

National inpatient medication chart 2014 national audit report

September 2015

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1. Executive summary

1.1 Overview

Medicine incidents continue to be the second most common type of incident reported in Australian hospitals. Medicine error studies in Australian hospitals report that prescribing errors occur at a rate of approximately five per patient, and that the error rate for medicines administered is 5–10%¹.

In 2004, Australian Health Ministers agreed to implement a standard inpatient medication chart in all Australian public hospitals to reduce harm to patients from medicine errors. The national inpatient medication chart (NIMC) was developed by the Commission, based on a Queensland Health medication chart.

The national audit of the NIMC was undertaken during 2014 and was based on data submitted to the Australian Commission on Safety and Quality in Health Care (the Commission).

The NIMC national audit, and opportunities it provides to improve the safety and quality of medicines management, align with the four priority areas of the Commission's Strategic Plan 2014–2019²:

- patient safety
- partnering with patients, consumers and communities
- quality, cost and value
- supporting health professionals to provide safe and high-quality care.

The safety features of the NIMC, and the associated audit criteria, are based on the need to ensure that medicines management is patient centred and that patients³:

- are provided with safe care, for example, through the use of recommended prescribing abbreviations, documented adverse drug reaction (ADR) history and accurate medication history
- receive the right care – the right medicine prescribed and administered in the correct dose and dose form, at the correct time and frequency, by the correct route
- are partners in their care, for example, they are involved in the medication history taking and medication reconciliation processes and receive medicines education.

Participation in the NIMC national audit, and review of the results, provides hospitals with evidence to assist verifying their services against accreditation requirements in the National Safety and Quality Health Service (NSQHS) Standard 4: Medication Safety⁴. This report identifies where specific audit results relate to the criteria in Standard 4, and/or to an indicator from the National QUM Indicators for Australian Hospitals⁵, as a means of linking the NIMC audit activity to the actions and suggested strategies relevant to accreditation.

As health services move from paper-based systems to electronic order entry and recording for medication management, a reduction in the error rate for many of the audit criteria can be expected. The benefits to be gained from electronic medication management (EMM) systems may translate to improvements that can be measured through the NIMC audit process (for example, documentation of medication history, prescription legibility, dose calculation). EMM has the potential to eliminate the risk of other errors (for example, duplicate prescribing and error-prone abbreviations).

As EMM systems rollout in health services, the national audit framework will need to evolve to remain relevant, useful and patient centred. Some adaptation will be required to detect the types of errors known to be associated with electronic systems and work practices. Hospitals are encouraged to use the results of the NIMC audit as a pre-implementation measure of safety and quality for comparison with post-implementation evaluation to demonstrate the benefits of EMM at a facility level.

The recommendations arising from the 2014 audit provide a basis for the Commission to establish direction for future work concerning the NIMC, NIMC audit and EMM that will continue to

support healthcare organisations in undertaking quality improvement activities that enhance the safety of medication-related care.

1.2 Background

The Commission is charged with maintaining version control of the NIMC and is advised on this responsibility by the Health Services Medication Expert Advisory Group.

An important part of ongoing NIMC maintenance is the use of quality improvement processes such as national auditing to evaluate use of the chart, to monitor compliance with its safety features and to assess the potential effect on reducing medicine error risk.

National audits of the NIMC have been conducted annually for the period 2009–2012, and every two years since. This audit report for 2014 presents aggregate results from public and private hospitals across eight jurisdictions, and includes historical data from 2010.

1.2.1 Aims

The NIMC national audit aims to:

- evaluate if NIMC safety features continue to benefit patient care
- identify if there are specific aspects of the NIMC or the audit process that might require modification
- identify if there are prescribing and medicine administration behaviours that could be improved
- identify other medication safety considerations for review with the Commission's Health Services Medication Expert Advisory Group.

For participating hospitals, the aim of the audit is to provide data that can support internal quality improvement strategies. Repeated involvement in audits enables hospitals to:

- measure trends in performance that will identify gaps in practice
- identify areas for improvement in prescribing and administration of medicines that may guide targeted education programs and other evidence-based interventions.

1.2.2 Audit framework

The Commission's *Guide to auditing the NIMC*⁶ provides a detailed rationale for each of the NIMC safety features, and guidance to assess compliance with each audit criterion.

The audit method and guidelines remain unchanged from 2012. When appropriate, the 2014 results are compared with data from NIMC national audits undertaken annually for 2010–2012.

1.2.3 Data quality

The results of the 2014 audit have been reported using an upgraded database system implemented by the Commission in 2013. As a consequence of this, the scope of reporting has broadened and changes have been applied where necessary to improve the consistency and comparability of results.

A data quality statement describing these changes in more detail can be found in Appendix 7.3, and is referenced in the applicable sections throughout this report.

1.3 Summary of NIMC 2014 national audit findings

Hospital participation in the NIMC national audit continues to grow, with data provided in 2014 representing a 26% increase over the previous audit. The 2014 audit captured data for 394 hospitals, 12 853 patients, and a total of 18 809 medication charts, representing a 35.5% increase in data available for analysis.

The 2014 audit demonstrates continued compliance with the NIMC safety features which reduce the opportunity for error and improve the quality and safety of patient care, and shows a small improvement in some audit criteria.

Sustained high levels of compliance (>85%) noted from the 2014 audit include:

- dose specified and correct
- route specified, clear and correct route
- correct dose calculations for paediatric medicine orders
- prescribing frequency matched to times of administration
- medicines of a similar class not prescribed (duplicated orders)
- orders signed by prescriber.

The results over the period of four audits from 2010 to 2014 suggest that the extent of improvement in many of the criteria has plateaued. None of the results show a substantial decline in compliance that would indicate an increased level of risk of medication error. However, areas of less than optimal performance have been identified, which can be addressed and targeted for further improvement.

Results are summarised in the following tables:

- Executive summary table 1 summarises audit results around compliance with NIMC safety features
- Executive summary table 2 summarises the trends in quality of prescribing and compliance with documentation
- Executive summary table 3: Minimum and maximum (hospital) results for selected quality and compliance criteria in 2014

Executive summary table 1: Compliance with NIMC safety features

Medicine error	Safety feature Alignment with NSQHS Standards	Areas requiring improvement in performance related to compliance with NIMC safety features
Patient wrongly identified and receives unintended medicine	Prompt for complete patient identification (ID) on top of page 3 and back page Prompt for prescriber to print name below computer generated ID label The requirement for complete patient ID aligns with NSQHS Standard 5: Patient ID and Procedure Matching Item 5.1, and Standard 4.5.2	<50% patients have complete ID documented
Dosing error due to lack of patient weight to inform decision	Prompt for patient weight	30% of all patients and 80% of paediatric patients had weight documented on the NIMC
Re-exposure of patients to a similar class of medicine previously causing an ADR	Prompt for details of medicines and description of ADR This safety feature aligns with NSQHS Standard 4 Medication Safety. Item 4.7	17% of patients had no documentation of previous ADR (medicine name and reaction or nil known) 11% of patients with one or more previous ADRs were re-prescribed a

Medicine error	Safety feature Alignment with NSQHS Standards	Areas requiring improvement in performance related to compliance with NIMC safety features
		similar class of medicine
Discontinuity of appropriate therapy, or inappropriate recommencement of previously ceased medicine	Addition of medication history section Medication history documentation aligns with NSQHS Standard 4 Medication Safety. Item 4.6, 4.8.1 and 4.12.1	Recording of patient medication history on MMP or equivalent remained low (37%) Medication history documented on MMP form – 33% of patients
Warfarin dose and duration errors	Designated section of chart prompts for indication and target international normalised ratio (INR). INR can be documented in dosing section This aligns with NSQHS Standard 4.9.1, 4.13 and 4.15 and Safety Outcome 1.15 in Australian Safety and Quality Goals for Health Care	55% of warfarin orders were not prescribed in warfarin section <60% of warfarin prescriptions in the warfarin section had an indication recorded – private facilities (35%) compared to public hospitals (63%) 29% of warfarin orders in the warfarin section were missing a documented target INR (compared with 88% of warfarin orders in the regular medications section) 82% of patients prescribed warfarin had no record of receiving warfarin education
Ambiguous trade names	Prompt for generic names This aligns with NSQHS Standard 4.5.2	20% of medicines were prescribed using trade names The result should be interpreted with caution as the list of approved combination and trade names may differ between facilities and hospital sector
Non-sustained release dosage form administered or SR dosage form inadvertently crushed	Prompt for tick if slow release medicine Explanation in centre of chart for nurses not to crush SR forms of medicines	40% of orders for sustained release products did not have the SR box completed
Lack of, or unclear, dosing instructions	Designated dose and frequency section. Prompt for prescriber to enter dosing times as well as frequency for regular medicines Recommended administration times included on medication chart This aligns with NSQHS Standard 4.5.2, 4.9.1 and 4.11.2	23% of orders were unclear for medicine name, route, dose or frequency 22% of orders for intermittent dosing administration were not blocked correctly 20% of orders used error-prone abbreviations 62% of orders not ceased correctly or clearly 38% of paediatric doses had the

Medicine error	Safety feature Alignment with NSQHS Standards	Areas requiring improvement in performance related to compliance with NIMC safety features
		calculation documented on the chart. (Note that some paediatric medicines do not require a dose calculation) Of the paediatric orders with dose calculation 93% of doses were correctly calculated
PRN medicine dosing errors	Forcing function to enter minimum number of hours between doses (hourly frequency) and maximum dose within 24 hours	29% of PRN orders had a missing, incorrect and/or unclear dose frequency 58% of PRN orders did not have a maximum dose in 24 hours recorded
Medicine or dose prescribed, dispensed or administered inconsistent with indication	Prompt for medicine indication added to regular and PRN orders	<25% of medicine orders (excluding stat only) had the indication documented
Inability to clarify error with prescriber	Prompt for prescriber to print name and enter contact details	Prescriber name was unclear in 28% of orders
Omission of dosing or duplicate dosing	Recommended administration times included on medication chart Designated area to sign when each dose is administered This aligns with NSQHS Standard 4.5.2 and 4.9.1	9% of orders with doses assumed omitted or administration not signed

Executive summary table 2: Trends in audit results for quality of prescribing and compliance with documentation (2010–2014)

Criteria for prescribing errors	Audit results (% of medicine orders)			
	2010 N=30 005 orders	2011 N=39 271 orders	2012 N=110 690 orders	2014 N=149 432 orders
Unclear orders for medicine name, route, dose and frequency	30.1	18.6	23.9	22.8
Unclear medicine names prescribed	4.0	3.3	3.6	3.0
Route errors (missing, unclear, incorrect)	10.3	8.5	11.0	10.4
Dose errors (missing, unclear, incorrect)	14.2	9.7	11.8	11.6
Sustained release dosage form identified	61.3	54	57.6	59.9
Frequency errors (missing, unclear, incorrect)	19.6	10.9	13.3	12.4
Error prone abbreviations used	24.6	16.9	19.7	19.6
PRN orders with max dose documented	42.5	26.8	35.5	41.5
Indication documented	20.2	11.3	17.8	21.8
Orders ceased correctly	49.5	35.3	36.0	38.0
Criteria for compliance with documentation requirements	Audit results (%)			
	2010	2011	2012	2014
Patients with complete patient identification	32.8	47.6	45.6	46.1
Patients with weight recorded on NIMC	24.4	24.0	24.4	30.0
Patients with ADR history documented	77.3	77.9	78.5	83.0
Patients with medication history documented on NIMC or MMP	33.8	27.0	31.6	36.5
% warfarin orders prescribed in warfarin section	63.1	34.7	48.7	45.0
% warfarin orders with indication documented (warfarin section)	70.0	43.2	58.4	56.6
% warfarin orders in warfarin section with target INR documented	96.0	n/a	70.2	71.1
% warfarin orders in warfarin section with target INR documented (regular)	9.8	10.7	16.4	11.5
Patients prescribed warfarin who have provision of education	12.6	14.6	14.5	18.3
Patients with pharmaceutical review documented on NIMC	38.3	34.3	38.2	45.9
% of orders with doses assumed omitted or administration not signed	11.0	9.3	9.9	9.4

Executive summary table 3: Minimum and maximum (hospital) results for selected quality and compliance criteria in 2014

Criteria for prescribing errors	Minimum {(total number of medicine orders audited)} – Maximum{%(total number of medicine orders audited)}*
Unclear medicine name	0 (371 medicine orders) – 27.8 (128 medicine orders)
Trade name used	0 (639 medicine orders) – 100 (93 medicine orders)
Missing route	0 (632 medicine orders) – 20 (490 medicine orders)
Unclear route	0 (632 medicine orders) – 59.1 (318 medicine orders)
Missing dose	0 (701 medicine orders) – 12.9 (233 medicine orders)
Incorrect dose	0 (3308 medicine orders) – 30.2 (126 medicine orders)
Missing frequency	0 (454 medicine orders) – 16.3 (135 medicine orders)
Unclear frequency	0 (344 medicine orders) – 54.3 (243 medicine orders)
Incorrect frequency	0 (2881 medicine orders) – 42.1 (202 medicine orders)
PRN orders with max dose documented	0 (89 medicine orders) – 100 (139 medicine orders)
Indication documented	0(258 medicine orders) – 100(422 medicine orders)
Orders ceased correctly	0 (150 medicine orders) – 100(81 medicine orders)-
Criteria for compliance with documentation requirements	Minimum {%(N)} – Maximum {%(N)}
Patients with complete patient identification	0 (71 patients) – 100 (44 patients)
Patients with weight recorded on NIMC	0 (32 patients) – 100 (41 patients)
Patients with ADR history documented	26 (50 patients) – 100 (60 patients)
Patients with medication history documented on NIMC or MMP	0 (107 patients)- 100 (33 patients)
Patients prescribed warfarin who have provision of education recorded	0 (11 patients) – 100 (6 patients)
Patients with pharmaceutical review documented on NIMC	0 (45 patients)– 100 (42 patients)
% of doses required where dose administration is omitted or not signed for	0 (258 medicine orders)– 80.9 (89 medicine orders)

*Medicine order types included in the denominator may vary between criteria

1.4 Recommendations

The 2014 audit has provided an opportunity to review the areas of the NIMC and the audit process that would benefit from further work to ensure continuing adherence to the aims of improving the quality and safety of medication management.

The recommendations focus on activities that are aligned with the Commission's operational work plan and are consistent with its strategic priorities.

Recommendation 1

Encourage development of local action plans to address areas of sub-optimal performance.

Recommendation 2

2.1 Undertake a detailed review of the NIMC audit form, User Guide and database reporting system to address anomalies identified with the NIMC and data recording.

2.2 Update the educational resources that are used to support the audit.

Recommendation 3

In conjunction with recommendation 2.1, seek feedback from participating sites about how the audit results are interpreted and used, what actions are taken, and improvements that may be made to the NIMC audit to provide further benefits to facilities from involvement in future audits.

Recommendation 4

Consider whether thresholds or targets for improvement in compliance with the NIMC safety features could be developed at facility or health service level to augment local review of audit results and guide quality improvement activities.

Recommendation 5

Examine the requirements for developing a national audit tool that is applicable to EMM systems.

1.5 Conclusion

Hospital participation in the NIMC national audit continues to increase, with data provided in 2014 representing a 26% increase over the previous audit, and a 35.5% increase in patient charts and medicine orders reviewed. The additional data available for analysis have consolidated the consistency and comparability of the audit results.

The Commission acknowledges that there are limitations associated with the audit, and that local or statewide initiatives and variances can influence the results. In addition, if national audits are to remain relevant, patient centred and based on an evaluation framework that accurately reflects work practices and environments into the future, EMM will need to be considered.

The information gained from the 2014 audit remains constructive and relevant to guide practice improvement. It provides a basis for the Commission to establish strategies and priorities for future work in supporting healthcare providers to further reduce the incidence of preventable adverse medicine events (AMEs).

2. Background to the NIMC

Evidence-based strategies to reduce the risk of error in prescribing and administration of medicines are focussed on standardisation of processes, terminology, documentation, dosing protocols and risk assessment tools⁷.

In 2004, Australian Health Ministers agreed to implement a standard inpatient medication chart in all Australian public hospitals to reduce harm to patients from medicine errors.

