

National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines

Evaluation of standardised medicine line labels for medicines in dedicated continuous infusions



29 January 2013

© Commonwealth of Australia 2013

This work is copyright. It may be reproduced in whole or in part for study or training purposes subject to the inclusion of an acknowledgement of the source. Requests and inquiries concerning reproduction and rights for purposes other than those indicated above requires the written permission of the Australian Commission on Safety and Quality in Health Care, GPO Box 5480 Sydney NSW 2001 or mail@safetyandquality.gov.au

Suggested citation

Australian Commission on Safety and Quality in Health Care 2013, *National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines: Evaluation of standardised medicine line labels for medicines in dedicated continuous infusions*, ACSQHC, Sydney.

Acknowledgment

Many individuals and organisations have freely given their time and expertise to support the development of this document. The Commission acknowledges The Geelong Hospital, Barwon Health, Victoria for coordinating the evaluation of pre-printed standardised medicine line labels in intensive care with particular thanks to Ms Claire Passlow, Medication Safety Pharmacist, for collating results and preparing the final report. The Commission acknowledge and appreciate the willing participation and contribution by all staff in the pharmacy and intensive care units of The Geelong Hospital, Royal Prince Alfred Hospital, Camperdown, Southern Health (Monash Medical Centre, Clayton) and The Tweed Hospital. This paper is available on the Commission web site at www.safetyandquality.gov.au.

National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines

Evaluation of standardised medicine line labels for medicines in dedicated continuous infusions

Table of contents

	Section	Page
1	Introduction	4
2	Aims and objectives	5
3	Methodology	7
4	Results	10
	4.1 Initial survey results	10
	4.2 Barwon Health post-trial survey results	22
5	Discussion	27
	5.1 Tape dimensions, text and adhesive properties	27
	5.2 Use of colour	27
	5.3 Warning labels	29
	5.4 Label selection	29
	5.5 Label placement	29
6	Recommendations	31
	6.1 Post evaluation feedback	31
7	References	33
8	Appendices	34
	8.1: 'Proposed standard' for pre-printed PVC medicine line labels	34
	8.2.1: Evaluation survey	37
	8.2.2: Barwon Health post-trial evaluation survey	41

1. Introduction

The Australian Commission on Safety and Quality in Health Care (the Commission) is responsible for maintaining the *National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines* (the *Labelling Recommendations*) described at www.safetyandquality.gov.au/our-work/medication-safety/user-applied-labelling/ (1). The Commission also identifies and reduces national barriers to implementation.

Implementation is an evolving process and *Labelling Recommendations* issues referred to the Commission's advisory groups are recorded in the *Labelling Recommendations Issues Register* on the Commission web site at www.safetyandquality.gov.au/our-work/medication-safety/user-applied-labelling/issues-register/ (2).

Issues Register Issue 1 from the *Labelling Recommendations Issues Register* provides advice on the suitability of pre-printed medicine line labels to identify medicines and fluids in dedicated continuous infusion lines.

The *Labelling Recommendations* require dedicated continuous infusion lines to be labelled to identify route and medicine (active ingredient). Many intensive care settings already use pre-printed medicine line labels developed locally. There is no established standard for pre-printed medicine line labels.

The *Labelling Recommendations* suggest extending the standardisation to improve practice, for example by considering pre-printing line labels to identify the medicines (active ingredient) for commonly used medicines.

The Labelling Recommendations Reference Group (LRRG) advises the Commission on maintenance and implementation of the *Labelling Recommendations*. They also consider issues recorded in the *Labelling Recommendations Issues Register*. For medicine identification in dedicated continuous infusion lines, the LRRG support the evaluation of an extension to the standardisation using nomenclature and colour coding described in the 'anaesthetic labelling standard' (*International Standard ISO 26825:2008 Anaesthetic and respiratory equipment- User-applied labels for syringes containing drugs used during anaesthesia – colours design and performance*) (3). The LRRG agreed that this was appropriate as colour coding according to drug class in the 'anaesthetic labelling standard' is widely accepted and they recognised that appropriate standardisation can improve patient safety especially for staff moving between health disciplines and services.

This study developed and evaluated standardised pre-printed medicine line labels based on colours and formatting in the 'anaesthetic labelling standard'. Labels were implemented in the intensive care unit (ICU) at four sites and were evaluated through a survey by ICU clinical staff.

The 'anaesthetic labelling standard'

Colour coding according to drug class is adopted by Australian/New Zealand Standard (AS/NZS) 4375: 1996 *User-applied labels on syringes containing drugs used during anaesthesia* (4). The International Standard ISO 26825:2008 *Anaesthetic and respiratory equipment - User-applied labels for syringes containing drugs used during anaesthesia – colours design and performance* (3), draws heavily on, and now supersedes, AS/NZS 4375:1996 (4). In addition to provision of colour, ISO 26825:2008 specifies differentiation of heparin and protamine with a solid black border for heparin and a black and white hatched border for protamine.

ISO26825:2008 is described as the 'anaesthetic labelling standard' throughout this document.

2. Aims and objectives

The *National Recommendations for User-applied Labelling of Medicines, Fluids and Lines (Labelling Recommendations)* require identification of the route and medicine for dedicated continuous infusion lines. The *Labelling Recommendations* provide a generic label to identify the medicine in a dedicated continuous infusion line and the label can be populated with the medicine name at the point of use. However, pre-printed labels may be more convenient in high-use areas, such as the intensive care unit (ICU). Indeed, many intensive care settings already use pre-printed medicine line labels developed for local requirements. Line medicine labels may be printed 'black on white'. However, the ICU has historically used colour, to assist differentiation of line content. This supports the medicine name which is the primary identifier. There is no established standard for colour coding to assist identification of the medicine in a dedicated continuous infusion line.

In this trial, a set of labels with the following characteristics were evaluated:

- Labels had full drug names; no abbreviations; no brand names; no medicine class names
- Font was plain sans serif font
- Text size was large as possible within a 6 to 7cm length of tape
- Either lower case letters with an initial upper case letter OR national Tall Man lettering were used to improve differentiation of look-alike/sound-alike drugs. Labels already in stock were used for the trial and therefore did not necessarily conform to this principle
- Colour complied with the 'anaesthetic labelling standard'
- Borders for heparin and protamine complied with the 'anaesthetic labelling standard'
- Medicines in the miscellaneous category of ISO26825:2008 (e.g. frusemide and 0.9% sodium chloride) were printed black on white
- High risk medicines in the miscellaneous category were printed red text on a white background
- Route labels were used according to the *Labelling Recommendations*

Label properties including size, text size and adhesive qualities were based on previously used labels. Therefore, pilot labels were produced

- In continuous strips (12mm wide) and the font size was 8mm tall, allowing 2mm border either side for printing diversion. The image width varied according to the length of the medicine name, but did not exceed 70mm. The gap between the images was 10-15mm printed on continuous tape
- Using C17 unplasticised PVC tape, with tensile strength >14.3 kg / 25mm
- With a peel adhesive 600 gr/25mm (+/- 10%)

The trial of a standard set of pre-printed medicine line labels developed in accordance with the above will be conducted in four centres.

1: The Geelong Hospital, Barwon Health, Victoria is a 450 bed general medical and surgical teaching hospital. The Intensive Care Unit (ICU) has 13 funded beds with a nursing EFT of 81. It is a level three CICM unit which covers the Geelong region with a catchment area extending to the western districts.

2: Southern Health, Monash Medical Centre, Clayton, Victoria is a 640 bed teaching and research hospital. The ICU has 22 beds, including 5 dedicated paediatric beds. The ICU offers all specialties except trauma patients.

3: The Tweed Hospital, Tweed Heads, NSW is a 220 bed public hospital with a 7 bed ICU/HDU. Intensive care is a level 2 CICM generalist unit and patients include both medical, surgical and trauma.

4: Royal Prince Alfred Hospital, Camperdown, NSW is a level 3 CICM metropolitan tertiary referral hospital in Sydney. It has a 48 funded ICU/HDU beds that include general, neuroscience and cardiothoracic beds across four ICUs in the Intensive Care Service.

Table 1: Trial centres and site coordinator contact details

Trial Centre	Site co-ordinator contact details
Barwon Health – The Geelong Hospital, Geelong. (principal investigator)	Claire Passlow, Medication Safety Pharmacist T: 03 5226 7918, email: clairepa@barwonhealth.org.au
Southern Health - Monash Medical Centre, Clayton	Wendy Ewing, Quality Use of Medicines Pharmacist T: 03 9594 3668, email: wendy.ewing@southernhealth.org.au
The Tweed Hospital	Kerrie Martin, Clinical Nurse Educator, Intensive Care Unit T: 07 5506 7429, email: kerrie.martin@ncahs.health.nsw.gov.au
Royal Prince Alfred Hospital, Camperdown	Marghie Murgo, Clinical Nurse Consultant, Intensive Care Service T: 02 9515 7669, email: marghie.murgo@sswahs.nsw.gov.au

3. Methodology

In October 2011, information was sought from various Victorian health services regarding existing practices for labelling continuous infusion lines. There was a wide range of tapes of different colours and wording in use. Many hospitals used brand names or abbreviated drug names, some only indicated drug class, rather than a specific drug name. Figure 1 demonstrates the range of pre-printed medicine line labels across 6 health facilities.

Figure 1: PVC Medicine line labels in use across different health services, Oct 2011.

