

Drug Utilization in Medical Inpatients

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Abstract

Introduction	Studies on drug utilization in the Internal Medicine ward using the Defined Daily Dose (DDD) concept are lacking in Western Nepal. Such studies are necessary to create a database so that future trends in drug utilization can be analyzed and interpreted. The study was carried out to obtain information of patients admitted to the internal medicine ward during the study period, assess different drug use parameters and measure drug use in DDD/100 bed-days.
Objectives	The study was carried out to obtain demographic information on patients admitted to the internal medicine ward during the study period.
Methods	The study was carried out in the Internal Medicine ward of the Manipal Teaching Hospital, Pokhara, Nepal. Inpatient records over a four-month period (01.01.2002 to 30.04.2002) were analyzed retrospectively. Mean \pm SD number of drugs and cost of drugs per hospital admission was calculated. The DDD/100 bed-days for different groups of drugs were calculated.
Results	Five hundred and fifty-four patients were admitted 631 times during the study period. The majority of patients were from Pokhara city and Kaski district. Mean \pm SD number of drugs prescribed was 4.3 ± 2.6 . Mean \pm SD cost of drugs was 14 ± 11.5 US\$. The DDD/100 bed-days of drug usage in the ward during the study period were 167.5 with antibiotics having the highest DDD. The utilization of dextrose saline was 3.65 liters/100 bed-days.
Conclusions	The use of cephalosporins is low and this is to be welcomed. The DDD in our study was lower than that reported elsewhere. Continuous monitoring of drug utilization and trends in drug prescribing are required. The study should be extended to other departments.
Key words	ATC classification, Defined daily dose, Drug utilization, Internal Medicine ward, Medical Audit, Retrospective studies

Introduction

Drug utilization has been defined as the marketing, distribution, prescription and use of drugs in a society with special emphasis on the resulting medical and social consequences¹. To improve the quality of life the standards of medical treatment have to be improved. Medical audit oversees the observance of these standards and forms a part of 'drug utilization' studies².

The Anatomical Therapeutic Chemical (ATC) classification divides drugs into different groups according to the organ or system on which they act and their chemical, pharmacological and therapeutic properties^{3,4}. The Defined Daily Dose (DDD) is defined as the assumed average maintenance dose per day for a drug used for its main indication in adults⁵. DDDs provide a fixed unit of measurement independent of price and formulation enabling the researcher to assess

trends in drug consumption and to perform comparisons between population groups.

The Manipal Teaching Hospital is a tertiary care hospital attached to the Manipal College of Medical Sciences and is situated in Pokhara city, Kaski district, Western Nepal. We had previously studied prescribing patterns in medical outpatients and had used the DDD concept to measure antibiotic utilization in the Internal Medicine ward⁶. Studies on the overall prescribing pattern and measurement of drug utilization in the Internal Medicine ward are lacking. The ward has bed strength of 70 and the average occupancy rate is 70 percent. Studies on drug utilization using DDD are necessary to create a database so that future trends in drug prescribing can be analyzed and interpreted. Hence the present study was carried out.

The objectives of the study were to:

- 1) obtain basic demographic information on patients admitted to the Internal Medicine ward during the study period
- 2) obtain information on the duration of hospitalization, patient outcome and morbidity profile
- 3) calculate mean \pm SD number of drugs prescribed during hospitalization, mean \pm SD cost of drugs, percentage of drugs prescribed from the Essential drug list of Nepal⁷, number of patient admissions where an antibiotic was prescribed and
- 4) calculate DDD/100 bed-days of different drugs and measure drug use during the study period.

Materials and Methods

Inpatient medical records over a four-month period (1st January 2002 to 30th April 2002) were analyzed retrospectively. The records were obtained from the Medical Records Department (MRD) of the hospital.

