

# Medication Prescribing, Surveillance and Safety in Australasian Emergency Departments

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## ABSTRACT

**Background:** The prescribing practices of the Fellows of the Australasian College of Emergency Medicine (FACEM) in Australasian emergency departments (EDs) are unknown.

**Aim:** To describe the FACEM's prescribing practices in relation to charting and monitoring medications in the ED; and to investigate the differences in the prescribing practices between the users and non-users of the National Inpatient Medication Chart (NIMC) in EDs.

**Method:** Analysis of a multimodal survey sent to FACEM across Australasia.

**Results:** Responses were received from 122 (n = 940) FACEM (13% response rate). 91% of FACEM considered medication safety to be a quality issue. Most FACEM (56%) prescribed on 2 to 3 different documents in the ED and only 39 (32%) prescribed on 1 document. Time pressure was the main barrier to safe prescribing in the ED. Prescribing guidelines for analgesics and antibiotics were often *in situ* but times to administration were not monitored. 65% of FACEM who used the NIMC tended to prescribe on only 1 document and came from larger EDs that employed an ED pharmacist. Strategies cited to decrease the rate of prescribing errors included educational interventions, ED pharmacists and use of the NIMC.

**Conclusion:** There are a wide range of prescribing and medication safety practices and a lack of conformity among Australian emergency physicians. Despite the introduction of the NIMC, most FACEM prescribed on multiple documents in the ED. The differences between users and non-users of the NIMC identified may aid future initiatives to increase its use.

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## INTRODUCTION

An estimated 3% of medication errors within emergency departments (EDs) involve adverse events stemming from healthcare management, of which 55% are preventable.<sup>1</sup> Factors contributing to medication errors identified in the literature include errors with the administration and dosing of analgesics and antibiotics.<sup>2</sup> Medication errors (e.g. wrong drug, incorrect dose, frequency, duration and route) have been positively correlated with the daily average ED Work Index (EDWIN) score, a measure of ED overcrowding.<sup>3</sup> Educational interventions, medication chart reviews by ED pharmacists and computer-assisted prescribing can reduce medication errors.<sup>4-14</sup>

The National Inpatient Medication Chart (NIMC) was designed to standardise the prescription, administration and monitoring of medications in

Australian hospitals.<sup>15,16</sup> The NIMC improves the documentation of adverse drug reactions, reduces medication errors and offers the benefits of structured medication practice on wards.<sup>15-18</sup> Only one study was identified in the emergency medicine literature regarding prescribing forms and medication errors. In their randomised controlled trial, Kozer et al.<sup>19</sup> reported that pre-printed order sheets significantly reduced errors (OR 0.55) in a paediatric ED.

There is no Australian literature on prescribing practices in EDs. The prescribing practices of the Fellows of the Australasian College of Emergency Medicine (FACEM) in Australasian EDs are unknown. Low staffing and time pressures are barriers to safe prescribing outside the ED.<sup>8,9</sup> Given the complexities of the ED, one could assume that these barriers are at least as equally important in the ED environment.<sup>20</sup>

This study's primary aim was to describe the FACEM's prescribing practices in relation to charting and monitoring medications in the ED. A secondary aim was to investigate the differences in the prescribing practices between the users and non-users of the NIMC in EDs.

## METHOD

A self-administered 20-item questionnaire was used to gather data on ED prescribing practices, with an emphasis on utilisation of the NIMC. The questionnaire and a cover letter were distributed by an Australasian College of Emergency Medicine employee not involved in the study to the 940 registered FACEM by mail and e-mail in August 2008. Participation in the study was voluntary. An e-mail reminder was sent in October 2008. Questionnaires were assigned identification numbers to ensure anonymity and confidentiality. Prior to distribution, the questionnaire was piloted on local registrars and consultants. The questionnaire was purpose designed to gather information in four domains.

1. FACEM demographics: year of qualification; type of ED (adult, paediatric, mixed) (< 10 000–20 000 = small-size; 20 001–40 000 = moderate-size; > 40 000 = large-size); annual census; and annual admission rate.
2. ED prescribing practices, guidelines and surveillance: different types of prescribing forms available; presence of prescribing guidelines for analgesics, antibiotics, antiemetics, constipation, procedural sedation and chemical restraint; and presence of ED education on safe prescribing.
3. Monitoring of medication safety: auditing aspects of analgesic and antibiotic use; presence of an ED pharmacist; and strategies implemented within the previous 12 months.
4. Aspects of medication safety: a global rating of the importance of medication safety (0 = not important; 1 = least important; 2 = less important; 3 = important;

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4 = more important; 5 = very important); usefulness and reliability of pre-hospital medication information; importance of proposed barriers to medication safety (staffing, time pressure, budget restraints, physical resources, medication presentation/storage).

