

Drug utilization pattern in an Omani pediatric population

Abstract

Objective: Evidence suggests that medication errors have a higher incidence in children and infants than in adults. At present, there is limited local data that investigates the drug prescription trends in pediatric populations. This study aims at understanding drug utilization patterns in pediatric patients at Sultan Qaboos University Hospital (SQUH), Oman.

Materials and Methods: A retrospective cross-sectional study was conducted in the outpatient pediatric clinics and inpatient pediatric wards at SQUH, a tertiary care hospital attached to the Sultan Qaboos University Medical College, Oman.

Results: The average number of drugs per prescription was 2.3 ± 1.5 , and it was almost similar in all age groups and in both males and females. About 16% of the study group received antibiotics. Paracetamol was the most prescribed drug in the patients (13%). Respiratory system drugs were the most prescribed class of drugs (22%) and salbutamol was the most prescribed drug in this class.

Conclusions: This study will help in assessing rational usage and cost control of various medications used in the pediatric setting.

Key words:

Drugs, pediatrics, prescribing

Introduction

Knowledge of drug administration in children and infants lags behind that of adults for many reasons. These include developmental differences that affect the pharmacodynamic and pharmacokinetic profiles of drugs, ethical and financial reasons, research capabilities, and regulatory guidelines and constraints.^[1] Irrational drug use, especially antimicrobials in a pediatric population, has become a commonly noted practice. A study in the USA and Canada has shown that 50% and 85% of antibiotics, respectively, were prescribed inappropriately to children.^[2] Evidence suggests that medication errors have a higher incidence in children and infants than in adults.^[3] Drug prescribing errors occur at rates as high as 4.2% in pediatric inpatients.^[4]

Prescribing unnecessary drugs to children has many pitfalls including increased consultation rates, wasting of resources, and exposing patients to adverse drug events. Studies have indicated that children are prescribed drugs frequently, with a mean number of drugs as high as 5.5.^[5] Another public health

concern in pediatric pharmacotherapy is the widespread off-label (prescribing outside the recommended dosage, indication, route of administration, or age of patient) and unlicensed use of drugs, which might lead to over- or under-dose of drugs in children. The overall off-label prescription rates ranged between 25% and 60% across populations and have been shown to be highest in children less than 2 years of age and in adolescents (11-17 year olds).^[6] Another review also showed that 80-93% of medications used in European and Australian neonatal wards are off-label or unlicensed.^[7]

The European Medicines Agency (EMA) and the Food and Drug Agency (FDA) encourage the development of studies involving individuals less than 18 years of age.^[8] At present, there is limited local data that investigates the drug prescription trends in pediatric populations. Therefore, this study aims at understanding the drug utilization patterns in pediatric patients at Sultan Qaboos University Hospital (SQUH), Oman. The study will provide baseline data about pediatric

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prescribing habits and will be helpful in planning longitudinal prospective studies on prescribing in pediatric patients. Furthermore, evaluating prescription patterns gives an insight into nature of the health care delivery system, which has an impact on clinical education and economic purpose.

Materials and Methods

This was a retrospective cross-sectional study conducted in the outpatient pediatric clinics and inpatient pediatric wards at SQUH, a tertiary care hospital attached to the Sultan Qaboos University Medical College, Oman. The study covered a period of 3 months (March-May 2012). The hospital patients' electronic records were used to obtain their relevant data. Ethical approval from the Medical Research and Ethics Committee at the College of Medicine and Health Sciences was obtained before implementing the study. The following data were collected for each patient: Demographic data (sex, age, and weight), type of patient (inpatient\outpatient), diagnosis, length of hospital stay, and drug prescription data (name of the drug, class, dose, frequency of administration, duration of treatment, indication, dosage form, route of administration, and number of drugs per prescription). The prescribed drugs were classified according to the Anatomical and Therapeutic Chemical (ATC) classification system.

The World Health Organization (WHO) core indicators for drug utilization were also evaluated and these are: Average number of drugs per encounter, percentage of drugs prescribed by generic name, percentage of encounters with an antibiotic, percentage of encounters with an injection, and percentage of drugs prescribed from the essential drug list.

