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Research Article

Analysis Of Drug Utilization Patterns In The Intensive Care Unit Of A Tertiary Care Hospital Using Who Core Prescribing Indicators: A Retrospective Study

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ABSTRACT

Objective: The aim of this study was to analyze the drug utilization patterns in the Intensive Care Unit (ICU) of a tertiary care hospital using the World Health Organization (WHO) core prescribing indicators.

Methods: A retrospective analysis of medication prescriptions in the ICU was conducted. The WHO core prescribing indicators, including the average number of drugs per prescription, percentage of prescriptions involving injections, percentage of prescriptions involving antibiotics, percentage of drugs prescribed by generic name, and percentage of drugs prescribed from the Essential Drug List/Formulary, were calculated.

Results: The study included 100 patients admitted to the ICU. The average number of drugs prescribed per patient was found to be 11.2 , exceeding the recommended norm. Injections were prescribed in 78% of the prescriptions, which surpassed the ideal threshold. Antibiotics were prescribed in 99% of the prescriptions, significantly higher than the standard range. The percentage of drugs prescribed by generic name was 14.1%, indicating scope for improvement. The percentage of drugs prescribed from the Essential Drug List/Formulary was 50.17%, demonstrating moderate adherence.

Conclusion: The analysis of drug utilization patterns in the ICU highlighted areas of concern, such as polypharmacy, excessive use of injections, and high antibiotic prescribing rates. These findings emphasize the need for interventions to optimize prescribing practices, promote rational drug use, and enhance adherence to essential drug lists. Addressing these patterns can improve patient outcomes, reduce healthcare costs, and mitigate the risks associated with inappropriate medication use in the ICUcosts, and mitigate the risks associated with inappropriate medication use in the ICU.

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INTRODUCTION

Drug utilization patterns in the intensive care unit (ICU) play a crucial role in patient care and treatment outcomes. Understanding these patterns is essential for optimizing drug therapy, improving patient safety, and reducing healthcare costs. Appropriate utilization of medications is crucial in reducing global morbidity and mortality rates. Unfortunately, the World Health Organization (WHO) has reported that a significant portion of medicines, approximately 50%, are prescribed, dispensed, or sold inappropriately. Furthermore, more than half of all patients do not adhere to their prescribed or dispensed medications. Such inappropriate use of medicines not only wastes resources but also poses risks to patients, leading to unsatisfactory treatment outcomes, serious adverse events, and the development of antimicrobial resistance (AMR) [1, 2].

To address these issues and promote rational drug use, the WHO has developed and validated core drug use indicators for prescribing, patient care, and facility-specific studies that provide a standardized framework for assessing drug utilization practices.. These indicators serve as performance measures for prescribers and assess five key areas: average number of drugs per prescription, percentage of drugs prescribed by generic name, percentage of prescriptions containing antibiotics, percentage of prescriptions containing injectable drugs, and percentage of drugs prescribed from the latest edition of national Essential Drug Lists (EDL) or formulary.[3,4]

The ICU is a specialized unit that provides critical care to patients with life-threatening conditions, requiring advanced medical interventions and close monitoring. In this high-stress environment, the appropriate use of medications is of paramount importance to ensure optimal patient outcomes. However, the complexity and severity of patients' conditions in the ICU often lead to complex medication regimens, polypharmacy, and potential drug interactions.

By conducting a retrospective analysis of drug utilization patterns in the ICU, this study aims to identify potential areas for improvement in prescribing practices. The findings of this study will contribute to enhancing the quality of patient care, optimizing medication use, and promoting rational prescribing practices.

In conclusion, understanding drug utilization patterns in the ICU is crucial for optimizing patient care. This study seeks to analyze the drug utilization patterns in the ICU of a tertiary care hospital using the WHO core prescribing indicators. The findings of this study will contribute to enhancing prescribing practices, improving patient safety, and promoting rational drug use in the ICU setting.

METHODOLOGY

The Retrospective and Observational study utilized a comprehensive analysis of medical records from the Intensive Care Unit of tertiary care hospital in Dakshina Kannada, focusing on prescription patterns. A sample size of 100 patients was included in the study. The study was conducted for duration of 6 months.

ETHICAL CLEARANCE:

The study protocol was approved by the Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science and Research Centre (SIMS & RC), Mangalore.

STUDY CRITERIA

Inclusion criteria:

•Patients who were admitted in the Intensive Care Unit.

