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Prescribing error and associated factors at the pediatric ward of Wachemo University Nigist Eleni Mohammed Memorial Hospital, Southern Ethiopia

Bruke B. Billoro[1], Million L. Lorato[2]

1 *Department of Pharmacy, College of Medicine and Health Sciences, Wachemo University, Hosanna, Ethiopia*
2 *Department of Medicine, College of Medicine and Health Sciences, Wachemo University, Hosanna, Ethiopia*

Abstract

Background: Pediatrics admitted to hospital have more problems in relative to adults due to prescribing error but there is similarity in adverse events. This reason is that standard doses are given for adults, whereas pediatric patients are medicated based on their body mass and medical cases. This needs a lot of dose adjustment by health care professionals who prescribe the drug, which leads to increase of medication prescribing error. **Objective**: To determine the magnitude and associated factors of medication prescribing errors (MPE) at pediatric ward of Wachemo University Nigist Eleni Mohamed Memorial Hospital (WUNEMMH), Southern Ethiopia. **Methodology**: A cross-sectional study was done at pediatric ward from January 1, 2017 to February 1, 2018. All abstracted and observed data from medical records were checked for errors by the Micromedex Drug-Reax database and guidelines for pediatric use in Ethiopia. We analyzed data using SPSS version 22.0. The association between dependent and independent variables were carried out using logistic regression model with statistics significance declared at P-value < 0.05 and 95%CI). The results were presented by descriptive as well as in table form. **Results**: Out of 622 errors, the highest MPE was wrong dose with error rate of 110 (48.0%).The medication category with most MPE was antibiotics. Pediatrics with one diagnose [AOR = 3.04(95% CI=1.41 - 6.56)] were more likely face wrong combination than with greater than or equal to two diagnoses. Pediatrics less than one year old [AOR= 3.19(95% CI=1.54 - 6.59)] and pediatrics between one and five year [AOR= 4.31(95% CI=2.09 - 8.91)] were more likely face wrong combination than six to ten years old. Patients with one diagnose [AOR = 3.06(95% CI= 1.39 - 6.71)] were more likely have drug omission than with greater than or equal to two diagnoses and pediatrics less than one year old [AOR=2.15(95%CI=1.04-4.44)]; pediatrics with age one up to five year [AOR=4.47(95%CI=2.10-9.50)] were more likely face drug omission than from six to ten years old. It was found that, only patients with one diagnose [AOR=2.57(95% CI=1.17 - 5.67)] were more likely face wrong abbreviation. Patients with age one up to five year [AOR=0.43(95% CI= 0.22 - 0.84)] were more likely face wrong dose than from six to ten years of age. Patients with one diagnose [AOR=2.32(95% CI=1.07 - 5.06)] were more likely to face wrong duration than with greater than or equal to two diagnoses. **Conclusion**: The overall rate of medication prescribing error is high. The most frequently detected error was wrong dose followed by wrong combination, omission, wrong frequency and wrong route. Age group less than one year, from one to five and prescription with one diagnosis were statistically significant with prescribing error. We recommend staffs to have access for update references and involvement of clinical pharmacist in ward for reducing the medication errors.

Keywords: Prescribing errors, Medication errors, Inpatient, Pediatrics.

***Corresponding author:**
Bruke B. Billoro
Ph.D. Candidate, Department of Pharmacy, College of Medicine and Health Sciences, Wachemo University, Hosanna, Ethiopia
Email: 3b2005pharm@gmail.com

INTRODUCTION

Medication usage is a multidisciplinary practice with a physician's prescription followed by a pharmacist evaluation and delivery of medications and finally the nurses prepare and administer drugs to pediatrics patient [1]. These multiple steps in the medication chain lead to significant scope for error and devastating results for pediatric patient and for occupation of medical professionals [1, 2].

Patient safety must be the primary aim in every clinical setting. Medication errors (MEs) have important implications for patient safety and their identification is the main target in improving clinical practice errors including prevention of adverse events [3].

