Quality and safety of prescribing practices in aged care and rehabilitation units in an Australian hospital

ORIGINAL ARTICLE

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ABSTRACT

Objectives. As 56% of preventable adverse drug events occur at the prescribing stage, this study aimed to improve the management of drug prescription by introducing an action research process into a hospital setting.

Methods. This study implemented a series of interventions through 'plan-act-observe-reflect cycles' in a stepwise fashion. The 6 key performance indicators from the National In-patient Medication Chart (NIMC), staff surveys on medication prescribing and administration, and the Incident Information Management System for reported medication errors in 2008 and 2009 were used.

Results. During the 2-year period, 85% of the NIMC indicators were achieved despite a regular change of medical teams every 3 to 4 months. There was also increased awareness of medication safety culture, improvement of collegial relationships, effective communication of medication management among team members, and the establishment of 'local champions' within the organisation.

Conclusions. Action research, which focuses on people, their practices, and interaction can improve the management of medication.

Key words: Health occupations; Health services research; Interdisciplinary communication; Medication therapy management

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INTRODUCTION

Medication error is a major concern in the New South Wales Public Health System. In an incident management report, falls and medication error were the top 2 most-reported incidents in 2007.[1] In 2002 to 2008, 2 to 3% of Australian hospital admissions were medication-related.[2,3] Medication errors can occur at any time during a hospital stay involving prescribing, dispensing, or administration of medication.[4-6] Prescription errors are one of the major risk factors for adverse drug events (ADEs), and 32 to 77% of these errors are preventable.[7,8] In 2009, 47% of medication errors occurred at the prescribing stage.[9]

Safety factors in relation to expertise in drug therapy, knowledge of individual patient factors, and adequacy of the existing monitoring system have been reported.[3,7] These factors have broadened the understanding of how to improve communication and interaction among physicians, pharmacists, nurses, and patients. Most of the ADEs occurring during the medication process within the hospital system are related to miscommunication among

health care workers.[3,7] The objective of best practice in prescribing drugs is to raise the standard of medication management and to minimise the risk of ADEs.

This study aimed to assess an approach to change in medication management that minimises this risk. This involved examining and recording the way the existing medication system worked within a hospital setting, where and how the errors emerged, and how these could be prevented. This study was innovative in that it particularly focused on the interaction and communication among professionals, and involved them throughout the process along with the use of a number of fora and tools. This generated change by implementing simple but innovative ways for improving both medication prescribing and administration, and the reporting process by staff. The action research (AR) approach[10,11] was used to achieve the aims and objectives, and findings that emerged from this 2-year study for developing new principles of medication management.

METHODS

By drawing on an AR approach, the study began by investigating existing practices of medication management in 4 aged care units of a Sydney metropolitan hospital. This was followed by an interactive process of communication and mutual support among researchers and health care workers in the units to foster team involvement and capacity building aimed at introducing changes and improving medication management within the hospital. The hospital selected for the study was within an 'area' health system of the broader state health care system.

Although medication errors can have serious health implications for patients of any age and condition, this investigation was conducted in the aged care units of a Sydney hospital because older people have a higher prevalence of disease and are often required to take multiple medications.[12,13] Compliance with the medication regimen is frequently poor among older people, and patients who have complex medication regimens can be at high risk of ADEs. One in 5 hospital admissions for older people is medication related.[13] When serious ADEs occur owing to medication errors, the ethical and legal fall-out can affect both the professionals and institutions. When faults are due to procedures not followed, or where patient details are missing, there is a possibility of negligence.[14] Failure to keep complete and accurate records can be regarded as a negligent omission.[14]

Standards in health care tailored to the elderly are set out in the Commonwealth Aged Care Act 1997. The Act outlines principles and guidelines regulating aged care units including nursing homes. It covers practices and services that are the appropriate management, dispensation, and recording of drugs including drugs charts not kept properly.[15] Attention to medication safety within a geriatric unit can be achieved through an approach that takes into consideration these complex interactions and inter-dependencies, while at the same time addressing day-to-day problems as they arise, and producing practice-based evidence.[16]

AR is a vehicle for professional learning, development, and social transformation, aiming at improvement and involvement.[10] All research aimed at implementing change involve integrating methods with people.[17] This underlies both complex adaptive systems theory and AR. AR involves an iterative process of planning, intervention and review.[10] Through AR, investigators can consider the unpredictable elements in a situation and allow for the process of change to be investigated and evaluated.[18] Drawing on AR, an approach to the inquiry cycle of 'Observe-Reflect-Plan-Act' was adopted within the hospital setting carried out in 3 stages.[19] Engaging and collaborating with stakeholders is the most effective means for integration of research findings into practice.[20] This helps to close the gap between theory and practice.