An initial pilot of the standard inpatient medication chart in 31 sites in 2006, and analysis of 22 matched sites' data, showed a significant reduction in prescribing errors and reduced risks of subsequent adverse medication events (AMEs)⁸.

The NIMC (Appendix 1) was implemented across public hospitals in all jurisdictions and many private hospitals during 2006 and 2007. Use of the NIMC is a required under NSQHS Standard 4: Medication Safety⁴.

The Commission maintains national version control of the NIMC, and is advised on this responsibility by an expert, representative group; the Health Services Medication Expert Advisory Group.

An important part of NIMC maintenance is the use of quality improvement processes such as national auditing to evaluate use of the chart, monitor compliance with its safety features and to assess the potential effect on reducing medicine error risk.

National audits of the NIMC were conducted annually for the period 2009–2012, and are now done every two years. This audit report for 2014 includes historical data from 2010 onwards.

The NIMC national audit aims to:

- evaluate if NIMC safety features continue to benefit patient care
- identify if there are specific aspects of the NIMC or the audit process that might require modification
- identify if there are prescribing and medicine administration behaviours that could be improved
- identify other medication safety considerations for the Commission's Health Services Medication Expert Advisory Group.

The Commission's Guide to Auditing the NIMC⁶ provides a detailed rationale for each of the NIMC safety features, and guidance to assess compliance with each audit criterion.

For participating hospitals the aim of the audit is to provide data that can support internal quality improvement strategies. Repeated involvement in audits enables hospitals to measure trends in performance that will identify gaps in practice, and areas for improvement in prescribing and administration of medicines.

3. Audit framework

The audit results provide a snapshot of in-hospital prescribing for admitted patients and use of the NIMC to evaluate the current level of compliance with NIMC safety features. The clinical appropriateness of medicine, route, dose and frequency and patient outcomes were not examined.

3.1 Audit process

The study involved a prospective chart audit of prescribing and administering documentation. The NIMC audit form (Appendix 7.2) and Guide to auditing the NIMC⁶ were support materials used to guide auditors.

Types of charts audited were:

- NIMC (acute) and private hospital version
- NIMC (long stay)
- NIMC (paediatric)
- NIMC (paediatric long stay).

Dedicated medication charts for anticoagulation, continuous infusions, insulin, chemotherapy, acute and chronic parenteral analgesia, clozapine and discharge prescribing, and electronically generated charts were excluded from the audit.

All hospitals (public and private) were invited to participate in the audit through the Commission's Health Service Medication Expert Advisory Group jurisdictional and private hospital contacts. Participation in the audit was voluntary. Sites were recruited on the basis that they used the national standard NIMC and were authorised to share their data. Jurisdictional heads provided written approval for public hospitals to provide NIMC hospital-level data to the Commission.

All participating hospitals across states and territories, including private hospitals, undertook the audit from 1 August to 30 September 2014.

The Guide to auditing the NIMC⁶ provided guidance for auditors. It was recommended that audit teams consist of a registered nurse and a pharmacist if available, otherwise a medical officer or another nurse. Inter-rater reliability was not assessed. However both auditors had to reach consensus about errors. It was recommended that a third auditor be involved if any disagreement occurred.

Hospitals were encouraged to audit all NIMC charts. If that was not feasible, a sampling method for the number of current medication charts to audit was recommended (see the following table).

Table 1: Suggested hospital audit sample size

Number of adult beds in hospital	Sample size
150 or more	20% of current patients
30–149	30 current patients
Less than 30	All current patients

All available NIMCs on the selected wards were audited to identify and document prescribing errors using established definitions^{6,9}. All medicine orders on active NIMCs were reviewed, including those cancelled or previously changed.

Where sampling is used, the selection of clinical units within each hospital may introduce factors that can influence audit results, including variation in the complexity and volume of prescribing. These factors are not taken into account in this report.

3.2 Analysis of data

Where appropriate, the 2014 results are compared with data from NIMC national audits undertaken annually for 2010–2012. It must be noted that the sites in each of the audits to date are unmatched, and a number of audit definitions have been amended since the 2006 post-implementation pilot audit.

3.3 Data quality

The results of the 2014 audit were generated from an upgraded reporting system. Changes were applied to calculations where necessary to improve the consistency and comparability of results.

A data quality statement describing the changes can be found in Appendix 7.3, and is referenced in the applicable sections throughout this report.

4. Results of 2014 NIMC audit

National aggregate results from the 2014 NIMC audit are presented in relation to individual NIMC safety features, highlighting results that demonstrate improvement as well as areas where past improvement has not been maintained. The results are compared with those from the 2010–2012 national audits.

4.1 Set up

4.1.1 Participation

Three hundred and ninety four hospitals from all states and territories participated in the 2014 audit. This represents an increased participation rate at approximately 38% of hospitals nationally (excluding private free-standing day hospitals)¹⁰.

The breakdown of hospital participation by peer grouping is provided in the following table, based on the Australian Institute of Health and Welfare (AIHW) hospital classification in use from 1999 to 2013^{11,12}, and this is replicated in the NIMC audit system. (Refer Appendix 7.3 Data quality statement). The Commission acknowledges that the AIHW peer group classification was changed in 2012/13 to categorise hospitals according to the type and nature of services provided, rather than specialisation, separations or geographic location¹⁰. However, to allow comparison for the purpose of this report, the classification used for previous audits has been retained for the 2014 audit.

Table 2: Hospital participation by peer group

Peer group	Number of hospitals (percentage of total)			
	2010	2011	2012	2014
Large major cities	3 (4.3)	5 (3.5)	11 (3.5)	13 (3.3)
Large regional and remote	3 (4.3)	5 (3.5)	11 (3.5)	15 (3.8)
Medium (group 1)	5 (7.2)	6 (4.2)	15 (4.8)	20 (5.1)
Medium (group 2)	5 (7.2)	10 (6.9)	21 (6.7)	33 (8.4)
Multi-purpose services (MPS)	10 (14.5)	14 (9.7)	17 (5.4)	20 (5.1)
Other non-acute	0 (0)	0 (0)	3 (1)	5 (1.3)
Principal referral	14 (20.3)	11 (7.6)	41 (13.1)	49 (12.4)
Private hospital	2 (2.9)	39 (27.1)	72 (23.1)	85 (21.6)
Psychiatric	1 (1.4)	2 (1.4)	4 (1.3)	6 (1.5)
Rehabilitation	1 (1.4)	1 (0.7)	1 (0.3)	4 (1)
Small non-acute	6 (8.7)	15 (10.4)	26 (8.3)	35 (8.9)
Small regional acute	5 (7.2)	13 (9)	34 (10.9)	46 (11.7)
Small remote acute	7 (10.1)	6 (4.2)	26 (8.3)	22 (5.6)
Specialist Women's and Children's	3 (4.3)	5 (3.5)	6 (1.9)	11 (2.8)
Un-peered and other	4 (5.8)	12 (8.3)	24 (7.7)	30 (7.6)
TOTAL	69	144	312	394

4.1.2 Data used for aggregate analysis

A summary of data for the number of patients, medication charts and orders is provided in Table 3 below. The NIMC reporting system now also includes functionality to allow reporting against the separate types of medication charts (acute, paediatric and long stay). (Refer Appendix 7.3: Data quality statement).

Table 3: Number of hospitals, patients, medication charts and orders per audit

Audit year	2010 No (%)	2011 No (%)	2012 No (%)	2014 No (%)
Total hospitals	69	144	312	394
Jurisdictions participating	7	7	8	8
Public hospitals	67 (97.1)	106 (73.6)	241 (77.2)	309 (78.4)
Private hospitals	2 (2.9)	38 (26.4)	71 (22.8)	85 (21.6)
Total patients	2591	3760	9689	12853
Public patients	2531 (97.7)	2593 (69)	7455 (76.9)	9978 (77.6)
Private patients	60 (2.3)	1167 (31)	2234 (23.1)	2875 (22.4)
Total medication charts audited	3720	5195	13 881	18 809
NIMC Acute	2615 (70.3)	4044 (77.8)	10 895 (78.5)	13 908 (73.9)
NIMC Long Stay	780 (21)	898 (17.3)	2283 (16.4)	3825 (20.3)
NIMC Paediatric	263 (7.1)	208 (4)	647 (4.7)	938 (5)
NIMC Paediatric Long stay	62 (1.7)	45 (0.9)	56 (0.4)	138 (0.7)
Medicine orders	30 005	39 271	110 690	149 432
Regular orders	18 252 (60.8)	24 328 (61.9)	67 918 (61.3)	92 794 (62.1)
PRN orders	6298 (21)	8908 (22.7)	24 272 (21.9)	33 107 (22.2)
Stat only orders	5194 (17.3)	5684 (14.5)	17 403 (15.7)	22 201 (14.9)
Warfarin orders	140 (0.5)	183 (0.5)	557 (0.5)	640 (0.4)
Variable dose orders	121 (0.4)	168 (0.4)	540 (0.5)	690 (0.5)

4.2 Demographics

4.2.1 Patients and medication charts

The 2014 audit captured data for 12 853 patients, and a total of 18 809 medication charts, representing a 35.5% increase in data available for analysis. 149 432 medicine orders were reviewed, with an average of 7.2 regular medicine orders per patient (see the following table).

Table 4a: 2014 audit demographics

	Patients	Charts	Charts per patient	Medicine orders	Regular medicine orders	Regular medicine orders per patient
Public hospitals	9978	14,857	1.5	115 920	72 440	7.3
Private hospitals	2875	3952	1.4	33 512	20 354	7.1
All hospitals	12 853	18 809	1.5	149 432	92 794	7.2

4.2.2 Medicine orders

2014 audit result (Figure 1, Table 4b)

- Prescription of regular medicine accounts for 62.1% of orders reviewed
- PRN orders (medicines to be used as needed) are the next most frequently prescribed type (22.2%)
- Variable dose and warfarin orders each accounted for less than 1% of all orders
- The relative proportion of each medicine order type is similar between public and private hospitals, and is consistent when compared to 2011 and 2012 audits
- The proportion of all medicine orders between public and private hospitals is 77.6% and 22.4% respectively

Figure 1: Type of medicine order

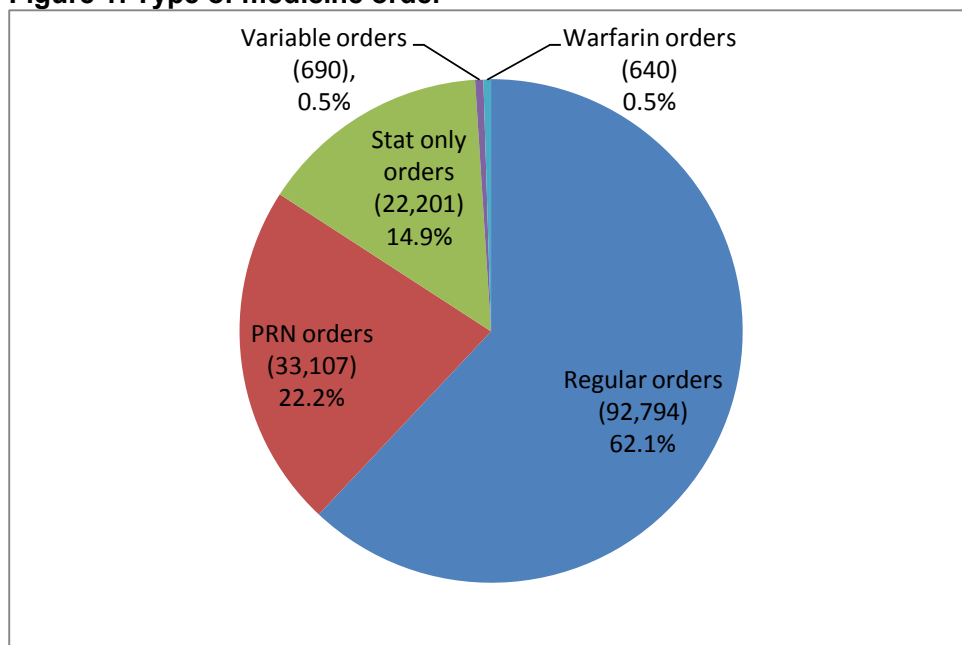


Table 4b: Medicine order type by hospital sector (2014)

Order types	Public hospitals		Private hospitals		All hospitals	
	N	%	N	%	N	%
Variable	510	0.4	180	0.5	690	0.5
Stat	17 245	14.9	4956	14.8	22 201	14.9
Warfarin	489	0.4	151	0.5	640	0.4
Regular	72 440	62.5	20 354	60.7	92 794	62.1
PRN	25 236	21.8	7871	23.5	33 107	22.2
Total	115 920		33 512		149 432	

4.3 Quality of use of the NIMC safety features

4.3.1 Patient identification, weight and ADR documentation

Results for **patient identification**, **weight** and **ADR documentation** are comparable to previous audits. There is a slight improvement in performance related to documentation of patient weight and previous ADRs (Figure 2.1). Results for private hospitals demonstrate a greater degree of the required documentation for patient identification and weight (Figure 2.2). However there remains significant potential to achieve a higher level of compliance for these features of the NIMC across both the private and public sectors.

Figure 2.1: Patient identification and ADR documentation (2010–2014 comparison)

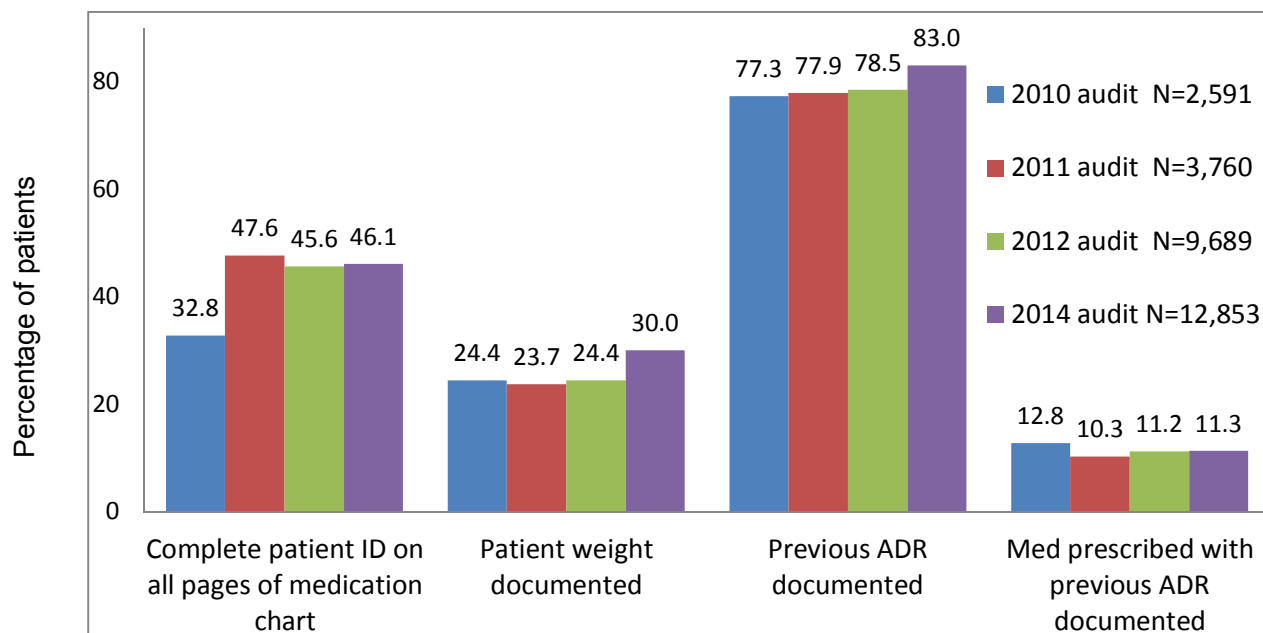
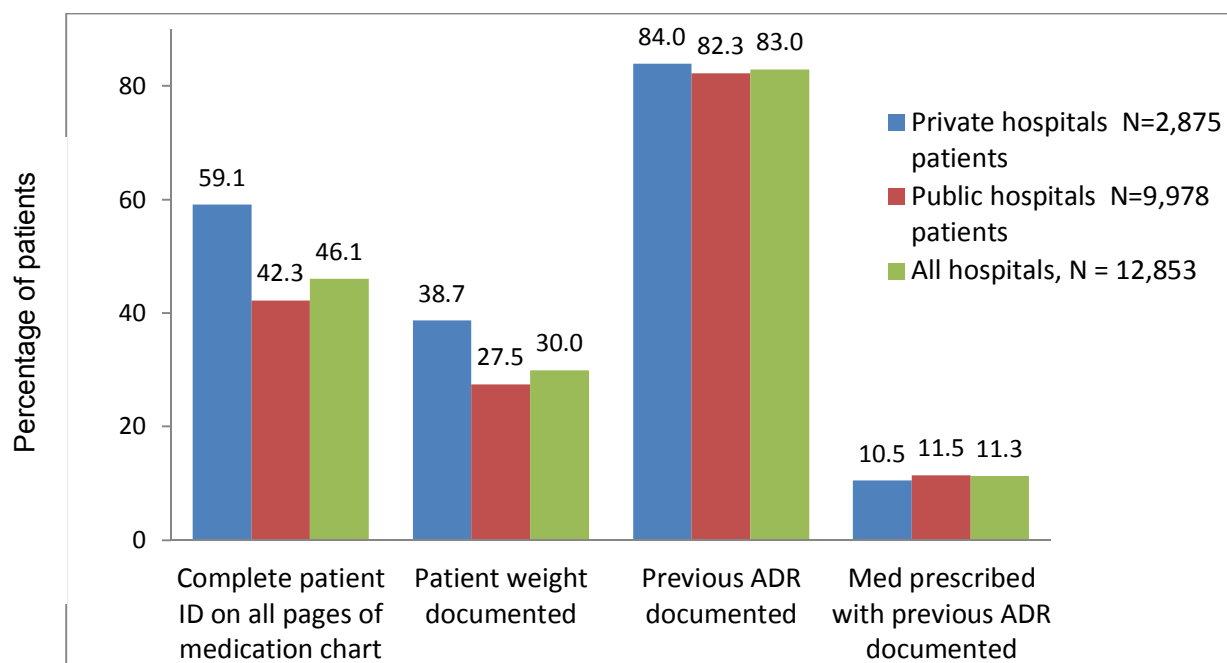


Figure 2.2: Patient identification and ADR documentation by hospital sector (2014)



Patient identification

Audit requirements for complete patient identification are unique record number (URN), patient name, patient address and date of birth on pages 3 and 4 of the NIMC.

