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WHO/DAP/95.1
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Distribution: Limited

IMPACT OF A SHORT COURSE IN PHARMACOTHERAPY FOR UNDERGRADUATE MEDICAL STUDENTS

An international multicentre study



Action Programme on Essential Drugs

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Summary

The impact of a short interactive training course in pharmacotherapy, using a new WHO student manual on the principles of rational prescribing, was measured in a controlled study on 219 undergraduate medical students in Groningen, Kathmandu, Lagos, Newcastle (Aus), New Delhi, San Francisco and Yogyakarta. The manual and the course presented to the students a normative model for pharmacotherapeutic reasoning, in which they were taught to generate a 'standard' pharmacotherapeutic approach to common disorders, resulting in a set of first-choice drugs called P(ersonal)-drugs. The students were then shown how to apply this set of P-drugs to specific patient problems using a six step model: (1) define the patient problem; (2) specify the therapeutic objective; (3) verify the suitability of your P-drug; (4) write a prescription; (5) inform and instruct the patient; and (6) monitor and/or stop the treatment. The impact of the training course was measured by three tests, each containing open and structured questions on the drug treatment of pain using patient examples. Tests were taken before the training, immediately after, and after six months.

After the course, students from the study group performed significantly better than controls in all patient problems presented ($p < 0.05$). This applied to all old (previously discussed) and new patient problems in the tests, and to all six steps of the problem solving routine. The students not only remembered how to solve old patient problems (retention effect), but they could also apply this knowledge to new patient problems (transfer effect). Both retention and transfer effects were maintained at least six months after the training session.

In view of the impossibility of teaching students and doctors all basic knowledge of the thousands of drugs available in the market, this approach constitutes an effective and efficient way of improving the rationality of pharmacotherapy. However, this can only be successful when it is accompanied by a fundamental change in the teaching methods of the trainers, away from the habit of transferring knowledge, towards real problem-based teaching of pharmacotherapy.

Introduction

Many doctors find it difficult to make a rational choice from the large number of medicines that are available on the market. Numerous studies from developed and developing countries report ineffective or unnecessary treatment^{1,2,3} sometimes causing serious side-effects and even resulting in hospital admission.^{4,5,6}

It is known that the rationality of drug treatment relates to characteristics of both doctor and patient, such as the age or prescribing predisposition of the doctor, and the expectations of patients.^{7,8} Despite this knowledge, several attempts to improve prescribing behaviour of practising doctors have failed.⁹ It has been suggested that this failure may be linked to inadequate pharmacotherapy education during undergraduate medical training.¹⁰

In many medical schools the methods of teaching pharmacology and therapeutics have not changed during recent years, despite the tremendous progress in pharmacotherapeutic approaches to disease. Pharmacotherapeutic teaching remains often characterized by transferring knowledge about drugs, rather than training the students in treating patients in a rational way.^{11,12,13} While it is clear that medical students need pharmacotherapy training in order to apply their pharmacological knowledge into therapeutic practice,^{14,15,16} surveys in Canada,¹⁷ the USA¹⁸ and Europe¹⁹ concluded that structured training in pharmacotherapy is uncommon.

In the last decade a number of educational programmes have been developed to improve the teaching of pharmacotherapy.^{20,21,22,23,24,25} One of these, developed by the department of Clinical Pharmacology of the University of Groningen (Netherlands), presents the students with a normative model for pharmacotherapeutic reasoning. The students are taught to generate a 'standard' (pharmaco)therapeutic approach to common disorders, resulting in a set of first-choice drugs, called P(ersonal)-drugs. They are then shown how to apply this set of P-drugs to specific patient problems, using a six-step problem-solving routine:

- (1) Define the patient problem;
- (2) Specify the therapeutic objective;
- (3) Verify the suitability of your P-drug;
- (4) Write a prescription;
- (5) Inform and instruct the patient; and
- (6) Monitor and/or stop the treatment.

This method is taught in 12 weekly sessions in a training programme for medical skills that serves as an introduction to the clinical (undergraduate) clerkships programme.²⁶ The programme, which is highly interactive, significantly improved the knowledge and skills of students to choose drugs rationally in written cases, up to 15 months after the sessions had ended.²⁷

Because of the good results obtained with this relatively concise training, the general approach of this programme was used as the basis for developing training materials for pharmacotherapeutic training of medical undergraduates in other countries. To this end a draft WHO manual, "Guide to Good Prescribing"²⁸ was developed jointly by the Groningen group and the WHO Action Programme on Essential Drugs.

