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**The prescribing performance and
confidence of final-year
medical students**

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ABSTRACT

Aim

To evaluate the current level of prescribing skills among final-year medical students during the last internship of context-learning pharmacotherapy curriculum in comparison to their prescribing confidence.

Methods

Final-year medical students (n= 602) performed four therapeutic consultations with four real patients during their clinical clerkship general practice. The supervising general practitioner assessed students' performance during these therapeutic consultations. At the end of the clerkship, students received a questionnaire about their prescribing confidence.

Results

On average, the students' performance for performing a therapeutic consultation was 7.93 on a 10-point scale. Only 22% of the students felt confident in verifying the suitability of the treatment for the patient, and 34% of the students felt confident in choosing the correct treatment.

Conclusions

This study shows that the level of prescribing skills among final-year medical students during their final internship general practice was more than sufficient. However, students did not feel confident in essential prescribing skills prior to qualifying.

INTRODUCTION

It is internationally accepted that the prescribing of drugs is an essential skill for medical doctors, and that medical students should master this skill before they graduate and become a junior doctor. Newly qualified doctors are required to prescribe rationally (i.e., effectively, safely, and at low costs) since they prescribe many times a day, make most prescribing decisions, and are responsible for writing the majority of prescriptions in hospitals.¹⁻⁴ However, despite the generally accepted importance of rational prescribing at the point of graduation, many medical students graduate without the basic knowledge and skills required for safe prescribing.⁵⁻⁷ In addition, studies have shown that the prescribing performance of junior doctors is poor and that they are responsible for many avoidable prescribing errors, resulting in inefficiencies in patient care and even patient harm.^{1,8-11} There has been accumulating evidence that one of the most important factors contributing to these prescribing errors is inadequate education in pharmacotherapy during the undergraduate medical curriculum.^{8,12-14} This may explain in part why many graduates feel insecure about their prescribing skills^{8,15-17} and under-prepared to take on prescribing responsibilities after graduation.^{3,16,18} A number of studies have shown that focused teaching in prescribing can lead to improvements in prescribing skills and confidence of medical students.¹⁹⁻²³ However, none of these studies evaluated students' prescribing skills or confidence in a clinical context with real patients at the end of the undergraduate medical curriculum. Moreover, it is still unknown how students' prescribing performance relates to their prescribing confidence in clinical practice. Therefore, we developed a pharmacotherapy training assignment during the final regular clinical clerkship at the VU University Medical Center (VUmc), Amsterdam, The Netherlands. The aim of this study was to evaluate the actual level of prescribing skills among final-year medical students in comparison to their prescribing confidence.

METHODS

Population

From September 2010 to March 2013, all final-year medical students, who performed their 6-week clinical clerkship in general practice – which is their last regular clerkship – at family practices affiliated with the VUmc, were included in the study. Prior to this clerkship, all included students had completed a full pharmacotherapy context-learning training program during the second to fifth year of the medical curriculum, as described below. The study was approved by the local educational research committee.

Previous pharmacotherapy context-learning training program

The pharmacotherapy context-learning training program at the VUmc is integrated in a problem-based medical curriculum and consists of a pre-clinical (years 2 to 3) and a clinical phase (years 4 to 5). The pre-clinical phase comprises two years of theory problem-based education during which students are trained in the form of 18 lectures (1 h) and 8 small group sessions (2 h). During these sessions students work out several written patient cases in a structured way according to the WHO six-step, approach and discuss these in small groups with a clinical pharmacologist and/or physician.²⁴

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During the clinical phase, students are trained in 3 lectures (1-2 h) and 4 role-playing sessions (2 h) in the form of a consultation during which student doctors perform therapeutic consultations with student patients. These consultations are observed by and discussed with student assessors. After the consultations and under supervision of a clinical pharmacologist, students discuss the various (drug) treatment options and how they performed as a physician. Subsequently, during the clinical clerkships students work out treatment plans for real patients and evaluate these with a clinical pharmacologist and/or physician during 10 therapeutic sessions (1-1½ h).

