirmed.

In the implementation of the guidelines, we recognize that medication safety risks and errors occur to different extents in the various healthcare sectors. To that end, the guidelines, where possible, have indicated where these practices should be implemented, or for which particular scope of medication safety practice.

NMST also held a series of medication safety forums during the development of the guidelines – two were held at the MOH Healthcare Quality Improvement Conferences in 2011 and 2012, and a Medication Safety Forum was convened in July 2012. At these forums, NMST shared guidelines with institutional quality officers, medication safety experts and ground staff. Feedback from these forums served to guide the workgroup in further refining the guidelines and recommendations.

4. Deployment of National Medication Safety Strategy

In recommending deployment of guidelines and best practices, the NMST and SMP will adopt a "pilot first" implementation strategy to ensure that any new changes proposed are practical and implementable on the ground. These will be done through various pilot projects undertaken by institutions or through Healthcare Quality Improvement and Innovation Fund (HQI2F) related projects.

NMST will foster sharing of outcomes and experiences from these pilots so that other institutions can leverage on the knowledge gained during the pilots. One such way is via the Medication Safety Forum, which we hope will be an annual event that brings together all stakeholders.

The SMP workgroup wish to express their appreciation to the individuals who have contributed to the development and testing of the interventions, to the institutions, organizations and individual healthcare professionals who have shared protocols and policies, and all those who have contributed feedback and suggestions during the development phase of these guidelines.

STANDARDIZATION OF HIGH-ALERT MEDICATIONS (HAM)

Background

All medications used incorrectly can have an adverse impact on patients, but a subset of drugs has inherently greater potential for significant patient harm.

High-Alert Medications are medicines that bear a heightened risk of causing significant patient harm when they are not used correctly. Errors with these medicines may not be more common than those from other groups but their consequences can be more devastating as they have smaller margins of safety than other medications and therefore warrant particular caution in their handling.

At the national level, it is important to define, review and standardize the High-Alert Medications list and safety guidelines so as to provide a useful reference to healthcare institutions in Singapore with suggested best practices in the safe practices in medication management.

Institutions are expected to develop their own action plans to systematically review, implement and evaluate their efforts to build a safer environment to manage these high risk medications. Institutions should also take into consideration their medication safety data to further build upon the High-Alert Medication reference list there by addressing the issues and practices relevant to them.

Methodology

The SMP Workgroup reviewed references for example the ISMP list of High-Alert Medications. The workgroup also actively sought feedback and suggestions from various healthcare institutions, practitioners and safety experts on the lists and safe practices. The institutions included primary care, acute hospitals, community hospitals, step-down care, professional bodies (e.g. SMA, SDA).

From the feedback received, drafts of standardized list and guidelines for High-Alert Medications, was compiled. To assure relevance and completeness, the SMP workgroup reviewed the list and guidelines for approval as national recommendations applicable to all healthcare institutions. The list and guidelines presented below reflect the collective consensus of all who provided valuable inputs and suggestions to improve safe medication practices.

Standardized High-Alert Medications Reference List

Classes/ Categories of Medications
All medications administered via intrathecal and epidural routes
Anaesthetic agents (e.g. Ketamine, Desflurane, Propofol, Sevoflurane)
Anticoagulants and Thrombolytics (e.g. Heparin, Warfarin)
Chemotherapeutic agents (Parenteral / Oral)
Concentrated Electrolytes (e.g. Potassium Chloride, Sodium Chloride)
Hypoglycaemic agents (Parenteral / Oral)
Inotropes (e.g. Digoxin, Milrinone)
Insulin
Neuromuscular agents (e.g. Pancuronium, Atracurium, Rocuronium, Suxamethonium)
Opiates
Radio-contrast agents
Sedatives (Parenteral / Oral)
Vasopressors (e.g. Adrenaline)

Recommended Guidelines for High- Alert Medications Management

High-alert medications can be targeted for specific error-reduction interventions. There are 3 primary principles that healthcare organizations can use to safe-guard against medication errors that might result from High-Alert Medications:

a) Eliminate or reduce the possibility of error

- Removing High-Alert Medications from clinical areas (a forcing function)
- Reducing the number of High-Alert Medications stocked by the hospital
- Limiting the available concentrations and volumes

b) Make errors visible

Have independent double-checking for infusion pump settings for High-Alert Medications to catch errors before they reach the patient.