Patient identification can be documented by handwriting the patient details onto the NIMC or affixing a printed label (patient addressograph sticker). The first prescriber to use the chart must confirm that it is the correct addressograph by handwriting the patient's name under the addressograph.

This information relates to NSQHS Standard 4.5.2 and NSQHS Standard 5.1

2014 audit result:

- 54% of all charts showed **incomplete** patient identification.
- In private facilities, 59% of patients had **complete** identification on all charts compared with 42% in public hospitals.

Analysis:

- There has been improvement over several years compared with 67% of charts with incomplete identification in 2010.
- Patient identification is a critical safety issue in reducing the risk of medication error related to patients receiving unintended medication, and is an area that can be targeted for improvement.

Patient weight

Weight is to be recorded on at least one medication chart for NIMC (acute) and NIMC (long-stay) and on each chart for NIMC (paediatric) and NIMC (paediatric long-stay).

Weight is essential information for dosing many medicines correctly, and is critical for safe prescribing, particularly in paediatrics. Patient weight must be recorded on all paediatric medication charts. Weight may have been recorded in other parts of the patient record, however this was not considered compliant for the purpose of this audit.

2014 audit result:

- 30% of all patients had a weight recorded on the NIMC.
- Separate analysis of paediatric charts shows that the proportion of patients with a weight documented on the NIMC is much higher at 80%.

Table 5: Paediatric patient weight documented on current NIMC (paediatric) (2010–2014)

Year	2010	2011	2012	2014
Paediatric patients total	263	200	620	911
Weight documented	207	149	499	730
% paediatric patients with weight documented on chart	78.7	74.5	80.5	80.1

Analysis: documentation of patient weight shows a trend of small improvement, and substantial compliance on paediatric charts, but remains well below an optimum level.

ADR documentation

Complete ADR documentation requires nil known, unknown or ADR with medicine name(s) and reaction documented, and a clinician's signature. The criteria used for assessing completeness of ADR documentation may influence these results. ADR documentation could be assessed by auditors as incomplete, for example, when the medicine and a reaction were recorded on the chart but the date of the reaction was missing. In some hospitals, separate allergy alert forms are used to document ADR history; however, this does not negate the need for ADR history information to be recorded on the NIMC.

This information relates to:

- NSQHS Standard 4.7.1 and 4.7.2
- National QUM Indicator 3.2.

2014 audit result:

- 83% of all patients had a complete ADR history documented on the NIMC.
- 11.3% of patients were prescribed a similar class of medicine to which they had previously experienced an ADR.

- Public hospitals reported more occasions of re-prescribing than private facilities (11.5% and 10.5% respectively).

Analysis:

- 2014 audit results reflect widespread use of documentation of ADR history on the NIMC safety feature and its importance for healthcare staff when prescribing, dispensing and administering medicines to reduce the risk of avoidable ADRs.
- There is no change is evident in the rate of re-prescribing, with an increased incidence of this error occurring in private hospitals (2012 – 5%; 2014 – 10.5%).

4.3.2 Medication history documentation

The audit requirements are that patient medication before admission is recorded on at least one medication chart that is currently in use, or on a Medication Management Plan (MMP) form or equivalent, and that is cross-referenced on the NIMC.

The use of a standardised MMP form provides a structure for obtaining a comprehensive medication history. The MMP form includes features which help identify and capture medication management problems for complex patients taking multiple medicines.

Documenting the medication history on the NIMC may be adequate for short-stay, medically stable patients with minimal medicine requirements.

Documentation of a complete and accurate list of a patient's current medicines upon admission, and reconciliation of this information with the medical officer's plan on admission, transfer and/or discharge orders, have been shown to reduce medicine errors and adverse events at transitions of care. Examples include the discontinuation of necessary therapy or inappropriate recommencement of previously ceased medication.

This information relates to:

- NSQHS Standard 4.6.1, 4.6.2, 4.8.1, 4.12.1
- National QUM Indicator 3.1

2014 audit result:

- Documented medication history (on NIMC or MMP form) was accessible for 36.5% of patients.
- 32.7% of patients had a completed MMP form in the end of bed folder.
- Medication reconciliation was documented as having been completed for 62.3% of patients with an MMP form; however this translates overall to only 20.4% of all patients having medication reconciliation occur during their admission.
- Use of the MMP form demonstrated higher compliance with recording of ADR history (88%) than the NIMC (83%).
- 52.4% of patients with a completed MMP form had the doctor's plan on admission recorded on the form.
- The activity of documenting medication history varied between public (34.5%) and private (43.7%) patients.
- Availability of a completed MMP form in the end of bed folder also differed (35.3% public patients compared to 24% for private hospital patients)

Analysis:

- Medication history continues to be infrequently documented on the medication chart or the MMP form (36.5% of patients), but nevertheless shows a small increase over previous audits. A summary and comparison of results for 2010–2014 audits is provided in the following table.
- Notable improvements for this audit criterion were demonstrated in the availability of the MMP form in the end of bed folder (16% in 2012 compared to 32.7% in 2014), and in the use of the MMP form and documentation of medication reconciliation in private hospitals (3.2% 2012 to 24% 2014). A major influence on this change is attributed to the

implementation of NSQHS Standard 4: Medication Safety⁴ which was introduced in January 2013 (after the last national audit).

- Medication reconciliation is an action item for the documentation of patient information within the NSQHS Standard 4: Medication Safety, and will be a continuing focus for health service organisations accrediting their services to the NSQHS Standards.

Resources and tools to assist health services to undertake quality improvement activities in medication reconciliation can be found on the Commission's web site: www.safetyandquality.gov.au/our-work/medication-safety/medication-reconciliation/

The proposed model for a national electronic medical record system (*PCEHR / myHealth Record*) that incorporates patients' medication and ADR history may assist health services to comply with the NSQHS Standard for a medication history to be documented. Potential benefits are the timely availability of information to inform accurate documentation of medication history on admission to hospital, facilitate medication reconciliation and reduce medication errors at transitions of care. The Commission's work to date in this area can be found on the web site at www.safetyandquality.gov.au/our-work/safety-in-e-health/.

Table 6: Medication history documentation (2010–2014 comparison)

Criterion	2010	2011	2012	2014
Patients for whom clinicians can access medication history either on NIMC or MMP. Note that the MMP was made available nationally in 2010. Medication history, including 'nil regular medicines', on current medication chart	33.8%	27% Public: 25.2% Private: 30.9%	31.6% Public: 34.4% Private: 22.1%	36.5% Public: 34.5% Private: 43.7%
Patients with a MMP in 'end of bed' folder ¹	18.8%	11.0% Public: 12.8% Private: 7.0%	16.6% Public: 20.6% Private: 3.2%	32.7% Public: 35.3% Private: 24.0%
MMP forms with complete ADR documentation	87.1%	87.9% Public: 87.3% Private: 90.4%	87.1% Public: 87.2% Private: 84.7%	88.1% Public: 89.0% Private: 83.7%
Medicines on the MMP with Dr's plan on admission documented	63.1%	56.9%	53.6% Public: 51.9% Private: 85.9%	52.4% Public: 51.4% Private: 57.9%
Medicines documented on the MMP with Reconcile column ticked	56.1%	65.9%	62.6% Public: 64.8% Private: 20.6%	62.3% Public: 65.0% Private: 46.2%

¹refer to Appendix 7.3: Data Quality Statement

4.3.3 Warfarin prescribing and documentation, and venous thromboembolism prophylaxis

Warfarin prescribing and documentation

The audit assessed use of the warfarin section that contains four elements for safe prescribing: a specific area designated for warfarin prescribing, target INR, indication, and provision of patient education. Warfarin prescribing in the regular medicine orders section of the chart is also recorded. Total warfarin orders equates to warfarin orders prescribed in the warfarin and regular sections of the NIMC acute (public and private versions).

(Refer to Appendix 7.3: Data Quality Statement for an explanation of changes to reporting and terminology related to warfarin data).

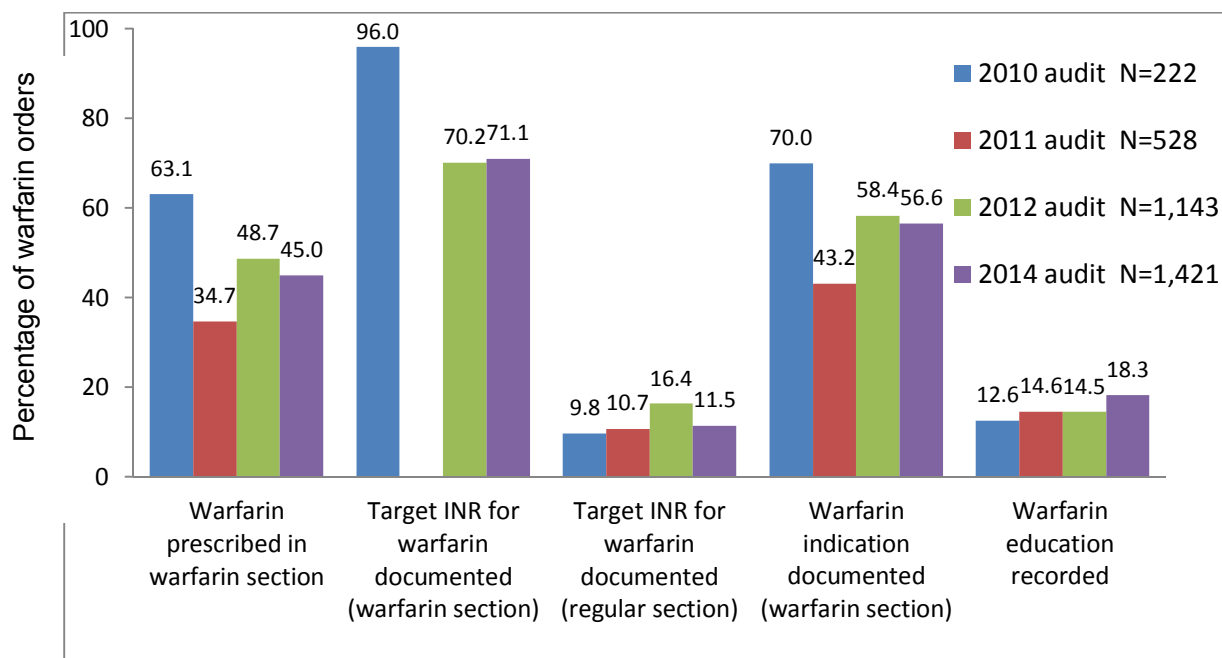
This information relates to:

- NSQHS Standard 4.9.1, 4.13.1, 4.13.2, 4.15.1
- National QUM Indicator 5.4.

2014 audit result (see Figure 3.1):

- 45% of warfarin orders were prescribed using the specific warfarin section of the NIMC.
- 71% of patients had a target INR documented when the designated warfarin section was used for prescribing, compared to only 11.5% when warfarin was ordered in the regular medicines section of the NIMC.
- Indication was recorded for 56.6% of warfarin orders prescribed in the warfarin section.
- Provision of patient education on warfarin was recorded for 18.3% of patients.
- The availability of warfarin guidelines at the end of the patient's bed or with the NIMC occurred for 44.1% of patients prescribed warfarin.

Figure 3.1: Warfarin prescribing (2010–2014 comparison)



Analysis:

- The 2014 audit results remain at levels similar to 2012.
- There was a small increase in documented provision of warfarin education, but a 4% reduction in warfarin prescribed in the designated section of the NIMC.

- Overall, performance against the criteria for warfarin prescribing is well below a satisfactory achievement given the known risks associated with anticoagulation and low margin for error.
- With more than 50% of warfarin orders not being written in the warfarin section of the chart, there is considerable scope for improvement.
- Note: the results do not exclude data from jurisdiction(s) where alternatives to the NIMC are used for prescribing of warfarin.

The benefits of using the warfarin section of the NIMC are clear from the results for documentation of **target INR**. A target INR was documented for 71.1% of warfarin orders prescribed in the warfarin section, compared to 11.5% for orders prescribed in the regular medicine section of the chart. Documentation of indication informs the target INR and subsequent dosing decisions, and reduces the risk of under or over-anticoagulation.

