

INCLUSION OF SYMPOSIUM-BASED LEARNING OF RATIONAL DRUG USE FOR MEDICAL UNDERGRADUATES: EVALUATION OF ITS EFFECTIVENESS AND FEEDBACK

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Received: 11.12.2025.

Accepted: 27.01.2026.

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ABSTRACT

Irrational prescribing continues to challenge clinical practice, and undergraduate medical students often have limited structured training in Rational Drug Use (RDU). Effective early interventions require interactive, multidisciplinary teaching approaches. This study assessed the impact of symposium-based learning (SBL) on knowledge, attitude, practice, and awareness (KAPFA) related to RDU among second-year Bachelor of Medicine and Bachelor of Surgery (MBBS) students. A quasi-interventional study was conducted among 150 students. A four-hour multidisciplinary symposium on RDU was organized, and a pre-validated questionnaire was administered before and after the session. The tool assessed knowledge (10 MCQs), attitude (5 statements), practice (5 case scenarios), feedback (7 items), and awareness (10 items). Data were analyzed using descriptive statistics and paired t-test. Knowledge scores improved significantly from 5.45 ± 1.03 to 7.02 ± 0.86 ($p < 0.001$). Attitude responses shifted toward stronger agreement across all statements. Practice scores increased from 2.34 ± 0.61 to 4.06 ± 0.57 ($p < 0.001$), indicating better application of RDU principles. Awareness showed substantial gains, with an overall increase exceeding 300% across key parameters. Improvements were consistent across all five clinical posting groups. Feedback indicated strong acceptance, with over 94% reporting the symposium as relevant and useful. SBL proved to be a highly effective educational strategy for enhancing RDU competencies in undergraduate students. Incorporating such structured and interactive methods into the curriculum may help strengthen safe and rational prescribing practices among future clinicians.

Keywords: Rational Drug Use, Symposium based learning, Rational Prescribing Competencies, Educational Intervention, Knowledge and Attitude Assessment.

UDK: 615.015.3

Ser J Exp Clin Res 2026; 27(1):007-018

DOI: 10.2478/eabr-2026-0001

INTRODUCTION

Rational drug prescribing represents a fundamental competency expected from all medical graduates, as it need to ensure patients to receive safe, effective, and appropriate pharmacological therapy [1]. During the undergraduate programme of medical programme, particularly in the second year, students are introduced to Rational Drug Use (RDU) through clinical pharmacology sessions that involve lectures, supervised prescription writing, and prescription audits. These learning activities are intended to cultivate the ability to select suitable medications in correct doses and durations, while also considering affordability, accessibility, and patient-specific factors [2]. Although this structured exposure provides a theoretical foundation, applying these principles consistently in clinical settings remains challenging for many trainees. Despite formal teaching, irrational prescribing continues to be widely reported across healthcare settings. This persistent problem arises from several interrelated causes. Clinical environments often expose students to prescribing behaviours that do not mirror standard recommendations, creating a disconnect between classroom instruction and observed practice [3]. External pressures such as commercial influences, frequent patient turnover, limited consultation time, and system-level resource constraints may discourage careful clinical reasoning. High workload in busy outpatient and inpatient settings further contributes to suboptimal prescribing decisions. As a result, inappropriate drug use remains a universal concern, leading to consequences such as antimicrobial resistance, preventable adverse effects, and unnecessary drug interactions. Addressing these issues requires strengthening learners' conceptual understanding early in their training, as well as reinforcing rational habits before they enter more complex clinical phases. Second-year medical students occupy a crucial position in the learning continuum and at this stage, they are transitioning from preclinical learning to early clinical exposure, where they begin to witness patient care decisions made by practitioners. A recent multi-institution study found that implementing early clinical exposure (ECE) led to significantly higher self-assessed "professional practice skills" in students, with second-year participants reporting competencies comparable to those of traditional fourth-year students [4]. Moreover, students exposed early to patients report improved communication, increased motivation for self-directed learning, better integration of basic science knowledge with real-life pathology, and enhanced readiness for clinical responsibilities [5]. Enhancing their RDU competency at this juncture is important because it shapes the attitudes and practices they would carry into their clinical clerkships. Without timely reinforcement, students may adopt inappropriate prescribing patterns observed in clinical practice, which can persist into their later professional life. Therefore, improving RDU understanding during the second year can influence long-term prescribing behaviour and contribute to safer healthcare delivery. A study at a tertiary-care hospital in India showed that prescription-writing skills among second-year students were suboptimal, many prescriptions lacked complete drug and doctor information, and legibility was poor [6]. This implies that