The draft manual was tested with groups of medical students in seven developed and developing countries. This report describes the results of this field test, which took place in medical schools in Groningen (Netherlands), Kathmandu (Nepal), Lagos (Nigeria), New Delhi (India), Newcastle (Australia), San Francisco (USA) and Yogyakarta (Indonesia). The test focused on whether a short training course based on the draft WHO manual would enable the students to use the knowledge and skills obtained during the course to solve new patient problems.

Acknowledgments

This research was designed, funded and executed as a joint effort between the WHO Action Programme on Essential Drugs and the Department of Clinical Pharmacology of the Faculty of Medicine, University of Groningen, Netherlands (WHO Collaborating Centre on Pharmacotherapy Teaching and Training). The support by all teachers and students who participated in the field test and the collaboration with the International Network for the Rational Use of Drugs, and its Coordinator, Dr Richard O. Laing, are gratefully acknowledged.

Materials and methods

Study design

Undergraduate medical students who were about to start their clinical clerkships (about two years before graduation) were invited to participate voluntarily in the study. All sat down for a pre-test to solve two patient problems. Thereafter, the students were divided randomly between study and control groups of about ten students. Some universities had two groups of each. The study groups continued with four weekly pharmacotherapeutic training sessions of about two hours supervised by one and the same teacher. During the first session, the general approach of the problem-solving method was explained. During the remaining sessions, specific patient problems were discussed. In view of the limited time, the principles of good prescribing were discussed using patient examples on pain medication only.

The impact of the training sessions was measured by means of open and structured questions, designed to differentiate between a retention effect (remembering what had been learned) and a transfer effect (applying the method to new patient cases). In addition, a separate series of closed questions was included to test the students' knowledge on the drug treatment of pain. This was done to analyse whether any progress in prescribing was due to better prescribing skills in general, or just to a better knowledge on the treatment of pain. Both control and study groups completed three tests, before (T1) and immediately after (T2) the training period, and after six months (T3).

Number of students

Of 219 students enrolled in the pre-test, 108 were assigned to control groups and 111 to study groups (Table 1). 93 (86%) students from the control groups and 91 (82%) from the study groups completed all three tests; their results were used in the analysis. Scores of drop-outs did not differ significantly from those included ($p > 0.05$).

Table 1 Number of students

	Control groups			Study groups		
	All	Incl	Excl	All	Incl	Excl
Groningen	9	9	0	7	7	0
Kathmandu	10	8	2	10	8	2
Lagos	20	19	1	20	18	2
New Delhi	20	17	3	18	15	3
Newcastle	16	15	1	20	19	1
San Francisco	13	7	6	16	5	11
Yogyakarta	20	18	2	20	19	1
Total	108	93	15	111	91	20

Training course

Teachers in all participating universities were carefully instructed not to provide solutions to the pharmacotherapeutic problems, but rather to guide the students in discussing and finding the answers themselves. During the course, five written patient problems were discussed: treatment of pain in patients with toothache, renal calculus, cancer with metastases, gout and low back pain. The patient's history, results of physical examination and the diagnosis were provided. The students were requested to analyse each patient problem in two stages. First they were to determine one or more first-choice drugs for the health problem (pain). In the second stage they had to develop a complete therapeutic action plan for the specific patient, using the six-step model. As all patients were to be treated for pain, the first stage was similar in all cases, which allowed for more time to practise the important second step.

Test procedure

During the three tests, a total of six different written patient problems concerning pain were presented to the students of both study and control groups (Table 2). Problem A was presented in each of the three tests in order to measure the retention effect. Patient problems B and C were new cases, presented at T2 and T3 respectively in order to measure the transfer effect. The patient data on history, physical examinations and relevant laboratory and X-ray data were provided. Students were requested to provide a complete therapeutic action plan within 15 minutes, using the open question: "Describe step by step what you are going to do from this moment on (the moment of determining the diagnosis) until you finish the consultation". Students were allowed to use any reference material, with exception of the WHO manual.

In addition to the open questions and after the answers to these questions had been collected, at each test one structured question was given. In this question the students were guided in the reasoning process by detailed questions such as "What is the patient's problem", "What is your therapeutic goal", etc. These questions were included to determine whether a possible increase in score for questions A, B or C was due to an increase in knowledge about drug treatment of pain, rather than to improved skills in problem solving.

Table 2 Patient problems used in tests

Test	Open questions		Structured questions
T1	A		X
T2	A	B	Y
T3	A	C	Z

T1=pre-test; T2=post-test; T3=6 months post-test

Scoring of test results

The test questions were such that no single good answer was possible. For example, the selection of the best drug or the dosage form could differ between different settings. In each university the correct answers to the test questions were separately determined by the teachers, usually in consensus with one or more members of the department. The answer forms from study and control groups were coded by number and scored blindly by the teacher of the group. Each of the six steps were separately scored between 0 and 3 (0 = no or bad answer, 1 = disputable answer, 2 = acceptable answer and 3 = good answer).

