

Medication Error (ME) in the Pediatrics Service of the University Teaching Hospital (CHU) of Bouaké (Côte d'Ivoire)

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Abstract

Introduction: Medication error (ME) is a common cause of childhood morbidity and mortality reported in developed countries. It has not yet been described in the pediatric services in Côte d'Ivoire. **Objective:** To evaluate ME in pediatrics for the improvement of professional practice. **Materials and Methods:** This was a cross-sectional, descriptive and analytical study conducted in the service of pediatrics at the University Teaching Hospital (CHU) of Bouaké from January 11 to February 25, 2016. It involved 204 children hospitalized and treated with drugs. The variables studied were the prescription, dispensing and administration of the drugs. **Results:** A total of 483 prescriptions notes were recorded for 733 therapeutic lines, *i.e.* 2.3 prescriptions notes and 3.6 lines per child. The overall prevalence of ME was 31% (prescription 83%, dispensing 0%, administration 11%). The prescription error concerned the illegible writing (20%), the omission of the stamp & signature (47%), the omission of the date (33%), weight (66%), age (25%) and name of the child (9%). The drug name and the dosage were incorrect in 99% and 1% respectively. Regarding the administration error, care was provided by a person without a nursing qualification in 65.5% of cases. On the patient's care record, the care giver's name was omitted in 100%, the child's name in 57% and the date in 47%. The route of administration and the administered dose were each incorrect in 5%. The student nurses and assistant nurse caregivers committed more prescription errors than doctors and nurses and midwives ($p = 0,000$ $X^2 = 44.91$). Administration error was not significantly related to

the service, the socio-professional category, the gender and the age of the patient. **Conclusion:** EM is common in pediatrics at the University Teaching Hospital (CHU) of Bouaké. To prevent it, it is necessary to strengthen the staff's capacity to prescribe and administer the drug in children.

Keywords

Pediatrics, Medication Error, Hospitalization, Ivory Coast

1. Introduction

Drug is commonly used in pediatric care units. In children, the handling of the drug is not an easy task. It requires the practitioner to consider several parameters such as the galenic form, the dose, the route of administration and the child age and weight. This complexity exposes the child to medication errors. In developed countries, the prevalence of medication error in pediatric care units varies between 3% and 11.4% [1] [2] [3] and concerns all stages of the care process, particularly that of the prescription [1] [4]. Medication error increases the length of hospital stay, increases the child's risk to death as well as the health costs. In France, the economic burden linked to medication errors is estimated to be above 1.5 billion Euros per annum [5]. In the United States, it would exceed \$ 100 billion per annum [6]. The knowledge of these medication errors is crucial and allows the implementation of corrective measures and guarantees the quality of care [7]. In Côte d'Ivoire, no study has evaluated the medication error in a pediatric ward to our knowledge. The objective of this study in the second largest city of Côte d'Ivoire was to evaluate the medication error in a pediatric service for the improvement of professional practice.

2. Materials and Methods

2.1. Materials

It is a cross-sectional study with descriptive and analytical aims. It took place in the Pediatric service of the University Teaching Hospital (CHU) of Bouaké from 11 January 2016 to 25 February 2016. The Pediatric service is the only referral service of the tertiary health pyramid level in the Gbèkè region which is located at about 347 km from Abidjan, the economic capital in the south of the country. It receives annually, all units combined (neonatology, general pediatrics) nearly 17,000 patients. The health staff includes 12 doctors, 29 qualified nurses (nurses & midwives) and 31 assistant nurses. This staff is topped up with the students in medical school (faculty of health sciences) and nursing school who are in training in the service. The patients' medications came from the central pharmacy of the University Teaching Hospital (CHU) of Bouaké and in case of unavailability from the private pharmacies in the city of Bouaké. The study population consisted of children hospitalized in the Pediatric Service of the University Teaching

Hospital (CHU) of Bouaké. It was included in the study that all children admitted in the pediatric service regardless of the reason for which a prescription note was made and whose parent or legal guardian gave verbal consent after explanation of the study investigational card. All hospitalized children who died early without any prescriptions were not included in the study.

In estimating the overall prevalence of the medication error at 30%, the minimum sample size calculated by the **Mark Lorentz formula** ($n = \frac{E^2 P (1 - P)}{d^2}$) gave 322 prescriptions notes. But for the study we have retained 483 prescriptions notes.

n : required sample size;

E : level of confidence targeted (standard value = 1.96);

P : estimated prevalence of the variable studied ($P = 30\%$);

d margin of error at 5%.