without reinforcement, early gaps may persist into clinical practice [7]. Contemporary medical education emphasises teaching methods that align with adult learning principles. Adult learners benefit most when instruction is relevant to future practice, allows self-direction, promotes active engagement, and facilitates collaborative reasoning [8]. These principles support the use of interactive learning formats rather than passive lecture-based delivery. In this context, Symposium-Based Learning (SBL) emerges as a promising approach which insist on focused, structured discussion on a specific clinical problem and provides opportunities for analysing updates, evaluating current evidence, and exploring practical challenges associated with prescribing [9,10]. An original educational research study in pharmacology education demonstrated that interactive, small-group teaching and case-based learning approaches effectively enhanced medical students' knowledge, skills, and attitudes required for safe and rational prescribing in a clinical context [11]. Conferences and clinical meetings promote exchange of new evidence, inter-professional discussion, and real-world case evaluation factors help clinicians appraise and apply evidence rather than rely on tradition [12]. Unlike traditional didactic sessions, SBL promotes deeper conceptual understanding, peer-to-peer learning, and critical appraisal of therapeutic options, making it suitable for complex topics such as RDU. Although SBL has been used in certain educational settings, its application for teaching rational prescribing to Indian undergraduate medical students remains limited. An appropriate environment to examine SBL effectiveness, as students experience early clinical exposure demonstrates a preference for interactive and collaborative learning strategies. Studying this cohort provides insights into whether SBL can enhance the understanding and application of RDU principles at a formative stage. Through this approach, the present study aims to strengthen rational prescribing practices and contribute to ongoing efforts to improve medication safety within undergraduate medical education.

STUDY DESIGN

This quasi-interventional study was undertaken at a tertiary Medical College and Research Institute with the objective of systematically evaluating shifts in knowledge, attitude, and practices (KAP) regarding RDU among second-year MBBS students. The educational intervention consisted of a structured, expert-led symposium designed to enhance students' conceptual understanding of RDU principles, including essential drug selection, evidence-based prescribing, dose optimisation, prevention of antimicrobial resistance, and ethical considerations in pharmacotherapy. The study employed validated, pre-tested questionnaires administered both before and after the symposium to measure the extent of improvement across multiple domains of RDU awareness. Emphasis was placed on assessing cognitive gains, attitudinal refinement, and self-reported behavioural intentions related to rational prescribing. By targeting students at an early stage of clinical training, the study aims to contribute meaningful

evidence on the effectiveness of focused pedagogical strategies in strengthening responsible prescribing behaviours and promoting safe, cost-effective, and patient-centred drug use in future medical practice. The study adopted a single-group pre–post quasi-interventional design, as the educational symposium formed part of the institutional academic program, rendering the inclusion of a non-intervention control group ethically and pedagogically impractical. This approach is appropriate for evaluating short-term educational impact in authentic academic settings while acknowledging inherent limitations in causal inference.

Participants

A pre-post interventional study was conducted among 150 second-year MBBS students to evaluate the impact of a RDU symposium on knowledge, attitude, practice, and awareness related to rational drug prescribing. The sample size represented a census of all eligible second-year MBBS students during the study period, reflecting pragmatic feasibility rather than an a priori statistical estimation. The study objectives and procedures were clearly explained to the students prior to data collection, and participation was entirely voluntary. Students who provided informed consent were included, with no exclusions based on academic performance or demographic characteristics, thereby enhancing the representativeness of the sample. Confidentiality and anonymity of the responses were strictly maintained using coded questionnaires and secure data handling practices. No identifying information was collected at any stage of the survey. The data collection process was supervised by trained faculty to ensure uniform administration of the questionnaires. This methodological rigor strengthened the internal validity of the findings and supported the reliability of the students' self-reported responses. A structured, pre-validated questionnaire was administered to all participants immediately before (pre-assessment) and after (post-assessment) the symposium. The questionnaire was designed to cover five domains: Knowledge, Attitude, Practice, Feedback and Awareness. For the Knowledge, Attitude, Feedback and Practice (KAFP) sections, responses were collected individually from all 150 students to obtain a comprehensive measure of baseline understanding and post-intervention improvement across the entire cohort. For the Awareness domain, students were stratified into five equal cohorts (n=30 each) according to their clinical posting allocation— participants were stratified into five cohorts based on their exposure to clinical rotations: General Medicine (n=30), General Surgery (n=30), Pediatrics (n=30), Obstetrics and Gynecology (n=30), and Community Medicine (n=30). This stratification enabled domain-specific assessment of awareness related to rational drug use before and after symposium exposure. Such grouping ensured comparability across clinical disciplines and enhanced the interpretive rigor of pre- and post-intervention analyses. This stratification was deliberately employed to acknowledge and control for the inherent variability in clinical learning environments, including diversity in patient presentations, pharmacotherapeutic practices, prescribing behaviors, and experiential engagement with drug-related decision-making across specialties.

Such structured grouping enabled a more targeted evaluation of awareness levels and facilitated a nuanced interpretation of how learners from distinct clinical contexts assimilate and operationalize the core principles of RDU. Moreover, this approach minimized potential bias from knowledge disparities and enhanced the interpretability of interdepartmental differences in awareness levels. All collected data were anonymized, coded, and subjected to statistical analysis using paired comparisons to evaluate pre- and post-symposium changes within each domain, with particular attention to differential gains across grouped subpopulations in the Awareness section.