Study design

A nursing unit manager (the first author) in an acute medical aged care ward with extensive knowledge and expertise in the administration, operations, and management of the unit was involved as part of the AR. The first author was within the Medication AR (MAR) group in her dual roles of staff member and researcher.

The researcher was able to contribute to the process of information exchange, evaluation, and communication of findings, assessment, and taking steps toward addressing the challenges to the

successful implementation of the action. The role of the researcher was to actively draw the clinical staff into the project, and to participate with them in the process of ongoing observation, reflection, learning, and action. This role was integral to engendering trust and understanding among the different professionals, and for teaching them and learning from them effective ways of using the findings (such as errors) to develop improvements in practice, as AR encourages ownership and long-term commitment.[21] By working closely with staff within the system, the researcher was also experienced in, exposed to, and made aware of the needs, expectations, and limitations experienced by staff within their workplace and roles. The feedback and participation by clinicians in the research helped the investigator to reflect, modify, and adapt the project accordingly.

The nursing unit manager was specifically involved in: (1) recruiting co-researchers from the hospital, including health professionals from 4 aged care and rehabilitation units who had participated in the 2003 National Medication Safety breakthrough collaborative project (Safety & Quality Council 2003); (2) working closely with the hospital chief pharmacist on the planning and delivery of lunch time tutorial sessions on medication prescribing practise for junior doctors, and promoting the use of e-learning prescribing resources and the e-bulletin in the hospital's intranet; (3) collaborating with the hospital educator for the purposes of developing and implementing annual drug calculation competency tests for nursing staff; (4) preparing and presenting a paper on the topic of medication management at the Annual Aged Care conference; and (5) conducting the fieldwork for the project involving observation of medication practice in the clinical setting.

A core group of participants, including the investigator and a number of health care professionals from the same hospital, was formed into the MAR group (**Table 1**). Following a briefing session on AR methods, responsibilities and actions to be taken by each participating member were established. The AR was then carried out in 3 stages during the course of 2 years (2008 and 2009). Throughout the study, during the MAR group meetings, 3 standard questions were asked: What is happening? What are our concerns? What is a possible solution for the future? Collaborators were part of the validation process as findings were reflected on and evaluated by all the participants. The validity of the research improved significantly when multiple voices were heard in inquiry reports.[22]

Stage 1: data collection and analysis

Data were collected through 3 methods. First, data were collected from monthly clinical medication chart (NIMC) audits for 2008 and 2009. Second, a survey on medication prescribing and administration was conducted for medical officers (MOs) and nurses. The sampling for this survey was a purposive sampling procedure[23] accessed both from open fora and staff from the 4 units in the aged care and rehabilitation units. The return rate for MOs was 78% (39/50) and the return rate for nurses was 90% (90/100). Third, data were collected from the Incident Information Management System (IIMS)[24] [a mandatory reporting system of all hospital incidents as part of a New South Wales state-wide safety initiative to improve patients' and employees' safety]. All data collected were de-identified and kept in a secure format.

Chi-squared tests were used to compare the differences between proportions of 2 designated groups (i.e. doctors vs. nurses for the staff survey and 2008 vs. 2009 for the IIMS data) for categorical variables. Odds ratios (OR) and 95% confidence intervals (CI) were reported with appropriate

Table 1
The Medication Action Research (MAR) group members

Title	MAR group member
Executive	Aged Care and Rehabilitation Director
Geriatricians	Aged Care and Rehabilitation Geriatricians x3
Registrars	Aged Care and Rehabilitation Registrars x3
Junior Medical Officers	Interns rotated in Aged Care and Rehabilitation Units
Pharmacists	Chief Pharmacist, Ward Pharmacist
Nurses	Nursing Unit Managers x4, Clinical Nurse Educator, After-hours Clinical Nurse Consultants, Senior Registered Nurses, Junior Registered Nurses, Enrolled Nurses

adjustments made for confounding variables. Binary logistic regression was used to formulate the risk of medication errors for some categorical data if they showed significant differences in the initial Chi-squared test ($p<0.05$). Unpaired independent sample *t*-tests were used for comparing categorical variables with continuous data. A difference was considered significant when the p value was <0.05. Predictive Analytics SoftWare statistics version 18.0.0 was used to perform the analyses.

