



Integrating Rational Drug Use into Healthcare Education: A Qualitative Study Across Five Professions in Thailand

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Abstract

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 IJPS, 2024; 20(4) : 17-35

 Received: 17 July 2024
 Revised: 8 November 2024

 Accepted: 8 November 2024

The irrational use of medicines is a global public health challenge, contributing to adverse patient outcomes, antimicrobial resistance, and escalating healthcare costs. Rational Drug Use (RDU) is critical to addressing these issues by promoting safe, effective, and appropriate medication use. However, integrating RDU into healthcare education remains inconsistent across professions. This study aimed to explore the initiatives and strategies employed by healthcare professionals and academic faculty to promote the education on RDU and incorporate its principles into their respective curricula. Material and Methods: A qualitative study was conducted to gather data between May and June 2023. Seven focus group discussions were conducted with 36 participants, including 17 members from professional councils and dean consortiums, and 19 faculty administrators and lecturers across five healthcare professions: Medicine, Dentistry, Pharmacy, Nursing, and Veterinary Medicine. Discussions followed a researcher-developed topic guide and were recorded, with verbatim transcripts subjected to thematic analysis. Results: Six major themes emerged: (1) The Memorandum of Understanding (MOU) formalized RDU competencies, requiring their inclusion in curricula and national licensing exams. (2) Professional councils and dean consortiums played key roles in setting accreditation standards and ensuring that RDU competencies are part of graduate gualifications. (3) The development of profession-specific RDU teaching guides led to variation in awareness and implementation across institutions. (4) Inconsistent management of RDU education was observed, with significant differences before and after the MOU's introduction, leading to uneven progress across institutions. (5) A lack of standardized methods for assessing RDU learning outcomes hindered consistent evaluation of student competencies. (6) RDU in licensing exams was unevenly emphasized, with stronger incorporation in nursing and veterinary medicine compared to other fields. Conclusion: Despite progress in RDU integration, significant gaps remain in standardization and assessment across healthcare professions. Strengthening collaboration between councils and institutions is essential for improving RDU education, ensuring healthcare graduates are better equipped to promote RDU and patient safety.

Keywords: rational drug use, rational use of medicine, healthcare professional education, educational activities, curriculum



Introduction

The irrational use of medicines is a serious public health issue worldwide (World Health Organization, 2002, 2023). Rational drug use (RDU) is crucial because it involves decisions based on the effectiveness, safety, convenience, and affordability of medicine. Ensuring an accurate prescription, along with guaranteed access to the prescribed medication and appropriate dispensing and administration, followed by the patient's correct usage, is also integral to the principles of RDU. The role of various professions, medicine, pharmacy, nursing, dentistry, and veterinary medicine is critical in promoting RDU, as these professions are directly responsible for the prescription, dispensing, administration, and management of medications. The irrational use of drugs in veterinary medicine also poses a significant concern, particularly when administered to food-producing animals. Residues of these drugs and their metabolites in edible tissues may pose health risks to humans consuming such foods, especially when used to enhance animal productivity (Sanders, 2007).

Several significant factors contributing to irrational drug use were identified, including insufficient training, a lack of recognition of the importance of the task, difficulty in identifying errors, expanding the array of therapeutic options (Barber, Rawlins, & Franklin, 2003; Dean, Schachter, Vincent, & Barber, 2002), Insufficient knowledge of dosage, treatment duration, and legal requirements, duration of antibiotic treatment and legal requirements of opioid prescriptions (Lewis et al., 2014), and lack of awareness regarding RDU (Chaudhari, Mali, Dawari, & Nishandar, 2017). These issues can leave students unprepared to prescribe medications safely (Coombes, Mitchell, & Stowasser, 2008; Pearson, Rolfe, & Smith, 2002). Insufficient training often leads to mistakes based on poor knowledge, such as incorrect dosing or treatment duration (Hansen, Bradley, & Sahm, 2016; Lewis et al., 2014). Additionally, not fully understanding the importance of RDU can cause students to apply their knowledge inappropriately in real-world situations. As a result, these gaps in training and understanding may cause students to feel unconfident and underprepared when prescribing medications. Therefore, various strategies, including educational intervention for undergraduate healthcare students, have been suggested to promote RDU (Poudel & Nissen, 2018; World Health Organization, 2002, 2023). This approach aims to develop the competencies and confidence necessary for real-world applications, ultimately enhancing patient safety and healthcare quality while mitigating issues such as antimicrobial resistance, polypharmacy-related complications, and healthcare expenditures.

The medical education curriculum shapes learners' experiences to achieve outcomes in the basic clinical sciences and skills (Archer *et al.*, 2016; Grant, 2018; Swanson & Roberts, 2016). Integrating RDU education into undergraduate healthcare curricula is crucial for equipping future professionals with the requisite knowledge, skills, and attitudes to effectively manage medication complexities (World Health Organization, 2002). Numerous educational initiatives and guidelines for aligning with RDU principles have been developed (Poudel & Nissen, 2018). Despite these efforts, integrating and implementing RDU into undergraduate curricula remains challenging, both globally and specifically in Thailand.

