

# WHO/INRUD Drug Prescribing Indicators in the Emergency Ward of a Teaching Hospital, South East of Iran

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## Abstract

**Background:** Rational drug use is an important issue in all healthcare settings. Core drug use indicators have been developed by World Health Organization/ International Network for Rational Use of Drugs (WHO/INRUD). The prescribing indicators measure healthcare providers' performance in five key areas of drug usage. The aim of this study was to evaluate WHO/INRUD indicators of prescribing in emergency ward of a teaching hospital.

**Methods:** This descriptive cross-sectional study was carried out in Emergency Ward of teaching hospital from March 2022 – March 2023. A standard prescribing indicators form was utilized to collect the required data using WHO drug prescribing indicators. Besides the rate of intravenous fluids and narcotic analgesics administration was evaluated. Index of rational drug prescribing (IRDP) was also calculated for each month and the mean of 12 IRDPs represent the emergency ward IRDP. Descriptive statistics were used for analysis.

**Results:** Antibiotics were prescribed in 34% of studied prescriptions and ceftriaxone was the most widely used antibiotic (33.8%). Index of rational drug prescribing (IRDP) was 0.73 for polypharmacy, 0.93 for generic name prescribing, 0.88 for antibiotic prescribing, 0.1 for injectable drug use and 1 for formulary-based drug prescription. Total IRDP for the emergency ward was 3.64 (from optimal value of 5). IV fluids and narcotics were prescribed in 61.1% and 8.3% of studied prescription respectively.

**Conclusion:** We concluded that although our overall IRDP value is below the WHO standard but it is about other neighbor countries. Our condition regarding IV drug administration showed a huge difference with WHO standards. It shows we need more input and regulations in this regard.

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**Keywords:** Prescribing Indicators; Emergency; Drug Use Evaluation

## Introduction

Medicines are the crucial component of all healthcare systems. In fact, prescription of medicines is the requisite of doctor visits (1). One of the most important factors that can affect the public confidence in health systems is availability of different medications in societies. Appropriate use of medicines can decrease rate of drug wastage and healthcare budget as well as increase the chance of better drug distribution in societies. It also improves the efficiency of drug therapy and reduces drug related problems all over the world (2,3). Unfortunately rate of inappropriate drug administration is relatively

high around the world especially in developing country (4,5). Therefore, improvement in drug use behaviors is an important aspect of public health.

In the early nineties, the WHO collaborated with the International Network for Rational Use of Drugs (INRUD) to develop a set of "core drug use indicators." The indicators measure performance in three related areas of "prescribing practices, patient care, and facility-specific factors" (6). The prescribing indicators measure healthcare providers' performance in five key areas as follows; Average number of medicines per encounters, percentage of medicines prescribed by

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generic name, percentage of encounters with an antibiotic prescribed, percentage of encounters with an injection prescribed and percentage of medicines prescribed from the essential medicines list (or hospital formulary).

These indicators are usually evaluated and reported by healthcare officials (9,10). But there was not any study evaluating WHO prescribing indicators in our hospital. Therefore, we decided to evaluate these indicators. These values can be used as a guide for our healthcare system providers to distinguish present drawbacks and figure out useful solutions. It would also provide policy makers with valuable information for upgrading current strategies on drug prescribing practices.

## Methods

This descriptive cross-sectional study was conducted in Emergency Ward of Amir- al Momenin hospital affiliated to Zabol university of medical sciences from March 2022 – March 2023. This research was approved by ethic committee of Zabol university of medical sciences (IR. ZBMU.REC.1402.046). We selected 100 electric prescriptions from each month using systematic random sampling from central pharmacy database. Total number of 1200 prescriptions were analyzed.

A standard prescribing indicators form was utilized to collect the required data using WHO drug prescribing indicators (7). A pilot study was conducted in which 50 prescriptions were reviewed to ensure the availability of the required data. The following WHO/ INRUD prescribing indicators were used in this study and were calculated using standard methods (7):

- 1- Average number of drugs prescribed per encounter (percentage of prescriptions with  $\leq 3$  drug was calculated whether the patient actually received the drugs or not) with Optimal level:  $\leq 3$ .
- 2- Percentage of drugs prescribed by generic name with optimal level: 100%.
- 3- Percentage of patient encounters with an antibiotic prescribed with optimal level:  $\leq 30\%$ .
- 4- Percentage of patient encounters with an injection prescribed with optimal level:  $\leq 10\%$ .
- 5- Percentage of drugs prescribed from the national EDL or the facility's formulary with Optimal level: 100%

Besides all these 5 indices, we also evaluated the rate of IV fluids as well as narcotic analgesics ordered in emergency ward prescriptions.