Austin	Barwon Health	Cabrini Health	Eastern Health	Southern Health	Alfred
G.T.N.	G.T.N.	G.T.N.	G.T.N.	G.T.N.	G.T.N.
G.T.N.					
DOBUTAMINE	DOBUTAMINE	DOBUTAMINE	DOBUTAMINE	DOBUTAMINE	DOBUTAMINE
ADRENALINE	ADRENALINE	ADRENALINE	ADRENALINE	ADRENALINE	ADRENALINE
MILRINONE	MILRINONE	MILRINONE	Not sighted	MILRINONE	MILRINONE
Not sighted	VASOPRESSIN	Not sighted	VASOPRESSIN	Not sighted	Not sighted
S.N.P.	NIPRIDE	NIPRIDE	Not sighted	NIPRIDE	NIPRIDE
AMIODARONE	AMIODARONE	AMIODARONE	Not sighted	AMIODARONE	AMIODARONE
DOPAMINE	DOPAMINE	DOPAMINE	Not sighted	DOPAMINE	DOPAMINE
Not sighted	ARAMINE	Not sighted	Not sighted	Not sighted	Not sighted
Not sighted	ISUPREL	Not sighted	Not sighted	ISUPREL	ISUPRENALINE
Not sighted	LIGNOCAINE	LIGNOCAINE	LIGNOCAINE	Not sighted	LIGNOCAINE
NORADRENALINE	NORADRENALINE	LIGNOCAINE	NORADRENALINE	NORADRENALINE	NORADRENALINE
MORPHINE	MORPHINE	MORPHINE	MORPHINE	MORPHINE	MORPHINE
MORPHINE 1mg/ml					
FENTANYL	FENTANYL	FENTANYL	Not sighted	Not sighted	Not sighted
INSULIN	INSULIN	INSULIN	INSULIN	INSULIN	INSULIN + UNITS/HR +10000HR
		INSULIN			
PROPOFOL	PROPOFOL	PROPOFOL	PROPOFOL	PROPOFOL	Not sighted
VENTOLIN	SALBUTAMOL	Not sighted	Not sighted	SALBUTAMOL	Not sighted
AMINOPHYLLINE	AMINOPHYLLINE	Not sighted	AMINOPHYLLINE	AMINOPHYLLINE	Not sighted
LASIX	FRUSEMIDE	FRUSEMIDE	LASIX		FRUSEMIDE 10MG/HR= 1ML/HR
Not sighted	MAGNESIUM	MAGNESIUM	Not sighted	Not sighted	Not sighted
HEPARIN	HEPARIN	HEPARIN	HEPARIN	HEPARIN	HEPARIN
Not sighted	PROTAMINE	Not sighted	Not sighted	Not sighted	Not sighted
Not sighted	Not sighted	Not sighted	DIAZEPAM	Not sighted	Not sighted
Not sighted	OCTREOTIDE	Not sighted	Not sighted	Not sighted	Not sighted
MUSCLE RELAXANT	MUSCLE RELAXANT	Not sighted	Not sighted	Not sighted	Not sighted
MIDAZOLAM	MIDAZOLAM	MIDAZOLAM	MIDAZOLAM	MIDAZOLAM	MIDAZOLAM
POTASSIUM K.C.L.	Not sighted	POTASSIUM POTASSIUM	K.C.L.	POTASSIUM K.C.L.	K.C.L.
K.C.L.					
KETAMINE	Not sighted	Not sighted	KETAMINE	Not sighted	Not sighted
NARCOTIC	Not sighted	NARCOTIC	Not sighted	Not sighted	Not sighted
IMMOBILISANT	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
PANCURONIUM	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
VECURONIUM	Not sighted	VECURONIUM	Not sighted	Not sighted	Not sighted
PETHIDINE	Not sighted	PETHIDINE	PETHIDINE	Not sighted	Not sighted
PETHIDINE 10mg/ml			PETHIDINE		
HEPARIN LOCKED - DO NOT USE	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
TPN	Not sighted	TPN	TPN	TPN DEDICATED LINE	Not sighted
Not sighted	ENTERAL NUTRITION	Not sighted	Not sighted	Not sighted	Not sighted
Not sighted	Not sighted	Not sighted	SYNTOCINON	Not sighted	Not sighted
Not sighted	Not sighted	Not sighted	Not sighted	NORMAL SALINE	Not sighted
Not sighted	Not sighted	HYDRATION	Not sighted	Not sighted	Not sighted
Not sighted	Not sighted	Not sighted	Not sighted	Not sighted	DRUG LINE
TRANEXAMIC ACID	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
MAINTENANCE	MAINTENANCE	MAINTENANCE	MAINTENANCE	MAINTENANCE	MAINTENANCE
MAINTENANCE					
C.V.P.	Not sighted	C.V.P.	CVC line	Not sighted	C.V.P.
CVC line					
P.C.A.	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
P.C.A. INTRAVENOUS					
Not sighted	NO NOT INJECT	Not sighted	Not sighted	DO NOT INJECT	Not sighted
Not sighted	RETURN TO I.C.U. IMMEDIATELY	Not sighted	Not sighted	Not sighted	Not sighted
Not sighted	INTENSIVE CARE UNIT	Not sighted	Not sighted	Not sighted	Not sighted
EPIDURAL	Not sighted	EPIDURAL	EPIDURAL	Not sighted	Not sighted
EPIDURAL					
ARTERIAL	Not sighted	ARTERIAL	Not sighted	ARTERIAL	Not sighted
INTERPLEURAL	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
EXTRAPLEURAL	Not sighted	Not sighted	Not sighted	Not sighted	Not sighted
DOUBLE STRENGTH	Not sighted	DOUBLE STRENGTH	Not sighted	DOUBLE STRENGTH	Not sighted

The ICUs in the four trial centres used a range of non-standard pre-printed PVC medicine line labels on dedicated continuous medication infusions (see example in Figure 2).

Figure 2: PVC Medicine line labels in use in Geelong Hospital ICU, March 2012



It was recognised that this range of labels did not comply with the *Labelling Recommendations*. The labels were made to individual health facility design. Therefore, there was no uniformity between health facilities for wording, colour or label specifications. Use of different colours in different hospitals may result in wrong drug administrations, particularly when clinical staff move from one hospital to another.

However, it was also evident that the generic 'medicine' label available in the *Labelling Recommendations* range of labels was inappropriate for use in ICU because:

- High-use of continuous infusions in this clinical area means that handwriting generic 'medicine' labels would increase health professional workload and potentially lead to non-compliance or unsafe work-arounds
- Often multiple continuous medication infusions run simultaneously for the same patient and a generic 'medicine' label would result in a label with a white background on each line. The colours currently used (although not standardised) are used as an additional mechanism to differentiate lines. This is of high importance when a particular line needs to be identified rapidly (e.g. it is important not to add a bolus dose through a vasopressor line when the patient's haemodynamic stability is dependent on the vasopressor).
- The durability of the paper generic 'medicine' labels may be inadequate as the lines can be in place for a long period of time (up to a week) compared with lines on the general wards. The lines and associated labels often require washing or get wet during usual care of the patient.

Geelong ICU and pharmacy staff drafted a list of medicines commonly used via continuous infusion, and applied the colours and format of the 'anaesthetic labelling standard' to produce a set of pre-printed PVC medicine line labels for use on dedicated continuous medication infusion lines in ICU.

Consultation was undertaken with the Victorian Therapeutic Advisory Group, Quality Use of Medicines (VicTAG QUM) to finalise wording and appropriateness of the range, including use of National Tall Man Lettering (5). The group agreed that high risk drugs, where there is no colour specified in the standards, should be distinguished by the use of red text on a white background. The resulting 'proposed standard' set of labels is attached in Appendix 8.1.

A distributor for the PVC medicine line labels (Intensive Print) was contacted about the possibility of producing a range compliant with the 'proposed standard'.

Identifying trial sites

Two VicTAG QUM-associated hospitals (Geelong Hospital and Southern Health) agreed to trial and evaluate the label set. The Tweed Hospital was included in the project when they independently approached label manufacturer Intensive Print to produce PVC medicine line labels consistent with the 'anaesthetic labelling standard'. Royal Prince Alfred Hospital became involved at a later date through communication with the Commission.

Three sites had already implemented the national standard labels according to the *Labelling Recommendations* in their ICUs. The fourth site implemented the national standard label set at the same time as the pre-printed medicine line labels.

Evaluating extending the 'anaesthetic labelling standard'

The LRRG endorse extension of the 'anaesthetic labelling standard' with regard to naming and colour coding medicine line labels for dedicated continuous infusions. The Commission supported a pilot study and evaluation as described in the *Labelling Recommendations Issues Register*. The four participating sites were ideally placed to evaluate the extension given their progress to date.

The evaluation intended to establish if medicine line labels may be coloured according to the 'anaesthetic labelling standard' where it is standard practice to use colour as an identifier secondary to the written word. In addition, the trial would evaluate content, quality, acceptability, and ease of use of PVC medicine line labels.

Funding was received from the Commission to facilitate artwork costs associated with procurement of 'proposed standard' pre-printed medicine line labels for the trial. Purchase of the actual labels and resources for implementation and evaluation were managed within the existing resources of the organisations.

From the 'proposed standard' range (Appendix 8.1) each ICU decided which line labels for medicine identification were required. To identify a medicine in a continuous infusion where a PVC medicine label has not been pre-printed or is not available in the ICU, it was expected that a handwritten generic medicine line label would be used and implementation commenced in July 2012.

The appropriate range of labels was sourced from Intensive Print and stocked in the ICUs. Existing stock was used where this closely aligned with the 'proposed standard' (e.g. labels compliant except for a lower case rather than upper case initial letter). Education was made available to the nursing and medical staff about the new 'proposed standard' PVC medicine line labels.

After implementation of the new range of 'proposed standard' PVC medicine line labels, the ICU staff were asked to complete a survey (Appendix 8.2.1). This included questions about the new range, including acceptability, ease of use, content and quality.

Due to delay in supply or delivery, there was only a very short period of time (1-4 weeks) between the labels being made available for use in each of the sites and the commencement of the survey evaluation.

The survey was set up on Survey Monkey (Appendix 8.2.1) and distributed to ICU clinical staff by providing the hyperlink in an e-mail or making it available on SharePoint (convenience sample). The distribution was managed by the investigator &/or nurse unit manager at each site. The survey was completed anonymously. The survey participants were asked to identify their site, but no other identifying details were sought.

Because of the short timeframe between implementing the new labels and the initial survey (about two weeks at Geelong Hospital), it was not possible to determine if there were issues with the labels or if negative feedback was due to unfamiliarity with the new colours. Therefore, a brief follow-up survey was undertaken after the labels had been in place for some months, to gain a better understanding of the main issues (Appendix 8.2.2). The survey was undertaken over a one week period in October 2012, at the Geelong Hospital trial site only.

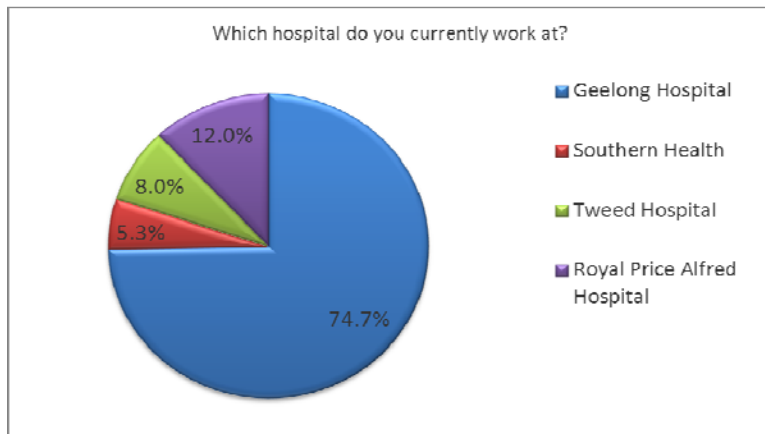
Instruction labels (e.g. Do Not Inject) were trialled by the individual health facilities. However, they fall outside the scope of the *Labelling Recommendations* standardisation.

4. Results

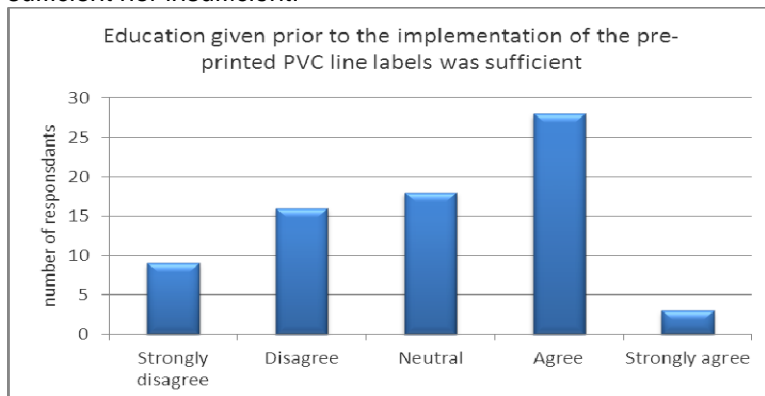
4.1 Initial survey results

There were 76 respondents to the survey with the majority (74.7%) from Geelong Hospital. As distribution of the survey was done through nurse unit managers, it is not known how many people received the survey. One site had technical difficulties providing clinicians access to the survey at the bedside, resulting in lower response rate than anticipated.