Pediatrics admitted to hospital have more problems in relative to adults due to prescribing error but there is similarity in adverse events. This reason is that standard doses are given for adults, whereas pediatric patients are medicated based on their body mass and medical cases. This needs a lot of dose adjustment by health care professionals who prescribe the drug, which leads to increase of medication prescribing error. Moreover, most medicines are prepared in adult dose and dosage form which is not comfortable for pediatric patients. As a result, health professionals who work in pediatric wards need to know dose

adjustment for pediatric patients which consist of a lot of preparation steps that leads to occurrence of medication prescribing error [4].

As a result, pediatric patients are at higher risk of encountering such errors than adults. Despite the fact that MEs result in harm to the patient and also have related costs, little studies are done on the extent of prescribing and administration errors in general and in pediatric inpatients in particular in Ethiopia. This study aims at filling this gap in information regarding the extent of prescribing errors in pediatric inpatients at WUNEMMH.

METHODOLOGY

Study area

The study was carried out at WUNEMMH, which is found in SNNPR as one of governmental hospitals and found at 230 and 194 km from the capital city of Ethiopia (Addis Ababa) and SNNPR (Hawassa), respectively. The hospital is found in hosanna town and currently, it is part of Wachemo University which is serving in four major clinical fields i.e. internal medicine, pediatrics, surgery, and gynecology.

Study design and duration

A cross-sectional study was carried out retrospectively from January 1, 2017, to February 1, 2018.

Study population

All hospitalized patients in pediatric ward who have medication prescribing interventions during the study time.

Sample size

A single population proportion formula with 5% marginal error, 95% CI and medication prescribing error rate of 58.1%(0.581) were used to calculate the sample [5].

Operational definition

Prescribing error: is an error in the choice or administration of drugs for patients. Included are incorrect dose or medicine, duplicate therapy, incorrect route of administration, or wrong patients. In current study, MPEs were recognized by comparing prescribed medicines with "national standard treatment guideline" [6] and "pocketbook of Pediatric Hospital Care in Ethiopia" [7].

Mediaction precribing rate: is the result obtained by dividing the sum of each category of prescribing to the total number of prescribed drugs.

Improper medicine choice: Prescribing drugs which have potential drug interaction, contradiction and known allergies.

Inappropriate frequency: deviation of prescribed drug from prescribed time schedule.

Wrong dose: deviation of prescribed drug dose by ±10% of optimal dose

Wrong route: prescribing drug in other route rather than the suggested route.

Incomplete prescription: prescription of drug with missing of necessary information like route of administration, dose frequency or type of dosage form.

Data processing and analysis

Data were analyzed using SPSS version 20. Descriptive statistics were used for sociodemographic and other variables. The association between dependent and independent variables were identified using multivariable logistic regression analysis. Factors which are statistically significance were stated at p value < 0.05 levels and 95% CI. The model of fitness for the variables was assessed by the Hosmer Lemeshow goodness of fit test. Finally, the results were presented by text and tables.

Ethical approval

Ethical clearance was obtained from the Ethical Review Committee of Wachemo University, College of medicine and Health Sciences. This committee has also written a formal letter of permission to WUNMMH to permit accessing the data and cooperate. As the study was carried out through a review of records, written informed consent was obtained from each study participant. Privacy of data was also assured and collected anonymously.

RESULTS

Characteristics of the participants

During the study period, the majority of patients were males 125 (54.6 %) and 94 (41.0%) patients were 1 up to 5 years and the number of patients with a single diagnosis was 194 (84.7%) (Table 1).

Table 1: Characteristics of patients admitted in the pediatric ward of WUNEMMH from January 1, 2017, to February 1, 2018 (N=229).

Characteristics		Frequency	Percent
Sex	Male	125	54.6
	Female	104	45.4
Age	<1	77	33.6
	1-5	94	41.0
	6-10	58	25.3
Number of diagnosis	One Diagnosis	194	84.7
	≥2 Diagnosis	35	15.3
Regimen taken	Complex	212	92.6
	Not Complex	17	7.4

Table 2: Types of medication prescribing errors at the pediatric ward of WUNEMMH from January 1, 2017, to February 1, 2018 (N=622).