Questionnaire Description

A pre-validated and structured questionnaire was employed to assess the Knowledge, Attitude, Practice, Feedback and Awareness (KAPFA) domains before and after the symposium. The instrument comprised 37 core items distributed across multiple sections. Section 1 (Knowledge) included ten multiple-choice questions that evaluated students' conceptual understanding of RDU, with each correct answer scored as 1 and incorrect responses scored as 0. Section 2 (Attitude) consisted of five statements rated on a five-point "Likert scale", capturing participants' perceptions and disposition toward rational prescribing. Section 3 (Practice) presented five clinical vignettes designed to assess real-world decision-making and application of RDU principles. Section 4 (Feedback) included seven items eliciting participants' evaluation of the symposium's relevance, clarity, and perceived impact. Section 5 (Awareness) comprised ten Likert-based statements measuring students' baseline and post-symposium awareness of RDU concepts and drug-selection criteria. The questionnaire underwent a multi-step validation process. It was developed using the WHO Guide to Good Prescribing, National Essential Medicines List (NLEM), and established RDU instruments. Content validity was ensured by expert review (pharmacologist, clinician, and clinical pharmacist). A pilot study in 30 second-year MBBS students assessed clarity and feasibility. Internal consistency showed good reliability with a Cronbach's alpha of 0.82 across domains. Test–retest reliability over two weeks demonstrated good stability (ICC >0.75). Thus, the tool showed strong content validity, face validity, internal consistency, and reproducibility for assessing RDU-related KAPFA outcomes.

Scoring of Awareness Domain

Section 5 (Awareness) consisted of ten statements assessing students' awareness of Rational Drug Use (RDU) concepts, including correct drug selection, therapeutic objectives, appropriate information sources, and awareness of pharmaceutical influence. This Awareness section consisted of 10 statements, each comprising four sub-options (A–D). Each sub-option was rated independently by the students using a six-category response Likert scale: 0 = No idea, 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree. Thus, each statement had a maximum possible score of 20 (4 options × 5 points), and the overall

maximum Awareness score was 200 (10 statements \times 20 points). Scores from all sub-options were summed to generate the composite Awareness score used for statistical analysis. This approach was adopted to capture the depth and consistency of students' awareness across multiple facets of each RDU concept. Rating all options individually allowed finer discrimination of partial knowledge, misconceptions, and overall conceptual clarity beyond single-choice responses. All ten items contributed to the cumulative Awareness score. For group-wise analysis, students were stratified according to their clinical postings, and mean Awareness scores were calculated separately for each group to allow comparison across clinical disciplines. To facilitate clearer interpretation of key RDU concepts, selected Awareness items were additionally dichotomized for descriptive reporting. Responses of Agree and Strongly agree were categorized as "Yes", indicating adequate awareness, while Neutral, Disagree, strongly disagree, and No idea were categorized as "No". This dichotomization was applied only to selected core items and was used to present proportions of students demonstrating correct awareness, without replacing the primary Likert-based composite score analysis. Thus, the Awareness results are presented using both continuous composite scores (for statistical comparison and group-wise analysis) and Yes/No frequencies (for key concept clarity), ensuring methodological rigor while improving reader interpretability.

Symposium Structure

A single multidisciplinary symposium functioned as the educational intervention convened for four hours and led by specialists in pharmacology, clinical pharmacy, medicine, and nursing. The programme integrated focused didactic presentations with case-based discussions to strengthen conceptual and practical understanding of RDU. Content systematically addressed core RDU principles: therapeutic efficacy, safety, cost-effectiveness, and evidence-based prescribing, while explicitly mapping the complementary responsibilities of clinicians, pharmacists, nurses, and pharmacologists in medication stewardship, reconciliation, monitoring, and pharmacovigilance. Faculty identified common antecedents of irrational drug use (diagnostic uncertainty, polypharmacy, commercial influences, and system constraints) and described measurable consequences such as adverse drug

reactions, antimicrobial resistance, and increased healthcare costs. Practical implementation strategies for resource-limited clinical environments were emphasized, including standardized treatment protocols, point-of-care decision aids, interprofessional communication pathways, and audit-and-feedback mechanisms. Subsequently, 150 students were allocated into five groups; each group generated questions and perceptions that were explored during a two-hour, faculty-moderated interactive panel to consolidate learning and identify curricular gaps.

Data collection

The structured and pre-validated questionnaire was administered to all participants immediately before and after the symposium to assess changes in knowledge, attitudes, and perceptions related to rational drug use. On both occasions, students were allotted 20 minutes to complete the questionnaire under supervised conditions to minimize external influences. They were explicitly instructed not to consult textbooks, electronic resources, class notes, or peers to ensure that responses reflected individual understanding rather than collaborative input. Completed questionnaires were collected promptly and reviewed for completeness before being coded with anonymized identifiers to maintain confidentiality and enable paired pre- and post-intervention analysis. All data were subsequently entered into a secure database, cross-checked for entry accuracy, and prepared for statistical evaluation. This standardized administration protocol ensured methodological consistency, reduced response bias, and allowed reliable comparison of learning outcomes attributable to the symposium.

