

# Rationality of Prescriptions for Patients Admitted With Common Illnesses in a Children's Hospital

Farideh Shiva,<sup>1</sup> Roxana Ghanaie,<sup>1,\*</sup> Fariba Shirvani,<sup>1</sup> Shahnaz Armin,<sup>1</sup> Sedigheh Rafiei Tabatabaei,<sup>1</sup> Seyed Alireza Fahimzad,<sup>1</sup> Fatemeh Fallah,<sup>1</sup> Ahmad Reza Shamshiri,<sup>1</sup> Samira Sayyah,<sup>1</sup> and Abdollah Karimi<sup>1</sup>

<sup>1</sup>Pediatric Infections Research Center, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran

\*Corresponding author: Roxana Ghanaie, Pediatric Infections Research Center, Mofid Children's Hospital, Shahid Beheshti University of Medical Sciences, Tehran, IR Iran. Tel: +98-9123182084, E-mail: roxanaghanaie@yahoo.com

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## Abstract

**Background:** Recent advances in medicine and the pharmaceutical industry have led to a multitude of treatment options for the management of illness in both adults and children.

**Objectives:** To identify prescribing patterns for children hospitalized with common acute illnesses in a tertiary-care children's hospital.

**Materials and Methods:** Case notes of children hospitalized from October 2013 to September 2014 with urinary tract infection, respiratory distress, pneumonia, acute gastroenteritis, febrile convulsions, acute bacterial meningitis, and fever with rash or without a localized source, as well as case notes of previously healthy children scheduled for surgery, were reviewed. Relevant data regarding diagnoses, hospital course, and treatment were documented on information sheets and reviewed independently by two members of the faculty (pediatric infectious disease specialists) to evaluate the appropriateness of prescriptions given for each patient.

**Results:** A total of 227 case notes were reviewed, 129 (56.8%) of which belonged to male patients. No medication was prescribed for 13 patients, whereas 697 drug prescriptions (excluding intravenous fluids) were given for 214 patients, equaling 3.25 drugs/patient; antibiotics were prescribed for 161 children (70.92%). Overall, 87.96% of drugs were prescribed by their generic names; 20% of prescribed medications were unnecessary; the dose was incorrect in 15% of prescriptions; and the duration of treatment was inappropriate in about 27% of prescriptions. Only 29% of children with acute diarrhea received oral rehydration therapy.

**Conclusions:** Findings reveal a significant degree of prescription errors, emphasizing the need for stringent surveillance.

**Keywords:** Prescription Practice, Drugs, Medications, Antibiotics

## 1. Background

Recent advances in medicine and the pharmaceutical industry have led to a multitude of treatment options for the management of illness in both adults and children. The availability of new medications has been accompanied by an increase in overprescribing for common ailments in children, a problem that has been reported worldwide, both from developed and developing countries (1-3). Several authors have documented global irrational prescribing patterns; examples of medication misuse include almost all categories of medications, with analgesics, cough and cold medications, and antibiotics occupying the top of the list, for outpatients and inpatients alike (1). A particularly worrisome aspect of irrational prescribing is the unnecessary use of injections in the pediatric population. According to reports from the world health organization (WHO), approximately 16 billion injections are prescribed every year worldwide; more than 70% of these in-

jections are unnecessary, and a sizeable proportion are unsafe and may lead to transmission of blood-borne infections like Hepatitis B, Hepatitis C, or the human immunodeficiency virus (4). Unnecessary medications increase health-care costs for families, create an avoidable burden on the health-care system of a country, and may cause adverse effects, thus augmenting the damage (5). The rate of drug exposure in children varies across different parts of the world; in most countries, the highest prescription rates have been reported for preschoolers, and the rates decline for patients older than 6 years of age (1). According to the WHO, "Rational use of medicines requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community" (6). Inappropriate prescribing, by contrast, may include prescribing medications unnecessarily, prescribing the wrong drug, prescribing an incorrect dosage, or failing to prescribe drugs when they are

needed. Systematic reviews have estimated that almost 50% of in-hospital admissions and a significant percentage of medication orders may be prone to prescribing errors (7).

It is crucial that health-care professionals be trained to prescribe in accordance with evidence-based national and/or international guidelines. In addition to cutting prescription costs, prescribing according to standard guidelines has been shown to improve the effectiveness of the management of different medical problems.