The questionnaire used a multimodal format and included single answer, multiple choice and options ranked in order of importance. Qualitative information was gathered through extended answer options. The questionnaire was approved by the Southern Health Human Research Ethics Committee and the Australasian College of Emergency Medicine's Scientific Committee.

Data were analysed using the Statistical Package for the Social Sciences (version 17). Data describing the 122 FACEM's prescribing practices were presented as proportions. Based on NIMC utility, the FACEM were dichotomised into two groups: NIMC (n = 79) and non-NIMC (n = 42). FACEM who reported using the NIMC were included in the NIMC group whether or not it was the sole avenue for the ordering of medications, while the non-NIMC group consisted of the remainder. Comparisons were made between the two groups on demographic variables, prescribing/monitoring/usage factors and opinions on medication safety using number and percentage, with hypothesis testing using the Chi-square test.

## RESULTS

Responses were received from 122 FACEM from a possible 940 (13% response rate). Most FACEM (n = 80; 66%) had completed their Fellowship in Emergency Medicine in the last decade. Respondents worked mainly in major referral centres (n = 33, 27%) and 'mixed' EDs (treating both adult and paediatric patients) (n = 89, 73%). Seventy-four (61%) FACEM worked in large EDs with annual attendances over 40 000 patients. Admission rates at the various EDs ranged from 13% to 70% (median 30%). Respondent FACEM were predominantly from New South Wales (n = 42; 34%), which is consistent with their regional distribution (Table 1).

### Prescribing and Monitoring Medication Usage

The majority of FACEM (n = 111; 91%) considered medication safety to be an important quality issue in ED (overall ratings: important, more important and very important). Medications were simultaneously prescribed on a number of ED documents: inpatient drug charts (n = 112; 92%); triage charts (n = 43; 35%), nursing observation charts (n = 34; 28%); specific ED drug charts (n = 29; 24%); medical notes (n = 19; 16%) and observation unit charts (n = 7; 5.7%). Other charts/documents where medications could be recorded included IV fluid charts, resuscitation flow charts, rapid assessment form charts and trauma charts. Sixty-eight FACEM (56%) also simultaneously prescribed medications on two or three different ED documents, while 15 (12%) FACEM used four or five documents. Only 39 (32%) FACEM prescribed on a single form. Drug allergy alerts were also documented in a number of places: patient wrist bands (n = 99; 81%), patient history alert pages (n = 75; 62%), computer screen alert pages (n = 73, 60%) and others (n = 66, 54%), such as nursing charts, the NIMC and triage notes.

One hundred and eleven (91%) EDs had formal prescribing guidelines for analgesics (53%), antibiotics (59%), procedural sedation (56%) and chemical restraint (46%). There were few formal prescribing guidelines *in situ* for antiemetics (21%) and aperients (16%).

**Table 1. Demographic characteristics of respondents**

Characteristics	No. of respondents (n = 122)
<i>ACEM Accreditation for Advanced Training</i>	
Major referral centre	33 (27%)
Regional referral centre	22 (18%)
Urban district hospital	19 (16%)
<i>ED Size (Annual Census)</i>	
< 10 000	2 (1.6%)
10 001-20 000	3 (2.5%)
20 001-30 000	11 (9%)
30 001-40 000	26 (21%)
40 001-50 000	34 (28%)
50 000 +	40 (33%)
<i>ED Type</i>	
Adult	22 (18%)
Paediatric	8 (6.6%)
Mixed (adult and paediatric)	89 (73%)
<i>Year of Attainment of FACEM Qualification</i>	
2006 and after	17 (14%)
2001-2005	37 (30%)
1996-2000	26 (21%)
1991-1995	19 (16%)
1986-1990	17 (14%)
Before 1986	3 (2.5%)
<i>Training Accreditation</i>	
≥ 6 months	23 (19%)
12 months	37 (30%)
18-24 months	44 (36%)
<i>Australasian Region of Practice</i>	
NSW	42 (34%)
Vic.	30 (25%)
Qld	18 (15%)
WA	8 (6.6%)
Tas.	5 (4.1%)
SA	5 (4.1%)
NZ	4 (3.3%)
NT	3 (2.5%)
ACT	1 (0.8%)
<i>Presence of ED Pharmacist</i>	
Yes	61 (50%)
No	38 (31%)

ACEM = Australasian College of Emergency Medicine. ED = emergency department. FACEM = Fellow of the Australasian College of Emergency Medicine.