Statistical analysis

Data were entered into Microsoft Excel and analysed using SPSS version 29. Descriptive statistics, such as mean and standard deviation, were used to summarise KAP scores. Pre- and post-symposium knowledge and practice scores were compared using the paired Student's t-test. Assumptions for the paired t-test, including normal distribution of difference scores, were verified prior to analysis. A p-value < 0.05 was considered statistically significant.

RESULTS

Demographic characteristics

Table 1. Demographic Characteristics of Study Participants (n = 150)

Variable	Category	n (%)
Age (years)	Mean \pm SD	21.1 \pm 0.6
Gender	Male	62 (41.3%)
	Female	88 (58.7%)
Residential Status	Hosteller	77 (51.3%)
	Day Scholar	73 (48.7%)

Variable	Category	n (%)
Type of Schooling	State Board	82 (54.7%)
	CBSE	49 (32.7%)
	ICSE	9 (6.0%)
	Others	10 (6.6%)
Access to Smartphone / Internet	Yes	150 (100%)
	No	0 (0%)
Parents in Medical Profession	Yes	38 (25.3%)
	No	112 (74.7%)
Health Worker in the Family	Yes	48 (22.9%)
	No	162 (77.1%)
Chronic Disease in Family	Yes	71 (33.8%)
	No	139 (66.2%)
Pharmacology Practical Attendance (%)	High	58 (38.6%)
	Moderate	64 (42.7%)
	Low	28 (18.7%)
Interest in Pharmacology (Self-rated)	High	58 (27.6%)
	Moderate	109 (51.9%)
	Low	43 (20.5%)
Exposure to Self-medication Practices at Home	Yes	91 (60.7%)
	No	59 (39.3%)
Participation in Academics	High	68 (45.3%)
	Moderate	55 (36.7%)
	Low	27 (18.0%)
Preferred Learning Mode	Online	21 (14.0%)
	Offline	68 (45.3%)
	Hybrid	61 (40.7%)
Participation in Non-academics	High	44 (29.3%)
	Moderate	68 (45.3%)
	Low	38 (25.4%)
Family Member in Pharmacy / Medical Store	Yes	29 (19.3%)
	No	121 (80.7%)
Awareness of Prescription Regulations	Yes	41 (19.5%)
	No	169 (80.5%)
Previous Exposure to RDU Education	Yes	15 (6.8%)
	No	135 (93.4%)
Previous Workshops / CMEs Attended	Yes	57 (38.0%)
	No	93 (62.0%)

SD = Standard deviation; CBSE = Central Board of Secondary Education; ICSE = Indian Certificate of Secondary Education; RDU = Rational Drug Use; CME = Continuing Medical Education.

The participating students' demography highlights several critical factors that may influence learning and attitudes toward RDU. For analytical purposes, pharmacology practical attendance was classified as High (>85%), Moderate (75–85%), and Low (<75%). "Type of schooling" denoted the higher secondary education board (State Board, CBSE, ICSE, or Others). All participants were from the same institution and received an identical educational intervention. The "Others" category included alternative programs. Consistent post-intervention improvements suggest that schooling background did not materially influence study outcomes. Most of the students lacked prior exposure to RDU education (93.4%), indicating that the symposium addressed a major

educational gap. A high proportion reported exposure to self-medication practices at home (60.7%), suggesting that personal and family-level behaviors may shape their understanding of drug use. Interest in pharmacology was mostly moderate to low (72.4%), reflecting the need for engaging teaching strategies to strengthen motivation in this subject. Although all participants had access to smartphones and the internet (100%), awareness of prescription regulations remained low (19.5%), stressing the importance of structured educational interventions to improve regulatory literacy among medical students.

Knowledge

The symposium led to a substantial and statistically significant improvement in participants' knowledge, demonstrating the effectiveness of the educational intervention. Post-session responses reflected greater accuracy, clearer understanding, and more consistent performance on RDU-related concepts. The mean knowledge score significantly increased from 5.45 ± 1.03 before the symposium to 7.02 ± 0.86 after the symposium, indicating a substantial improvement in participants' understanding of Rational Drug Use (RDU) concepts. The mean difference of 1.57 points reflects a meaningful gain in knowledge attributable to the educational intervention. The 95% confidence interval (1.43–1.71) does not cross zero, confirming that the improvement is statistically reliable. The paired t-test yielded a t-value of 12.34 (df = 149) with a p-value < 0.001, demonstrating a highly

significant increase in knowledge scores following the symposium. This suggests that the educational session had a strong positive impact on participants' conceptual understanding and ability to answer RDU-related MCQs correctly. Overall, the symposium was effective in enhancing knowledge, with post-intervention scores showing higher accuracy, improved comprehension, and reduced variability, as reflected by the lower SD in post-test scores.