c) Minimize the consequences of errors

- Change practices to reduce the adverse effects of errors that do occur
- Close monitoring to improve early detection of errors and institute prompt remedial action

References

1. ISMP's List of High Alert Medications (2012)
2. Information abstracted from the chapter on "High-Alert Medications: Safeguarding against Errors" by Michael Cohen and Charles Kilo, in: Medication Errors; edited by Michael Cohen. Published by the American Pharmacists Association, 2007, pgs. 317-396.
3. NHG High Alert Medications Collaborative (2009)

STANDARDIZATION OF CONCENTRATED ELECTROLYTES

Background

Concentrated electrolytes are high-risk medications and should not be stored in patient care areas. Removal of concentrated electrolyte solutions from patient care areas reduces the risk of sentinel events associated with these agents.

The Joint Commission International (JCI) has outlined its requirement under International Patient Safety Goal 3 that necessitates all accredited organizations to remove concentrated electrolytes from patient care areas, restricting access, standardizing drug concentrations, using specialized labeling or separate storage to prevent inadvertent administration. It is critical that the availability, access, prescribing, ordering, preparation, distribution, labeling, verification, administration and monitoring of these agents be planned in such a way that possible adverse events can be avoided and eliminated.

Standardizing the dosing, units of measure and terminology are cardinal for the safe use of concentrated electrolyte solutions. Moreover, mix-ups of specific concentrated electrolyte solutions must be avoided (e.g., confusing sodium chloride with potassium chloride). These efforts require special attention, appropriate expertise, inter-professional collaboration, process of verification and several forcing functions that would ensure safe use. Institutional and cultural changes are essential to ensure fail-safe systems are in place to avoid harm associated with the inappropriate use of concentrated electrolyte solutions.

Standardized Concentrated Electrolytes Reference list

Description	Concentration (Volume)
Calcium Chloride Injection	**10% (10mL)**
Calcium Gluconate Injection	**10% (10mL)**
Magnesium Sulphate 49.3% Injection	**2 mmol/ mL**
Potassium Chloride 7.45% Injection	**1 mmoL/ mL**
Potassium Dihydrogen Phosphate 13.6% Injection	**1 mmoL/mL**
Sodium Chloride Infusion	**Equal to or greater than 3% (500 mL)**
Sodium Bicarbonate Injection	**8.4% (250mL)**
Sodium Phosphate Injection	**1 mmol/ mL**

Guidelines for Concentrated Electrolytes Management

Removing concentrated electrolytes from floor/ward stock is not enough to prevent all potential errors. The Safe Medication Practices Workgroup recommends that the following additional strategies must be considered:

a) **Standardize intravenous electrolyte solutions.** Develop standard protocols for intravenous administration. Do not accept orders if the dose is not specified. Require use of programmable pumps to precisely control the dose and amount of electrolyte solutions administered to a patient. Programme alerts into computer systems to warn of excessive doses.

b) **Patient monitoring**. Monitor patient's electrolyte levels before, during, and after replacement therapy. Other monitoring modalities may be required, e.g., ECG monitoring.

c) **Use premixed solutions.** Standardize electrolyte replacement therapy. Use premixed or commercially outsourced admixtures whenever possible. Do not compound electrolyte solutions that are available commercially.

d) **Restrict access of concentrated electrolytes.** A discrete stock of carefully selected, after-hours medications, including premixed potassium chloride solutions, should be available in a secured area, preferably a controlled-access cabinet.

e) **Segregate and label.** In the pharmacy, store concentrated electrolytes separately from other drugs. On all storage shelves and bins, affix warning labels about the need to dilute these products before administration.

f) **Prohibit the dispensing of vials.** Strict controls must be placed on dispensing concentrated electrolytes to individual patients. Pharmacy should dispense premixed solutions or prepare patient-specific-admixtures as needed. Vials should not be provided as floor/ward stock. However, if vials are dispensed to critical care areas, they should carry bold auxiliary warnings and be placed in proper, secured storage area.

g) **Conduct safety rounds.** Conduct regular walkabouts at patient care units and in pharmacy to ensure safe storage of medications.

h) **Perform Failure Mode and Effects Analysis (FMEA).** Be sure to evaluate the look-alike potential of products. When possible, purchase concentrated electrolytes from different vendors to avoid packaging similarities.