Although 65 (53%) FACEM received education on medication prescribing within their ED, only 30 (25%) reported the existence of a regular ED medication review committee. Despite the existence of guidelines for analgesics and antibiotics, only 27% and 15% of FACEM respectively monitored time to administration. When monitored, the median (IQR) times to analgesics and antibiotics were 30 (25 to 35) minutes and 60 (42 to 78) minutes, respectively.

Sixty-one (50%) FACEM had a pharmacist in their ED, of which 44% had a full-time equivalent of 0.5 to 1.0.

Forty-eight (39%) respondents found the ambulance/pre-hospital patient information to be very helpful, and 12% believed the information was accurate. Thirty (25%) FACEM perceived patients' pre-hospital information and the computer generated medication list by the general practitioner (GP) to be unreliable or misleading.

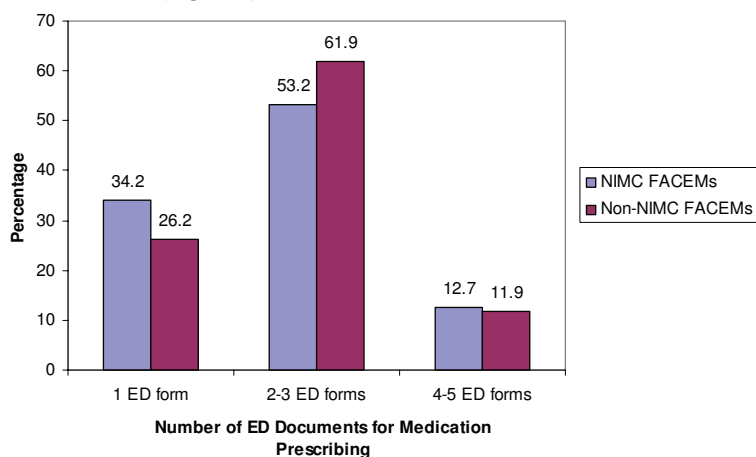
Time pressure was frequently reported as the most important barrier to safe prescribing followed by staffing, physical resources, medication labelling, packaging and storage, and budget restraints.

Strategies or programs implemented in the ED over the previous 12 months to promote safe prescribing included: introduction of the NIMC (41%); educational interventions (29%); appointment of an ED pharmacist (22%); medication dispensing (22%); and the elimination of multiple places for medication prescribing (20%).

### National Inpatient Medication Chart

Seventy-nine (65%) FACEM utilised the NIMC. Of the 42 non-NIMC FACEM, 15 (36%) would support its use in their ED, while 24 (57%) would not. The most common reason for not supporting the NIMC was its lack of applicability to the emergency setting (n = 19, 56%).

Although FACEM were more likely to prescribe on only one ED document when the NIMC was in use, it did not reach statistical significance (OR 1.5; 95%CI 0.6–3.4] (Figure 1).



**Figure 1. Different prescribing documents used by the FACEM in the ED (NIMC = National Inpatient Medication Chart).**

The NIMC group tended to come from large EDs with annual admission rates of over 40 000 (n = 51, 40%; vs n = 10, 23%; p < 0.05), tended to work in major referral centres (n = 23, 46%) and worked in mixed EDs as their primary workplace (n = 60, 78%). Respondents from New South Wales were significantly more likely to use the NIMC, while respondents from the Australian Capital Territory and New Zealand were least likely to do so (n = 49, 49%; vs n = 1, 1.3% and 0%; p < 0.01).

The NIMC group tended to have formal prescribing guidelines (n = 74, 94%) and an ED pharmacist in their EDs compared to the non-NIMC group (n = 42, 65%; vs n = 18, 55%; OR 1.5; 95%CI 0.3–1.5).