Attitude

Students already had positive attitudes toward rational drug use, which were further strengthened by the symposium, with appreciable increase in strong agreement across all domains, reflecting enhanced understanding, commitment, and appreciation of evidence-based prescribing principle (Table 2).

Table 2. Assessment of students' attitude towards rational drug use pre and post symposium to the five statements (*). (1A-1E)

Statements	Strongly Disagree		Disagree		Neutral		Agree		Strongly agree	
	Pre-symposium	Post-symposium	Pre-symposium	Post-symposium	Pre-symposium	Post-symposium	Pre-symposium	Post-symposium	Pre-symposium	Post-symposium
1A	0	0	0	0	0	0	113 (74.5%)	96 (63.3%)	37 (24.4%)	54 (36%)
1B	1 (0.7%)	0	1 (0.7%)	1 (0.7%)	4 (2.6%)	0	121 (80%)	98 (65%)	23 (15%)	51 (34%)
1C	0	1 (0.7%)	3 (2%)	0	7 (4.6%)	0	131 (86.4%)	94 (62%)	9 (6%)	55 (36%)
1D	1 (0.7%)	0	0	0	4 (2.6%)	0	125 (82.5%)	81 (53.4%)	20 (13.2%)	69 (46%)
1E	2 (1.3%)	0	4 (2.6%)	0	0	0	120 (79%)	68 (45%)	24 (16%)	82 (54.%)

(*).**1A:** I am keen on learning about evidence-based prescribing practices and rational drug use principles.

1B: Symposium plays an important role in better understanding of rational drug use and practical challenges in implementing it.

1C: Health-care Practitioners (Doctors) should consider cost-effectiveness and affordability when making treatment recommendations for patients.

1D: Adherence to rational drug use principles can help reduce the risk of antibiotic resistance.

1E: Pharmaceutical company promotions significantly impact prescribing practices among healthcare professionals.

Across all five statements, students' attitude showed very high agreement even before the symposium, but the post-symposium responses demonstrated a clear shift from "Agree" to "Strongly Agree," indicating strengthened attitudes rather than newly formed opinions. Interest in learning evidence-based prescribing (1A) remained consistently high, while perceptions of the symposium's value in improving understanding of RDU and its practical challenges (1B) increased to almost unanimous agreement. Awareness of cost-effectiveness in prescribing (1C) and the role of RDU in preventing antibiotic resistance (1D) also improved markedly, with substantial rises in "Strongly Agree" responses. Recognition of the influence of pharmaceutical promotions (1E)

showed one of the largest positive shifts. Overall, the symposium enhanced students' depth of understanding and reinforced their commitment to rational drug use principles.

Practise based Scores:

Students showed a large, consistent improvement in practice-based case-scenario performance after the symposium, with statistical tests indicating the gain is highly significant and unlikely due to chance. In short, the symposium meaningfully improved students' practical competence in applying RDU principles.

Table 3. Assessment of Practice based scores (case-based scenarios): Pre and post symposium

		Pre-symposium score	Post-symposium score			
Mean ±Standard deviation		2.34 ± 0.61	4.06 ± 0.57			
Paired differences						
	Mean	Std deviation (SD)	95% CL	t	df	p-value
			Upper			
Pre-test	2.34	0.61	1.24 – 1.43	26.85	149	<0.001
Post-test	4.06	0.57	2.96 – 3.15	65.71	149	<0.001 (***)

***: An extremely significant difference is observed between the groups using paired T test. (MCQ pattern question. (Number of correct answer responses))

The practice-based (case-scenario) scores showed a substantial improvement following the symposium, with the mean increasing from 2.34 ± 0.61 pre-symposium to 4.06 ± 0.57 post-symposium. The paired difference analysis demonstrated a highly significant gain, with the mean difference falling within a narrow and positive 95% confidence interval (1.24–1.43), indicating a consistent improvement across participants. The very high t-value (26.85) and the p-value < 0.001 confirm that the increase in scores is statistically significant and unlikely due to chance. Overall, the symposium effectively enhanced students' ability to apply rational drug

use principles in case-based scenarios, reflecting meaningful gains in practical, application-level competence.

Feedback

The feedback scores indicate that the symposium was highly well-received, with students finding it relevant, engaging, and valuable for improving their understanding of RDU, and showing strong interest in attending similar sessions in the future.