In Thailand, efforts to integrate RDU into undergraduate curricula began in 2013 as part of the National Drug Policy Act of 2011 and the National Drug System Development Strategy 2012-2018. These efforts have been advanced through initiatives led by the health workforce development group for RDU. In 2017, the Memorandum of Understanding (MOU) was established to RDU enhance competencies among healthcare professionals. Despite over a decade of efforts to promote RDU education, there has been no systematic evaluation of how these initiatives have been implemented at both the professional and faculty levels. Specifically, there is limited understanding of the strategies employed by academic faculty to effectively incorporate RDU principles into their curricula. This study aims to address this gap by exploring the initiatives and strategies employed by healthcare



professionals and academic faculty to promote RDU education and incorporate its principles into their respective curricula. The findings from this study will address the gap and contribute to enhancing the effectiveness of RDU education, helping to develop future healthcare professionals with the necessary competencies in RDU, ultimately leading to improved patient safety.

Materials and Methods

Focus group discussions (FGDs) were conducted with stakeholders from five healthcare professions: medicine, pharmacy, dentistry, nursing, and veterinary medicine. The participants were recruited from 1) members of professional council committees, 2) members of dean faculty consortiums, 3) faculty administrators, and 4) lecturers involved in teaching or overseeing medication use.

Purposive and snowball sampling were used for participant recruitment. For purposive sampling, the research team aimed to recruit representatives from all five healthcare professional councils and the dean consortium (Medicine, Dentistry, Pharmacy, Nursing, and Veterinary Medicine). Moreover, Administrators and lecturers across these five healthcare professions were recruited to ensure a balance between institutions with notable progress in promoting RDU education and those that exhibited minimal engagement in RDU initiatives. To supplement the purposive sampling, snowball sampling was employed. Initial participants who were known to have played a significant role in the development of RDU education in their respective professions were asked to refer other key individuals. This approach allowed the research team to capture a wider range of perspectives, ensuring that additional participants had diverse experiences with RDU education. However, the potential selection bias inherent in this approach was mitigated by deliberately seeking recommendations that spanned different regions and levels of engagement with RDU. During recruitment, the information sheet and consent form were provided to the participants.

Sampling and data collection were conducted until data saturation was reached, as indicated by the absence of new data were found in later group interviews (Viginia Braun & Clarke, 2013b). However, this cannot be said with certainty.

Interview guide development

An interview guide for the FGDs on RDU education in undergraduate studies was developed through a literature review and expert recommendations regarding the study objectives. Ten experts from various disciplines provided valuable insights into the essential topics. Open-ended questions were drafted to explore in-depth information from participants and sent to the experts for their feedback to finalize the guide, ensuring clarity and relevance for participants while allowing flexibility for open discussion.

The three key themes of the interview guide include:

1) Initiatives and strategies implemented to promote RDU education

2) Integration of RDU principles into academic curricula

3) Monitoring and evaluation of an implementation/ integration

The finalized interview schedule is provided as a supplementary document.

Data collection

Online FGDs, aiming to include 3–8 participants per group—considered optimal for generating rich discussions and easier to manage(Viginia Braun & Clarke, 2013a) were conducted and recorded via Zoom meetings. Before the interviews, participants completed a consent form confirming they had read the information sheet and that participation was voluntary. The interview purpose was explained, and they were reminded of their right to withdraw or skip questions without consequences. Permission to audio-record was also requested.



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Participants were assigned to two subgroups: 1) representatives from professional councils and dean consortiums to explore perspectives on policy-making and oversight, and 2) faculty administrators and lecturers to understand the implementation of these policies. While it was not necessary to have all five professions represented in each group due to scheduling constraints, participants who collaborated with other professions provided insights on interdisciplinary efforts in RDU education. At least two researchers with training in leading FGDs attended each discussion. One researcher moderated the data, while the other took notes. The interviews followed the topic guide developed by the research team. A trained researcher moderated each focus group, guiding discussions to meet study objectives, ensuring balanced participation, and encouraging contributions from all participants.

The recording files were securely saved to a shared cloud drive that was accessible only to the research team. The transcripts were anonymized and stored on the same secure drive. All interviews were transcribed verbatim by research assistants using Microsoft Word's transcription feature. Transcription accuracy was double-checked by a researcher, SD, before data analysis. The interviews ranged from 90 to 130 min. Inductive thematic analysis was employed to analyze the data, to uncover narratives surrounding the integration of RDU into the curriculum.

Ethical approval

This study was approved by the Research Ethics Committee of Ubon Ratchathani University (UBU-REC-56-2566).

