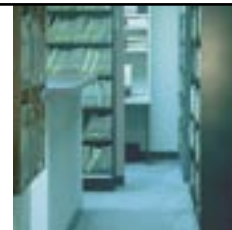




Introduction of electronic prescribing in an aged care facility



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Residents of aged care facilities are at high risk of adverse drug events. Electronic prescribing may reduce some of these risks. This article reports on the introduction of electronic prescribing software to a residential aged care facility with the aim of improved medication safety.

The Australian Safety and Quality Council released its Second National Report on Patient Safety in July 2002.¹ This report discussed the risks patients are exposed to when prescribed medication in hospital or in the community. These risks suggest that health care is not as safe as it should be, and those of us working in the area of health care need to examine ways in which we can improve safety for patients. On average there are 140 000 hospital admissions and 900 deaths each year in Australia due to medication misadventure.¹ Between one and two-thirds of these deaths and admissions could be avoided if better systems were put in place.² One in 1000 persons aged 65 years or over will die in hospital due to medication misadventure.¹ When a person reaches 75 years or over, roughly 30% of their hospital admissions are related to medication misadventure.¹

'Medication misadventure' is a term that covers the different types of medication incidents and adverse drug reactions, ie. prescribing, dispensing and administering the medication, as well as the level of patient compliance with the medication.

There is a lack of research trial evidence for the safe and therapeutic use of medication in the elderly, although they are at higher risk of adverse drug reactions than younger populations. Aged care facility (ACF) residents have a higher complexity than 5 years ago.³ In addition they frequently:

- are administered many medications
- have poor documentation of past medical history and renal function status in their paper notes, and
- have a high burden of concurrent chronic illness.

Thomas and Brennan⁴ concluded preventable adverse drug events were more common among elderly patients, probably because of the clinical complexity of their care rather than age based discrimination. Pirmohamed and James² acknowledge older people experience more adverse drug events than a younger population and suggest prescribers use computerised prescribing to improve the benefit-harm ratio of medications. If the relevant data is entered, medical prescribing software can give prescribers information about potential drug-drug, drug-disease and drug-allergy interactions that can have

adverse effects ranging from minor to death. Computer support reduces serious prescribing errors by 55%, and overall prescribing errors by about 83%.⁵

The project

In a collaborative research project between Helping Hand Aged Care Ingle Farm, University of South Australia, and the Adelaide North East Division of General Practice, electronic prescribing (via Medical Director version 2) was introduced into a 100 bed residential ACF in Adelaide (South Australia). The aim was to discover if the safety of residents could be improved through the introduction of electronic prescribing.

Electronic prescribing terminals (personal computers with printers and the prescribing software) were placed at nurses' stations in each of the two main wards. Residents' records (medications, medical history, allergies) were entered into the software by nursing staff. Upon completion of the data entry, from December 2002, facility policy espoused electronic production and update of patient medication charts. Nursing staff encouraged the general practitioners

to adhere to this policy and endeavoured to keep the electronic records up-to-date. The GPs were encouraged to write the prescriptions using Medical Director, and record new medications, dosage changes and cessations on the electronic record. When medication changes were made via phone orders, the nursing staff made the changes electronically.

Evaluating the process

Staff surveys and focus groups

Nursing staff and GPs were surveyed (before introduction of the software and 12 months later) concerning information technology (IT), chart and associated medication review quality, and (at 12 months), perceptions of the software.

Nursing staff and GP focus groups were run at 6 and 12 months after introduction of the software with an agenda based on the structure of the survey and emphasis on identification of perceived barriers and opportunities in use of the software. Nursing focus groups consisted of four nurses in each session, GP focus groups consisted of four GPs in the 6 month session, and three GPs in the 12 month session; including the GP author acting as convenor.

Measuring patient outcomes

The outcomes measured at 6 and 12 month

checkpoints were:

- change in total medications per patient chart (prescribed medications excluding ‘as required’ medications)
- percentage of charts printed electronically, and
- percentage of medication charts with all changes made electronically.

Reports for medication incidents and falls were tallied by quarter for 2002 and 2003.