Indices were calculated for each prescribing indicator by dividing the optimal values by the actual values obtained. All the indicators had the same optimal index of 1. The closer to 1, the more rational a drug use indicator. The total index of rational drug prescribing (IRDP) was calculated for each month adding the values of all 5 indices described above, using the method of Dong et al. (8). This enabled us to rank months of the year based on IRDP. The overall IRDP value for this center was calculated using the mean value, of IRDPs from different months for all of 5 indices.

Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 25.0, Armonk, NY: IBM Corp.) was used for analysis of data. Descriptive statistics such as frequencies, percentages, mean and standard deviation were calculated. Differences between months regarding prescribing indicators were tested using chi-square test. The statistical significance was determined by a P-value  $< 0.05$ .

## Results

Total number of 1200 electronic prescription were evaluated during our study period. The number of drugs per prescription ranged between 1 to 10 with average number of 2.67 ( $\pm 1.67$ ) per prescription. This value is within the WHO optimal range ( $< 3$ ).

Antibiotics were prescribed in 34% of studied prescriptions. This is above the WHO optimal value ( $< 30\%$ ). About 25% of prescriptions with antibiotic had combination of 2 or 3 antibiotics. Ceftriaxone was the most frequently prescribed antibiotic in our studied prescriptions (33.8%). Percentage of each administered antibiotic is described in figure 1. Rate of antibiotic administration was statistically higher (50% of prescriptions) in month of December compare to other months ( $P=0.013$ ). We found injectable drugs in 94.3% of prescriptions that is about 9 times above the WHO optimal value ( $< 10\%$  of prescriptions). The number of injectable drugs per prescription, varies between 1 (34.4%) to 8 (0.4%) items. At least one form of IV fluids was prescribed in 61.1% of studied prescriptions and NaCl 0.9% was used more frequently (50.7%). We also evaluated the rate of narcotic analgesic administration. We observed that narcotic analgesics were prescribed in 8.3% of cases. Morphine sulfate ampul was the most frequently used narcotic (60.4%). The standard of WHO for writing a prescription in generic name is 100% but our results showed only 93.1% of drugs were written in their generic names. Formulary based prescribing value was 100% in all 12 months (WHO optimal value is 100%).

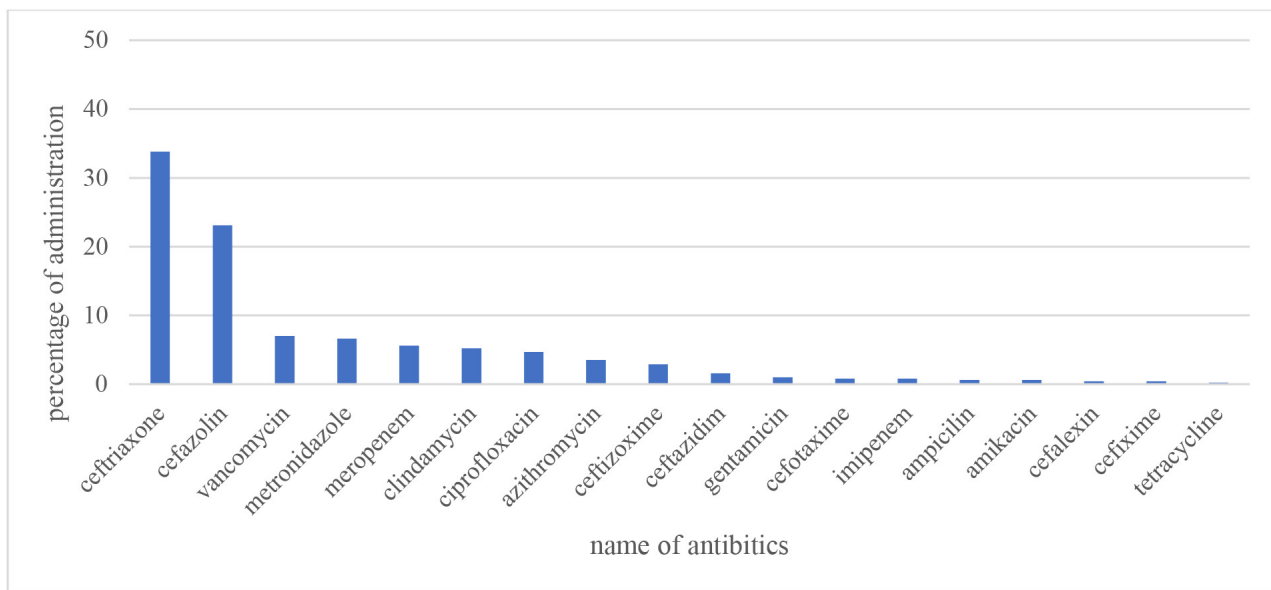
Total IRDP was 3.64 (WHO optimal value =5). This value

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is calculated from adding all five values together (table 1). Among different months, in November ranked first

for IRDP, meeting near the index values in all categories except injectable drugs (Table 1).