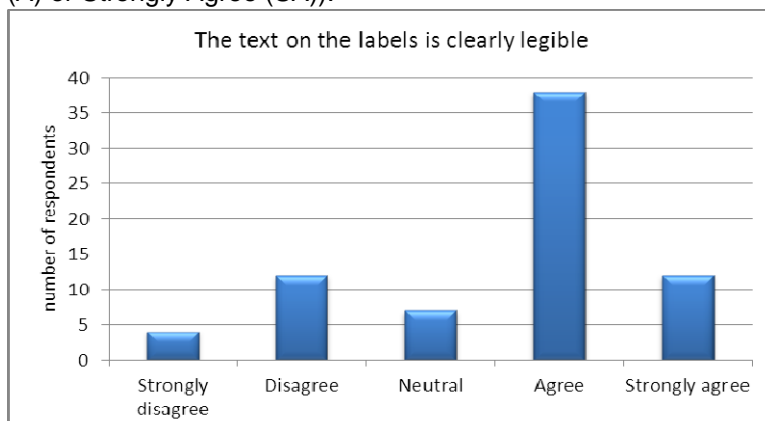
Graph 1: Survey respondents



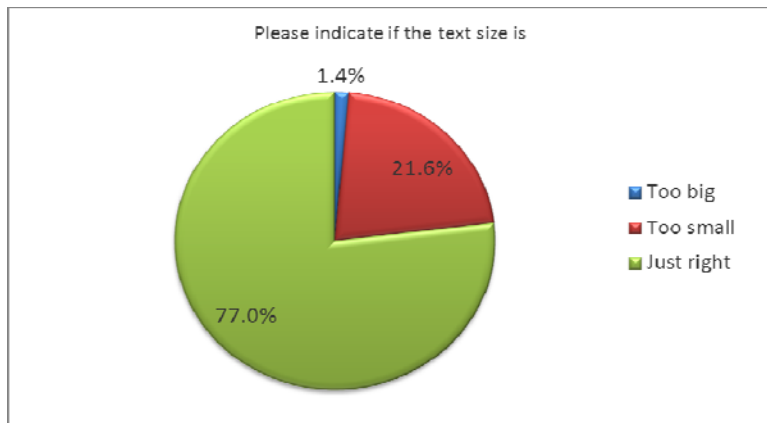
Graph 2: The education given prior to implementation of the PVC medicine line labels was neither sufficient nor insufficient.



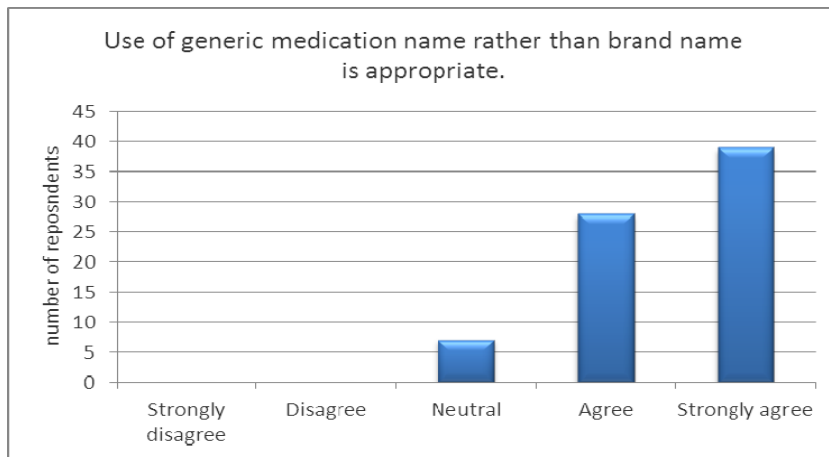
Graph 3: The majority of respondents thought the text on the labels was clearly legible (68.5% Agree (A) or Strongly Agree (SA)).



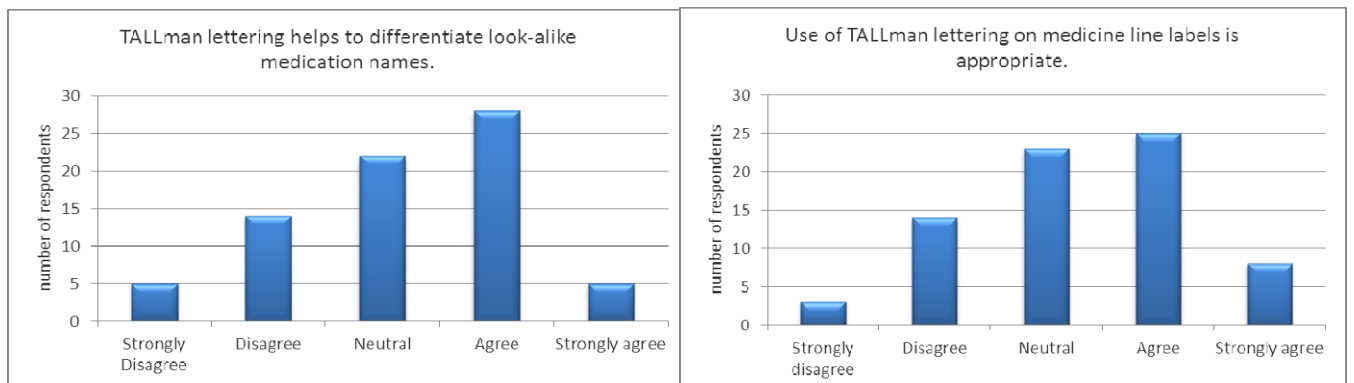
Graph 4: The size of the text was thought to be just right by the majority (77%) of respondents.



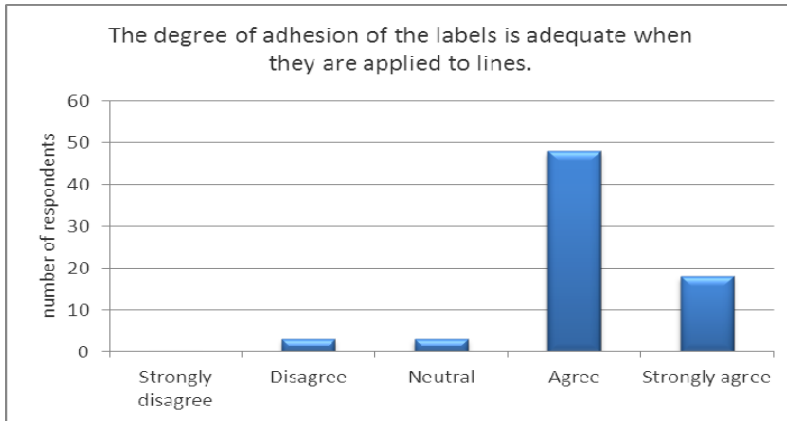
Graph 5: The use of generic medicine name, rather than brand name was thought to be appropriate for pre-printed medicine line labels.



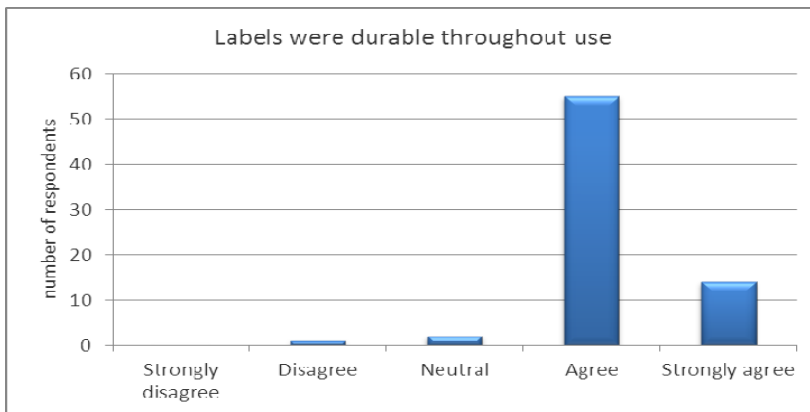
Graphs 6 and 7: National Tall Man lettering had not been implemented across other medication labelling in the facilities. Respondent reaction as to whether this helps to differentiate look-alike medication names was mixed, although slightly more positive than negative (45% A, SA).



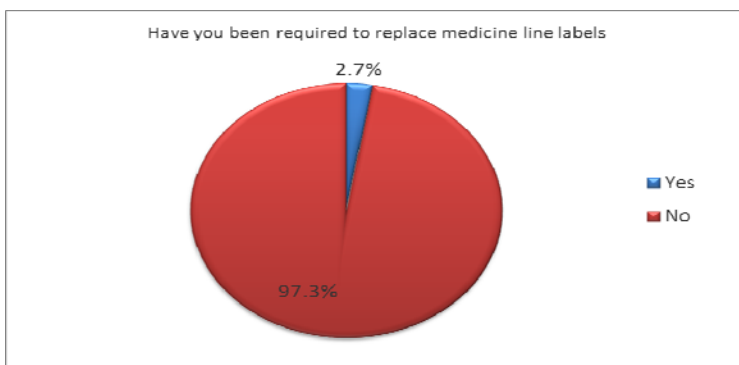
Graph 8: There were no perceived issue with the level of adhesion of the labels.



Graph 9: There were no perceived issue with the durability of the labels.



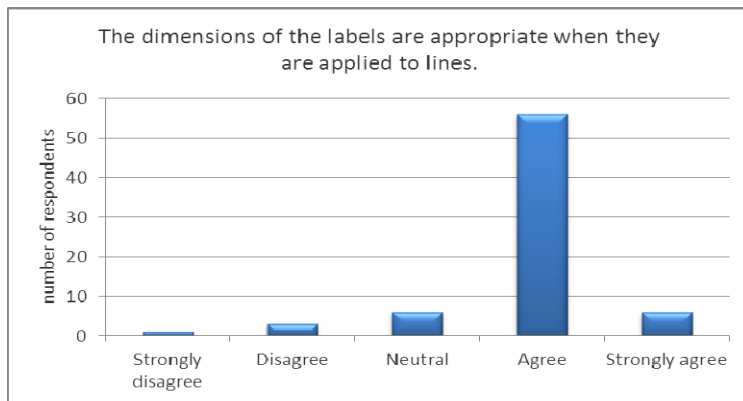
Graph 10: Few medicine line labels required replacing. The labels remained applied for the duration of the continuous infusion in the majority of cases.



Free text responses to the survey question “If labels were replaced, please explain why”:

- labels fell off or crinkled when applied
- labels required changing when “line changes were due” (Investigators note: A new dedicated continuous infusion must be labelled on commencement)

Graph 11: There were no perceived issues with the label dimensions.

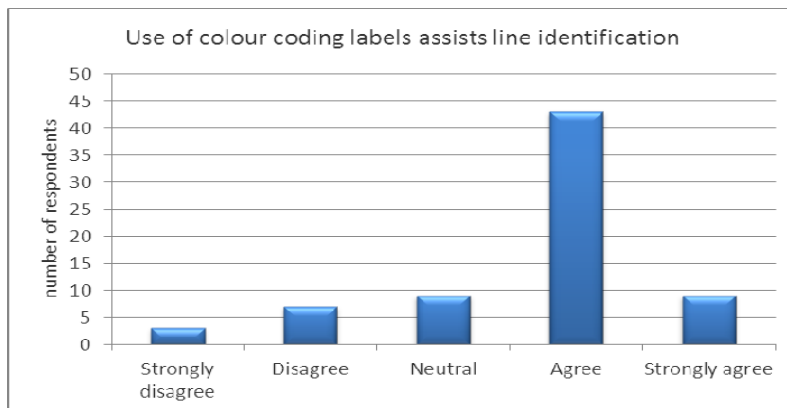


Free text responses to the survey question “If label dimensions were not appropriate, please indicate the preferred size”

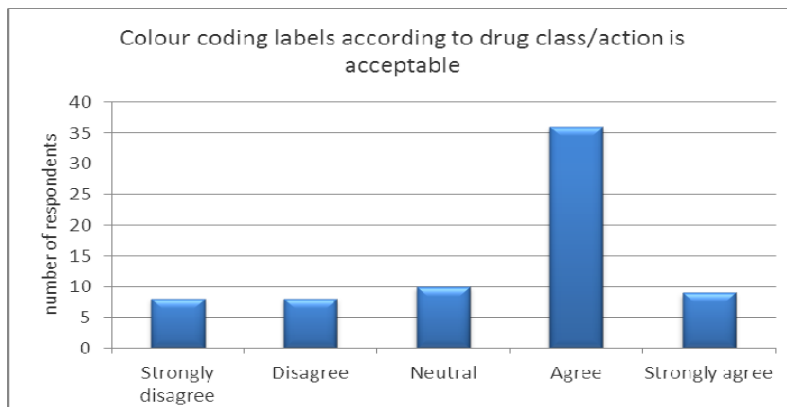
Two respondents found the label length unacceptable:

- Long medication labels (e.g. Midazolam or Noradrenaline) become a hazard. They are too long and cumbersome to be applying. Smaller labels should be used for these.”
- The ‘DO NOT INJECT’ label is dangerous when wrapped around the line. It says ‘INJECT’ one side and ‘DO NOT’ on the other side.

