

MEDICATION ADMINISTRATION ERRORS: UNDERSTANDING THE ISSUES

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ABSTRACT

Objective:

This paper surveys current literature related to medication administration errors, the role of nurses in such errors, and current initiatives that are underway within New Zealand to address this aspect of patient safety.

Setting:

The literature review focused on research that primarily addresses the issues related to medications that arise in tertiary care facilities.

Primary argument:

Medication administration errors are reported to occur in one in five medication dosages. Such events have long been scrutinised, with the primary focus being the practice of nurses and their role in medication error. Analysis of such events frequently identifies the nurse as the deliverer of unsafe practice. However, over the past few years a shift in how medication errors are understood has led to the identification of systems-related issues that contribute to medication errors.

Conclusion:

Initiatives such as the 'Quality and Safe Use of Medicines' raise the opportunity to address some of the safety related issues with a view to enhancing patient safety. A call for nurses to pre-emptively drive and contribute to these initiatives, along with the development of nursing led research, is offered.

INTRODUCTION

The issue of medication administration (MA) within the acute-care setting has long been the focus of scrutiny and research, in part because medication administration errors (MAE) contribute directly to patient morbidity and mortality (Tissot et al 2003; Barker et al 2002a; Schneider et al 1998). A desire to provide patients with optimum and safe care fuels practitioners and academics alike to create strategies to reduce the likelihood of administration errors occurring. However, MAE continue to occur.

The development of the Safe and Quality Use of Medicines group in Australia in the early 1990s prompted Australian practitioners to review historically-accepted practices surrounding MA and re-configure how they conceptualised the safe use of medicines (Hunt and Parks 1999). In late 2003, New Zealand health care practitioners began to adopt a similar strategy of the same name for addressing medication issues in relation to patient safety. These strategies provide nurses with a unique opportunity to contribute to practice initiatives at the national policy level and enhance the quality of patient care. It is crucial that nurses actively engage in this debate and contribute to the body of knowledge in this area.

This paper examines the issue of MA in the acute-care setting. It highlights: how MAE are defined in the literature, which has historically positioned nurses as incompetent and in need of remedial assistance; common reasons for MAE; and strategies for the prevention of such events. Literature that speaks specifically to the New Zealand context is considered, and a critique of current understandings of nursing practice in relation to MA is offered. The article concludes with a call for research on MA that is focused on, and driven by, nurses.

SEARCH METHOD

The search methods employed for this literature review included both nursing and medical databases. Specific

Table 1: Research measuring medication error rates

Participants/setting	Method of measurement	Prescribing	Preparation	Administration
Nurses: geriatric & cardio-thoracic units (Tissot et al 2003)	Observational	Not observed	Not observed	14.9:100
Nurses: paediatric ICU (Schneider et al 1998)	Observational	Not observed	23:100	32.4:100
Junior medical staff (Davydov et al 2004)	Prospective observational	1.1:100	Not observed	Not observed
Clinical charts and incident reports (Headford et al 2001)	Chart audit Analysis of incident reports	8:100 (of all incidents)	13.7:100 (Ratio of incident classification)	74.7:100 (Ratio of incident classification)
Nurses & doctors: intravenous medication in acute care (Wirtz et al 2003)	Observational	Not observed	26:100	34:100
Medical and surgical units in two tertiary-care hospitals (Leape 1995)	Prospective cohort study	39:100	Not measured	38:100
Doctors, nurses, pharmacist: tertiary-care hospital (Wilson et al 1998)	Prospective cohort study	68:100	7:100	25:100
Doctors, nurses, pharmacist: tertiary-care hospital (Ashcroft et al 2003)	Retrospective analysis of incident reports	22:100	15:100	32:100
All HCP in PACU (Hicks et al 2004)	Secondary analysis of MEDMARX database	22.5:100	5.9:100	59.5:100

databases accessed included: Cumulative Index to Nursing and Allied Health (CINAHL), Cochrane Database of Systematic Reviews, Medline, Proquest, Web of Science, Blackwell Synergy and EBSCO megafile. The key words employed for the search were: 'medication administration', 'drug administration', 'medication administration errors', 'medication safety', 'quality use of medicines', 'nursing and medicines', 'patient safety', 'incident reporting', 'quality improvement strategies', and 'organisational safety'. The literature was limited to English based articles.

Definition of medication administration errors

Multiple definitions of what constitutes a MAE exist in published research and literature. One definition frequently employed by medical doctors of MAE is any deviation from the physician's medication order as written on the patient's chart (Headford et al 2001; Mark and Burleson 1995), which fails to consider that prescribing errors do contribute to MAE (Davydov et al 2004; Headford et al 2001; Wilson et al 1998).

