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# Drug Therapy Problems in Pediatric Ward of Hiwot Fana Specialized University Hospital, Harari National Regional State, Eastern Ethiopia

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## Abstract

**Background:** Drug therapy problem (DTP) is any undesirable event experienced by patient that involves, or is suspected to involve drug therapy, and that interferes with achieving the desired goal of therapy and require professional judgment to resolve. The pediatric medication-use process is complex and error-prone because of the multiple steps required in calculating, verifying, preparing, and administering doses.

**Methods:** A retrospective cross-sectional study was employed to assess drug therapy problem in the pediatric ward of Hiwot fana specialized university hospital, Harar Ethiopia. The data was collected from pediatric patients who admitted during a period of January 14, 2014 to January 14, 2015 G.C. and from total of 422 patients. Descriptive statistics and logistic regression were used to summarize data.

**Result:** Out of 422 study participants, 256(60.7%) had DTPs. Total frequency of DTPs was 446; these were about 1.06 DTPs/patient. From the studied five classes dosage too high in 106(25.12%), dosage too low in 92(21.8%), need of additional drug therapy in 76(18%) cases, unnecessary drug therapy in 70(16.59%) and inappropriate drug selection in 16(3.79%). A drug that most commonly associated with DTPs was ampicillin (10.54%) and followed by gentamicin (9.42%). Patients with poly-pharmacy were 3.020 times more likely to had drug therapy problems than patients without poly-pharmacy (AOR= 3.020(1.691-5.395). The rest variables were not significant by multivariable analysis.

**Conclusion:** Drug therapy problems are common among pediatric ward patients. Dosage too high was the most common type of DTP among pediatrics ward patients. Patients with poly pharmacy had increased risk for possibility of drug therapy problems.

## Introduction

About 35 % of the world's population is less than 18 years of age [1]. Children represent the future, and ensuring their healthy growth and development ought to be a prime concern of all societies. Pediatric patients should be given medicines that have been appropriately evaluated for their use [2]. A drug-therapy problem (DTP) is defined as 'an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes' [3]. DTPs are classified into seven classes, including: need additional drug therapy, unnecessary drug therapy, ineffective drug, too low or too high dosage, adverse drug reactions, and noncompliance [4].

Pediatric patients are more prone to drug therapy problem. A number of factors may predispose pediatric inpatients for DTPs: weight-based dosing, the need for stock medicine dilution, decreased communication abilities of children and the high vulnerability of young and critically ill children to injury from medication; immature renal and hepatic systems to compensate drug therapy problem [5]. Children are also vulnerable for DTPs as a result of lack of appropriate studies [6].

Pediatric patients' management should be augmented by high caliber effort to identify and provide care by medicines that have been appropriately evaluated for their use [2]. Drug dosing in pediatric is a function of age, weight, or both. But, dosing may differ because of maturational differences in absorption, distribution and elimination [7]. Drug dosing is also altered by co-morbid conditions and obesity [8].

Unrecognized and/or unresolved DTPs can potentially lead to significant drug-related morbidity and/or mortality [9]. Although epidemiological and economic data of DTPs in the pediatric population are still limited, a recent study from the UK and the Kingdom of Saudi Arabia that investigated DTPs in hospitalized children found that 45.2% of pediatric patients experienced DTPs, 80.3% of which were assessed as preventable [10]. DTPs are also common in Ethiopia. According to retrospective cross-sectional study in pediatrics ward of Jimma University Specialized Hospital, 293 (57.45%) and 41 (8.04%) of the drugs were given without mentioning the dose and by incorrect dose, respectively [11]. Also in cross-sectional study which was carried out in the pediatric wards of Dessie Referral Hospital, Ethiopia identified a total of 223 prescribing errors from 384 medication orders [12].

Pediatric patients are population at high risk for drug related problem [13]. Infectious diseases, parasitic disease and number of prescribed drugs per patient (five or more) increased the risk of occurrence of DTPs [14]. The objectives of this study were to assess DTPs and study the factors associated with DTP among admitted pediatric patients.