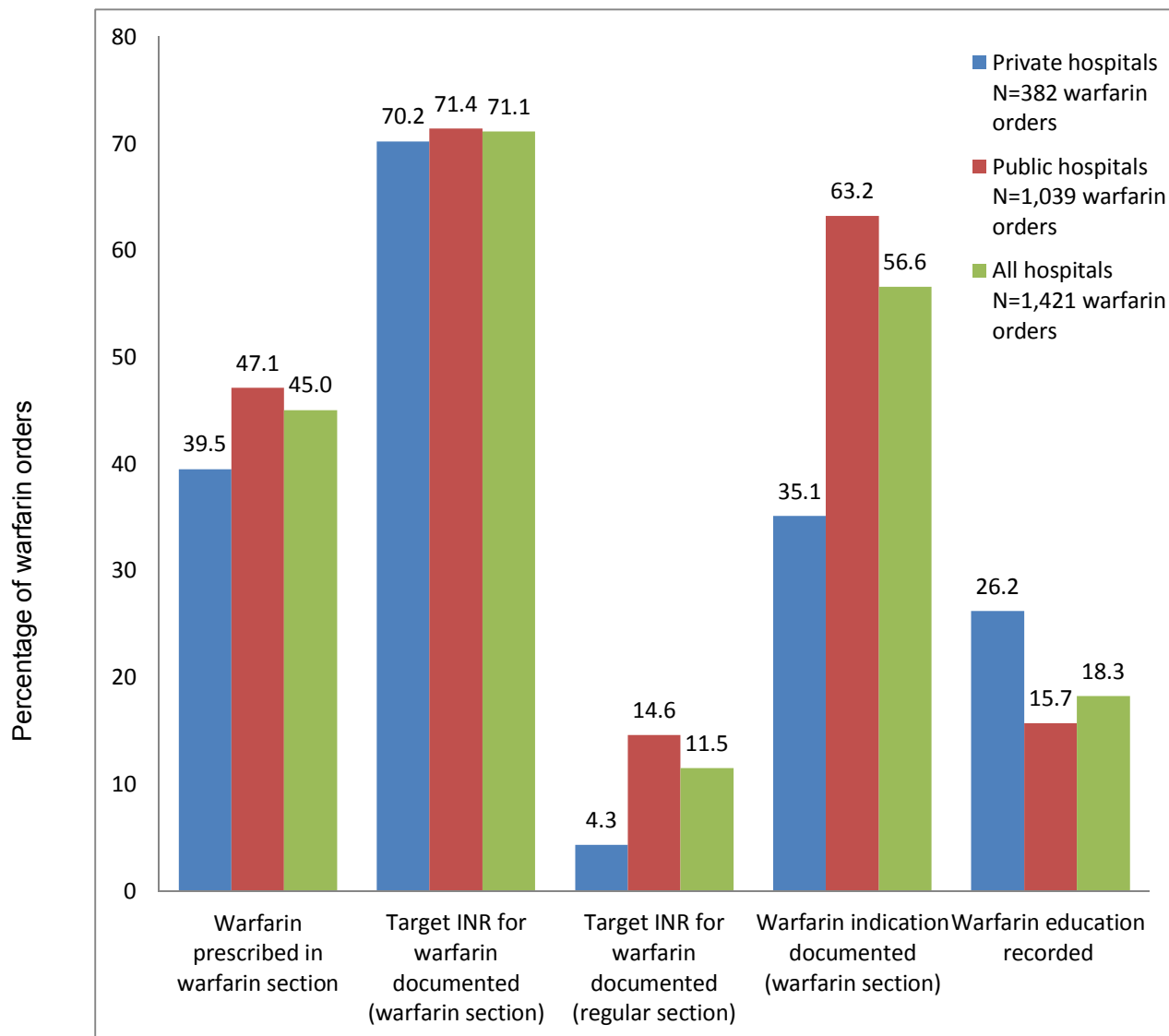
Documentation of **patient warfarin education** remains at levels similar to previous audits. Continued low rates may reflect the focus of education being on patients who are initiated on warfarin therapy in the inpatient setting, as many long term warfarin patients may not need, or may decline, further education. Future audits may benefit from differentiating between patients recently commenced on warfarin and those whose anticoagulation is stable and are well informed about warfarin therapy¹⁹.

Availability of warfarin guidelines at the end of the patient's bed or with the NIMC occurred for 44% of patients prescribed warfarin (2012: 35.7%). Increased compliance with this criterion would be expected to assist with improving use of the warfarin section of the NIMC, due to prompts and information being more readily available at the point of prescribing¹⁹.

Differences between the results for public and private facilities are noted for two criteria

	Public	Private
Prescribing in warfarin section	2011: 39.5%	2011: 26.6%
	2012: 52.5%	2012: 37.7%
	2014: 47.1%	2014: 39.5%
Warfarin indication documented	2011: 53.9%	2011: 17.0%
	2012: 64.2%	2012: 34.6%
	2014: 63.2%	2014: 35.1%

Figure 3.2: Warfarin prescribing by hospital sector (2014)



Venous thromboembolism prophylaxis

The NIMC version that includes a specific Venous thromboembolism (VTE) prophylaxis section was developed in 2010 as a result of acknowledged gaps between clinical evidence and current practice. Evidence suggests that point-of-prescribing prompts increase the rate of VTE risk assessment and prophylaxis prescribing¹³. Following successful pilot studies in 2010 and 2012, the amended chart was made available to all hospitals in 2013.

The VTE prophylaxis section in the NIMC is intended to prompt prescribers to assess all adult patients for risk of VTE on admission and prescribe appropriate VTE prophylaxis. It should be used in conjunction with the hospital's approved VTE risk assessment and prophylaxis policies, protocols or guides.

This information relates to:

- NSQHS Standard 4.5.2
- National QUM Indicator 1.1.

2014 audit result:

- Release of the NIMC version with a specific VTE section in 2013 has enabled sufficient data to be collected for analysis.

- As VTE Risk Assessment and VTE Section are not on the paediatric, paediatric long stay, and NIMC Long Stay medication charts, these charts have been excluded from the results
 - 16.6% of patients with a NIMC (acute) chart had a VTE risk assessment documented (2012: 6.2%).
 - 3,634 patients with a NIMC (acute) chart had medication orders for VTE prophylaxis.
 - 1,228 patients had both a VTE risk assessment documented and VTE prophylaxis prescribed (this equates to 33.8% of the patients prescribed VTE prophylaxis).
 - A further 2406 patients were prescribed prophylaxis with no documentation of risk assessment on the NIMC (however, this may have been recorded in clinical notes).
 - 80.9% of VTE prophylaxis orders were documented in the designated VTE prophylaxis section (2012: 56.4%).

Analysis:

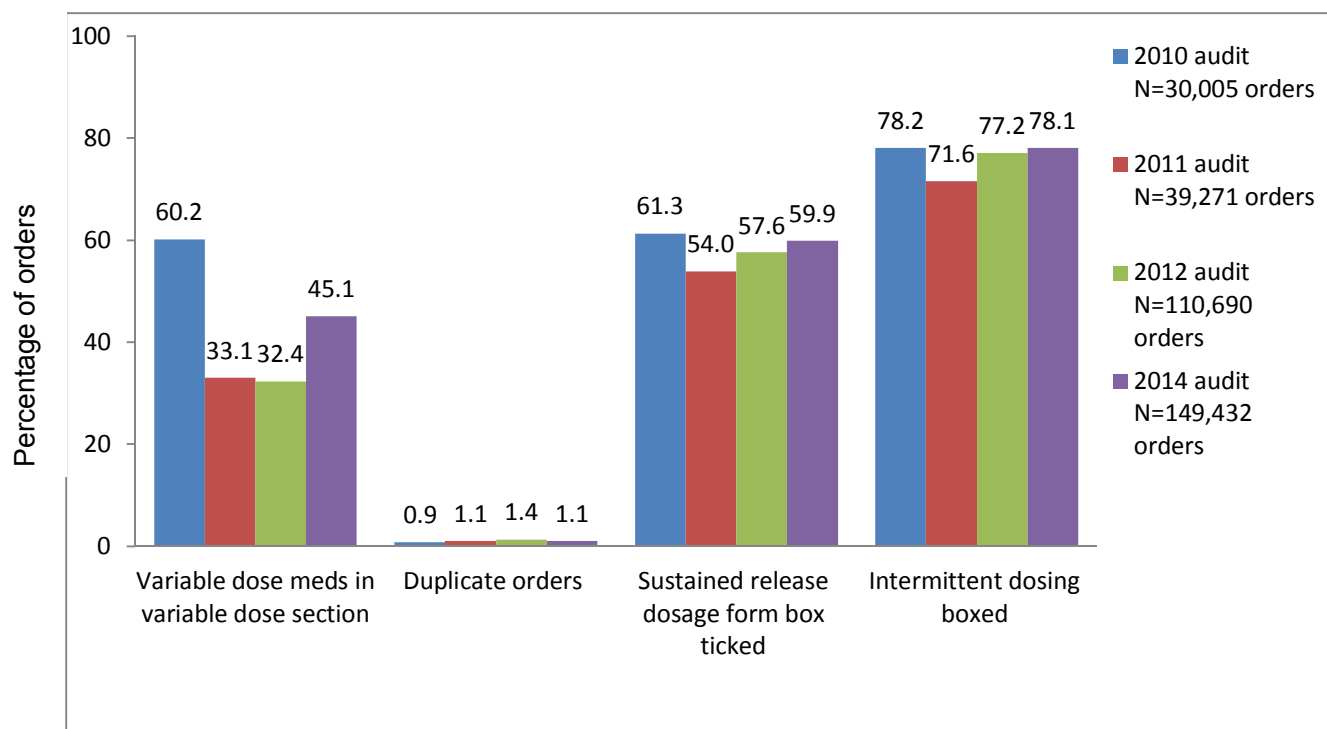
- As VTE prophylaxis has been included in only the last two audits, comparison of results is limited.
- The large difference in results between the audits may be accounted for by the timing of general release of the revised NIMC.
- The 2014 audit result establishes a baseline measurement for this section of the NIMC.
- As the outcome of the risk assessment is not matched to the prescribing of prophylaxis, the appropriateness of use of the VTE section cannot be fully evaluated from this audit.
- Modification of the NIMC audit tool for future audits needs to be considered in order to obtain a clearer indication of the appropriate use of the VTE section.
- Additional validations are required in the audit reporting system that address the anomalies between the audit guide, audit response and the NIMC reporting system and prevent the entry of invalid responses for long stay and paediatric charts.

In line with national and international guidelines, the Commission recommends that health services develop a formal strategy that addresses the prevention of VTE. Resources and tools to support health services undertaking quality improvement activities in VTE prophylaxis can be found on the Commission's web site:

www.safetyandquality.gov.au/our-work/medication-safety/vte-prevention-resource-centre/

4.3.4 Variable dose, duplicated orders, sustained release formulation and intermittent medicine orders

Figure 4: Variable dose, duplicated orders, sustained release formulations and intermittent dosing orders (2010–2014 comparison)



Variable dose

The audit measured the extent to which variable dose orders were prescribed in the variable dose section of the NIMC. This section is designed to support accurate prescribing and administration of medicines that have specific variable dosing regimens.

2014 audit result – 45% of variable dose orders were prescribed in the designated variable dose section.

Analysis:

- A considerable increase in the use of this section of the chart is noted from 32.4% in 2012.
- However, review of the medicines prescribed in the variable dose section indicates that the use of this section is not always consistent with the definition of variable dose, for example, prn medications, warfarin and intermittent dosing are noted to have been ordered in the variable dose section.
- The appropriateness of use of the variable dose section is not factored into the audit result.

Duplicated orders

Duplicated orders refer to once only (stat), telephone, regular (including variable dose and warfarin), and PRN medicine orders that are repeated for the same medicine or class of medicine. In some circumstances this may be clinically appropriate, for example prescribing of both regular and PRN orders of analgesics or bronchodilators. This judgment has been acknowledged in the recording of audit data by defining 'duplicate' as whether the patient would have received unintentional additional doses of medicine with potential to harm, for example two different ACE inhibitors.

2014 audit result – duplicate orders (or similar class of medicines) prescribed showed a slight decrease to 1.14% (1.4% in 2012).

Analysis – duplicate orders are prescribed at a low rate, consistent with previous audits.

Sustained release dosage forms

Sustained release (SR) medicines are prescribed in the regular medicine order sections of the chart and are indicated by ticking a sustained release box. This safety feature of the NIMC prompts staff to check that the correct dosage form is administered, and minimise the risk of an SR dosage form being inadvertently crushed.

2014 audit result – 40% of orders for sustained release products did **not** have the SR box completed.

Analysis:

- The rate of compliance with the sustained release box ticked (59.9%) remained consistent with previous audits.
- It is an area requiring substantial improvement to minimise the risk of permanent patient harm that can result when the standard release dose forms are mistakenly interchanged with sustained release preparations.

Intermittent dosing orders

When medicines are prescribed for intermittent administration (at regular intervals longer than 24 hours), the administration boxes on days when the medicine is not to be administered are required to be crossed out. This is to reduce the risk of the medicine inadvertently being given on days it is not ordered with the consequent effect of the patient receiving more than the intended dose.

Intermittent orders without the administration boxes crossed correctly present a risk to patients. Medicines that are intended to be administered at designated dosing intervals longer than 24 hours, for example, may be administered daily. These may include potentially toxic medicines such as methotrexate for rheumatoid arthritis, bisphosphonates for osteoporosis and buprenorphine patches for analgesia.

This information relates to National QUM Indicator 3.5

2014 audit result – 78.1% of intermittent dosing orders were clearly marked with dosing frequency (dose administration section 'boxed and crossed' to show dose regimen)

Analysis:

- Minor improvement is noted (from 77.2% in 2012), and there is scope for further improvement.
- Qualitative information on which types of medicines were involved has not been collected through the audit, but could be a consideration for future analysis to assess the quality of prescribing and potential patient risk, and enhance the information available.
- This information could then be used to provide practical examples for feedback to clinical staff.

4.4 Quality of prescribing documentation

Prescribing errors in medicine orders are defined as unclear (including use of error-prone abbreviations), illegible or missing, when assessing the prescribing elements of medicine name, route of administration, dose and frequency. The data comparing prescribing errors between paediatric and adult chart types have not been analysed separately.

NIMC safety features are designed to improve the completeness and clarity of prescribing instructions, and therefore improve the quality of prescribing. Data collected during the audit help determine if this is achieved.

This information relates to NSQHS Standard 4.9.1 and 4.11.2.

4.4.1 Medicine name errors

For the purposes of the audit, a medicine name is considered 'clear' when there is no potential for error through misinterpretation. Clear name includes generic names and trade/brand names for combination products approved for use in the facility.

This information relates to NSQHS Standard 4.5.2

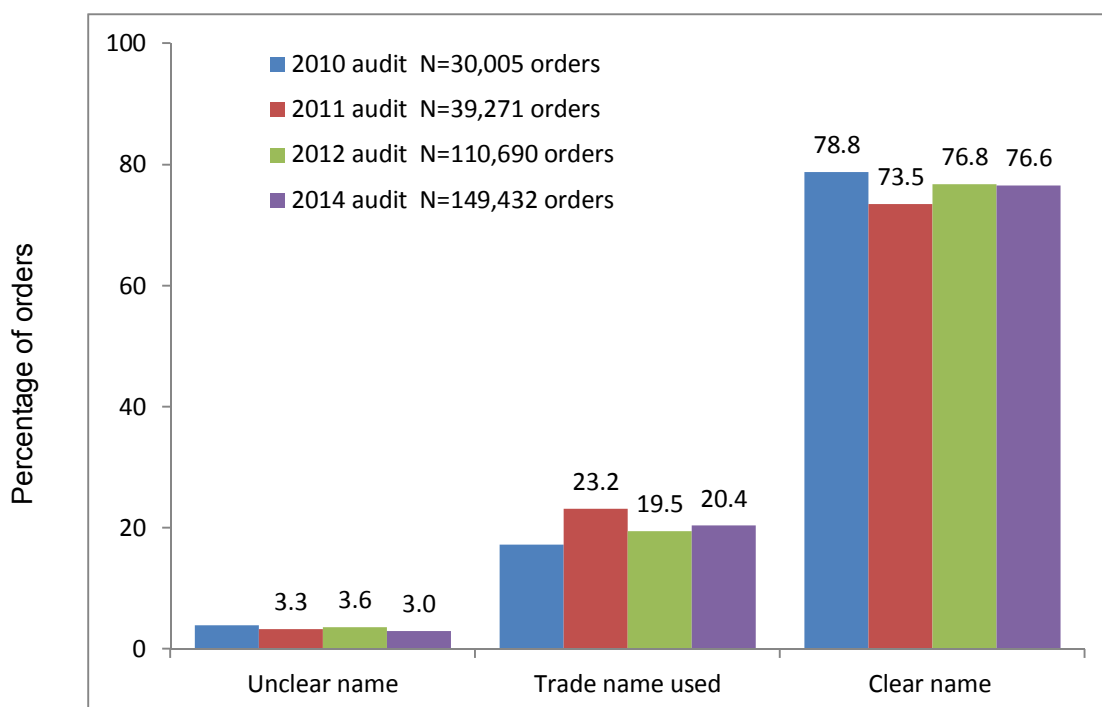
2014 audit result (see Figure 5):

- 3% of medicine names were unclear as they were illegible and could be misinterpreted as another medicine, or were abbreviated inappropriately e.g. EPO for epoetin.
- Prescribing by generic medicine name decreased slightly to 79.6% (2012: 80.5%).
- 20.4% of orders were prescribed using unacceptable trade names.

Analysis:

- Overall the 2014 audit results for this criterion show similar error rates to previous audits, with clear medicine name recorded for 76.6% of orders, despite the NIMC prompting for generic name to be written.
- Use of unclear names, particularly for combination products, may differ widely across the participating jurisdictions and private facilities, depending on whether the use of an approved list of accepted trade names is standard practice within the hospital.
- Hospitals that do not have an approved list of trade names are encouraged to review the Commission's recommendations for terminology used in prescribing medicines¹⁴, and to develop a suitable list or adapt an existing version in use at other sites.