**Figure 1. Percentage of administered different antibiotics**



**Table 1. Index of rational drug prescribing (IRDP) in different months in a teaching hospital, southeast of Iran, 2022.**

| Month of year | Polypharmacy | Generic name prescribing | Antibiotic prescribing | Injectable drug prescribing | Formulary based prescribing | IRDP |
|---------------|--------------|--------------------------|------------------------|-----------------------------|-----------------------------|------|
| first         | 0.77         | 0.88                     | 0.9                    | 0.1                         | 1                           | 3.65 |
| 2nd           | 0.76         | 0.95                     | 0.88                   | 0.1                         | 1                           | 3.69 |
| 3rd           | 0.70         | 0.92                     | 1                      | 0.1                         | 1                           | 3.72 |
| 4th           | 0.75         | 0.96                     | 1                      | 0.1                         | 1                           | 3.81 |
| 5th           | 0.74         | 0.93                     | 0.81                   | 0.1                         | 1                           | 3.58 |
| 6th           | 0.64         | 0.91                     | 0.75                   | 0.1                         | 1                           | 3.40 |
| 7th           | 0.75         | 0.88                     | 0.76                   | 0.1                         | 1                           | 3.49 |
| 8th           | 0.72         | 0.96                     | 1                      | 0.1                         | 1                           | 3.78 |
| 9th           | 0.69         | 0.93                     | 0.60                   | 0.1                         | 1                           | 3.32 |
| 10th          | 0.65         | 0.93                     | 0.83                   | 0.1                         | 1                           | 3.51 |
| 11th          | 0.86         | 0.95                     | 1                      | 0.1                         | 1                           | 3.91 |
| 12th          | 0.75         | 0.93                     | 1                      | 0.1                         | 1                           | 3.78 |
| Overall       | 0.73         | 0.93                     | 0.88                   | 0.1                         | 1                           | 3.64 |

**Discussion**

Rational drug use is an important concern in health systems all-over the world, especially in underprivileged areas with limited drug resources. So, recognizing the weak points in each setting can help to improve existing situation.

The results of the present study revealed that the average number of drugs prescribed per encounter was within the WHO optimal range ( $\leq 3$  drugs prescribed per patient encounter). This value was also within optimal range in all individual months during our study period. Data from other parts of Iran shows higher values, e.g. 3.14 in Kermanshah and 3.34 in Isfahan (9,10). This study

was performed just in emergency ward of one hospital. Therefore, cannot show the precise picture of prescribing pattern in our region. This may be the reason why our value is better comparing to other parts of Iran. Results from other developing countries were even less than ours 1.3–2.2 (11,12). Although our value is within WHO optimal value, it is wise to try to decrease it as much as possible. Reducing rate of poly pharmacy can decrease overall cost of treatment in healthcare systems. There is also a direct relationship between the number of drugs a patient administered and rate of adverse drug reactions, this would further contribute to healthcare expenses.

WHO highly recommends prescribing medications by generic names. The number of drugs getting registered during the last decades is constantly increasing, and brand names by different pharmaceutical manufacturers are very confusing both for the patients and providers. So, there is a strong need to ensure the identification of each pharmaceutical compound by a unique, universally available and accepted name (13). The mean percentage of drugs prescribed by generic names in our study was below the WHO optimal value (100%). This value is similar to another study performed in Kermanshah province of Iran (9). But it is significantly higher than some other developing countries like Saudi Arabia and Pakistan (7,14). This may reflect that prescription writing training for medical students is more focused on generic names in Iran. It is reasonable to improve this standard toward WHO optimal values more.