Exclusion criteria:

•Patients who were not admitted in Intensive Care Unit

SOURCE OF DATA:

Data(s) for the study were collected using data collection form from the case files of MRD of Srinivas Hospital Mukka, Mangalore.

OPERATIONAL MODALITY:

This retrospective and observational study was conducted over a period of 6 months in the intensive care unit (ICU) of a tertiary care hospital in Dakshina Kannada, aimed at analyzing the prescription patterns of patients admitted to the ICU. The study methodology was divided into three phases.

Phase 1: Preparation

In this phase, a data collection form was prepared to gather relevant information from the patients' case files. The form included demographic details, duration of ICU stay, diagnosis, and prescription details such as drug names, strengths, doses, and indications.

Phase 2: Data Collection

After obtaining ethics approval, the research team visited Srinivas Hospital in Mukka and collected patients' case files from the Medical Records Department (MRD) based on predefined inclusion and exclusion criteria. The required information was then filled in the data collection form.

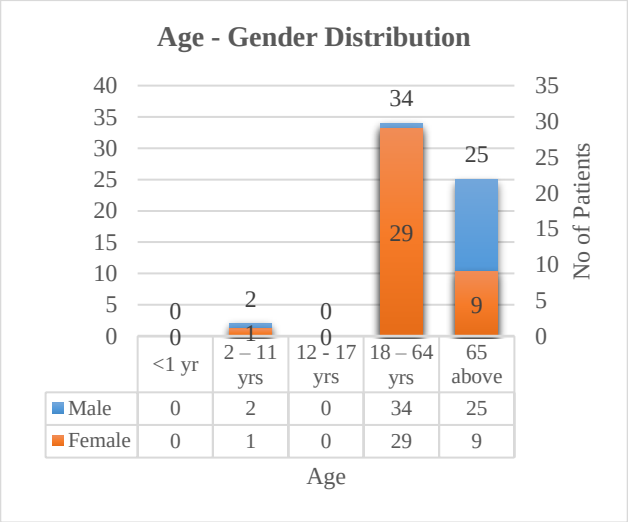
Phase 3: Data Analysis

Using the collected data, the rationality of prescriptions was evaluated using the World Health Organization (WHO) core prescribing indicators. These indicators included determining the average number of drugs per prescription, the percentage of injections and antibiotics prescribed, commonly prescribed drugs and drug categories, whether prescriptions were in generic form, and if they were from the Essential Medicine List.

Data analysis was performed using Microsoft Excel 2021

RESULTS

A retrospective observational study was conducted in intensive care unit in tertiary care hospital over period of six months. The prescription data of 100 patients was collected and analyzed. Among the 100 patients, number of male patients admitted (61%) was higher than number of admitted female patients (39%) and male to female ratio was 3:2. The most frequent age was 18 – 64 years group (63%, n=63) with males representing 54% (n=34) and females representing 46% (n=29). 25 males and 9 females were in the group of 65 above years of age which constitutes 34% of the research subjects.



Average number of Drugs per prescription

The assessment of drug utilization patterns in the intensive care unit (ICU) of a tertiary care hospital using WHO prescribing indicators revealed an important metric for measuring the degree of polypharmacy: the average number of drugs per prescription. In this study, the average number of drugs prescribed per patient was found to be 11.2, which exceeded the average number recommended by WHO guidelines.

The higher average number of drugs per prescription can be attributed to the presence of multiple co-morbid conditions among the ICU patients. These complex medical conditions often require a more extensive and diverse range of medications to manage effectively. Additionally, the prolonged length of stay in the ICU further contributes to the need for multiple medications, as patients may require various treatments and interventions over an extended period.

The observed polypharmacy in the ICU setting highlights the importance of comprehensive medication management strategies. Healthcare

professionals in the ICU must carefully evaluate the appropriateness and necessity of each medication prescribed to minimize the risks associated with polypharmacy, such as adverse drug reactions, drug interactions, and medication errors.

Percentage of encounters with an Antibiotic prescribed

In our analysis of drug utilization patterns in the intensive care unit (ICU) of a tertiary care hospital using WHO prescribing indicators, we found that the percentage of prescriptions involving injections was remarkably high at 99%, surpassing the established standard for ideal prescribing. This finding can be attributed to several factors inherent to our study setting within a hospital where patients with serious and critical conditions are treated.