Pharmacotherapy training assignment in general practice

The pharmacotherapy training assignment consisted of performing four therapeutic consultations (TC) with four real patients who visited the general practitioner (see Box 1). Each student performed one TC per week (weeks 2 to 5). A few days before the TC, the student and the supervising general practitioner (GP) selected an appropriate consultation with a patient who had already made an appointment. A consultation was considered appropriate if the patient used drugs or when a drug treatment recently was started or changed for the patient, and preferably if the patient had one of the 23 clinical problems in which the student had already been trained during the pharmacotherapy program (see Table 1). The student had to prepare the consultation by studying the patient record, reading standard treatment guidelines and looking up essential drugs for the concerned disease. Subsequently, the student performed the TC by evaluating the complains of the patient, and then by formulating his or her own therapeutic plan based on the WHO six-step approach. The therapeutic plan involved the written completion of the following six steps: step 1, define the indication for the treatment; step 2, specify the therapeutic objective; step 3a, specify the standard treatment for the diagnosis; step 3b, verify the suitability of your treatment; step 4, choose a preliminary (drug) treatment, taking all relevant patient characteristics into account; step 5a, write a prescription in the case of drug treatment; step 5b, determine what information, instructions and warnings should be given to the patient; and step 6, determine what should be measured and when, in order to monitor the progress of treatment. Finally, together with the patient, the student determined the definite therapeutic plan supervised by the GP.

Prescribing performance

After finishing the consultation, the student had to explain their proposed treatment plan and reasons affecting their drug choice for the patient. Students' performance during the TC was discussed with the student and evaluated (both orally and in writing) by the supervisor.

Prescribing assessment

After completion of the clerkship, students were also assessed in an oral exam by an independent GP from the general practice department at the VUmc, who was not involved in the supervision of these students. Prior to this assessment, students had to submit one of their treatment plans they had made during the clerkship. Subsequently, this treatment plan was discussed and evaluated with the student, and his or her knowledge about the treatments was tested by the independent

Table 1. Overview of the clinical problems for which a therapeutic consultation was conducted during the training assignment (weeks 2 to 5), divided in clinical problems which had been trained explicitly earlier in de pharmacotherapy curriculum, and those that had not been trained.

Diagnosis	Number of therapeutic consultations	
	Trained	Untrained
Respiratory		
COPD/asthma	56	
Cough		41
Hay fever		6
Community-acquired pneumonia	54	
Cold		11
Bronchitis	41	
Ear/Nose/Throat		
Otitis media	43	
Sinusitis maxillaris		32
Pharyngitis/tonsillitis		35
Dermatology		
Acne vulgaris		19
Constitutional eczema	5	
Erysipelas	33	
Folliculitis		3
Furuncle		3
Herpes infection		14
Skin wound	11	
Itchiness, urticaria		8
Cardiovascular		
Essential hypertension	95	
Angina pectoris	3	
Heart failure	4	
Central nerve system		
Fever		1
Pain	59	
Migraine	30	
Urinary tract		
Urinary tract infection	61	
Renal colic	4	
Gynaecology and anticonception		
Anticonception	26	
Dysmenorrhea	5	
Herpes genitalis		2
Bacterial vaginosis		3
Vaginitis		23
Gastrointestinal		
Diarrhoea		4
Dyspepsia		14
Nausea and vomiting	5	
Constipation		35

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Table 1. (continued)

Diagnosis	Number of therapeutic consultations	
	Trained	Untrained
Ulcus pepticum/reflux esophagitis	23	
Irritable bowel syndrome		1
Metabolic		
Diabetes mellitus type 2	33	
Anaphylactic reaction		6
Drug reaction		5
Iron deficiency anemia	7	
Musculoskeletal		
Osteoarthritis	1	
Gout		21
Lower back pain		24
Psychiatry		
Anxiety/nervousness		5
Depression	11	
Insomnia		6
Eye		
Conjunctivitis (bacterial/allergic)	43	
Others		375
Total	653	697

