

JOURNAL OF MULTIDISCIPLINARY SCIENCE AND INNOVATION

An international online peer reviewed Journal Published by Cignix Press

Content available at www.cognixpress.in Online ISSN: XXXX-XXXX**DRUG UTILIZATION EVALUATION: METHODS, APPLICATIONS, AND ITS ROLE IN PROMOTING RATIONAL PHARMACOTHERAPY****G VENKATA NAGARAJU***Assistant Professor, Department of Pharmacy Practice, Hindu College of Pharmacy, Guntur.*

ARTICLE HISTORY	ABSTRACT
Received: 09.03.2026 Revised: 16.04.2026 Accepted: 13.05.2026	Drug Utilization Evaluation (DUE) is a systematic, criteria-based process used to assess and improve the appropriateness, safety, effectiveness, and cost-effectiveness of medication use. Irrational medicine use, including inappropriate prescribing, polypharmacy, incorrect dosing, unnecessary antimicrobial therapy, and poor adherence to treatment guidelines, remains an important public-health concern. DUE provides a structured approach for identifying medication-use problems and developing interventions to optimize pharmacotherapy. It may be conducted prospectively, concurrently, or retrospectively and can evaluate prescribing, dispensing, administration, and patient outcomes. [Drug utilization research commonly uses the Anatomical Therapeutic Chemical (ATC) classification and Defined Daily Dose (DDD) methodology to quantify and compare medicine consumption across populations and healthcare settings. Patient-level DUE further evaluates clinical parameters such as indication, dose, duration, contraindications, drug interactions, therapeutic response, adverse drug reactions, and adherence to evidence-based guidelines. Data may be obtained from prescriptions, medical records, pharmacy databases, electronic health records, insurance claims, hospital information systems, and dispensing records. Appropriate selection of study design, criteria, indicators, and data sources is essential for generating meaningful findings. DUE can support antimicrobial stewardship, formulary management, medication safety, pharmacoeconomic evaluation, and quality-improvement programs. Effective DUE requires multidisciplinary collaboration among pharmacists, physicians, nurses, epidemiologists, and healthcare administrators. Continuous monitoring followed by targeted educational, administrative, or clinical interventions can improve prescribing quality and patient outcomes. Thus, DUE represents an important component of rational pharmacotherapy and evidence-based healthcare.
Keywords: Drug utilization evaluation; Rational pharmacotherapy; Drug utilization research; ATC/DDD; Medication safety; Rational drug use. *Communication Author Dr. Konda Ravi Kumar	

INTRODUCTION

Medicines are fundamental components of modern healthcare; however, their benefits depend largely on appropriate selection, dosing, duration, monitoring, and patient adherence. Rational use of medicines requires patients to receive medicines appropriate to their clinical needs, in individualized doses, for an adequate duration, and at the lowest appropriate cost to the patient and community [1]. Irrational medicine use may involve polypharmacy, inappropriate antimicrobial prescribing, unnecessary injections, non-adherence to treatment guidelines, inappropriate self-medication, and incorrect dosing [2].

Drug Utilization Evaluation (DUE), also referred to as Drug Utilization Review (DUR) in many settings, is an ongoing and systematic process in which medicine use is evaluated against predetermined evidence-based criteria [3]. The purpose is not merely to identify prescribing errors but to improve the complete medication-use process and ultimately patient outcomes. Drug utilization research has developed into an interdisciplinary field incorporating clinical pharmacology, epidemiology, pharmacy practice, health services research, pharmacoeconomics, and public health. The World Health Organization (WHO) emphasizes drug utilization research as an important means of assessing whether drug therapy is rational and identifying opportunities for improvement [4-6].

CONCEPT OF DRUG UTILIZATION EVALUATION

DUE is a structured, criteria-based evaluation of medication use at the individual patient or population level. It can assess whether medicines are prescribed and used appropriately according to clinical indications, therapeutic guidelines, patient characteristics, safety considerations, and economic principles.

DUE may focus on a specific medicine, therapeutic class, disease condition, patient population, or prescribing problem.