The use of injectable medications often offers a faster onset of action, which is particularly crucial in the ICU where prompt and immediate therapeutic interventions are often required. In emergency situations or when patients' conditions rapidly deteriorate, injections provide a more rapid and reliable delivery method compared to oral or other routes of administration. This preference for injections in the ICU setting can be seen as a result of the urgency and critical nature of the patients' medical conditions.

It is important to note, however, that while injections may offer benefits in terms of speed and efficacy, their excessive use can also lead to potential risks, such as increased healthcare costs, higher rates of medication errors, and an elevated risk of infections at the injection site.

Percentage of encounters with an Injection prescribed

In our analysis of drug utilization patterns in the intensive care unit (ICU) of a tertiary care hospital using WHO prescribing indicators, we observed a significantly high percentage of prescriptions involving antibiotics, which stood at 78%. This finding surpassed the standard range of 20.0% to 26.8% established as the ideal benchmark for antibiotic prescribing.

Ceftriaxone and Meropenem emerged as the most frequently prescribed antibiotics, accounting for 7.32% and 1.8% of all prescriptions, respectively. The high utilization of antibiotics can be attributed to several factors, including the severity of patients' conditions in the ICU, where infections are common and require aggressive treatment. Additionally, the ICU setting often involves patients with compromised immune systems or those who have undergone invasive procedures, thereby increasing the risk of acquiring or developing infections

Percentage of generic and brand drugs utilized in ICU

In spite of various benefits like low cost of drug therapy, increased patient adherence and equivalent therapeutic benefits as brand name alternatives, generic prescribing is not a common practice in India. The branded alternative should be opted only if generic drugs option is not feasible[6]. American Academy of family physicians recommends prescribing drugs in generic forms as strategy to avoid high cost of drug therapy. In this study lower proportion of drugs prescribed as generics i.e., out of 100 prescriptions, 17% of prescription did not have any drugs prescribed by generic names,40% of prescription had 1 drug prescribed in generic name, 35% of prescriptions had 2 - 3 drugs prescribed in generic name, and 4% of prescription had 4 - 5 drugs prescribed in generic name. A total of 1120 drugs were identified during the study, 158 (14.1%) were prescribed in generic name and 962 (85.89%) by brand names.

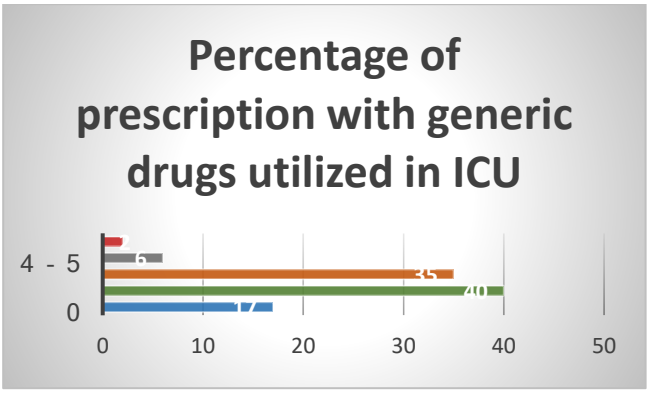


Fig 05: Percentage of prescription with generic drugs utilized in ICU

Percentage of Drugs prescribed from WHO Essential Medicine List

Essential drugs offer a cost-effective solution to many health problems in a developing country. Knowledge availability and access to drugs in the essential list of drugs promote rational therapeutics. Out 100 prescriptions,22% prescriptions had 4 drugs prescribed from WHO-EML,17% of prescription had 6 drugs,13% of prescription had 5 drugs,10% of prescription had 7 drugs,6% of prescription had 10-15 drugs prescribed from WHO-EML. In the present study, utilization of WHO – EML was poorly observed (n=562, 50.17% of drugs). This proportion should be higher since list of drugs is prepared with regard to public health relevance, evidence on efficacy and safety of the drugs, and comparative cost - effectiveness.