2.2. Methods

For data collection, we used the medical file, the handwritten prescription notes of the patients issued in duplicate by the staff and the administration of care card. These sources served to complete the study investigational card (survey sheet) including the socio-demographic characteristics of the child and the mother, the medical diagnosis, the prescription, the dispensing and the administration of the drugstore. The prescription data was collected by means of the handwritten prescription notes issued by the staff and the information from the administration of care card. The dispensing data was collected through the return of the duplicate of the prescription notes honored by the parents at the central pharmacy of the hospital. The prescription variables were the prescriber, the patient and the drug.

- Prescriber: 5 mandatory elements: name, quality, signature, stamp and date of prescription; 3 optional elements: address, patient and medication;
- Patient: 3 compulsory elements: name, age and weight; 1 optional element: sex;
- Drug: 7 compulsory elements: name of the specialty or International Non-proprietary Names (INNs), galenic form, dosage, dose and frequency of administration, duration of treatment and route of administration; 4 optional elements: quantity, renewal, instructions for use, hygienic advice—dietetics.

For each mandatory criterion, we assigned a score of 1 point. From these criteria, we assessed the compliance of the prescription using the Tukey method [8] that we adapted by including at the patient level the age and weight (Table 1). The compliance of the prescription was good if the score is between 11 and 14, average between 7 and 10 and poor between 1 and 6. The variables of the administration of the drug were the identity of the caregiver, the identity of the child, the date and time of care, the administered product, the dosage and the route of administration.

Dispensing variables were the identification of the prescriber, the registration number, the pharmacy stamp, the galenic form, the dosage and the name of the

Table 1. Evaluation of the compliance to the prescription according to the adapted Tukey method [8].

Compliance Indicators	Odds	
	No	Yes
Identification of the prescriber	0	3
Presence of patient's name and age and weight	0	3
Name, presence of galenic form, dose, dosage, route of administration, duration of treatment	1	6
Readability of the prescription	0	1
Presence of the prescription date	0	1
Total score (sum of odds)		14 Oints

The summation of the odds gives a total score between 1 and 14 • Score between 11 and 14: good compliance • Score between 7 and 10: average compliance • Score between 1 and 6: poor compliance.

product. In this study, the skilled caregiver refers to a nurse or midwife who has completed the state-certified nursing educational program. The administration error was proven when the administered drug, the dose, the route of administration, and the regimen were incorrect.

The administration error was qualified as potential, if it is intercepted before the product is administered to the patient. The error was latent or risk of error if it is an observation indicating a potential danger to the patient [9].

In this study, the medication error was defined as “any avoidable event that may cause or lead to an inappropriate use of the drug or harm to the patient when the drug is under the control of the healthcare professional, patient or consumer” [10].

2.3. Ethical Considerations

Before carrying out the study, we obtained the authorization of the Scientific Medical Directorate board of the hospital. In addition, to participate in the study, the parent or legal guardian gave verbal consent after explaining the survey card.

2.4. Statistics

The data was entered and analyzed on the SPSS software. The analysis was descriptive and consisted of calculating the total numbers and determining averages and proportions. Quantitative and qualitative variables were expressed as mean and proportion respectively. The comparison of the quantitative variables was done with the Chi-2 test. The threshold of significance was set for a value of $P \leq 0.05$.

3. Results

The characteristics of the study population were described in **Table 2**.

Table 2. Characteristics of the study population.

Variables	Effectifs	Percentage
Sex		
Male	118	58
Female	86	42
Age group		
Newborns	46	22.5
Infants	89	43.6
Children	69	33.9
Average age (months)	26.7 (extreme 0 and 192 months)	
Mothers instruction & activity		
Low level	139	68
Household activity	129	63
Mains pathologies		
Newborn		
· Perinatal asphyxia	27/46	58.7
· Bacterial infection	15/46	32.6
· Haemorrhagic disease of the newborn	6/46	13
Infant & children		
· Malaria	101/158	64
· Acute bacterial meningitis	45/158	28.5
· Acute broncho-pneumopathy	43/158	27.2
· Vaso-occlusive sickle cell crisis	38/158	24

3.1. Overall Prevalence of Medication Error in the Service

The analysis of the three stages of the drug process revealed an overall average prevalence of the medication error at 31% (prescription 83%, dispensing 0%, administration 11%).