Stage 2: intervention

Staff education using electronic prescribing training, annual competency test in drug calculation, and regular open fora (discussions, lunch time sessions, presentations, tutorials) with MAR members and any other interested staff were arranged.

Stage 3: evaluation

Critical reflection and evaluation by all participants of evidence gathered and interventions implemented during earlier stages was performed, as was discussion on sustainability of interventions.

Ethics

Participation by staff who became members of the MAR group was voluntary, and each gave written consent after the research activities were explained in detail. The MAR group members were made aware that group meetings were being audio-recorded. The members of the MAR group were also informed they could withdraw from the study at any time without prejudice. Non-MAR group staff members who were interested in participating in meetings were told of the study, but no formal consent was required; the decision to stay at a meeting was taken as informal consent. The study was approved by the Sydney South West Area Health Service Ethics Committee and was ratified by the University of Sydney Human Research Ethics Committee.

RESULTS

Stage 1: preliminary data collection

The NIMC was implemented in all public hospitals in New South Wales by January 2007. A target of 85% compliance was set for each of the 6 key performance indicators. From the analysis of the NIMC entries for 2007,[25] the following findings were yielded: (1) patient identification: only 51% of the records audited showed complete and accurate annotation of full patient identification, and some charts had recorded the prescribing of medication with no patient identification; (2) allergy reaction: 80% of entries documented the history of patient allergy reactions in the medication chart; (3) administration time: 63% of entries had included the administration time by the prescribing physician; (4) frequency of drug administration: 92% of entries were completed using the abbreviations recommended in the 2007 NIMC audit, and error-prone abbreviations such as 'od' for 'once daily' and 'bd' for 'twice daily' were confusing; (5) prescriber name: 79% of the entries had both the printed names and signatures of the prescriber, which are important for identifying the prescribing physicians in the event that clarification is required; and (6) Warfarin: 89% of entries included the target international normalised ratio documentation, which is required for safe and effective decisions regarding the use of this high-risk medication.

Staff attitudes to safe medication practices

When the study commenced in 2008, a survey on staff attitudes to medication safety was conducted. 50 MOs were asked to complete an anonymous, self-administered questionnaire about their prescribing practice, and 39 completed it (**Table 2**). On the questionnaire, 51% of the MOs surveyed indicated that they would check the guidelines on prescribing information before prescribing new drugs, 71% noted that they would check for drug allergies, 5% received prescribing training, 48% used the recommended terminology and abbreviations when prescribing, and 1% asked for advice from a senior staff member about changing drug therapies for patients. Of the nurses surveyed across 4 units on issues relating to the administration of medication, 90 of 100 completed the questionnaire. The most significant findings of this questionnaire were that only 51% checked patient armbands before administering medication, and that 48% would check the medication chart while administering medication (**Table 3**).

The questionnaires also inquired about participants' perceptions of common causes of medication errors (**Table 4**). Both MOs and nurses noted that illegibility (85% and 74%, respectively, p=0.2) was the leading cause of prescribing errors, followed by confusing orders/instructions (80% by both, p=0.9) and incorrect orders (64% and 73%, respectively, p=0.3). There were significant differences between MOs and nurses on the issue of misunderstanding verbal prescribing orders and

Table 2
Medication prescribing survey

Procedure	% of respondents
Check guidelines before prescribing medication	51
Check patient allergy prior to prescribing medication	71
Have training on prescribing during induction period	5
Complete online module of the National In-patient Medication Chart	89
Use only the recommended terminology and abbreviations when prescribing medication	48
Write patient identification in all medication charts	64
Seek advice from the senior clinician prior to changing patient drug therapy	1
Have specified *pro re nata* medication maximum dose	87
Medication chart rewrite before the order expires on the next day	99
Double check prescribing order before signing the chart	69

Table 3
Medication administration survey

Procedure	% of respondents
Check patient's arm band prior to administering medication	51
Check patient's allergy history before administering medication	71
Prepare medication for one patient at a time	95
Double check medication order against patient's medication chart	89
Give medication alongside patient's medication chart	48
Patient's intravenous fluid or medication syringes labelled as per policy	64
Give medication prepared by others	1
Double check heparin dosage by another nurse prior to administering the drug	87
Double check insulin dosage by another nurse prior to administering the drug	99
Remain with the other nurse for the whole procedure of scheduled drug giving	67

