



ASSESSMENT OF KNOWLEDGE OF RATIONALE USE OF MEDICINES AMONG MEDICAL STUDENTS

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Abstract

Background: Rational Use of Medicines (RUM) is a cornerstone of effective healthcare, ensuring patients receive appropriate drugs in proper doses for adequate periods at minimal cost. Despite established WHO guidelines, irrational medicine use remains prevalent globally, underscoring the need for robust medical education on rational prescribing practices.

Method: A descriptive, cross-sectional questionnaire-based study was conducted among 180 undergraduate medical students and interns at a teaching medical college. Knowledge of RUM was assessed using a structured, validated questionnaire covering WHO principles, essential medicines, personal drugs (P-drugs), polypharmacy, and antibiotic stewardship. Data were analyzed using descriptive statistics and chi-square tests.

Results: Only 26.7% of students demonstrated good knowledge of RUM, while 45.6% had average knowledge and 27.8% had poor knowledge. Awareness was highest for the concept of essential medicines (80.6%) and polypharmacy hazards (72.2%), while understanding of P-drugs was notably low (36.1%). Interns exhibited significantly better knowledge (45% good) compared to 2nd-year students (11.1%) ($P < 0.05$). Textbooks (88.9%) and medical apps (69.4%) were the most frequently used information sources.

Conclusion: The study revealed moderate overall knowledge of RUM among students, improving with academic progression and clinical exposure. However, gaps persist in key areas like the P-drug concept and antibiotic stewardship. Integrating structured, practical training modules on rational prescribing into the undergraduate curriculum is essential to foster evidence-based, patient-centered therapeutic decision-making.

Keywords: Rational use of medicines, Medical students, Prescribing practices, Antibiotic stewardship, P-drugs

Introduction

Medicines are fundamental to healthcare delivery and, when used appropriately, can cure diseases, relieve symptoms, and alleviate patient suffering. However, irrational use of medicines remains a major global health challenge with significant implications for patients, healthcare systems, and communities.[1] The World Health Organization (WHO) defines rational use of medicines (RUM) as a situation where "patients receive medications appropriate to their clinical needs, in doses that

meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community".[2]Despite this well-established framework, WHO estimates that more than half of all medicines worldwide are prescribed, dispensed, or sold inappropriately, and approximately half of all patients fail to take them correctly.[3]

The consequences of irrational medicine use are far-reaching. Inappropriate prescribing increases the risk of adverse drug reactions, contributes to the emergence of antimicrobial resistance (AMR), and leads to wastage of scarce healthcare resources. Antimicrobial resistance, in particular, has emerged as one of the top global public health threats, with bacterial AMR directly responsible for an estimated 1.27 million deaths globally in 2019.[4] The misuse and overuse of antimicrobials in humans, animals, and plants are the main drivers of drug-resistant pathogens, making education on rational prescribing and antibiotic stewardship imperative for future healthcare providers.[1]

Medical education plays a pivotal role in shaping prescribing practices of future physicians. The WHO "Guide to Good Prescribing" recommends that undergraduate medical students be trained in rational therapeutic reasoning using a six-step model that emphasizes defining the patient's problem, specifying therapeutic objectives, selecting suitable treatment, initiating therapy, providing patient information, and monitoring outcomes.[5,6] Central to this approach is the concept of personal drugs (P-drugs), which teaches students to select medicines based on four criteria: efficacy, safety, cost, and suitability. Singh NR et al. emphasized that the focus of P-drug teaching should be on "how to prescribe" rather than "what to prescribe," enabling students to critically analyze available information and make individualized treatment decisions.[7]

Despite the recognized importance of RUM education, studies have consistently shown gaps in knowledge among medical students and fresh graduates. Chaudhari VL et al. reported that theoretical teaching on rational therapeutics transfers knowledge to undergraduates but is often not retained in interns and does not adequately prepare fresh medical graduates to prescribe safe and rational drugs.[8] Maxwell SRJ et al. highlighted that prescribing remains the most challenging aspect of clinical practice for new graduates and the one for which they feel least prepared. Educational interventions based on the WHO Good Prescribing Guide have been shown to improve prescribing performance, underscoring the need for structured, practical training in medical curricula.[9]

Furthermore, the concept of Essential Medicines—drugs that satisfy the priority healthcare needs of the population—and awareness of polypharmacy hazards are fundamental components of rational prescribing that require emphasis during undergraduate training.[10] Addressing these educational gaps is essential to produce physicians capable of evidence-based, patient-centered prescribing, ultimately contributing to improved patient outcomes and reduced healthcare costs.