In two universities (New Delhi and Yogyakarta) all test results (study and control group, all three tests) were later blindly scored again by an independent scorer.

Statistical analysis

Results are presented as mean value and 95% confidence limits, for each component of the prescribing routine. Control and study groups were compared using multiple analysis of variance (MANOVA).

In addition to the MANOVA analysis of the groups as a whole, a matched pair analysis was also performed. In this analysis, for each university, the individual students from the study group were paired with the students from the control group on the basis of their scores for question A1 in the T1 test. The differences in the scores of the individual pairs was calculated and compared, using the paired student's *t*-test. The results are presented as the mean value and 95% confidence limits of the increase of the scores between T1 and T2 (difference of individual pairs between A1 and A2 and between A1 and B), and between T1 and T3 (difference between A1 and A3 and between A1 and C). MANOVA and matched pair analysis were also performed separately for each individual university.

The independent scores from Yogyakarta and New Delhi were compared with MANOVA and by matched pair analysis. Teacher and independent scoring were analysed by correlation analysis, to measure a possible bias of higher teacher scoring for students in the study group.

In all analyses, differences were considered significant at $p < 0.05$.

Questionnaire

After the training course (at T2) the students of the study group were requested to anonymously complete a questionnaire with 13 questions to measure the degree of their self-confidence in choosing and prescribing drugs in the future, as well as their opinion of the manual, the teaching programme and the test procedure. The questionnaire used a negative to positive score between 0 and 4.

Results

Retention effect

The mean scores for each of the six basic steps of the problem solving routine of problem A at T1, T2 and T3 are given in Annex 1a and visualised in Figure 1. At T1 there was no difference between study and control groups for each of the six steps in the problem-solving routine, with a total mean score 6.76 versus 7.14 (maximum score 3 points per step, 18 in total). At T2 the study group showed significantly higher scores than the control group (11.88 vs 7.24). At T3 the study group again scored significantly higher on all steps compared to control students (12.23 vs 7.77), and also when compared to their own previous results at T1.

Results of the matched pair analysis for each of the six steps in problem A are given in Annex 1b, presenting the average increase in student scores in the study group between T1 and T2, and between T1 and T3, when compared with those in the control group.

Transfer effect

The mean results for each of the six components of tests A, B and C are given in Annex 2a and shown in Figure 1. At T1 there was no difference between the study and control groups in solving problem A (total mean score 6.76 vs 7.14). At T2 the study group scored significantly better than the controls on all steps of problem B (10.61 vs 5.96); except for step 6, their scores were also significantly better than their own for A at T1 (10.61 vs 6.76). At T3, with problem C, the study group scored better on all 6 items when compared to controls at T3 (11.31 vs 7.63) and also when compared to their own previous scores with problem A at T1 (11.31 vs 6.76). The results of matched pair analysis are summarized in Annex 2b.

Knowledge on drug treatment of pain

The mean scores of questions X, Y and Z are given in Annex 3 and illustrated in Figure 2. At T1 (problem X) no difference was found between the study group and controls (total mean score 9.63 vs 10.24). At T2 (problem Y) the study group scored better than controls in four steps of the problem solving routine; the total mean score was 11.89 vs 9.58. With problem Z at T3 the study group scored better than controls in three out of six items with a total mean score of 11.66 vs 10.17.

Figure 1

Scores for open questions A-A-A (retention effect) and A-B-C (transfer effect). Each panel represents one step of the problem solving routine.