No	Types of error	Frequency	Percent
1	Omission	74	32.3
2	Wrong abbreviation	56	24.5
3	Wrong combination	79	34.5
4	Wrong dosage form	48	21.0
5	Wrong Dose	110	48.0
6	Wrong duration	59	25.8
7	Wrong frequency	72	31.4
8	Wrong indication	58	25.3
9	Wrong route	66	28.8

Prescribing errors

The total number of prescription orders observed was 515 and the frequency of prescribing errors detected was 622, considering one or more than one error from each type of errors per prescription order per 229 patient chart reviewed. Out of 622 errors, highest prescription error type observed was the wrong dose which accounted 110(48.0%) of the cases, followed by wrong combination 79(34.5%), omission 74(32.3%) and the least was wrong dosage form 48(21.0%) (Table 2).

Therapeutic category of medications

Therapeutic category of medications with types of error was observed and drugs involved in the wrong combination were characterized based on their therapy classes and the most predominant drugs were antimicrobials (antibiotics) (Table 3).

Factors associated with Prescribing Errors

Wrong combination

In this study, factors considered to potentially predict the wrong combination were tested using multivariate logistic regression analysis. Based on this, pediatrics less than one years old, one diagnose and pediatrics between one and five years old were found to be a significant predictor of the wrong combination. Pediatric patients with one diagnosis were more than three times likely to be prescribed with the wrong combination compared to those with more than or equal to two diagnoses [AOR = 3.04 (95% CI=1.41 - 6.56)]. Pediatrics less than one years old [AOR= 3.19 (95% CI=1.54 - 6.59)] and pediatrics between one and five years [AOR= 4.31(95% CI=2.09 - 8.91)] were more likely to face the wrong combination than six to ten years old (Table 4).

Omission

Pediatric with age less than one year [AOR=2.15(95% CI= 1.04 - 4.44)], one up to five [AOR=4.47(95% CI= 2.10-9.50)] and one diagnose [AOR = 3.06(95% CI= 1.39- 6.71)] were factors independently associated with omission (Table 5).

Wrong abbreviation

After adjusting for other variables (sex, age, and prescriber being on duty), it was found that patients with one diagnosis were 2.57 times more likely to face the wrong abbreviation than patients who had greater than or equal to two diagnoses[AOR=2.57(95% CI=1.17 - 5.67)] (Table 6).

Wrong Dose

After adjusting for other variables (sex, number of diagnoses, and prescriber being on duty), it was found that patients with age one up to five [AOR=0.43(95% CI= 0.22 - 0.84)] were more likely to face the wrong dose than from six to ten years of age (Table 7).

Wrong duration

After adjusting for other variables (sex, age, and prescriber being on duty), it was found that only patients with one diagnosis [AOR=2.32, (95% CI=1.07 - 5.06)] were more likely to face the wrong duration than with greater than or equal to two diagnoses (Table 8). Remaining variables like the wrong route, wrong dosage form, and the wrong indication were not significantly associated with prescribing errors.

Table 3: The Therapeutic category of medications with types of error at pediatric ward of WUNEMMH from January 1, 2017 – February 1, 2018

No	Therapeutic class	Wrong combination	Omission	Wrong Indication	Wrong Abbreviation	Wrong Route	Wrong Dose	Wrong dosage form	Wrong frequency	Wrong duration
1	Antibiotics	74	69	55	55	65	110	47	72	58
2	Anti-infective	4	4	1	2	2	5	0	2	2
3	CVS drugs	3	3	2	2	2	0	2	1	1
4	antipyretic	33	27	37	25	35	64	25	34	25
5	Anticonvulsants	2	2	2	1	0	0	1	2	2
6	GI drugs	6	5	5	3	5	11	3	7	3
7	Blood acting	0	0	1	0	1	2	0	0	0
8	hormonal preparations	4	4	1	0	1	1	0	0	0
9	Immunomodulating	1	0	0	0	0	0	2	1	0
10	Respiratory drugs	7	6	2	5	3	9	1	10	5

Table 4: Results of binary and multivariable logistic analysis indicating predictors of the wrong combination at pediatric ward of WUNEMMH from January 1, 2017 – February 1, 2018.