In our study the percentage of encounters with an antibiotic was 34% which is slightly higher than the WHO optimal value ( $\leq 30\%$ ). This value reported in China, Pakistan and Africa was 48.4%, 48.9%, and 46.8% respectively (8,14,15). Data of a national survey from retail pharmacies in Iran showed 45% of patients received at least one antibiotic (16). This value was 52.1% in Kermanshah province of Iran (9). Considering the fact that we just studied prescriptions in the emergency ward, our projection is that the rate of antibiotic administration would be higher in whole hospital and even higher in whole region. Irrational antibiotic administration is a global concern as this is the main cause of antibiotic resistance and its related complications (17). It is also one of the key components of adverse drug reactions and drug related costs. Although this value does not show the pattern and justification of antibiotic administration but it can be used as an indicator of how much antibiotics are administered in each setting. We also observed that ceftriaxone was the most frequently used antibiotic in emergency ward. We need more education and regulations

regarding ceftriaxone use in our hospital.

Injectable drugs were prescribed in 94.3% of encounters, which has huge difference with WHO standard ( $\leq 10\%$ ). The rate of prescribing injections is also considerably higher in our emergency ward compare to our neighbor countries like Kuwait (9.1%) and Bahrain (8.3%) (18,19). Other studies in Iran about general physicians' prescriptions and retail pharmacies prescriptions showed values of 24.4% and 41% respectively (9,16). This study was performed just in emergency ward of a teaching hospital. The majority of admitted patients in emergency ward suffer from acute pain or gastrointestinal problems like nausea and vomiting and the goal is always immediate relieving symptoms. Therefore, the rate of IV administration in this study is super high. It may be a problem in many emergency wards as one in Pakistan with rate of injectable drugs of 98% (20). Another contributor to this shocking high rate of injections is traditional belief of our patients that misinterpret injection as the most efficient rout of drug administration and force doctors to prescribe them injectable drugs especially when their conditions are acute. Another major problem that was demonstrated in this study, that is also linked to rate of IV drug administration, is the high rate of IV fluids administration. These are mostly used for drug irrigation or low BP management in emergency ward. Therefore, optimizing parenteral drug administration would significantly decrease their rate of administration. It has been demonstrated that parenteral rout of drug administration should be preserved for patients with special conditions e.g. when a rapid drug effect is desired, when drugs are unstable or poorly absorbed in the GI tract, in patients with altered mental status or severe nausea or vomiting, unable to tolerate oral medications (21). So, lots of these cases could be managed easily with enteral rout of drugs. Rational administration of injectable drugs can decrease the costs in healthcare settings as well as reducing injection related adverse effects. It is also an important determinant of work load of nursing staffs especially in busy emergency wards.

The percentage of drugs prescribed from the hospital drug formulary was 100% which is exactly the same as optimal value of WHO. This value is higher than those of other middle eastern countries (22). This value was 96% in Kermanshah province of Iran, which is close to ours (9). After implantation of Health System Reform Plan in Iran in 2014, all hospitals were obligated to establish a drug list as the hospital formulary. Since then, central pharmacies in hospitals provide drugs based on the approved formulary list. Doctors are just

allowed to prescribe drugs from that formulary list and all non-formulary drug orders are processed through drug and therapeutic committee of hospitals. So, it is predictable that this value would be close to optimal of WHO. Prescribing drugs from approved hospital formulary has several advantages: it can improve the quality of patient care by using the most effective drugs with best safety profile, promoting pharmacy standards of practice in pharmacy and enhancing doctor and nurses experience and knowledge with drugs that they usually work with (23). In present study we just evaluated electronic prescriptions from central pharmacy database. Considering the fact that sometimes drugs which are not listed in hospital formulary are ordered in emergency ward in paper prescriptions and are provided from retail pharmacies, this value should be less than 100% in real.

The overall IRDP for our emergency ward is 3.64 (the optimal WHO value is 5) that shows 72.8% of standards of IRDP are followed. This value in Kermanshah province was 3.7 that is slightly different from ours (9). IRDP reported in China and India are 3.32 and 3.42 that are less than our IRDP (8,24). Trying to reach the WHO goal of IRDP is something that should be taken into account buy all healthcare systems.

This study has some limitations. First it was a retrospective study performed in only emergency ward of a hospital. Multi center studies in different hospital wards would be of greater value. Second, we just evaluated WHO values which are based on rate of administration not the patterns. Therefore, future studies combining this information with pattern of drug administration will be more helpful for depicting existing situations.

We can conclude that although our overall IRDP value is below the WHO standard but it is about other neighbor countries. Unfortunately, our condition regarding IV drug administration showed a huge difference with WHO standards. This is an issue of urgent input and supervision. Other prescribing indicators that need to improve are rate of antibiotic administration and polypharmacy.

**Conflict of interest:** No potential conflict of interest was reported by the authors.

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