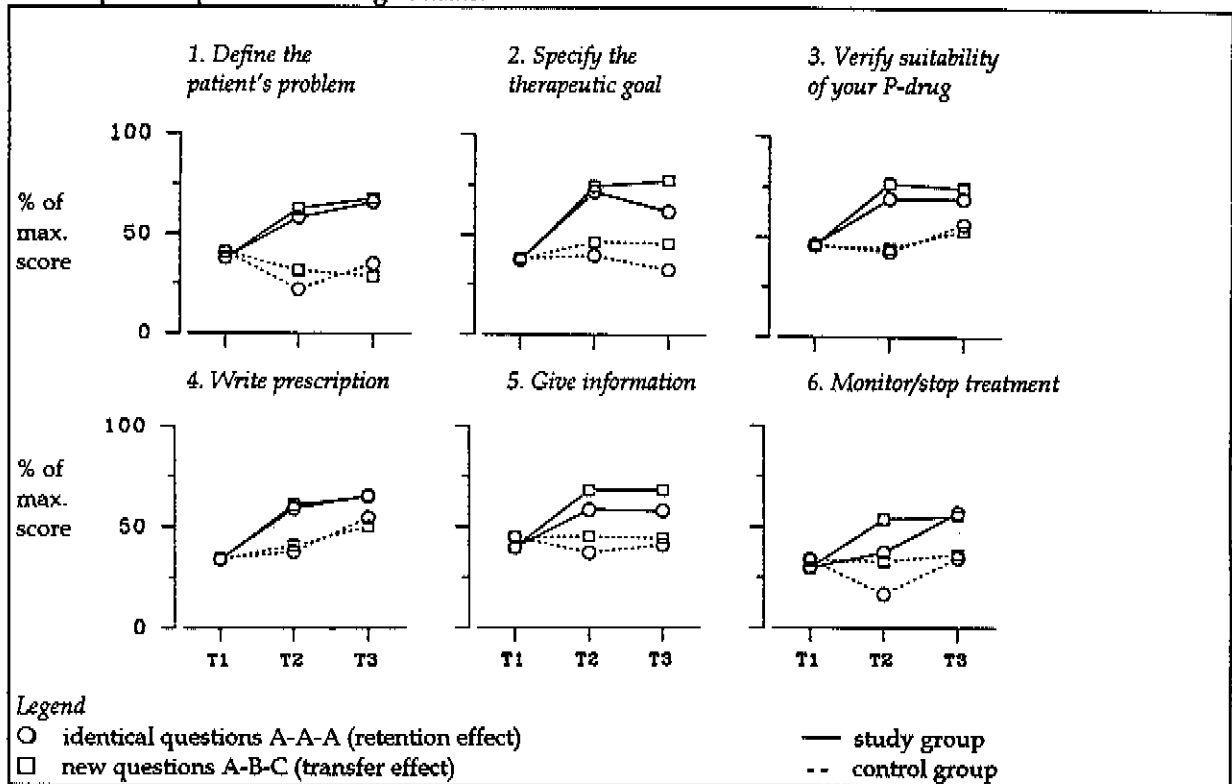
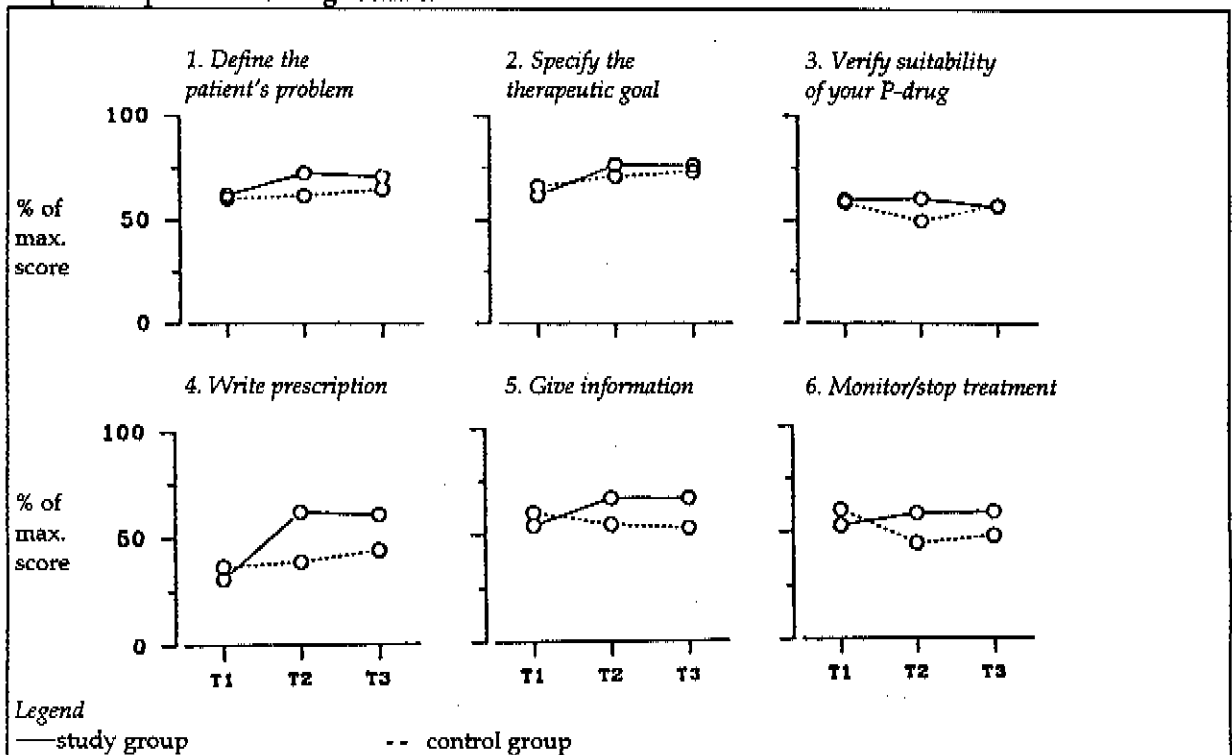