Data analysis

A mixed inductive and deductive thematic analysis approach was used to analyze the data. NVivo 11 software (QSR International) to manage and organize the data. Thematic analysis was conducted following six-phase approach (Virginia Braun & Clarke, 2006), beginning with familiarization through transcription and repeated readings. Initial coding was carried out inductively by coding raw data to identify emergent themes, while deductive coding was guided by pre-existing research questions and literature. NVivo facilitated the organization of codes, allowing for systematic data management and tracking of patterns. Transcripts were independently coded by SD and RN, followed by collaborative discussions to ensure agreement on potential themes. The themes were reviewed iteratively, and multiple rounds of discussion with the research team helped refine and validate the themes, ensuring a comprehensive representation of the data. Manual review complemented the software analysis, preserving the richness of the narratives while minimizing researcher bias. A thematic map was generated, exploring relationships between codes, themes, and subthemes to uncover key narratives related to the integration of RDU into the curriculum.

Results

Seven FGDs involved 1 7 members from professional councils and Dean consortiums, 19 faculty administrators and lecturers across five healthcare professions: Medicine, Dentistry, Pharmacy, Nursing, and Veterinary medicine. The majority of participants were female (53%, N=19). Professionally, the largest group was pharmacists, making up 28% (N=10). Most participants were from institutes located in central Thailand (58%, N=21), as shown in Table 1. There were three groups with professional council committee members and dean consortium members, and four groups with faculty administrators and lecturers (Figure 1).



Table 1 Participants characteristics

	Number of participants	Percent
Gender		
Male	17	47
Female	19	53
Profession		
Medicine	8	22
Dentistry	7	19
Pharmacy	10	28
Nurse	6	17
Veterinary medicine	5	14
Region		
Central	21	58
Northern	1	3
Northeastern	7	19
Southern	7	19





The analysis revealed six major themes in RDU integration and management within healthcare education, as shown in Figure 1: (1) the Memorandum of Understanding (MOU) establishes RDU competencies for graduates and includes them in licensing exams; (2) Professional Councils and Dean Consortiums set curricular accreditation criteria and define graduate competencies; (3) the creation of both generic and profession-specific RDU Teaching Guides, despite varying levels of awareness and implementation; (4) RDU Education Management is inconsistent both prior to



and after MOU execution; (5) the absence of standardized methods for assessing RDU Learning Outcomes; and (6) the varied emphasis on RDU competencies in professional

license examinations, particularly within the nursing and veterinary field



Figure 2 Six major themes in RDU integration and management within healthcare education.

1. Memorandum of Understanding (MOU)

The Thai FDA and representatives from healthcare professional councils and dean consortiums from five healthcare professions (including Medicine, Dentistry, Pharmacy, Nurse, and Veterinary medicine) signed the MOU to strengthen healthcare professionals' skills and abilities to promote rational drug use. All five healthcare professional councils agreed to mandate RDU as a competency for graduates by 2017 and included the RDU examination as part of the professional license exam. Additionally, they would support integrating of rational drug use into professional continuing education.

"After the 2017 MOU, the framework became more structured. The Nursing Council established a dedicated task force to clearly define the necessary competencies. Consequently, we developed our own teaching guide for RDU. This decision was influenced by our observation that the existing teaching guide, recognizable by its green cover, primarily reflects a physician-centered approach. Starting with nurse-specific competencies, we conducted a thorough review of both the competencies and the RDU teaching content, which we then clearly outlined. In summary, through these efforts, we systematically defined the competencies and established detailed content guidelines."RN PF_02

"The Dental Council maintains a committee specifically for curriculum revisions. When it's time for a curriculum update, this educational committee takes charge. At present, their main task involves the certification of graduates who have studied abroad and the approval of their submitted curricula. However, they have not yet defined the criteria for institutional evaluations that are due in upcoming reviews. As for professional competencies, these are under the purview of the Dental Council. Despite this, there appears to be little current discussion within the council about student competencies. It's possible that the recent comprehensive curriculum revision across all institutions has imposed specific competency requirements. Consequently, all institutions now adhere to these standards, which has led to a somewhat static situation."Dent PF 01

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Moreover, the five healthcare professionals would collaborate to promote interdisciplinary patient care teaching and learning development in undergraduate education. This included promoting understanding and teaching among lecturers and integrating RDU content into their curriculum.

The dissemination of these policies was conducted through meetings that involved deans, heads of educational institutions, and academic deputies overseeing national curricula. These meetings, led by the President of the Nursing Council, featured the formal announcement of the policies and the distribution of related RDU documentation prepared by the task force. These documents are intended to guide the administrative strategies and provide a framework for each educational institution to implement RDU. Every aspect of the MOU has been integrated into the operational practices mandated by the professional council, ensuring that RDU is included as a key component in the course descriptions for both theoretical and practical segments of the Nursing Science curriculum."NU_PF_03

"The Faculty of Pharmacy is presently revising its curriculum structure, including updates to various sections within the Thailand Qualifications Framework for Higher Education (TQF1). We have explicitly incorporated RDU into the essential knowledge framework mandated for all students in TQF1. This inclusion aims to enhance the clarity of our national policy directions and to strongly encourage actual implementation. With RDU specified in TQF1, all 19 affiliated institutions are required to comply with this standard." RX_PF_03

2. Role of professional councils and dean consortiums

Professional Councils play a crucial role in establishing curriculum accreditation criteria and evaluating the accreditation of institutional curricula. In addition, they determine the competencies of graduates and administer professional license exams. Thus, incorporating RDU as a criterion for curriculum accreditation and professional competency would ensure its inclusion in healthcare education curricula.