However, the definition typically cited in literature that is authored by nurses is that of Wolf (1989), who defines MAE as 'mistakes associated with drugs and intravenous solutions that are made during the prescription, transcription, dispensing, and administration phases of drug preparation and distribution (Wolf 1989, p.8).

These errors can be classified as either acts of commission or omission, and may include the following:

wrong drug; wrong route; wrong dose; wrong patient; wrong timing of drug administration; a contra-indicated drug for that patient; wrong site; wrong drug form; wrong infusion rate; expired medication date; or prescription error. Such errors can occur in either an intentional or unintentional manner (Wolf 1989).

Medication error rates

The manner in which MAE rates are determined varies greatly and is dependant on the method of measurement employed to assess the error rates. However, observations of practice are considered to be the most accurate way of measuring the occurrence of MAE (Thomas and Peterson 2003; Barker et al 2002b; Flynn et al 2002).

Two such observational studies found that MAE rates in the acute-care setting varied between 14.9% (Tissot et al 2003) and 32.4% (Schneider et al 1998). The medication error rate for intravenous medications is significantly higher than other types of medications, with researchers observing preparation error rates of 26% and administration error rates of 34% (Wirtz et al 2003). The total of all observed medication errors indicates that errors occur in almost one out of every five doses (Barker et al 2002a). Research that has assessed the error rates during either the prescribing, preparation or administration phases of medication handling is further described in table one.

Table 2: Types and ratios of medication administration errors

Type of error	Research & ratios of factors contributing to MAE						
	Fortescue et al (2003)	Hicks et al (2004)	Tissot et al (2003)	Wirtz et al (2003)	Headford et al (2001)	Wilson et al (1998) PIC statistics	Schneider et al (1998)
Wrong administration rates		5:100	19:100	21.6:100	8:100	7:100	8.7:100
Wrong IV push rate				88:100			
Omission of dose	8.1:100	20:100	16:100	10.6:100	50:100	5:100	1.1:100
Drug compatibility			6:100	10:100		3:100	
Wrong dose	37.1:100	24:100	12:100	10:100	7.6:100	4:100	7.7:100
Calculation errors				12:100			
Wrong drug					5.7:100	1:100	
Wrong patient		2:100			1.9:100		
Wrong time	12.5:100	3:100	26:100	16.9:100	2.7:100	9:100	8.7:100
Dose delayed > 1 hour						49:100	
Wrong route	17.7:100	1:100			1.5:100	1:100	0.7:100
Allergy related error	1.8:100				1.3:100		
Additional/unauthorised dose	0.7:100	14:100	13:100		9.3:100		

When addressing the issue of MAE rates, researchers return to standard categories for describing the various ways in which errors occur. These factors cover errors such as wrong administration rates, calculation errors, and wrong dose. Research suggests that the number one occurring error is inaccurate IV push rates, with 88 in 100 doses being improperly administered (Headford et al 2001). Other frequently observed errors included wrong administration rates, which ranged between five to 21.6 in 100 doses (Hicks et al 2004; Wirtz et al 2003), and the omission of dosages, which ranged between 8.1 to 50 in 100 doses (Fortescue et al 2003; Headford et al 2001). The least frequently observed error was an allergy related error, which occurred between 1.3 and 1.8 times in 100 doses (Fortescue et al 2003; Headford et al 2001). Additional statistics that have emerged from a number of different studies are further described in table two.

Factors that contribute to medication errors

Factors that contribute to medication errors are typically divided into two sub-groups: those caused by systems errors, and those caused by individual health care professional issues. Another issue that is worthy of examination in the context of contributing factors is that of incident reporting.

Systems issues

Hospitals are complex systems comprising both human and technological aspects (Clancy 2004a; Freedman Cook

et al 2004; Singer et al 2003; Anderson and Webster 2001). Such systems may be thought of as consisting of components that include design, equipment, procedures, operators, supplies and environments (Anderson and Webster 2001), within any of which errors may occur.

The medication process is, in itself, a complex sub-system of a hospital. Prescribing, preparing and administering medications is therefore reliant on a variety of processes intended to ensure that patients receive appropriate treatment. However, if a problem arises in any phase of either an organisational system or the medication process, it increases the likelihood that a patient will not receive the correct medication, compromising their safety.

