Effect of computerised prescribing on use of antibiotics

David A Newby, Jayne L Fryer and David A Henry

ABSTRACT

Objectives: To examine whether the use of current prescribing software systems might raise rates of repeat prescribing, with a consequent increase in use of antibiotics in the community.

Design and setting: A prospective audit of consecutive prescriptions for amoxycillin, cefaclor, roxithromycin and amoxycillin/clavulanate presented to community pharmacies in the Hunter region of New South Wales and a follow-up survey of people who received a repeat prescription, October to November 2000.

Main outcome measures: The frequency of repeat prescription ordering on computer-generated and handwritten prescriptions; the proportion of people who filled their repeat prescription.

Results: Data were collected for 1667 prescriptions presented to 35 pharmacies; 126 people who received repeat prescriptions completed the survey. The rate of repeat prescription ordering on computer-generated prescriptions was 69%, compared with 40% for handwritten prescriptions (odds ratio, 3.3; 95% CI, 2.6–4.2). Computer-generated repeat prescriptions were as likely to be filled as hand-written prescriptions (61% and 69%, respectively).

Conclusions: The default settings on computerised prescribing packages result in a significant increase in the use of antibiotics. We estimate these settings result in about 500 000 additional prescriptions being filled annually in Australia for the four antibiotics in the study.

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MORE THAN 27 MILLION prescriptions are dispensed for antibiotics in Australia each year.[1] Respiratory tract infections are the most common indication for antibiotic use,[2] with antibiotics for upper respiratory tract infections (URTI) being among the most frequently prescribed.[3]

Under the Pharmaceutical Benefits Scheme (PBS) rules, prescribers are permitted to order one repeat supply of most antibiotics when resolution of the infection with one course of therapy is likely to prove difficult, for example in some soft-tissue infections. Given the prescribing of a single course of antibiotics for URTI in adults is often inappropriate, the use of extended courses of antibiotics for this indication should be discouraged.

The use of computerised prescribing packages in Australia is increasing rapidly.[4] Currently, more than 70% of general practitioners use prescribing software for most of their prescriptions,[5] and 85% of doctors using prescribing software are using Medical Director.[6]

Prescribing software packages provide a number of potential benefits, including quick access to patient records, legible prescriptions, and decision aids to assist the physician when prescribing. However, concerns have been raised about the additional time required to generate a prescription.[7,8] To overcome some of these concerns, software manufacturers have provided shortcuts and default settings that limit the number of keystrokes required to complete a prescription. An example is a shortcut to insert the maximum quantity and maximum repeats available under the PBS with the press of a single button.

Evidence from the Drug Utilisation Subcommittee of the Pharmaceutical Benefits Advisory Committee suggests repeat ordering for antibiotics used to treat URTI may be increasing (Peter McManus, Secretary, Drug Utilisation Subcommittee, personal communication). In view of this, we have conducted a study to identify whether computer-assisted prescribing may be leading to an increase in repeat prescribing and consumption of antibiotics used to treat URTI.

For editorial comment, see page 196. See also pages 203 and 207.

Department of Clinical Pharmacology, School of Medical Practice and Population Health, Faculty of Health, University of Newcastle, Newcastle Mater Misericordiae Hospital, Newcastle, NSW.
David A Newby, BPharm, PhD, Lecturer;
Jayne L Fryer, BMath, GradDipMedStats, Statistical Analyst;
David A Henry, MB ChB, FRCP, Professor.
Reprints will not be available from the authors. Correspondence: Dr D A Newby, Department of Clinical Pharmacology, School of Medical Practice and Population Health, Faculty of Health, University of Newcastle, Newcastle Mater Misericordiae Hospital, Newcastle, NSW 2298.
mddan@alinga.newcastle.edu.au

METHODS

Our study was conducted in October and November 2000, and was divided into two phases: a prescription audit in community pharmacies, and a follow-up survey of people who received a repeat prescription.

Prescription audit

Pharmacists from the Newcastle and Hunter Valley Pharmacists' Association, New South Wales, were invited to take part. Those who participated collected data on 20 consecutive prescriptions for amoxycillin, cefaclor, roxithromycin, and amoxycillin/clavulanate, or for four weeks, whichever came first.

For original prescriptions, data were collected on the type of prescription (computer-generated versus handwrit-

1: Rates of repeat ordering on computer-generated and handwritten prescriptions for four antibiotics

	Computer-generated prescriptions with repeats	Handwritten prescriptions with repeats	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Overall crude rates	461 (69%)	228 (40%)	3.34 (2.64–4.22)	3.82 (2.55–5.72)
Amoxycillin/clavulanate	119 (76%)	54 (47%)	3.53 (2.11–5.93)	4.20 (1.94–9.12)
Amoxycillin	129 (58%)	36 (17%)	6.45 (4.13–10.08)	5.95 (3.18–11.13)
Cefaclor	88 (80%)	57 (57%)	3.02 (1.64–5.57)	3.52 (1.24–10.00)
Roxithromycin	125 (70%)	81 (55%)	1.99 (1.26–3.14)	2.27 (1.22–4.25)

ten), the antibiotic ordered, and whether a repeat had been ordered. Information collected on repeat prescriptions included the type of original prescription (computer-generated versus handwritten), the antibiotic ordered, and the date of the original prescription. The sex of the person for whom the prescription was written, and their concession card status, was recorded for both original and repeat prescriptions.