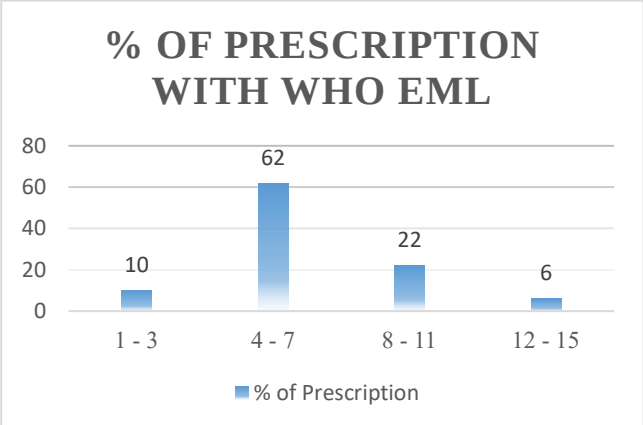


Fig 06: Percentage of drugs used from WHO - EML

Drug use indicators (Prescribing indicators) by WHO

The assessment of drug utilization patterns in the ICU using WHO core prescribing indicators is crucial in evaluating the rationality of medication prescribing. In this study, we examined several key indicators. Firstly, the average number of drugs prescribed per patient was found to be 11.2, exceeding the recommended norms. This highlights the presence of polypharmacy in the ICU, which could be attributed to the complex and prolonged nature of patients' conditions.

Another significant finding was that the percentage of prescriptions involving injections was remarkably high at 99%, surpassing the ideal standard. This can be attributed to the acuity and criticality of patients in the ICU, where rapid therapeutic interventions are often necessary, and injections provide faster onset of action.

Moreover, the percentage of prescriptions involving antibiotics was found to be 78%, significantly higher than the recommended standard range. This indicates potential overuse of antibiotics in the ICU, which can contribute to antibiotic resistance and other adverse outcomes.

In terms of prescribing practices, the percentage of drugs prescribed by their generic names was 14.1%, suggesting room for improvement in promoting generic prescribing. Additionally, the percentage of drugs prescribed from the Essential Drug List/Formulary was 50.17%, indicating moderate adherence to formulary guidelines.

These findings underscore the importance of optimizing drug prescribing practices in the ICU, including rationalizing polypharmacy, reducing unnecessary injections, and promoting appropriate antibiotic use. Encouraging the use of generic names and adherence to essential drug lists can also contribute to more cost-effective and evidence-based prescribing practices. Addressing these patterns identified through the WHO prescribing indicators can lead to improved patient

outcomes, enhanced patient safety, and more efficient healthcare delivery in the ICU setting.

Table 07: WHO Core Prescribing Indicators

Indicators	WHO Standard Value	Observed Value
Average no. of Drugs per encounter	1.6 – 1.8	11.2
Percentage of encounters with an Antibiotic prescribed	20.0 – 26.8	78%
Percentage of encounters with an Injection prescribed	13.4 – 24.1	99%
Percentage of Drugs prescribed by Generic Name	100.0	14.1%
Percentage of Drugs prescribed from Essential Drug List/ Formulary	100.0	50.17%

DISCUSSION

Intensive Care Unit is a potential area for drug-related problems. The patients who are critically ill and with multiple complications are admitted. The pharmacological management of these patients is usually complex and typically involves the administration of several classes of drugs that make them more susceptible to medication error, poor treatment response, adverse drug reactions and also raises the health care costs, patient morbidity and mortality. Hence prescription analysis was conducted in Intensive care unit using WHO core drug use indicators with objective of studying pattern of drug use and determining the rationality of prescriptions.

WHO developed core and complementary drug use indicators for evaluation of drug use in healthcare settings among which, the core drug use indicators have been considered as the first line indicators validated by WHO for measurement of rationality of drug use. These indicators include average number of drugs per prescription, percentage of drugs prescribed by generic names, percentage of prescription with an antibiotic, percentage of prescription with an injection and percentage of drugs prescribed from the essential drug list.[5]

The average number of drugs per prescription is an important index of a prescription audit. It should be kept as low as possible to minimize the risk of drug interactions (polypharmacy), development of bacterial resistance, and hospital costs.[6] In the present study the average number of drugs prescribed per prescription was 11.2 with maximum of 23 drugs per prescription which is more than the average number (2) recommended by WHO. This is due to multiple co-morbid conditions lead to higher length of stay in ICU and consequently multiple medications. This finding was similar to study by Patanik SK *et al* [7]and Barot PA *et al* [8]but higher than study done by Kaur *et al* [9]. and Singh et al 4.9 and 3.6 drugs per prescription respectively.