Results

Initial surveys indicated that many GPs use IT regularly in their practice; 92% (12/13) reported using the computer for clinical reference (eg. drug information) at least once a week and regularly use a computer system for medication management. In contrast, nursing staff had much less familiarity. None of the nursing staff used a computer for clinical reference (eg. drug information) more than ‘maybe once a month’. Although 33% (3/9) of the nurses used the internet every day, the same number had never used the internet.

Six and 12 months surveys

Nursing staff survey response rates were 64% (9/14) before the introduction of electronic records, and 50% (7/14) at the 12 months survey; GP response rates were low, 45% (13/29) at 6 months, and 27% (7/26) at

12 months. Nonetheless, there appears to be a marked disparity of chart perception and medication review process between nursing staff and GPs, with nursing staff perceptions substantially more negative. There may be a slight improvement in the perceived efficiency of the medication charting process by both nurses and GPs with the introduction of the software.

Twelve months later, nursing staff gave positive or strongly positive responses regarding the informational and educational functionality of the software.

The rate of use of the prescribing software increased over time (Table 1). Although over 80% of all charts were printed electronically in the higher participation ward at 12 months, there were still only about a third of all medication charts with all changes and additions (over a 6 month period) being done electronically.

Patient outcomes

Total medications per patient reduced significantly (a mean reduction of 0.44 medications per patient, $p<0.01$) for the ward with highest use of electronic prescribing at the latter checkpoint (Table 1).

There was a trend toward decreased medications per chart with the increased use of the software (Figure 1). A linear regression line on this plot has a significant negative slope ($R\text{-square}=0.93$, $p=0.037$). A similar, but

Table 1. Intensity of use of the prescribing software by the two wards at the 6 and 12 months checkpoints and associated changes in number of prescribed medications (excluding PRNs) per patient

	No. of patient charts	Charts printed electronically	Charts with changes completed electronically	Mean change in medications per chart	SD change per chart	p (t) mean change ≥ 0 (one-tailed)
Ward 1						
6 month	41	20% (8/41)	7% (3/41)	0.216	1.530	0.698
12 month	38	50% (19/38)	29% (11/38)	-0.297	1.266	0.081
Ward 2						
6 month	42	67% (28/42)	21% (9/42)	-0.275	1.768	0.166
12 month	43	81% (35/43)	35% (15/43)	-0.442	0.983	0.003

weaker trend and linear regression appears on change in medications per chart versus percentage of charts printed electronically ($R^2=0.89$, $p=0.057$).

Figure 2 and 3 show quarterly incident report rates for medication incidents and falls for the entire ACF. High variability prevents identification of any expected downward trend in medication incidents, however, falls show a repeating quarterly pattern. Mean falls per quarter for 2003 versus 2002 show a significant mean reduction of 36 falls per quarter (SD: 6.48, $p<0.001$).

Focus groups

The 6 months focus groups revealed that at the time (or until shortly before) there were considerable practical and work practice barriers to the uniform use of the software. Problems included confusion over passwords, the computer frequently being turned off, and availability of prescription stock. The nursing staff described GP resistance as variable, but significant, with nurses characterising a common GP attitude as 'easier to just write it' (an attitude echoed by at least one GP focus group participant). This barrier was overcome as the nursing staff became more confident in the system, and were permitted to reprint the drug chart with the GP reviewing the medication accuracy before signing. Nursing staff expressed a strong desire for more formal training with the software. Moreover, while one ward had a clear nurse champion for the software, it was evident that things were going less well in the other ward. Both GP and nursing staff attitudes toward the project were mixed, and all felt that the amount of effort was considerably greater when working electronically.