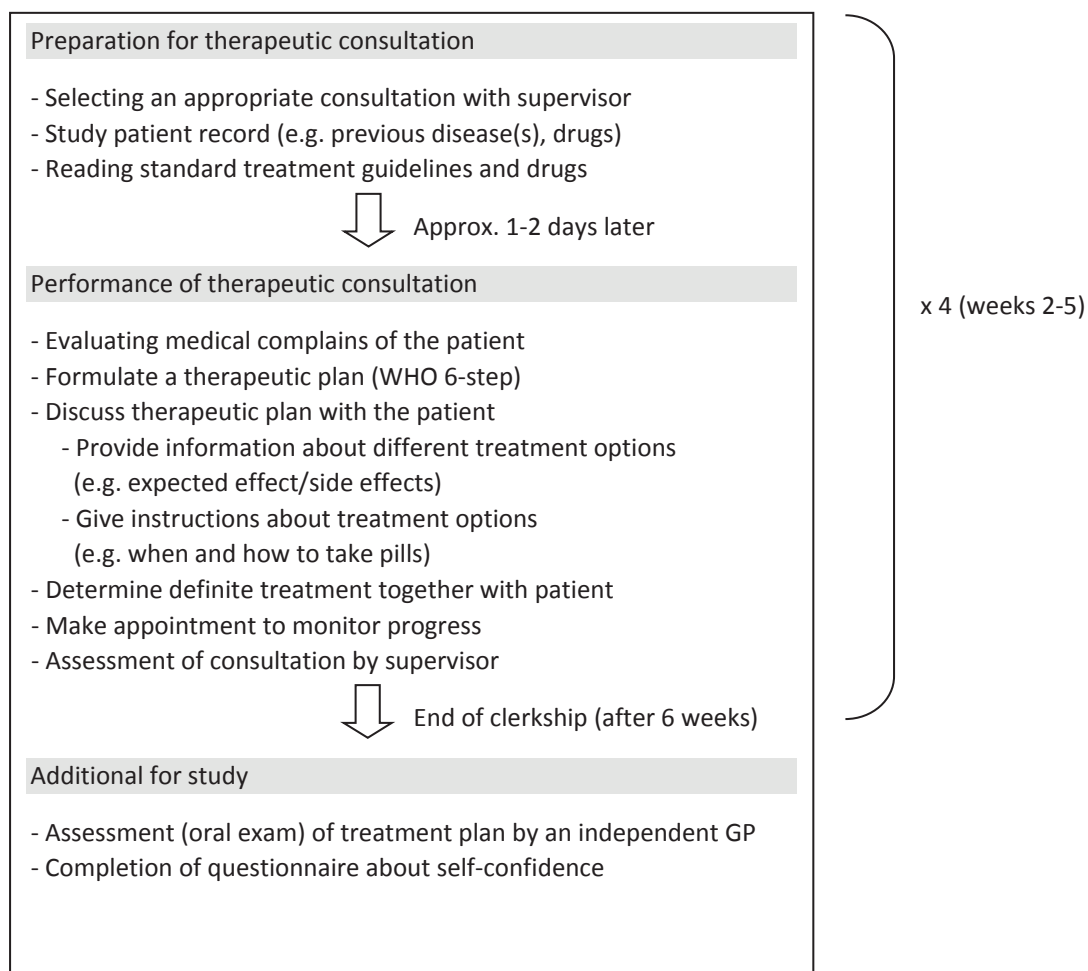
assessor. Considering it was a written treatment plan rather than a real-life patient consultation, only the most important cognitive therapeutic skills (steps 1, 3b and 4) were scored.

Confidence questionnaire

At the end of the clerkship, students received an e-mail from our administrator inviting them to participate in a self-administered Internet based questionnaire (using surveymonkey.com). This questionnaire contained a list of nine prescribing skills and students were asked to rate their level of confidence in performing each skill with a real patient during TC. Further e-mail reminders were sent 1 and 2 weeks after the initial message. Participation was voluntary, anonymous and without compensation. Confidentiality of the information tendered was assured to the participants.

