# Assessment of Drug Related Problems and its Associated Factors among Medical Ward Patients in University of Gondar Teaching Hospital, Northwest Ethiopia: A Prospective Cross-Sectional Study

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## ABSTRACT

**Background:** Drug related problems (DRP) are common in hospitalized patients and may lead to increase hospital stay, health care cost and augment the risk of morbidity and mortality. **Objective:** The aim of this study was to assess the prevalence of DRP and associated factors among medical ward patients in University of Gondar teaching hospital (GUH). **Methods:** A hospital based prospective cross-sectional study was conducted on 256 patients who were admitted in the medical wards from February to April 2016. Data were collected using a pre-tested standard data abstraction format and semi-structured questionnaire. The collected data was checked for completeness and entered into Epi Info 7 software, and analysed using SPSS version 20. Descriptive, binary and multiple logistic regression analyses were used to assess the association between different variables. **Results:** Of the 256 study participants, 169 (66.0%) of patients had DRP. A total of 174 DRPs were identified on average of 0.67 DRPs per patient. Of the identified DRP the most common DRPs were found to be due to inappropriate dosage 39.1%, non-compliance 28.9%, and need additional therapy 24.2%. Length of hospital stay (adjusted odds ratio (AOR)=2.416 [95% confidence interval (CI) 1.111-5.253, p=0.027]) and number of drugs per patient (AOR=9.088 [1.012-81.623], p=0.033) significantly affect DRP. **Conclusions:** DRPs are common among medical ward patients in GUH. Inappropriate dosage and unnecessary drug therapy were the top and the least prevalent DRPs respectively. Early identification of DRP and the associated factors to them may enhance the prevention and management of DRPs. **Key words:** Drug related problems, drug-therapy problems, inappropriate prescribing, medical wards, Gondar, Ethiopia

## INTRODUCTION

Even though, medications play a major role in the cure, palliation and inhibition of disease, they also expose patients to drug-related problems (DRPs). According to Pharmaceutical Care Network Europe (PCNE) classification volume 6.2, drug related problems is an ‘event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes ‘and it is classified them as dosing problems, ADR, drug-drug interaction, inappropriate prescription and patient Adherence to the drug.[1]

Previous studies reported that majority of hospitalized patients have some kind of DRPs.[2-5] For instance, studies conducted in Norway reported that, 2.6 DRPs occurred per patient in medical ward.[6] In addition to this Viktil et al. found that the occurrence of DRPs per patient increased linearly with the number of drugs used, with one unit increase in number of drugs yielded 8.6% increase in the number of DRPs.[7] Furthermore, a prospective study done in Jordan from medical ward reported that from the total patients, 98.3% had treatment related problems (TRPs) and on average 9.35 TRPs occurred per patient.[8]

In many instances, DRPs are a major safety issue for hospitalized patients and it may lead to reduced quality of life, increased hospital stay, increased overall health care cost and even increases risk of morbidity and mortality.[9]

There are a number of consequences associated with DRPs which include hospitalizations, long-term care admissions, emergency department visits, additional physician office visits, and additional prescriptions. In addition to these, substantial costs are also associated with DRPs. For example, the economic burden arising from drug related morbidity and mortality in United State of America (USA) was $177.4 billion annually;[10] Whereas, £100707 was reported in Australian study.[11] Therefore, DRPs are major area concern of the patient’s physical, psychological and economic burden to the patients as well as to the whole society. Hence, improving drug therapy by preventing drug-related problems may have an important effect on the patients’ health, treatment related costs, potentially save lives and enhance patients’ quality of life.[12]

However, to the best of our knowledge, studies related to DRPs are limited in Ethiopia and no previous research was done in University of Gondar referral Teaching hospital. Like other health Intuitions University of Gondar referral hospital tries to reduce the incidence of DRPs by assigning clinical pharmacists in each ward. However, this effort is not able to control the negative impact of drug therapy problem on the quality of the health service which is provided by this health institution. Therefore, the aim of this study is to assess the extent of DTP and to determine the risk factors associated for the occurrence of DTPs among hospitalized medical ward patients with in this hospital, so the study findings would be used as a base line on epidemiology and potential associated risk factors for DRP in hospitalized medical ward patients in northwest Ethiopia.