For categorical variables, frequencies and percentages were reported. For continuous variables, means and standard deviation [or medians and interquartile range (IQR)] were used to summarize the data. Analyses were performed using Chi-squared tests (non-parametric data) and Student's *t*-tests (parametric data), whenever appropriate to test for statistical associations. Significance was set at the 2-tailed 0.05 level. Statistical Package of Social Sciences version 19 (SPSS Inc., Chicago, IL, USA) was used for analysis.

Results

Patients' characteristics

The study analyzed 499 patients with a total of 1186 prescriptions. The median (IQR) age of the pediatric patients was 3.5 (1.0-9.0) years. The most frequent age group was 0-6 years (65.9%, *n* = 329). Male children were the most frequent, representing 57% of the cohort. Most of the children (64%) were from the pediatric outpatient's clinic at SQUH. The median (IQR) drug treatment duration of the patients was 7.0 (0.0-30.0) days [Table 1].

WHO core prescribing indicators

Analysis of the WHO core drug prescribing trends is shown in Table 2. The average number of drugs per prescription was 2.3 ± 1.5 , and it was almost similar in all age groups and in both males and females (2.3 ± 1.5 and 2.3 ± 1.4 , respectively).

Table 1: Demographic characteristics of the patients (N=499)

Age, years (median, IQR)	3.5, 1.0-9.0
Age groups, years (<i>n</i>)	
Up to 6	329
7-11	117
More than 12	53
Gender (<i>n</i> , %)	
Male	285, 56.9%
Female	214, 42.9%
Weight, kg (mean \pm SD)	18.5 \pm 15.1
Patient's status (<i>n</i> , %)	
Inpatient	178, 35.7%
Outpatient	321, 64.3%
Drug treatment duration, days (median, IQR)	7.0, 0.0-30.0

IQR: Interquartile range, SD: Standard deviation

Table 2: Assessment of WHO core prescribing indicators by age group (N=1186 prescriptions)

Parameter assessed	All (<i>n</i> =1186)	0-6 years (<i>n</i> =775)	7-11 years (<i>n</i> =284)	≥ 12 years (<i>n</i> =127)
Average number of drugs per prescription	2.3 \pm 1.5	2.3 \pm 1.3	2.4 \pm 1.9	2.4 \pm 1.5
% of encounters with an antibiotic	15.9	19.1	10.9	7.9
% of encounters with an injection	15.2	13.8	12.9	11
% of drugs from the WHO essential drug list	45.1			

About 16% of the study group received antibiotics, with the pre-school children (0-6 years) receiving the highest percentage of antibiotics (19%) compared to the children of other age groups. In addition, 15% of the patients received their drugs in an injectable form.

Drug prescription patterns

A total of 1186 prescriptions were written for the 499 patients. The most common route of drug administration was the oral route (59%) followed by injection and inhalation (15% and 13%, respectively). Table 3 shows a list of the most commonly prescribed drugs. Paracetamol was the most prescribed drug in the patients (13%) and was the most commonly prescribed drug in the pre-school children of up to 6 years of age (15%). It was the most prescribed drug in both male and female patients (12% and 14%, respectively), whilst it was the most prescribed drug in inpatients but not outpatient children (20% and 7%, respectively). Table 4 shows the most commonly prescribed drug classes as per the WHO Anatomical Therapeutic Chemical (ATC) classification system. Respiratory system drugs were the most prescribed class of drugs (22%) and salbutamol was the most prescribed drug in this class (8%) [Table 3]. When compared by age groups, anti-infectives for systemic use and gastrointestinal drugs were the most prescribed drugs in 0-6 years age group (26%)

Table 3: List of the top common drugs by age group, sex, and patient's status (N=1186 prescriptions)

All drugs	%	0-6 years (n=775)		7-11 years (n=284)		≥ 12 years (n=127)		Male (n=665)		Female (n=521)		Inpatient (n=541)		Outpatient (n=645)	
		Drug	%	Drug	%	Drug	%	Drug	%	Drug	%	Drug	%	Drug	%
1	12.6	1	15.1	2	12.3	4	7.9	1	12.2	1	13.5	1	19.9	2	8.9
2	7.6	2	6.7	1	9.5	5	7.9	2	8.4	2	6.7	3	6.5	1	7.3
3	4.7	3	6.2	7	4.6	1	5.5	5	4.8	3	5.4	2	6.3	6	5.1
4	3.6	6	3.6	5	4.2	13	5.5	3	4.2	8	3.5	4	3.7	5	4.5
5	3.5	9	3	4	3.5	14	3.9	4	3.9	4	3.3	9	3.3	7	4.5
6	3	4	3	13	3.5	15	3.1	7	2.9	6	3.3	18	3.0	4	3.6
7	2.6	11	2.7	6	2.8	7	3.1	6	2.9	18	2.5	20	3.0	3	3.3
8	2.3	12	2.6	8	2.5	2	3.1	9	2.7	7	2.3	8	2.8	13	2.8
9	2.1	5	2.6	3	2.5	16	2.4	10	2.7	11	2.3	5	2.4	11	2.0
10	2	8	2.3	14	2.1	17	2.4	14	2	19	2.1	10	2.2	21	2.0