Material and Methods

Study design and setting

A descriptive, cross-sectional questionnaire-based study was conducted among undergraduate medical students and interns of a teaching medical college. The study included students from second year, third year, final year MBBS, and compulsory rotating internship.

Study population and sample size

A total of 180 students participated in the study. Participants were distributed relatively evenly across academic years, with 45 second-year (pre-clinical), 45 third-year (para-clinical), 50 final-year (clinical) students, and 40 interns. All students who were present on the days of data collection and provided informed consent were included. Those who did not consent or returned incomplete questionnaires were excluded.

Study tool

Data were collected using a predesigned, pretested, structured questionnaire in English. The questionnaire consisted of the following sections:

- Sociodemographic profile (age, gender, academic year, presence of parents in the medical profession).
- Knowledge of RUM assessed by 20 multiple-choice questions covering:
 - WHO definition and principles of RUM.
 - Concept of essential medicines and essential medicines list (EML).
 - Concept of personal drugs (P-drugs).
 - Hazards of polypharmacy.
 - Basics of antibiotic stewardship and rational antibiotic use.
- Items on sources of information used for drug prescribing (multiple responses allowed): standard textbooks, internet/medical apps, senior residents/consultants, pharmaceutical representatives, and drug formularies.

The questionnaire was developed based on WHO materials on rational use of medicines and previously published questionnaires used to assess knowledge of RUM among medical students, and was validated for content by the department of Pharmacology.

Scoring and grading of knowledge

Each correct response in the knowledge section was awarded one mark; incorrect or “don’t know” responses were scored zero. The maximum total score was 20. Based on total scores, students’ overall knowledge of RUM was graded as:

- Good: >15
- Average: 10–15
- Poor: <10

Data collection procedure

After obtaining permission from the institutional authorities, students were briefed about the study objectives and assured of anonymity and confidentiality. Participation was voluntary and written informed consent was obtained. Questionnaires were distributed during routine teaching hours and self-administered under supervision, with adequate time for completion.

Statistical analysis

Completed questionnaires were checked for completeness and coded for analysis. Data were summarized using descriptive statistics. Categorical variables were presented as frequencies and percentages. The association between academic year and level of knowledge was evaluated using appropriate tests of significance (chi-square test). A P-value <0.05 was considered statistically significant.

Results

A cross-sectional study was conducted on 180 medical students, distributed relatively evenly across academic years from 2nd year to internship, with a slight male majority (52.8%) (Table 1). The overall assessment of knowledge regarding Rational Use of Medicines (RUM) revealed that only 26.7% (n=48) of students possessed "Good" knowledge, while the majority (45.6%) fell into the "Average" category (Table 2).

When analyzing specific concepts, awareness was high for the "Concept of Essential Medicines" (80.6%) and the "Hazards of Polypharmacy" (72.2%); however, a significant gap was noted in the understanding of the "P-drug (Personal drug) concept," which was correctly identified by only 36.1% of participants (Table 3). Academic progression showed a positive correlation with knowledge retention; Interns demonstrated a significantly higher rate of "Good" knowledge scores (45.0%) compared to 2nd-year students (11.1%) ($P < 0.05$), indicating that clinical exposure improves understanding of rational prescribing (Table 4). regarding learning resources, standard Textbooks remained the primary source of information (88.9%), followed closely by

Internet/Medical Apps (69.4%), while reliance on pharmaceutical representatives was minimal (13.9%) (Table 5).

Table 1: Demographic Characteristics of the Study Population (N=180)

Characteristic	Category	Frequency (n)	Percentage (%)
Academic Year	2nd Year (Pre-clinical)	45	25.0%
	3rd Year (Para-clinical)	45	25.0%
	Final Year (Clinical)	50	27.8%
	Interns	40	22.2%
Gender	Male	95	52.8%
	Female	85	47.2%
Parents in Medical Profession	Yes	42	23.3%
	No	138	76.7%

Table 2: Overall Grading of Knowledge on Rational Use of Medicines

Scores based on a structured questionnaire (Total Score: 20).