Figure 2

Scores for closed questions X-Y-Z (knowledge on drug treatment of pain). Each panel represents one step of the problem solving routine.



Results per medical school

In general the results per medical school, for both the tests and the questionnaire, did not differ from the pooled results except for a lack of statistical significance in unpaired analyses in Kathmandu, Lagos, Newcastle and San Francisco, usually due to low student numbers.

In the MANOVA and matched-pair analyses of open questions A1-A2-A3 and A-B-C, the individual results in Yogyakarta and Delhi were also statistically significant. As an example, the MANOVA analysis results from Yogyakarta are summarized in Table 8. Other data are available upon request.

Table 3
MANOVA analysis of open questions, compared with A1 (Yogyakarta)

n=20	A2	p	A3	p
1. Patient problem	2.17	.000	2.38	.000
2. Therapeutic goal	1.05	.002	1.61	.000
3. Verify suitability	1.89	.000	1.5	.000
4. Write prescription	0.86	.000	0.61	.024
5. Inform patient	1.83	.000	2.22	.000
6. Monitor treatment	1.17	.000	1.83	.000

	B	p	C	p
1. Patient problem	2.00	.000	1.78	.000
2. Therapeutic goal	1.89	.000	1.44	.004
3. Verify suitability	1.61	.000	0.67	1.44
4. Write prescription	1.00	.000	2.27	3.62
5. Inform patient	1.78	.000	1.72	.000
6. Monitor treatment	1.17	.003	1.39	.002

Independent scoring of results

In the case of Yogyakarta and Delhi, an additional independent blind scoring of all results was available. In both universities, the independent scoring was very similar to the teachers' scores. The MANOVA analysis of the independent scores was statistically significant in both cases, at a slightly higher level than for the teachers' scores.

In the paired *t*-test analysis between teacher and independent scoring, no systematic differences were found. The pattern was very consistent in Yogyakarta, with very few differences between the two scores; in Delhi there were more individual differences, but in both directions and without systematic bias.

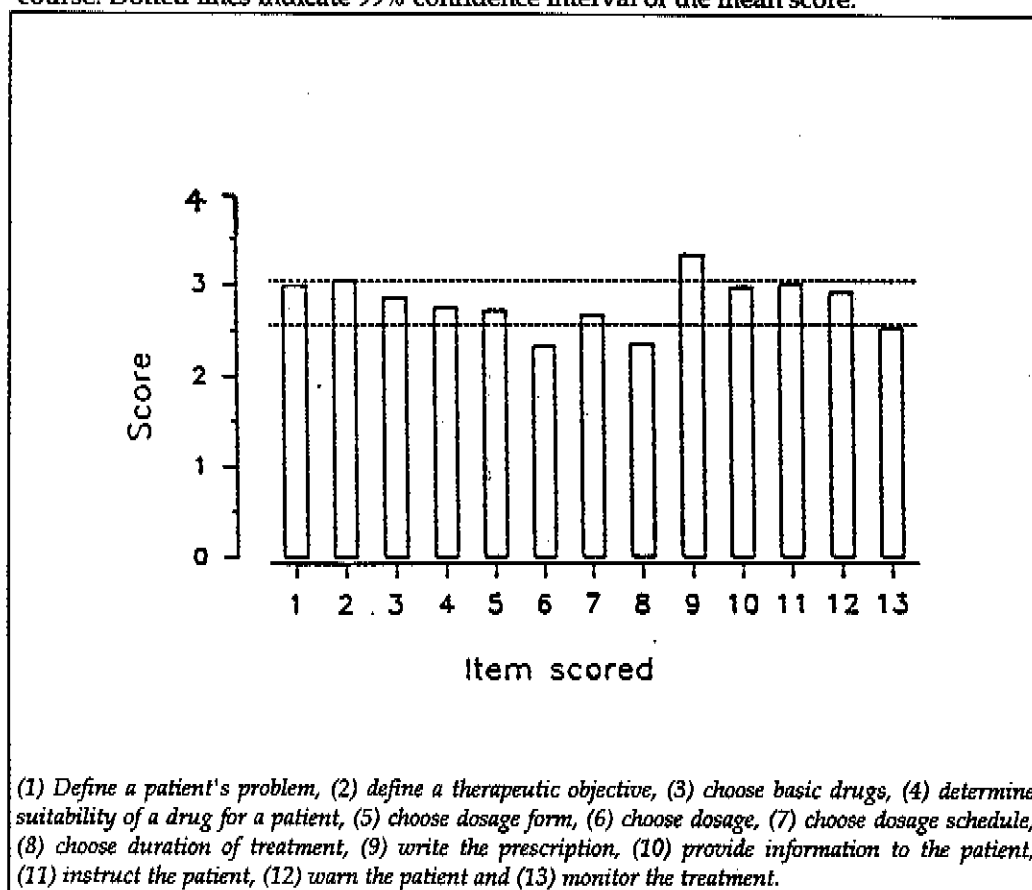
In the analysis of 3505 pairs of scores in the two universities together, the mean teachers' score was 1.49, compared with 1.43 for the mean independent score. The slightly higher teachers' scores occurred in the study and control groups alike, without systematic bias for either group. There was a significant correlation between the teachers' and independent scores ($r=0.675, p<0.001$).