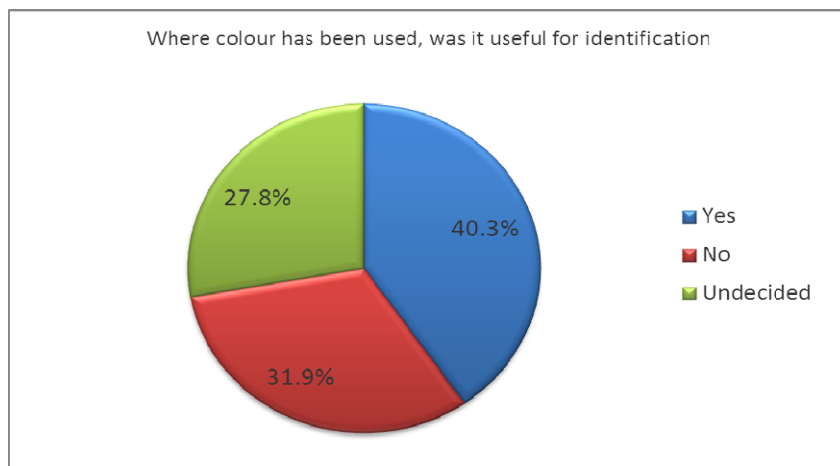
Graph 12: Most respondents agreed that colour coding labels was useful (73% A, SA).



Graph 13: The application of colours in the proposed standard was acceptable (63% A, SA). However the responses were variable.



Graph 14: There was varied, and equivocal responses to the utility of colour for identification purposes.



Respondents that did not find colour useful for identification identified a number of issues:

In relation to labels for vasopressors (black on violet background) there were difficulties experienced trying to read the labels (with free text responses dot pointed below):

- The colours used are black lettering and a dark purple background. At night or in darkened areas it is difficult to read. It would be nice to have all vasopressors in a bright colour to stand out from other labels due to their sensitive and quick acting natures
- I find the noradrenaline on purple hard to read
- Inotropes, hard to see lettering on dark purple background
- Difficult to read some labels due to text colour on dark colour
- Hard to read letter colouring on some background colours, prefer brighter background colours there more easily seen
- Difficult to read the black lettering inotropes on the violet background

With many medicine line labels in the same class or miscellaneous ending up the same colour, there were issues with differentiation:

- All of them look the same and it's hard to determine which is which. Very confusing and the old labels were much better to identify. These new ones all look too similar
- I find that the white labels with the black writing all look the same and at a glance it is difficult to differentiate the labels
- Because of multiple drugs having same colour it is more confusing at present but feel that this will improve as I get used to them
- Similar colours so you still need to double check names on lines
- Inotropes should be different colours as they end up on the same manifold
- Noradrenaline & Milrinone should be different colours
- Confusing the way drugs grouped- do not inject and maintenance same colour
- Do not inject and maintenance labels the same! Very confusing

Some respondents had other colour coding preferences:

- Inotropes I prefer in red
- Would prefer vasopressors to be a brighter colour, red was good
- Used to inotropes in red so clearly identifiable, unsure if purple is associated with cardiac meds
- Fentanyl and morphine. I think each drug should have its own colour
- Each medication should have a different colour
- All labels same colour increase risk of error /using wrong label

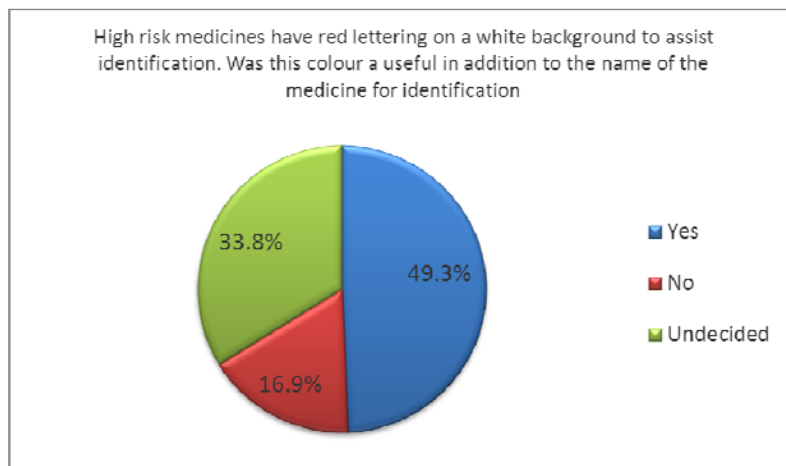
Some preferred not to use colour for label identification:

- Colour no substitute for large print text of name, I would take little notice of colour
- I don't believe clinicians should be reliant on colour coding.

Some admitted they are taking some time to adapt due to unfamiliarity with the new colour coding system:

- Some I am still having trouble with, probably time will alter this
- You have to know what colour corresponds to what drug
- Not used to colour coding
- Nobody I speak with about these labels actually can identify them from 2meters away let alone 1 meter and I need to grab the label and read it up close As the nursing population is ageing and the average age is 45 years then these labels need to be clearer and the colours such that an older nurse can read them from at least a meter away before a huge error occurs especially at night

Graph 15: There was support for high risk medicines being identified by red lettering on a white background.

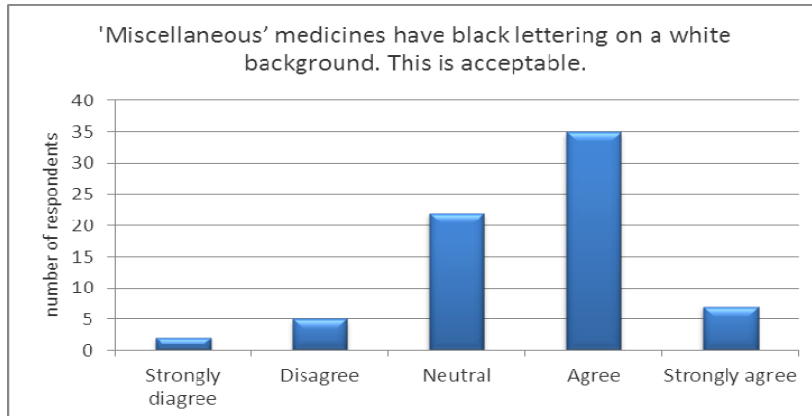


Survey participants that responded no were asked in relation to which medicine, to explain why and to suggest an alternative:

Some thought the colour choice employed in the 'proposed standard' was not appropriate:

- Not bold enough. I suggest red lettering on black background
- Plenty of other white labels
- Easier to see coloured tape rather than white tape. Would rather see High risk meds on black tape and warnings on white tape
- The black writing on red would be more appropriate for these drugs
- What about people who are red-/green colour blind. Poor choice!! Given it is high risk I would have thought a neutral colour would be more appropriate
- Isn't red usually associated with arterial route?
- Heparin too hard to see. Make it thick and larger like the insulin also in red
- Some disagreed with the drugs designated as high risk:
- Different people have different opinions as to what is a high risk medicine
- All drugs are high risk, for example if the noradrenaline runs through this can have dramatic consequences.
- Was not aware that high risk medicines were in red

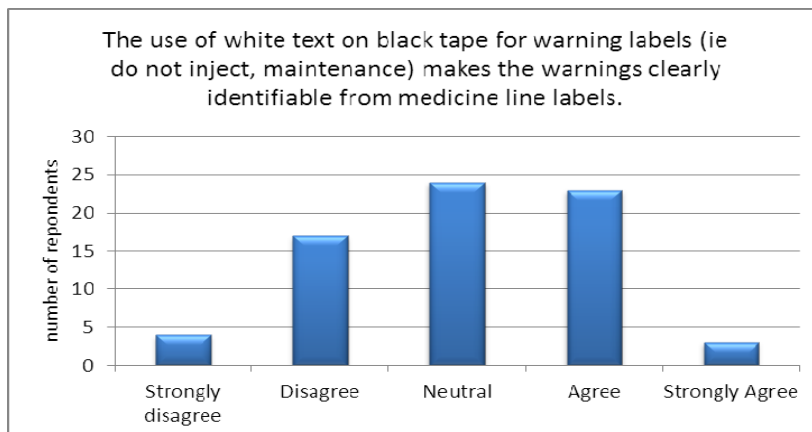
Graph 16: There was some support for 'miscellaneous' medicines being identified with black lettering on a white background.



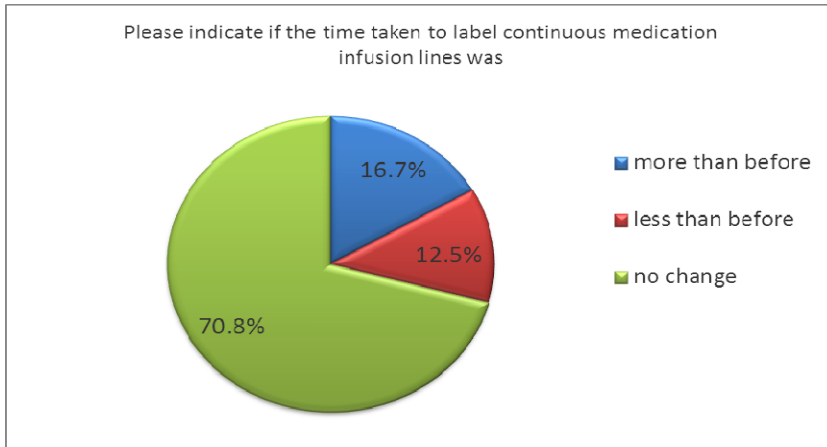
Survey participants that responded no were asked in relation to which medicine, to explain why and to suggest an alternative:

- Still unsafe to identify the medication when it doesn't have a specific colour for each medication
- There seems to be a large number of labels of the white with black lettering
- Need to be able to easily identify double strength and do not inject labels, maybe red background and white writing
- The black with white writing and the white with black writing are too similar
- Can't read protamine too small

Graph 17: There was an equivocal response to the use of white text on black background for warnings.



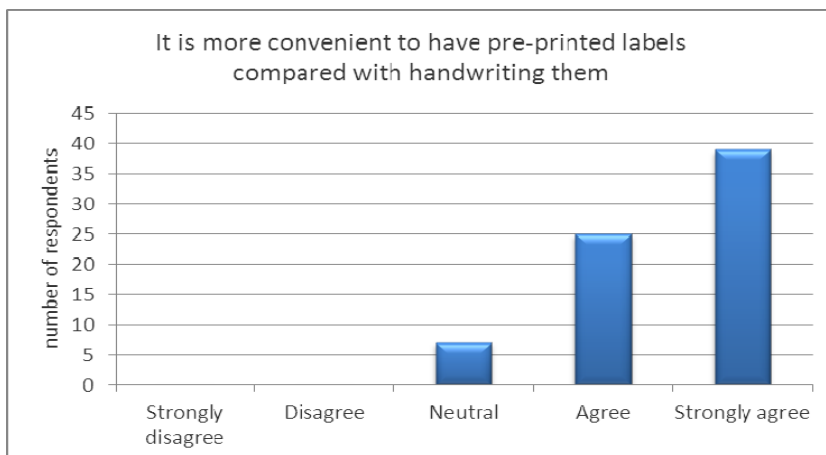
Graph 18: There was agreement that the new labelling requirements did not require additional time.



