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The Effect of an Interactive Tutorial on the Prescribing Performance of Senior Medical Students

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Abstract

Objectives: To evaluate the effectiveness of small group tutorials in teaching senior medical students the requirements of prescription writing.
Design: Random allocation to interactive tutorial or didactic lecture with blinded evaluation.
Subjects: All 1999 6th year medical students, the University of Adelaide.
Results: The Tutorial Attenders (mean 13.3, SD 2.6) performed significantly better than the Lecture Group (mean 12.2, SD 3.0) $p=0.041$ and the Non-attenders (mean 10.7, SD 3.1) $p=<0.001$. The 13 individual OSCE items formed four logical subgroups, and the Tutorial Attenders performed significantly better in Prescription Writing in all comparisons.
Conclusion: A single, one-hour interactive tutorial is likely to be the minimum amount of intervention that will be effective in improving prescribing skills.

Key Learning Points

1. Prescription writing is a key skill that almost every doctor will use – numerous times a day.
2. The learning of Clinical Pharmacology is a continuum that begins at the undergraduate level and continues throughout a doctor's postgraduate career.
3. A single, one-hour interactive tutorial is likely to be the minimum amount of intervention that will be effective in improving prescribing skills.

Keywords: Clinical science education, Problem Based Learning, PBL, Education, measurement; Education, medical; Undergraduate; Prescription writing.

Prescription writing is a key skill that almost every doctor will use numerous times a day. But are medical students effectively taught how to write a complete and accurate prescription? Most commonly the answer is no. Most students and junior doctors, insecure in their knowledge of rational drug prescribing, imitate what is being done by senior clinicians, they too having learned in the same way from their predecessors.

Prescribing can be influenced by aggressive pharmaceutical marketing. Commonly resulting in the prescription of newer, more expensive agents at the expense of older, cheaper ones that may be just as appropriate.[1]

There is increasing recognition of the need for the rational use of medicines and clearly appropriate prescribing is a key to achieving this.

Ray *et al*[2] provides a broad definition of rational drug use: "[the] need-based use of drugs depending upon clinical parameters and up to date knowledge of therapeutics on the basis of biological necessity of the recipient."

Irrational drug prescribing includes practices such as inappropriate polypharmacy, wrong medication for the diagnosis, use of expensive drugs when less expensive alternatives are available, use of the wrong dose (both overdosing and underdosing), and prescribing when medications are not necessary, particularly relevant to the prescription of antibiotics.[3]

Knowing which drug (if any) is required is only the first step. The prescription must contain the name of the appropriate drug at the optimal dose for the correct duration, and also take into consideration the financial cost to the patient. There are also legal requirements that vary from one country to another.

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During the 1990's, there developed a greater awareness of the need to teach rational prescribing. It was felt that there was a "limited perception of the importance of prescribing in the undergraduate curriculum….".[4] Recommendations to improve rational prescribing skills included the establishment of a core curriculum in clinical pharmacology and therapeutics, for undergraduate, postgraduate and continuing medical education, and emphasising the importance of rational prescribing.

Development of a new core curriculum in clinical pharmacology is based on the view that the learning of clinical pharmacology is a continuum that begins at the undergraduate level and continues throughout a doctor's postgraduate career.[5] The undergraduate years should provide the foundations upon which rational prescribing will occur.

Traditionally, undergraduate clinical pharmacology has been taught through didactic lectures with the aim of transferring as much knowledge and factual information as possible. Students were told what they needed to know. Assessment focussed on how much knowledge or how many facts students were able to remember and reproduce.

Transmission of the core knowledge of Clinical Pharmacology, for example pharmacodynamics and pharmacokinetics of many drugs, can be achieved during lectures. Clinical diagnostic skills are also well taught by a variety of methodologies.

Rational prescribing depends on the effective combination of these two knowledge sets to enable the students to choose the right drug for the correct clinical diagnosis and write a complete and appropriate prescription.

The causes of poor prescription writing are multi-factorial, including governmental drug policies, care conditions, patient expectations or demands, pharmaceutical industry promotion and inappropriate training.[6] But lack of knowledge or having the incorrect knowledge is not always a reason for inappropriate prescribing, nor can it be assumed that having all the correct information will lead to improvements in prescription writing[3].

Traditional teaching methods are passive, and we hypothesized that a more active process, where the student participates in what is being learnt, would be more successful in the teaching of prescribing skills. There is little literature guidance in this context.[7,8] In 1999 a deficit in teaching rational prescribing became apparent at the University of Adelaide and this pilot study was performed.

Methods

The sixth (final) year class of 1999 was randomly divided into two groups, by a clerical officer with no knowledge of the study. One group (n=71) was invited to attend a 1 hour, large group didactic lecture on prescription writing (LG), the other group (n=73) was invited to participate in a 1 hour tutorial on practical prescribing, delivered in small groups (TG). The common learning objectives of the lecture and the tutorial were the practical aspects of prescription writing and rational decision making.