Questionnaire

104 students in the study group completed the questionnaire at the end of T2. The median time spent on the homework assignments (solving one patient problem) was reported as 30-44 minutes. The students reported to be most confident in prescription writing, but were less confident about choosing the dosage of a drug and choosing the treatment's duration (Fig. 3). All scores from the questions on the manual (comprehensives, readability, understandability, lay-out), the course (approach, duration, teacher) and the test procedures (instructions, validity, available time) ranged between 3 and 4 on the scale.

Figure 3

Degree of self-confidence in prescribing skills, as indicated by students after the course. Dotted lines indicate 99% confidence interval of the mean score.



Discussion and conclusion

The results of this study, which involved 217 students in seven different medical schools in developed and developing countries, show that a short training course presenting a normative model for pharmacotherapy can significantly improve the ability of students to solve written patient problems.

The results of the same open question A at T1, T2 and T3 showed that the study group remembered what was learned (retention effect), even after six months; in the same period the scores of the study group remained virtually the same. The better score was obtained in each of the six steps of the problem solving routine. No such effect was seen in the control group.

The results of the open questions A at T1, B at T2 and C at T3 are proof of a transfer effect: students in the study group were able to apply this knowledge to new patient problems. It is especially important to note that this effect was also maintained for at least six months. Again, no such effect was seen in the control group.

A last indication of the success of the method is the outcome of the questionnaire which indicated that the students felt confident in prescribing skills, although less in choosing a dosage for a drug and the duration of treatment. As there is no control group in this subjective measurement, the outcome needs to be interpreted with caution.

How do we know *what* has been transferred: knowledge about the pharmacotherapy of pain, or the skill in solving problems of patients with pain? The highly structured questions X, Y and Z were specifically designed to measure the knowledge on the treatment of pain, as compared to problem solving ability. The difference between study and control groups was largest in the open questions A, B and C, and much less in the structured questions. This suggests that the transfer effect in the study group is mainly due to better problem solving skills, rather than increased knowledge.

The significant and persistent positive impact of such a short training course may meet with some scepticism. Objections against the results could be: (1) students are self-selected and not representative; (2) teachers were biased in their scoring; (3) "cross-contamination" occurred between the study and control groups, especially in the period between T2 and T3; and (4) control students could learn from the test, and score better in subsequent tests.

All participating students were self-selected and all were probably eager to learn; in general they may have been better than average students. However, assignment to one of the two groups was random and their mean scores for questions A and X at T1 were identical. There is therefore no evidence that students in the study group were better than those in the control group.

Possible teacher scoring bias was separately tested in two universities (New Delhi and Yogyakarta), through an additional blind scoring of all test results by independent experts. In both cases the independent scores gave exactly the same results as the teachers' scores, there were no systematic differences between the teachers' and independent scores, and there was a significant correlation between the teachers' and independent scores. We therefore conclude that there was no teacher scoring bias.

Cross-contamination between the two groups was prevented as much as possible by careful instruction of the students. Often the control students were very disappointed to be excluded from the training and were eager to learn as well. However, they were promised their own copy of the guide (after T3) and in two universities the same training programme was given to them as well, after T3. Cross-contamination can therefore not be excluded completely, but it should be stressed that, if it occurred, it would have *decreased* the difference between the two groups and would have hidden rather than flattered the positive impact of the training.