Scoring and analysis

Both the supervising GP and the independent GP scored students' performance on each step 1 to 10 (1= lowest attainable score and 10= maximum attainable score). All GPs were previously provided with scoring instructions. In the questionnaire, each skill was scored by students on a five-point Likert scale (1= very unsure, 2= unsure, 3= neutral, 4= confident, 5= very confident). In addition to the separate scores per week, we analysed whether the average scores on each step tend to increase as students conducted more consultations. Also, we investigated whether there was a difference in scores between the TCs for the 23 clinical problems in which the student had already been trained



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Box 1. The pharmacotherapy training assignment during the clinical clerkship general medicine.

and those for new clinical problems. The data were analysed using SPSS 20.0 (SPSS, Chicago, IL). Differences were analysed using an independent T-test and by means of a one-way analysis of variance. A *P* value of <0.05 was considered statistically significant.

RESULTS

Demographics

From September 2010 to March 2013, a total of 602 eligible final-year students participated in this study. Two hundred forty-one (40%) students performed all therapeutic consultations. 242 (40%) students performed between one to three consultations. One hundred nineteen (20%) students did not perform any TC.

Students' performance of TC

A total of 388 supervising GPs and 8 independent GPs evaluated the students. An overview of the clinical problems for which a therapeutic consultation was conducted is shown in Table 1. Students' scores for performing TCs during weeks 2 to 5 are shown in Table 2. The supervisors gave the overall performance of students (steps 1 to 6) during the whole clerkship an average score of 7.93, with verification of treatment suitability (step 3b) being the lowest score (7.92 ± 0.52), and writing a prescription (step 5a) being the highest score (8.02 ± 0.53). There was no significant difference between one to three TCs (40%). The scores on steps 1, 2, 3a, 3b, 4, 5b and 6 increased significantly ($P < 0.001$) during the clerkship (see Figure 1); no significant increase was found with regard to the scores on writing a prescription (step 5a). No significant difference were found between the overall scores for new clinical problems (7.90 ± 0.60) and for known clinical problems (7.98 ± 0.53) in which the students had already been trained during the undergraduate curriculum.

Students' prescribing assessment

The independent GPs gave step 1 a score of 7.83 (± 0.46), step 3b a score of 7.84 (± 0.47) and step 4 a score of 7.82 (± 0.44). These scores were significantly lower ($P < 0.05$) than the scores of the supervising GPs.

Students' prescribing confidence

The questionnaire data about students' confidence in performing a TC with a real patient are presented in Table 3. A total of 236 (39%) students completed the questionnaire. 93% and 91% of the students felt confident or very confident in respectively diagnostic competencies and taking all relevant information into consideration in prescribing (step 1). In accordance with the high scores for writing a prescription (step 5a), the majority of the students (85%) felt confident or very confident in performing this skill. Similarly, consistent with the lower scores on verification of treatment suitability (step 3b), a rather small proportion (22%) of the students felt confident or very confident in performing this skill, whereas 36% were neutral, and 42% felt unsure or very unsure. Finally, only thirty-four percent of the students felt confident or very confident in choosing the correct (drug) treatment (step 4), 48% were neutral, and 18% felt unsure or very unsure.

DISCUSSION

The results of this study shows that the level of prescribing skills among nearly graduated medical students during their last clinical clerkship in general practice was more than sufficient after an undergraduate context-learning pharmacotherapy training program during the preceding years. Moreover, the majority of students felt most confident in performing diagnostic skills, whereas most of them did not feel confident in essential prescribing skills prior to qualifying: verifying the suitability of the treatment for the patient, and choosing the correct treatment. The overall level of prescribing skills tends to increase as students conducted more consultations. Finally, students could not only apply their prescribing skills to clinical problems in which they had been

Table 2. Average scores (max= 10; \pm SD) for the students' performance of the therapeutic consultations during weeks 2 to 5, defined by each step of the WHO 6-step. n = number of therapeutic consultations.