There was a significant difference among the users and non-users of the NIMC on three commonly cited barriers to safe prescribing: staffing (p = 0.03), time pressure (p = 0.01) and budget restraints (p = 0.004).

Time pressure was the most significant barrier to safe prescribing in the non-NIMC group (n = 26, 63%; vs n = 30, 40%; p = 0.01). Conversely, the NIMC group most frequently rated staffing (n = 30, 37%) as a significant barrier to safe prescribing.

The NIMC group tended to have strategies on medication safety introduced within the previous 12 months (OR 3.4; p = 0.03). These strategies included the introduction of the NIMC as the sole prescribing source, appointment of an ED pharmacist, medication dispensing guidelines and training and audit activities (Table 2).

### DISCUSSION

The majority of FACEM rated medication safety as an important issue. Most FACEM prescribed on two to three different ED documents while fewer than one-third prescribed on a single document. Provision of education on ED prescribing was reported by only half of the FACEM. Furthermore, medication monitoring in EDs was generally poor; with many FACEM working in EDs that lacked a medication review committee or an ED pharmacist. The Australasian College of Emergency Medicine's policy on pain management recommends 'regular monitoring of key clinical indicators related to best quality pain management', including timeliness to intervention.<sup>21</sup> Our findings did not show compliance with this recommendation, with most FACEM reporting no active auditing of compliance or outcome in the use of prescribing guidelines.

Our study found a higher prevalence of ED pharmacists than the 14% documented in 2003 by Thomasset et al.<sup>11</sup> The increased activity of clinical pharmacists within the ED may be due to recent evidence for improved medication safety and economics attributed to ED pharmacists.<sup>12–14</sup>

FACEM had mixed responses on the usefulness and reliability of pre-hospital and GP patient information. At least one-quarter of FACEM found this information to be unreliable. FACEM's opinions were in keeping with previous findings that medication lists from GP referral letters had an overall accuracy of only 58%.<sup>22</sup> These referral letters have little impact on patient management in the ED, and medication reconciliation is most accurate when ambulances bring patients' medications with them to the ED.<sup>23,24</sup> Our findings are concerning given the importance of accurate and rapid clinical decisions in the ED. If medication information is not trusted or used, errors of commission or omission become more likely.

### National Inpatient Medication Chart

The NIMC was more likely to be used in large EDs and in EDs that actively implemented medication safety strategies. Possible explanations may be that large EDs have more resources to focus on medication error reduction and are more likely to have an ED pharmacist (evident on sub-analysis, although not statistically significant). One-third of ED physicians who were not prescribing on the NIMC at the time of the survey, reported that they would be willing to use the NIMC. Surprisingly, FACEM that used the NIMC also used other documents to prescribe medications. A possible reason for the lack of conformity to the single NIMC may be the belief that it lacks applicability in the ED (56% non-NIMC group). There are no statistically significant associations between the use of the NIMC and the use of clinical prescribing guidelines, departmental medication review committees or department type.

Time pressure and staffing were important barriers to safe prescribing in both groups, but time pressure was more significant in the non-NIMC group. In contrast, Millar et al.<sup>9</sup> found that the NIMC increased time pressure in the wards by a doubling in the number of charts

required per patient episode. Whether this is a concern in the ED, or whether the overall benefit outweighs this cost has not been studied.

New medication safety strategies were more prevalent in the NIMC group potentially indicating