To assess the completeness of data collection, a small sample of pharmacies provided computer printouts of the prescriptions dispensed for the four antibiotics during the study period. These reports identified the number of original prescriptions with a repeat, original prescriptions without repeats, and repeat prescriptions that were dispensed. The reports were used to calculate crude rates of repeat ordering that could be compared with the data collected during the audit.

Follow-up survey

People who received a repeat prescription were invited to participate in a follow-up survey. To reduce the chance of participants changing their behaviour related to filling the repeat prescription (the "Hawthorn effect"),[9] the invitation stated only that we were interested in their experiences with antibiotics. People who participated completed either a paper questionnaire, or undertook a computer-assisted telephone survey. Contact was made two to four weeks after the person had filled their original prescription, to allow time for them to fill the repeat if they wished to.

The questions asked in the telephone survey and the paper questionnaire were identical. Participants were asked whether they had filled the repeat prescription. Those who had filled their repeat were asked why they had filled the repeat. Participants who indicated they had not filled their repeat were asked why they had not, and whether they still had the repeat prescription. Demographic characteristics of the participants were recorded, including sex and concession card status, and whether their doctor had used a computer to generate the original prescription.

Data analysis

The analysis was conducted using SAS[10] and SPSS[11] statistical software packages. The primary outcome was the rate of repeat ordering on computer-generated versus handwritten original prescriptions. Data on repeat prescriptions being filled were only used to compare the audit data with the computer printouts, using the goodness-of-fit χ^2 test statistic.

The audit data were used to calculate crude rates of repeat ordering on original prescriptions, both overall and stratified by antibiotic. The rates for computer-generated and handwritten prescriptions were compared by calculating the odds ratio (OR). Logistic regression analysis using generalised estimating equations[12] was used to calculate an adjusted OR to explore potential correlations due to clustering at the pharmacy level.

Data from the follow-up survey were used to calculate crude rates of repeat filling and repeat retention, both overall and stratified by antibiotic. The rates for computer-generated and handwritten prescriptions were compared by calculating the OR. An adjusted OR could not be estimated for repeat filling or repeat retention as no data were collected on which pharmacy had filled the original prescription. However, the likelihood of clustering was thought to be very small. The responses to why participants had, or had not, filled a repeat were precoded. The list of reasons for filling or not filling the repeat was generated by the investigators, and modified after a pilot study.

Based on estimates of the average number of prescriptions dispensed per pharmacy (from PBS statistics), we estimated that a sample of 40–60 pharmacies would be required to detect a difference of 15% in the rate of repeat ordering between computer-generated and handwritten prescriptions. This was based on pilot study results of the proportion of handwritten scripts with repeats ordered of 30% ($\alpha = 0.05$; power, 80%; intracluster correlation coefficient, 0.1).

The study was approved by the Human Research Ethics Committee of the University of Newcastle.

RESULTS

Prescription audit

We approached 125 pharmacies, of which 35 (28%) agreed to participate. Data were collected on 1667 prescriptions, 1245 (75%) of which were original prescriptions. Of the original prescriptions, 672 (54%) were computer-generated and 689 (55%) had a repeat ordered on them. The most commonly prescribed antibiotic was amoxycillin (32%), followed by roxithromycin (28%), amoxycillin/clavulanate (23%), and cefaclor (17%). These results are similar to data on prescriptions paid for under the PBS.[13]

Repeats were ordered on 461 (69%) computer-generated original prescriptions, compared with 228 (40%) handwritten prescriptions (Box 1). The difference was significant and did not change when adjusted for possible clustering by pharmacy. Although there were differences between the antibiotics in the rates of repeat ordering, in each case computer-generated prescriptions were more likely than handwritten prescriptions to have a repeat.

There was a significant difference between the data from the prescription audit and the records obtained from the

2: Assumptions in the calculation of the impact of automatic repeat ordering on antibiotic use

	Amoxycillin/ clavulanate	Amoxycillin	Cefaclor	Roxithromycin
Assumption				
Number of original prescriptions dispensed under the Pharmaceutical Benefits Scheme* (A)	1 162 468	1 894 657	856 659	1 585 386
Computer-generated prescriptions (B)	57%	52%	52%	54%
Computer-generated prescriptions with repeats ordered (C)	76%	58%	80%	70%
Handwritten prescriptions with repeats ordered (D)	47%	17%	57%	55%
Computer-generated prescriptions with repeats filled (E)	61%	61%	61%	61%
Outcomes of model				
Excess prescriptions filled as a result of computer-generated prescriptions†	117 215	246 404	62 498	78 334

*Data from the Health Insurance Commission for calendar year 2000. †Excess prescriptions = A×B×(C−D)×E.

sample of pharmacy computers ($P = 0.01$). This was entirely due to amoxycillin, with fewer originals without repeats (50% v 62%), more originals with repeats (30% v 25%), and fewer repeats being filled (20% v 13%) being recorded in the prescription audit compared with the computer records ($P = 0.037$).