The sex and age of the patient were noted. The duration of hospitalization and the diagnosis written on the discharge summary was recorded. Patient outcome was studied. The patient may have been discharged, transferred to another department, may have expired in the hospital or been discharged at request. In some cases the patient left against medical advice. The drugs prescribed, route, frequency and duration were noted. The percentage of drugs prescribed from the Essential drug list of Nepal was calculated⁷. The percentage of drugs prescribed by generic name was determined.

Readmission of the patient to the Internal Medicine ward during the study period was counted as a separate admission. The total number of admissions was noted. The percentage of admissions where an antibiotic was prescribed was calculated. The percentage of antibiotic use for bacteriologically proven infection

(BPI) was noted. The specimens sent for culture and sensitivity testing and the organisms isolated were recorded.

Mean \pm SD number of drugs prescribed during the period of hospital stay was calculated. The percentage of injectable preparations was noted. The hospital pharmacy price list was used to calculate the mean \pm SD cost of drugs per hospital admission. The percentage of the total cost constituted by injectable preparations was determined.

The DDD/100 bed-days were calculated for different drug groups and for individual drugs. The total drug use in the Internal Medicine ward during the study period was calculated as DDD/100 bed-days. DDD/100 bed-days were calculated using the formula:

$$\text{DDD/100 bed-days} = \frac{\text{No. of units delivered in a four-month period (mg)} \times 100 \text{ beds}}{\text{DDD (mg)} \times 120 \text{ days} \times \text{number of beds} \times \text{occupancy index}}$$

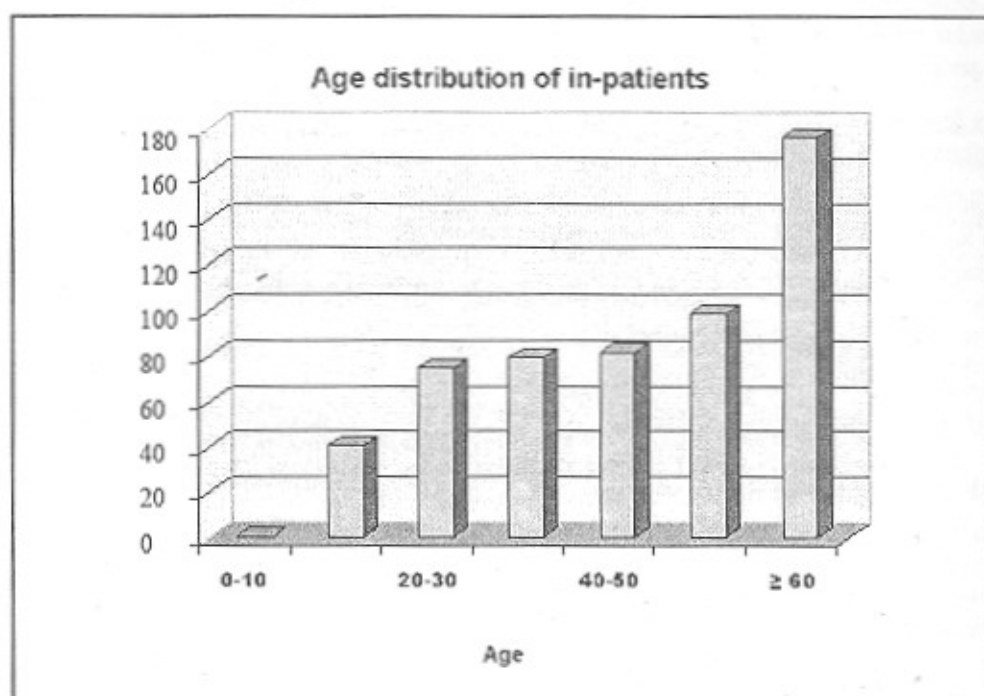
In our study, the number of beds in the ward was 70 and the average occupancy index was 0.7. Hence

$$\text{DDD/100 bed-days} = \frac{\text{No. of units delivered in a four-month period (mg)} \times 100 \text{ beds}}{\text{DDD (mg)} \times 120 \text{ days} \times 70 \times 0.7}$$

Results

A total of 554 patients were admitted to the Internal Medicine ward during the study period. The 554 patients had been admitted 631 times during the four-month period. Three hundred and nine patients were male while 245 were female. One hundred and seventy-seven patients were aged above 59 years. The age distribution of the in-patients is shown in Figure 1. The mean duration of hospitalization was 6.96 days.