## Methods

A retrospective cross-sectional study was conducted in Hiwot Fana Specialized University Hospital (HFSUH) found in Harar town,

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Harari People's National Regional State, Ethiopia. HFSUH pediatrics ward has one neonatology ICU, one pediatrics ICU, two nutrition rooms and two wards for admitted patients. It has a total of 55 beds and 43 health care professionals. The study was conducted from February 01 to April 07, 2015. 422 pediatric patients were selected from 1724 total admission in HFSUH from January 14, 2014 to January 14, 2015. The sample size was determined by using a single proportion formula and a systematic random sampling was used to select the study participants. Selected patients with complete chart were included in the study. Patients with incomplete chart were excluded and replaced by complete patient chart.

Data was collected by using data collection format. DTPs were identified by using Nelson textbook of pediatrics, 19th edition; standard treatment guideline for general hospitals, 2014; guideline updates on the management of severe acute malnutrition in infants and children 2013; pediatric hospital care Ethiopia 2010; guidelines for clinical and programmatic management of TB, leprosy and TB/HIV in Ethiopia, 5th edition 2012; and WHO consolidated guidelines on the use of anti-retroviral drugs for treating and preventing HIV infection: recommendations for a public health approach 2013.

The data was collected by using pretested data collection format which was prepared in English language. The format contains age, sex, diagnosis, anthropometric findings, laboratory results, past medical history, drug therapy problems, and medications involved. Data was collected from patient cards, who were admitted over one year, after consent of hospital administrator. Cards were numbered and the first card was selected by simple random sampling. Three graduating class clinical pharmacy students were involved in the data collection. Before starting the data collection, data collection format was pretested on 20 patient cards; and the study questions were rearranged as necessary. One day training on how to collect the data was given for data collectors. Data collection format was checked for the completeness and consistency after completion of every five cards.

The collected data was checked for completeness and consistency. After that data was coded and entered into Epi data version 3.1 and then transferred to SPSS window version 16.0 statistical software. Descriptive statistics and logistic regression were done to analyze the data. Multivariate analysis was done for those variables found to be significant (P-value <0.05) in univariate analysis.

## Operational definition

**Dosage too low:** the dosage is too low to produce the desired response in the patient;

**Dosage too high:** the dosage is too high, resulting in undesirable effects experienced by the patient;

**Inappropriate drug selection:** the selected drug product is not being effective at producing the desired response in the patient;

**Need additional drug therapy:** additional drug therapy is required to treat or prevent a medical condition in the patient.

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

**Polypharmacy:** more than three drugs.

## Result

### Demographic Characteristics

From the total of 422 pediatric patients who were involved in the study, 243 (57.6%) were male and 156 (37.0%) were within the age group of 1year to 5 years (Table 1).

| Demographic characteristic | | Frequency (%) |
|---|---|---|
| Sex | Male | 243(57.6%) |
| | Female | 179(42.4%) |
| Age | Less than 1 month | 11(2.6%) |
| | 1month-12 month | 148(35.1%) |
| | 12 month-5 years | 156(37.0%) |
| | >5 years | 107(25.4%) |

Table1: Demographic characteristics of pediatric.

### Drug therapy problems

Out of 422 participants, 256 (60.7%) had drug therapy problem. A total of 446 drug therapy problems were identified. 130 of the study participants had only one DTP (Figure 1). 106 (25.12%) had dosage too high, followed by dosage too low which account for 92 (21.8%) of participants (Table 2).

### Drugs involved in drug therapy problems

Antibiotics were highly involved with drug therapy problems than any other drugs followed by Zinc supplement (Table 3).

### Associated factors for drug therapy problem

Although being non-ICU, having severe acute malnutrition, more than two disease, polypharmacy and having laboratory result were associated with DTP in univariate analysis; only poly-pharmacy was found to have association with DTP in multivariable analysis. Patients with poly-pharmacy were 3.020 times more likely to have drug therapy problem than patients without poly-pharmacy (AOR = 3.020 (1.691-5.395) (Table 4).

| DTP | | Frequency (%) |
|---|---|---|
| DTP | Yes | 256(60.7%) |
| | No | 166(39.3%) |
| Need additional drug therapy | Yes | 76(18%) |
| | No | 346(82%) |
| Unnecessary drug therapy | Yes | 70 (16.59%) |
| | No | 352(83.41%) |
| Dosage too high | Yes | 106(25.12%) |
| | No | 316(74.88%) |
| Dosage too low | Yes | 92(21.8%) |
| | No | 330(78.2) |
| Ineffective drug therapy | Yes | 16(3.79%) |
| | No | 406(96.21%) |

