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ORIGINAL ARTICLE

Teaching Rational Prescribing in Medical Education: Knowledge, Attitude and Practice of Pharmacology and Community Medicine Among Final-Year MBBS Students in Karachi

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ABSTRACT

Background: Rational prescribing is a fundamental clinical competency that ensures the safe, effective, and economical use of medicines. Prescribing knowledge, attitudes and clinical decision-making skills are important areas of undergraduate medical education. Pharmacology and Community Medicine help in understanding the choice of proper drugs, patient safety and rational use of drugs.

Objective: To assess knowledge, attitudes, and practices regarding rational prescribing among final-year MBBS students in Karachi and examine their association with previous educational exposure to Pharmacology and Community Medicine.

Materials and Methods: A cross sectional descriptive study was done on 151 students from the final year MBBS in Karachi from January 2023 to June 2023. The structured questionnaire was used to measure the knowledge of rational prescribing, attitudes towards medicine use, self-reported prescribing practices and demographic characteristics. The assessment of knowledge was carried out with 10 questions and 5-point Likert scales were used for the assessment of attitudes and practices. In the proposed analytical framework descriptive statistics, group comparisons and Spearmann correlation analyses were used, and the statistical significance was set at p<0,05.

Results: Among 151 students, the mean age was 23.65 ± 1.23 years, and 61.6% were female. Good knowledge of rational prescribing was demonstrated by 27.2%, while 46.4% had moderate knowledge and 26.5% had poor knowledge. Positive attitudes were observed in 26.5%, neutral attitudes in 60.9%, and negative attitudes in 12.6%. Good prescribing practices were identified in 7.3%, fair practices in 37.1%, and poor practices in 55.6%. Previous rational prescribing training was associated with higher knowledge (p=0.003) and practice scores (p=0.010). Knowledge showed a positive correlation with prescribing practices (ρ=0.486, p<0.001).

Conclusion: The analysis demonstrates a potential gap between theoretical understanding and practical prescribing competency among final-year MBBS students. Integrated teaching, structured prescription-writing exercises, case-based learning, and supervised clinical training may strengthen rational prescribing education.

Keywords: Rational Prescribing; Pharmacology; Community Medicine; Knowledge; Attitude; Practice; Medical Education; MBBS Students.

INTRODUCTION

Rational prescribing is a key component of efficient healthcare service delivery and is crucial to achieving best therapeutic outcomes, reducing adverse drug reactions and ensuring rational use of healthcare resources. It includes choosing appropriate drugs for specific patients, giving the right dose, for the right amount of time and taking into account the financial cost of treatment and its safety for the patient. As drugs become more complex, more diseases are chronic and more drugs are available for treatment, healthcare practitioners are more and more charged with the task of prescribing appropriately. Medication use that is inappropriate can lead to avoidable adverse effects and to medication errors, to unnecessary expenditure of treatment resources, and to suboptimal treatment outcomes. Rational prescribing also involves correct communication with patients, the consideration of possible drug interactions and respecting evidence-based therapeutic guidelines. It is therefore important that these competencies are developed during undergraduate medical training to equip future physicians for safe and responsible prescribing[1-3].

Rational therapeutic decision making relies on the scientific and clinical underpinning that underpins the undergraduate medical education. Pharmacology is a part of the understanding that students gain about the mechanism of action, lipid solubility, absorption, excretion, and biotransformation of drugs, therapeutic indications and contraindications, adverse effects, and drug interactions. Community Medicine complements this knowledge by focussing on issues of public health implications of the use of medicines, the prevention of irrational prescribing, the availability of essential medicines and the promotion of cost effective medication strategies. These disciplines are integrated, prompting students to think about patients' needs on the one hand and healthcare considerations on the other. However, having the theoretical knowledge is not sufficient to make well informed prescribing decisions in practice. Learners might find it difficult to choose medicines, work out dosage, identify drug interactions, and understand the treatment instructions, especially if they have received little experience in learning about prescription writing in the classroom. It is therefore crucial to incorporate a curriculum that balances scientific and clinically structured knowledge into prescribing competency[4, 5].