By 12 months, focus group attitudes and confidence, especially among the nursing staff, appeared much higher with less disparity in levels of confidence. In the intervening time, some nurses had received training. Nursing staff welcomed the software's drug information because it could be consulted easily and was up-to-date. Issues of system availability and printing had

been largely resolved, and the recent introduction of a faster printer was seen as a big help. However, printing of PRN medication to a separate sheet was still seen as a drag on efficiency. General practitioner perception was it was less effort to work electronically and that alert messages were highly positive. While not agreeing they had changed any specific decisions due to alerts, they were seen as positive for making one 'stop and think,' for being thorough, and for being complementary to the assessment given in a pharmacist's review. Nursing staff felt that about 50% of additions were made with the GP in front of the computer to see alerts. However, they expressed confidence in keeping charts 'mostly' up-to-date in the face of additions. Both focus groups expressed enthusiasm for further technology innovation and an interest to see more integration of electronic records between the doctor's practice, pharmacy and ACF, and to see integration of nursing notes with electronic prescribing.

Discussion

There are positive trends on some quality measures (medications per chart and falls), but the reduction in medication incidents is not statistically significant. A larger number of residents and incidents should be investigated. Falls reduction was an interesting finding. Monane and Avorne⁸ previously noted an association between falls reduction and reduced medication use. Improving the drug regimen is probably one of the most effective means of reducing falls risk, especially in the frail elderly.⁸ Residential facilities are the second most common coded place of occurrence of falls for persons aged 70 years and over in Australia.⁹ The cost of falls to the health system are increasing, as is Pharmaceutical Benefits Scheme expenditure.¹⁰ The use of electronic prescribing can potentially have an impact upon reducing both. It is beyond the scope of this article to estimate cost

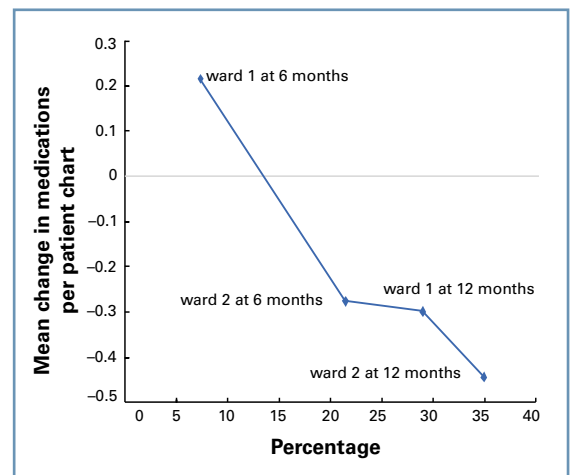


Figure 1. Mean change in total medications by percentage of charts with all changes and additions completed electronically (scatter-plot of data from both wards and both assessment checkpoints)

reductions, but it should stimulate discussion regarding further wide scale implementation and research of the benefits of electronic prescribing in ACFs.

An opportunity existed to systematically assess renal function of all residents using a glomerular filtration rate calculator on the software. This resulted in alerts on impaired renal function patients being entered into the software, and prescribers subsequently received alerts when prescribing medications with renal clearance.

A further challenge is keeping electronic records in the facility and in the surgery synchronised – this points to future directions as addressed by health online projects of the Commonwealth Department of Health and Ageing, notably HealthConnect.¹¹

There are problems with generalisability of these findings as a single ACF was involved and overall numbers are small. However, it should promote further discussion and collaboration between ACFs, GPs and divisions of general practice to examine the need for improvements in the current systems that exist in medication management in ACFs.

Conclusion

Facility commitment is needed to implement change as major as the switch to electronic prescribing, and ongoing identification