Variables		Outcome N (%)		P-value (COR)	COR (95%CI)	AOR (95% CI)	P- value (AOR)
		Yes	No				
Age	<1	23(29.9)	54(70.1)	0.003	2.89(1.42-5.89)	3.19(1.54-6.59)	0.002**
	1-5	24(25.5)	70(74.5)	0.000	3.59(1.79-7.19)	4.31(2.09-8.91)	<0.001**
	6-10	32(55.2)	26(44.8)		1	1	
Sex	male	42(33.6)	83(66.4)	0.754	1.09(0.63-1.89)	1.21(0.67-2.18)	0.535
	female	37(35.6)	67(64.4)		1	1	
Major diagnosis	one diagnosis	61(31.4)	133(68.6)	0.024	2.31(1.11-4.79)	3.04(1.41-6.56)	0.005**
	2 or >2 diagnosis	18(51.4)	17(48.6)		1	1	
On duty	yes	27(44.3)	34(55.7)	0.063	0.56(0.31-1.03)	0.59(0.31- 1.11)	0.102
	no	52(31.0)	116(69.0)		1	1	

Table 5: Results of binary and multivariable logistic analysis indicating predictors of drug omission at the pediatric ward of WUNEMMH from January 1, 2017 – February 1, 2018.

Variables		Outcome N (%)		P value (COR)	COR (95%CI)	AOR(95% CI)	P value (AOR)
		Yes	No				
Age	<1	25(32.5)	52(67.5)	0.041	2.08(1.03-4.19)	2.15(1.04-4.44)	0.038**
	1-5	20(21.3)	74(78.7)	0.000	3.70(1.81-7.55)	4.47(2.10-9.50)	<0.001**
	6-10	29(50.0)	29(50.0)		1	1	
Sex	male	40(32.0)	85(68.0)	0.911	1.032(.59-1.80)	1.19(0.655- 2.18)	0.561
	female	34(32.7)	70(67.3)		1	1	
Major diagnosis	one diagnosis	57(29.4)	137(70.6)	0.028	2.27(1.09- 4.72)	3.06(1.39-6.71)	0.005**
	2 or >2 diagnosis	17(48.6)	18(51.4)		1	1	
On duty	yes	26(42.6)	35(57.4)	0.046	0.54(0.29- 0.99)	0.55(0.29-1.05)	0.068
	no	48(28.6)	120(71.4)		1	1	

Table 6: Results of binary and multivariable logistic analysis indicating predictors of the wrong abbreviation at the pediatric ward of WUNEMMH from January 1, 2017 – February 1, 2018

Variables		Outcome N (%)		P value (COR)	COR(95%CI)	AOR(95% CI)	P value (AOR)
		Yes	No				
Age	<1	23(29.9)	54(70.1)	0.151	0.55(0.24-1.25)	0.52(0.23- 1.21)	0.128
	1-5	22(23.4)	72(76.6)	0.520	0.77(0.34- 1.73)	0.86(0.37- 1.98)	0.721
	6-10	11(19.0)	47(81.0)		1	1	
Sex	male	27(21.6)	98(78.4)	0.272	1.40(0.77- 2.57)	1.69(0.89- 3.18)	0.107
	female	29(27.9)	75(72.1)		1	1	
Major diagnosis	one diagnosis	42(21.6)	152(78.4)	0.023	2.41(1.13- 5.15)	2.57(1.17- 5.67)	0.019**
	2 or >2 diagnosis	14(40.0)	21(60.0)		1	1	
On duty	yes	18(29.5)	43(70.5)	0.285	0.69(0.36- 1.35)	0.67(0.34- 1.33)	0.253
	no	38(22.6)	130(77.4)		1	1	

Table 7: Results of binary and multivariable logistic analysis indicating predictors of the wrong dose at the pediatric ward of WUNEMMH from January 1, 2017 – February 1, 2018.