A last source of bias is the fact that control students can learn from the tests and score better in subsequent tests. This could only have been prevented by enrolling a second control group at T2 and a third at T3, which was practically impossible. However, the nearly identical scores of control students for problem A in all three tests indicate that this effect is probably limited and restricted to prescription writing only. Moreover, as with cross-contamination, it would have hidden rather than increased the positive outcome.

It has been mentioned already that the results in this study are only valid for patient problems concerning pain. Nevertheless, the results are very similar to those of a previous study with mixed problems.²⁷ This would suggest that the normative problem solving method is generally applicable in developed and developing countries, although a separate study with mixed patient problems would be needed to give definitive proof. It should also be stressed that our study assessed student *competence* to solve a written patient problem, which does not necessarily predict their actual *performance* in subsequent clinical practice. In view of the promising results, it seems worthwhile to study the impact of this training method on subsequent performance.

It may seem surprising that a short training course of only eight hours of teaching can induce the persistent transfer effect demonstrated by this study. In view of the impossibility of teaching students all basic knowledge on the thousands of drugs available, this approach seems to constitute an efficient way of improving the rationality of prescribing. However, this method can only be successful when it is accompanied by a fundamental change in the teaching methods of the trainers, away from the habit of transferring knowledge towards real problem-based teaching of pharmacotherapy. The principles of rational prescribing should also be reinforced in the clinical phases of training.

Retention effect**Annex 1a: Mean scores (95%CL) of same open question A at three tests**

	T1 ^o	T2	T3
<i>Study group (n=91)</i>			
1. Define patient problem	1.14 (0.93-1.35)	1.88 (1.65-2.11)*	2.04 (1.82-2.27)*
2. Specify therapeutic goal	1.12 (0.93-1.31)	2.23 (2.04-2.42)*	2.32 (2.15-2.49)*
3. Verify suitability P-drug	1.40 (1.19-1.60)	2.31 (2.11-2.51)*	2.25 (2.07-2.44)*
4. Write prescription	1.02 (0.89-1.15)	1.82 (1.69-1.94)*	1.94 (1.81-2.07)*
5. Inform patient	1.19 (1.00-1.38)	2.03 (1.86-2.21)*	2.03 (1.85-2.21)*
6. Monitor treatment	0.89 (0.65-1.12)	1.61 (1.38-1.83)*	1.65 (1.43-1.87)*
Total	6.76	11.88	12.23
<i>Control group (n=93)</i>			
1. Define patient problem	1.23 (1.02-1.43)	0.95 (0.75-1.15)	0.86 (0.65-1.07)
2. Specify therapeutic goal	1.15 (0.96-1.35)	1.40 (1.22-1.58)	1.38 (1.18-1.58)
3. Verify suitability P-drug	1.38 (1.19-1.58)	1.34 (1.14-1.55)	1.61 (1.44-1.79)
4. Write prescription	1.03 (0.90-1.15)	1.22 (1.10-1.34)	1.51 (1.37-1.64)
5. Inform patient	1.34 (1.15-1.54)	1.35 (1.19-1.52)	1.32 (1.15-1.49)
6. Monitor treatment	1.01 (0.77-1.25)	0.98 (0.72-1.23)	1.09 (0.87-1.30)
Total	7.14	7.24	7.77

LEGENDA: T1 before training course, T2 after training course, T3 after six months

^o maximum score per step = 3

* differences with control and with results of T1 ($p < 0.05$)

Annex 1b: Mean increase (95%CL) of study group in score for same question A at T2 and T3 (matched pair analysis)

(n=86)	Difference A1-A2	Difference A1-A3
1. Define patient problem	0.60 (0.04-1.17)	0.92 (0.40-1.44)
2. Specify therapeutic goal	0.93 (0.60-1.26)	1.12 (0.77-1.46)
3. Verify suitability P-drug	1.36 (0.84-1.89)	0.78 (0.41-1.15)
4. Write prescription	0.54 (0.35-0.72)	0.42 (0.24-0.61)
5. Inform patient	0.76 (0.44-1.07)	0.78 (0.42-1.14)
6. Monitor treatment	0.57 (0.20-0.94)	0.58 (0.24-0.92)
Total	4.76	4.6

Transfer effect**Annex 2a: Mean scores (95%CL) of new open questions A, B and C at three tests**