Typical evaluation criteria include:

- Appropriate indication
- Correct medicine selection
- Appropriate dose and route
- Appropriate frequency and duration
- Contraindications and precautions
- Drug-drug and drug-disease interactions
- Laboratory and clinical monitoring
- Therapeutic effectiveness
- Adverse drug reactions
- Medication adherence
- Cost-effectiveness

A major strength of DUE is that it converts general concerns regarding irrational drug use into measurable criteria that can be evaluated consistently.

OBJECTIVES OF DRUG UTILIZATION EVALUATION

The major objectives of DUE include:

1. Promoting rational and evidence-based prescribing.
2. Improving medication safety and therapeutic outcomes.
3. Identifying inappropriate prescribing and medication-related problems.
4. Evaluating compliance with standard treatment guidelines.
5. Reducing preventable adverse drug reactions and drug interactions.
6. Controlling unnecessary medication expenditure.
7. Supporting formulary and drug-selection decisions.
8. Improving antimicrobial prescribing and stewardship.
9. Identifying opportunities for pharmacist-led interventions.
10. Monitoring the effect of interventions on prescribing practices.

DUE therefore functions as both an evaluative and quality-improvement mechanism [3,7].

TYPES OF DRUG UTILIZATION EVALUATION

DUE is commonly classified according to the timing of evaluation.

1. Prospective DUE

Prospective DUE evaluates medication therapy before a medicine is dispensed or administered. Pharmacists or other healthcare professionals assess prescriptions against predefined criteria. Potential problems such as excessive doses, contraindications, allergies, therapeutic duplication, and drug interactions can therefore be identified before they reach the patient.

2. Concurrent DUE

Concurrent DUE occurs while the patient is receiving treatment. It allows healthcare professionals to evaluate the ongoing appropriateness of therapy and modify treatment when necessary. Monitoring may include laboratory parameters, therapeutic response, adverse effects, and treatment duration.

3. Retrospective DUE

Retrospective DUE examines medication use after treatment has occurred. Patient records, prescriptions, dispensing data, or electronic health records are reviewed against predetermined criteria. This approach is particularly useful for identifying prescribing trends, assessing guideline adherence, and designing educational interventions.

These three approaches can complement one another and may be incorporated into continuous medication-use improvement programs [3,5, 8].

METHODS USED IN DRUG UTILIZATION EVALUATION

A successful DUE begins with clearly defining the medication-use problem, population, study objectives, evaluation criteria, data sources, and outcome measures. WHO guidance recommends selecting data sources according to the research question, such as prescribing, dispensing, utilization, indication, dose, duration, and patient characteristics.

1. Prescription and Medical Record Review

Prescription and medical record reviews provide patient-specific information about diagnosis, prescribed medicines, dose, frequency, duration, laboratory findings, comorbidities, and clinical outcomes. They are particularly useful for hospital-based DUE studies.

2. Pharmacy and Dispensing Data

Pharmacy databases can be used to examine medicine consumption, refill patterns, adherence, generic substitution, expenditure, and changes in utilization over time.

3. Electronic Health Records and Claims Data

Electronic health records and health insurance claims provide large-scale data that can be used for population-level utilization research. Individual-level dispensing data can also support analyses of treatment initiation, persistence, adherence, polypharmacy, and prescribing quality [8].

4. ATC/DDD Methodology

The Anatomical Therapeutic Chemical (ATC) classification system categorizes medicines according to their anatomical, therapeutic, pharmacological, and chemical characteristics. The Defined Daily Dose (DDD) represents the assumed average maintenance dose per day for a medicine used for its main indication in adults.

ATC/DDD methodology permits comparison of medicine utilization between hospitals, regions, countries, and time periods despite differences in brand names, package sizes, dosage forms, and pricing. WHO recommends ATC/DDD as an international standard for drug utilization monitoring and research.

Common utilization measures include DDD/1,000 inhabitants/day, DDD/100 bed-days, prescription rates, treatment prevalence, incidence of medicine use, and expenditure.