3.2. Prescription Stage

A total of 483 prescriptions notes were recorded. The prescription was issued by a physician in 47% (227/483) and a non-physician in 53% (nurse 24 prescriptions, midwife 10 prescriptions, student nurses & assistant nurses 222 prescriptions). The prescription compliance was in **Table 3**. The distribution of the number of prescriptions and therapeutic areas is shown in **Table 4**. The prescribed medications classes as per the prescription notes are shown in **Table 5**. Of the 483 prescriptions notes issued, 403 had at least one error, a prevalence of 83%. The error on the prescription concerned the prescriber in 20% (98/483), the patient in 46% (222/483) and the drug in 85% (410/483) cases. The error relating to the prescriber, patient and drug is presented in **Table 6**. Unclear or

Table 3. Compliance to the prescription according to the adapted Tukey method.

Compliance to the prescription	Effectifs	Percentage
Good compliance (score between 11 and 14)	60	12
Average compliance (score between 7 and 10)	186	39
Poor compliance (score between 1 and 6)	237	49
Total	483	100

Table 4. Distribution of number, lines of prescriptions by total population, newborns and infants & children.

	Total number (n)	Average per child n/N (Range)
Total population (N = 204)		
Number of prescriptions notes	483	2.3 (1 - 4)
Prescription line over the 483 prescriptions notes	733	3.6 (1 - 7)
Newborn (N = 46)		
Number of prescriptions notes	109	2.4 (1 - 3)
Prescription line over the 109 prescriptions notes	192	4.2 (1 - 5)
Infant & child (N = 158)		
Number of prescriptions notes	374	2.4 (2 - 3)
Prescription line over the 158 prescriptions notes	541	3.4 (1 - 4)

Table 5. Distribution of the prescribed drug schedules as per the newborns, infants and children prescription notes.

Drug Schedules	n/N	Percentage
Newborns (N = 46)		
Solute & electrolytes	45/46	98
Vitamin K1	39/46	85
Antibiotics	37/46	80
Antipyretic	11/46	24
Blood	5/46	11
Infants & Children (N = 158)		
Solute & electrolytes	152/158	98.7
Vitamin K1	140/158	88.6
Antimalaria	105/158	66.5
Antipyretic	89/158	56.3
Blood	38/158	24

Table 6. Distribution of errors found at the prescription and drug administration stages in pediatrics service at The University Teaching Hospital of Bouaké.

Errors found	n/N	Percentage
PRESCRIPTION STAGE		
Prescriber (N = 98)		
Signature & absence of stamp	46/98	47
Absence of the Date	32/98	33
Writing slightly legible or illegible	20/98	20
Patient (N = 222)		
Absence of Weight	147/222	66
Absence of Age	56/222	25
Absence of Name & Surname	19/222	9
Drugs (N = 410)		
Incorrect Name	406/410	99
Incorrect Dosage	04/410	1
ADMINISTRATION STAGE		
(N = 23)		
Absence of the caregiver identity	23/23	100
Unspecified patient identity	13/23	57
Date not specified	11/23	47
Time not specified	11/23	47
Incorrect dose	1/23	5
Incorrect route of administration	1/23	5

illegible handwriting was attributed to the physician in 71 cases (72.5%), to the nurse in 5 cases (5%) and to students and assistant nurses in 22 cases (22.5%). There was relationship between the prescription error and the socio-professional category of the staff but not for the child's admission unit (**Table 7**).

The student nurses and assistant nurse caregivers committed more prescription errors than doctors and nurses and midwives.

3.3. Dispensing Stage

Of the 483 prescription notes, no errors were recorded at the dispensing stage,

3.4. Administration Stage

We recorded 23 children out of 204 children with a drug administration error, a prevalence of 11%. The error was latent in all cases and reported to the emergency department in 14 cases (61%), in hospitalization in 6 cases (26%) and in the neonatal unit in 3 cases (7%). The care was performed by a qualified staff in 34.5% and unqualified (student nurse, assistant nurse, patient's parents) in

Table 7. Associated factors to the prescription error.