The lecture covered the importance of prescribing and the hazards of incorrect prescribing. Students were shown how to correctly write a Health Insurance Commission Pharmaceutical Benefits Scheme (HIC-PBS) prescription including the legal requirements. The advantages and disadvantages of new technology such as computerized prescription were discussed. Students were told of the need to write in English, avoiding Latin terminology. Sources of independent information such as the Australian Medicines Handbook were identified, and the process of decision making was demonstrated.

The tutorial included two case scenarios as well as covering the requirements of a 'rational' prescription. Each tutorial group had an instructor and ranged in size from 12-19 students and were held concurrently. Students were unaware of who the tutorial facilitators would be. Students were provided with the tutorial material in advance and were expected to research the issues and to contribute during the tutorial. By the end of the tutorial, the group had developed a consensus 'ideal prescription' for each case scenario and each student had written a simulated HIC-PBS prescription.

Prescribing performances, incorporating 13 separate scored items (Table 1), were assessed independently by two examiners during a simulated patient objective structured clinical examination (OSCE) in the final examination period (8-20 weeks post intervention). The examiners were blind to the allocation of the students to the lecture or tutorial. The OSCE included a simulated clinical scenario and required students to determine the correct drug for the condition, and to write an appropriate prescription for that drug. The results from the two examiners were averaged to provide a single result per student (maximum 20 marks). For purposes of analysis, the 13 items were aggregated into 4 subgroups (Table 1).

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Table 1
OSCE Items and Sub Scores

Individual OSCE Items	Sub Scores
Patient profile (1 point)	Relevant history (6)
Excludes systemic symptoms (1 point)	
Asks about allergies (2 points)	
Asks about other medications (2 points)	
Appropriate drug choice (2 points)	Drug choice (3)
Generic drug use (1 point)	
Correct dose and route (2 points)	Prescription writing (6)
Correct frequency (1 point)	
Correct duration (1 point)	
Legibility, signature and date (2 points)	
Explains to patient the drug dose and duration of use (2 points)	Overall approach (5)
Overall approach to patient (1 point)	
Overall approach to task (2 points)	

Statistical tests were performed using Minitab Version 13.1 (Minitab Inc, PA, USA). Total scores were compared between groups using two-sample "t" tests. $p < 0.05$ was taken as the threshold of significance. Where groups differed significantly, an exploratory analysis of data was performed. Differences between sub-scores were looked for using two-sample "t" tests. Where subscores differed, individual items were compared between groups using the Mann-Whitney test.

Results

An "intention to treat" analysis comparing all students allocated to the TG to the LG showed no significant difference between these groups, either in total score or the 4 subscores (Table 2).

Of the 73 students allocated to the TG, 46 students (63% of the allocated number) attended the tutorial (Tutorial Attendees, TA). . Comparing the tutorial attendees and non-attendees (TNA), the mean total score for the TA group was 13.3 and for the TNA group was 10.7. Two sample t-test analysis indicates the total scores to be significantly different between the TA and TNA,

$p<0.001$. Highly significant improvement in Prescription Writing and Drug Choice was achieved for the TA when compared to the TNA. When individual items were analyzed, significant differences were seen in four items all favouring the TA: Appropriate drug choice $p=0.0217$, Correct dose and route $p=0.0004$, Correct Frequency $p=0.0152$, and Legibility, signature and date $p=0.0077$.

When the TA and the LG were compared, a significant difference in total score was found ($p=0.041$). This difference was due to an improvement in Prescription Writing ($p=0.003$). Item analysis showed a significant difference in two questions: Correct dose and route $p=0.002$, and Legibility, signature and date $p=0.0369$.

Comparing the lecture group with the non-attendees, a significant difference was found in total score ($p=0.024$), due to an improvement in Relevant History ($p=0.028$). Item analysis showed a significant difference in Excludes Systemic Symptoms ($p=0.0411$).

The combined non-attendees and lecture group mean score was significantly lower ($p=0.004$) than that of the Tutorial Attendees. This significance was due to improvements in Prescription Writing ($p<0.001$) and

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Table 2
Mean Total Score and Sub Score Results*