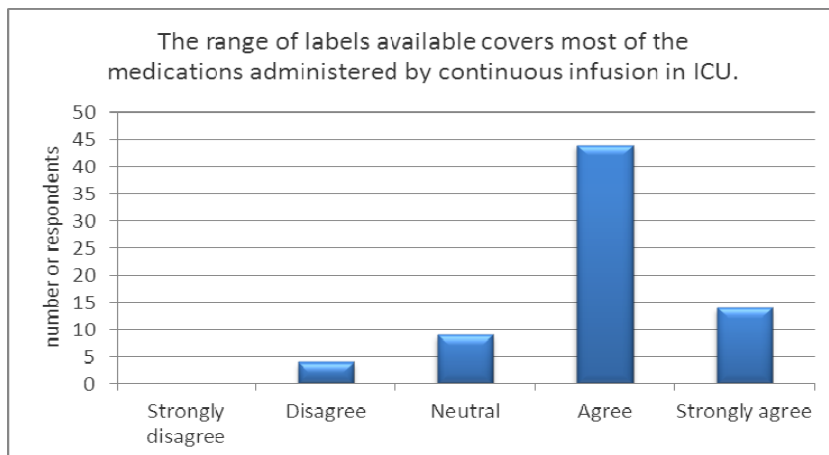
Survey participants that responded “more than before” were asked what was the reason:

- Sourcing labels
- As far as I was aware there were no standards before for labelling or not labelling lines, now there is, therefore it takes longer than not labelling them
- Learning the new colour system
- Writing the other labels for line change due
- Longer time looking for labels due to colour change
- Because it takes so long to find the label I need to use
- Always labelled lines previously
- Trying to find them in the rolls because they don't stand out anymore
- Getting used to new colours

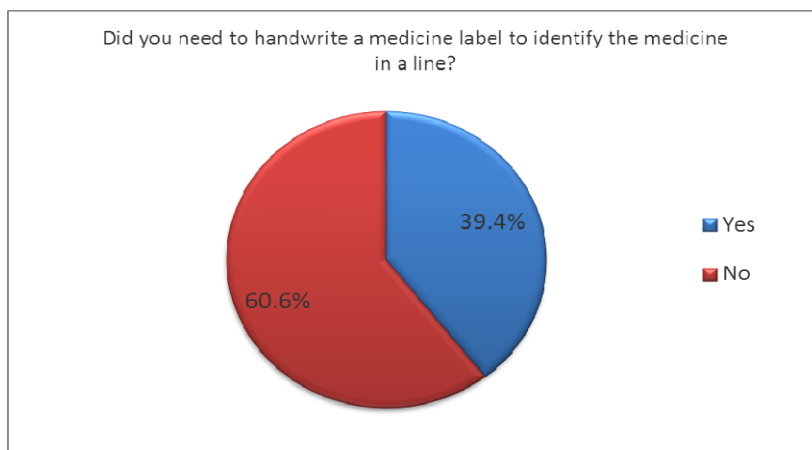
Graph 19: There was strong agreement that pre-printed labels were more convenient than handwriting them.



Graph 20: There was strong agreement that the available label range covered most medicines.



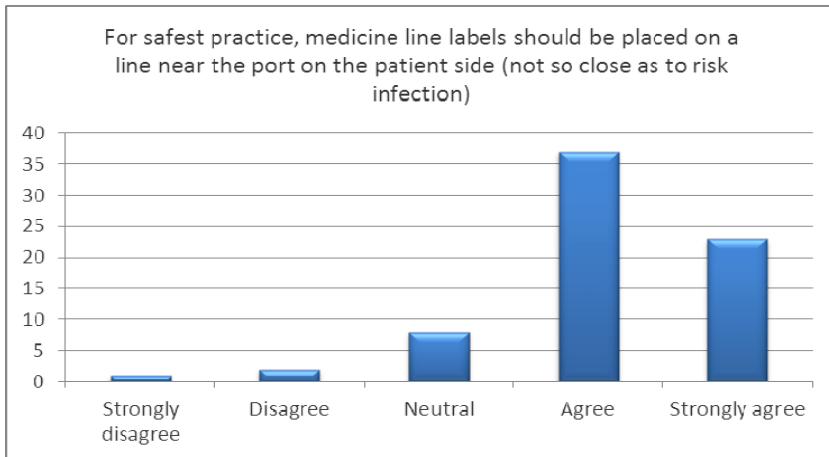
Graph 21: Nearly 40% of respondents needed to handwrite a medicine line label.



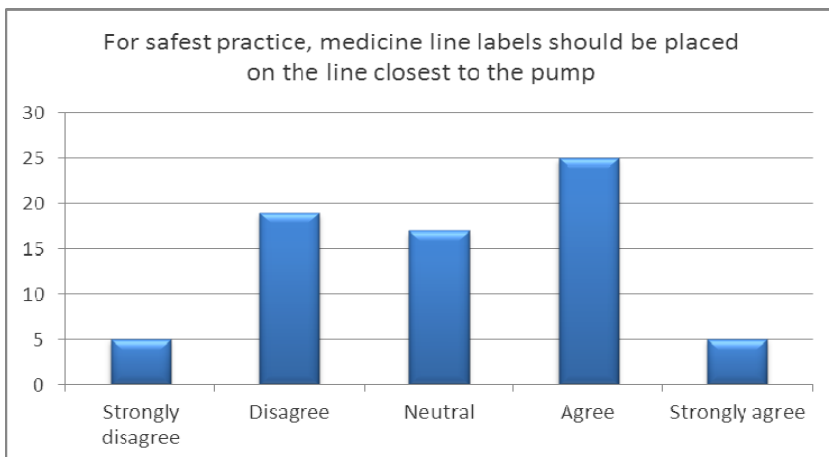
Survey participants that responded “yes” were asked for which medicine was a pre-printed label not available:

- Fentanyl,
- Tazocin
- 5% dextrose
- Thiopentone
- Dexmedetomidine
- Milrinone
- Various antibiotics when on dedicated line
- Pantoprazole
- Hydralazine
- Ketamine,
- Protamine
- The odd occasion when one is used that is not commonly used

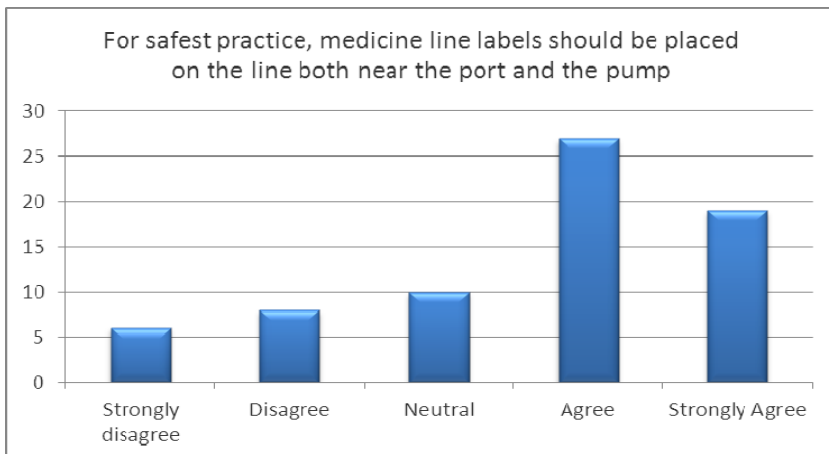
Graph 22: There was strong agreement that medicine line labels should be placed near the port on the patient side.



Graph 23: There was more support for the proposition that medicine line labels should be placed on the line closest the pump than against.



Graph 24: There was strong support for placing medicine line labels on the line both near the port and the pump.



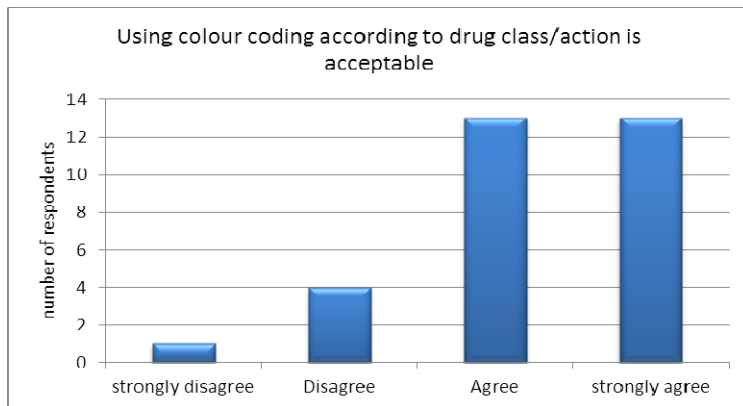
Finally, any other comments about the new range of medicine line labels were sought from respondents:

- The pumps should also be labelled. Although some of the new labels have adhesives that are too strong, for both the old and new syringe drivers and Agilia pumps
- They are confusing, hard to find the right label and it takes ages to read them with the different writing. Not a good idea to have same colour it just confuses the entire issue of labelling lines
- Doesn't matter where the label is placed the nurse should always check that the line is correctly labelled by following the infusion along the line
- For medication lines they should not have an injection port at all so people cannot accidentally inject. Just a port near the pump to aspirate air if required
- We put a label near the port and one on the actual pump. Antibiotic lines sometimes have a handwritten (in black) on a white label attached
- The colours are too the same - having the same class the same colour leads to confusion
- Colour selection poor
- We don't run infusions of muscle relaxants often so I think it would be safer to have inotropes and vasopressors with the red background

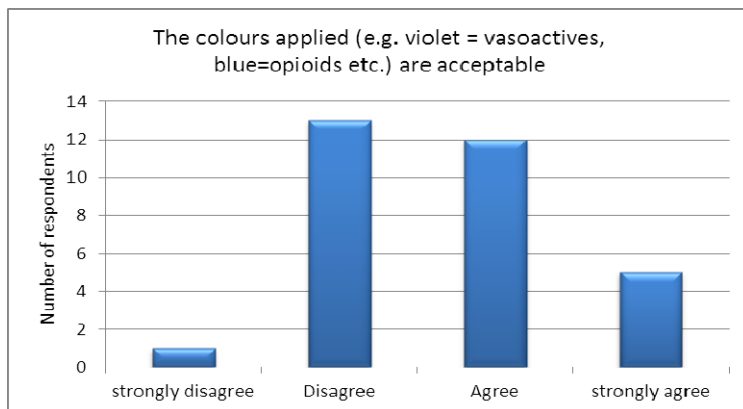
4.2 Barwon Health post-trial survey results

Forty hardcopy surveys were handed out and 31 responses received (77.5% response rate).

Graph 25: Acceptability of colour coding according to drug class.



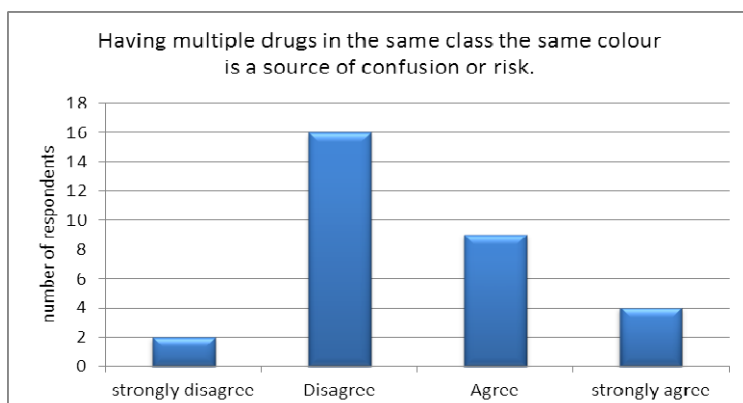
Graph 26: Acceptability of colours used.