Table 2: Prevalence of drug-therapy problems and specific type of drug therapy problems.
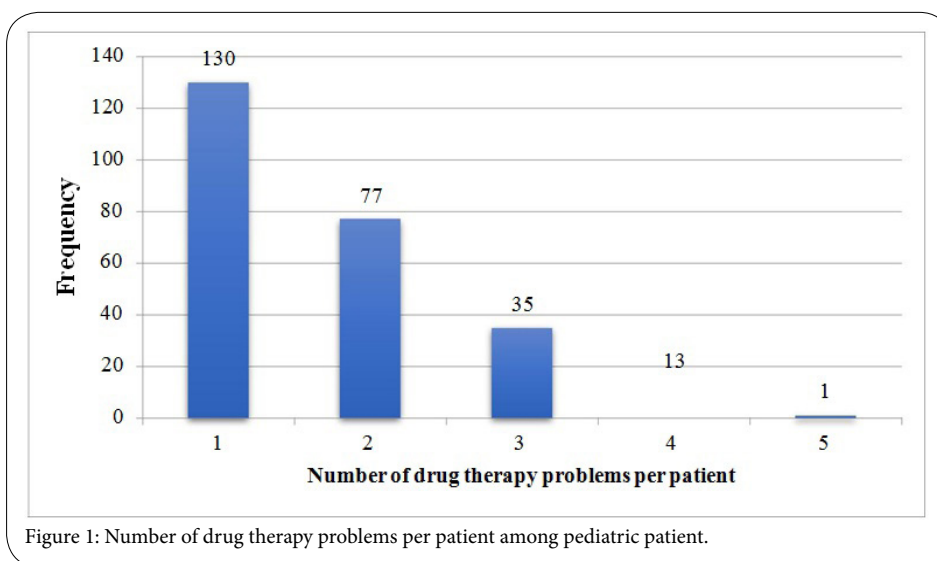
Figure 1: Number of drug therapy problems per patient among pediatric patient.

| S.No | Drug name | Frequency (%) |
|---|---|---|
| 1. | Antibiotics | 191(42.8) |
| 2. | Zinc | 33(7.4) |
| 3. | Folic acid | 24 (5.4) |
| 4. | Corticosteroid | 21(4.7) |
| 5. | Rehydration solution for severe malnutrition (ReSoMal) | 21(4.7) |
| 6. | Vitamin A | 20(4.5) |
| 7. | Metronidazole | 20(4.5) |
| 8. | F -75 | 15(3.4) |
| 9. | Maintenance fluid | 15(3.4) |
| 10. | Paracetamol | 13(2.9) |
| 11. | Ferrous preparations | 8(1.8) |
| 12. | Phenytoin | 7(1.6) |
| 13. | Chlorpromazine | 7(1.6) |
| 14. | Furosemide | 6(1.3) |
| 15. | Pyridoxine | 6(1.3) |
| 16. | Others | 39(8.7) |

Table3. Drugs associated with each type of DTPs.
Others: diazepam(5), insulin(5), ORS(5), spironolactone(4), cimetidine(3), miconazole(3), tetanus antitoxin(3), quinine(2), aspirin(1), captopril(1), gentian violate(1), griseofulvin(1), ibuprofen(1), lactulose(1), nifedipine(1), phenobarbital(1), praziquantel(1).

## Discussion

The prevalence of drug therapy problems was very high (60.7%). The current study finding was even higher than findings of similar studies in Hong Kong (21.0%) [14] and Saudi Arabia (56%) [15]. The possible reason for this difference might be low standard of care in low income countries like Ethiopia.

Dosages too high (25.12%) followed by dosage too low (21.8%) were the most prevalent problems. Dosing errors are common problems among pediatric patients as revealed by a study from Hong Kong (dosing problems (42.7%)) [14]; Saud Arabia (the incidence of dose errors was the highest (22.1%)) [15]; Norway (18% were non-optimal doses) [16]; and Northeast, Ethiopia (dosing errors (31.39%)) [12].

This higher dosage related problems might be due to a frequent need to calculate a required amount of dose for each patient as opposed to adults.