1: Paracetamol, 2: Salbutamol, 3: Augmentin, 4: Ibuprofen, 5: Folic acid, 6: Fluticasone, 7: Mometasone, 8: Azithromycin, 9: Rehydration salt, 10: Chlorpheniramine, 11: Hepatitis B vaccine, 12: BCG vaccine, 13: Symbicort turbuhaler, 14: Diclofenac gel, 15: Lactulose solution, 16: hydroxycarbamide, 17: Moov gel, 18: Cefuroxime, 19: Ferrous sulfate, 20: Ceftriaxone, 21: Sodium valproate

Table 4: List of the top classes of drugs by age groups, sex, and patient's status (N=1186 prescriptions)

All classes	%	0-6 years (n=775)		7-11 years (n=284)		≥ 12 years (n=127)		Outpatient (n=665)		Inpatient (n=521)		Male (n=541)		Female (n=645)	
		Class	%	Class	%	Class	%	Class	%	Class	%	Class	%	Class	%
12	22.1	7	26	12	45.7	1	28.2	12	41.5	7	29.1	12	27.3	7	25.4
7	21.4	9	20.1	9	23.4	9	22.6	9	19.7	9	25.2	9	23.2	12	19.6
9	19.5	1	18.7	7	12.7	12	18.5	7	17.4	1	17.5	7	19.6	9	19.4
1	18.4	12	18.2	1	9.6	7	8.9	1	13.5	12	11.6	1	18.3	1	16.7
10	7.2	10	5.7	10	3.0	10	8.1	6	3.0	10	6.1	3	3.1	10	8.5
4	4.3	4	5.3	6	2.5	6	5.6	3	2.5	4	5	10	3.1	4	4.2
3	3.1	3	3.1	3	2.0	3	3.2	10	1.4	3	2.9	4	2.6	6	2.9
6	2.9	6	2.1	4	0.5	4	2.4	4	0.5	6	1.5	6	2.0	3	2.3
2	0.4	2	0.4	8	0.5	2	0.8	8	0.5	2	0.6	8	0.6	2	0.8
13	0.4									13	0.4				

1: Gastrointestinal, 2: Blood and blood forming organs, 3: Cardiovascular system, 4: Dermatological, 5: Genitourinary system and sex hormones, 6: Systemic hormonal preparations, 7: Anti-infectives for systemic use, 8: Anti-neoplastic and immunomodulating agents, 9: Musculoskeletal system, 10: Nervous system, 11: Antiparasitic products, 12: Respiratory system, 13: Sensory system

and ≥12 years (28%) age group, respectively. Respiratory system drugs were the most prescribed class of drugs in male patients (27%) and outpatient children (42%), while anti-infectives for systemic use were the most prescribed class of drugs in female patients (25%) and inpatient children (29%).

Discussion

Drugs prescribed for children are the same as those originally developed for adults. However, growth and development processes in children, in addition to disease profile, might expose them to different adverse effects. There has been a growing interest in recent years to study the efficacy and safety of drug use in children. For instance, the WHO launched a global campaign in 2007 called "make medicines child size" to address the issues of drug use in pediatric patients.^[9] The results of this study will help in rationalizing drug use, decreasing medication errors, and improving therapeutic outcomes, and form the basis for effective policies to address

appropriate medication use in pediatric patients at SQUH in Oman.