Figure 5: Medicine name errors (2010–2014 comparison)



4.4.2 Route errors

Errors for route of administration include missing, unclear or incorrect route prescribed. An unclear route may be where an abbreviation is used that could be misinterpreted, for example, where multiple routes are prescribed for one order (e.g. IV/PO), or where the use of error-prone abbreviations such as SC (subcutaneous) can be mistaken for SL (sublingual) and vice versa. Examples of incorrect route are where the wrong route for the medicine is prescribed such as a sublingual product ordered to be taken orally, or vancomycin ordered intramuscularly when it is only administered by the intravenous route.

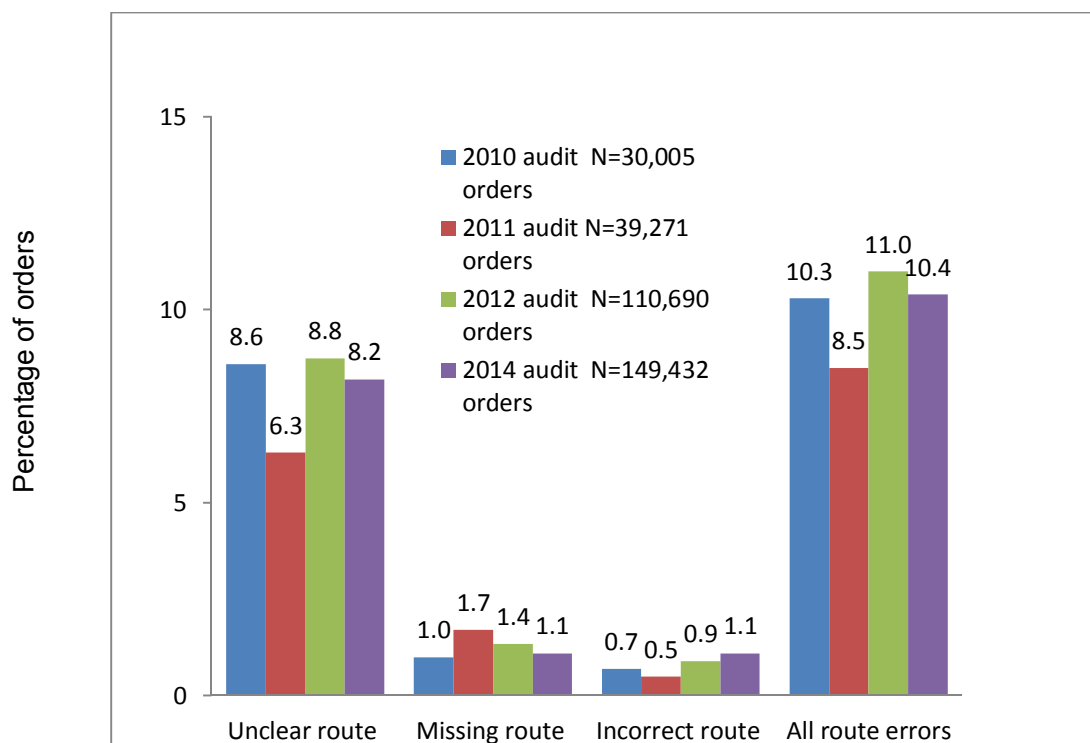
This information relates to NSQHS Standard 4.5.2.

2014 audit result (Figure 6):

- The majority of route errors are due to **unclear** route of administration (8.2% of orders).
- A small reduction occurred in total errors related to route.
- Very few orders (1.1%) had an incorrect or unspecified route of administration.

Analysis – the trend for route of administration errors in prescribing remains consistent across all audits and there is scope for further improvement.

Figure 6: Route of administration errors (2010–2014 comparison)



4.4.3 Dose errors

Dose is assessed as unclear when metric and Arabic systems are not used, or error-prone abbreviations are used e.g. u for units, mcg for microgram, or the dose is ordered as 'one' tablet when multiple tablet strengths are available.

Incorrect dose for the medicine is recorded when an incorrect dose is prescribed e.g. heparin 50,000 units subcutaneously BD instead of 5,000 units.

This information relates to:

- NSQHS Standard 4.5.2, 4.9.1, 4.11.2
- National QUM Indicators 3.3, 3.4.

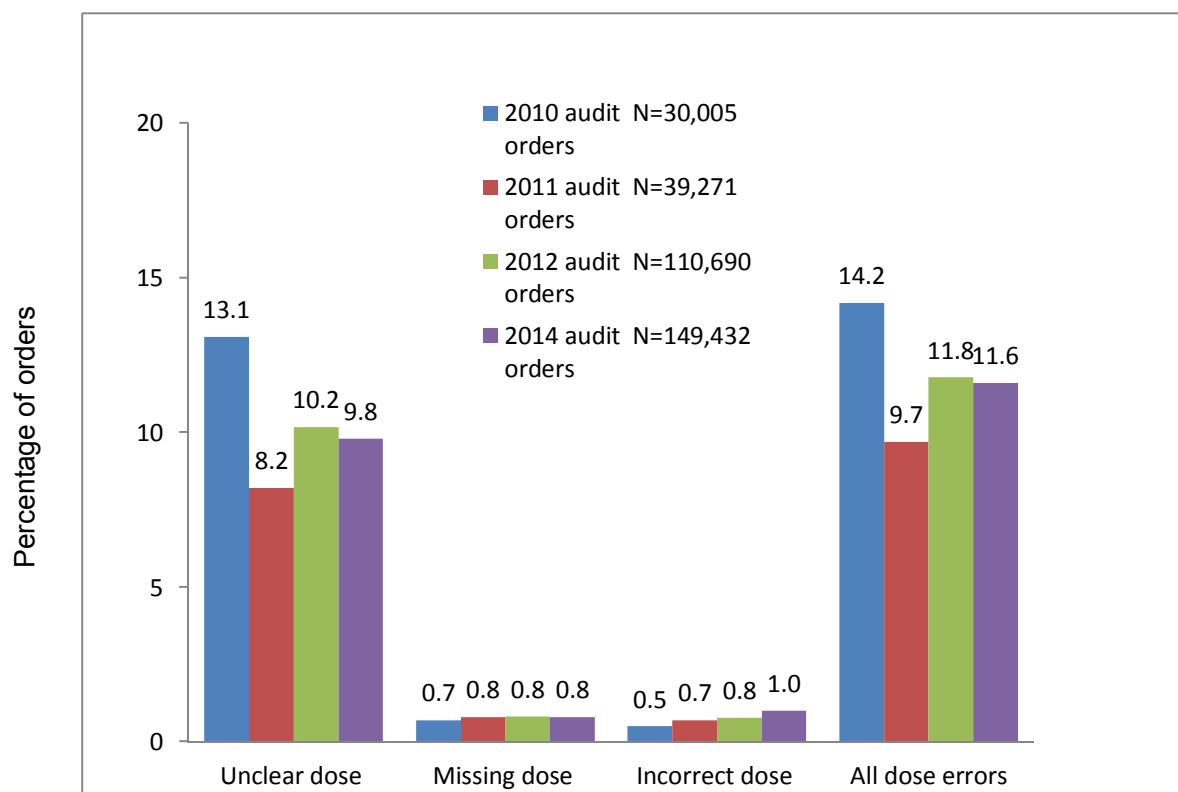
2014 audit result (see Figure 7):

- 11.6% of orders contained a dose error.
- Unclear doses account for the majority of dosing errors, occurring in 9.8% of orders.
- Orders with missing or incorrect dose remain at a low level, each $\leq 1\%$.

Analysis:

- The incidence of all dose errors remains unchanged from 2012, but shows a small increase in incorrect doses (from 0.8 to 1%).
- Efforts to improve in this parameter may focus on the development and availability of standardised dosing protocols, decision support tools, the use of recommended terminology, and awareness campaigns providing education on error-prone dose designations.

Figure 7: Dose errors (2010–2014 comparison)



Paediatric dose calculations

For paediatric and neonatal medicine orders, the NIMC paediatric versions prompt the prescriber to document the basis for the dose calculation in the dose calculation box (e.g. mg/kg/dose). This serves as an additional safety mechanism to enable pharmacists, nurses and other prescribers to double-check the prescribed dose and ensure that the intended and actual dose is calculated correctly.

The audit of this section of the NIMC paediatric versions (acute and long stay) verifies that the prescribed dose is the safe, total dose using the patient's body weight or BSA and a current paediatric dosing reference.

This information relates to:

- NSQHS Standard 4.5.2, 4.9.1, 4.11.2
- National QUM Indicator 3.4.

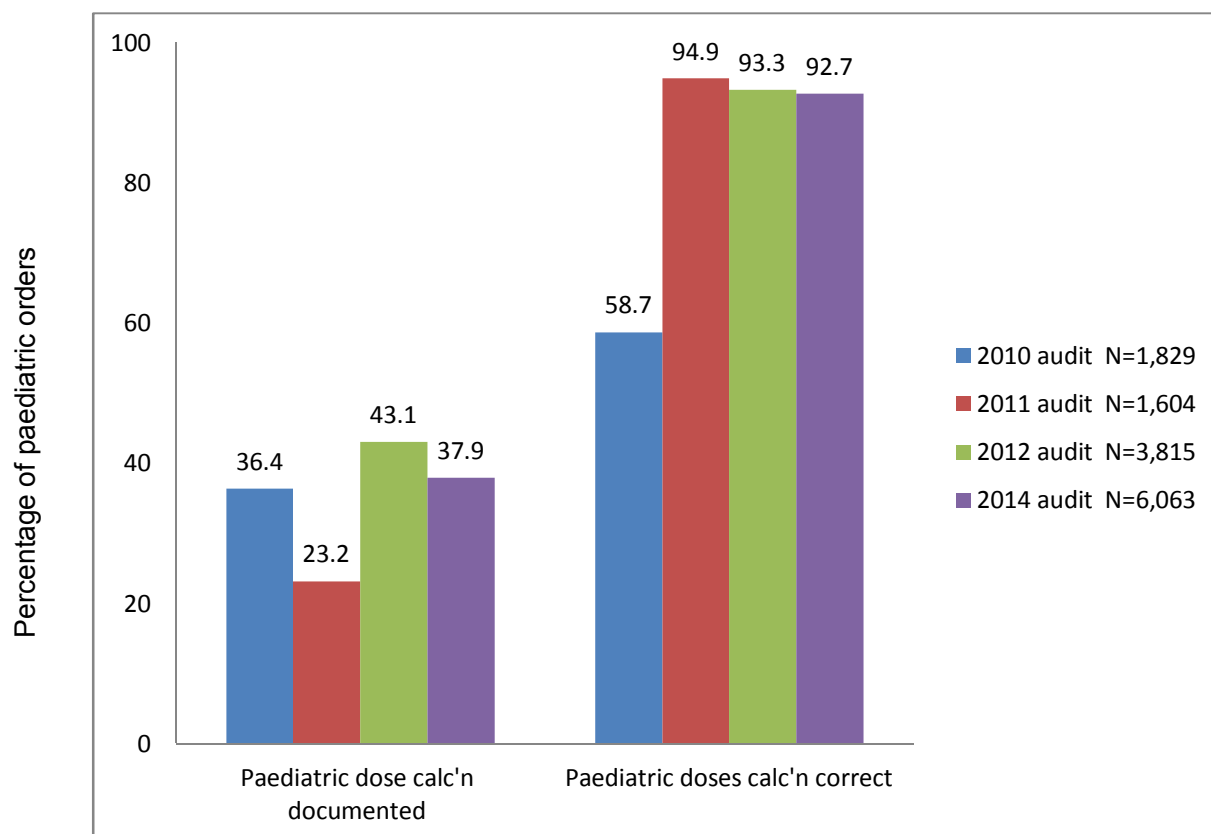
2014 audit result (see Figure 8):

- 37.9% of medicine orders on paediatric charts had the basis for the dose calculation documented.
- 92.7% of these dose calculations were correctly documented.

Analysis:

- The marked improvement in documented dose calculations seen in 2012 (43.1%) has not been maintained in the 2014 audit.
- It should be noted that these results may include orders that do not require a dose calculation, and the relative proportion of doses that need calculation may vary across audits, affecting the overall result.
- Changes to the audit tool would be needed in order to accurately measure the denominator as only doses that require calculation.

Figure 8: Documentation of paediatric dose calculations (2010–2014 comparison)



4.4.4 Frequency errors

Dosing frequency is considered unclear if illegible or error-prone abbreviations have been used, or if a dosing interval is not specified in hours. For example, Irbesartan 150mg qd is an unclear frequency as qd is an error-prone frequency abbreviation, easily confused with qid. Incorrect frequency is the wrong frequency for the medicine prescribed, for example Azithromycin 500mg IV BD as opposed to once daily. For PRN orders, a minimum dosing interval needs to be specified.

This information relates to:

- NSQHS Standard 4.1.2, 4.5.1, 4.5.2
- National QUM Indicator 3.3.

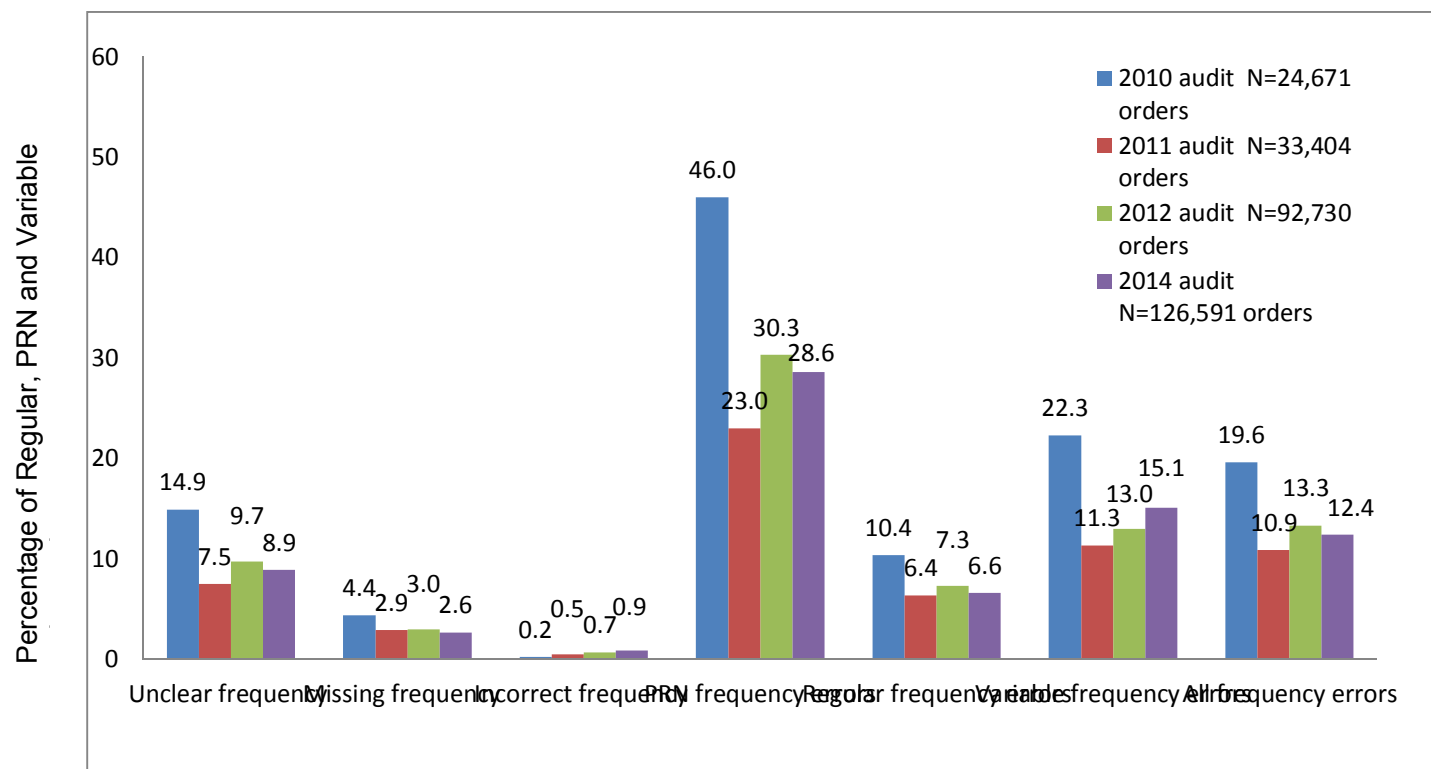
2014 audit result (see Figure 9):

- Frequency errors occurred at a rate of 12.4% of total regular, PRN and variable orders
- 'Unclear' is the most common frequency error type (8.9%)
- 2.6% of orders (regular, PRN and variable) did not specify any dosing frequency
- Incorrect instructions for frequency of dosing occurred in less than 1% of orders
- Frequency errors were much higher for PRN orders (28.6%) than regular orders (6.6%).