Comments provided:

- Inotropes should be brighter
- Colours should be brighter i.e. inotropes
- Don't like light purple for vasopressors. Need to be brighter
- Red opioids would be better
- Hard to recognise and some are linked in same colour

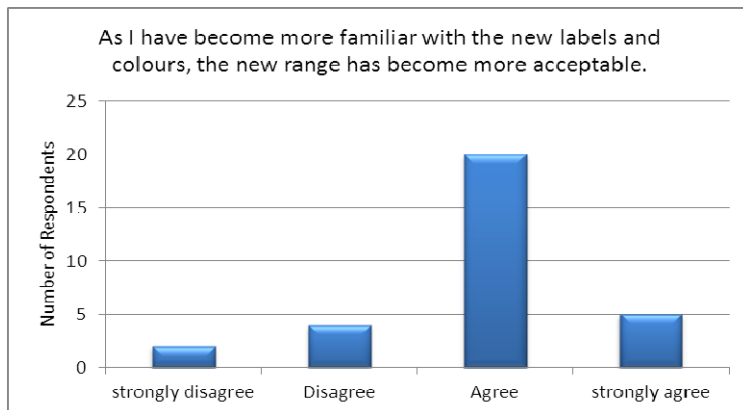
Graph 27: Acceptability of colours used.



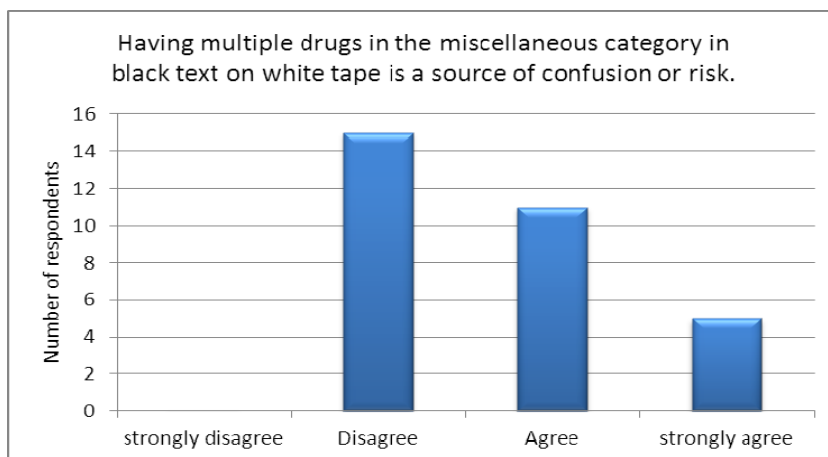
Graph 27 (cont.): Comments provided:

- Variation in text could be more pronounced
- If are same class it makes it easier, not when like above

Graph 28: Strong agreement that familiarity improves acceptability.



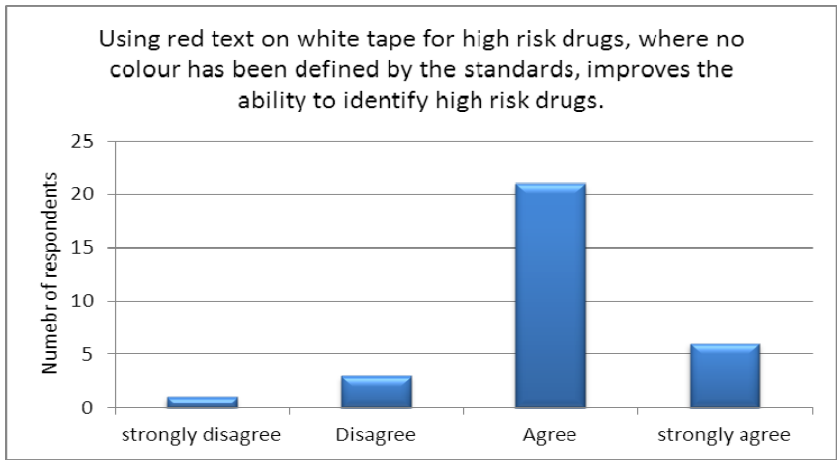
Graph 29: Polarised views on multiple drugs in miscellaneous category as a source of confusion or risk.



Comments provided:

- As “DO NOT INJECT” is black on white and is the same as injectable medicines labels, could make mistakes.
- Different text helps

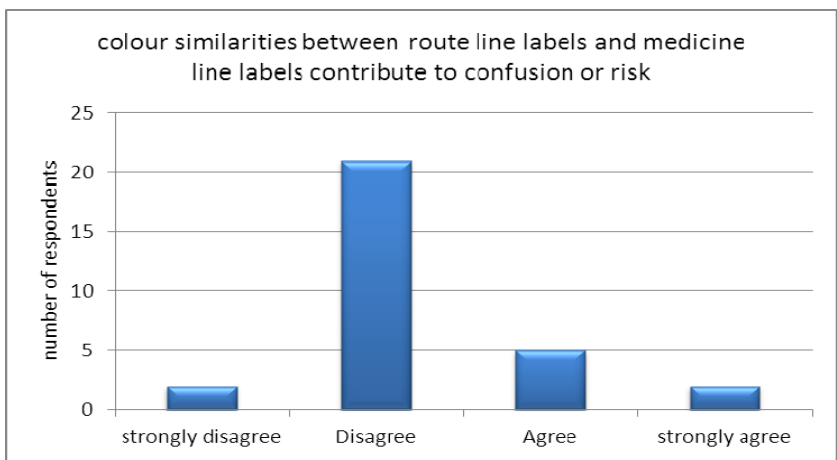
Graph 30: Strong agreement that identifying high risk drugs with red text on white background (and when not otherwise standardised) improves identification.



Comments provided:

- Letters should be bigger
- Perhaps coloured tape Red/Yellow – warning with black text. White not easy to identify/distinguish

Graph 31: Strong disagreement that colour similarities between route line labels and medicine line labels contribute to confusion or risk.



Compiled responses to the following survey question: Agree/Disagree the colour similarity contributes to confusion or risk because:

Strongly Agree/Agree	Disagree/Strongly disagree
<ul style="list-style-type: none"> • Risk of looking at line labels and injecting drugs via routes that are same colour • They all look similar. Please keep the labels simple so they are easy to read. Need contrast between text and colour so they are easy to read. • Too many different labels for various areas can be detrimental to the original idea of promoting safety. • Morphine usually goes through PCA and can get confused to only run on pump. Cisatracurium sticker looks like arterial line sticker still simply because it is red. • We are changing colours to improve system yet have these route line labels in colours as well – these should be white with black print with ‘Arterial’ written in red, or ‘epidural’ written in yellow. • I think is could possibly be confusing in particular for junior/inexperienced staff who are having a very busy shift, especially ward nurses with multiple patients. 	<ul style="list-style-type: none"> • Better to have different colours to identify quick if you need quick access • Totally different size and appearance of the stickers • If you take the time to read the labels and not simply glance at them, confusion and risk is almost zero. • They are entirely different labels used for different reasons. • Because you are checking what you are putting on your lines. You should always be identifying your lines before attaching anything to them, i.e. piggy backs, bolus etc. • You need to read the labels anyway. • It is still the most important factor to read the label. • Labels look quite different – are larger and different shape and have date written on them. • Labels have a different format. People still need to read the label despite colours. • One is simply a date sticker, and the other is clearly a drug label. • I don’t think there is confusion. I usually don’t go by colour; I read the label to be 100% sure. • Different sizes. Black around the edges of line labels. • They are different sizes. The route line labels have a lot more writing. Easy to see differences. • The IV or IA labelling is large enough to reduce the risk of confusion • The appearance of the labels is different. • I think they are clearly label and coloured appropriately. The route line labels are labelled clearly in bold black text, & the correct route should be checked by the RN before admin anyway. • These drugs can also be given in different routes. • The site labels are obvious with black checked border and different shape. • Borders make them different. Difference in size. Different lines in use (epidural line is yellow with no access ports, arterial access port is at the transducer)

Compiled responses to the following survey question: We would be pleased to hear any additional comments you may have about the medicine line labels.

- Inotrope colour scheme is too dark. This increases the risk of drug error particularly at night when the environment is darker.
- The line change labels are too big. Simplify.
- I think violet for inotropes is not an alarming/notable colour.
- I'm not sure if this contributes to an overall safety ideal. There are so many different drug groups etc – it needs to be more basic if possible- keep it simple.
- I much prefer our original labels in all different colours. So long as the text was reasonable large and clear it was easy to see what was being identified in that line. Having set colours for any drug classes doesn't differentiate them easily. More risk of making mistakes.
- Individual colours for individual drugs are the safest methods to label lines. Same colour stickers are confusing and waste time trying to find drug when individual colours stand out more. Different lettering makes it hard to read and can easily be put on to wrong line because it's the same colours. Bad idea whoever thought of it. Obviously they don't work at the bedside.
- I do not like the 'do not inject' --a very important label on arterial lines. To be the same colour as 'Double strength' and 'Maintenance' – I think 'do not inject' should be red. I know one needs to read the label in an arrest or emergency situation. Too similar to maintenance stickers
- Even after the labels in use for a few months, I still have trouble finding the right labels.
- I like the blue/red/yellow labels for IV/IA/epidural. Not sure that different colour labels are entirely necessary for drugs, apart from making the patients complexion look a little brighter with all of the colour.
- I believe the vasoactive drugs should have a colour that stands out more. Mauve & violet are not very good colours for these drugs as they do not clearly alert people to how potent and dangerous these drugs can be.
- I think they are a great improvement and contribute to delivering intravenous/arterial/epidural line safety.
- Although difficult to adjust to different colours when first introduced I now recognise the labels easily. However I would prefer all vasoactive had adopted the orange colour, not violet.
- Getting used to them.

5. Discussion

Line labelling to identify the medicine in dedicated continuous infusions was well accepted. There was strong support for pre-printed medicine line labels in preference to handwritten labels. All of the trial sites continue to use the 'proposed standard' pre-printed medicine line labels.

5.1 Tape dimensions, text and adhesive properties

The size of the tape, the size of the text, and the adhesive qualities of the labels were already familiar and generally well accepted with the following exceptions:

- Length of the printed text: For medicines with longer names, the name of the medicine can become illegible when wrapped around a line. This issue can be overcome with minor practice change by selecting enough tape to include two medicine names and allow the tape to wrap around the line between the printed texts resulting in a longer, but legible, flag on the line.
- Generic medicine names rather than brand names were not always recognised.
- National Tall Man Lettering was reasonably well accepted. However, the look-alike/sound-alike pair Dopamine – Dobutamine (of particular relevance in the ICU setting) is not differentiated in National Tall Man Lettering. Further differentiation of these two drugs using this system may be beneficial.

5.2 Use of colour

The colour of medicine labels according to drug class as described in the 'anaesthetic labelling standard' represented a change in practice. This change was most contentious amongst nursing staff.

The nursing staff were unaware of the existing standard colour coding for anaesthetics and made many alternative suggestions for colour changes contrary to the 'anaesthetic' standards. Perhaps education prior to implementation was inadequate and the rationale and background was not clear. Three of the sites had already implemented the national standard labels according to the *Labelling Recommendations* in their ICUs. The fourth site implemented the national standard label set at the same time as the pre-printed medicine line labels. This may have confounded the survey responses at this site.

Whether the resistance to colour coding by drug class according to the 'anaesthetic labelling standard' will resolve with increasing familiarity and education, or whether the perceived risk will still exist with ongoing use, was discussed post-survey with a focus group. The resistance to the colour choices was probably related to lack of education prior to implementation and does not pose an ongoing risk of error. The group hypothesised the application of colour coding according to drug class and the choice of colours applied according to the 'anaesthetic labelling standard' will become less of an issue as staff become more familiar with the standard. The benefit of standardising colour coding, both within and between organisations, was endorsed as a positive outcome of this project.

The post-trial survey demonstrated that the majority (80.6%) agreed that as they have become more familiar with the standardisation, the new range of labels had become more acceptable. There was a more strongly positive response to colour coding according to drug class (83.9%) in the post-trial survey compared with the original survey (63%).