The average number of drugs per prescription was 2.3 ± 1.5 , and it was almost similar in all age groups [Table 2]. This finding was similar to that of the studies conducted in many European countries. A large cohort study in three European countries found the highest prescription rate in children aged under 2, ranging from 2.2 to 4.7 prescriptions per person year.^[10] Furthermore, a study from Sweden showed an average number of drugs per prescription as 2.27.^[11] In an Italian study, the prescription prevalence rate was higher in children of 1-5 years (65%) that decreased to 38% in adolescents^[1] and the average number of drugs per prescription was 2.9. A study from Nepal on pediatric inpatients^[5] showed an average of 4.5 ± 3.7 drugs prescribed per patient, with 38% of drugs prescribed intravenously. In our study, only 15% of the drugs were prescribed intravenously. The most common route of drug administration observed in our study was the oral route (59%). This was similar to a prospective

study on pediatric patients conducted in Switzerland which showed that the oral route was the most common route of administration (59% in 2010).^[3]

In our study, the four most common drugs used in children by anatomical class were respiratory drugs (22%), anti-infective drugs (21%), musculoskeletal system drugs (20%), and gastrointestinal drugs (18%) [Table 4]. These four drug classes were the top four groups used by children in the different age groups, but in different orders, and also in male and female patients and in inpatient and outpatient children [Table 4]. Similar to our results, in the large European cohort study, both anti-infective drugs and respiratory drugs were among the most commonly used drugs in different age groups,^[10] rating 30% and 21% in children aged 2-11 years, respectively. In addition, studies from Sweden, the Netherlands, and Denmark showed that anti-infective drugs, respiratory drugs, and dermatological drugs were the most commonly prescribed drugs in pediatric patients.^[12-14] Another study from Italy showed that anti-infective drugs and respiratory drugs were the most commonly prescribed drugs.^[1] Anti-infective drugs were the most prescribed drugs in inpatients (29%) of our study [Table 4], similar to that reported in a study from Nepal (70%).^[5] Generally, in our study, most of the drug classes were prescribed at a higher rate in males than in females, except for anti-infective drugs and nervous system drugs [Table 4]. This was similar to the trend in an Italian study.^[1] The European cohort study^[10] had a different trend in which user prevalence for almost all drugs in younger age groups was similar in both sexes,^[10] while studies from Sweden, the Netherlands, and Denmark showed more prescribing for girls than boys after the age of 10.^[12-14] In our study, co-amoxiclav followed by azithromycin were the most common drugs prescribed from the anti-infective drugs ATC class, while salbutamol followed by fluticasone were the most common drugs prescribed from the respiratory drugs ATC class [Table 3]. This was similar to the finding of the European study.^[10]

Paracetamol was the most commonly prescribed drug in our study population, with a prevalence rate of nearly 13%, followed by salbutamol (8%), while ibuprofen was the most prescribed drug in those aged ≥ 12 years [Table 3]. Paracetamol was mentioned in many studies as the most prescribed drug in pediatric patients, ranging from 7 to 14%. For instance, paracetamol and ibuprofen were the two most prescribed drugs in a prospective study on pediatric patients conducted in Switzerland, with a prevalence rate of 23% and 16% in 2005 and 22% and 23% in 2010, respectively.^[3] Co-amoxiclav followed by amoxicillin were the most prescribed drugs in Italian pediatric patients, with a prevalence rate of 18% and 13%, respectively.^[1] In contrast, the study on Nepalese pediatric inpatients showed that ampicillin (10%) and paracetamol (9%) were the most commonly prescribed drugs.^[5] A study on outpatient pediatric patients from India indicated paracetamol as the most frequently prescribed drug (14%).^[15] A large study from the USA showed that in 2010, amoxicillin was the most frequently dispensed in infants (0-23 months) (17%) and children (2-11 years) (11.3%) while methylphenidate was the top prescribed drug to

adolescents (12-17 years) (5%).^[16]

Similar to the study from Nepal, 45% of drugs in our study were prescribed from the WHO essential drug list. A study of the WHO core drug prescribing indicators in Indian neonatology unit showed that 89% of the drugs were prescribed from the essential drug list,^[17] and the average number of drugs per prescription, percentage of prescription with an antibiotic, and percentage of prescription by injection were 4.8, 30%, and 92%, respectively, compared to 2.3, 16%, and 15%, respectively, in our study. These parameters were 2.3, 29%, and 1.2%, respectively, in another study on pediatric outpatients in India.^[15]

Conclusion

Since pharmaco-epidemiological studies detailing prescribing patterns of physicians in pediatric patients are very few from developing countries, this study will help in assessing rational usage and cost control of various medications used in the pediatric setting.

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