WHO 6-step	Week 2 (n= 380)	Week 3 (n= 374)	Week 4 (n= 333)	Week 5 (n= 301)	Week 7 (n= 414)
Step 1: Define indication	7.79 \pm 0.70	7.89 \pm 0.67	7.95 \pm 0.63	8.06 \pm 0.65	7.83 \pm 0.46
Step 2: Specify therapeutic objective	7.73 \pm 0.71	7.84 \pm 0.67	7.93 \pm 0.71	8.02 \pm 0.66	
Step 3a: Specify standard treatment	7.74 \pm 0.67	7.74 \pm 0.67	7.95 \pm 0.65	8.00 \pm 0.60	
Step 3b: Verify the suitability of your treatment	7.73 \pm 0.71	7.88 \pm 0.67	7.96 \pm 0.68	8.04 \pm 0.69	7.84 \pm 0.47
Step 4: Choose a (drug) treatment	7.74 \pm 0.72	7.94 \pm 0.72	7.97 \pm 0.69	8.03 \pm 0.70	7.82 \pm 0.44
Step 5a: Write prescription	8.04 \pm 0.91	8.13 \pm 0.79	8.17 \pm 0.74	8.17 \pm 0.72	
Step 5b: Give information, instructions and warnings	7.82 \pm 0.74	7.94 \pm 0.69	7.96 \pm 0.65	8.02 \pm 0.81	
Step 6: Determine monitoring parameters	7.75 \pm 0.78	7.85 \pm 0.72	7.98 \pm 0.65	8.05 \pm 0.67	
Mean score per week	7.79 \pm 0.58	7.90 \pm 0.54	7.98 \pm 0.54	8.05 \pm 0.56	

Weeks 2-5, assessment by supervising GP. Week 7, assessment by independent GP.

Table 3. Students' confidence in performing a TC with a real patient, defined by each step of the WHO 6-step (n = 236). Data are expressed as n (%). Highest scores in bold.

Questions	Very confident	Confident	Neutral	Unsure	Very unsure
How confident are you in:					
Q1. Diagnostic competencies (e.g. taking history)	31 (13)	190 (80)	13 (6)	2 (1)	0 (0)
Q2. Taking all the relevant information about patient into consideration in prescribing	27 (11)	189 (80)	18 (8)	2 (1)	0 (0)
Q3. Specifying the therapeutic objective	8 (3)	136 (58)	83 (35)	9 (4)	0 (0)
Q4. Specifying the standard treatment for the diagnosis	10 (4)	114 (48)	92 (39)	20 (9)	0 (0)
Q5. Verifying the suitability of the treatment for the patient	7 (3)	45 (19)	85 (36)	93 (39)	6 (3)
Q6. Choosing the correct (drug) treatment	5 (2)	75 (32)	113 (48)	42 (18)	1 (0)
Q7. Writing a drug prescription	63 (27)	137 (58)	30 (13)	5 (2)	1 (0)
Q8. Giving patient all relevant instructions, information and warnings	14 (6)	112 (48)	85 (36)	24 (10)	1 (0)
Q9. Determining all relevant monitoring parameters	16 (7)	147 (61)	67 (28)	5 (2)	1 (0)

trained during the undergraduate pharmacotherapy program, but also to "new" clinical problems, so-called transfer effect of the training.

Strengths and limitations

Before interpreting the results, the strengths and limitations of this study need to be addressed. As far as we know, this is the first study to investigate the actual level of students' prescribing skills in

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TCs with real patients during their last regular clinical clerkship. Furthermore, this is the first study to investigate the difference between objectively assessed prescribing performance and students' self-rated prescribing confidence. This was measured in a large cohort of final-year students who underwent the whole undergraduate pharmacotherapy program (n= 602). However, not all medical students performed all the therapeutic consultations during the clerkship. This might be because there was not always an appropriate opportunity or sufficient time to carry out a TC with a real patient within this 6-week period. Second, this study was an observational study rather than a randomized controlled trial. Just like other studies in this area, it was not only possible, but also not considered "ethical" to withhold the obligatory pharmacotherapy program from any group of students. Third, the level of prescribing was measured only during the clerkship general medicine, which is a primary care setting. The reason for this was that during the pharmacotherapy program students are primarily trained in diseases common in the primary health care. However, therefore we do not really know how students perform in a secondary care setting, like a busy hospital ward. Fourth, the students who responded to the questionnaire (39%) represent only a small proportion of the whole cohort, so it cannot be necessarily extrapolated to represent the prescribing confidence of all graduates. Finally, the uniformly high scores (>7.5) are consistent with earlier reports of scores