Knowledge, attitudes and practices are interrelated aspects of rational prescribing behavior. Attitudes affect professional responsibility, patient-centered decision making and responding to evidence-based recommendations, and knowledge contributes to understanding of appropriate therapeutic principles. These concepts are applied to prescribing in real clinical practice and therapy decision making activities. Even if students have a good theoretical understanding, they might still be short in their prescription completeness, drug selection or application of clinical guidelines. Inappropriate usage of antibiotics, including unnecessary antibiotic use and wrong dose, is a particular concern as it leads to antimicrobial resistance and increases the burden on health systems. Prescribing should therefore be taught as more than just memorisation of drug classifications; it requires critical

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thinking, promoting antimicrobial stewardship, patient counselling, and appropriate monitoring of the medication. Application and retention of prescribing knowledge may be enhanced by interactive teaching approaches such as clinical case discussions, prescription simulations and supervised practical sessions[6-8].

The assessment of rational prescribing competencies among final-year medical students is important because this period represents the transition from undergraduate learning to greater clinical responsibility. Educational experiences during the final academic year provide opportunities to identify deficiencies in prescribing knowledge, assess professional attitudes, and evaluate preparedness for supervised clinical practice. In Pakistan, the growing burden of infectious and noncommunicable diseases, concerns regarding inappropriate antibiotic use, and variation in access to healthcare services highlight the importance of rational medicine use. Evaluating students' knowledge, attitudes, and practices may help identify educational gaps and inform improvements in undergraduate teaching. Moreover, understanding the relationship between previous prescribing training and perceived competency can support the development of targeted workshops, integrated teaching activities, and competency-based assessments. Therefore, the present study aimed to assess the knowledge, attitudes, and practices regarding rational prescribing among final-year MBBS students in Karachi, with particular emphasis on educational exposure to Pharmacology and Community Medicine[8-10].

MATERIALS AND METHODS

A descriptive cross-sectional study was designed to assess the knowledge, attitudes, and practices regarding rational prescribing among final-year Bachelor of Medicine and Bachelor of Surgery (MBBS) students in Karachi, Pakistan. The study period extended over six months, from January 2023 to June 2023. The study focused on undergraduate medical education, particularly the contributions of Pharmacology and Community Medicine to students' understanding of appropriate drug selection, safe medication use, evidence-based prescribing, and cost-effective therapeutic decision-making.

The study population comprised final-year MBBS students enrolled in medical colleges in Karachi during the study period. The proposed sample size was 151 students, estimated using the single-population proportion formula with a 95% confidence level, an anticipated proportion of 50%, and an absolute precision of 8%. The minimum calculated sample size was approximately 151 participants. The assumed proportion of 50% was selected to provide the maximum sample size in the absence of a reliable prior estimate for the primary outcome. A previously published study by Udomsuk et al. (2020) [11], which investigated knowledge, skills, and attitudes concerning rational drug use among medical students and postgraduates, was considered relevant background literature.

A non-probability consecutive sampling method was suggested to recruit eligible students of the final year MBBS. If students are eligible, they would be contacted during the study period and offered enrollment. It was planned to recruit until the sample size of 151 students was met.

All the Final year (MBBS) students of the recognized medical colleges of Karachi from January-June 2022 were considered eligible. All undergraduate students (both male and female) who had taken Pharmacology and Community Medicine as subjects and who had given their consent to participate were considered eligible. Pupils from previous years, those who were not willing to take part and those who did not return the questionnaire. If students were absent during the initial data collection period, they were not included unless they were available for data collection in a later scheduled period.

A structured, self-administered questionnaire, derived from well-known principles of rational prescribing, such as the World Health Organization's Guide to Good Prescribing, was planned to be used for data collection. The questionnaire consisted of four parts. The first part focused on demographic and educational factors, such as age, gender, medical college type, attendance at previous rational prescribing training, attendance at a prescription-writing workshop and involvement in case-based learning. The second part focused on the knowledge of rational prescribing which comprised the WHO 6 step prescribing approach, generic prescribing, appropriate drug choice, antibiotic stewardship, Drug-Drug interactions, contraindications, adverse drug reactions, dose adjustment in renal insufficiency, and essential medicines.

The third section evaluated attitudes on rational prescribing, patient safety, prescription of generics, cost-conscious prescription, role of Pharmacology and Community Medicine, antimicrobial resistance and perceived confidence in prescribing decision. The fourth section assessed prescribing practices via self-reported supervised clinical activities or standardized clinical scenarios such as assessing allergies, completing the prescription, selecting appropriate dosages, checking for interactions, using prescribing guidelines, and counselling the patient.