The recommendations and safety guidelines laid out by the SMP workgroup are an essential framework to ensure patient safety. Implementation by organizations is strongly recommended. Further, we encourage a philosophy of "self-auditing" to reduce the risks of inadvertent use of concentrated electrolytes.

References

1. ISMP's list of Concentrated Electrolytes (2012)
2. Information abstracted from the chapter on "High-Alert Medications: Safe-guarding against errors" by Michael Cohen and Charles Kilo, in Medication Errors; edited by Michael Cohen. Published by the American Pharmacists Association, 2007, pgs.397-410.
3. NHG Medication Safety Collaborative (2003)

STANDARDIZATION OF "DO NOT USE" ABBREVIATIONS

Background

The use of non-standard abbreviations remains a significant potential source of errors and adverse patient outcomes. Lapses in communication, whether written, verbal and computer generated are usually due to using non-standard abbreviations when conveying medication orders. Staff responsible for processing and executing the medication orders may misinterpret the abbreviations, resulting in the alteration of the intended medication order. The consequences of misinterpreting abbreviations, dosages and symbols can be fatal. This has heightened the need for a national list of "Do Not Use "abbreviations to minimize the risk of medication errors.

Standardized list of "Do Not Use" Abbreviations/Symbols

Do not use	Reason	Use
u or U	It may be mistaken as zero	unit
iu or IU	It may be mistaken as IV or 10	unit
µg or UG	It may be mistaken for mg (1000x more)	mcg; micrograms
Qd,QOD,qod	It may be mistaken for 4 times daily	daily, every other day
qH, qHS	It may be interpreted as QDS	at night or ON
DC , D/C	Misinterpreted as "discontinued" when followed by a list of medications	discontinue
.5mg	It may be mistaken for "5mg" (10x more)	0.5mg with a leading zero
10.0mg	It may be mistaken for "100mg" (10x more)	10mg without trailing zero
cc	It may be mistaken for "u" (units)	mL or ml
> or <	Easily mistaken as opposite of intended: "<10" can be mistaken as "40"	greater than or lesser than
@	Can be confused for "2"	at
ID	May be mistaken for "10"	intradermal
IN	May be mistaken for "IM" or "IV"	intranasal
IA	May be mistaken for "14"	intra-arterial
Per os	The "os" may be mistaken as OS (left eye)	"PO" or by mouth or orally
SC, SQ, sub q	Mistaken as SL (sublingual) or "5 every"	subcutaneous

AD,AS or AU (R/L/both ears)	**May be mistaken for OD, OS or OU (eyes)**	**"right ear", "left ear" or "both ears"**
OD,OS or OU (R/L/both eyes)	**May be mistaken for AD, AS or AU (ears)**	**"right eye", "left eye" or both eyes**
SL	**Mistaken as SC (sub-cutaneous)**	**sublingual**
MS, MSO4, MgSO4	**Confusion between morphine sulphate and magnesium sulphate**	**Magnesium sulphate, Morphine Sulphate**

Recommended Guidelines for Implementation

1. Align All Stakeholders (physicians, nurses and pharmacists) to champion the cause in eliminating "Do Not Use" abbreviations.

Physician's (Prescriber) Role

- Be familiar with the list
- Change order prescribing to eliminate the use of non- approved abbreviations
- Participate in re-writing any order that contains "Do Not Use" abbreviations
- Encourage fellow prescribers not to use these abbreviations

Nurse's Role

- Be familiar with the list
- Check all medication orders for non-approved abbreviations before sending to pharmacy and inform prescriber of discrepancies

Pharmacist's Role

- Be familiar with the list
- Check all medication orders for non-approved abbreviations
- If a "Do Not Use" abbreviation is found, contact the prescriber for a rewrite
- Depending on the medication, hold the order for the rewrite

2. Provide on-going Education

- Recommended list to be discussed at all relevant clinical meetings (for example: medical, nursing, pharmacy, medical records)
- All clinical staff to be issued with the recommended list (compiled in a handy and hardy material)

- Introduction of recommended list for clinical staff during the orientation
- Recommended list to be visually accessible in the form of posters and computer screensaver