5. Drug Utilization 90% Method

The Drug Utilization 90% (DU90%) method identifies the medicines accounting for approximately 90% of total utilization based on DDDs. It can be used alongside treatment guidelines to examine prescribing quality and variations between healthcare facilities [9]. The method is simple and inexpensive but should be supplemented with medicine-specific quality indicators because high utilization alone does not necessarily indicate inappropriate use.

EVALUATION CRITERIA AND QUALITY INDICATORS

DUE requires explicit criteria against which actual medicine use can be compared. Criteria may be developed from national treatment guidelines, hospital formularies, regulatory recommendations, systematic reviews, clinical practice guidelines, and expert consensus.

Important indicators include the proportion of prescriptions with appropriate indications, percentage of medicines prescribed by generic name, adherence to recommended dose and duration, frequency of therapeutic duplication, incidence of potential drug interactions, antimicrobial guideline compliance, and frequency of preventable adverse drug reactions.

WHO prescribing indicators can also be incorporated into drug utilization studies to assess prescribing patterns. Prescription monitoring studies have demonstrated that guideline non-adherence can contribute to treatment failure, antimicrobial resistance, adverse outcomes, and increased economic burden [10].

APPLICATIONS OF DRUG UTILIZATION EVALUATION

1. Antimicrobial Stewardship

DUE is particularly valuable in antimicrobial stewardship. Evaluation of antibiotic selection, dose, route, duration, culture-directed therapy, and de-escalation can identify inappropriate antimicrobial use and support interventions to reduce antimicrobial resistance.

2. Hospital Pharmacy Practice

Hospital pharmacists can use DUE to monitor high-risk or high-cost medicines, including anticoagulants, antimicrobials, antidiabetic agents, antiepileptic drugs, and biologic medicines. Findings may support formulary decisions and medication-safety initiatives.

3. Pharmacoeconomics

DUE can identify unnecessary expenditure caused by inappropriate drug selection, excessive duration, therapeutic duplication, or use of expensive medicines when suitable alternatives exist. However, cost should be considered alongside clinical effectiveness and patient safety rather than as an isolated outcome.

4. Medication Safety

DUE can identify preventable medication-related problems such as inappropriate dosing, contraindications, drug interactions, therapeutic duplication, and inadequate monitoring. This makes DUE an important component of medication-safety programs.

5. Chronic Disease Management

In chronic diseases such as hypertension, diabetes, asthma, and cardiovascular disorders, DUE can assess adherence to treatment guidelines, appropriate combination therapy, persistence with treatment, and monitoring of therapeutic outcomes.

ROLE OF PHARMACISTS IN DUE

Pharmacists have an important role in designing, implementing, and evaluating DUE programs because of their expertise in pharmacotherapy, medication safety, drug interactions, dosing, and medicine-use processes. Pharmacist-led DUE can include prescription screening, clinical intervention, provider feedback, patient counseling, formulary management, and follow-up monitoring.

DUE is most effective when conducted as a multidisciplinary activity involving physicians, pharmacists, nurses, clinical pharmacologists, epidemiologists, and healthcare administrators. WHO emphasizes multidisciplinary collaboration as an important requirement for successful drug utilization research and rational medicine use.

INTERVENTIONS FOLLOWING DUE

Identification of inappropriate medicine use is only the first step. Findings should be followed by appropriate interventions. These may include:

- Prescriber education and feedback
- Development or revision of treatment guidelines
- Formulary restrictions
- Clinical decision-support systems
- Pharmacist interventions
- Audit and feedback
- Patient education
- Antimicrobial stewardship programs
- Medicine-use policies
- Reassessment after intervention

The effectiveness of an intervention should subsequently be evaluated using the same or comparable indicators. This creates a continuous quality-improvement cycle. Prescription monitoring studies suggest that systematic monitoring can provide useful information for improving rational medicine use.

CHALLENGES AND LIMITATIONS

Despite its usefulness, DUE has several limitations. The quality of findings depends on the availability and accuracy of data. Incomplete medical records, inconsistent documentation, limited access to prescribing information, and differences between institutions may affect interpretation.