Ten multiple-choice or single-best-answer questions were suggested as a way to evaluate knowledge. One point would be awarded for every correct answer and zero would be awarded for every incorrect answer, resulting in a maximum knowledge score of 10. Poor, moderate and good knowledge were allocated the scores of 0–4, 5–7 and 8–10, respectively. A set of 10 statements on a five-point Likert scale (ranging from strongly disagree to strongly agree) were to be used to measure attitudes. If there were statements that were reverse coded, they would be negatively worded. The total attitude score would be between 10 and 50, with a score of 10 to 29 being considered negative, a score of 30 to 39 being neutral and a score of 40 to 50 being positive. Assessment of prescribing practices was to be based on 10 questions with a 5-point scale (1 never, 5 always). The total scores would be 10 to 50, with 10-29 indicating poor practices, 30-39 indicating fair practices and 40-50 indicating good practices. Items that were more appropriate prescribing behaviours were given higher scores. The following cutoffs were suggested for analysis and would need to be validated with a questionnaire or referenced in the literature.

Eligible students would be approached and informed about the study objectives after gaining the necessary institutional permission. This would be voluntary and informed consent would be done prior to the questionnaire being given. Students will fill out the questionnaire independently, not with faculty or other participants' help. The analytical dataset would not contain any information that could identify the person. Completed questionnaires would be checked for missing data and then coded for statistical analysis.

The data was to be entered and analysed in IBM SPSS Statistics version 25.0. For quantitative variables, such as age and total knowledge, attitude, and practice scores, means and standard deviations would be used for data that were approximately normally distributed, and medians and interquartile ranges would be used for skewed data. The frequencies and percentages would be used to represent categorical variables. Independent-samples t-tests or Mann–Whitney U tests were performed for differences in KAP scores based on sex, type of medical college, previous prescribing training, and workshop attendance based on the distribution of data. Association between categorical characteristics and prescribing competency classifications would be explored using chi-square tests or Fisher's exact tests. Pearson's or Spearman's correlation coefficients would be applied to determine the relationships among the scores of the knowledge, attitude and prescriber practice. A two-sided P value of < 0.05 would be considered statistically significant.

RESULTS

A total of 151 final year MBBS students were included in the study, with a mean age of 23.65 ± 1.23 years. 61.6% of the sample consisted of female students and 53.0% attended public medical colleges. 33.8% of participants had undertaken any formal training in rational prescribing and 35.1% had attended any workshops on

prescription writing. Just over half (51.0%) had engaged in case based learning.

Table 1: Sociodemographic and Educational Characteristics of Participants (n=151)

Variables	Frequency (%) / Mean ± SD
Age (years)	23.65 ± 1.23
Gender	
Male	58 (38.4%)
Female	93 (61.6%)
Medical college	
Public	80 (53.0%)
Private	71 (47.0%)
Previous rational prescribing training	
Yes	51 (33.8%)
No	100 (66.2%)
Prescription-writing workshop attendance	
Yes	53 (35.1%)
No	98 (64.9%)
Participation in case-based learning	
Yes	77 (51.0%)
No	74 (49.0%)

Table 2: Knowledge Regarding Rational Prescribing Among Final-Year MBBS Students

Knowledge variables	Correct responses n (%)
Awareness of WHO rational prescribing principles	112 (74.2%)
Knowledge of WHO six-step prescribing	106 (70.2%)
Understanding of generic prescribing	89 (58.9%)
Appropriate selection of medicines	94 (62.3%)
Dose adjustment in renal impairment	66 (43.7%)
Antibiotic stewardship	98 (64.9%)
Recognition of contraindications	83 (55.0%)
Identification of drug–drug interactions	90 (59.6%)
Knowledge of adverse drug reactions	77 (51.0%)
Awareness of essential medicines	82 (54.3%)
Total knowledge score (0–10)	5.87 ± 2.25
Knowledge classification	
Good (8–10)	41 (27.2%)
Moderate (5–7)	70 (46.4%)
Poor (0–4)	40 (26.5%)

Table 3: Attitudes Toward Rational Prescribing Among Medical Students

Attitude variables	Frequency (%) / Mean ± SD
Total attitude score (10–50)	36.04 ± 5.66
Attitude classification	
Positive (40–50)	40 (26.5%)
Neutral (30–39)	92 (60.9%)
Negative (10–29)	19 (12.6%)
Total	151 (100%)

Table 4: Assessment of Rational Prescribing Practices

Practice variables	Frequency (%) / Mean ± SD
Total practice score (10–50)	28.61 ± 7.12
Practice classification	
Good (40–50)	11 (7.3%)
Fair (30–39)	56 (37.1%)
Poor (10–29)	84 (55.6%)
Total	151 (100%)