The initial survey identified colour coding according to drug class results in multiple drugs in the same colour/format. We gauged clinician opinion of this in the post-trial survey and, where colour was used, most (58.1%) did not believe that this contributed to confusion or risk. There was still some disagreement on the application of the 'anaesthetic labelling standard' colour to the ICU pre-printed medicine line labels (45.2%) and, again, suggestions for alternative colour choices for particular classes/medications not in conformity with the 'anaesthetic labelling standard'.

There was a particular issue with the legibility of vasopressors 'black text on violet 256' identified in the initial survey. Upon further investigation, old stock was found in use in one unit. The old stock (right hand side, Figure 3 below) has a much darker background than the new trial labels (left side below). This may account for the visibility/legibility issues with the vasopressor range in the survey. The old stock was discarded.

Figure 3: New and old stock of noradrenaline (vasopressor) labels



This was resolved prior to the post-trial survey. Free text comments on the post-trial survey still indicated dissatisfaction with the choice of violet for vasopressors. Clinicians indicated the vasopressor labels need to be brighter, a more alarming or notable colour. The standards that specify violet for vasopressors are internationally recognised and broadly applied across Australia in the perioperative environment. It would not be reasonable to suggest any colour contrary to these standards.

Medicines for which there is no specified colour in the 'anaesthetic labelling standard' fell into the miscellaneous category. These were identified by use of black text on a white background. This was generally well accepted in the initial survey. However, half (51.6%) the respondents to the post-trial survey thought that having a large number of medicine line labels in this same format contributed to confusion or risk.

High risk medicines for which there is no specified colour in the 'anaesthetic labelling standard' (heparin, insulin and potassium chloride) were distinguished by the use of red text on a white background. The alternative was to group these drugs in the miscellaneous category and print the medicine name in black on a white background. Red on white text was generally well accepted with reservations about red as a colour choice and the criteria for determining a drug as 'high risk'. This resistance again probably related to the inadequate education prior to implementation, a clear rationale for how the high risk range was decided upon (i.e. only if there was no specified colour) and implications if special additional colour coding was not applied (i.e. printed black on white). In the post-trial survey, most (87.1%) thought the additional differentiation of using red text on white tape for high risk drugs improved the ability to identify high risk drugs. Further discussions with the focus group and the VicTAG QUM Group indicated strong support for high risk drug differentiation should remain.

Other hospitals identified potential risk if there is mix-up between the colours used in route line labels and medicine line labels (e.g. blue used for intravenous route lines labels as well as blue for opioid medicine line labels). Most respondents to the post-trial survey (76.6%) at Geelong Hospital did not consider this a significant risk due to text, size, border, format differences between the two types of labels.

5.3 Warning labels

Warning labels were tested alongside the trial labels although these are beyond the scope of the *Labelling Recommendations* and the present evaluation.

The use of white text on black tape for warning labels (i.e. do not inject, maintenance) was not well accepted with only 36.6% of respondents agreeing or strongly agreeing they were clearly identifiable from medicine line labels. Inadequate information was sought in the survey to identify the particular problems or solutions with these labels. Further discussion with the focus group suggested that colour change is unlikely to improve differentiation (given the number of 'anaesthetic labelling standard' colours in use and avoiding potential clashes). A change to the size or format of the label may be appropriate and will be investigated with the label supplier.

During the pilot, the need for an additional warning label was raised following an incident in the intensive care setting where cytotoxic medications were administered. The VicTAG QUM Group endorsed the creation of a warning label, consistent with Clinical Oncological Society of Australia Guidelines (6). A label printed 'CYTOTOXIC' in reverse purple print would be applied in addition to a medicine line label completed with the specific medicine name (and as provided in Figure 4 below).

Figure 4: Cytotoxic warning label endorsed by VicTAG QUM Group.



5.4 Label selection

The change in colour, and nurses' unfamiliarity with the new colours, meant it took longer to find the appropriate label tape on the dispenser and perhaps longer to identify which medicine was running through the line. Some sites have since rearranged their tape dispensers to improve selection (alphabetical ordering). This will become less of an issue as staff become more familiar.

The range of labels available covered the majority of medications administered by continuous infusion. Many of those identified as needing to be handwritten were actually available (e.g. fentanyl, dexmedetomidine, ketamine, and protamine), but perhaps the nurse was unaware of its availability, couldn't find it at the time, or the ICU had chosen not to stock it. The range can easily be broadened if required by applying the 'anaesthetic labelling standard' principles.

5.5 Label placement

Label placement amongst the respondents was preferred either near the port on the patient side as currently specified as a minimum requirement in the *Labelling Recommendations* or labelling both near the port and the pump. Label placement near the pump had the weakest support.

Current practice regarding label placement varies between sites and between clinicians, but the majority of staff would place the medicine line labels on the patient side of the port (not so close as to risk infection) as required by the *Labelling Recommendations*. Some clinicians/sites routinely place an additional medicine line label on the pump (depending on software capacity of the infusion device to display a drug labelling function) or on the container (bag or syringe). This practice goes beyond minimum requirements of the *Labelling Recommendations*.

The Geelong Hospital reviewed the issue of potential confusion between the blue intravenous route label (PMS 2985) and the blue 'opioid' medicine label (e.g. fentanyl, PMS 297). The intravenous route label was placed near the source and the medicine label was placed on the patient side of the port. The use of both labels on the same line was rendered acceptable by positioning the labels on the line in this way. This also suited the physical properties of the labels. The route labels are paper-based and not as durable as the PVC medicine labels which can withstand handling and fluids near the patient.

6. Recommendations

The 'proposed standard' pre-printed medicine line labels were well accepted in the ICU environment. While there were some issues, there are no clear suggestions to inform further change to the proposed standard. In the absence of any other standard, we recommend this be endorsed as a national standard for pre-printed medicine line labels for use in intensive care settings.

The following recommendations are made for identification of dedicated continuous infusions based on the outcomes of the trial:

1. Dedicated continuous infusions may be labelled with a pre-printed line label including the name of the medicine or fluid.
2. Colour-coding on pre-printed labels should follow the colour-coding set out in the 'anaesthetic labelling standard' with the following exception: High risk medicines that fall in the 'miscellaneous category' should be printed red on white.
3. Size of label and font size should be such that the text is clearly legible:
 - a. Pilot labels were produced in continuous strips (12mm wide) and the font size was 8mm tall, allowing 2mm border either side for printing diversion. The image width varied according to the length of the medicine name, but did not exceed 70mm. The gap between the images was 10-15mm printed on continuous tape.
4. Labels must be produced using material that remains intact for duration of use:
 - a. Pilot labels were produced using C17 unplasticised PVC tape, with tensile strength >14.3 kg / 25mm.
5. Labels must be produced with glue that ensures the label remains attached for the duration of use:
 - a. Pilot labels were produced with a peel adhesive 600 gr/25mm (+/- 10%)

Additionally, the report recommends:

6. The dopamine / dobutamine' look alike/sound alike drug name pair be considered for adding to the National Tall Man Lettering List.
7. A pre-printed warning label should identify 'Cytotoxic' medicine running through a line.

The principal investigator consulted extensively with members of the VicTAG QUM group and the recommendations of this report have been endorsed by VicTAG QUM group.

6.1 Post evaluation feedback

The application of colour-coding according to drug class has been further considered by the LRRG. The following changes to the trialled 'proposed standard' set of labels described in Appendix 8.1 are endorsed:

- Full colour on labels for medicines of opposite action, including antagonists. Therefore, labels for glyceryl trinitrate, nimodipine, sodium nitroprusside will be coloured violet (PMS 256) with a violet and white hatched border. Naloxone will be coloured blue (PMS 297) with a blue and white hatched border. (Trial labels had a white centre).

- Isoprenaline is a sympathomimetic and chronotrope and should be labelled violet with a violet and white hatched border (PMS 256). Milrinone and levosimendan should also be labelled violet with a violet and white hatched border.

The following extension to the 'anaesthetic labelling standard' is suggested in the cardiac catheter laboratory (see Issues Register 14).

- antiplatelet agents/anticoagulants associated with teal green (PMS 3255)
- heparin and protamine to be coloured teal green (PMS 3255) in addition to differentiation of heparin and protamine with a solid black border for heparin and a black hatched border for protamine as specified in the 'anaesthetic labelling standard'

The application of colour to labels for the antiplatelet agents/anticoagulant drug class has yet to be evaluated on medicine line labels. The extension of colour to this drug class is ongoing in the cardiac catheter laboratory and in time will possibly extend to other areas where these medicines are used, including line labelling of continuous infusions.

Evaluation of the pre-printed labels for identification of medicines in dedicated continuous infusions is an evolving process which is reported through the *Issues Register* and re-evaluated as appropriate. The Commission will continue to work with users and the Labelling Recommendations Reference Group to monitor the safety and utility of the extension and the recommendations for identification of medicines in dedicated continuous infusion lines.

7. References

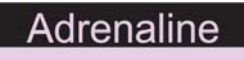
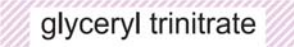

1. Australian Commission on Safety and Quality in Health Care. (2010). *National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines*. Sydney: ACSQHC. Retrieved April 4, 2012 from www.safetyandquality.gov.au/our-work/medication-safety/user-applied-labelling/
2. Australian Commission on Safety and Quality in Health Care 2012, *National Recommendations for User-applied Labelling of Injectable Medicines, Fluids and Lines: Issues Register*, ACSQHC, Sydney. Retrieved August 20, 2012 from www.safetyandquality.gov.au/our-work/medication-safety/user-applied-labelling/issues-register/
3. International Standard. (2008). *Anaesthetic and respiratory equipment — User-applied labels for syringes containing drugs used during anaesthesia — Colours, design and performance*. ISO 26825:2008(E). www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43811
4. Australian Standard. (1996). *User-applied labels for use on syringes containing drugs used during anaesthesia* (AS:NZS4375:1996).
5. Australian Commission on Safety and Quality in Health Care. *National Tall Man Lettering*. ACSQHC. Retrieved April 10, 2012 from www.safetyandquality.gov.au/our-work/medication-safety/national-tall-man-lettering/
6. Clinical Oncological Society of Australia 2008. *Guidelines for the Safe Prescribing, Dispensing and Administration of Cancer Chemotherapy*, COSA, Sydney. Retrieved January 21, 2013 from www.cosa.org.au/


8. Appendices

Appendix 8.1 'Proposed standard' for pre-printed PVC medicine line labels

The following principles have been applied:

- Full drug names; no abbreviations; no brand names; no medicine class names
- Colour coding, stripes and borders according to AS/NZ4375:1996 and ISO26825:2008
- Text size as large as possible within a 6 to 7cm length of tape
- A plain sans serif font
- Black on white where no colour is specified in the standards
- High risk drugs use red text on a white background where no colour is specified
- Either lower case letters with an initial upper case letter OR apply National Tall Man Lettering. Labels already in stock were used for the trial and therefore may not conform to this principle)
- Use route labels according to the *Labelling Recommendations*
- White text on black tape for warning labels noting these are beyond scope of *Labelling Recommendations*.