Fig 1: The age distribution of the in-patients



One hundred and nineteen patients were from Pokhara city while 124 patients were from the district of Kaski in which Pokhara is situated. Ninety patients and 60 patients were from the neighbouring districts of Syangja and Tanahun respectively. The patients were discharged during 546 admissions. During 33 admissions the patients were discharged at request. Twenty patients expired during hospital stay while during 32 admissions the patients left against medical advice.

The top ten diseases among medical inpatients are shown in Table 1. Chronic obstructive pulmonary disease (COPD), hypertension and type 2 diabetes mellitus were the three most common diseases. Mean \pm SD number of drugs prescribed during the period of

hospital stay was 4.3 ± 2.6 . Fifty-seven percent of the drugs were prescribed from the Essential drug list of Nepal. A total of 2726 drugs were prescribed. Parenteral preparations and inhaled drugs constituted 22.7 percent and 5.3 percent of the total. The percentage of drugs prescribed by generic name was 43.4. Mean \pm SD cost of drugs was 1093.9 ± 900.9 Nepalese rupees (14 ± 11.5 US\$).

Antibiotics were prescribed during 260 of the 631 hospital admissions (41.2%). Antibiotics were prescribed for bacteriologically proven infections (BPI) in 71 cases (27.3%). The commonest organisms isolated on culture and sensitivity testing were *E. coli*, *S. aureus*, *H. influenzae*, *K. pneumoniae*, *S. pneumoniae* and *S. typhi*.

Table 1: Morbidity profile of medical in-patients during the study period

Disease condition	No. of patient admissions
Chronic obstructive pulmonary disease	79
Hypertension	66
Diabetes mellitus type 2	42
Congestive cardiac failure	38
Rheumatic heart disease	26
Urinary tract infection	26
Enteric fever	21
Cerebrovascular accidents	21
Generalized tonic-clonic seizures	18
Pulmonary tuberculosis	17
Viral fever	15
Others	262

The DDD/100 bed-days of drugs prescribed in the four-month study period were 167.5

Table 2: Utilization of individual drugs (DDD/100 bed-days) in the Internal Medicine ward

Drugs	DDD/100 bed-days
Antibiotics	33.3*
Antiulcer drugs	31.7
Ranitidine	13.6
Omeprazole	8.7
Antacids	4.4
Famotidine	2.7
Others	2.3
Diuretics	26.1
Furosemide	19.2
Spirinolactone	3.8
Amiloride and frusemide combination	1.9
Amiloride and hydrochlorothiazide combination	1.2
Antiasthma drugs	24
Ipratropium	8.4, 5.4**
Salbutamol	3.1, 1.8, 0.8
Theophylline	1.4
Others	3.1
Antihypertensives	22.4
Amlodipine	12.7
Enalapril	4.8
Atenolol	2.2
Others	2.7
Vitamins	12.9
NSAIDs	3.8
Antidiabetic drugs	4.3
Antihistamines	2.6
Other drugs	6.4
Total	167.5

* The DDDs of individual antibiotics is shown in Table 3

** The drug has two DDDs; one for inhaled aerosol and the other for inhaled solution

Δ The drug has three DDDs; one for systemic use, another for inhaled aerosol and the third for inhaled solutions

Antibiotics were the drugs with the highest DDD/100 bed-days and the DDD/100 bed-days of the ten most commonly used antibiotics are shown in Table 3.