Table 5: Association Between Educational Characteristics and Rational Prescribing Competency

Educational characteristics	Knowledge score (mean)	Practice score (mean)
Previous rational prescribing training		
Yes (n=51)	6.61	30.76
No (n=100)	5.50	27.51
p-value	0.003	0.010
Prescription-writing workshop		
Yes (n=53)	6.60	29.89
No (n=98)	5.48	27.92
p-value	0.002	0.082
Medical college type		
Public (n=80)	5.55	28.09
Private (n=71)	6.24	29.20
p-value	0.036	0.274

P-values were calculated using the Mann–Whitney U test on the sstudent-level data.

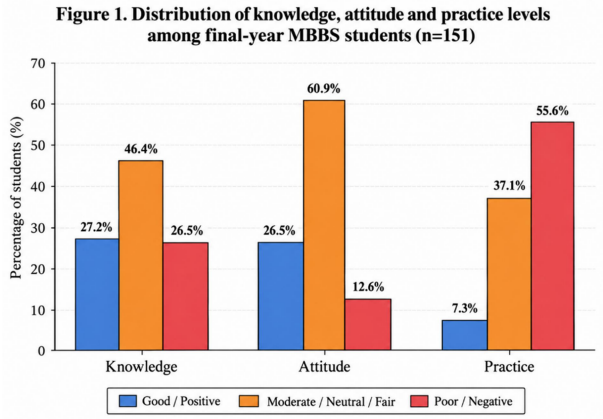


Figure 1: Distribution of knowledge, attitude and prescribing practice classifications among final-year MBBS students (n=151).

There was variation in the knowledge assessed at different aspects of prescribing competence. Students' awareness of the principles of rational prescribing in WHO was seen in 74.2% and the six step prescribing approach in WHO was correctly identified in 70.2% of students. Antibiotic stewardship knowledge was shown by 64.9%. Lower knowledge was also noted in the areas of dose adjustment in renal impairment (43.7%) and drug contraindications (55.0%). The mean knowledge score was 5.87 ± 2.25 out of 10. Overall, the good, moderate, and poor levels of knowledge were 27.2%, 46.4%, and 26.5% respectively.

The average attitude score was of 36.04 ± 5.66 out of 50 points. The majority of students (60.9%) had neutral attitudes towards rational prescribing while 26.5% had positive attitudes and 12.6% had negative attitudes. The results indicate that students have a good understanding of the importance of rational prescribing, but they have scope to become more confident and positive regarding evidence based prescribing.

The mean score for the prescribing practice was 28.61 ± 7.12 out of 50. Poor prescribing practice scores were obtained from more than half of the students (55.6%) while the fair practices scores were obtained from 37.1% of the students. 7.3% reached the threshold of good practice. The gaps between the knowledge and reported practice scores indicate that knowledge does not equate to good prescribing practice, and supervised clinical teaching and structured clinical prescription writing exercises could have value.

Students reporting previous rational prescribing training demonstrated higher mean knowledge and practice scores than those without such training. Knowledge scores were 6.61 versus 5.50 (p=0.003), while practice scores were 30.76 versus 27.51 (p=0.010). Prescription-writing workshop attendance was associated with higher knowledge scores (p=0.002), although the difference in practice scores was not statistically significant (p=0.082). Students from private medical colleges showed modestly higher knowledge scores than those from public colleges (p=0.036), with no statistically significant differences in practice scores. These comparisons represent unadjusted associations and do not establish educational causation.

Correlation analysis demonstrated a moderate positive relationship between knowledge and prescribing practice scores (Spearman's ρ=0.486, p<0.001). Attitude scores were also positively correlated with prescribing practices (ρ=0.295, p<0.001). These findings indicate that students with stronger theoretical knowledge and more positive attitudes tended to demonstrate better reported prescribing practices.