Experts and researchers alike have identified a number of systems issues that impact on patient safety in relation to MA, including patient acuity levels, available nursing staff, access to medication and policy documentation (see table 3). As a result, acute-care organisations have put systems strategies in place to reduce the number of systems errors (Freedman Cook et al 2004; Sokol 2004; Brush 2003; Revere 2003; Singer et al 2003; Orser 2000). These include, for example, purchasing a single type of intravenous medication pump that requires access to a specific computer program to alter the pump's settings (Brush 2003; Orser 2000). Unfortunately, there is little research evaluating the impact of these systems strategies in reducing the numbers of medication errors.

Table 3: Systems issues that contribute to medication errors

Systems issues identified	Supporting research/literature
Lack of adequate staffing	Committee on the work environment for nurses and patient safety (2004) Vincent (2003) Dean et al (2002) Wakefield et al (1998) Blegen and Vaughn (1998) Leape et al (1995)
Patient acuity levels	Dean et al (2002) Leape et al (1995)
Inadequate access to policy and medication information	Clancy (2004b) Committee on the work environment for nurses and patient safety (2004) American Academy of Pediatrics (2003) Andersen (2002) Cohen and Cohen (1996)
Physical environment: lighting, drug preparation facilities	Hicks et al (2004) Brush (2003) Dean et al (2002) Poster and Pelletier (1988)
Organisational culture	Bagian (2004) Committee on the work environment for nurses and patient safety (2004) Freedman Cook et al (2004) Singer et al (2003) Vincent (2003) Baker (1999b)
Organisational communication channels	Committee on the work environment for nurses and patient safety (2004) American Academy of Pediatrics (2003) King, Paice, Rangrej, Forestell and Swartz (2003) Tissot et al (2003) Vincent (2003) Baker (1999b) Vincent et al (1998)
Organisational routines	Andersen (2002) Baker (1994) Raju et al (1989)
Pharmaceutical related issues	Traynor (2004) Brush (2003) Tissot et al (2003) Orser (2000) Wakefield et al (1998)
Incident reporting culture	Berntsen (2004) Bulla (2004) Freedman Cook et al (2004) Lamb (2004) Mayo and Duncan (2004) Suresh et al (2004) Frankel et al (2003) Webster and Anderson (2002)Anderson and Webster (2001) Pape (2001) Baker (1997) Day et al (1994) Davis (1990)

Within the past decade there has been a shift internationally in how adverse events, including MAE, are understood, and more attention is being paid to organisational systems errors (Vincent 2003; Institute of National Academies 1999). The Veterans Health Administration in the United States of America (Bagian 2004; Vincent 2003), and more recently the National Health System in Britain (National Patient Safety Agency 2003), have completely changed their approach to adverse events.

Instead of focusing on individual culpability, attention is

focused on systems issues that contribute to errors, in an attempt to address gaps and failings within a system itself (Vincent 2003). In essence, rather than assigning blame, the intent is to prevent the event from occurring again. The focus on improving systems to avoid errors has led to a marked decrease in the rate of error occurrence (Bagian 2004).

Professional issues

The issues that affect an individual professional's practice are varied and multifaceted (see table 4).

Table 4: Personnel issues that contribute to medication errors

Personnel issues identified	Supporting research/literature
Understanding of how errors occur	Mayo and Duncan (2004) Tissot et al (2003) Vincent (2003) Andersen (2002) Wakefield et al (1998) Wilson et al (1998) Segatore et al (1994)
Failure to adhere to policy and procedure documents	Hicks et al (2004) Tissot et al (2003) Dean et al (2002) O'Shea (1999) Wakefield et al (1998) Cohen and Cohen (1996)
Number of hours on shift	Mayo and Duncan (2004) Tissot et al (2003) Dean et al (2002) Raju et al (1989)
Distractions	Hicks et al (2004) Tissot et al (2003) Wakefield et al (1998) Segatore et al (1994)
Lack of knowledge about medications	King (2004) Tissot et al (2003) Andersen and Webster (2002) Meurier et al (1997) Leape (1995)
Dosage calculating	Oldridge et al (2004) Wong et al (2004) Preston (2004) Schneider et al (1998) Segatore et al (1994)
Workload	Hicks et al (2004) Mayo and Duncan (2004) Anderson and Webster (2001) O'Shea (1999) Meurier et al (1997)
Care delivery model	Hicks et al (2004) Dean et al (2002) Jarman et al (2002) O'Shea (1999) Bates et al (1998) Ridge and While (1995)

The literature that explores MAE frequently links errors to specific professional traits, focusing on individual practitioner's attributes, skill levels and competencies (Preston 2004; Pape 2001; O'Shea 1999; Ernst, Buchanan and Cox 1991). For example, it is reported that an individual practitioner may contribute to a medication error through a lack of general knowledge about medications (Tissot et al 2003; Meurier, Vincent and Parmar 1997; Leape 1995). This lack of knowledge may include the inability to accurately calculate medication dosages which, according to research, significantly contributes to a nurse's likelihood of making an error (Oldridge et al 2004; Preston 2004; Schneider et al 1998; Segatore et al 1994). This is of particular importance in paediatric settings and neonatal intensive care where drug dosages are determined by body weight.