	Prescription without error n (%)	Prescription with error n (%)	Total n (%)	X ² , P-value
Units				
Emergency	37 (18)	167 (82)	204 (100)	X ² : 0.70, P = 0.703 (NS)
Hospitalization	27 (16)	143 (84)	170 (100)	
Neonatology	16 (15)	93 (85)	109 (100)	
Socio-professional categories				
Doctors	38 (17)	187 (83)	225 (100)	X ² : 44.91, P = 0.000 (S)
Student Nurses & Assistant Nurses	25 (11)	205 (89)	230 (100)	
Nurses & midwives	17 (61)	11 (39)	28 (100)	

(NS): non-significant, (S): significant.

65.5% of cases. The error identified in the administration stage is shown in **Table 6**. It was not related to sex, age, socio-professional category and child's admission unit (**Table 8**).

4. Discussion

This descriptive and analytical cross-sectional study aims to evaluate the medication error in a general pediatric service in a tropical African environment for the improvement of professional practice. It emerges from the study that the overall average prevalence of medication error in the service is 31%. The student nurses and assistant nurse caregivers committed more prescription errors than doctors and nurses and midwives ($p=0,000$ $X^2 = 44.91$). The prescription error relates to the omission on the prescription note of the stamp and signature (47%), the date (33%), the weight (66%), the age (25%), and the name and surname of the child (9%). The handwriting is unreadable or illegible (20%) and the name of the prescribed drug and the dosage are incorrect in respectively 99% and 1%. For the administration, the care is provided by a person without a nursing qualification in 65.5% of cases. The identity of the caregiver and that of the patient are not specified in 100% and 57% respectively. The date and time of care are not mentioned in 47% and 47% respectively. The route of administration and the administered dose are incorrect in 5% and 5%, respectively. The work elicits at the level of the study population, the overall prevalence, the prescription, the dispensing and administration stages of the drug the following discussion points.

5. Study Population

The characteristics of the population that the study reports namely the low level of education and activity of mothers (68%), the predominance of newborns and infants (66.5%) without distinction of sex, the prevalence in the newborn of

Table 8. Associated factors to the administration error.

	Administration errors			
	Yes n (%)	No n (%)	Total	
Units				
· Emergency	14 (16)	72 (84)	86 (100)	X ² : 3.8, P = 0.14
· Hospitalization	6 (8)	66 (92)	72 (100)	
· Neonatology	3 (7)	43 (93)	4 (100)	
Socio-professional categories				
· Nurses & midwives	6 (9)	64 (91)	70 (100)	X ² : 0.42, P = 0.51
· Student Nurses & Assistant Nurses	17 (13)	117 (87)	134 (100)	
Sex				
· Male	16 (14)	102 (86)	118 (100)	X ² : 0.97, P = 0.32
· Female	7 (8)	79 (92)	86 (100)	
Age				
· 0 - 24 months	15 (11)	121 (89)	136 (100)	X ² : 1.44, P = 0.69
· >24 months	8 (12)	60 (88)	68 (100)	

perinatal asphyxia (58.7%), infection (32.6%) and in the infant & child of malaria 64%, acute bacterial meningitis 28.5% and broncho-pneumonopathy 27.2% have no specificity and have already been reported with different proportions by other authors in Sub-Saharan Africa [11] [12].

6. Prevalence of Medication Error

The average prevalence of medication error in the service is 31%. In France, Debary *et al.* [2] reported in 2016 in a neonatal pediatric and resuscitation department a rate of 3%. In 2008, Otéro *et al.* [3] reported a rate of 11.4% in 2002 and 7.3% in 2004. The high prevalence observed in the study could be explained by the lack of resources, the high workload with insufficient number of staff, the malpractice of practitioners and the lack of protocol displaying the drug process in the service for to training purpose.