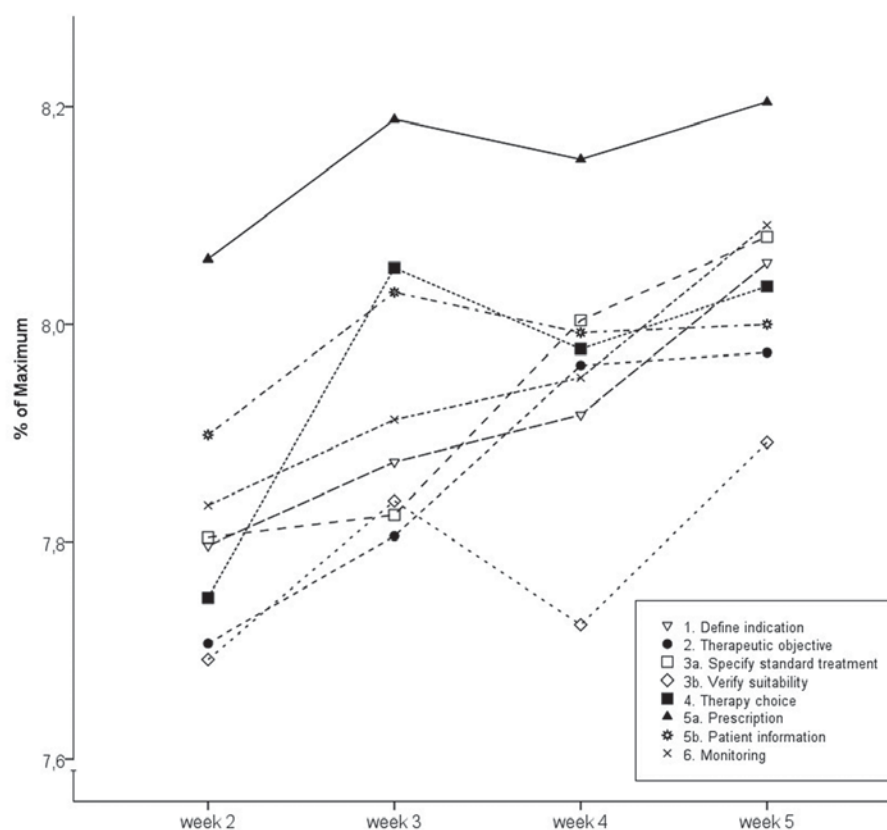


Figure 1. Scores for the students' performance of the therapeutic consultation during weeks 2 to 5, defined by each step of the WHO 6-step. Data are presented as mean percentage of the maximum score. Unbroken lines, $P < 0.001$.

for TCs of about 80% of the maximum attainable score.^{25,26} We are aware that clinical supervisors tend to overestimate performance scores and hardly fail student during clerkships,²⁷ so the scores must be interpreted carefully. The independent GPs scored the students significantly lower than did the supervising GPs, although the scores were still more than sufficient. This finding is comparable with an earlier study,²⁶ and might be due to the context in which the assessments took place. In contrast to the independent GPs, the supervising GPs already knew the patients from their family practice and had access to patients' medical records, which might have influenced their evaluation of the students' performance.