ATC/DDD methodology is valuable for population-level comparisons but does not necessarily represent the actual prescribed or consumed dose for an individual patient. Therefore, DDD-based measures should not be interpreted as direct measures of individual treatment appropriateness.

Another challenge is selecting appropriate evaluation criteria. Criteria that are too broad may fail to identify clinically important problems, whereas excessively restrictive criteria may classify appropriate individualized therapy as inappropriate. Resistance from prescribers, limited resources, inadequate information systems, and insufficient follow-up can also reduce the effectiveness of DUE programs [6,8,10].

FUTURE PERSPECTIVES

The future of DUE is closely linked to electronic health records, clinical decision-support systems, artificial intelligence, real-world data, and advanced analytical methods. Large healthcare databases can facilitate longitudinal monitoring of prescribing trends and medicine use in different patient populations. Modern drug utilization research also incorporates qualitative approaches, advanced statistical methods, visualization, and comparative effectiveness research [11, 12].

Automated alerts may help identify inappropriate prescribing in real time, while machine-learning approaches may assist in detecting complex medication-use patterns. However, these technologies require appropriate validation, data quality, transparency, privacy protection, and clinical oversight.

CONCLUSION

Drug Utilization Evaluation is an important component of rational pharmacotherapy and healthcare quality improvement. It provides a systematic framework for assessing whether medicines are selected, prescribed, dispensed, administered, and monitored appropriately. The integration of patient-level DUE with population-level drug utilization research, ATC/DDD methodology, prescribing indicators, and evidence-based treatment guidelines provides a comprehensive approach to improving medicine use. Effective DUE programs can contribute to improved medication safety, better therapeutic outcomes, antimicrobial stewardship, cost containment, and more rational allocation of healthcare resources. Continued multidisciplinary collaboration and the integration of electronic health data and advanced analytical methods will further strengthen the role of DUE in evidence-based clinical practice.

REFERENCES

1. World Health Organization. Introduction to drug utilization research. Geneva: World Health Organization; 2003.
2. World Health Organization. Promoting rational use of medicines: core components. Geneva: World Health Organization; 2002.
3. Fick DM, Semla TP, Beizer J, Brandt N, Dombrowski R, DuBeau CE, et al. Drug utilization review. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026.
4. World Health Organization Collaborating Centre for Drug Statistics Methodology. ATC/DDD Index and ATC/DDD methodology. Oslo: Norwegian Institute of Public Health; 2026.
5. Fulda TR. Current status of prospective drug utilization review. *J Manag Care Pharm.* 2004;10(5):433-441.
6. Elseviers M, Wettermark B, Almarsdottir AB, Andersen M, Benko R, Bennie M, et al, editors. Drug utilization research: methods and applications. 2nd ed. Chichester: Wiley; 2024.
7. World Health Organization. Methods to analyse medicine utilization and expenditure to support pharmaceutical policy implementation. Copenhagen: WHO Regional Office for Europe; 2021.
8. Topp L, et al. Core concepts in pharmacoepidemiology: measures of drug utilization based on individual-level drug dispensing data. *Pharmacoepidemiol Drug Saf.* 2022;31(10):1001-1011.
9. Bergman U, Popa C, Tomson Y, Wettermark B, Einarson TR, Aberg H, et al. Drug utilization 90%--a simple method for assessing the quality of drug prescribing. *Eur J Clin Pharmacol.* 1998;54(2):113-118.
10. Jain S, Upadhyaya P, Goyal J, Kumar A, Jain P, Seth V, et al. A systematic review of prescription pattern monitoring studies and their effectiveness in promoting rational use of medicines. *Perspect Clin Res.* 2015;6(2):86-90.
11. Hogerzeil HV. Promoting rational prescribing: an international perspective. *Br J Clin Pharmacol.* 1995;39(1):1-6.
12. Bergman U, Wettermark B. Drug utilization research: methods and applications. In: Elseviers M, Wettermark B, Almarsdottir AB, Andersen M, Benko R, Bennie M, et al, editors. Drug utilization research: methods and applications. Chichester: Wiley; 2016.