Each professional Dean consortium promotes RDU education by appointing committees for rational drug use in each healthcare profession. These committees are responsible for planning and proposing guidelines for promoting rational drug use education, such as setting curriculum-content frameworks, developing teaching methodologies, and developing teaching guides tailored to each profession.

"To ensure successful advancement, it is crucial that the collaboration between the council and the consortium is robust. As highlighted during the meeting, our confidence in the new council has significantly increased because the current president is not only an academic but also has extensive experience as an administrator, dean, and former member of the consortium. He has consistently agreed with all the points discussed. Thus, to drive our initiatives forward and fully realize the objectives outlined in the MOU, we should consider inviting him to serve on a sub-committee or a collaborative task force."Dent_PF_03

"The Nursing Council actively supports the national policy aimed at strategically developing the national drug system and enhancing healthcare manpower for RDU. This initiative focuses on improving nursing graduates' knowledge and skills in RDU to foster a society that uses drugs safely and efficiently, thereby minimizing financial and fiscal losses. Beyond policy formulation, the committee has produced a document endorsed by the FDA that details the integration of RDU into the Nursing Science curriculum. This document, based on a manual, lists ten essential competencies and



specifies the necessary content and learning outcomes for nursing students. It translates these competencies into practical tasks and outlines the relevant subjects that faculties need to cover. The document also maps out how each competency is incorporated into specific course modules. We have distributed this manual to all educational institutions and invited faculty members from various institutions to familiarize themselves with RDU concepts. In the initial stages, we also conducted training sessions for instructors on how to teach RDU effectively. This effort resulted in the creation of a comprehensive guide for managing educational programs at various institutions."RN_PF_01

However, the implementation mentioned above for each profession has not yet been clearly outlined to ensure consistent actions among educational institutions. For example, specifics such as the number of courses or content to be taught have not been specified, nor have the proportions of RDU assessments in professional certification exams.

3. The teaching guide for RDU

Thai National RDU sub-committee developed the first RDU teaching guide. This teaching quide was developed to serve as a guideline for health professional instructors, enabling them to understand the direction of teaching and learning development regarding RDU. However, the contents of the teaching guidelines were not suitable for certain professions, such as dentistry, nursing, and veterinary medicine. Consequently, committees for RDU within each healthcare profession have developed their own RDU teaching guides. Despite this, some lecturers, faculties, or colleges were unaware of these teaching guides or chose not to incorporate them into their teaching.

"The Nursing Science curriculum now includes a structured format for teaching RDU. This curriculum was derived from a manual detailing ten essential competencies along with the required content and subjects that need to be covered. We've translated these competencies into practical tasks that nurses are expected to perform and have detailed what is required for each faculty. Additionally, we've mapped out where each competency should integrate into different subjects. This teaching guide for RDU has been distributed across all educational institutions." RN PF 01

The Teaching Guide for RDU reveals a strategic integration of essential competencies into the Nursing Science curriculum, emphasizing practical application and standardization across educational platforms. The curriculum adopts a structured format, guided by a manual that outlines ten crucial competencies, specifying the necessary content and subjects. This approach translates theoretical knowledge into actionable tasks tailored for nurses, ensuring each competency is appropriately embedded within various subjects. These guidelines have been disseminated widely across educational institutions to foster uniformity in teaching RDU. To further enhance this framework, using existing resources is encouraged to avoid redundancy in educational efforts. An inclusive manual compiles these resources, featuring examples of best practices from leading institutions. This manual strengthens effective education management and aligns with the Thailand Qualifications Framework (TQF), providing a readily accessible model via a QR code. This system allows institutions to adopt and implement proven teaching strategies, exemplified by direct models from courses that have demonstrated success in specific subjects. Such resources are instrumental in refining the pedagogical approach to teaching RDU, ensuring that educational standards are met in an exemplary manner.

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"Furthermore, there's no need to reinvent the wheel. For instance, we have a comprehensive manual that aggregates resources which can be readily utilized. This guide on educational management includes examples of exemplary practices from leading institutions regarding how they manage teaching and structure their Thailand Qualifications Framework (TQF). This guide has been formatted into a teaching guide for RDU complete with a QR code for easy access, allowing any institution to implement these practices straight away. For example, if there is a subject that is particularly well-taught, it can be used as a direct model." RN_PF_03

4. RDU education management

The deans of each faculty are responsible for announcing policies received from the professional council and the dean's council to relevant parties through various methods, such as faculty committee meetings, faculty meetings, and assignments for responsible departments.