7. Prescription Stage

The study revealed that the prescription compliance was poor in 49% with a prevalence of medication error at 83%. In 2006, Bourlon *et al.* [13] reported in France 24.6% of prescription non-compliant. Concerning the frequency of the prescription error, Gouyon *et al.* [14] reported in a neonatology unit in France a rate as high as 74%. By contrast, Palmero *et al.* [15] and Bourlon *et al.* [13] reported lower rates of 20.2% and 6.9%, respective Lyon. Analyzing over 5 months, 2941 prescriptions notes of pediatric residents included in training programs, Honey *et al.* [16] reported a rate of 4% in the United States. Unlike for these authors where the prescription was computerized, in our study the pre-

scription is handwritten. There is evidence in the literature that computerization of the prescription significantly reduces the prescription error [17] [18]. The other reasons that could explain the high prevalence of the study are the little or illegible writing of the prescriber (20% of cases), the significant workload of the physician compelling him to delegate in 53% of the cases the prescription to non-physicians and the absence of a written prescription procedure in the service. The study also reveals that staff prescribes an average of 2.3 prescriptions notes per child with an average of 3.6 drugs. The drugs often prescribed are the antimalarial and antibiotic because of the relative high frequency of malaria and bacterial infection in Côte d'Ivoire. Bourlon *et al.* [13] reported a higher number of prescription drugs, 6.8. Our study also reveals that the prescriptions note does not include a doctor's signature & stamp in 47%, date in 33%, and the weight of the child in two thirds of cases. In addition, the name of the drug is incorrect in 99% of cases. These errors on the prescription notes could partly be attributed to the negligence of the physician and also to the fact that the prescription are made in more than half percent of cases (53%) by a non-physician. Kozer *et al.* [19] reported that the risk of prescription error among students is significantly higher at the beginning of the academic year. The misidentification of the patient, 35.6% of the cases, constituted for Bourlon *et al.* [13] the main prescription error. In 2013, Ould in Mauritania [20] reported that the name of the medicine on the prescription note contained an error in 12% of cases. Our work reveals that the student nurses and assistant nurse caregivers committed more prescription errors than doctors and nurses and midwives. In the literature, the emergency units, the intensive care units and neonatology units were reported to be at greater risk of prescription errors [1] [17] [18] [21] [22].

8. Dispensing Stage

The study does not report any error at the dispensing stage. In 2016, Lachevre reported in France that the three main dispensing errors at the pharmacy were medication errors (32%), dosage errors (28%) and number of boxes errors (20%) [23]. In the study, the absence of cases of dispensing error can be explained by the existence of a written drug dispensing procedure posted at the hospital pharmacy that all agents are required to scrupulously respect.

9. Administration Step

Our study indicates a prevalence of 11% for the administration error. Steckmeyer *et al.* [24] reported in France in 2007 a rate of 17.4%. In the United States, Sureh *et al.* [25] reported a rate of 31% in 2004. In the study, the administration error was latent in all cases and occurred in the emergency unit in 61% of cases. In the study by Debary *et al.* [3], the administration error was proven in three quarters of the cases. It focuses on the omission in the care record of the patient's name, the name of the caregiver, the date and time of care. The dose and route of administration errors are relatively less frequent, 5% each. In the litera-

ture, the main administration errors reported are the time of administration 34.5%, the omission 22.1%, the flow 21% and the dose 20% [4] [26]. In our study, the emergency care provided to several patients at the same time when there are less human resources explains the under-reporting of these facts on the care sheet. But in practice, the omission is corrected once the emergency is lifted. In the study, the administrative error is not related to the gender, the age, the socio-professional category of the staff and the child's admission unit.

The results of this study must be qualified because the study has limitations. Patients whose parents did not give consent for the study were not enrolled. The study period of one (1) month is short; in addition, the dosage of certain drugs is given as a figure over a period of time which makes it difficult to assess the exact dose that was prescribed by the doctor. Some drugs not available at the central pharmacy of the hospital have been purchased by parents in private pharmacies. We did not have access to those prescription notes. These reported facts constitute selection bias that may underestimate or overestimate the results of the study. Despite the methodological limitation, this work provided for the very first time in Côte d'Ivoire, an information basis on the prescription and administration of drugs errors in children in a general pediatric service. It can be used for other, more in-depth studies.

10. Conclusion

The medication error is frequent in pediatrics at the CHU of Bouaké and concerns especially the stage of prescription and administration of the drug. The adoption of a standardized procedure for prescribing and administering care, the use of a computerized prescription system, the strengthening of the capacity of the pediatric service in human resources, the strengthening of health personnel on the rules of prescription and administration of the drug are the priority actions to be taken to reduce the incidence of medication error in the pediatric service at the CHU of Bouaké.

Contribution of the Authors

All authors contributed intellectually to the writing and revision of the manuscript.

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Conflicts of Interest

The authors state that they have no conflict of interest in this study.

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