Severe or life-threatening infections are common among patients in the intensive care unit (ICU). Irrational over usage of antibiotics leads to development of drug resistant bacterial strains[10]. WHO considers antibiotic resistance to be one of the biggest threats to global health, food security and development as of today[11]. In this study besides treatment of infections, antibiotics are administered as prophylaxis to prevent nosocomial infections. This led to the increased percentage of prescription with antibiotics prescribed when compared to WHO standard (20-26.8%) but lower than study by Adhikari K *et al*[6](100%).

The percentage of prescription in which an injection was prescribed in this study was higher than the standard (13.4%-24.1%). The results of other studies done by Kaur *et al* [9]and Patel *et al* [12] documented that injections were the most frequent route of administration. Since patients admitted in ICU suffer from severe diseases and need rapid interventions, injections were found to

be the most frequently prescribed which provide immediate onset of action[13].

Generic prescribing and use of essential medicine are important parameter to evaluate the rational use of medicine (RUM).[6] In spite of various benefits like low-cost therapy, better patient compliance and similar therapeutic benefits as that of branded alternative generic prescribing is not common in India. The branded alternative should be opted only if generic drug option is not feasible.[14] In the present study, utilization of generic medicines was poorly observed compared to study done by Rakesh *et al* [15]and Shinde RM *et al*[14].

Essential drugs offer a cost-effective solution to many health problems in a developing country. Knowledge, availability and access to drugs in the WHO-EML promote rational therapeutics. Drugs prescribed from the WHO essential medical list comprised only of 50%, which was lower than WHO standard value (100%). This was similar to study conducted by Shinde RM *et al*[14] and Al-zakwani *et al*[13] reported 47% and 52%of drugs prescribed from WHO essential list of medicine. This proportion should be higher since this list of drugs is prepared with regard to public health relevance, evidence on efficacy and safety of the drugs, and comparative cost effectiveness[9,14].

CONCLUSION

The study conducted in the Intensive Care Unit (ICU) of a tertiary care hospital aimed to analyze the drug utilization patterns using the World Health Organization (WHO) core prescribing indicators. These indicators are widely recognized as a validated method to assess the rationality of drug use. The study evaluated various parameters such as the average number of drugs per prescription, percentage of drugs prescribed by generic names, percentage of prescriptions with antibiotics, percentage of prescriptions with injections, and percentage of drugs prescribed from the essential drug list.

The findings of the study revealed several important insights. Firstly, the utilization of generic medicines was observed to be poor compared to previous studies, indicating a lack of adherence to generic prescribing practices in India. Generic prescribing offers numerous benefits, including lower costs and better patient compliance, and it should be encouraged unless there are specific reasons to opt for branded alternatives.

Secondly, the average number of drugs per prescription was significantly higher than the WHO recommendation. This can increase the risk of drug interactions, bacterial resistance, and overall healthcare costs. The higher number of drugs prescribed in the ICU can be attributed to the complex nature of critically ill patients with multiple co-morbid conditions, leading to the need for multiple medications.

Thirdly, the percentage of prescriptions with injections was higher than the standard, indicating a preference for injections as the route of administration in the ICU. This is understandable considering the need for rapid interventions in severely ill patients. However, it is essential to ensure that injections are prescribed judiciously and only when necessary, as they can have associated risks and costs.

Furthermore, the study found that only 50% of the drugs prescribed were from the WHO essential drug list, which is lower than the recommended standard. The essential drug list promotes rational therapeutics by providing cost-effective solutions and ensuring the availability of drugs based on evidence of efficacy, safety, and cost-effectiveness. Increasing the proportion of drugs prescribed from the essential drug list can contribute to improved healthcare outcomes and cost savings.

Lastly, the percentage of prescriptions with antibiotics was higher than the WHO standard but lower than another study cited. Antibiotics are

crucial for treating severe infections and preventing nosocomial infections in the ICU. However, irrational overuse of antibiotics can lead to the development of drug-resistant bacterial strains, posing a significant threat to global health. It is important to strike a balance between appropriate antibiotic use and the prevention of antibiotic resistance.

In conclusion, the analysis of drug utilization patterns in the ICU using WHO core prescribing indicators highlights areas of concern such as poor utilization of generic medicines, a high average number of drugs per prescription, overreliance on injections, and suboptimal adherence to the essential drug list. Addressing these issues through interventions aimed at promoting rational drug use can improve patient outcomes, reduce costs, and mitigate the risks associated with medication errors, adverse drug reactions, and antibiotic resistance.

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