Incident reporting

The issue of reporting medication errors has been widely debated in the literature (Bulla 2004; Freedman Cook et al 2004; Lamb 2004; Suresh et al 2004; Frankel, Gandhi and Bates 2003; Vincent and Coulter 2002; Webster and Anderson 2002; Anderson and Webster 2001; Pape 2001; Baker 1997; Fonseka 1996; Day et al 1994; Davis 1990) (also see table 3).

It is acknowledged in this literature that the vast majority of accidents are not reported and that near-miss accidents are almost never reported. In part this has been attributed to the fact that, historically, most incident reporting forms require individuals to identify themselves and, if directly involved, accept responsibility for the error, regardless of the circumstances.

Table 5: Medication error statistics from three District Health Boards

Type of medication error	DHB 1*	DHB 2	DHB 3
Medicine given despite contra-indications		0.27%	
Medication given in wrong amount	11.3%	24.2%	42%
Medicine incorrect	27.3%	14.2%	9%
Adverse reaction to medication noted		1%	5%
Pharmacy related medication issues	0.4%	6.4%	4%
Medicine prescribed incorrectly		4.3%	5%
Medicine given via incorrect route	11.7%	0.27%	
Medication omitted/given at wrong time	26.1%	20.7%	20%
IV therapy timing/dosage/administered incorrectly	16.6%	28.3%	
Wrong patient	5.2%		2%
Allergy related errors	1%		4%

* DHBs are not individually identified to protect anonymity

Nurses and other health care professionals participating in research have discussed how they fear the consequences of reporting a medication error because of the disciplinary and professional ramifications (Vincent 2003; Arndt 1994). Baker (1997) highlights that because of this, nurses frequently embrace their own version of what constitutes a medication error. She reports that nurses engage in a process that seeks to negotiate between institutional policy and the practical constraints that govern everyday practice.

Another issue that affects incident reporting is the format of the forms, many of which are structured in such a way that systems issues are not identified. For this reason researchers and practitioners have suggested changing incident forms to incorporate the identification of systems issues and have proposed anonymous reporting (Bulla 2004; Suresh et al 2004; Anderson and Webster 2001).

These strategies have been documented to increase the likelihood of practitioners reporting errors as well as near-misses (Suresh et al 2004; Vincent 2003). Such approaches to the issue of incident reporting also increase the opportunity to discover the factors that contribute to systems-related errors (Bulla 2004; Lamb 2004; Suresh et al 2004; Vincent 2003; Anderson and Webster 2001; Day et al 1994). Authors such as Baker (1999a) and Lamb (2004) assert that unless reporting mechanisms that focus on a single individual are changed, systems issues will not be addressed, and will remain invisible.

The New Zealand context

A national database describing the prevalence of MAE is not available in New Zealand and little literature has been published about such events (Seddon and Merry,

2002; Webster and Anderson 2002; Anderson and Webster 2001; Healee 1999). It has been reported that the overall incidence of adverse events occurring within the hospital system in New Zealand is 6.3% (Davis et al 2002). However, this study did not specifically target MAE.

Some information about the number of medication errors being reported from within three District Health Boards (DHBs) gives some indication as to the type of errors that occur (see table 5). However, there is considerable variation between the different hospital statistics in relation to the point at which errors occur, suggesting that the systems issues of greatest concern may vary from one hospital to another.

Information about medication errors on a national level is available from the Accident Compensation Corporation (ACC), which administers New Zealand's national accident insurance scheme. ACC's Medical Misadventure Unit assesses individual cases where medical error or medical mishap may have occurred, and provides compensation accordingly. During the period from 1993-2004 ACC has accepted 31 drug error claims (O'Neill 2004), which constitutes 3% of all that have been accepted on the grounds of medical error. Of the 31 drug error claims, 17 (33%), have been attributed to nurses (O'Neill 2004).

Over the past few years the New Zealand Ministry of Health has developed a number of initiatives to help individual DHBs enhance patient safety in relation to sentinel events (Ministry of Health 2001a; Ministry of Health 2001b). The National Health Epidemiology and Quality Assurance Advisory Committee (referred to as EpiQual) was also established following a legal mandate in 2000 to provide assistance to DHBs on issues such as

quality improvement, leadership and advice. Another crucial task referred to EpiQual was the collection of national data to assist with quality improvement within the DHBs.