Before entering the MOUs, each faculty or college taught RDU, however, such instruction was not explicitly defined or clearly outlined. After policies were established to promote rational drug use instruction, various faculties implemented different measures. These measures included an appointing committee to lead the development of RDU teaching and enhance faculty development in teaching RDU.

"In faculties where the dean and a key member acknowledge the significance of an initiative, they will collaborate to develop specialized projects specifically designed for that faculty." RX_FC_03

Some faculties have incorporated the RDU topic into their course subjects, embedded content related to RDU within various topics, and launched courses that specifically focused on RDU, emphasizing practical implementation and continuous assessment. The vice dean of academic affairs at one medical school detailed the proactive implementation of RDU policies across pre-clinical and clinical levels that originated from national medical standards. This initiative involved collaboration with regional medical school directors, providing them with structured policy frameworks and educational strategies tailored to their local contexts. The recent curriculum reassessment highlighted the successful integration of RDU principles in specific subjects such as pediatrics, focusing on pediatric drug use and ethics with practical application. Additionally, continuous education and regular monitoring of RDU practices are ensured at affiliated hospitals, particularly through coordination with pharmacy departments to maintain high standards of drug use among medical professionals.

The faculty of dentistry at another university has formally embedded RDU into its curriculum following a significant revision in 2017. Before this, RDU concepts were addressed informally, but the curriculum overhaul made these principles a well-defined component of the education process, particularly emphasized in lectures on proper drug administration to prevent redundancy and misuse. To deepen the understanding and application of these concepts, the faculty employs small group teaching and case-based discussions, allowing to assess drug use scenarios critically. This approach aims to heighten awareness and caution among students, especially regarding the misuse of commonly overprescribed drugs like antibiotics and NSAIDs. Efforts are ongoing to bridge these teachings more seamlessly from preclinical to clinical levels to foster greater interdisciplinary collaboration and reinforce the practical application of RDU principles in clinical settings.

"In my role as Vice Dean of Academic Affairs, we focused on implementing the RDU policy, informed by a national medical institution body. To effectively spread this policy to the Pre-clinic and Clinic levels, we utilized our connections with medical schools in two regional locations. We engaged the medical center directors in both places, providing them with the necessary policy frameworks and detailed educational strategies. This year, I had the chance



to reassess the curriculum at these centers, noting their incorporation of RDU into specific subjects like Pediatrics, which includes teaching about drug use in children, and ethics across various contexts, blending theory with practice. We also ensure continuous education and monitoring of RDU at our affiliated hospital, coordinating with the pharmacy department to educate and oversee drug use practices among new and existing medical professionals, with regular review sessions throughout the year." MD_FC_01

"The Faculty of Dentistry at one university has incorporated RDU into its curriculum as part of a policy initiative. Before the curriculum revision in 2017, the faculty had been addressing this topic informally. Post-revision, RDU was explicitly included to enhance students' understanding of its principles and the importance of proper drug administration, including avoiding redundancy and misuse, all of which are now integral to specific lectures. To reinforce these concepts, we employ small group teaching methods, often utilizing case-based discussions to evaluate the appropriateness and rationality of drug use in various scenarios. Our objective is to foster greater awareness and caution in drug use among students, particularly concerning the misuse of antibiotics and NSAIDs, which are frequently overprescribed. Although this teaching primarily occurs in the Pre-Clinic teaching, we are working towards a more integrated approach with the Clinic teaching to enhance collaboration, although structured sessions are still under development." RX_FC_03

Several faculties have revised their curricula by clearly specifying RDU issues and designating them as learning outcomes in updated curricula. However, some faculties have yet to include RDU in their curricula.

"In our faculty, we treat this aspect as a key competency. Currently, we are implementing it through a milestone approach, where we outline the specific outcomes students are expected to achieve each year, from their first through sixth year. This progression is specifically for competencies related to RDU, detailing what they will learn and achieve annually. This structured approach to student development in RDU is an ongoing project." MD_PF_03 All faculty members began teaching RDU issues in the early years of study, typically in the first or second year, and continued to do so until the final year. The teaching methods vary depending on the learning objectives, including lectures, case-based learning, problem-based learning, project-based learning, task-based learning, case discussions, seminars, assignments, interprofessional education (IPE), clerkship, and clinical rotation.

"Outcome assessment has not been firmly standardized at the faculty level but is implemented within specific subjects based on the activity, content, or teaching methods. Assessments might evaluate knowledge or analytical thinking abilities. The teaching methods vary and can include Task-Based Learning (TBL), Problem-Based Learning (PBL), Case Discussions, and Role Plays, all of which integrate RDU. During these sessions, faculty members observe and evaluate students on how well they apply their knowledge, skills, and attitudes. In the senior year, students participate in real patient care through Workplace-Based Learning, with assessments focusing more on practical application than on specific academic subjects. Additionally, a comprehensive assessment conducted in 2021 showed high engagement from graduates, who likely completed the task force's surveys with a high response rate."RX_FC_04

Primarily, the fields that have emphasized RDU include pharmacology, pharmacotherapy, and pharmacotherapy in special populations. Therefore, in most cases, responsibility for teaching RDU was assigned to departments or disciplines related to pharmacotherapy instruction, such as the departments of internal medicine, pharmacology, clinical pharmacy, oral and maxillofacial surgery, clinical medicine, and public health (veterinary medicine), which typically oversee this aspect of education. However, it is noteworthy that only nursing faculties explicitly mandate teaching RDU in all relevant subjects.