Table 3: ATC code and DDD/100 bed-days of the ten most commonly used antibiotics in the Internal Medicine ward

Drug	ATC Index	DDD/100 bed-days
Ampicillin	J01CA01	8.3
Amoxicillin	J01CA04	7.7
Metronidazole	J01XD01	2.9
Ciprofloxacin	J01MA02	2, 1.2*
Norfloxacin	J01MA06	1.4
Ceftriaxone	J01DA13	1.3
Doxycycline	J01AA02	1.1
Ampicillin and cloxacillin	J01CA51	0.9
Cefotaxime	J01DA10	0.9
Benzyl penicillin	J01CE01	0.9

* The drug has two DDDs, one for oral use and the other for parenteral use

Drugs used in peptic ulcer, bronchial asthma and hypertension, diuretics and vitamins were other groups of drugs with high DDDs. The ATC code and the DDD values of the ten most commonly used drugs are shown in Table 4.

Table 4: DDD/100 bed-days of the ten most commonly used drugs in the Internal Medicine ward

Drugs	ATC Index	DDD/100 bed-days
Furosemide	C03CA01	19.2
Ranitidine	A02BA02	13.6
Vitamins	A11AA03	12.9
Amlodipine	C08CA01	12.7
Omeprazole	A02BC01	8.7
Ampicillin	J01CA01	8.4
Amoxicillin	J01CA04	8.2
Ipratropium	R03BB01	8.5, 5.4*
Enalapril	C09AA02	4.8
Antacids	A02AD01	4.4

* The drug has two DDDs; one for inhaled aerosol and the other for inhaled solution

The utilization of intravenous fluids was measured in litres/100 bed-days. The utilization of dextrose saline was 3.65 litres/100 bed-days. The utilization of sodium chloride, 5 percent dextrose and Ringer lactate were 1.74, 0.93 and 0.48 litres/100 bed-days respectively.

Discussion

Average number of drugs prescribed is an important index in drug utilization studies. The number must be as low as possible to decrease the risk of drug interactions and the cost to the patient. The mean \pm SD number of drugs prescribed during the period of hospital stay was 4.3 ± 2.6 . In a study from Pakistan

carried out in three major teaching hospitals the mean number of drugs per prescription was 2.97⁸. In a Sri Lankan study, the mean drug exposure in government institutions varied between 3.6 and 3.7, whereas in private institutions, patients were exposed to an average of 7.2 drugs⁹. Prescription monitoring in an Irish hospital revealed that the average number of prescriptions per patient was 5.47 in medical in-patients¹⁰. In the Internal Medicine ward antibiotics were changed either due to lack of clinical response or after receipt of the culture and sensitivity report. On improvement of the condition patients were switched over from parenteral to oral antibiotics. Vitamins and

mineral preparations were also prescribed. All these may be responsible for the increased number of drugs prescribed.

In our study 55.6 percent of drugs were prescribed by brand name. We considered a drug to be prescribed by brand name if it was mentioned by brand name even once in the drug order sheet. The percentage of drugs prescribed by generic name (43.4) is higher than the 23.6 percent reported from Pakistan⁸. In a study among antenatal care patients in Nagpur, India, 68.5 percent of drugs were prescribed by generic names¹¹. In our study brand names were commonly used to prescribe vitamins, iron and mineral preparations, fixed-dose combinations and inhaled drugs.

COPD, hypertension and type 2 diabetes mellitus were the three most common diseases among medical in-patients. Most of the patients suffering from COPD were admitted following an acute exacerbation of the disease. Around 70 percent of them were treated with antibiotics but an organism was isolated on culture and sensitivity testing in only 31.6 percent of the cases. Infectious and parasitic diseases accounted for 41.7 percent of the total admissions while cardiovascular diseases accounted for 22 percent of admissions. In a South African study, cardiovascular disorders and infectious diseases were responsible for 34.4 percent and 29.2 percent of total admissions¹². The high prevalence of infectious diseases in developing countries may be associated with lower standards of socioeconomic development.