Table 4
Perception of medication errors between doctors and nurses, and between junior and senior staff

Medication error	No. (%) of doctors	No. (%) of nurses	p Value	OR (95% CI)	No. (%) of junior staff	No. (%) of senior staff	p Value	OR (95% CI)
Prescribing								
Illegibility	33 (85)	67 (74)	0.2	0.5 (0.2-1.4)	56 (74)	44 (83)	0.2	1.7 (0.7-4.2)
Incorrect order	25 (64)	66 (73)	0.3	1.6 (0.7-3.4)	46 (61)	45 (85)	0.003	3.7 (1.5-8.9)
Confusing order	31 (80)	72 (80)	0.9	1.0 (0.4-2.6)	63 (61)	40 (39)	0.3	0.6 (0.3-1.5)
Misunderstood verbal order	13 (33)	15 (17)	0.03	0.4 (0.2-0.9)	16 (21)	12 (23)	0.8	1.0 (0.5-2.6)
Administering								
Knowledge deficit	15 (27)	40 (73)	0.5	1.3 (0.6-2.8)	31 (41)	24 (45)	0.6	1.2 (0.6-2.5)
Distractions	16 (41)	49 (54)	0.2	1.7 (0.8-3.7)	36 (47)	29 (55)	0.4	1.4 (0.7-2.7)
Miscalculation	15 (39)	57 (63)	0.009	2.8 (1.3-6.0)	38 (50)	34 (64)	0.1	1.8 (0.9-3.7)
Procedure/policy not followed	13 (33)	35 (39)	0.6	1.3 (0.6-28)	25 (33)	23 (43)	0.2	1.6 (0.8-3.2)
Dispensing								
Filled incorrectly	10 (26)	28 (31)	0.5	1.3 (0.6-3.0)	27 (36)	11 (21)	0.7	0.5 (0.2-1.1)
Mislabelled	10 (26)	25 (28)	0.8	1.1 (0.5-2.6)	27 (36)	8 (15)	0.01	0.3 (0.1-0.8)
Sound alike	15 (39)	38 (42)	0.7	1.2 (0.6-2.5)	26 (34)	27 (51)	0.1	2.0 (1.0-4.0)
Look alike	8 (21)	14 (16)	0.5	0.7 (0.3-1.9)	13 (17)	9 (17)	1	1.0 (0.4-2.5)
Label look alike	1 (3)	5 (6)	0.5	2.2 (0.3-20)	3 (4)	3 (6)	0.7	1.5 (0.3-7.5)
Others	3 (8)	9 (10)	0.7	1.3 (0.3-52)	8 (11)	4 (6)	0.6	0.7 (0.2-2.4)

also on miscalculation in administration, with 33% of the MOs noting that medication errors were due to misunderstanding of verbal prescribing orders, as opposed to 17% of nurses (p=0.03). 63% of the nurses noted that miscalculation in administration was a major factor contributing to medication errors, as opposed to 39% of MOs (p=0.009). The difference between MOs and nurses may be associated with roles, responsibility, and communication styles.[12] As doctors are highly mobile within the hospital setting, there may be breakdowns in communication with nurses.[26]

When data were analysed by years of experience (junior vs. senior staff), miscalculation (50% vs. 64%, p=0.1) and illegibility (74% vs. 83%, p=0.2) were the major errors. Mislabelling of medication was more of a concern for junior staff (36% vs. 15%, p=0.01), whereas incorrect order was more of a concern for senior staff (61% vs. 85%, p=0.003).

2008 Incident Information Management System report

Of 157 medication incidents reported in the 2008 IIMS, 66% were administration errors, 10% were dispensing errors, and 24% were prescribing errors. The rest (narcotics and others) were defined as other medication incidents and accounted for 6% of incidents. Most errors were made by nursing and midwifery staff (68%), followed by MOs (16%) and pharmacists (5%). 11% of the reported incidents could not be traced to the reporting professionals. 7% of administration errors were due to incorrect or confusing prescribing orders, and 56% of medication errors occurred after office hours.