"Before the implementation of the MOU, I was responsible for teaching students transitioning from their fifth to sixth year, focusing on RDU with a special emphasis on its application in special populations and its cost-effectiveness. Following curriculum adjustments to integrate a dedicated RDU team, the specific week allocated for this teaching was reduced. However, we adapted by spreading the content throughout the curriculum. For instance, RDU principles were incorporated into the pharmacology lectures for third-year students. In the fourth and fifth years, the content was expanded, particularly as students began their clinical rotations in departments like pediatrics and obstetrics. This period also saw the introduction of topics such as economic evaluation, with assistance from an additional teaching member. Instead of reducing the RDU content due to the MOU, we strategically reallocated it across the third to fifth years to align better with the students' clinical exposure and learning needs."MD_FC_07

5. Assessment of RDU learning outcomes

No faculty has yet established a specific format for assessing students' competencies in RDU. Currently, assessments are primarily based on the learning objectives of each subject. The assessment method depends on the teaching method used in the topic or course.

From 2019 to 2021, the Thai FDA sponsored an assessment of RDU competence among final-year students in all five professions. However, only the nursing curriculum explicitly aimed for the enhancement of more rigorous assessment methods. However, only the nursing curriculum explicitly aimed for the enhancement of more rigorous assessment methods. They also planned to utilize the EPA (Entrustable professional activities) to evaluate the competencies of nursing students in their final year.

"We need to emphasize learning in this specific area, though it has not been formally established as a Key Performance Indicator (KPI). Currently, assessments are predominantly based on teaching specific subjects, such as pharmacology, where students are required to pass evaluations related to RDU embedded within those lessons. At the advanced Clinic level, we use a rubric-based assessment method that includes a range of skills and knowledge areas. One key area assessed is the application of drug use, evaluated by faculty members or practicing doctors who contribute to teaching. This method is particularly applied to the teaching of drug administration to animals, both pets and livestock, which can be complex due to the breadth of our curriculum. Although the rubric provides a clear framework for assessing students' understanding of RDU across different categories of drugs, these assessments are yet to be quantified as formal KPIs, focusing instead on individual performance within specific academic subjects." Vet_FC_01

"We are continuing our crucial work in tracking graduates, particularly focusing on RDU and the development of EPA. After completing these developments, we will require funding for public relations efforts to facilitate nationwide discussions with faculty members about the progress and implementation of EPA."NU_PF_01

6. Professional license exam

All healthcare professional councils have incorporated RDU competency into their licensing exams however only nursing and veterinary professionals have allocated part of the examinations to RDU testing.

"The licensing exam serves as a practical test, with exam questions collaboratively developed by nursing institutions across the country. There is a specified blueprint from the regulatory council, it includes specific directives about RDU. Nevertheless, the council's exams definitely encompass RDU-related questions, integrating the entire continuum from policy formulation to assessing outcomes. The nursing council has mandated that candidates for a nursing license must demonstrate proficiency in RDU. Specific details or questions are not currently recalled, but RDU is assuredly a component of these exams. When assessing each academic subject, the method is consistent, ensuring that exams must include RDU to evaluate students' understanding effectively." RN_FC_05



Discussion

This study provides new insights into the integration of RDU education within healthcare curricula in Thailand. It underscores the need to assess the effectiveness of these curricula in improving healthcare professionals' knowledge, attitudes, and competencies. The research examined how RDU education is incorporated into the curricula of five healthcare professions in Thailand. Although RDU principles are included in national policies, their implementation varies. The Memorandum of Understanding (MOU) has standardized RDU competencies, but challenges remain in curriculum design, execution, and assessment. Key themes include the role of councils in setting standards, professionspecific teaching guides, inconsistent management, a lack of standardized assessments, and varying emphasis on RDU in licensing exams.

This study found that the MOU aimed to enhance healthcare professionals' skills in promoting RDU-initiated changes in RDU education. This led professional councils to define rational drug use competencies for graduates, including rational drug use assessment in professional licensing examinations. All faculties had to revise th curriculum to include RDU, ensuring the attainment of RDU competency in graduates. This can be compared to the survey of the baseline situation of undergraduate program RDU teaching among six health sciences professions (medicine, dentistry, veterinary medicine, pharmacy, nursing, and public health) in Thailand during the academic year 2013, where it was found that only 14-56% of curriculum objectives incorporated RDU (Suttajit S et al., 2023). These developments align with the World Health Organization (WHO) recommendations which emphasize educational standards for healthcare practitioners and the development and enforcement of ethical codes. WHO underscores the Furthermore. necessity of collaboration between professional associations and universities in this endeavor (World Health Organization, 2002).