Variables		Outcome N (%)		P value (COR)	COR (95%CI)	AOR (95% CI)	P value (AOR)
		Yes	No				
Age	<1	31(40.3)	46(59.7)	0.943	0.98(0.49- 1.96)	0.94(0.47-1.89)	0.863
	1-5	56(59.6)	38(40.4)	0.018	0.45(0.23- 0.87)	0.43(0.22- 0.84)	0.014**
	6-10	23(39.7)	35(60.3)		1	1	
Sex	male	64(51.2)	61(48.8)	0.294	0.76(0.45- 1.27)	0.72(0.42- 1.24)	0.240
	female	46(44.2)	58(55.8)		1	1	
Major diagnosis	one diagnosis	92(47.4)	102(52.6)	0.663	1.17(0.57- 2.41)	0.96(0.46- 2.04)	0.924
	2 or >2 diagnosis	18(51.4)	17(48.6)		1	1	
On duty	yes	35(57.4)	26(42.6)	0.090	0.59(0.33- 1.08)	0.57(0.31-1.05)	0.072
	no	75(44.6)	93(55.4)		1	1	

Table 8: Results of binary and multivariable logistic analysis indicating predictors of the wrong combination at pediatric ward of WUNEMMH from January 1, 2017 – February 1, 2018.

Variables		Outcome N (%)		P value (COR)	COR(95%CI)	AOR(95% CI)	P value (AOR)
		Yes	No				
Age	<1	21(27.3)	56(72.7)	0.520	0.77(0.35- 1.71)	0.74(0.33- 1.67)	0.471
	1-5	25(26.6)	69(73.4)	0.563	0.79(0.37-1.72)	0.88(0.40-1.94)	0.751
	6-10	13(22.4)	45(77.6)		1	1	
Sex	male	28(22.4)	97(77.6)	0.203	1.47(0.81- 2.67)	1.66(.89- 3.07)	0.109
	female	31(29.8)	73(70.2)		1	1	
Major diagnosis	one diagnosis	45(23.2)	149(76.8)	0.040	2.21(1.04- 4.69)	2.32(1.07- 5.06)	0.034**
	2 or >2 diagnosis	14(40.0)	21(60.0)		1	1	
On duty	yes	18(29.5)	43(70.5)	0.436	0.77(0.40- 1.48)	0.76(0.39- 1.48)	0.414
	no	41(24.4)	127(75.6)		1	1	

DISCUSSION

The result of the study showed that the total percentage of prescribing errors were above a hundred (i.e. 271.6). This implies that more than one type of error occurred per patient. Among prescribing errors, the most frequently detected error was the wrong dose followed by a wrong combination, omission, wrong frequency, and wrong route.

In this study, the most frequent prescribing error was the wrong dose. This result was in line with a study done in Saudi Arabia and India [8, 9], in which dose errors were the most common medication-related error. Likewise, a study conducted in a pediatric tertiary care hospital in Toronto, Canada showed a similar result where the wrong dose was the most common types, followed by incorrect frequency [10]. The current result was also consistent with the study conducted in Dessie referral hospital in 2014 [5] where incomplete prescriptions, incorrect dose, inappropriate dose formulation and incorrect drug prescribing time schedule were the most prescribing error types. Again it was agreed with the study done across five hospitals in the London area, the United Kingdom in which incomplete prescriptions were the commonest prescribing error type, and wrong dose was the third type of prescribing error occurring next to prescription writing error and use of abbreviations [11]. The present result was consistent with this in terms of rank but differs in percentage and the difference might be because of sample size, patient load, and the number of pediatricians.

Prescriptions with the wrong combination/drug- drug interaction was the second most frequent errors found next to the wrong dose and followed by omission, wrong frequency, wrong route, and wrong duration. However, it was in disagreement with study in Saudi Arabia and the UK [8, 11], where drug-drug interaction was very small (it was classified as miscellaneous (<1%). This might be because of the difference in the prescribing habit of the hospitals selected (i.e. the number of drugs prescribed per prescriptions).

The omission of prescription was the third most frequent type of error found, which was in line with the study conducted on medication error in the pediatric department at Italy where omission was a third prescription error [4]. In this study, the wrong frequency was the fourth most frequent error found, which was in line with a study conducted at the pediatric wards of Dessie referral hospital [5]. However, in Saudi Arabia and the UK [8, 11] wrong frequency was found to be the least common error detected.