## 2. Objectives

This study was carried out to identify prescribing patterns and determine the prevalence and the nature of prescribing errors for patients hospitalized with common illnesses in a university-affiliated children's hospital in Tehran.

## 3. Materials and Methods

Case notes of children hospitalized during the study period of one year, from October 2013 to September 2014, were reviewed by members of the study team.

Children admitted with respiratory distress or fever with rash and those with one of the following discharge diagnoses were included: urinary tract infection (UTI), acute gastroenteritis, pneumonia, febrile seizures, acute bacterial meningitis, fever without localizing signs (FWLS), and those undergoing surgery.

Charts of patients with underlying chronic diseases, major congenital malformations, immunodeficiency, or debility were excluded.

Trained members of the study team included one pediatric resident, one epidemiologist, and eight members of the faculty (one microbiologist, one pediatrician, and six pediatric infectious disease specialists). Recommendations from the WHO protocol DAP 93.1 were applied in designing this study; patient demographic data, diagnosis, and prescribed medications were recorded (8).

Relevant data, including chief complaints, clinical manifestations, results of investigations, admission and discharge diagnoses, duration of hospitalization, number, name, dosage and route of administration of the drugs prescribed at admission, and any change in treatment, were extracted from the files and documented on information sheets.

The information sheets were then reviewed independently by two members of the faculty (pediatric infectious disease specialists) to evaluate the appropriateness of prescriptions given for each patient. Treatment was

deemed rational and appropriate if conformed to standard national and/or international guidelines as specified in textbooks, WHO recommendations, clinical journals, or in-hospital protocols. If these two members had differing opinions about any aspect of management, the files were given to a third member for a final decision.

All data were then transferred to the PASW statistics data editor, and the percentage of drugs used for different patients was calculated, along with the rationality of prescriptions, dosing errors, and treatment duration.

## 4. Results

A total of 227 case notes were reviewed; 129 charts (56.8%) belonged to male patients. Pediatric residents made the initial diagnoses in 113 patients (49.8%), and fellows or attending physicians did so in 114 cases (50.2%). The discharge diagnoses were made by residents in 18% of the patients, by fellows in 11.9%, and by attending physicians in 69.2%.

Particulars of medications prescribed for different diagnoses are summarized in [Table 1](#).

Overall, 87.96% of drugs were prescribed by their generic names; however, antiasthma medications, namely ipratropium bromide inhalers and albuterol nebulizers, were prescribed by trade names in 75% and 67% of cases, respectively ([Tables 2](#) and [3](#)). Almost 20% of drug prescriptions were deemed unnecessary or irrational by members of the study team (pediatric infectious disease specialists); the dose was incorrect in 15% of prescriptions, and the duration of treatment was inappropriate in about 27% ([Table 2](#)).

While 13 patients scheduled for surgery did not receive any medications (in addition to those needed for preoperative care), 697 drug prescriptions (excluding intravenous fluids) were given for 214 patients (3.25 drugs/patient). Antibiotics were not prescribed for 66 patients (29.07%), whereas 273 antibiotic prescriptions were given for 161 children (70.92%), equaling 1.7 antibiotics/patient ([Table 1](#)).

The most commonly prescribed drug was ceftriaxone, with rational prescriptions given for 72.3% of patients, followed by the antipyretic acetaminophen, given to 59 patients, with a rational prescription rate of > 96% ([Table 3](#)).

Of 30 patients scheduled for surgery, 16 were given 28 prescriptions for antibiotics (1.75 antibiotics/patient; [Table 1](#)).

Of 24 cases admitted with acute gastroenteritis, oral rehydration therapy was administered in only 7 cases (29.16%), and antibiotics were administered in eight patients (33.3%).