3. Hospital IT Systems

- Standardized medication order sets to be designed with only the approved abbreviations in place

References

1. ISMP's list of "Do Not Use" abbreviations (2012)
2. Information abstracted from the chapter on "High-Alert Medications: Safe-guarding against errors" by Michael Cohen and Charles Kilo, in Medication Errors; edited by Michael Cohen. Published by the American Pharmacist's Association, 2007, pgs.175-202
3. NHG Medication Safety Collaborative (2003)

GUIDELINES FOR INFUSION PUMPS AND DEVICES

Introduction

General purpose infusion pumps are used to deliver drugs and fluids through the intravenous, subcutaneous, epidural and other routes. These pumps are however NOT to be used for naso-gastric feeds. They are used in hospitals and alternative care settings such as clinics, nursing homes and patient's homes. Infusion pumps can be divided into volumetric and syringe pumps.

Although there is no local data on the rate of errors from the use of infusion pumps, the Medicines and Healthcare Products Regulatory Agency in UK investigated over 1000 incidents involving infusion pumps over a period of 5 years from 2005 to 2010.

This serves as a guideline that general purpose infusion pumps should be adhered to so as to reduce medication errors and improve patient safety. For institutions that are still using "legacy" infusion pumps that do not fulfill all parts of this guideline, it is recommended that the institution perform a risk assessment of their existing pumps and employ alternative controls, like education, training and regular maintenance, to mitigate risk(s).

To avoid user error and confusion in programming these infusion devices, each facility should work towards having no more than 2 different of each type of infusion pumps.

Functions

a) The general infusion pump should be able to provide a wide range of flow rates, from 0.1 ml/hr up to 1200 mls/hr and maintain an accurate flow rate to within 5% of flow settings
b) The general infusion pump should be able to infuse a wide range of volumes, from 0.1 ml up to 999 mls
c) The user should be able to do the following:
   - Enter volume
   - Enter rate of administration (mls/hr) or time to be delivered (hrs or mins)

Technical Standards

The infusion pump should conform to the following standards:

a) AAMI ID26-P – Association for the Advancement of Medical Instrumentation Standard for Infusion devices
b) IEC 60601-2-24 – Particular Requirements for the Safety of Infusion Pumps and Controller
c) IEC 60601-1 – General Safety Requirements for medical electrical equipment

d) IEC 60601-1-2 – Collateral Standards for Electromagnetic Compatibility – Requirements and Tests
e) IEC 60601-1-8 – General Requirements for Safety, Collateral Standards for Alarm Systems

Electrical Requirements

a) The pump should be able to operate on AC power supply and its own internal battery
b) Switch over to battery operation should be automatic when AC power fails
c) The battery indicator light should clearly indicate that the device is running on battery power
d) The pump should give an indication of battery life
e) The internal battery should have regular preventive maintenance checks and replaced if defective

Safety

a) Switches and controls should be protected against penetration of fluids
b) Switches and controls should be protected against accidental setting changes
c) Switches and controls should be visible and clearly identified

Alarms

a) The pump should have alarms that are audible and cannot be permanently disabled
b) Audible alarm signals should be in the range of 20 dB to 100 dB
c) Alarms should occur when:
    - air is present in the infusion line
    - the infusion line is occluded
    - the infusion is ending
    - the administration set has not loaded properly
    - the syringe is dislodged or disengaged from the device
    - the battery is flat

Display

a) Screens should be large enough such that important information is clearly visible from an arm's length
b) The display should be able to show:
    - flow rate
    - device status (infusing / stopped / standby)
    - time remaining / volume to be infused
    - volume infused / total volume infused

- mode of delivery
- power supply (mains / battery / battery life)

Volumetric Pump Administration Sets

a) Administration sets should be transparent or sufficiently translucent so that the presence of air bubbles can be easily observed
b) Incorrect loading of administration sets should be impossible or the pump should not function if mis-loading occurs
c) The pump should have a free-flow protection feature

Syringe Administration Sets

a) The syringe loading process should be simple
b) The pump should not function when loaded incorrectly
c) The syringe and plunger should not be able to disengage easily
d) The pump should be able to auto-sense the size of syringe being used or should require confirmation from the user

Training and Maintenance

a) All users should be properly trained and have completed a competency checklist and undergone a yearly competence test
b) Pumps should undergo at least yearly preventive maintenance. However, shorter intervals may be necessary based on the manufacturer's recommendations
c) The pump should be protected to a sufficient degree against safety hazards caused by overflow, spillage, leakage, humidity, ingress of liquids, cleaning, sterilization and disinfection

Special Requirements

Pumps for pediatric use should have adjustable occlusion pressure limits.