DISCUSSION

Rational prescribing is an essential component of undergraduate medical education because it directly influences patient safety,

therapeutic effectiveness, medication adherence, and healthcare expenditure. Developing prescribing competency requires more than theoretical knowledge of pharmacological principles; it involves clinical reasoning, appropriate medicine selection, recognition of contraindications, dose optimization, and consideration of individual patient characteristics. Medical students are expected to integrate these competencies during clinical training before assuming prescribing responsibilities. Pharmacology provides the scientific basis for understanding drug actions, adverse effects, interactions, and therapeutic indications, while Community Medicine emphasizes population-level medicine use, accessibility, affordability, and responsible healthcare practices. A coordinated educational approach involving both disciplines may strengthen students' ability to make evidence-based therapeutic decisions. Nevertheless, conventional classroom teaching may not adequately prepare students for the practical complexities of prescription writing, particularly when opportunities for supervised prescribing are limited. Integrating structured prescribing exercises and clinical problem-solving activities into undergraduate curricula may help bridge the gap between theoretical understanding and clinical application[12-14]

Rational prescribing is closely linked to other aspects of knowledge such as essential medicines, generic prescribing, antimicrobial stewardship and patient specific treatment selection. These principles are presented in undergraduate medical curricula in the preclinical years; but the retention of the pharmacological knowledge and its application to clinical practice may be influenced by how the knowledge is taught, the amount of clinical experience gained and the opportunities for applying the knowledge. When patients have several medical conditions, impaired renal or hepatic function, or use multiple medications, selecting appropriate drugs can be a difficult task. Unappropriate prescribing decisions can lead to drug allergy, drug mistakes, unnecessary costs of medical prescriptions, and medical complication. Rational Px is therefore something that needs to be reinforced during medical education beyond the scope of isolated pharmacology lecture. Students can be motivated to use their knowledge in real-world scenarios through a variety of tools, such as case-based discussion, prescription audits, supervised therapeutic decision-making, and frequent formative assessment. Structured teaching on antimicrobial resistance, essential medicines and appropriate antibiotic prescribing is especially pertinent as irrational use of antimicrobials is a growing public health problem[15-17].

Attitudes towards rational prescribing affect therapeutic decision making, counselling of patients and professional responsibility of medical students. Positive attitudes to patient safety, generic prescribing, evidence-based prescribing guidelines and cost-effective medicine use may reinforce the practice of more responsible prescribing. But this doesn't necessarily mean competence, especially if students don't have many opportunities to apply knowledge under clinical supervision. The teaching settings that focus on critical thinking, reflective practice and interprofessional working can enhance prescribing awareness. Individual patient management and public health issues, such as antimicrobial resistance, access to medicines and preventing inappropriate use of them, can be brought together with complementary perspectives from Pharmacology and Community Medicine. Interactive teaching methods (e.g., workshops, prescriptions, clinical scenarios and small group discussion) can be used to allow students to recognise prescribing errors and to consider alternative therapeutic strategies. Additionally, attitude measurement along with objective knowledge and prescribing knowledge and performance can give a holistic view of the students' preparedness for clinical practice[18, 19].

Competency should be viewed as a progressive educational process and build over time with practice, feedback and increasing clinical responsibility. The gap between undergraduate education and clinical practice can reveal gaps in the completeness of prescriptions, dosage calculation, drug interactions, and the use of guidelines for standard treatment. Enhancing education in the collaboration between Pharmacology, Community Medicine and clinical departments may be helpful in reaching a more integrated approach to rational prescribing. Standardized prescription-writing exercises, objective structured clinical examinations, antimicrobial stewardship training, and direct feedback from trained supervisors are examples of competency-based teaching. Routine evaluations might aid in pinpointing areas of student need and help inform personalized learning experiences that occur throughout their academic journey, prior to their graduation. Patient communication, ethical prescribing, affordability of medicines and the use of electronic prescribing resources should be considered as key components of educational planning. While knowledge, attitude and practice testing at a single point in time may be able to detect educational needs and associations, it does not prove that a specific educational approach leads to more appropriate prescribing practice or better patient outcomes. Therefore, longitudinal studies and structured educational interventions are required to assess if there is maintenance of improvement in undergraduate prescribing competence as they progress to their clinical practice[20].

CONCLUSION

Rational prescribing education represents a fundamental requirement of undergraduate medical training and requires the integration of pharmacological knowledge, positive professional attitudes, and practical clinical competencies. Pharmacology and Community Medicine have complementary roles in promoting safe, effective, evidence-based, and cost-conscious medication use. Greater emphasis on case-based learning, prescription-writing workshops, supervised clinical practice, and antimicrobial stewardship education may strengthen the preparedness of final-year MBBS students for responsible prescribing. Incorporating structured competency assessment and continuous educational feedback into medical curricula may further improve the transition from theoretical knowledge to clinical application. Future longitudinal and interventional research is recommended to evaluate the effectiveness of integrated prescribing education and its influence on subsequent clinical performance.

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