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METHODS

Study setting and study population

The study was conducted in University of Gondar teaching hospital (GUH), Gondar, northwest, Ethiopia from February 1, to April 30, 2016. The hospital has 466 beds for inpatient service at five wards. The internal medicine ward is the one among these wards and provides health care services with 2 rooms and 63 beds. The hospital provides primary and referral health care services for nearly 5 million people living in Gondar town and neighbourhoods as and zones (University of Gondar Teaching Hospital Statics and Information Center, unpublished data, 2015). All Patients admitted to the medical ward, whose age was greater than or equal to 18 years and whose hospital stays were greater than 48 hours (inpatient) were included in the study.

Study design and study period

A hospital based prospective cross-sectional study was employed.

Variables

Independent variables include demographic characteristics of the patient (age, sex...), number of disease, number of drugs used and duration of hospital stay. The dependent variables were presence of the major types of drug related problems.

Sampling technique and sample size determination

The study participants were chosen by using simple random sampling method. The sample size was calculated based on single population proportion formula by assuming that confidence interval=95%, where Za/2 of 95%=1.96, P=73.5% (Because of our source and time limitation we take P=73.5% of Jimma,[10] and W=5%.

So, estimated sample size = \( \frac{(1.96)^2 \times (0.735) \times (1-0.735)}{0.05^2} \) = 299.299 = 299.

Then, corrected estimated sample size = \( \frac{299.299 \times 1053}{299.299 + 1053} \) = 233.

Finally, adjusted estimated sample size = 233 + (233 \times 0.1) = 256 were included in the study using systemic random sampling technique.

DATA COLLECTION PROCEDURE

Data collection was undertaken from February 1, 2016, to April 30, 2016. The clinical information such as patient demographics characteristics, date of admission, date of discharge, lactation and pregnancy status for female, physical examination, diagnostic and laboratory results, current medications, co-morbidities, length of hospital stay, previous medical and medication histories was recorded from patient medical records using data abstraction format which was developed from Pharmaceutical care practice: the clinicians guide.[11] Identified DRPs was recorded and classified using DRP registration format which was taken from Pharmaceutical care practice: the clinicians guide.[11] The collected data were code, cleared and checked for completeness and whether recorded information makes sense to ensure the quality of data collected.

DATA ENTRY, ANALYSIS AND INTERPRETATION

The collected data were code, cleared and checked for completeness and entered into a computer using Epi Info 7 software and analysed using SPSS version 20. Descriptive statistics was used to characterize drug related problems. Results of the study were organized in the form of frequencies and percentages. The data was summarized and described using tables and figures. Binary logistic regression was used to see the association between independent variable and dependent variable. Those variables with a p value<0.2 in bivariate analysis was a candidate for multivariate analysis and those variables with a p value<0.05 were considered as significant in multivariate analysis. Odds ratio and confidence interval of 95% were used to see the strength of association.

Ethical clearance

This study was conducted after ethical clearance obtained from the research and ethics review committees of school of pharmacy and the clinical directorate of GUH. The permission to collect data was obtained after official letters were approved by the head of medical ward. All patients in the study were asked for their willingness to participate in the study. Moreover, all other concerned bodies were informed about aim of the study. Besides, to this all the information were collected from the study subjects handled confidentially and data was used for the research purpose only, additionally confidentiality of all the data to be gained were seriously respected.

Operational definitions

Drug related problem

An event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes.

Hospital stay

The time gap spent by the patient in the hospital from his/her admission till his/her discharge (discharge date was determined by looking his/her discharge date from his/her medical chart).

Poly-pharmacy

Use of five or more different drugs concomitantly.

Unnecessary drug therapy

The drug therapy is unnecessary because the patient does not have a clinical indication at this time.

Needs additional drug therapy

Additional drug therapy is required to treat or prevent a medical condition or illness from developing.

Ineffective drug therapy

The drug product is not being effective at producing the desired response or outcome.
Inappropriate dosage

The dosage is too low to produce the desired response or outcome or
The dosage is too high, resulting in undesirable toxic effects.

Adverse drug reaction

The drug is causing any noxious, unintended, and undesired effect,
which occurs at doses used in humans for prophylaxis, diagnosis or
therapy.

Noncompliance

The patient is not able or willing to take the drug therapy as intended.

Drug-drug interaction

An interaction is defined as occurring when the effects of one drug
are changed by the presence of another drug, food, drink or some
environmental chemical agent.

• Within this study drug interactions which are categorized under
  risk D (i.e., Consider therapy modification) or X (i.e., Avoid
  combination) was taken as a Drug interaction drug therapy problem.