References

1. IEC 601-1
   http://www.601help.com/Other_601_Standards/other_601_standards.html
2. AAMI ID26 -
   http://marketplace.aami.org/eseries/scriptcontent/docs/Preview%20Files/ID260412preview.pdf
3. Generic Infusion Pump Hazard Analysis and Safety Requirements Version 1.0 University of Pennsylvania, 2009
4. Design for Patient Safety - A guide to the design of electronic infusion devices National Patient Safety Agency NHS, 201
5. Device Bulletin – Infusion Systems The Medicines and Healthcare products Regulatory Agency (MHRA) November 2010
6. Total Product Life Cycle: Infusion Pump- Pre-market Notification [510(k)] Submissions FDA

ACKNOWLEDGEMENTS

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APPENDIX 1

NATIONAL MEDICATION SAFETY TASKFORCE, WORKGROUPS AND SUBGROUPS

National Medication Safety Taskforce

S/N	MEMBERS	DESIGNATION	INSTITUTION
1	Mr Wu Tuck Seng (Chairperson)	Deputy Director, Pharmacy	NUHS
2	Dr Joseph Manuel Gomez (Co-chairperson)	Head & Senior Consultant, Neonatal Intensive Care Unit	KKH
3	Adj A/Prof Tai Hwei Yee	Deputy Chief Quality Officer	NHG
4	Mr Hing Wee Chuan	Principal Pharmacist	NUHS
5	Mr Wong Kok Cheong	Deputy Director, Nursing	CGH
6	Ms Jalene Poh	Acting Director 1, Therapeutic Products Branch, Pre-Marketing Division	HSA
7	Ms M K Fatimah	Director, Operations	KTPH
8	Dr Ng Heng Joo (from Sep 2012)	Senior Consultant, Hematology	SGH
9	A/Prof Lita Chew	Chief Pharmacist	MOH
10	Dr Voo Yau Onn	Director, Standards & Quality Improvement Division	MOH
11	Adj A/Prof Serena Koh	Deputy Director, Standards & Quality Improvement Division/ Hospital Services Division	MOH
12	Dr Ng Yeuk Fan	Associate Consultant, Standards & Quality Improvement Division	MOH
13	Dr Aley Moolayil (Jun 2010 – May 2013)	Principal Manager, Patient Safety, Standards & Quality Improvement Division	MOH
14	Ms Poh Ming Ting (Nov 2011- Jul 2012)	Manager, Healthcare Standards Branch, Standards & Quality Improvement Division	MOH
15	Ms Winnie Tan (from Nov 2012)	Assistant Manager, Patient Safety, Standards & Quality Improvement Division	MOH

Safe Medication Practices Workgroup

S/N	MEMBERS	DESIGNATION	INSTITUTION
1	Adj A/Prof Tai Hwei Yee (Chairperson)	Deputy Chief Quality Officer	NHG
2	Mr Wong Kok Cheong (Co-chairperson)	Deputy Director, Nursing	CGH
3	Ms Fatimah M K	Director, Operations	KTPH
4	Dr Patrick Chia	Director, Clinical Transformation Services	MOHH
5	Ms Alison Sim	Director, Nursing	St Andrew's Community Hospital
6	Ms Kimmy Liew	Head, Pharmacy	JGH
7	Ms Clarybell Fernandez (Nov 2011-May 2012)	Assistant Director, Nursing	CGH
8	Ms Ng Toon Mae (Nov 2011- Jul 2012)	Assistant Director, Quality Management, Community Care Development Division	AIC
9	Ms Leong Chin Jong (from Nov 2012)	Assistant Director, Quality Management, Community Care Development Division	AIC
10	Mrs Ruth Quek (Nov 2011- May 2012)	Vice-President, Clinical Safety & Risk Management	Parkway Hospital
11	Ms Karen Lim Chu Ai (from Jul 2012)	Senior Executive, Clinical Safety & Risk Management	Parkway Hospital
12	Dr Benjamin Li (from Nov 2012)	Program Director, Information Services Division	MOHH
13	Ms Poh Ming Ting (Nov 2011- Jul 2012)	Manager, Healthcare Standards Branch, Standards & Quality Improvement Division	MOH
14	Ms Priya Sugandhi (from Jul 2012)	Project Executive, NMST, Pharmacy	NUHS