	Tutorial Group n=73		Lecture Group n=71	p value
Total Score	12.3 ± 3.0		12.2 ± 3.0	0.815
Relevant History	3.5 ± 1.2		3.8 ± 1.2	0.141
Drug Choice	2.5 ± 0.8		2.5 ± 0.8	0.824
Prescription Writing	3.2 ± 1.4		2.9 ± 1.4	0.210
Overall Approach	3.1 ± 1.1		3.03± 1.1	0.745
	Tutorial Attendees n=46	**Non-attendees n=27**		*p* value
Total Score	**13.3 ± 2.6**	**10.7 ± 3.1**	-	**<0.001**
Relevant History	3.7 ± 1.2	3.2 ± 1.2	-	0.089
Drug Choice	**2.7 ± 0.6**	**2.2 ± 0.9**	-	**0.016**
Prescription Writing	**3.7 ± 1.3**	**2.4 ± 1.2**	-	**<0.001**
Overall Approach	3.2 ± 1.1	2.9 ± 1.1	-	0.161
	Tutorial Attendees n=46		**Lecture Group n=71**	*p* value
Total Score	**13.3 ± 2.6**	-	**12.2 ± 3.0**	**0.041**
Relevant History	3.7 ± 1.2	-	3.8 ± 1.2	0.614
Drug Choice	2.7 ± 0.6	-	2.5 ± 0.8	0.161
Prescription Writing	**3.7 ± 1.3**	-	**2.9 ± 1.4**	**0.003**
Overall Approach	3.2 ± 1.1	-	3.0 ± 1.1	0.340
		Non-attendees n=27	**Lecture Group n=71**	*p* value
Total Score	-	**10.7 ± 3.1**	**12.2 ± 3.0**	**0.024**
Relevant History	-	**3.2 ± 1.2**	**3.8 ± 1.2**	**0.028**
Drug Choice	-	2.2± 0.9	2.4 ± 0.8	0.171
Prescription Writing	-	2.4 ± 1.2	2.9 ± 1.4	0.079
Overall Approach	-	2.9 ± 1.1	3.0 ± 1.1	0.475
	Tutorial Attendees n=46	**Non-attendees + Lecture Group n=98**		*p* value
Total Score	**13.3 ± 2.6**	**11.8 ± 3.1**		**0.004**
Relevant History	3.7 ± 1.2	3.6 ± 1.2		0.812
Drug Choice	2.7 ± 0.6	2.4 ± 0.8		0.055
Prescription Writing	**3.7 ± 1.3**	**2.8 ± 1.4**		**<0.001**
Overall Approach	**3.6 ± 1.0**	**2.7 ± 1.1**		**<0.001**

*All data as mean +/- SD

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Overall Approach (p<0.001). Item analysis indicated significant difference for Correct dose and route (*p*=0.0003) and Legibility, signature and date (*p*=0.0113).

Discussion

Not all students allocated to the tutorial group attended the tutorial. Since the study was designed to test whether the tutorial was effective, including TNAs in the same group as TAs for analysis will dilute the effect (if any) of the tutorial. This is apparent in the results when TG is compared to LG, when differences are not seen. On the other hand, the effect of the tutorial is highly significant when it is compared either to the LG, the TNA group, or the combined TNA and LG groups. Students were randomized to the TG and LG at the beginning of the academic year, therefore these differences in performance are unlikely to be due to selection bias. Self-selection may have contributed to the students' decisions whether or not to attend the tutorial and attendees may have been more knowledgeable students than the students in the LG. An attendance roll was not collected for the students allocated to the LG. Students would not have been able to attend both the lecture and tutorial, as they had other timetable commitments to attend to at the same time.

An exploratory analysis to describe which skills changed with tutorial attendance found that in all comparisons with TA, prescription writing skills were significantly improved. These skills were specifically targeted by the tutorial.

The TNA group demonstrated worse skills than the LG in the end-of year assessment, both overall and specifically in history taking. This difference could be due to a benefit of the lecture or due to the TNA group being a self-selected group of under-performing students. The study design does not allow these two possibilities to be differentiated.

A single, one hour interactive tutorial was effective in influencing drug prescribing skills to undergraduate students when these skills were assessed objectively several months later. This is likely to be the minimum amount of input that will be effective in improving the prescribing skills of undergraduate medical students, but for the best outcome, more time should be dedicated to this aspect of therapeutics in the curriculum Our study does not assess how long students will retain the information, or whether they will be able to transfer the knowledge to different clinical conditions.

Traditional teaching methods are not adequately preparing medical students for the tasks they face once qualified[9] and this study has shown that an interactive tutorial may provide better outcomes. Further development of this concept could include additional tutorials, including a focus on the WHO Guide to Good Prescribing concept.[10] Once the foundations of pharmacology have been laid down, students are encouraged to develop a personal drug list, where the major classes are represented by a prototype drug. This forms a basic personal formulary which students can amend over time as pharmacological knowledge changes. They can then refer to this list and make a rational choice after assessing all possible drug choices and taking into account the patient's requirements.

Interactive tutorial-based teaching that focuses on practical clinical scenarios and active problem-solving by students is more effective than didactic lecture-based approach in improving the prescribing skills of undergraduate medical students.

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Statement of Ethical Approval

None required as it involved the evaluation of standard teaching methodologies employed by the Medical School at the University of Adelaide

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