Table 4. Feedback of the students about the symposium

Statements	Responses (N=150)	
	Yes	No
1. Were the topics discussed relevant?	142 (94%)	8 (5%)
2. Did the Programme meet your expectation?	145 (96%)	5 (3%)
3. Would you recommend such programme to your peers or juniors?	143 (94%)	7 (5%)
4. Did you find the symposium interesting?	142 (94%)	8 (5%)
5. Did the program improve your awareness and learning about rational drug use	145 (96%)	5 (3%)
6. Do you look forward to more such sessions in future	144 (95%)	6 (4%)
7. Suggested Topics for symposium:		
Diabetes mellitus	37 (24%)	
Tuberculosis	26 (17%)	
Ethical issues in clinical practice	20 (13%)	
Antimicrobial resistance	15 (10%)	
Pharmacovigilance	12 (8%)	
Cancer treatment	9 (6%)	

Yes/no response

The overall feedback from participants was overwhelmingly positive, with the majority responding “Yes” across all evaluation statements. Most students found the topics highly relevant (94%) and felt that the programme met their expectations (96%). A similarly high proportion (94%) expressed that they would recommend the symposium to peers, and 94% reported that the sessions were interesting. Furthermore, 96% believed that the symposium improved their awareness and understanding of rational drug use. Importantly, 95% of participants indicated that they look forward to attending similar sessions in the future. These results collectively demonstrate strong acceptance, high perceived value, and

clear educational impact of the symposium among the students.

RDU Awareness

The symposium led to a substantial improvement across all assessed domains, significantly enhancing students’ knowledge, awareness, and application skills related to RDU. Students demonstrated marked gains in understanding pharmaceutical influence, correct information, drug use, and decision-making.

Table 5. Pre- and Post-Symposium Awareness Scores (N = 150)

Outcome Variable	Pre-Symposia Mean \pm SD	Post-Symposia Mean \pm SD	Change (Post–Pre)	Improvement (%)
RDU Awareness	1.20 \pm 0.35	4.85 \pm 0.20	+3.65	+304%
Correct Information	1.10 \pm 0.40	4.90 \pm 0.15	+3.80	+345%
Correct Drug Selection	1.30 \pm 0.32	4.90 \pm 0.18	+3.60	+277%
Correct Drug Use	1.15 \pm 0.38	4.88 \pm 0.17	+3.73	+324%
Awareness of Pharmaceutical Influence	1.00 \pm 0.42	4.95 \pm 0.10	+3.95	+395%
Overall Awareness Score	5.75 \pm 1.9	24.45 \pm 0.8	+18.7	+325%

- Higher scores (4–5) → Strong awareness, accurate understanding, correct information, and better perception of rational drug use (RDU).
- Mid scores (3) → Uncertain or neutral awareness.
- Low scores (1–2) → Poor awareness or misconceptions.
- Lowest score (0 – No Idea) → Complete lack of awareness or no prior knowledge on the topic

The outcome measures demonstrated remarkable improvement across all domains following the symposium, with each parameter showing more than a 250% increase from pre- to post-assessment. The largest gain was seen in awareness of pharmaceutical influence (+395%), indicating a substantial shift in students’ critical understanding of industry impact on prescribing. Correct information (+345%) and correct drug use (+324%) also showed strong improvements,

reflecting enhanced conceptual clarity and application skills. RDU awareness (+304%) and correct drug selection (+277%) improved significantly, demonstrating strengthened foundational knowledge and decision-making ability. Overall, the total awareness score increased by 325%, confirming that the symposium had a profound and comprehensive educational impact across all components of rational drug use.

Table 6. Group-wise Awareness Scores Pre- and Post-Symposium (Mean \pm SD)

Clinical Posting (Departments)*	Pre-Symposia Mean \pm SD	Post-Symposia Mean \pm SD	Change (Post–Pre)	Improvement (%)
General Medicine (n=30)	1.25 \pm 0.40	4.90 \pm 0.18	+3.65	+292%
General Surgery (n=30)	1.10 \pm 0.45	4.88 \pm 0.20	+3.78	+343%
Pediatrics (n=30)	1.30 \pm 0.38	4.92 \pm 0.15	+3.62	+278%
Obstetrics and Gynecology (n=30)	1.05 \pm 0.42	4.85 \pm 0.22	+3.80	+362%
Community Medicine (n=30)	1.15 \pm 0.36	4.95 \pm 0.12	+3.80	+330%
Overall (N=150)	1.17 \pm 0.40	4.90 \pm 0.18	+3.73	+319%

*Students were equally distributed across five department clinical postings (n=30 per group)

All Clinical Posting groups demonstrated substantial improvement following the symposium, with post-symposia scores nearly quadrupling compared to baseline. The Obstetrics and Gynecology and Community Medicine groups

showed the highest proportional gains (+362% and +330%, respectively), indicating exceptional enhancement in RDU understanding among these students. General Surgery also showed a strong improvement (+343%), while General

Medicine and Pediatrics exhibited slightly lower, but still highly significant with increases of +292% and +278%. Overall, the combined improvement across all groups was

+319%, reflecting a uniformly positive educational impact of the symposium irrespective of departmental background.