RDU teaching guides tailored to the specific needs of each healthcare professional were mentioned in this study, serving as instructional frameworks. These guides provide essential topics and materials to assist instructors in teaching. A noteworthy resource in this regard is the Guide to Good Prescribing produced by the WHO, which employs a structured problem-solving approach to aid medical selecting and students in prescribing appropriate medications for individual patients (World Health Organization, 1994). Consequently, the Guide to Good Prescribing has been widely adopted across numerous medical schools (Budakoğlu, CoŞkun, Kıyak, & Uluoğlu, 2023; Dekker et al., 2015; Desai, Panchal, Shah, & lyer, 2016; Gritta, Jonathan, Betty, & Rebekah, 2013; Tichelaar et al., 2016; World Health Organization, 2002). The Botucatu School of Medicine in Brazil officially incorporated RDU based on the WHO's Guide to Good Prescribing, into its fourth-year student curriculum. Feedback from students indicates a positive perception of the discipline, attributed to the opportunity to reflect on the multifaceted aspects of the prescription process (Patrício, Alves, Arenales, & Queluz, 2012). Furthermore, two systematic reviews examined the efficacy of integrating WHO's Guide to Good Prescribing into educational interventions within undergraduate medical education. The review identified increased prescribing competency within the learner's training context and positive impacts on patient outcomes following training (Budakoğlu et al., 2023; Gritta et al., 2013).

Considering the significance of early clinical exposure in developing skills, there appears to be a growing preference for RDU instruction from the first year onward (Littlewood *et al.*, 2005; Young, Van Merrienboer, Durning, & Ten Cate, 2014). Additionally, a study conducted at Aga Khan University Medical College, Pakistan demonstrated that the implementation of a one-week course on patient safety for third-year medical students before their clinical rotations significantly improved students' knowledge. Moreover, students expressed favorable experiences with the course through their reflections. The course was

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delivered through various modalities including lectures, interactive sessions, and hands-on skill workshops (Ahmed *et al.*, 2022). However, it is essential to acknowledge the need to adjust and simplify the training content to align with the cognitive capacities of first-year students, thereby avoiding cognitive overload (Young *et al.*, 2014). This study also demonstrated that each academic institution began RDU instruction early in the program and continued through the final year of education. While RDU teaching has been implemented across various undergraduate years, it has been notably less frequent in the first year of undergraduate medical education, with greater frequency observed during the clinical years (Budakoğlu *et al.*, 2023).

A range of teaching methods was employed to instruct RDU, predominantly relying on case studies. Casebased discussions, patient encounters, clerkships, and clinical rotations are frequently utilized to impart RDU knowledge and skills to clinical-year students (Budakoğlu *et al.*, 2023; Panchal, Dudhia, Damor, & Desai, 2023; Toklu & Demirdamar, 2014). These teaching approaches were also documented in this study.

A national professional license examination ensures that healthcare graduates meet the required standards of professional knowledge and clinical skill competencies for practice (Bajammal *et al.*, 2008). This study explored the inclusion of RDU in national professional licensing examinations. However, no standardized test blueprints were provided. Aligned with professional licensing exams in many countries where there is no clear specification of topics to be assessed (Bajammal *et al.*, 2008; Harden, 2009; Melnick, 2009; Swanson & Roberts, 2016), including RDU assessment in the professional licensing exam would ensure confidence in a healthcare professional's ability to practice rational medication use for patient safety.

This qualitative study provided in-depth insights into the implementation of RDU in the undergraduate curriculum at the professional and faculty levels across five different healthcare professions. However, it should be noted that the study did not allow for direct comparisons between the approaches of each profession. Nonetheless, it was able to highlight contextual differences that may exist.

The findings of this study highlight several important policy and practical implications for integrating RDU education across healthcare professions. First, professional councils should establish clear and consistent policies that mandate the inclusion of RDU principles within the curricula of all relevant healthcare programs (Holloway et al., 2020). These policies should be supported by comprehensive guidelines and implementation models that provide practical frameworks for incorporating RDU education across diverse professional contexts (Chuenjitwongsa, Oliver, & Bullock, 2018). RDU teaching guides should be prioritized, ensuring that faculties and institutions are aware of and utilizing these resources (Gritta et al., 2013). Faculty development programs must be implemented to train educators on how to effectively teach RDU principles (Chike-Harris, Durham, Logan, Smith, & DuBose-Morris, 2021). Additionally, the assessment of RDU competencies should be standardized across all professions, incorporating clear, measurable outcomes into national licensing exams. This will ensure that healthcare graduates are adequately prepared to apply RDU principles in practice, enhancing patient safety and the quality of care provided. The findings of this study can also serve as a resource for other health science programs, such as Public Health, Medical Technology, Physical Therapy, and Traditional and Applied Thai Medicine, to integrate RDU principles into their curricula.