RESULTS

Demographic details and characteristics of patients

During a three month study period a total of 256 patients were
included in the study for analysis, of which 144 (56.2%) were females.
Majority of patients 114 (44.5%) were in the age group of 18-35 years.
A total of 1297 medications were prescribed. Average number of drugs
per day for a patient was five. During the hospital stay, majority of
the study participant 183 (71.1%) received greater than 5 drugs per
day. Demographic characteristics along with other factors that may
influence DRPs like number of disease, length of hospital stay, and
average number of drugs received per day taken from the medical chart
and are presented in Table 1.

The principal diagnoses at admission were confirmed or suspected were
infections 124 (48.4%), cardiovascular disease 79 (30.9%), respiratory
76 (29.7%), haematological disease 43 (16.8%), renal and genitourinary
disease 23 (9%), endocrine disease 19 (7.4%), gastrointestinal disease
5(2.0%), musculoskeletal and joint disease 5(2.0%), and CNS disorders
4 (1.6%).

Prevalence of DRPs

Out of 256 study participants, 169 (66.0%) of patients had DRPs. A
total of 174 DRPs were identified on average, 1.03 DRPs per patient.
From the total DRPs, one DRP was identified in 140 (54.7%) patients,
two DRPs in 33 (12.9%), and more than 2 DRPs in 10 (4.0%) patient.
From the studied DRPs, most highly reported DRP was found to be due to
inappropriate dosage 39.1%, non-compliance 74 (28.9%), followed
by need additional therapy 62 (24.2%). The types and number of drug
related problem identified are summarized in Figure 1.

Drugs and drug classes involved in drug related problems (DRPs)

Commonly prescribed drug classes were anti-infective 192 (75%),
Gastro intestinal drugs (GI) 92 (35.9%), Cardiovascular system (CVS)
drugs 84 (32.8%), and drugs for blood disorder 87 (34%) [Table 2].
A total of 59 drugs were involved in different types of DRPs and the most common agents associated with drug therapy problems were
omperazol 45 (17.6%), heparin 22 (8.6%), and aspirin 21 (8.2%). The
common drugs associated with the major types of DRPs and drug-drug
interaction are shown in Table 3.

Table 1: Socio demographic characteristics and clinical data of admitted medical patients in UoGTH, from February 1 to April 30, 2016 (N=256)

<table>
<thead>
<tr>
<th>Demographic characteristics and clinical data</th>
<th>Category</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>112</td>
<td>43.8</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>144</td>
<td>56.2</td>
</tr>
<tr>
<td>Age group</td>
<td>18-35</td>
<td>114</td>
<td>44.5</td>
</tr>
<tr>
<td></td>
<td>36-64</td>
<td>104</td>
<td>40.7</td>
</tr>
<tr>
<td></td>
<td>≥ 65</td>
<td>38</td>
<td>14.8</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>&lt; 7</td>
<td>53</td>
<td>20.7</td>
</tr>
<tr>
<td></td>
<td>≥ 7</td>
<td>203</td>
<td>79.3</td>
</tr>
<tr>
<td>Number of diseases</td>
<td>1</td>
<td>60</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>113</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>58</td>
<td>22.7</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>16</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>≥ 5</td>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>Number of drugs prescribed</td>
<td>&lt; 5</td>
<td>73</td>
<td>28.5</td>
</tr>
<tr>
<td></td>
<td>5-9</td>
<td>166</td>
<td>64.8</td>
</tr>
<tr>
<td></td>
<td>≥ 10</td>
<td>17</td>
<td>6.3</td>
</tr>
</tbody>
</table>