	AS/NZS 4375:1996 and ISO26825 (PMS colour)	proposed new medicine line labels	Barwon Health	Southern Health	Royal Prince Alfred	Tweed
Adrenaline	Vasopressor, violet 256. Background -bold reverse plate letters within a black bar on the upper half of the label.		✓	✓	✓	✓
Aminophylline	B/W, Tall Man lettering	amINOPHYLLine	✓	✓		✓
Amiodarone	B/W, Tall Man lettering	amIODAROne	✓	✓	✓	✓
Atropine	anticholinergic, green 367	Atropine				✓
Cisatracurium	muscle relaxant, fluorescent red 811 or warm red	Cisatracurium	✓		✓	✓
Dexmedetomidine	B/W	dexmedetomidine	✓	✓	✓	✓
Diazepam	tranquilliser, Orange 151. Tall Man letters	DIazepam	✓			✓
Dobutamine	vasopressor, violet 256	Dobutamine	✓	✓	✓	✓
Dopamine	vasopressor, violet 256	Dopamine				✓
Fentanyl	narcotic, blue 297	Fentanyl	✓	✓	✓	✓
Frusemide	B/W	frusemide	✓	✓	✓	✓
Glyceryl trinitrate	hypotensive, violet 256 & white diagonal stripe		✓	✓	✓	✓
Heparin	black border with a width between 1-2mm. high risk drug, red on white		✓	✓	✓	✓
Insulin	high risk drug, red on white	Insulin	✓	✓	✓	✓
Isoprenaline	vasopressor, violet 256	Isoprenaline	✓		✓	✓
Ketamine	induction agent. Yellow	Ketamine	✓	✓	✓	✓

Levosimendan	vasopressor, violet 256	levosimendan	✓		✓	✓
Lignocaine	local anaesthetic, grey 401	Lignocaine	✓			
Magnesium	B/W	Magnesium	✓	✓	✓	✓
Metaraminol	vasopressor, violet 256	Metaraminol	✓		✓	✓
Midazolam	tranquilliser, Orange 151	Midazolam	✓	✓	✓	✓
Milrinone	vasopressor, violet 256	Milrinone	✓	✓	✓	
Morphine	narcotic, blue 297	Morphine	✓	✓	✓	✓
Naloxone	narcotic antagonist, blue 297 & white diagonal stripe		✓			✓
Nimodipine	hypotensive, violet 256 & white diagonal stripe			✓	✓	
Nitroprusside	hypotensive, violet 256 & white diagonal stripe		✓	✓	✓	
Noradrenaline	vasopressor, violet 256	Noradrenaline	✓	✓	✓	✓
Octreotide	B/W	Octreotide	✓		✓	✓
Oxycodone	narcotic, blue 297	Oxycodone	✓			
Oxytocin	B/W	Oxytocin				
Pancuronium	muscle relaxant, fluorescent red 811 or warm red	Pancuronium	✓			✓
Parenteral Nutrition	B/W	parenteral nutrition	✓	✓	✓	✓
Pethidine	narcotic, blue 297	pethidine				
Potassium chloride	high risk drug = red on white	potassium chloride	✓	✓	✓	✓
Propofol	induction agent, Yellow, Tall Man lettering	propOFol	✓	✓	✓	✓
Protamine	Black & white diagonal stripe		✓	✓	✓	✓
Rocuronium	muscle relaxant, fluorescent red 811 or warm red	Rocuronium	✓			✓
Salbutamol	B/W	Salbutamol	✓		✓	✓
Sodium chloride 0.9%	B/W	sodium chloride 0.9%			✓	✓
Suxamethonium	muscle relaxant, fluorescent red 811 or warm red. Background colour as bold reverse plate letters within a black bar on the upper half of the label.					✓

Thiopentone	induction agent. Yellow	Thiopentone			✓	✓
Tranexamic Acid	B/W	Tranexamic acid				
Urokinase	B/W	Urokinase	✓		✓	
Vasopressin	vasopressor, violet 256	Vasopressin	✓	✓	✓	✓
Vecuronium	muscle relaxant, fluorescent red 811 or warm red	Vecuronium	✓			✓
Maintenance fluid	No standard, warning label	MAINTENANCE	✓		✓	✓
Do Not Inject	No standard, warning label	DO NOT INJECT	✓	✓	✓	✓
Double Strength	No standard, warning label	DOUBLE STRENGTH	✓	✓		✓
Heparin Lock- do not use	No standard, warning label	HEPARIN LOCK – DO NOT USE			✓	✓

B/W = Black text on white background is used for drugs that fall into the miscellaneous category of the AS/NZS4375:1996 and ISO26825:2008 standards.

Appendix 8.2.1 : Evaluation Survey

BACKGROUND AND INTENT

Recently the ICU implemented a new range of PVC medicine line labels to identify continuous medication infusions. These labels are designed according to a new proposed 'standard'.

This evaluation (survey) will help to inform whether the national user applied labelling standard. Whilst we recognise adapting to change can be difficult, the benefits of standardising practice within and between health services are well recognised.

The following rules drawn from Australian and international standards:

- Full generic medication names; no abbreviations; no brand names; no medicine class names
- Colour coding, stripes and borders according to the ASNZ4375: 1996 and ISO26825:2008 which group medications according to class/action (i.e. opioids = blue)
- Text size as large as possible within a 6-7cm length of tape
- A plain sans serif font
- Black on white where no colour is specified in the standards
- For high risk medications, where no colour is specified in the standards, use red text on a white background
- Lower case lettering and applying Tall Man lettering according to National Standards

Warning labels with white text on black tape (double strength, do not inject) will be evaluated but do not form part of the Labelling Recommendations standardisation.

As clinical staff using these labels day-to-day, your opinion of the new range of labels is valuable. We wish to seek an understanding of how these work in practice.

This survey will take less than 10minutes to complete.

You will be asked to identify your hospital ICU. However, personal identifying information will not be sought.

After completion and data analysis, results from each site will be made available to you through the communication book.

The information obtained from the survey results from all sites will form the basis for a report to the Australian Commission on Safety and Quality in Health Care's Labelling Recommendations Reference Group. The information may also be used to promote standardisation to other health services.

CONSENT

Participation in any research is voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to withdraw from the project at a later stage. If you do consent to participate, you may withdraw at any time.

Your decision whether to take part or not, or to take part and then withdraw, will not affect any aspect of your care or your relationship with Barwon Health and only the researchers will know which residents have participated in the research.

By completing the online questionnaire I acknowledge that:

I have read and understood the attached Participant Information and Consent Form and freely agree to participate in this project according to the conditions outlined in the Participant Information and Consent Form.

I have the Participant Information and Consent Form to keep.

The researchers have agreed not to reveal my identity in any report, publication, or presentation.

QUESTIONS

Which hospital do you currently work at?

- Geelong Hospital
- Southern Health
- Tweed Hospital
- Royal Price Alfred Hospital

For each of the following statements, please tick the box which best describes your opinion;

Education given prior to the implementation of the pre-printed PVC line labels was sufficient

strongly agree Agree Neutral Disagree strongly disagree

The text on the labels is clearly legible.

strongly agree Agree Neutral Disagree strongly disagree

Please indicate if the text size is

too big too small about right

Use of generic medication name is appropriate.

strongly agree Agree Neutral Disagree strongly disagree

TALL Man lettering helps to differentiate look-alike medication names.

strongly agree Agree Neutral Disagree strongly disagree

Use of TALL Man lettering on medicine line labels is appropriate.

strongly agree Agree Neutral Disagree strongly disagree

The degree of adhesion of the labels is adequate when they are applied to lines.

strongly agree Agree Neutral Disagree strongly disagree

Labels were durable throughout use

strongly agree Agree Neutral Disagree strongly disagree

Have you been required to replace medicine line labels

Yes No

If yes, please explain why.

The dimensions of the labels are appropriate when they are applied to lines.

strongly agree Agree Neutral Disagree strongly disagree

If no, please indicate the preferred size

Use of colour coding labels assists line identification

strongly agree Agree Neutral Disagree strongly disagree

Colour coding labels according to drug class/action is acceptable

strongly Agree Neutral Disagree strongly
agree disagree

Where colour has been used, was it useful for identification

yes no undecided

If no, please state medicine name and reason why colour was not useful.

High risk medicines have red lettering on a white background to assist identification. Was this colour a useful in addition to the name of the medicine for identification

yes no undecided

If no, please state medicine name, explain why and suggest an alternative.

'Miscellaneous' medicines have black lettering on a white background. This is acceptable.

strongly Agree Neutral Disagree strongly
agree disagree

If no, please state medicine name, explain why and suggest an alternative.

The use of white text on black tape for warning labels (i.e. do not inject, maintenance) makes the warnings clearly identifiable from medicine line labels.

strongly Agree Neutral Disagree strongly
agree disagree

Please indicate if the time taken to label continuous medication infusion lines was

more than before less than before no change

If there was a time difference, what was the reason?

It is more convenient to have pre-printed labels compared with handwriting them

strongly Agree Neutral Disagree strongly
agree disagree

The range of labels available covers most of the medications administered by continuous infusion in ICU.

strongly Agree Neutral Disagree strongly
agree disagree

Did you need to handwrite a medicine label to identify the medicine in a line?

yes no

If so, for which medicine was a pre-printed label not available

For safest practice, medicine line labels should be placed on a line near the port on the patient side (not so close as to risk infection)

strongly Agree Neutral Disagree strongly
agree disagree

For safest practice, medicine line labels should be placed on the line closest to the pump

strongly Agree Neutral Disagree strongly
agree disagree

For safest practice, medicine line labels should be placed on the line both near the port and the pump

strongly Agree Neutral Disagree strongly
agree disagree

Any other comments about the new range of medicine line labels:

THANKS

Thank you for taking the time to complete this survey. Your opinion is valuable and your contribution appreciated.

After completion and data analysis, each site's result will be made available to you through the communication book.

The information obtained from the survey results from all sites will form the basis for a report to the Australian Commission on Safety and Quality in Health Care's Labelling Recommendations Reference Group. The information may also be used to promote standardisation to other health services.

Kind Regards, The research team.

If you require further information about this survey or the new 'standard' medicine line labels, please contact:

Appendix 8.2.2: Barwon Health post-trial evaluation survey

Thank you for your previous participation in evaluation of the pre-printed ICU medicine line labels

Because of the short timeframe between implementing the new labels and the previous survey (about 2 weeks), we were unable to determine if there were some real issues with the labels OR if some of the negative feedback was due to unfamiliarity with the new colours.

Now that the labels have been in place for some months, we want to repeat a brief survey to gain better understanding of the main issues.

The colours chosen for colour coding of medicine line labels are based on the 'anaesthetic standards' according to drug class/action.

Using colour coding according to drug class/action is acceptable

strongly agree Agree Disagree strongly disagree

The colours applied (e.g. violet = vasoactives, blue=opioids etc.) are acceptable

strongly agree Agree Disagree strongly disagree

Having multiple drugs in the same class the same colour (i.e. violet = dobutamine, milrinone & noradrenaline etc) is a source of confusion or risk.

strongly agree Agree Disagree strongly disagree

As I have become more familiar with the new labels and colours, the new range has become more acceptable.

strongly agree Agree Disagree strongly disagree

Where no specific colour is defined in the anaesthetic standard (=miscellaneous class), the default is black text on white tape.

Having multiple drugs in the miscellaneous category in black text on white tape is a source of confusion or risk.

strongly agree Agree Disagree strongly disagree

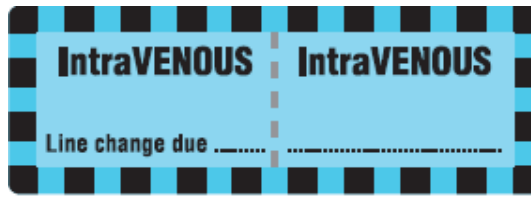
For high risk drugs where no colour is defined (i.e. potassium, insulin, heparin), red text on white tape has been chosen to further differentiate them from other tapes in the miscellaneous class.

Using red text on white tape for high risk drugs, where no colour has been defined by the standards, improves the ability to identify high risk drugs.

strongly agree Agree Disagree strongly disagree

Other hospitals have identified potential risk if there is mix-up between the common colours used in route line labels and medicine line labels.

Blue used for intravenous route lines labels and the blue for opioid medicine line labels



Red used for arterial route line labels and the red used for neuromuscular blockers medicine line labels



Yellow used for neural route line labels and yellow used for induction agent medicine line labels



In practice, these colour similarities between route line labels and medicine line labels contribute to confusion or risk

strongly agree

Agree

Disagree

strongly disagree

I think this because:

Again we thank you for your time. We really appreciate your input into the evaluation of these labels.

We would be pleased to hear any additional comments you may have about the medicine line labels.