Surveillance, Research and Patient Education Workgroup

S/N	MEMBERS	DESIGNATION	INSTITUTION
1	Mr Hing Wee Chuan (Chairperson)	Principal Pharmacist	NUHS
2	Ms Jalene Poh (Co-chairperson)	Acting Director 1, Therapeutic Products Branch, Pre-Marketing Division	HSA
3	Mr Gary Khoo	Deputy Director, Patient Education	HPB
4	Ms Choo Ren Min	Senior Executive, Patient Education/ Healthy Ageing Division	HPB
5	Ms Chan Soo Chung	Executive Director, NHG Pharmacy	NHG
6	Ms Soh Lay Beng	Head, Pharmacy	IMH
7	Ms Angeline Liew	Senior Pharmacist, Pharmacy	CGH
8	Dr Wong Li Lian	Assistant Professor, Department of Pharmacy	NUS
9	Ms Tan Mui Ling	Senior Lecturer, Department of Pharmacy	NUS
10	Prof Ho Lai Yun (Nov 2011- Jul 2012)	Emeritus Consultant, Department of Neonatal and Developmental Medicine	SGH
11	Dr Ng Heng Joo (from Jan 2013)	Senior Consultant, Hematology	SGH
12	Ms Yasmin Ng (Nov 2011- Jul 2012)	Senior Pharmacist	CGH
13	Ms Karen Parera (Nov 2011- Jul 2012)	Assistant Director, Nursing	SGH
14	Ms Christine Teng (from Jan 2013)	President	PSS
15	Ms Poh Ming Ting (Nov 2011- Jul 2012)	Manager, Healthcare Standards Branch, Standards & Quality Improvement Division	MOH
16	Ms Priya Sugandhi (from Jul 2012)	Project Executive, NMST, Pharmacy	NUHS

Pumps and Devices Subgroup

S/N	Members	Designation	Institution
1	Dr Nelson Chua (Chairperson)	Senior Consultant, Anesthesiology, Intensive Care and Pain Medicine	TTSH
2	Dr Mok Yee Hui	Consultant, Children's Intensive Care Unit, Department of Pediatric Subspecialties	KKH
3	Dr Soh Lay Tin	Senior Consultant, Medical Oncology	NCC
4	Dr Stephen Chan Yung Wei	Consultant, Anesthesiology, Intensive Care and Pain Medicine	TTSH
5	Mr Png Thiam Peng	Manager, Biomedical Engineering	TTSH
6	Ms Chan Hong Eng	Nurse Clinician	CGH
7	Ms Hooi Pik Yee	Principal Pharmacist	NUHS
8	Ms Hsu Pei Chu	Nurse Clinician	KTPH
9	Ms Vivienne Lim	Senior Clinical Nurse Educator	Gleneagles Hospital
10	Ms Priscilla Chua Chai Ping	Clinical Architect, Information Systems Division/ Standards	MOHH
11	Ms Joepin Legaspi	Senior Executive, HPO, Medical Affairs	TTSH