Stage 2: intervention by Medication Action Research group

In view of the stage 1 findings, the MAR group developed strategies for improving practices in the units geared at increasing safety practices and reducing potential harms to patients. This included staff education on medication prescribing and administration, and the implementation of more effective inter-personal and inter-disciplinary communication among the professional groups. Members of the MAR group agreed that the objective was to promote patient safety through improved knowledge and understanding about effective medication management among front-line clinicians. In particular, it was decided that special attention should be given to improving support to after-hours staff to address the higher rate of incidents recorded in the IIMS during these hours.

Staff education

Posters were chosen for promoting front-line clinicians' awareness of safe medication management; these focused on the requirements and recommendations issued in the NIMC regarding the key performance indicators. The posters highlighted different, but related, issues each month (including error prone abbreviations, high-risk medication, administration time, allergy alert, legibility). Flyers on medication safety were also posted around the participating units to draw attention to the findings and resources that individual professionals could access for further clarification and support if required. A monthly pharmacy electronic bulletin was posted on the hospital website and hard copies were delivered to hospital units to inform all staff about additional information on safe medication management. In addition, staff were encouraged to complete an online E-Learning module on medication prescribing, and were reminded to complete the mandatory annual competency test on drug calculation.

Improving communication among professionals

According to the survey on staff attitudes to safe medication practices, nurses' and MOs' perceptions about contributing factors to drug errors differed. The MOs' instructions on dosage needed to be communicated more clearly and effectively to nurses. Communication breakdowns among multi-disciplinary teams may be due partly to the division of labour within the health care system. In a hospital setting, there is a hierarchy of professions in which power and authority are skewed in favour of medical specialists. This 'medical dominance' is often played out in the manner in which patient treatment is communicated among the different health care workers, and can frequently undermine the goal of optimal patient care.[27] In addition, the MOs and nurses had indicated that they were not receiving adequate support and guidance from senior specialists and supervisors. Discussions with senior staff, such as geriatricians and registrars who supervised junior doctors, and nurse educators were held to provide more support and direction to front-line staff.

Members of the MAR group also presented a progress report to front-line clinicians and other staff in the aged care units to remind staff about the

study and how it was progressing. This was done via a number of fora, such as the Annual Aged Care and Rehabilitation Conference, during lunch-time education sessions for staff, and during a nursing grand round. Staff and the MAR group agreed to trial the use of a communication book in each unit to standardise the transfer of information among staff. The MAR group also met on a monthly basis to revise and to build on emerging principles for safe medication management. These principles helped MAR members to formulate strategies and activities that would both be sensitive to patient and staff needs and be appropriate to the relevant context.

Stage 3: reflection on and evaluation of the study

Improved National In-patient Medication Chart compliance

The NIMC was audited monthly to register any changes in practice. The AR project yielded a significant degree of clinician engagement and behaviour change in prescribing practices, including improvements in accuracy and documentation. 85% of the benchmark for NIMC was met. There was also a significant improvement in the annotation of patient details to the relevant documentation from 49% (in October 2007) to 73% (in May 2008). The participants noted that the monthly NIMC audit had been incorporated into the hospital's existing quality register.

Changes in the 2009 Incident Information Management System report

When pre- and post-changes were compared (**Table 5**), prescribing errors were significantly reduced by 2-fold (OR, 2.0; 95% CI, 1.2-4.8) and administration error reduced by 1.5-fold (OR, 1.5; 95% CI, 0.9-2.4). These decreases were noticeable in the groups of nurses and doctors. When investigated further on error types, there was improvement in the error of wrong patient (OR, 1.7; 95% CI, 0.6-5.0) and wrong

Table 5
Medication incidents by error modality form Incident Information Management System

Procedure	Medication incidents (%) in 2008 (n=157)	Medication incidents (%) in 2009 (n=116)	p Value	OR (95% CI)
Prescribing	24 (n=37)	11 (n=13)	0.002	2.0 (1.2- 4.8)
Doctors	27	11	0.2	3.0 (0.5-20)
Nurses	21	9	0.02	2.8 (1.1-6.9)
Pharmacists	37	33	0.6	1.2 (0.2-8.0)
Others	20	17	0.6	1.3 (0.2-9.0)
Dispensing	10 (n=16)	12 (n=14)	0.4	0.8 (0.4-1.7)
Doctors	0	5	0.6	0.5 (0.4-0.7)
Nurses	6	11	0.1	0.5 (0.2-1.3)
Pharmacists	47	17	0.2	4.5 (0.4-46)
Others	7	25	0.2	0.2 (0.0-2.4)
Administration	66 (n=103)	56 (n=65)	0.07	1.5 (0.9-2.4)
Doctors	80	58	0.2	3.0 (0.6-14)
Nurses	71	60	0.1	1.7 (0.9-3)
Pharmacists	21	17	0.7	1.3 (0.1-15)
Others	67	50	0.3	2.0 (0.4-9.5)
Narcotic	3.6 (n=6)	9.6 (n=11)	0.05	0.4 (0.1-1.0)
Doctors	0	5	0.6	0.5 (0.4-0.7)
Nurses	5	12	0.1	0.4 (0.1-1.2)
Others	7	8	0.7	0.8 (0.0-14)
Other procedures	2.5 (n=4)	11 (n=13)	0.004	0.2 (0.1-0.7)
Doctors	0	21	0.1	0.5 (0.4-0.7)
Nurses	4	9	0.1	0.4 (0.1-1.4)
Pharmacists	0	33	0.1	0.2 (0.1-0.4)