**Table 1.** Diseases and Prescriptions Included in the Study<sup>a</sup>

Disease/ Presentation	No. of Patients	Total no. of Drugs Prescribed, Excluding IV Fluids (Drugs/Patient)	No. of Patients Given Antibiotics	No. of Antibiotic Prescriptions (Anti- biotic/Patient)	Most Prescribed Drug	No. of Different Drugs	Most Prescribed Antibiotic
UTI	47 (20.7)	81 (1.72)	47 (100)	78 (1.66)	Ceftriaxone	11	Ceftriaxone
Pneumonia	31 (13.7)	170 (5.48)	26 (83.87)	38 (1.22)	Ceftriaxone	58	Ceftriaxone
Meningitis	25 (11)	105 (4.2)	25 (100)	62 (2.48)	Vancomycin/ceftriaxone	25	Vancomycin
Gastroenteritis	24 (10.6)	27 (1.12)	9 (37.5)	8 (0.33)	Zinc sulfate	5	Ceftriaxone
Fever + rash	20 (8.8)	115 (5.75)	8 (40)	14 (0.7)	Acetaminophen		
Respiratory distress (including asthma)	15 (6.6)	116 (7.73)	12 (80)	16 (1.06)	Ipratropium bromide	35	Ceftriaxone
FC	22 (9.7)	27 (1.23)	11 (50)	16 (0.72)	Phenobarbital	7	Ceftriaxone
FWLS	13 (5.7)	25 (1.92)	7 (53.84)	11 (0.84)	Acetaminophen	14	Ceftriaxone
Surgical procedures	30 (13.2)	31 (1.82)	16 (53.3)	28 (0.93)	Cephalexine	9	Cephalexine
<b>Total</b>	<b>227</b>	<b>697 (3.070)</b>	<b>161 (70.92)</b>	<b>271 (1.19)</b>	-	-	-

<sup>a</sup>Values are expressed as No. (%).**Table 2.** Prescription Practices<sup>a</sup>

Diagnoses	Drug Prescribed by Generic Name	Appropriate Drug Prescribed	Appropriate Dose	Administered for Appropriate Duration
UTI	95	73.81	93.65	71.43
Pneumonia	73.65	84.43	95.21	82.63
Meningitis	85.26	91.58	91.58	86.31
Gastroenteritis	98.08	84.61	82.69	88.46
Fever + rash	79.46	88.39	97.32	83.93
Respiratory distress (including asthma)	84.46	82.52	90.29	84.47
FC	100	76.74	100	58.14
FWLS	94.78	79.92	92.31	84.61
Surgical procedures	78.57	60.71	21.42	14.82
<b>Total</b>	<b>87.69</b>	<b>80.30</b>	<b>84.94</b>	<b>72.75</b>

<sup>a</sup>Values are expressed as %.

## 5. Discussion

We documented a total of 875 drug prescriptions, including prescriptions for intravenous fluids for 227 patients (3.85 drugs/patient), with almost 71% of children receiving at least one antibiotic. Studies from different parts of the world have depicted widely varying prescribing patterns for both inpatients and outpatients (2, 9-12). A study of prescriptions from 20 Gambian health centers reported

the mean number of drugs as 2.2 per encounter, with over 63% of patients receiving antibiotics, and a study from Minnesota recorded that 57% of children hospitalized in an academic center were administered antimicrobials (2, 10). A survey on prescriptions dispensed in the outpatient clinics in four pediatric hospitals in Khartoum, Sudan, documented the mean number drugs per prescription as 2.0; 49.3% were prescribed by their generic names, and 81.3%

**Table 3.** The 21 Most Commonly Prescribed Drugs in 227 Patients, Including the 11 Most Commonly Administered Antibiotics<sup>a</sup>

Name	Times Prescribed	Data Available	Generic Name	Rational Prescription	Correct Dose	Approved Duration
<b>Antibiotics</b>						
Ceftriaxone	113	112	96 (85.71)	81 (72.32)	99 (88.39)	82 (73.21)
Vancomycin	39	39	36 (92.3)	32 (82.05)	35 (89.74)	26 (66.66)
Amikacin	29	29	29 (100)	10 (34.4)	28 (96.55)	15 (51.72)
Cefotaxime	16	16	16 (100)	14 (87.5)	15 (93.75)	13 (81.25)
Ceftazidime	15	15	12 (80)	9 (60)	13 (86.6)	9 (60)
Azithromycin	12	11	11	7	10	10
Ampicillin	5	5	4	5 (100)	5 (100)	4
Clindamycin	5	5	5 (100)	4	4	4
Imipenem	4	4	4 (100)	0	3	0
Gentamycin	3	3	3 (100)	3	3	2
Meropenem	3	3	3 (100)	2	3	2
<b>Other Medications</b>						
Acetaminophen	59	54	45 (83.3)	52 (96.29)	51 (94.4)	50 (92.59)
Ventolin nebulizer	26	24	6 (25)	19/23	23/24	20/23
Salbutamol MDI Inhaler	15	11	10 (90.9)	10 (90.9)	11 (100)	11 (100)
Atrovent	12	12	4 (33.3)	11 (91.6)	12 (100)	11 (91.6)
Spray beclomethasone	13	13	12 (92.3)	9 (69.23)	13 (100)	10 (76.92)
Epinephrine	12	10	10 (100)	5 (50)	8 (80)	4 (40)
ORS	11	10	10 (100)	9 (90)	7 (70)	9 (90)
Phenobarbital	21	20	19 (95)	16 (80)	19 (95)	17 (85)
Ranitidine	24	24	21 (87.5)	21 (87.5)	22/22	15/21
Antihistamines (hydroxyzine, cetirizine, loratadine)	13	12	9 (75)	11 (91.6)	11 (91.6)	11 (91.6)
Total	447	430	365 (84.88)	327 (76.2)	392 (91.5)	324 (76)