The role of pharmacist in identification of medication prescribing error and intervention of this errors from reaching patients were also indicated. This can be achieved through participating in ward activities and providing advice for prescribing health professionals on individualization of dose, dose adjustment, necessary drug related information for each patients and also delivering health education for patients on adherence and compliance of prescribed drugs up on discharge time from hospital. [12]. A study done in Spain showed the importance of an intervention by clinical pharmacists in reducing prescribing error [13]. The need for more teaching in this area is also appreciated in countries where healthcare professionals other than doctors are involved in prescribing [14].

In this study, it was revealed that the three predominant medication type involved in medication prescribing errors were antibiotics, antipyretic/analgesics, gastrointestinal drugs, and respiratory drugs. This result was in line with a study done in Dessie in which antibiotics were the most common followed by analgesics and antipyretics and diuretics [5]. Also, it was in agreement with a study done in the UK where antibiotics were the most common classes of drugs [11]. This might be because of antibiotics were among the most common drugs prescribed.

Among predictors of prescribing error, age group less than one year and from one to five, and prescription with one diagnosis were statistically significant with medication prescribing error. In this study, factors considered to potentially predict prescribing of the wrong combination were tested using binary logistic regression analysis as the dependent variable. Based on the test, more one diagnoses were found to be a significant predictor of the wrong combination. So it was predicted that pediatric patients with one diagnosis were more than two times likely to be prescribed with the wrong combination, omission, wrong abbreviation and wrong duration compared to those with more than or equal to two diagnoses only controlling for other factors including age, sex and prescriber being on duty. This may be correlated with limited use of medication in such patients as oppose with a seriously ill patient in which there is increased use of medication. This was disagreement with a retrospective cohort study conducted on medication prescribing errors in pediatric tertiary care hospital in Toronto, Canada has identified that prescribing error were seen more in critically ill pediatric patients compared to least ill patients [10].

Pediatrics age both less than one years old and from one to five year were more likely to face wrong combination and omission than six to ten years old. It was found that only patients age from one up to five were more likely to face the wrong dose than from six to ten years of age. This was inconsistent with the study conducted in Italy on medication errors in pediatric inpatients where pediatric age< 2 months and pediatric age< 1 year were most significant factor for prescribing error and administration error respectively [4]. Similarly, in Saudi Arabia medication prescription errors more frequently in infants (Less than 1 year) [8]. Current finding was in disagreement

with the study conducted in Dessie and Toronto, Canada where there was no significant difference in medication prescribing error rate among age groups but age group 29 days – 1 year was the highest age group and there was no statistically significant difference in prescribing error in any of the age groups in comparison within age group of 12 -18 years [5, 10].

Sex of the patient and prescriber being on duty was not found to have a statistically significant effect on medication error as opposed to study done in Saudi Arabia where medication prescription errors were found more frequently in males [8] and in Dessie where pediatric patients who were seen during weekdays face prescribing error more likely than pediatrics patients were seen during weekends and holidays [5]. Finding was also inconsistent with study conducted on medication prescribing errors in pediatric tertiary care hospital in Toronto, Canada where pediatric patients who were seen during weekend face prescribing error more likely than pediatric patients who were seen during weekdays in between 4 am and 8 am compared with 8 am to 12 pm (night might) [10]. Likewise, the study done on medication errors in pediatric inpatients in Italy 2008, showed no differences between weekday and weekend and however, the prescription error was significant at Nightshift (9:00 PM to 6:59 AM) [4].

CONCLUSIONS

The prevalence of medication prescribing error was high. Among prescribing errors, the most frequently detected error was the wrong dose followed by a wrong combination, omission, wrong frequency, and wrong route. In this study, the three predominant medication type involved in medication prescribing errors were antibiotics, antipyretic/analgesics, and gastrointestinal drugs. Age group less than one year, from one to five, and prescription with one diagnosis were statistically significant with prescribing error. Improving reporting structure and intervention of medication error in the pediatric wards is suggested.

Improvement and application of a computerized doctor's order entry system, improving the engagement of clinical pharmacists in pediatric wards, and improving inter-communication between different health professionals in the hospital are suggested for intervening the occurrence of medication prescribing error in future plan.

Conflicts of Interest

The authors declare that they have no conflicts of interest

Authors' Contributions

BB: Involved conception, analysis, interpretation of data and manuscript writing. **ML**: Involved in design of the study, report writing. All authors approved the final manuscript.

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