Drug Image Database and Bar Coding Subgroup

S/N	Members	Designation	Institution
1	Mr Wu Tuck Seng (Chairperson)	Deputy Director, Pharmacy	NUH
2	Ms Jalene Poh (Co-chairperson)	Acting Director 1, Therapeutic Products Branch, Pre-Marketing Division	HSA
3	Ms Angeline Liew	Senior Pharmacist, Pharmacy	CGH
4	Ms Tee Joa Ling	Senior Pharmacist, Pharmacy	JHS
5	Ms Sharon Soo	Senior Pharmacist, Pharmacy	KTPH
6	Ms Afidah Binte A Manaf	Principal Pharmacist, Pharmacy	NCCS
7	Ms Lim Sook Wei	Principal Pharmacist, Pharmacy	NUH
8	Mr Mohammed Nazri Bin Abdul Ghani	Senior Pharmacist, Pharmacy	KKH
9	Ms Soh Lay Beng	Head, Department of Pharmacy	IMH
10	Ms Mary Chong	Principal Pharmacist, Pharmacy	TTSH
11	Ms Ainol Mardziah	Procurement Manager	NHG Pharmacy
12	Mdm Low Mui Lang	Executive Director	Peacehaven Nursing Home
13	Ms Kam Huey Min	Senior Principal Pharmacist, Pharmacy	SGH
14	Ms Ng Yong Wei	Senior Pharmacist, Retail Pharmacy	NTUC Unity Healthcare Cooperative Ltd
15	Ms Adeline Tay Hsu Peng	Clinic Pharmacy Manager, Pharmacy Administration	SingHealth Polyclinics

16	Ms Jenny Oo	Manager, Department of Pharmacy	St Luke's Hospital
17	Dr Benjamin Li	Program Director, Information Services Division	MOHH
18	Ms Priscilla Chua Chai Ping	Clinical Architect, Information Systems Division/ Standards	MOHH
19	Ms Tan Wei Chuen	Senior Regulatory Specialist, Vigilance Branch	HSA

Allergy Review Sub-group

S/N	Members	Designation	Institution
1	Dr Benjamin Li (Chairperson)	Program Director (Healthcare Informatics), Information Systems Division /Clinical Transformation Services	MOHH
2	Dr Bernard Thong	Head and Senior Consultant, Department of Rheumatology, Allergy & Immunology	TTSH
3	A/Prof.Paul Lorenz Bigliardi	Senior Consultant, Department of Rheumatology for Adult Allergy	NUH
4	Dr Lim Yen Loo	Consultant, Dermatology	NSC
5	Dr Lee Haur Yueh	Consultant, Dermatology	SGH
6	Ms Shyamala Narayanaswamy	Pharmacy Practice Manager, Pharmacy	SGH
7	Ms Lim Wan Peng	Principal Pharmacist (Clinical), Pharmacy	TTSH
8	Ms Tan Siew Har	Senior Regulatory Specialist, Adverse Event Monitoring Unit, Vigilance Branch	HSA
9	Ms Karen Lim Chu Ai (Nov 2012 - May 2013)	Senior Executive, Clinical Safety & Risk Management	Parkway Hospitals
10	Ms Priscilla Chua Chai Ping	Clinical Architect, Information Systems Division/ Standards	MOHH
11	Dr Tammy Chan	Family Physician, Chairman of Medik Awas, Community Services and Education, Singapore Medical Association	TC Family Clinic Pte Ltd
12	Dr Rajeshwar Rao	Senior Consultant, Paediatrics, Allergy Service	KKH

Medication Review Sub-group

S/N	Members	Designation	Institution
1	Dr Benjamin Li (Chairperson)	Program Director (Healthcare Informatics), Information Systems Division /Clinical Transformation Services	MOHH
2	Dr Theresa Yap	Family Physician	Yang & Yap Clinic & Surgery
3	Dr Roland Boey	Senior Consultant, Department of General Medicine, Chairman of Medication Safety	TTSH
4	Ms Serene Seow	Director, Sales, Operations, Pharmacy Practice	Guardian Health & Beauty
5	Ms Wendy Ang	Senior Project Administrator, Chief Pharmacist Office	CGH
6	Mr Yap Soon Ghee	Assistant Director Nursing (Informatics)	Singapore Health Services
7	Ms Yee Mei Ling	Senior Principal Clinical Pharmacist, Pharmacy	SGH
8	Ms Lim Mui Eng	Principal Pharmacist, NHG Pharmacy	Clementi Polyclinic
9	Ms Jasmine Kang	Advanced Practice Nurse (Geriatrics), Nursing Service	TTSH
10	Ms Jeena Thomas (Nov 2012 –Dec 2012)	Senior Staff Nurse, Nursing	Peacehaven Nursing Home
11	Ms Faezah Binte Shaikh Kadir	Senior Manager, Care Integration Division	AIC
12	Mdm Low Mui Lang (From Dec 2012)	Executive Director	Peacehaven Nursing Home
13	Ms Priscilla Chua Chai Ping	Clinical Architect, Information Systems Division/ Standards	MOHH