Analysis:

- The occurrence of frequency errors remains at levels consistent with the 2011–2012 audits and below the baseline results of 2009 audit (20%).
- There is minimal shift in the results to indicate improvement or decline in performance.
- As with previous audits, dosing frequency errors remain the most common type of prescribing error at 12.4%.
- Hospitals are encouraged to review the examples of error-prone frequency abbreviations in the Commission's recommendations for terminology used in prescribing medicines¹⁴, and implement education strategies to promote the use of recommended prescribing terminology.

Figure 9: Frequency errors (2010–2014 comparison)



4.4.5 Communication of prescribing decisions

Clear communication of prescribing decisions relies on complete and unambiguous documentation of each of the components of the medicine order. To provide an overall assessment of this concept, the audit results for the relevant critical elements of a medicine order are aggregated in Figure 10.1, and presented for 2014 for public and private sites in Figure 10.2.

Refer to Appendix 7.3 Data Quality Statement for an explanation of changes made to the formula for calculating 'unclear orders'.

2014 audit result:

- 22.8% of orders were unclear (either medicine name, route, dose and/or frequency).
- High level of concurrence between prescribed frequency and documented administration times at 95.7%.
- Use of error prone abbreviations occurred in 19.6% of orders.
- Low rate of documentation of indication at 21.8%.
- 38% of ceased orders were ceased correctly in both the prescribing and administration sections of the NIMC.
- Documentation of a maximum 24 hour dose was recorded for 41.5% of PRN orders.

Figure 10.1: Communication of prescribing decisions (2010–2014 comparison)

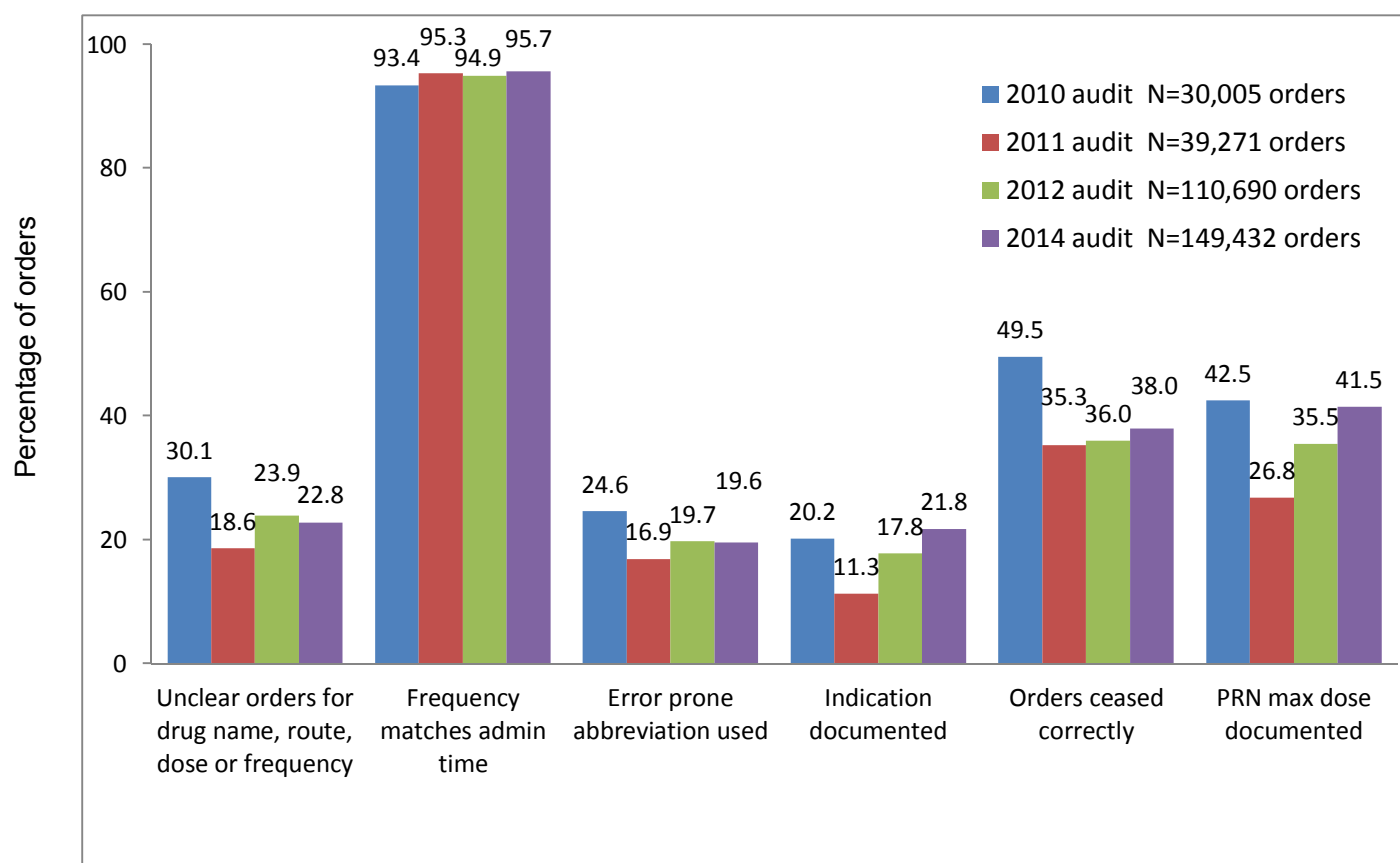
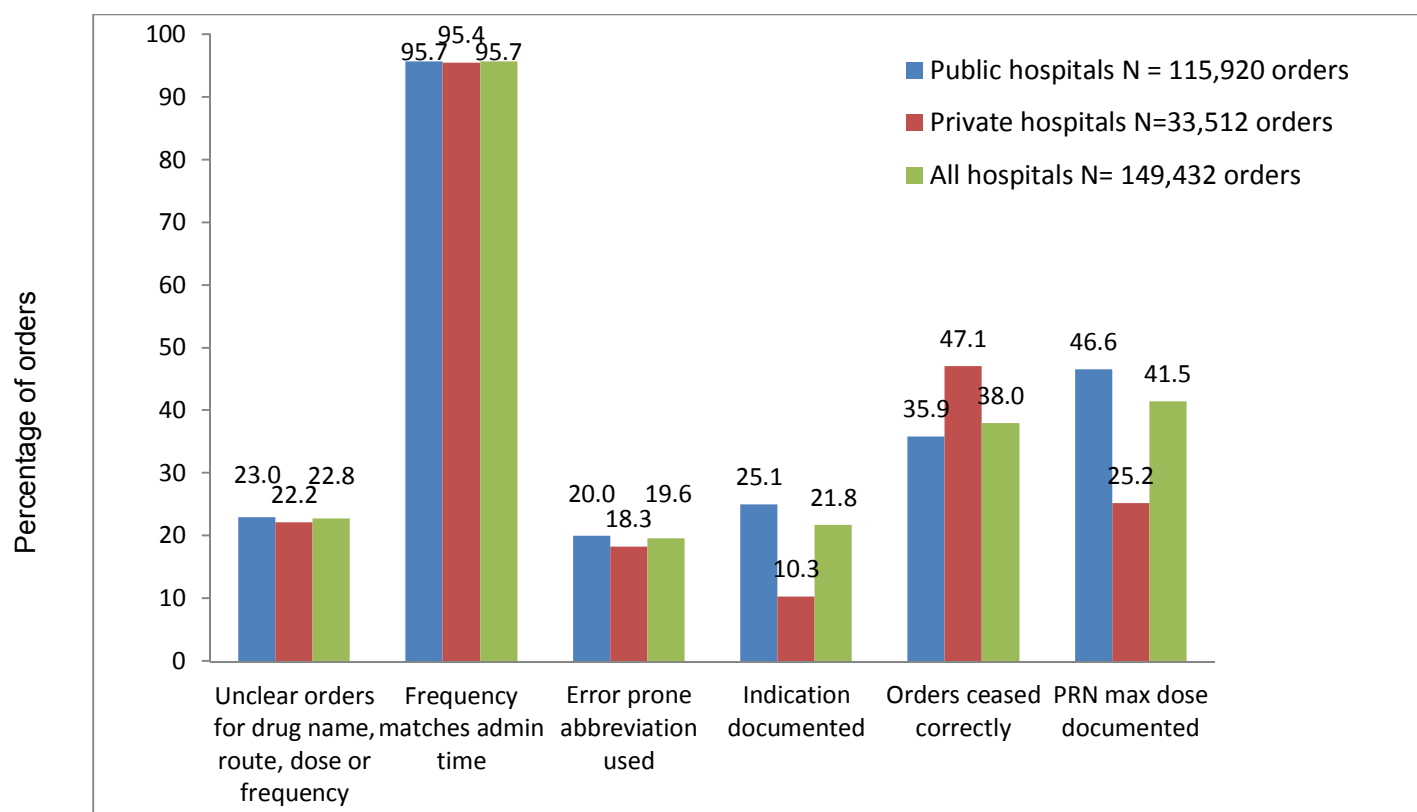


Figure 10.2: Communication of prescribing decisions by hospital sector (2014 audit)



Analysis:

- **Unclear orders**
 - This variable is intended to show all medicine orders which were unclear in either drug name, route, dose or frequency. Orders were counted only once although may have contained errors in more than one category.
 - The 2014 error rate for unclear orders for medicine name, route, dose or frequency remains consistent with past audits.
 - To gain a true indication of this error, the data from each audit has been re-calculated, counting each medicine order only once. Results for 2010–2012 are lower than reported previously (refer Appendix 7.3 Data Quality Statement).
 - Assessment of this measure is one of the more subjective audit criteria, and the results need to be considered in the context of multiple auditors working across the 394 sites.
- **Documented administration times corresponding to prescribed frequency**
 - The high level of compliance for dosing administration times matching the prescribed frequency has been maintained in 2014.
 - However, the clinical implications of a discrepancy between the prescribed frequency and administration time (under or over-dosing) are not known, and this continues to represent a potential risk for adverse events.
- **Error-prone abbreviations**
 - The use of error-prone abbreviations remains at a similar level to past audits, and is marginally higher in public hospitals compared to private facilities (Figure 10.2).
 - With 20% of all medicine orders containing one or more error-prone abbreviations, there remains significant potential for misinterpretation of prescribing, and therefore scope for improvement.

This information relates to:

- NSQHS Standard 4.1.2, 4.5.1, 4.5.2
- National QUM Indicator 3.3.

Strategies to improve adoption of the national terminology, abbreviations and symbols to be used in the prescribing and administration of medicines in Australian hospitals¹⁴ can be addressed at many levels of the healthcare system. These strategies were described in detail in the NIMC 2012 National Audit Report Supplement (Outcome 10)¹⁵.

Analysis of the 2014 results has identified a discrepancy arising from the use of an invalid response of 'error prone abbreviation' against route, dose or frequency on the electronic audit tool. The impact of this on the 2014 results is that 'unclear' route, dose and frequency orders are under-reported. The actual variation is less than 0.07% in the results recorded for these fields. Similarly, the combined category of 'unclear orders for medicine name, route, dose and frequency' is affected (exactly 0.07% variation as each drug order is counted once in calculating the combined response). The numbers involved are small (112 drug orders out of 149,432), however the audit system will be modified to include a validation for these fields for future audits to prevent this error from recurring.

Documentation of indication

Documented indication provides an additional safety element for subsequent prescribers, for pharmacists and nurses to check and ensure the correct medicine and appropriate dose has been ordered. The indication is also helpful for educating the patient and preparing medicines lists.

The documentation of indication for prescribed medicines remains low at 21.8%, and is more commonly provided in public hospitals (25.1%) than in private facilities (10.3%).

Variability in compliance with this requirement between medicine order types is also evident: regular (16.6%), PRN (35.6%), variable (24%) and warfarin (56.6%).

The practical importance of documenting indication on the NIMC from a patient safety perspective appears to be under-recognised by prescribers and could be considered a future focus for practice change.

PRN medicine orders

When required (PRN) medicine orders are prone to errors due to the need for interpretation regarding dosing intervals and twenty-four hour maximum total doses.

Documentation of a PRN maximum total dose in 24 hours shows further improvement over previous audits, but at less than 50% can be deemed to be poorly documented. This occurs despite the prompt on the NIMC to enter the hourly frequency and maximum 24 hour total dose.

It was more commonly documented in public facilities (46.6% compared to 25.2%) with both sectors demonstrating an improvement over 2012 and past audits.

Ceased orders

62% of all ceased orders were not ceased correctly in both the prescribing and administration sections of the chart, a similar error rate to 2011 and 2012.

Incorrectly ceased orders may cause unintentional harm to patients. Reducing this risk requires significant practice changes to meet the audit definition of correctly ceased orders.

The majority of error categories described above may be addressed through the implementation of EMM systems, and this is discussed further in Section 5.1 of this report.

4.5 Documentation of professional responsibility

4.5.1 Prescriber signature and identifier

As the prescriber's signature is a legislative requirement for medicine orders, a high level of compliance with this feature of the NIMC is expected. Prescriber identification is assessed as clear if the prescriber has printed their name and contact details at least once on the medication chart.

Providing prescriber contact information on the medication chart enables other healthcare staff to contact the prescriber for clarification or confirmation of orders. It is a mechanism for timely resolution of problems and can avert unnecessary delays to treatment or errors related to misinterpretation of orders.

This information relates to NSQHS Standard 4.3.

2014 audit result (see Table 7):

- A high level of compliance for prescriber signature has been maintained 97%, and is a consistent result across public and private facilities.
- Moderate compliance for prescriber identification is achieved, with minor improvement across both sectors.

Table 7: Orders signed by prescriber and with prescriber identification

Criterion	2010 %	2011 %	2012 %	2014 %
% of medicine orders signed by prescriber	97.5	95.7 Public: 96.3 Private: 94.3	96.7 Public: 97.3 Private: 94.3	96.8 Public: 97.6 Private: 93.8
Of the medicine orders with prescriber signature, % where prescriber name is clear	79.5	63.8 Public : 64.4 Private: 62.5	69.1 Public : 71.1 Private: 62	71.6 Public: 73.5 Private: 64.9

Analysis:

- Prescriber name and contact details were absent in 28% of orders (where a signature had otherwise been provided).
- The absence of prescriber identification may limit the ability for other staff to clarify prescribing intent, and can result in subsequent medication error.
- Prompts for this information are on the NIMC, however compliance continues to be sub-optimal.

4.5.2 Pharmacist annotation and pharmaceutical review**Pharmacist annotation**

Clarification and review of medicine orders, and provision of information by clinical pharmacists, reduces the risk of patients experiencing harm from preventable prescribing and administering errors¹⁶. Annotation of orders is an important activity of a clinical pharmacy service, however it is recognised that work practices related to medication order review may vary between facilities, clinical units and individual practitioners, and therefore influence the audit result.

Pharmaceutical review

The NIMC has provision for clinical pharmacists to record that medicine orders have been reviewed by initialling the pharmaceutical review box for each day on the chart. The audit measures the percentage of patients who have had at least one pharmaceutical review documented in the current NIMC.

This information relates to National QUM Indicator 6.2.

2014 audit result (see Table 8):

- An increase in the number of orders annotated and the documentation of pharmaceutical review is evident in 2014.
- Increases in compliance were of a greater magnitude for medication charts in private facilities.