dose (OR, 2.3; 95% CI, 1.3-4.0). The omission rate was reduced from 22% in 2008 to 12% in 2009 (OR, 0.5; 95% CI, 0.2-0.9). The rate of medication incidents occurring after hours slightly decreased in the 2009 IIMS report (46% in office hours vs. 44% after office hours).

Improved communication: frontline clinician's voices

To strengthen relationships among team members and enhance interpersonal communication among different professional groups, this study was designed as a multi-disciplinary collaboration between researchers and participating professionals to facilitate shared decision-making in relation to medication management and the application of safe medication practices. Nurses became more assertive about requesting clarification on medication when required. For example one nurse noted: "I feel more confident about questioning orders from the doctors to ensure the best care for my patients". During an open forum, another nurse noted: "I am not afraid to speak up and get answers if a drug order doesn't seem right". One of the doctors in the lunch-time tutorial session stated that she had been "interrupted every 5 minutes" during the early stage of the study. Previously, the units used different communication tools to relay information among team members; subsequently, team members suggested the clinicians to use a communication book located in the nurses' station for recording messages. Following this intervention, medical teams experienced "less interruption after the introduction of the communication book in each unit". The standard communication book and an after-hours staff support role had become part of the hospital's new procedures. One of the benefits of adopting the AR approach is that it can foster opportunities for health professionals to communicate and interact with higher degrees of veracity, trust, transparency, and professionalism, while maintaining disciplinary autonomy. Following the implementation of the AR project, staff noted: "we were more willing to talk with each other about problems and finding solutions together", suggesting that the collaborative processes were perceived as worthwhile and meaningful.

Improved teamwork

Participation in the inquiry by health professionals was important as it fostered cooperation among clinicians and shared decision-making at different levels of interaction. Emerging data and findings were made accessible to participants and were adopted for making decisions about subsequent interventions, thereby improving teamwork. For example, one member of staff noted: "in the past, prescribed medication was not routinely checked by the senior MOs except where a side effect occurred". Instead, during and after the study, "patient medication was routinely checked and reviewed by hospital pharmacists and MOs on admission and discharge". Similarly, before the study, almost half of all patient discharge summaries were found to be inaccurate, often completed by the junior MOs and rarely checked by the geriatricians or the registrars. During this study, the junior MOs ensured that the patient discharge summaries were presented to the geriatricians or registrars for cross-checking during their lunch-time tutorial sessions.

Doctors, pharmacists, and nurses had an opportunity to work closely together on the common goal of implementing change to medication management. In the process, team members also gained a deeper understanding of effective and safe prescribing practices. During a meeting, the junior MOs noted that prior to the study, adhering to prescribing practices was perceived as "repetitive, low-risk clerical work". This deterred them from seeking support from busy senior colleagues. Following the discussions and explanations held during lunch-time education sessions, junior MOs acknowledged that the task of prescribing safely and accurately was critical to best practice, and this included asking for support from senior colleagues if required.

Sustainability: formation of 'local champions'

Key participants from the MAR group emerged as the 'local champions', a term used in the health setting for referring to leadership. They were willing to invest time and energy into the study and positioned themselves as able to assist with the implementation of interventions. It is through the commitment and enthusiasm of the 'local champions' that an AR study on safe medication practice remained sustainable in the hospital setting.