Follow-up survey

Six hundred and eighty-nine people were eligible for the follow-up survey; 676 were sent an invitation and 158 (23%) consented to participate. Thirty-two people were excluded because they failed to return a questionnaire, could not be contacted again for the telephone survey, or could not recall receiving a repeat prescription, leaving 126 completed surveys. The demographic characteristics of those who participated in the follow-up survey were similar to those recorded in the prescription audit.

Eighty respondents (64%) had filled their repeat. There was no difference in the proportion filling their repeat between those who received a computer-generated prescription and those receiving a handwritten prescription (61% v 69%; OR, 0.69; 95% CI, 0.27–1.70). Results were similar when stratified by antibiotic. The most common reasons for filling a repeat prescription were because the person felt no better after the first course (58%), the person had been told by their doctor to fill the repeat (21%), or they assumed they had to take both courses (13%). The most frequently cited reasons for not filling a repeat were because the person felt better (64%), they experienced a side effect (14%), or the antibiotic did not appear to work (11%). Of those not filling their repeat, 36 (82%) still had their repeat when they completed the survey.

Impact of repeat prescription ordering

To study the potential impact that repeat ordering may have on antibiotic use, we have extrapolated our results using prescription data obtained from the Health Insurance Commission (Box 2). The results suggest that computer-generated prescriptions may result in more than 500 000 additional prescriptions for the four antibiotics of interest being dispensed annually.

DISCUSSION

We found computer-assisted prescribing is associated with a significant increase in repeat ordering for antibiotics commonly used to treat URTI. Further, this excess repeat ordering is resulting in a net increase in the use of these antibiotics. Computer-assisted prescribing is reported to improve drug use by reducing medication errors[14] and by providing access to evidence-based guidelines.[15] Our study has demonstrated that it may also have a negative effect on the quality use of medicines.

The response rate from the pharmacies was low. This is due in part to the study starting three months after the introduction of the Goods and Services Tax, which increased the amount of paperwork done by pharmacists and significantly impinged on their time. Despite this low response rate, we found a significant difference in the rates of repeat ordering on computer-generated and handwritten prescriptions. Given this was the focus of the study, there is a possibility that pharmacists recorded more data on computer-generated prescriptions than handwritten prescriptions. However, comparison of the audit data with Health Insurance Commission data and the computer records provided by a sample of the pharmacies suggested the data collection was reasonably accurate. Further, the proportion of computer-generated prescriptions in the audit (54%) was lower than the proportion of doctors thought to be using computer prescribing at the time (70%). Although the uptake of computer-assisted prescribing may be lower in the Hunter region than in other areas, it seems unlikely that the uptake would be so different as to indicate we have oversampled computer-generated prescriptions. Overall, we feel that these data can be extrapolated to the wider community.

The response rate from in the follow-up survey was less than we had expected from previous studies of this type conducted by us.[16] The response rate was estimated by subtracting the number of letters returned to us by the pharmacies from the number they were issued with. Some pharmacies may not have returned unsent invitations. Thus, we may have overestimated the number of invitations sent, and therefore underestimated the response rate.

The small sample size in the follow-up survey raises uncertainties about the magnitude of the effect on antibiotic use. Although the effect may be smaller than we have estimated (> 500 000 excess prescriptions filled per year), we believe the potential for excess repeat ordering to increase antibiotic use is important. We found that more than 80% of people who did not fill their repeat still had their repeat at two to four weeks after the initial course of antibiotics. Thus, even though the excess of repeats may not lead to an immediate increase in antibiotic use, it may lead to poor-quality use of medicines by people filling the repeats some time later.

There are several potential solutions to address the increase in repeat ordering. First, software manufacturers could be lobbied to change the settings so that the defaults are set to "no repeats". It could be argued that clinicians should make decisions each time they prescribe about the amount of medicine to order and whether a repeat is required. However, there is currently no legislative power to enforce such a change, and little incentive on the part of the software manufacturer to do so. Further, there is likely to be resistance to this option from doctors, as it may slow down the prescribing process.

A second option is to remove the ability to order repeats on the PBS for some antibiotics. It can be argued that patients presenting with URTI should only receive one course of antibiotics, and return to their doctor after that course if they remain unwell. Doctors would still be able to order extended courses, when required, using the Authority system of the PBS.

A third option is to educate doctors about the automatic functions of the prescribing software. Educational campaigns, such as those promoted through the National Prescribing Service, could assist doctors in changing the default settings.

COMPETING INTERESTS

None identified.

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