Table 8: Pharmacist annotation and pharmaceutical review

Criterion	2010	2011	2012	2014
% of medicine orders with pharmacist annotation	33.5	26.8	34.03	37.2
		Public: 26.2 Private: 28.2	Public: 35.6 Private: 28.5	Public: 37.2 Private: 37.3
% of patients with at least one pharmaceutical review documented in current medication charts	38.3	34.3	38.21	45.9
		Public: 35.9 Private: 30.9	Public : 39.7 Private: 33.3	Public: 46.0 Private: 45.4

Analysis:

- The extent of pharmacist annotation of medicine orders can be influenced by a number of variables
 - Not every medicine order will require annotation (this judgment is not factored in to the data collection).
 - The timing of NIMC audit data collection in relation to pharmacist ward rounds
 - Resourcing issues with the number and frequency of chart reviews.
 - Variation in practice, service delivery models and service levels between individual pharmacists, between clinical units and between facilities.
- To address the apparent gap in annotation of medicine orders and reduce variability in service provision, facilities could consider developing a core set of standardised annotations for the most frequently prescribed medicines.
- Review of the audit criterion for pharmacist annotation may need to be considered for future audits, to measure the rate annotation only for orders requiring clarification (i.e. as a percentage of unclear orders rather than total orders).
- Documentation of pharmaceutical review may also be influenced by factors related to service delivery, individual work practices, and interpretation of the purpose of signing for pharmaceutical review.
- Concerns related to the implications of signing for pharmaceutical review, may need to be addressed through education to improve understanding of this aspect of the chart.

4.5.3 Recording of medicine doses administered

Documenting doses administered requires clinician initials for each dose given or use of the NIMC administration reason code when a dose could not be administered.

The audit measures the percentage of orders where one or more doses that should have been documented as given are not recorded as having been administered. This figure excludes doses that have a 'reason for not administering' code documented.

This information relates to NSQHS Standard 4.5.2, 4.9.1.

2014 audit result (see Table 9):

- Percentage of orders with doses omitted or not initialled remains at 9%.
- Recording of doses administered is consistent across public and private facilities.

Table 9: Dose administration not initialled, or assumed omitted

Criteria	2010	2011	2012	2014
% of orders where one or more doses were <i>omitted</i> or administration not signed (<i>regular, stat only, variable, warfarin, excludes PRN orders</i>)	11	9.3 Public: 9.1 Private: 9.8	9.9 Public: 10.3 Private: 8.5	9.4 Public: 9.7 Private: 8.5

Analysis:

- Unintentional omission of doses is the most frequent type of medication administration error, and the second largest reported cause of medication incidents¹⁷.
- Omission of dose administration can be influenced by many factors including the type of medication distribution system, frequency of interruptions experienced by staff, and dose timing in relation to shift changes.
- Standardised codes related to reasons for not administering a dose are printed on the NIMC and should serve as a prompt for accurately documenting administration.
- Although the clinical outcome of omitted or duplicated doses is not assessed through this audit, the overall error rate of 9.4% represents a significant risk of potentially avoidable medicine events.
- Education strategies and work practice changes should target the need for further improvement in this practice area.

5. Summary

Hospital participation in the NIMC National Audit continues to increase, with data provided in 2014 by 394 hospitals (309 public hospitals, 85 private hospitals) from all states and territories, representing a 26% increase over the previous audit. A total of 18,809 patients' charts were audited and 149,432 medicine orders reviewed, providing a 35.5% increase in data available for analysis.

The NIMC 2014 National Audit results demonstrate ongoing compliance with important NIMC safety features which reduces the opportunity for error and improves the quality and safety of patient care. Although none of the results indicate a substantial decline in compliance that would suggest an increased level of risk of medication error, areas of less than optimal performance can be identified which present opportunities for further improvement.

Examples of **sustained high levels** of compliance (>85%) noted from the 2014 audit include:

- dose specified and correct
- route specified, clear and correct route
- correct dose calculations for paediatric medicine orders
- prescribing frequency matched to times of administration
- medicines of a similar class not prescribed (duplicated orders)
- orders signed by prescriber.

Examples of **moderate compliance** (60–85%) with the safety features of the NIMC are:

- clear medicine name, use of generic medicine name
- intermittent dosing blocked/crossed out
- ADR history details documented
- documentation of target INR for warfarin orders prescribed in the warfarin section
- prescribing of VTE prophylaxis in the VTE section.

Features of the NIMC that continue to be at a level of compliance where **significant improvement** is needed include:

- complete patient identification
- documentation of weight
- documentation of medication history
- warfarin prescribing in warfarin section
- documentation of patient warfarin education
- documentation of PRN maximum 24 hour dose
- paediatric dose calculation documented
- documentation of indication
- sustained release dosage forms of medicines identified
- use of error-prone abbreviations
- documentation of dose administration orders ceased correctly.

5.1 Quality of prescription documentation

The 2014 audit results show no conspicuous increase in prescribing error rates compared to 2012, with many of the audit criteria showing a marginal improvement. However opportunities for medicine errors and possible AMEs remain as a result of incomplete or unclear communication of prescribing decisions at levels that potentially may compromise patient care. Table 10 summarises the audit criteria for missing, incorrect or unclear medicine orders that are core elements of prescribing communication.

Many of these aspects of prescribing documentation may achieve improvement with the implementation of EMM systems, and consequent reduction of medication errors through improved prescription legibility, dose calculation and access to clinical decision support¹⁸. While there is potential for introducing new medication errors with the use of EMM, the errors are

recognised as being of a different type to those with paper-based systems, and commonly involve selection (pick list) errors.

The influence of forcing functions requiring mandatory compliance in key components of an EMM can significantly enhance the safety and quality of patient care. For example, the use of error-prone abbreviations would be expected to fall to 0% as a result of appropriate configuration of this field in the EMM system. Similarly, re-prescribing a medication for which there is a documented previous adverse reaction would not be possible where the recording of ADR history is mandatory before prescribing or where error alerts are activated.

National guidelines for on-screen display of clinical medicines information are being developed by the Commission to support standardisation in e-health initiatives and to maximise patient safety. The guidelines incorporate other national standardisation strategies for medication safety such as recommendations for prescribing terminology, abbreviations and symbols.

Resources and tools to support health services in implementing EMM systems can be found on the Commission's web site:

www.safetyandquality.gov.au/our-work/medication-safety/electronic-medication-management-systems/

Table 10: Examples of prescribing error rates

Criteria for missing, incorrect or unclear medicine orders	Audit results (% of medicine orders)			
	2010 N = 30,005 orders	2011 N = 39,271 orders	2012 N = 110,690 orders	2014 N= 149,432 orders
Unclear orders for medicine name, route, dose and frequency	30.1	18.6	23.9	22.8
Unclear medicine names prescribed	4.0	3.3	3.6	3.0
Route errors (missing, unclear, incorrect)	10.3	8.5	11.0	10.4
Dose errors (missing, unclear, incorrect)	14.2	9.7	11.8	11.6
Dose unclear only	13.1	8.2	10.2	9.8
Frequency errors (missing, unclear, incorrect)	19.6	10.9	13.3	12.4
PRN frequency errors only	46.2	23.1	30.0	28.6
Error prone abbreviations used	24.6	16.9	19.7	19.6
PRN orders with max dose documented	42.5	26.8	35.5	41.5
Orders ceased correctly	49.5	35.3	36.0	38.0

NIMC online training module

The use of the NPS MedicineWise-hosted NIMC online learning tool by universities and hospitals continues to increase, and is considered to be a positive influence on the quality of prescribing. Table 11 shows the trend in uptake of the online training modules.

This information relates to NSQHS Standard 4.1.1

Table 11: NIMC online training data (at 31 March 2015)

Course completion	1/11/06 – 1/11/10 (4 years)	1/12/10 ^a – 30/6/11 (7 months)	1/7/11 – 30/6/12 (12 months)	1/7/12 – 30/6/13 ^b (12 months)	1/7/2013 – 30/6/2014 ^b (12 months)	1/7/2014 – 31/3/2015 ^c (9 months)
Commenced course	6841	2093	7328	11 421	23 441	16 878
Completed all 6 core modules	4652	1639	6472	11 421	23 441	14 454
Completed all modules plus paediatrics module	n/a	1255	5117	4845 (to 31/3/2013)		
Paediatrics module completion				7505	10 254	7299

- a) course completely revised and re-written in 2010; new course introduced from December 2010
b) software functionality only recorded participation upon completion
c) software upgrade in July 2014 enabled separate tracking of participation and completion
d) the paediatrics module can be completed as a stand-alone module; completion of the core modules is not a pre-requisite, therefore this data is not linked to the data on completion of the core modules.

Source: NPS MedicineWise April 2015

Data provided by NPS MedicineWise about the different professions completing the six core modules for the period 1 July 2013 to 30 March 2015 shows that nursing staff (including students) are the highest users of the online training as a percentage of the total number of people completing the modules:

	% (N=37,895)
Academic/educator	0.2
Community health worker	0.06
Dentist/dental student	0.06
GP/GP registrar	0.78
Medical	18.8 (includes student, intern, staff)
Nursing	70.3 (includes student, enrolled nurse, registered nurse, nurse practitioner, midwife)
Pharmacy	6.7 (includes student, intern, pharmacy assistant, registered pharmacist)
Other	3.2

Further interpretation of this data is limited as the denominator for total numbers of staff/students is unknown, and there are many variables that can influence the use of the online learning tool, including:

- whether the training is a mandatory component of academic courses and health service orientation programs
- the timing of changes in numbers of staff employed or students enrolled in tertiary courses
- changes to academic curricula and intern training programs

- local education programs within health service organisations and quality improvement strategies that promote the NIMC safety features.

5.2 Limitations of audit

Limitations associated with the audit have been described in detail in the 2012 audit report¹⁹, and remain applicable to the 2014 audit. An additional factor in 2014 concerns the use of an upgraded database system for reporting the audit results (Section 3 of this report).

Each of the limitations is summarised below and should to be taken into account when interpreting and using the audit results.

5.2.1 Aggregated data, hospital and patient demographics

The ability to compare individual hospital results against the national aggregated data is limited as the patient and hospital demographics vary between each audit, and between jurisdictions.

However, the continued growth in overall participation rates provides an increasingly representative pool of data for analysis. Factors that may influence the comparability of results include:

- hospitals are unmatched across consecutive audits
- the proportion of results related to the public and private hospital sectors is unequal (78% and 22% respectively)
- a relatively small dataset of results relates to specialised facilities such as psychiatric, rehabilitation and women's and children's hospitals.

5.2.2 Sampling method

In facilities where the sampling method is used (refer Section 3: Audit Framework), results may be influenced by variance in the complexity and volume of prescribing between the clinical units that are selected for audit.

In addition, the audit does not require data to be collected at a site level in relation to the total number of medicine orders/charts/patients in hospital at the time of the audit. Therefore, the true incidence of prescribing errors and the incidence of medicine errors as a proportion of all medicine orders cannot be extrapolated from the audit data.

5.2.3 Medicine orders

The majority of data for medicine orders relates to Regular and PRN orders (62.1% and 22.2% respectively), with less than 1% of results associated with warfarin and variable dose orders due to a lower frequency of use of this type of order. Consequently, an assessment of the level of compliance with some NIMC safety features of warfarin, VTE prophylaxis and variable dose orders is based on small numbers. This limits the ability to draw generalised conclusions from the results.

5.2.4 Audit timing

As the audit is a snapshot of the use of the NIMC, the timing of auditing in relation to a number of variables can influence the results, for example:

- medical staff rosters and term rotations
- errors that have been addressed immediately before the audit e.g. through clinical pharmacist intervention
- the impact of local and/or national strategies that may have been implemented since the previous audit.

The interpretation of audit results at an individual site level therefore needs to consider the influence of changes that may have occurred between each audit, as this is unable to be factored in to the audit process.

5.2.5 Audit definitions

Revision of many audit definitions, and increased rigour in the audit terminology has occurred as part of the iterative improvement process of auditing since the NIMC pilot in 2006. This may affect

the comparability of audit results for sites that have participated in multiple audits. No changes in the audit definitions have been introduced between the 2012 and 2014 audits.

5.2.6 Interpretation of audit criteria

The audit does not seek to measure the clinical significance of the medicine errors measured nor the effect in terms of patient outcomes. However, subjective judgement and interpretation by the auditors is required for some of the criteria, for example in determining unclear orders. Lack of consistency in interpretation of audit criteria and differences in local policy/procedures between hospitals and jurisdictions may affect the comparability of audit results.

Other issues that have not been factored into the audit are noted throughout this report for consideration when reviewing and updating the audit resources, for example:

- documentation of warfarin education (4.2.3)
- VTE data (4.2.3)
- appropriateness of use of the variable dose section (4.2.4)
- paediatric dose calculation (4.3.3)
- appropriate coding of the use of error-prone abbreviations (4.3.5)
- calculation of the extent of pharmacist annotation of medicine orders (4.4.2).

5.2.7 Change of database reporting system

The results of the 2014 audit have been reported using an upgraded database system implemented by the Commission in 2013. As a consequence, some changes in data analysis have been applied to improve the consistency and comparability of results. However, this process has also identified some discrepancies between the paper-based audit forms and the reporting system. These are explained further in the data quality statement (Appendix 7.3) and will be investigated in more detail through the Commission's process of review of the audit tool.

5.3 Recommendations

The 2014 audit provided an opportunity to review the areas of the NIMC and the audit process that would benefit from further work to ensure continuing alignment with the aims of improving the quality and safety of medication management.

Recommendations for action by the Commission (below) will be considered by the Commission and its Health Services Medication Expert Advisory Group. These recommendations focus on activities that are aligned with the Commission's operational work plan and are consistent with its strategic priorities:

Recommendation 1

Encourage development of local action plans to address areas of sub-optimal performance

Local audit results are available for download from the NIMC audit system. Results from local audits can be used to identify practice gaps and direct focus for future quality improvement activities.

High-risk issues are noted within this report and are summarised in Executive Summary Tables 1 and 2, and Section 5. Local action plans may focus on educational interventions that address issues including:

- patient identification
- warfarin prescribing in warfarin section, documentation of target INR, indication and warfarin education, availability of warfarin guidelines
- appropriate use of the variable dose order section
- use of recommended national terminology and abbreviations
- evidence-based interventions to improve the documentation of dose administration and pharmaceutical annotations/review
- strategies to improve the documentation of sustained release dosage forms, indication, PRN maximum 24 hour dose, ceasing orders correctly.

Recommendation 2

2.1 Undertake a detailed review of the NIMC audit form, User Guide and database reporting system to address anomalies identified with the NIMC and data recording

2.2 Update the educational resources that are used to support the audit

Examples of specific areas that have been noted in the Data Quality Statement and within this report include:

- VTE prophylaxis
- paediatric doses requiring calculation
- unclear orders
- error-prone abbreviations
- pharmacist annotations.

Recommendation 3

In conjunction with recommendation 2.1, seek feedback from participating sites about how the audit results are interpreted and used, what actions are taken, and improvements that may be made to the NIMC audit to provide further benefits to facilities from involvement in future audits

With the accumulation of significant amounts of audit data collected from the four audits undertaken since 2010, and the increasing implementation of EMM systems, it is timely to seek formal feedback from the audit end-users in healthcare services. Although there is an ongoing opportunity to provide feedback to the Commission at any time, a structured approach using validated survey tools has not been undertaken to date, and may elicit additional useful information. Barriers to participation in the audit could also be explored by seeking feedback from non-participants.

Recommendation 4

Consider whether thresholds or targets for improvement in compliance with the NIMC safety features could be developed at facility or health service level to augment local review of audit results and guide quality improvement activities

While recognising that EMM systems have the potential to reduce or eliminate some medicine errors, there will be facilities that need to continue with the paper-based NIMC in the short to medium term where implementation of EMM is not available.

With either type of medicine order system, defining an acceptable level of risk in establishing thresholds or targets for NIMC compliance may prove challenging without the ability to link audit results to clinical outcomes. For many of the audit criteria the goal would be 100% compliance.

Developing agreed targets for 'percentage improvement over time' may provide a practical alternative, recognising the potential risks associated with the concept of thresholds. A review of the international literature and experience in this area may give guidance and direction on this issue for local consideration by individual hospitals.

Recommendation 5

Examine the requirements for developing a national audit tool that is applicable to electronic medication management systems

With the expanding implementation of EMM systems, the process and tools for national auditing will need to adapt to reflect the electronic medication order entry environment and its unique characteristics.