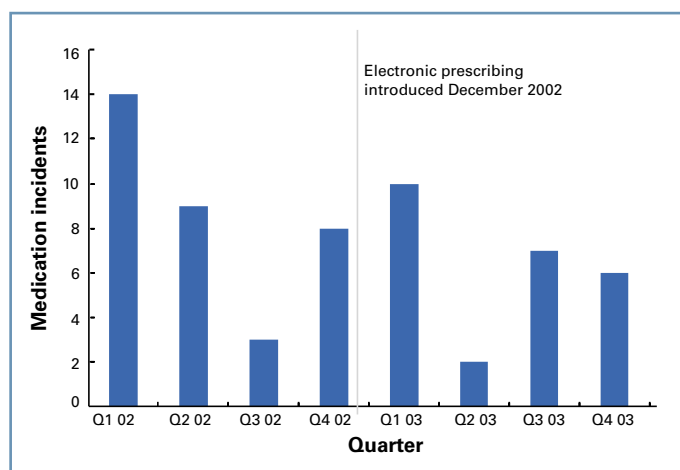


Figure 2. Medication incidents by quarter

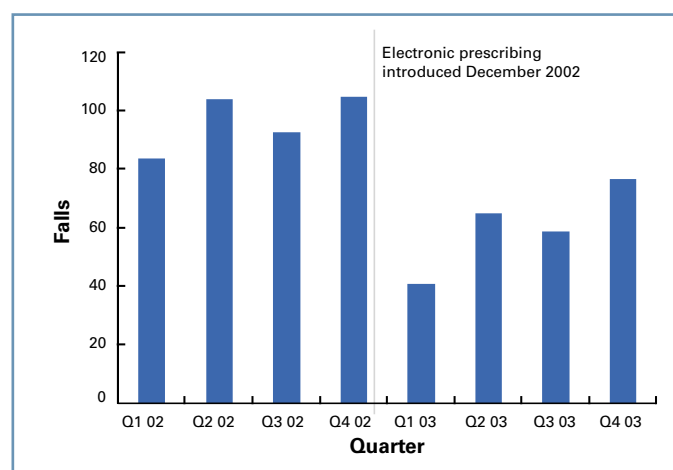


Figure 3. Falls by quarter

and remediation of barriers is vital. The gradual rate of software uptake was not anticipated and hence trend analysis on rates of charts completed and medication changes made electronically was post hoc. Interpretation of the results is limited by the lack of experimental control: they reflect performance changes at one ACF over time, on which there may have been other significant influences. However, the rationale of moving to electronic prescribing is sound, and the measured trends are encouraging with the project demonstrating a reduction in both medications per resident and falls per quarter. Controlled research on the effects of electronic prescribing in the aged care setting is warranted.

Conflict of interest: none.

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References

1. Safety and Quality Council. Second National Report on Patient Safety (improving medication safety). July 2002;19.
2. Pirmohamed M, James S, Meakin S, et al. Adverse drug reactions as cause of admission to hospital: prospective analysis of 18 820 patients. *BMJ* 2004;329:15–9.
3. Australian Institute of Health and Welfare. Residential aged care in Australia 2002–2003. Aged Care Statistics Series Number 18, AIHW cat. No. AGE 38, p16. Available at: www.aihw.gov.au/publications/age/raca02–03/raca02–03.pdf.

- Accessed 8/9/2004.
4. Thomas EJ, Brennan TA. Incidence and types of preventable adverse events in elderly patients: population based review of medical record. *BMJ* 2000;320:741–4.
 5. Bates D, Cohen M, Leape L, et al. Reducing the frequency of errors in medicine using information technology. *J Am Med Inform Assoc* 2001;8:301–8.
 6. Gurwitz JH, Col NF, Avorn J. The exclusion of the elderly and women from clinical trials in acute myocardial infarction. *JAMA* 1992;268:1417–22.
 7. Mitchell SL, Sullivan EA, Lipsitz LA. Exclusion of elderly subjects from clinical trials for Parkinson disease. *Arch Neurol* 1997;54:1393–8.
 8. Monane M, Avorn J. Medications and falls: causation, correlation, and prevention. *Clin Geriatr Med* 1996;12:847–57.
 9. Cripps R, Carman J. Falls by the elderly in Australia, trends and data for 1998. Canberra: Australian Institute of Health and Welfare, 2001. AIHW cat. No. INJCAT 37, p12, 16. Available at: www.nisu.flinders.edu.au/pubs/reports/2001/eldfalls.php. Accessed 10/9/2004.
 10. Australian Institute of Health and Welfare. Health expenditure Australia 2001–02. Health and Welfare Expenditure Series No. 17. Canberra: AIHW cat. No. HWE 24. Available at: www.aihw.gov.au/publications/hwe/hea01–02/hea01–02–c02.pdf. Accessed 8/9/2004.
 11. Commonwealth Department of Health and Ageing. Health online projects, 11 May 2004. Available at: www7.health.gov.au/healthonline/projects/projects.html. Accessed 19/10/2004.

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