**Table 2. Comparison of the NIMC FACEM and Non-NIMC FACEM**

Variables		NIMC group (n = 79)	Non-NIMC group (n = 42)	95%CI, Odds Ratio	p-value	
Medication prescribing location*	1 document	27 (34%)	11 (26%)	[0.6-3.4]	1.5	0.4
	2-5 documents	52 (66%)	31 (74%)			
Annual census†	< 10,000	0	2 (5.1%)	[0.01-0.1]		0.05
	10 001-20 000	3 (3.9%)	0			
	20 001-30 000	9 (12%)	2 (5.1%)			
	30 001-40 000	13 (17%)	13 (33%)			
	40 001-50 000	21 (28%)	13 (33%)			
	50 000 +	30 (40%)	9 (23%)			
ACEM accreditation	Major referral	23 (46%)	10 (42%)	[0.9-1.0]		0.9
	Urban district	13 (26%)	6 (25%)			
	Regional referral	14 (28%)	8 (33%)			
ED pharmacist	No	23 (35%)	15 (46%)	[0.3-1.5]	1.5	0.3
	Yes	42 (65%)	18 (55%)			
ED type†	Paediatric	4 (5.2%)	4 (9.8%)	[0.5-0.7]		0.6
	Adult	13 (17%)	8 (20%)			
	Mixed	60 (78%)	29 (71%)			
Formal prescribing guidelines	Yes	74 (94%)	36 (86%)	[0.7-8.6]		0.2
	No	5 (6.3%)	6 (14%)			
Review committee	Yes	17 (23%)	13 (33%)	[0.3-1.4]	0.6	0.2
	No	57 (77%)	26 (67%)			
Education	Yes	40 (52%)	25 (60%)	[0.3-1.6]	0.7	0.4
	No	37 (48%)	17 (41%)			
Implementation of strategies	Yes	35 (83%)	16 (59%)	[1.1-11]	3.4	0.03
	No	7 (17%)	11 (41%)			
Medication safety†	Very important	39 (51%)	24 (57%)	[0.7-0.9]		0.8
	More important	26 (34%)	11 (26%)			
	Important	7 (9.2%)	3 (7.1%)			
	Less important	3 (3.9%)	2 (4.8%)			
	Least important	1 (1.3%)	1 (2.4%)			
	Not important	0	1 (2.4%)			
<i>Most Significant Barriers to Safe Prescribing</i>						
Staffing	Yes	28 (37%)	7 (18%)	[1.1-7.0]	2.8	0.03
	No	48 (63%)	33 (83%)			
Time pressure	Yes	30 (40%)	26 (63%)	[0.2-0.8]	0.4	0.01
	No	46 (61%)	15 (37%)			
Budget restraints†	Yes	4 (5.3%)	2 (5%)	[0.2-6.0]	1.1	0.004
	No	72 (95%)	38 (95%)			
Medication labelling†	Yes	4 (5.3%)	4 (9.8%)	[0.1-2.2]	0.5	0.4
	No	72 (95%)	37 (90%)			
Physical resources†	Yes	13 (17%)	2 (4.9%)	[0.9-19]	3.9	0.06
	No	64 (83%)	39 (95%)			

\*Linear by Linear Association or Mantel-Haenszel test. †Fisher's exact test.

ACEM = Australasian College of Emergency Medicine. FACEM = Fellow of the Australasian College of Emergency Medicine. NIMC = National Inpatient Medication Chart.

increased medication safety activity in this group. Twenty per cent of the NIMC group indicated that the NIMC had been made the sole place for prescribing in their ED within the last year. If this shift to a single standardised document were to gather momentum, an important potential source for error could be reduced.

### Limitations

The most significant limitation of this study was a low response rate, which exposes the results to the possibility of a significant sampling error affected by positive reporting and non-response bias. The method of distribution or appearance of the questionnaire may have contributed to the low response rate.

As our sample size was small, results are subject to selection bias. However, this was partly overcome, as the geographical distribution of respondents was consistent with the Australasian College of Emergency Medicine's database of practising Fellows. A further limitation on sampling was the lack of a sample size calculation for the comparison of NIMC and non-NIMC FACEM. As this was the first survey to be conducted, the sample size will not affect survey bias when practices are unknown but will provide the information required to perform a meaningful future sample size calculation.

Respondents provided very little additional information in the free text section, and hence the multiple choice format of the questionnaire limited the range of responses which may lead to relevant issues not being raised.

Although the questionnaire was piloted among a group of FACEM to ensure face validity, it has not been used by others and hence the survey has not been validated for content.

There is a potential for measurement bias around the reporting of medication prescribing forms. Despite fluid orders not being mentioned in the questionnaire, respondents may have considered fluid charts as a second form, and thereby skewing the results towards more forms being utilised.

Our study did not look at patient outcomes. However, it is reasonable to expect that the benefits following the introduction of the NIMC can translate to better outcomes in the ED.

### CONCLUSION

There are a wide range of prescribing and medication safety practices and a lack of conformity among Australian emergency physicians. Despite the introduction of the NIMC, most FACEM prescribed on multiple documents in the ED. The differences identified between users and non-users of the NIMC may aid future initiatives to increase its use.

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