<sup>a</sup>Values are expressed as No. (%).

were antibiotics (11). A study of treatment charts of children hospitalized in a tertiary-care teaching hospital in West Nepal documented the median duration of hospitalization as four days and the mean number of drugs per case as 4.5, with antibiotics administered to 69.9% of patients (12).

Findings from hospital outpatient clinics from two different studies in Nigeria reported a drug/prescription ratio varying from 3.2 to 2.8, with 28.1% of patients receiving antibiotics and about 49% of medications prescribed by their generic names (13, 14).

Ceyhan et al. conducted a point prevalence survey on antimicrobial use in hospitalized children in 12 hospitals in Turkey; they reported consumption of antibiotics in 54.6% of patients and in 75.7% of those admitted to the

ICU. Inappropriate prescriptions of at least one medication were observed in 46.7% of cases; most instances of inappropriate prescription were recorded for fluoroquinolones (81.8%) (15).

In our study, various types of prescribing errors were identified, including irrational prescriptions (20%), dosing errors, (15%), and administering the medication for an inappropriate duration (27%). Reports from the United States and the United Kingdom have estimated that prescribing errors may cause adverse effects in 1% - 2% of patients. In these studies, prescribing errors largely comprise erratic dosing and irrational decisions; although the former is more common, the latter may lead to serious adverse effects (16-18). In a study conducted in 11 wards across five hospitals in London (four of these centers were teaching

institutions), Ghaleb et al. identified incorrect prescribing in 13.2% of their cases and found that incomplete prescriptions and incorrect dosing were frequent prescribing errors (17). Because medication doses require adjustment according to the child's weight, the likelihood of dosing errors is high; in a systematic review of 16 studies, dosing error was shown to be the most common error type, and in some cases 10 times the required dose had been prescribed (18).

In our study, most medications were prescribed by their generic names (> 87%); these figures are much higher than the widely varying range of 5.8% - 74.8% reported by other authors (2, 11, 13, 14, 19). The practice of prescribing drugs by their generic names cuts the cost of therapy and has been shown to increase appropriate usage (12, 19).

In our study, the most frequently prescribed drugs were antibiotics and analgesics; ceftriaxone was the most commonly prescribed antibiotic, administered to 113 patients (49.78%), followed by vancomycin, given to 39 children (17.2%). Acetaminophen was the most frequently prescribed antipyretic; it was interesting to note that ibuprofen was given to only four patients, who presented with fever and rash.

Regarding the management of children admitted with acute gastroenteritis, we observed an underutilization of oral rehydration therapy in patients with mild dehydration and an overuse of antibiotics and parenteral fluid therapy.

Another point of concern was the use of antibiotics in previously healthy children scheduled for surgical procedures; out of 28 antibiotic prescriptions, only four were for treatment, and the rest were solely for prophylactic use. Although the use of prophylactic antibiotics for surgical procedures is deemed inappropriate by authorities, it has been reported from other centers as well (15, 20, 21).

The fact that the present study was conducted by reviewing case notes and not by examining the actual patients is one of its limitations, because it is possible that some clinical findings that might have prompted the use of a certain medication were not recorded in the patient's chart, resulting in our overestimation of unnecessary drug use. We attempted to minimize this limitation by choosing files of previously healthy children not receiving medications for chronic diseases who were admitted only for an acute illness. It should be noted that other authors have used chart review with or without other measures to estimate prescription patterns in their institutions (12, 15, 21).

Our results reveal a significant degree of error in prescriptions written for children admitted for the treatment of common illnesses in a tertiary-care children's hospital. These findings underscore the need for strict vigilance and

regular surveillance of the prescribing habits of the medical staff, together with regular training sessions on appropriate prescribing in pediatric practice.

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