In late 2003, the drive to develop a system to address national issues related to MA saw the development of the Quality and Safe Use of Medicines initiative in New Zealand. This exciting initiative has the potential to address many of the systems-related issues affecting patient safety. It spans all facets of health care delivery and promotes collaborative and multidisciplinary input into the process. In response, some DHBs have appointed professionals within their organisations to drive the development of Quality and Safe Use of Medicines. One such DHB, Capital and Coast District Health Board, has embraced a multidisciplinary approach, appointing a nurse, a pharmacist and a doctor to address issues to enhance the safe use of medicines.

These initiatives are the first steps toward re-defining how we understand the handling of medications, and it is important that nurses across the country take the initiative and respond by offering their input. However, for nurses to embrace their important role in patient safety, it is imperative they examine their previously-held understandings of nurses' role in the medication process, and move on from that position to positively influence change.

Historical understandings and future directions for nurses

Nurses take responsibility for MA, as well as monitoring the prescribing practices of other professionals. They are the gate-keepers, maintaining active surveillance over the process on a continual basis. This can leave nurses feeling vulnerable, and therefore, their MA practices may be motivated by factors such as fear and professional liability, instead of client safety (Freedman Cook et al 2004; Frankel et al 2003; Day et al 1994). This position within the medication chain may lead to nurses accepting the responsibility for prescribing, dispensing and medication errors they may not have contributed to.

As demonstrated in this analysis of the literature, the biomedical model holds sway over nursing knowledge in relation to MA, shaping nursing practice accordingly. As a consequence, expertise on MA is afforded to those outside the profession (Gibson 2001). However, nurses are key to the process of MA and it makes sense that they take control of the process, instead of listening to other disciplines' musings on what nurses need to do differently. It is important that nurses contribute to nursing knowledge, and thereby extend our professional body of knowledge and expertise.

Nurses work in a multidisciplinary environment, but must question the blanket acceptance of the belief that nurses are incapable of practicing safely without oversight from other disciplines. Nurses need to examine the

historical tendency to step outside their professional domain and expertise to find the answers to MAE from others. Indeed, what right do other professions have to define nursing practice? Nurses can begin addressing this issue from the position of being knowledgeable-practitioners, who have significant expertise in detecting prescribing errors, and celebrate our distinguished history of keeping patients safe despite multiple systems errors.

Nurses can also gain control of their practice discipline by addressing difficult issues that have held them captive to prescribed ways of 'being in the world'. The example of MAE in relation to nursing practice demonstrates that nurses needlessly leave themselves open to critique and censure, because so often they have ignored the fact that the prescribing process is multidisciplinary in nature. Therefore it is important that nurses consciously take up the challenge of addressing important practice issues and energetically contribute to change.

In a landmark study, based in Australia, Baker (1997) spent time talking with nurses about how they understood medication errors. The findings of this study highlight that nurses are continually mindful of delivering optimal and safe patient care. As a result, nurses are constantly having to walk the tight-rope between adherence to policy and delivering responsive client-oriented care. This situational complexity defines the experience of nursing practice in relation to MA. The outcomes of Baker's study stress the importance of talking to nurses about their practice, as these discussions can fuel the development of nursing-focused strategies that will provide meaningful support in relation to MA-related decision making.

Ultimately, there is a need to throw off the culture of 'blame and shame' that has traditionally cloaked the issue of MAE, and has contributed to erroneous perceptions about nurses' ability to deliver safe practice. This will only be achieved if nurses actively drive change within both the clinical and research settings. It is imperative that clinically-based nurses contribute their expertise towards directing practice strategies, as well as driving research that examines the issue of MA. If nurses do not respond to the call to change our professional culture, we will forever be at the mercy of other disciplines' commentaries about our practice.

The Quality and Safe Use of Medicines initiative provides nurses with the opportunity to proactively change the way MAE is understood and dealt with on a national level. Nurses need to participate in initiatives that seek to tap into their expertise on MA, which can be achieved by actively participating in guideline development and contributing to New Zealand-based research. Through this process nurses, can significantly enhance patient safety and promote professional standing.

CONCLUSION

This paper has highlighted that MA is an important part of delivering safe patient care. Despite a desire to

deliver high quality care, errors occur on both a systems and personal level. Nurses have historically taken a back-seat role in initiatives that have sought to address issues related to MA, however nurses have developed significant expertise in MA and have considerable knowledge of associated systems. This knowledge needs to be accessed and utilised within quality initiatives tackling the issue of MA. The Quality and Safe Use of Medicines Group provides New Zealand nurses with an opportunity to contribute to national policies on the safe use of medicines.

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