Future research should evaluate the long-term impact of RDU education on clinical practice and patient outcomes, focusing on reducing medication errors and improving patient safety. Additionally, developing and validating comprehensive assessment frameworks for RDU competencies across healthcare professions is essential to ensure consistent and effective evaluation of RDU education. Expanding research to include more diverse and larger participant groups, along with employing quantitative



methods, will provide more reliable, generalizable findings. This approach will enhance understanding of RDU education's effectiveness and its broader implications for healthcare quality and patient safety.

While this study included participants from all five healthcare professional stakeholders (professional councils, dean consortiums, faculty administrators, and lecturers), several limitations may have influenced the findings. First, due to the evolving nature of RDU education efforts, some participants may not have had comprehensive knowledge of all developments since the initiatives began, potentially limiting the information they could provide. Second, most FGDs included only two professions, and one group consisted solely of participants from medicine. The absence of participants from all professions within each group discussion may have also led to incomplete views on how RDU is managed across disciplines. Additionally, only one participant was from a private institution, limiting the generalizability of the findings to private universities. Moderator bias and dominant voices in smaller groups could also have influenced the discussions, despite efforts to remain neutral. Furthermore, dominant voices in smaller groups may have skewed the conversation, limiting the diversity of perspectives. Despite these limitations, the study of clear interprofessional highlights the absence collaboration in RDU education, an important area for future research and improvement (Barbour, 2007). Data saturation might not have been fully achieved, as the study's sample was relatively small, and participants were primarily from central Thailand, limiting the generalizability of the findings to other regions or countries.

Conclusions

This study explored the integration of RDU into the curricula of five healthcare professions in Thailand. While the Memorandum of Understanding (MOU) has led to the inclusion of RDU competencies in curricula and licensing exams, the implementation remains inconsistent across institutions. Challenges include variability in teaching

methods, a lack of standardized assessments, and limited faculty awareness. Addressing these gaps through standardized evaluations and enhanced interdisciplinary collaboration is crucial to align RDU education with improved healthcare outcomes. Integrating RDU into healthcare education can significantly enhance patient safety, reduce medication errors, and combat antimicrobial resistance.

Acknowledgment

This study was supported by the National Drug Policy Division, Food and Drug Administration, Ministry of Public Health, Thailand.

Conflict of Interest

All authors declare no conflicts of interest

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Supplemental Content

Interview Schedule

(Professional councils and Dean Consortiums)

Introduction:

- Welcome and explanation of the purpose of the interview.
- Consent process and confidentiality assurance.
- Brief background on the RDU Memorandum of Understanding (MOU)

Key Topics:

Understanding RDU and its Importance

- In your view, how is rational drug use (RDU) relevant to your professional role?

Policy development and implementation

- How have policies been developed by your professional council/Dean consortium to promote RDU education in healthcare curricula?
 - O What processes have been used to communicate these policies to educational institutions?
- How has your profession designed and implemented strategies to integrate Rational Drug Use (RDU) into the curriculum?
 - Is RDU included in professional licensing exams or in the process of renewing professional licenses? If so, how is this managed?
- How is the implementation of RDU education in undergraduate programs monitored?

Support and Challenges

- How does your council/Consortium support faculties and educational institutions in integrating RDU into their curricula?
- What have been the major challenges in promoting RDU education, and how has your organization addressed these challenges?

Future Plans and Recommendations

- What are the future plans for promoting RDU education in the next 3 years?
- How can collaboration with external bodies (such as the FDA or HA) be improved to ensure a sustained focus on RDU?

Conclusion:

- Final thoughts or suggestions to further enhance RDU education.
- Thank the participants for their time and contributions.



Interview Schedule

(Faculties' administrative and lecturers)

Introduction:

- Welcome and explanation of the purpose of the interview.
- Consent process and confidentiality assurance.

Key Topics:

Perception of RDU

- How does RDU relate to your professional roles?
- What is your knowledge of the MOU signed in 2017 regarding RDU in healthcare curricula?

Curriculum Development and Integration

- What actions has your faculty taken to integrate RDU into the curriculum?
 - O Has your institute established any policies regarding Rational Drug Use (RDU) and its integration into the curriculum? If so, what are they? How are these policies implemented?
 - O What content and teaching methods are used throughout the program?

Faculty Support and Resources

- How does your institution support the integration of RDU, including resource allocation and faculty development?
 - O What strategies have been implemented to develop lecturers' capabilities to teach RDU?

Assessment

- How does your institution assess the integration of RDU into the curriculum?
- What mechanisms are used to track and evaluate students' RDU competencies and their performance?

Challenges and Success Factors

- What are the key success factors that have helped your faculty promote RDU education?
- What challenges or obstacles have you faced in implementing RDU education, and how have they been addressed?

Future Strategies

- What are your faculty's plans for promoting RDU education over the next 3 years?
- What additional support or resources do you need to ensure smooth implementation of these plans?

Conclusion:

- Final thoughts or suggestions to further enhance RDU education.
- Thank the participants for their time and contributions.