DISCUSSION

Studies on prescribing safety suggest that heavy workloads, poor team communication, inadequate

knowledge, and limited training on medical management are critical risk factors conducive to errors in the hospital setting.[28,29] Drawing on AR, this study showed that improving the modes of communication among and between participants in relation to medication had the potential to reduce errors and improve medication safety. Data from the IIMS report and the survey of the MOs and nurses suggested that these 2 groups of health care workers perceived errors in medication practices differently. To avoid miscommunication between groups and to minimise the risk of medication errors, members of MAR and other staff had implemented a number of strategies to improve communication.

This study supported similar findings from other investigations.[30,31] Junior MOs had received poor formal training on safe prescribing practices. Formal education alone does not provide medical students and interns with sufficient training on safe prescribing practices.[32] In this study, junior MOs reported a lack of guidance from their senior colleagues. Inadequate supervision, heavy workloads, and time pressures led to medication charts having been completed by staff rostered after hours. This practice increased the risk of prescribing errors owing to the insufficient knowledge of the patients by staff who work after hours. According to the NIMC audit report, staff did not fully appreciate the requirement to record patient identity accurately. This can place patients at risk of wrong medication.[7,25] Most medication incidents were made by nurses, followed by MOs and pharmacists. This finding is similar to that reported in other Australia and international studies.[10,33,34]

When staff engaging in research into their own methods, practices, and standards, the required routine audits and reviews implemented by supervisors or management can be viewed as 'top-down' assessments of employees' work, competencies, and skills. This may lead staff to feel scrutinised and alienated from their own work. Errors can become cumulative owing to an entrenched breakdown in communication among disciplinary specialists, nursing staff, and management. In this study, a method designed to promote and encourage 'critical reflection' and 'ownership' of their own work by staff was adopted.[21]

AR is different to other methods of inquiry. It involves active participation on the part of the researchers. This includes researchers working within the system, alongside practitioners, so as to foster high-level professional exchanges on process, applicability, and implementation. This approach fosters an understanding of the need and methods required for implementing change to improve clinical practice. This promotes ownership and long-term commitment[21] that are crucial to sustainability in the long term. By including staff in research practice, staff become co-producers and co-authors of a framework from which to work and develop changes. It is also a framework enriched by the values of the workplace and various professionals.

By becoming co-researchers, clinicians develop an outlook on improved practice that is dynamic because the adjustments they implement reflect local relevance, changes in the context, and patient and organisational needs, without compromising the essential requirements of safety, high-standard health care, and commitment to the duty of care toward patients. Without active participation in the research, clinicians would be distanced from any attempts at implementing change. AR presupposes necessary participation by clinicians in order to foster the kind of organisational commitment that makes improvements and best practice an ongoing project in the long term.

In this study, the AR approach paved the way for engaging a multidisciplinary team. This was important for implementing interventions to reduce medication errors. Each member of the MAR group was a co-researcher and was allowed to comment, reflect on, and discuss their own views and practices, as well as those of other colleagues. The monthly meetings gave participants the opportunity to give and receive peer support and debriefing, and to develop effective inter-personal and intra-professional communication. As the study and action plan evolved, the network of participating health professionals expanded, as other staff in the hospital took part in the AR project. This extended network provided multiple opportunities to both researchers and participants for sharing information and implementing change.

Limitations

As an AR case study, some of the benefits (such as multiple interactive components, fostering effective inter-disciplinary relationships, and promoting flexibility among front-line clinicians) are difficult to measure and may not be obvious in the short term. Moreover, any useful findings including improvements to medication safety in one clinical setting cannot be presumed to apply equally among

other sites, particularly where there are significant systematic, structural, or cultural differences at the local level. Another limitation is that incident reporting is voluntary, and under-reporting can occur over time. Reported incidents can be biased when data are recorded retrospectively; the severity of medication errors and subsequent patient outcomes are based on the perception of the person who reports the incident and on the degree of accuracy with which information is annotated retrospectively.[33,34] These findings cannot be generalised across the board; the application of this AR study to a single clinical setting precludes any claims to representative value.

Through AR, change could be achieved with active involvement of clinical staff. This included encouraging staff to observe, record, reflect, and act on their practices and interactions, fostering inter-disciplinary communication and intra-professional discussion, critique, and support. The participants found this strategy effective for building team effort and capability. The staff began to show a mutual interest in being open to change, in generating knowledge, and in implementing ongoing improvements. In conclusion, drug prescribing, dispensation, and administration are high-risk clinical tasks requiring vigilance, individual and team efforts, and commitment to achieve and preserve safe medication practice.

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