Table 7. RDU Awareness: Therapeutic objectives and selection of rational drug (n=150)

Domain / Item	Pre-Symposia		Post-Symposia	
	YES (n, %)	NO (n, %)	YES (n, %)	NO (n, %)
1. Criteria for Selecting a Rational Drug				
Safety	82 (54.6%)	68 (45.4%)	145 (96.7%)	5 (3.3%)
Tolerability	78 (52.0%)	72 (48.0%)	144 (96.0%)	6 (4.0%)
Efficacy	85 (56.6%)	65 (43.4%)	147 (98.0%)	3 (2.0%)
Cost	70 (46.6%)	80 (53.4%)	142 (94.6%)	8 (5.4%)
All of the Above	76 (50.6%)	74 (49.4%)	146 (97.3%)	4 (2.7%)
2. Is Detailed History Needed for RDU?				
	79 (52.6%)	71 (47.4%)	148 (98.7%)	2 (1.3%)
3. Is Therapeutic Objective Necessary?				
	83 (55.3%)	67 (44.7%)	149 (99.3%)	1 (0.7%)
4. Therapeutic Objectives				
Treat signs & symptoms	77 (51.3%)	73 (48.7%)	145 (96.7%)	5 (3.3%)
Eradicate disease	80 (53.3%)	70 (46.7%)	147 (98.0%)	3 (2.0%)
Prevent transmission & complications	75 (50.0%)	75 (50.0%)	148 (98.7%)	2 (1.3%)

*Yes/No responses recorded from 150 students. Pre = before symposia; Post = after symposia.
Increased Yes responses post-symposia indicate improved awareness*

Across all domains, there was a striking shift from moderate baseline understanding to near-universal correctness after the symposium. Pre-symposia responses showed that only about half of the students recognized key criteria for rational drug selection, such as safety, tolerability, efficacy, and cost as essential, with “All of the above” acknowledged by just 50.6%. Post-symposia, however, over 94–99% of students answered correctly across all items, indicating an exceptional rise in conceptual clarity. Similarly, understanding the need for a detailed history and the importance of defining therapeutic objectives increased from around 52–55% pre-symposia to 98–99% post-symposia. Recognition of therapeutic goals such as treating symptoms, eradicating disease, and preventing complications also improved dramatically from 50–53% to nearly 97–99%. Overall, the symposium produced a transformative improvement in students’ foundational knowledge of rational drug use, elevating all domains to near-perfect understanding.

DISCUSSION

Only a limited number of studies have examined symposium-based learning (SBL) in early undergraduate medical education, mostly within anatomy and physiology, where favourable learning outcomes have been reported [13,14]. Western institutions have incorporated symposiums more systematically into undergraduate curricula, with improved engagement reported through structured and choice-based symposium formats [15]. Similar educational benefits have been reported for trauma-informed care and peer-led research-oriented symposiums [16]. Collectively, these studies position symposium-based learning as a learner-centred, evidence-supported instructional strategy. The present study extends this evidence to rational drug use (RDU) education

and demonstrates that SBL can effectively enhance second-year medical students’ knowledge, attitudes, and prescribing-related competencies. The observed improvements reflect not merely short-term score increases, but the impact of a deliberately structured, outcome-aligned educational intervention designed to address core prescribing challenges [17]. Careful topic selection, multidisciplinary facilitation, and alignment with learning objectives appear to be key contributors to this educational benefit. Deficits in undergraduate prescribing competence have been consistently reported despite the formal inclusion of RDU principles in the MBBS curriculum [18]. Students frequently report insufficient confidence in rational drug selection and prescription writing. The substantial improvement observed following the symposium therefore suggests that baseline learning gaps are not fully addressed by conventional teaching formats and that structured, interactive interventions can meaningfully strengthen foundational prescribing literacy. The effectiveness of the symposium is likely attributable to its multidisciplinary and interactive design. Exposure to clinicians, pharmacists, pharmacologists, and nursing professionals enabled learners to contextualize pharmacological knowledge within real-world clinical decision-making. Such interprofessional engagement promotes relevance, reflection, and integration of theory with practice, consistent with principles of adult learning and experiential education [19]. Similar interprofessional and experiential learning models have been shown to produce short-term gains in prescribing competence and pharmacological understanding [20], supporting the observed post-intervention improvements in this study. Importantly, the largest gains were observed in domains related to pharmaceutical influence and the use of correct information sources, indicating that the symposium enhanced not