	T1° (A)	T2 (B)	T3 (C)
<i>Study group (n=91)</i>			
1. Patient problem	1.14 (0.93-1.35)	1.75 (1.62-1.97)*†	1.98 (1.74-2.21)*†
2. Therapeutic goal	1.12 (0.93-1.31)	2.15 (1.98-2.33)*†	1.86 (1.63-2.09)*†
3. Verify suitability P-drug	1.40 (1.19-1.60)	2.09 (1.90-2.28)*†	2.09 (1.93-2.25)*†
4. Write prescription	1.02 (0.89-1.15)	1.76 (1.65-1.88)*†	1.95 (1.81-2.10)*†
5. Inform patient	1.19 (1.00-1.38)	1.74 (1.57-1.90)*†	1.73 (1.49-1.96)*†
6. Monitor treatment	0.89 (0.65-1.12)	1.12 (0.90-1.34)*	1.70 (1.49-1.92)*†
Total	6.76	10.61	11.31
<i>Control group (n=93)</i>			
1. Patient problem	1.23 (1.02-1.43)	0.66 (0.48-0.83)†	1.06 (0.84-1.27)
2. Therapeutic goal	1.15 (0.96-1.35)	1.19 (1.02-1.37)	0.98 (0.78-1.18)
3. Verify suitability P-drug	1.38 (1.19-1.58)	1.29 (1.10-1.47)	1.71 (1.56-1.86)
4. Write prescription	1.03 (0.90-1.15)	1.22 (1.00-1.24)	1.63 (1.49-1.76)
5. Inform patient	1.34 (1.15-1.54)	1.11 (0.93-1.28)	1.22 (1.02-1.41)
6. Monitor treatment	1.01 (0.77-1.25)	0.49 (0.32-0.67)†	1.03 (0.83-1.23)
Total	7.14	5.96	7.63

LEGENDA: T1 before training course, T2 after training course, T3 after six months

° maximum score per step = 3

* difference with control ($p < 0.05$); † difference with T1 ($p < 0.05$)

Annex 2b: Mean increase (95%CL) in score of new open questions B and C at T2 and T3 (matched pair analysis)

(n=86)	Difference A-B	Difference A-C
1. Define patient problem	0.74 (0.27-1.22)	0.59 (0.07-1.05)
2. Specify therapeutic goal	1.13 (0.79-1.47)	1.12 (0.68-1.55)
3. Verify suitability P-drug	0.95 (0.46-1.44)	0.52 (0.13-0.92)
4. Write prescription	0.64 (0.45-0.83)	0.34 (0.14-0.53)
5. Inform patient	0.69 (0.34-1.03)	0.64 (0.26-1.02)
6. Monitor treatment	0.60 (0.24-0.97)	0.70 (0.35-1.05)
Total	4.75	3.91

Knowledge on treatment of pain**Annex 3: Mean scores (95%CL) of closed questions X, Y and Z at three tests**

	T1° (X)	T2 (Y)	T3 (Z)
<i>Study group</i>			
1. Patient problem	1.86 (1.72-1.99)	2.18 (2.05-2.31)*	2.13 (1.97-2.30)
2. Therapeutic goal	1.85 (1.73-1.97)	2.30 (2.17-2.42)	2.29 (2.17-2.40)
3. Verify suitability P-drug	1.79 (1.59-1.99)	1.81 (1.65-1.97)*	1.69 (1.51-1.87)
4. Write prescription	0.93 (0.79-1.06)	1.85 (1.72-1.98)*	1.80 (1.63-1.97)*
5. Inform patient	1.62 (1.44-1.79)	2.00 (1.84-2.16)*	1.99 (1.84-2.14)*
6. Monitor treatment	1.58 (1.38-1.79)	1.75 (1.55-1.94)*	1.76 (1.56-1.96)*
Total	9.63	11.89	11.66
<i>Control group</i>			
1. Patient problem	1.81 (1.67-1.94)	1.85 (1.70-1.99)	1.95 (1.79-2.11)
2. Therapeutic goal	1.99 (1.83-2.15)	2.13 (2.00-2.26)	2.20 (2.07-2.34)
3. Verify suitability P-drug	1.74 (1.58-1.90)	1.48 (1.30-1.67)	1.71 (1.54-1.88)
4. Write prescription	1.10 (0.96-1.02)	1.16 (1.03-1.29)	1.31 (1.14-1.47)
5. Inform patient	1.80 (1.66-1.93)	1.63 (1.49-1.78)	1.57 (1.39-1.75)
6. Monitor treatment	1.80 (1.60-1.99)	1.33 (1.15-1.51)	1.43 (1.21-1.64)
Total	10.24	9.58	10.17

LEGENDA: T1 before training course, T2 after training course, T3 after six months

° maximum score per step = 3

* difference with control ($p < 0.05$)

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