As part of this examination, an assessment of EMM systems implemented in Australian settings using the NIMC Audit Tool could be conducted. This assessment could provide national baseline results and help to inform the development of an appropriate EMM audit tool.

Consideration of the framework for auditing electronic medication orders aligns with, and expands on, the Commission's work in EMM to date. Exploration of this issue will need to achieve an appropriate balance between investment in education and strategies related to the paper-based NIMC and the relative timing of EMM implementations. As healthcare organisations and jurisdictions are at various stages of progress in the uptake of EMM, this recommendation may be done in conjunction with Recommendation 3.

6. Conclusion

Hospital participation in the NIMC National Audit continues to increase, with data provided in 2014 representing a 26% increase over the previous audit, and a 35.5% increase in patients' charts and medicine orders reviewed. The additional data available for analysis has consolidated the consistency and comparability of the audit results. There are limitations associated with the audit, and local or statewide initiatives and variances can influence the results. However, the information gained from the audit remains constructive and relevant to guide practice improvement.

The 2014 audit demonstrates continued compliance with the NIMC safety features that reduce the opportunity for error and improve the quality and safety of patient care, and a small improvement in some audit criteria. Consideration of the results over the period of four audits from 2010 to 2014 suggests that the extent of improvement has plateaued. Although none of the results show a substantial decline in compliance that would indicate an increased level of risk of medication error, areas of less than optimal performance have been identified that can be addressed and targeted for further improvement. These areas will provide a basis for establishing strategies and priorities for future work at hospital, state and national level.

As hospitals move from paper-based systems to EMM, the approach to national auditing will need to evolve to remain relevant, useful and patient centred. Future audits will require a different approach, with appropriate criteria and data collection tools that can accurately detect the types of errors associated with electronic systems and work practices. This will be a challenging task given the diversity of technology, configurations and decision-support tools within EMM systems. Hospitals are encouraged to use the results of the NIMC audit as a pre-implementation measure of safety and quality for comparison with post-implementation evaluation to demonstrate the benefits of EMM at a facility level.

Within the context of EMM initiatives, and in setting future direction for the NIMC and audit processes, it is time to undertake a review of the audit framework and tools. In conjunction with feedback from participating sites, the outcome of delivering enhancements to the NIMC and NIMC audit will provide a foundation for ongoing efforts to reduce the incidence of preventable AMEs.

7.1 National inpatient medication chart (acute)

[illegible]

DO NOT WRITE IN THIS BINDING MARGIN

DO NOT WRITE IN THIS BINDING MARGIN

National Maritime Museum - 0 420 42 - 0 Commonwealth of Australia 2015 - As amended 2012

Cut off section

[illegible]

NIMC (acute)

Cut off section

Attach ADR sticker

Allergies and adverse drug reactions (ADR)
☐ Nil known ☐ Unknown (tick appropriate box or complete details below)
 Medicine (or other) Reaction / type / date Initials

Sign: _____ Print: _____ Date: _____

Attach patient identification label here and overleaf

URN:
 Family name: _____
 Given names: _____
 Address: _____
 Date of birth: _____ Sex: M ☐ F ☐
 First prescriber to print patient name and check label correct: _____ Weight (kg): _____ Height (cm): _____

Regular medicines
 Year 20 _____ Date and month _____

Variable dose medicine
 Date: _____ Medicine (print generic name): _____ Drug level: _____
 Route: _____ Frequency: _____ Time level taken: _____
 Indication: _____ Pharmacy: _____
 Prescriber signature: _____ Print your name: _____ Contact: _____
 Time to be given: _____ Time given: _____

Dose
 Prescriber: _____
 Time to be given: _____
 Time given: _____

VTE risk assessed: Yes ☐ Prophylaxis not required ☐ Contraindicated ☐
 Date: _____ Medicine (print generic name): _____
 Route: _____ Dose: _____ Frequency and NOW enter times: _____
 Indication: _____ Pharmacy: _____
 Prescriber signature: _____ Print your name: _____ Contact: _____

VTE prophylaxis
 Prescriber signature: _____ Print your name: _____ Contact: _____

Mechanical prophylaxis
 Prescriber/NI signature: _____ Print your name: _____ Contact: _____

Warfarin
 Date: _____ Warfarin Marevan / Coumadin select brand: _____
 Route: _____ Prescriber to enter individual dose: _____ Target INR Range: _____
 Indication: _____ Pharmacy: _____
 Prescriber signature: _____ Print your name: _____ Contact: _____
 Initial 1: _____ Initial 2: _____

PRESCRIBER MUST ENTER administration times
 Date: _____ Medicine (print generic name): _____
 Route: _____ Dose: _____ Frequency and NOW enter times: _____
 Indication: _____ Pharmacy: _____
 Prescriber signature: _____ Print your name: _____ Contact: _____

Pharmaceutical review:

Recommended administration times
 Guideline only
 Morning: _____
 Night: _____
 Three times a day: _____
 Four times a day: _____
 Five times a day: _____
 Six times a day: _____
 Seven times a day: _____
 Eight times a day: _____
 Nine times a day: _____
 Ten times a day: _____
 Eleven times a day: _____
 Twelve times a day: _____

Warfarin education record
 Patient educated by: _____
 Sign: _____ Date: _____
 Given warfarin book: _____
 Sign: _____ Date: _____

Reason for not administering
 Code MUST be entered
 Absent (A) _____
 Fading (F) _____
 Refused - notify prescriber (R) _____
 Vomiting (V) _____
 On leave (L) _____
 Not available - obtain supply or contact prescriber (N) _____
 Withheld - enter reason in clinical record (W) _____
 Self administered (S) _____

Regular medicines
 Year 20 _____ Date and month _____

PRESCRIBER MUST ENTER administration times
 Date: _____ Medicine (print generic name): _____
 Route: _____ Dose: _____ Frequency and NOW enter times: _____
 Indication: _____ Pharmacy: _____
 Prescriber signature: _____ Print your name: _____ Contact: _____

Pharmaceutical review:

7.2 National inpatient medication chart audit form

AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE		National Inpatient Medication Chart Audit Form	
State	Healthcare Facility Code	Hospital Name	UR No.
Ward	Bed No.	Audit Date	Date of Birth
Chart Type ☐ NIMC ☐ NIMC Long Stay ☐ NIMC Paediatric ☐ NIMC Paediatric Long Stay		Gender ☐ Male ☐ Female	
Reviewer 1		Reviewer 2	
1. Patient Identification & Weight		5. Venous Thromboembolism (VTE) Prophylaxis	
1.1 Total current Medication Charts (ie. charts in use)		5.1 VTE Risk Assessment documented on any current medication chart Y N NA	
1.2 Patient ID complete on all pages (incl. hand-printed name if label used)		5.2 VTE Prophylaxis prescribed (VTE & Regular sections) (If No, go to Q. 6.1)	
1.3 Weight documented on a Medication Chart (Paeds must be all charts)		5.3 VTE Prophylaxis prescribed in VTE section (If multiple VTE Prophylaxis orders, at least one in VTE section)	
2. Adverse Drug Reaction (ADR) Details		6. Warfarin	
2.1 ADR documentation complete on all charts (incl. NKDA / Unknown)		6.1 Warfarin Guidelines at end of patient's bed or with Medication Chart	
2.2 Patient has previous ADR (If No or Unknown, go to Q. 3.1)		6.2 No. times patient prescribed warfarin (Warfarin & Regular Order sections) (If Nil / Zero, go to Q. 7.1)	
2.3 Similar class of medication prescribed (Document Drug, Reaction & Represcribed Drug here)		6.3 No. Target INR ranges documented if prescribed in Warfarin section ...	
2.4 If previous ADR, do all pages have ADR Alert Stickers in place ..		6.4 No. Target INR ranges documented if prescribed in Regular section ...	
3. Medication History		6.5 Warfarin Education recorded	
3.1 Medication History documented on Medication Chart (If Yes, go to Q. 3.3)		7. Sustained Release	
3.2 If 'No' is a Medication History cross-referenced on Medication Chart		7.1 No. Sustained Release medications ordered (Regular Order section) (If Nil / Zero, go to Q. 8.1)	
3.3 Medication Management Plan (MMP) Form in 'end of bed' folder (If No, go to Q. 4.1)		7.2 No. Sustained Release medications with SR box ticked	
3.4 Allergies / ADR box completed on MMP Form		8. Intermittent Medications	
3.5 No. medicines taken prior to presentation to hospital recorded on MMP Form		8.1 No. Intermittent medications ordered (ie. weekly, fortnightly, twice weekly) (If Nil / Zero, go to Q. 9.1)	
3.6 No. medicines with Dr's Plan on Admission completed on MMP Form		8.2 No. Intermittent medications ordered & 'boxed'	
3.7 No. medicines with Reconcile column ticked on MMP Form		9. Duplicate Orders	
3.8 More than one source indicated on MMP Form		9.1 No. Duplicated orders (Record Duplications here)	
4. Variable Dose		10. Pharmaceutical Review	
4.1 No. Variable Dose medications (Variable Dose & Regular Order sections) (If documented in Regular section, write Drug Name & Frequency here)		10.1 Pharmaceutical Review occurred (ie. initial at bottom of chart)	
Comments:			

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National Inpatient Medication Chart Audit Form

11. Prescribing and Administration

Legend

Drug Order:

R = Regular
P = PRN
S = Stat/Phone/Once Only
V = Variable Dose
W = Warfarin

Drug Name:

U = Unclear
T = Trade
C = Clear

Route / Dose:

C = Clear & Correct
M = Missing
U = Unclear
I = Incorrect

Frequency:

C = Clear
M = Missing
U = Unclear
I = Incorrect
NA = Not Applicable

Others:

Y = Yes
N = No

Definitions: Error Prone Abbreviations

mcg, µg, ug = microg, microgram
U or u = unit
qd or QD = daily, every day
o.d. or OD = once daily

SC, S/C = subcut, subcutaneous
SL, S/L = subling, sublingual
o (degree symbol) = hourly frequency
No leading zero before a decimal point (eg .5mg) = 0.5mg
Trailing zero after decimal point (eg 1.0mg) = 1mg

UR No.

Order No.	Drug Order	Drug Name	Route	Dose	Frequency	Dose Calc'n Documented	Dose Calc'n Documented Correctly	Error Prone Abbrev'ns Used	Indication Documented	Pharm Annot.	Pres. Signed	Pres. Clear	Freq. Matches Admin Time	Drug Ceased	Ceased Correctly	Doses Required	Doses Admin	If PRN, Max Dose doc.
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA
						Y N NA	Y N NA	Y N	Y N NA	Y N	Y N	Y N	Y N NA	Y N	Y N NA			Y N NA

7.3 Data quality statement

Executive summary table 1: Trends in audit results for prescribing errors and compliance with documentation

Change made

New variable added – % Warfarin orders in Warfarin section with target INR documented (regular section)

In previous reports, one of the items in the table was: 'Patients with a target INR for Warfarin documented'. The figure reported against this variable was taken from section '6.3 No. Target INR ranges documented if prescribed in Warfarin section' of the NIMC audit tool. As this variable name did not specify whether Warfarin was prescribed in the Warfarin or the regular section, it is more accurate to report the two figures separately. Therefore there are now two variables in the 2014 report:

- 6.3 No. Target INR ranges documented if prescribed in Warfarin section and;
- 6.4 No. Target INR ranges documented if prescribed in Regular section

Data quality

The denominator for section 6.3 in the NIMC audit system report is the count of Warfarin drug orders (that is, the count of times Warfarin is entered under 'Drug order' in section 11 'Prescribing and Administration' of the NIMC audit tool). Sometimes this does not correspond with the count of times the patient was prescribed Warfarin overall, which is recorded in section 6.2 'No. times patient prescribed Warfarin (Warfarin & Regular order sections)' and thus the denominator may be too small in relation to the numerator. For example, in the 2011 report, the figure for section 6.3 '% of Warfarin orders with target INR range documented in Warfarin section' was 114.21%, which is incorrect (due to a data quality error).

Auditors occasionally make data entry errors in reporting section 6.2. This then does not correspond correctly with the count of 'W' drug orders. For example, a keying error may have resulted in a figure that is too large describing how many times the patient was prescribed Warfarin in both sections, but then the auditor may have correctly entered the number of Warfarin orders in section 11 'Prescribing and Administration' of the NIMC audit tool. There are validation rules in the system to try and address these keying errors but these are not failsafe.

Executive Summary Table 2: Trends in audit results for prescribing errors and compliance with documentation

Change made

This change relates to patients prescribed Warfarin who have provision of education recorded. The 2011 and 2012 figures in this table were reported as 15.0; they should have been reported as 14.6 and 14.5 respectively. This was due to a rounding error.

Table 2: Hospital participation by peer group

Change made

In previous years, the classification of hospitals by peer group was used to report hospital participation based on the AIHW categorisation for 1999–2013.

The ACSQHC NIMC Audit System reflects the AIHW categories, and the recent changes to the reporting system have allowed the peer group classification to be reported in more detail. This has been used in the 2014 report and has been reapplied to earlier years' data.

Changes to hospital categories

In previous reports	In NIMC audit system and current report
Large major cities	Large major cities
Large regional & remote	Large regional and remote
Medium group	Medium (group 1)
	Medium (group 2)
Multi-purpose services	Multi-purpose services (MPS)
	Other non-acute
Principal referral	Principal referral
Private	Private hospital
Psychiatric	Psychiatric
Rehabilitation	Rehabilitation
	Small non-acute
Small regional and remote acute	Small regional acute
	Small remote acute
Specialist women's & children	Specialist women's and children's
Un-peered & Other	Unpeered and other

Table 3: Number of hospitals, patients, medication charts and orders per audit
First change made

The split of audited medication charts into NIMC Acute, NIMC Long Stay, NIMC Paediatric, NIMC Paediatric Long stay has now been provided in the 2014 report.

Second change made

Warfarin orders in 2006 were reported as 30 (0.3). The figure has been changed to 23 in the 2014 report, which is consistent with the figures from subsequent years in this table, which counts the number of Warfarin orders prescribed in the Warfarin section only.

Table 6: Medication history documentation

Change made

'Patients with a medication history documented on MMP form' is changed to 'Patients with a Medication Management Plan (MMP) Form in "end of bed" folder' consistent with the wording on question 3.3 of the NIMC audit tool.

Figure 3.1: Warfarin prescribing – comparison with previous years

First change made

As above, a new variable has been added – % Warfarin orders in Warfarin section with target INR documented (regular section).

In previous reports, one of the items in the table was: 'Patients with a target INR for Warfarin documented'. The figure reported against this variable was taken from section '6.3 No. Target INR ranges documented if prescribed in Warfarin section' of the NIMC audit tool. As this variable name did not specify whether Warfarin was prescribed in the Warfarin or the regular section, it is more accurate to report the two figures separately. Therefore there are now two variables in the 2014 report:

- 6.3 No. Target INR ranges documented if prescribed in Warfarin section
- 6.4 No. Target INR ranges documented if prescribed in Regular section

Second change made

Warfarin indication is documented (Warfarin section). The words 'Warfarin section' have been added to improve the precision of this variable.

Figure 8: Documentation of paediatric dose calculations National – comparison with previous years

Change made

Counts of paediatric drug orders have been provided.

Figure 10.1: Communication of prescribing decisions – comparison with previous years

Change made

The formula for calculating 'Unclear orders for drug name, route, dose or frequency' has been updated as follows to reflect the true intention of the variable:

Include once if drug name = 'U', or route = 'U' or dose = 'U' or frequency = 'U'/Total [drug order = R; P; S; V & W]*100 Note: count one error type per order only.

The variable was intended to show all drug orders that had a 'U' (unclear) in any of drug name, route, dose or frequency; only counting each drug order once if it had more than one U. The intention of this variable is not to count the same drug order twice if there was an unclear in more than one category. This now gives a true overall indication of how many drug orders were unclear.

As summarised in the following table, the numbers drop dramatically and give a much clearer indication of communication of prescribing decisions.

Number of unclear drug orders reported

Audit year	2009 audit N=9047 orders	2010 audit N=30 005 orders	2011 audit N=39 271 orders	2012 audit N=110 690 orders
Previous reports	49	38	24	37.6
Current report	30.1	18.6	23.9	22.8

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