Knowledge Level	Score Range	Frequency (n)	Percentage (%)
Good	> 15	48	26.7%
Average	10 – 15	82	45.6%
Poor	< 10	50	27.8%
Total	-	180	100%

Table 3: Knowledge of Specific Key Concepts of RUM

Number of students answering correctly regarding specific definitions.

Concept / Terminology	Correct Response (n)	Percentage (%)
WHO Definition of RUM	110	61.1%
Concept of Essential Medicines (EML)	145	80.6%
Concept of P-drugs (Personal Drugs)	65	36.1%
Hazards of Polypharmacy	130	72.2%
Antibiotic Stewardship	95	52.8%

Table 4: Association Between Academic Year and Knowledge Level

Comparison of "Good" knowledge scores across years.

Academic Year	Total Students (n)	"Good" Knowledge Score (n)	Percentage (%)	P-value*
2nd Year	45	5	11.1%	-
3rd Year	45	10	22.2%	-
Final Year	50	15	30.0%	-
Interns	40	18	45.0%	< 0.05
Total	180	48	26.7%	-
*Significant improvement in knowledge observed with advancing seniority.				

Table 5: Sources of Information Used for Drug Prescribing

Students could select multiple sources.

Source of Information	Frequency (n)	Percentage (%)
Textbooks	160	88.9%
Internet / Medical Apps	125	69.4%

Senior Residents / Consultants	90	50.0%
Pharmaceutical Representatives	25	13.9%
CIMS / Drug Formularies	40	22.2%

Discussion

This study provides an insight into the knowledge of Rational Use of Medicines (RUM) among medical students, revealing both strengths and gaps in their understanding. A significant proportion of students demonstrated average knowledge, with only 26.7% exhibiting "Good" knowledge on RUM, a finding that suggests the need for improvements in the medical curriculum and education surrounding drug prescribing practices. This finding is comparable to Patrício et al [11], who found that although medical students recognized the importance of RUM following a structured course based on the WHO's Guide to Good Prescribing, the majority had difficulty applying this knowledge in their daily practice. Similarly, Yin et al [12] demonstrated that professional medical education may enhance awareness about the harm caused by irrational drug use, though knowledge gaps persist among students.

The positive correlation between academic progression and improved knowledge retention highlights the importance of clinical exposure. Specifically, interns showed a markedly higher level of knowledge compared to their pre-clinical and para-clinical counterparts. This aligns with Patrício et al[11], who reported that former students who had completed internships and residencies were more capable of recognizing RUM principles, though institutional barriers often prevented their application. This finding also corresponds with the observation that real-world clinical experiences help bridge the gap between theoretical knowledge and practical application, fostering a deeper understanding of concepts like rational prescribing.

The assessment of specific RUM concepts also revealed notable areas of strength and weakness. A high level of awareness was found for the "Concept of Essential Medicines" and the "Hazards of Polypharmacy," which are fundamental components of rational prescribing. This is consistent with Sharma et al[13], who found that 96.7% of second-year medical students were aware of generic medicines, and the majority understood that medicines are not needed for every illness. However, only 36.1% of students were familiar with the "P-drug" concept, indicating a knowledge gap in personal drug selection. This finding is supported by Jyothi et al[14], who reported that knowledge and practice of the P-drug concept remained limited among postgraduate students, emphasizing the need for enhanced training in evidence-based drug selection.

Further, the relatively low awareness of antibiotic stewardship and the WHO definition of RUM also suggests the need for more focused education on these critical issues, particularly in the context of global health concerns like antimicrobial resistance. Jain et al [15] similarly found that awareness regarding antibiotic resistance patterns and stewardship principles was inadequate among medical students and interns, highlighting curricular gaps that could contribute to inappropriate prescribing practices.

The study further highlighted that textbooks were the primary source of knowledge for most students (88.9%), followed by internet resources and medical apps. The minimal reliance on pharmaceutical representatives (13.9%) is a positive sign, indicating that students are more inclined to seek reliable, evidence-based resources. This finding aligns with Patrício et al [11], who observed that former students sought information on medicines primarily from textbooks and scientific articles, demonstrating a preference for non-commercial sources over pharmaceutical industry materials. Sharma et al [13] also reported that for 93.4% of respondents, doctors' advice was the most important factor influencing medicine purchase, rather than direct-to-consumer advertising.