The current study revealed that 18% pediatric patients admitted in ward need additional drug. This finding was lower than the result from France, Quebec, Switzerland and Belgium (untreated indication (25 %)) [13]. This difference might be due to differences on the variety of conditions that can be managed in high come countries. More than a quarter of pediatric patients (16.59%) had unnecessary drug therapy which was greater than the result of study in Saudi Arabia (duplicate therapy (1%)) [15]. This difference might be due to unconfirmed diagnosis and empiric therapy in poor clinical set ups.

| Factors | | Drug therapy problem | | COR ( 95% CI) | AOR( 95% CI) |
|---|---|---|---|---|---|
| | | Yes | No | 1.306(.880-1.938) | |
| Sex | Male | 154(63.4%) | 89(36.6%) | | |
| | Female | 102(57.0%) | 77(43.0%) | 1 | |
| Age | Less 1 month | 8(72.7%) | 3(27.3%) | 1.296(0.324-5.189) | |
| | 1month-12month | 86(58.1%) | 62(49.1%) | 0.674(0.401-1.133) | |
| | 1year-5years | 90(57.7%) | 66(42.3%) | 0.663(0.397-1.108) | |
| | >5years | 72(67.3%) | 35(32.7) | 1 | |
| Site of care | ICU | 101(52.1%) | 93(47.9%) | 1 | 1 |
| | Non-ICU | 155(68.0%) | 73(32.0%) | 1.955(1.316-2.905)* | 1.501(0.965-2.335) |
| Nutritional level | Normal | 165(52.9%) | 147(47.1%) | 1 | 1 |
| | Moderate | 17(68.0%) | 83(2.0%) | 1.893(0.794-4.515) | 1.761(0.689-4.501) |
| | Severe | 74(87.1%) | 11(12.9%) | 5.993(3.063-11.727)* | 1,898(0.853-4.221) |
| Laboratory | Not done | 21(46.7%) | 24(53.3%) | 1 | |
| | Done | 235(62.3%) | 142(37.7%) | 1.891(1.016-3.522)* | 1.683(0.865-3.278) |
| Number of disease per patient | With <=2 | 156(52.3%) | 142(47.7%) | 1 | 1 |
| | With >2 | 100(80.6%) | 24(19.4%) | 3.793(2.300-6.254)* | 1.734(0.964-3.117) |
| Number of prescribed drug per patient | With <=3 | 129(48.0%) | 140(52.0%) | 1 | 1 |

Table 4: Factors associated with drug therapy problem in pediatrics.
COR=Crude odds ratio, AOR=Adjusted odds ratio, CI=Confidence interval. *Statistically significant

Most of the DTPs were from Antibiotics prescribing which was similar with what was found in Dessie, Ethiopia (antibiotics (54.26%)) [12]; and France, Quebec, Switzerland and Belgium (anti-infective (23%) [13].

Poly-pharmacy (>3 drugs) was found to have a statistical significant association with DTPs prevalence (AOR= 3.020(1.691-5.395). A similar study from Hong Kong had also identified it as important associated factor [14]. Other factors like site of care, sex and age group had no statistical association with DTPs.

## Conclusion

Drug therapy problems were common among patients who were admitted to pediatric ward of HFSUH. Inappropriate dosage (dosage too high and dosage too low) were the most prevalent problems. Antibiotics were most frequently associated medicines with drug therapy problems. From antibiotics, ampicillin was the common drug associated with drug therapy problems. Numbers of drugs prescribed per patient had statistical significant association with DTPs.

## Limitations

Important drug therapy problems; adverse drug reactions and patient adherence were not included because the study design was retrospective and poor documentation of adverse drug reactions.

## Declaration

### Ethical consideration

Ethical approval was obtained from Haramaya University College of Health and Medical Science, School of pharmacy. An official letter was written from the school to HFSUH. Confidentiality of information's was maintained by removing patient's name and address during data collection process.

### Consent to participate

This study was done on secondary data, so consent was not applicable. But patients name and address were left intentionally during data collection to keep privacy of patients.

### Consent for publication

Since this work included an aggregated report but not individual patient response consent for publication was not applicable.

Availability of data the data entered in SPSS will be available and given to any researcher who is willing to look at it from Miss Natanim Degefu Agazhi.

## Competing Interests

The authors declare that they have no competing interests.

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