Table 2: Common drug classes involved in drug related problems

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Drug class</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anti-infective</td>
<td>192</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Gastrointestinal drugs</td>
<td>92</td>
<td>35.9</td>
</tr>
<tr>
<td>3</td>
<td>Cardiovascular drugs</td>
<td>87</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>Drugs for blood disorder</td>
<td>84</td>
<td>32.8</td>
</tr>
<tr>
<td>5</td>
<td>Analgesics and antipyretics</td>
<td>77</td>
<td>30.1</td>
</tr>
<tr>
<td>6</td>
<td>Anti-inflammatory and glucocorticoid</td>
<td>51</td>
<td>19.9</td>
</tr>
<tr>
<td>7</td>
<td>Central nervous system drugs</td>
<td>26</td>
<td>10.2</td>
</tr>
<tr>
<td>8</td>
<td>Endocrine drugs</td>
<td>15</td>
<td>5.9</td>
</tr>
<tr>
<td>9</td>
<td>Vitamins</td>
<td>14</td>
<td>5.5</td>
</tr>
<tr>
<td>10</td>
<td>Respiratory drugs</td>
<td>11</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Table 3: Top 10 drugs which are associated with the occurrence of DRPs among admitted medical patients in GUH from February 1 to April 30, 2016 (N=256)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Drug</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Omeprazole</td>
<td>52</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>Ceftriaxone</td>
<td>22</td>
<td>8.2</td>
</tr>
<tr>
<td>3</td>
<td>Vancomycin</td>
<td>15</td>
<td>5.6</td>
</tr>
<tr>
<td>4</td>
<td>Refampic, isoniazide, pyrazinamide</td>
<td>12</td>
<td>4.5</td>
</tr>
<tr>
<td>5</td>
<td>And ethambutol combination</td>
<td>12</td>
<td>4.5</td>
</tr>
<tr>
<td>6</td>
<td>Cotrimoxazole</td>
<td>11</td>
<td>4.1</td>
</tr>
<tr>
<td>7</td>
<td>Potassium chloride</td>
<td>9</td>
<td>3.4</td>
</tr>
<tr>
<td>8</td>
<td>Alovastatin</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Warfarin</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Furosemide</td>
<td>7</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Intervention for DRP

Suitable intervention was taken to correct the identified DRPs. The majority of DRPs (55%) interventions were given by the investigators
and physicians. The most commonly practical interventions was informing the physician to change the dose, add drugs and educate
their patient to enhance the compliance.

Factors associated with DRPs

Independent factors which predicted the occurrence of DRPs in the study population were sex, age, average number of drugs/day, length of hospital stay and number of disease, poly pharmacy, and clinically significant potential drug-drug interactions, were analysed to
Bhagavathula AS, et al.: Assessment of Drug Related Problems and its Associated Factors among Medical Ward Patients in University of Gondar Teaching Hospital, Northwest Ethiopia: A Prospective Cross-Sectional Study

The incidence of DRPs among hospitalized patients is associated with different reasons and risk factors. Identifying these factors is critical for the prevention and control of DRPs in an individual patient. This study was employed to assess DRPs in medical inpatients of among the tertiary care teaching hospital in Ethiopia.

The current study showed that a total of 174 drug related problems were identified of these DRP was in 140 (54.7%) patients, 2 DRPs in 33 (12.9%), and more than 2 DRPs in 1 (0.4%) patient. This finding was lower than with those similar studies done in India in which, 1 DRP was found in 33 (67.4%) patients, 2 DRPs in 12 (24.5%) patients and 3 DRPs in 4 (8.2%) patients. Addis Ababa, Ethiopia[13] in which DRP was identified in 82 (70.1%) patients, 2 DRPs in 31 (26.5) patients and more than 2 DRPs in 4 (3.4%). However the result of this study was higher compared with a similar study done in Jimma, Ethiopia in which a single DRP was identified in 97 (37.7%) of patients.[12] This may be due to the reason that more clinical pharmacists were involved in the ward based activities in GUH.

DISCUSSION

Figure 1: Percentage of specific Type of drug related problems identified among admitted medical patients in GUH, from February 1 to April 30, 2016 (N=256)