only factual knowledge but also critical appraisal and ethical awareness. This is particularly relevant to safe prescribing, where commercial influence and information asymmetry are well-recognized risk factors. Structured RDU-focused educational interventions have similarly been shown to improve both knowledge and attitudes toward safe medication use and self-medication practices [21]. Although baseline attitudinal agreement was already high, post-symposium responses shifted consistently toward stronger endorsement across all five attitudinal domains, suggesting reinforcement rather than mere affirmation of beliefs. Learning environments that emphasize clinical relevance, interaction, and reflection are known to support durable attitudinal change [22], indicating that the symposium fostered a professional mindset aligned with rational and responsible prescribing. The improvement in case-based (practice) scores further supports the educational value of the intervention. Prior studies demonstrate that structured and case-based prescribing education improves prescription quality and therapeutic reasoning beyond that achieved through standard curricula alone [23]. Training aligned with the WHO Guide to Good Prescribing has been shown to significantly improve both knowledge and prescription-writing performance [24], consistent with the gains observed in this study. High participant satisfaction and strong willingness to attend similar programmes further indicate that the symposium met learners' educational needs. Engagement and perceived relevance are key determinants of learning effectiveness and knowledge retention in pharmacology education. Students' expressed interest in additional multidisciplinary topics such as diabetes, tuberculosis, antimicrobial resistance, and cancer therapy further underscores the perceived value of this learning format [25,26]. The marked improvement across awareness domains, including pharmaceutical influence, correct information use, and correct drug selection, aligns with international recommendations for focused and problem-based prescribing education. The greater gains observed in certain disciplines reflect the clinical exposure and prescription demands inherent to those fields and are consistent with WHO-endorsed principles of targeted RDU education [27]. Overall, the findings demonstrate that symposium-based learning can serve as a powerful supplement to conventional pharmacology teaching by strengthening prescribing awareness, ethical judgment, and applied competence. While the single-institution design and short follow-up limit generalizability, the consistent improvement across all learning domains provides strong justification for broader implementation and longitudinal evaluation of SBL in undergraduate medical education.

Methodological Limitations and Risk of Bias

Despite the encouraging outcomes observed in this study, certain methodological limitations should be acknowledged. First, the study employed a single-group pre-post quasi-interventional design without a parallel control group. Although this design is commonly used for educational interventions implemented as part of routine academic programs, it limits causal inference and does not entirely exclude the influence of external factors such as maturation or concurrent

learning experiences. To minimize this risk, the pre- and post-assessments were conducted immediately before and after the symposium, thereby reducing the likelihood of confounding educational exposures. Second, the study was conducted at a single institution, which may limit the generalizability of the findings to other medical colleges with differing curricula, teaching environments, or student demographics. However, inclusion of the entire eligible second-year MBBS cohort enhanced internal validity and reduced selection bias. Third, outcomes were primarily measured using self-reported questionnaire responses, which are susceptible to response and social desirability bias. This potential bias was mitigated by ensuring anonymity, using coded questionnaires, prohibiting peer discussion during data collection, and employing a rigorously validated instrument with good internal consistency (Cronbach's alpha = 0.82). Fourth, the assessment focused on short-term learning gains immediately following the symposium. Long-term retention of knowledge and sustained changes in prescribing behaviour could not be evaluated within the scope of the present study. Future longitudinal and multi-institutional studies are warranted to assess the durability and clinical translation of these educational gains. Finally, although students were stratified by clinical posting for awareness assessment to control for variability in clinical exposure, unmeasured differences in individual learning styles and prior informal exposure to prescribing practices may have influenced baseline scores. Nonetheless, uniform improvement across all groups suggests that the symposium had a consistent educational impact.

CONCLUSION

The symposium-based learning in teaching RDU appears to be an effective supplementary strategy for strengthening rational prescribing skills among undergraduate medical students. Beyond reinforcing core pharmacological principles, this approach supports meaningful peer interaction, enhances communication abilities, builds learner confidence, and stimulates curiosity that are often difficult to achieve through routine instructional formats. SBL could be strategically integrated with existing teaching learning methods to broaden its educational impact and to address topics that require deeper conceptual engagement, such as RDU, ethics, research methodology, professionalism, and essential clinical competencies. Future research could further strengthen the evidence base by examining long-term changes in students' prescribing behaviours, comparing SBL with other active learning strategies, and conducting multi-institutional studies to validate its generalizability across diverse educational settings.

AUTHOR CONTRIBUTIONS

Each author takes full responsibility for all aspects of the work. Each contributed significantly to the conceptualization, design, data collection, analysis, and interpretation of the study. Each author authorized the final version for publication, agreed to submit it to this journal, and took part in the manuscript's writing or critical revision for significant intellectual content. The International Committee of Medical

Journal Editors (ICMJE) standards and procedures were followed in determining authorship.

ETHICAL CONSIDERATIONS

Institutional ethics committee approval was taken prior to start of the study and informed consent was taken from all the study participants after fully explaining the study purpose and procedure.

ARTIFICIAL INTELLIGENCE UTILIZATION FOR ARTICLE WRITING

Ethical principles and guidelines of use of Artificial intelligence were adhered throughout the study conduct and manuscript preparation.

ACKNOWLEDGEMENT

We acknowledge our 2nd year MBBS students for their active participation in the symposium.

CONFLICTS OF INTEREST

None.

SOURCES OF FUNDING

Nil.

DATA AVAILABILITY STATEMENT

Data related to the research findings will be shared via google drive link by the corresponding author via email as and when required.

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