Interpretations of the results

Taking these strengths and limitations into account, this study shows that both supervising and independent GPs agree that final-year medical students are sufficiently competent to carry out TCs with real patients in general practice. This finding is in contrast to previous studies that claim medical students are not well prepared and sufficiently skilled in prescribing at the outset of their careers as they should be.^{5,13,15,22,28} However, as shown by Richir and co-workers, a pre-clinical context-learning pharmacotherapy program improves the level of students' therapeutic skills during the ensuing clinical clerkship internal medicine.²⁵ Our data suggest that implementation of both a pre-clinical and clinical pharmacotherapy program in a medical curriculum may lead to further holding of this improvement upon the point of graduation. More interesting, although the prescribing performance of final-year medical students seems rather adequate, they still lack confidence in essential therapeutic skills, i.e., verifying the suitability of the treatment for the patient; and choosing the right drug treatment. This low perception of their capability is even more remarkable since students were already aware of their high scores before they filled in the questionnaire. A possible explanation for this could be that during the pharmacotherapy training program students are explicitly taught to verify their treatment suitability (e.g., checking all relevant and interactions) before prescribing a drug, making them perhaps more afraid to omit. On the other hand, a disparity between self-reported confidence and assessed competence of new graduates has been reported elsewhere,²⁹⁻³¹ giving more credence to our results. Nevertheless, it may be useful for educational programmes to address this possible underconfidence in final-year students. It is not surprising that students not only lack confidence, but also perform less well in verifying the treatment suitability for the patient (step 3b). This important cognitive skill requires students to analytically weigh many individual patient's characteristics (such as age, gender, size, severity of complaints, prognosis, co-medication, co-morbidity, and sociocultural characteristics) in order to make a rational therapeutic decision.³² In contrast to doctors who do this process mainly unconsciously, students have not yet acquired such clinical experience, thereby may finding it hard to be thorough in weighing all relevant items. This might also encourage undesired copying behavior of students, without having to make their own rational decision.³³ With regard to the lack of confidence, Sandilands *et al.* suggested that an inappropriate level of prescribing confidence among students may have significant implications for patient safety.²¹ We doubt this, as some anxiety or insecurity about prescribing skills may reduce overconfidence and make students more cautious to check the suitability of their treatment choice, thereby making

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a more rational decision. Finally, the finding that students felt confident about their diagnostic skills is not surprising since the teaching in many curricula tends to be centered on the acquisition of diagnostic, rather than therapeutic, skills.

Remarkable findings

It is noteworthy that the scores on prescribing skills tend to increase as students performed more consultations with patients. This could at least partly be explained due to the so-called “testing effect”, that is, students who take a similar assignment a second time, usually do better than those taking the assignment for the first time.³⁴ However, TCs with real patients are a valuable component of clinical clerkships and constitute an optimal form of context learning, which is an effective learning method.³⁵⁻³⁹ As reported by Coles, one of the criteria for context learning is repetition.⁴⁰ Our results indicate that carrying out multiple TCs with patients may lead to further improvement of prescribing performance. In addition, this could also lead to an increase in confidence since clinical experience with real patients is a significant predictor and more important than any other variable for building students’ confidence.⁴¹ Thus for optimal learning, during the clinical clerkships students should carry out as many TCs with real patients as possible.

It is also worth mentioning that in comparison to the other six steps, the scores on step 5a, “writing a prescription”, did not increase significantly during the assignment. This may be explained by the fact that the scores started at a relatively high level (8.04), thereby leaving little room for improvement. Another reason could be that some medical prescriptions were filled in electronically rather than hand-written, which may be a less complicated task. In addition to the above findings, this study also indicated that students were not only able to perform TCs for clinical problems in which they already had been trained during the pharmacotherapy program, but were also able to apply the acquired skills to new situations. This so-called “transfer effect” has been reported in several studies,^{25,42-44} and indicates that students only need to be trained in a limited number of disease situations in order to reach an adequate level of prescribing.

CONCLUSIONS

According to our knowledge, this is the largest observational study so far evaluating final-year students’ prescribing performance in comparison to their prescribing confidence in therapeutic consultations with real patients. In spite of its obvious limitations, our study shows that the current level of students’ prescribing skills was more than sufficient after an undergraduate pharmacotherapy context-learning program; however, they still lack confidence in some essential prescribing skills prior to qualifying. This lack of confidence in prescribing needs further attention in educational programmes. Future studies should focus on the effect of a full pharmacotherapy context-learning program on the prescribing performance of junior doctors, and the consequences of prescribing uncertainty on patient safety. It would also be interesting to study the correlation between self-rated prescribing confidence and objectively assessed performance.

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