Table 4: Binary and multinomial logistic regression result of factors associated with DRPs in medical wards of GUH from February 1 to April 30, 2016 (N=256)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>COR (95%CI)</th>
<th>AOR (95%CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>77 (45.6)</td>
<td>67 (77)</td>
<td>1.147 (0.681-1.929)</td>
<td>0.923 (0.476-1.790)</td>
<td>0.813</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>92 (55.4)</td>
<td>20 (23)</td>
<td>1.00*</td>
<td>1.00*</td>
<td></td>
</tr>
<tr>
<td>Age group</td>
<td>18-35</td>
<td>64 (37.9)</td>
<td>50 (57.4)</td>
<td>0.340 (0.166-0.694)</td>
<td>2.240 (0.930-5.392)</td>
<td>0.072</td>
</tr>
<tr>
<td></td>
<td>36-45</td>
<td>72 (42.6)</td>
<td>32 (36.8)</td>
<td>0.822 (0.322-2.104)</td>
<td>1.023 (0.335-3.124)</td>
<td>0.968</td>
</tr>
<tr>
<td></td>
<td>≥ 65</td>
<td>33 (19.5)</td>
<td>5 (5.8)</td>
<td>1.00*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital stay</td>
<td>&lt;7</td>
<td>24 (14.2)</td>
<td>29 (33.3)</td>
<td>1.00*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 7</td>
<td>145 (85.8)</td>
<td>58 (66.7)</td>
<td>0.331 (0.178-0.616)</td>
<td>2.416(1.111-5.253)</td>
<td>0.028**</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>25 (14.8)</td>
<td>35 (40.2)</td>
<td>0.220 (0.027-1.818)</td>
<td>1.263 (0.119-13.418)</td>
<td>0.160</td>
</tr>
<tr>
<td>Number of disease</td>
<td>2</td>
<td>72 (42.6)</td>
<td>41 (47.1)</td>
<td>0.089 (0.010-0.76)</td>
<td>3.315 (0.301-36.573)</td>
<td>0.027**</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>49 (29)</td>
<td>9 (10.3)</td>
<td>0.681 (0.076-6.124)</td>
<td>0.564 (0.049-6.528)</td>
<td>0.731</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>15 (8.9)</td>
<td>1 (1.1)</td>
<td>1.875 (1.03-34.131)</td>
<td>1.063 (0.045-25.178)</td>
<td>0.671</td>
</tr>
<tr>
<td></td>
<td>≥ 5</td>
<td>8 (4.7)</td>
<td>1 (1.1)</td>
<td>1.00*</td>
<td>1.00*</td>
<td></td>
</tr>
<tr>
<td>Number of drugs prescribed</td>
<td>&lt;5</td>
<td>71 (42.0)</td>
<td>2 (2.3)</td>
<td>2.219 (0.189-25.995)</td>
<td>0.313 (0.024-4.011)</td>
<td>0.399</td>
</tr>
<tr>
<td></td>
<td>5-9</td>
<td>82 (48.5)</td>
<td>84 (96.6)</td>
<td>0.061 (0.008-0.471)</td>
<td>9.088 (1.012-81.623)</td>
<td>0.033**</td>
</tr>
<tr>
<td></td>
<td>≥ 10</td>
<td>16 (9.5)</td>
<td>1 (1.1)</td>
<td>1.00*</td>
<td>1.00*</td>
<td></td>
</tr>
</tbody>
</table>

Note: COR-crude odds Ratio; AOR-adjusted odds ratio; *Significant at 0.05; **Significant; 1*- Constant

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In this study anti-infective, GI medicines and central nervous system (CNS) drugs were common drug classes involved in DRP. The study on DRPs at Jimma university specialized hospital, Ethiopia found antimicrobials were the top ranking drug classes involved in drug related problems.[22] Another study in France indicated anti-infective and CNS drugs were from the top 3 drug classes involved in DRP.[20]

This study showed that most common agents associated with drug therapy problems were omeprazole, heparin, ceftriaxone, vancomycin, RHZE, cotrimoxazole, warfarin, atorvastatin, potassium chloride (KCL), and furosemide. This is similar with the a study conducted in Medical Wards of TikurAnbessa Specialized Hospital, Addis Ababa, Ethiopia were heparin, prednisolone, and warfarin found to be were the top ranking drugs involved in DRP.[15]

Limitations of the study

DRPs related to medication administration were not addressed in the study. The result of the study may not be generalized to all hospitals because it was single centred study conducted in a hospital serving referred patients who have severe illnesses and more co morbidities.

Finally, because our study involved patients admitted to medical service generalization of the results to other services (i.e., surgery ward, paediatrics ward etc.) may be limited. Further research is warranted to determine the most commonly implicated drugs and risk factors associated with drug-related hospitalizations in other hospitalized populations, patients living in the community, and nursing home residents.

CONCLUSION

The present study indicated that DRPs are common among medical ward patients. Noncompliance and unnecessary drug therapy were the top and the least prevalent DRPs respectively. The most common drug classes involved in DRP were anti-infective, GI medicines, CNS drugs and medicines affecting the blood. Omeprazole and heparin were the most common agents associated with drug therapy problems. The risk factors associated with the presence of DRPs were number of medications, number of diseases and length of hospital stay.

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Author Contributions

All authors were involved in proposal writing, data analysis and interpretation; write up of the final research and manuscript preparation and finalization.

Disclosure

The authors have no conflicts of interest that are directly related to the content of this study.

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None.

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