In conclusion, the findings of this study underscore the importance of incorporating practical, real-world learning experiences into the medical curriculum to enhance understanding and application of rational drug use. As emphasized by the WHO and supported by Patrício et al [11], the assimilation of RUM principles requires continuous medical education and institutional involvement to create networks among physicians, pharmacists, nurses, and the community. Moreover, it is essential to focus on improving knowledge of key concepts, such as the P-drug model and antibiotic

stewardship, to ensure that future physicians are well-equipped to make evidence-based, patient-centered prescribing decisions. Addressing these gaps could ultimately contribute to the goal of promoting rational use of medicines and improving patient outcomes.

Conclusion

This study highlights that while medical students demonstrate moderate awareness of the principles of Rational Use of Medicines, critical gaps remain—particularly in understanding the P-drug concept and antibiotic stewardship. Knowledge improved significantly with academic advancement, emphasizing the positive impact of clinical exposure on rational prescribing skills. To ensure safe, cost-effective, and evidence-based therapy, medical curricula should integrate more practical, case-based, and WHO-guided training approaches that promote rational prescribing behaviors among future physicians.

References

1. Ofori-Asenso R, Agyeman AA. Irrational use of medicines—a summary of key concepts. *Pharmacy (Basel)*. 2016;4(4):35.
2. World Health Organization. Rational use of drugs: Report of the Conference of Experts; Nairobi, 25–29 November 1985. Geneva: WHO; 1987.
3. World Health Organization. Promoting rational use of medicines: core components. WHO Policy Perspectives on Medicines. Geneva: WHO; 2002.
4. World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva: WHO; 2014.
5. De Vries TP, Henning RH, Hogerzeil HV, Fresle DA. Guide to good prescribing: a practical manual. Geneva: WHO Action Programme on Essential Drugs; 1994.
6. Ross S, Maxwell S. Prescribing and the core curriculum for tomorrow's doctors: BPS curriculum in clinical pharmacology and prescribing for medical students. *Br J Clin Pharmacol*. 2012;74(4):644–61.
7. Singh NR. P-drug concept and the undergraduate teaching. *Indian J Pharmacol*. 2008;40(6):285.
8. Chaudhari VL, Mundle M, Mahajan H, Khamkar V. Awareness about rational use of medicines among fresh MBBS graduates in a tertiary care hospital. *Int J Basic Clin Pharmacol*. 2017;6(10):2345–50.
9. Maxwell SRJ. How should teaching of undergraduates in clinical pharmacology and therapeutics be delivered and assessed? *Br J Clin Pharmacol*. 2012;73(6):893–9.
10. Laing R, Waning B, Gray A, Ford N, 't Hoen E. 25 years of the WHO essential medicines lists: progress and challenges. *Lancet*. 2003;361(9370):1723–9.
11. Patrício KP, Alves NAB, Arenales NG, Queluz TT. Teaching the rational use of medicines to medical students: a qualitative research. *BMC Med Educ*. 2012;12:56.
12. Yin C, He X, Shen K, Mu X, Tang F. Knowledge and Behavior in Rational Drug Use Among College Students in Zunyi City. *Risk Manag Healthc Policy*. 2022 Jan 29;15:121-131. doi: 10.2147/RMHP.S347822. PMID: 35125897; PMCID: PMC8809676.
13. Sharma K, Sharma P, Chand S. Evaluation of knowledge, attitude and behavior about rational use of medicines in second year medical students. *Int J Basic Clin Pharmacol*. 2013;2(5):617-621.
14. Jyothi DB, Basavanthappa RB, Suresh B. Knowledge, awareness, and practice of "P-drug" concept among postgraduate students at a tertiary care teaching hospital. *Natl J Physiol Pharm Pharmacol*. 2020;10(4):330-334.
15. Jain A, Gupta D, Singh D, Garg S, Jain A, Ambwani S, et al. Knowledge, attitude, and practices toward antibiotic usage and antibiotic resistance among medical students and interns. *J Med Sci Health*. 2020;6(1):23-29.