Injectable preparations accounted for 22.7 percent of the total drugs prescribed. The percentage is lower than that reported from a study in Eastern Nepal, where injectable drugs accounted for 40.4 percent of the drugs prescribed¹³. However, the authors had looked at the entire in-patient population and not just at the Internal Medicine ward. In Pakistan injectable drugs constituted only 17.1 percent of the drugs prescribed⁸. Use of injectable preparations should be minimized to reduce the cost to the patient and consumption of scarce nursing resources.

Antibiotics accounted for 13.7 percent of the total drugs prescribed and were prescribed during 41.2 percent of the total admissions. The DDD/100 bed-days of antibiotics were 33.3. In a study from Thailand, 307 of the total 690 patients (44.5%) had received an antibiotic¹⁴. In a South African hospital and a teaching hospital in Malaysia, 27 percent and 29 percent of patients in the Medicine ward had received antibiotics^{15,16}. The DDD/100 bed-days of antibiotics in our study was lower than the value reported from Estonia and Spain^{17,18}. However, the Spanish study was carried out in all the wards of a medium-sized

hospital while the Estonian study measured antibiotic utilization in two Intensive Care Units (ICUs) and the Surgery and Internal Medicine wards.

The five most commonly prescribed antibiotics were ampicillin, amoxicillin, metronidazole, gentamicin and ciprofloxacin. This is similar to the observations in a previous study⁵. Patients on parenteral ampicillin were switched over to oral amoxicillin on improvement of their condition. The use of cephalosporins continues to be low in the Internal Medicine ward (2.3 DDDs/100 bed-days). This is much lower than the 13.1 DDDs/100 patient-days observed in Serbia¹⁹. Cephalosporins are expensive and as the microorganisms isolated continue to be sensitive to the older antibiotics, judicious use of cephalosporins should be encouraged.

The DDD/100 bed-days of drugs used in peptic ulcer, drugs used in bronchial asthma, diuretics, drugs used to treat hypertension and vitamins were 31.7, 26.1, 24, 22.4 and 12.9 respectively. In the Serbian study the total drug consumption was 6815.8 DDDs/1000 patient-days in the year 1999 and 8597 DDDs/1000 patient-days in 1998. The DDD/1000 patient-days for vitamins were 1128 in 1999 while for antihypertensive drugs it was 583.2. Our DDDs/100 bed-days are lower than the Serbian figures. But the Serbian study was carried out in all the wards of a University hospital (1200 beds) while our study was limited to the Internal Medicine ward.

The mean \pm SD cost of drugs prescribed during the hospital stay was 1093.9 \pm 900.9 Nepalese rupees (14 \pm 11.5 US\$). As the mean duration of hospitalization was 6.96 days the drug cost per day of hospitalization was 2 US\$. In the Pakistani study the average cost of treatment per day was 88.36 Pakistani rupees (1.52 US\$).

The study was carried out over a four-month period and seasonal variations in morbidity patterns and in drug prescribing could not be evaluated. We had limited the study to the Internal Medicine ward. In the absence of hospital guidelines for the treatment of different diseases and the retrospective nature of the study the rationality of treatment was not evaluated. These were the limitations of the study.

Continuous monitoring of drug utilization using the DDD concept is required. The present study has helped to create a drug utilization database for the Internal Medicine ward. Further work is required to study trends in drug prescribing in the Internal Medicine ward and the entire hospital. We propose to take it up in the near future.

Author contributions

PRS planned the study, collected the data, analyzed the data, compiled the results and wrote the manuscript. PP helped in planning the study, collecting the data and helped in writing the manuscript. He also searched the literature. AKD was involved in the planning of the study, analyzing the data, writing the manuscript and revising the initial drafts of the manuscript. DU helped in planning the study, searching the literature, analyzing the data and writing the manuscript. PM helped in planning the study, compiling the results and writing the manuscript.

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