Assessment of a Clinical Pharmacy Activity in a Pediatric Inpatient Department in Cote D'ivoire

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ABSTRACT

Background: Clinical pharmacy activities in a pediatric inpatient department help to improve the management of patients clinically and economically. **Objective:** To assess the relevance of pharmaceutical interventions (PIs) in a pediatric inpatient department in Abidjan (Cote d'Ivoire). **Materials and Methods:** We carried out a cross-sectional, descriptive study from February to September 2014. The information collected was classified according to the classification of drug-related problems (DRPs) and PIs of the French Society of Clinical Pharmacy. The score assigned to each PI varied from PI_0 (without direct clinical impact) to PI_3 (vital clinical impact) as the importance of the potential clinical impact of the DRP was correlated to the severity of clinical consequences avoided by the PI. The relevance of PIs was assessed by their rate of acceptance by physicians and by the analysis of their clinical impact. **Results:** A total of 116 PIs were performed with 31% performed during medical rounds, 68.1% during patients' records analysis, and 0.1% on patient's admission. The main DRPs were related to noncompliance with recommendations (24.1%), overdose (21.1%), and underdosing (13.8%). The most important PIs were dose adjustment (31.8%), accuracy of drugs administration modalities (29.3%), and proposals of therapeutic choice (27.6%). The acceptance rate of PIs was highly significant (94.8%). The majority of PIs (67.3%) was assessed as having a significant clinical impact (PI_1) and 16.4% of PIs as very significant clinical impact (PI_2). A single PI (0.9%) was found with vital clinical impact. **Conclusion:** PIs performed were relevant and contributed to the therapeutic optimization and the prevention of iatrogenic events in pediatric inpatients.

Key words: Cote d'Ivoire, drug-related problem, inpatient, pediatrics, pharmaceutical intervention

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INTRODUCTION

The current context of high frequency of iatrogenic events favors an important process of continuous improvement of the management of patients at the hospital.[1] The initial assumption is that the presence of a pharmacist in a care department helps to improve the patient's care.[1] Several studies have shown that the prescription review carried out by pharmacists reduces medication errors.[2-4] In departments such as pediatric units medication errors are common, about 5%–27% of prescriptions result in a medication error.[5-8] Medication errors have a significant proportion as causes of morbidity and mortality. In the USA, 7000 patients die due to medication errors.[9,10] In hospitalization, medication errors are three times more frequent and more serious in children.[6] Indeed, children are more exposed to medication errors because of drug dose calculation errors related to the continued growth of their body weight.[11,12] Various strategies have been suggested to physicians and nurses to increase their capacity to prevent errors of dose calculations. However, it is clear that pharmacists make fewer miscalculations than the nursing team.[13] In a study by Fortescue *et al.*, pharmacists were able to improve communication among physicians and nurses, which might have prevented most potentially harmful errors in pediatric inpatients.[14] In the USA, clinical pharmacists are increasingly becoming full members of the medical teams in several hospitals.[15] We find in Cote d'Ivoire, a lack of clinical pharmacy routine activity attached to a pediatric department. Studies have shown that a clinical pharmacy activity in clinical departments helps to reduce the number of adverse events and mortality, optimize the cost of drug therapy, and shorten the length of hospitalizations.[16-18]

The establishment of a permanent activity of clinical pharmacy must be preceded by the implementation of a pilot study.

This study should teach us about the nature of drug-related problems (DRPs) met in a pediatric department and the profile and relevance of pharmaceutical interventions (PIs) performed. Our study aimed to assess the impact of clinical pharmacy activity in a pediatric inpatient department in Abidjan (Cote d'Ivoire).

MATERIALS AND METHODS

Ethical approval

The study was conducted in an ethical manner whereby the participants' identities and data collected were protected according to the three important aspects of research ethics in qualitative research (anonymity, confidentiality, and informed consent). The study began after obtaining permission from the Cocody Teaching Hospital through its Medical Scientific Department (DMS).

Study design

We carried out a descriptive, cross-sectional study from February 2014 to September 2014 in the Pediatric Department in the hospitalization

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unit in the Teaching Hospital of Cocody-Abidjan (Cote d'Ivoire). This 8-month period was related to the time of the presence of an internal pharmacist in the pediatric department. After these 8 months, the internal pharmacist was assigned to another department as planned.

The study consisted of a prescription review conducted by the pharmacist. This review was done proactively (during medical rounds and staff meetings) or retrospectively (by analysis of patients' records). The proactively activity took place during the staffs' meeting (department meeting) from 7.30 am to 9 am and during medical rounds (9 am to 10 am) each day. Be limited to a proactive activity would be limited to an active presence of the pharmacist in his practice at 2:30 of activity per day. Hence, a retroactive activity with the analysis of patients' medical records fills the rest of the daily time of the pharmacist. It should be noted that PIs on these medical records are related to actually present inpatients in this hospital.

We used a support of information collection called "dashboard" inspired by the classification tool of PIs of the French Society of Clinical Pharmacy.[19] The "dashboard" included the identification and description of DRPs, the nature of PIs, the pharmaceutical opinion, and other patient-related information.

The prescription review was performed with reference documents: Practical Guide of Drugs 2014 Dorosz®[20] dictionary Vidal® 2012,[21] thesaurus of drug–drug interactions developed by the National Security Agency of Medicines and Health Products (ANSM-France),[22] Thériaque basis (France).[23]

Study procedures

PIs were conducted by a pharmacist during the staff meetings, medical visits, and during the analysis of patients' records. He analyzed the prescription of inpatients in the pediatric department. When the therapeutic response, safety, efficiency, comfort, and economy could be improved, he emitted a pharmaceutical opinion about the detected DRPs that he communicated to physicians.

The pharmacist was trained for this specific role in this pilot study. PIs were carried out on an *ad hoc* basis in the context of the practice of clinical pharmacy after an upgrade and training with selected pharmacists in this health facility.

Assessment of the relevance of pharmaceutical interventions

The relevance of PIs was assessed by their acceptance rate and the analysis of their clinical impact. The potential clinical impact of PIs was interpreted through a score based on a particular rating.[24,25] This rating derived from that used in the USA in the studies of Bayliff and Einarson.[26] In practice, a score was assigned to each PI depending on whether the importance of the potential clinical impact of the DRP was correlated with the severity of the clinical consequences avoided by the PI. The scale that was used was:

- PI_0 (PI without direct clinical impact but with financial or informative purpose)
- PI_1 (PI with significant clinical impact increases the effectiveness of treatment and/or patient safety and/or improves the patient's quality of life)
- PI_2 (PI with very significant clinical impact prevents organ dysfunction, avoids intensive medical supervision, or irreversible sequela)
- PI_3 (PI with vital clinical impact avoids a potentially fatal accident).

The assessment of the clinical impact of PIs was performed by physicians to whom they were addressed. In total nine physicians participated in the study. During the staffs' meeting (meeting department), these physicians have received detailed information on the rating scale of the clinical impact of PIs before the beginning of our study according to standard protocol related to this pilot study.

Statistics

Descriptive statistics were used to analyze data collected. Data were analyzed using the Statistical Packages for Social Sciences version 20.0; SPSS Inc., Chicago, IL, USA.

RESULTS

Characteristics of patients and context of identification of drug-related problems

Patients involved in PIs were 76 in number and had an average age of 54.2 months. The sex ratio was 1.1 for more males [Table 1].

During our study, 116 PIs were performed. These DRPs were related to the 76 inpatients for an average of 1.52 DRPs/patient.

PIs were performed in 68% of cases after analyzing patients' records when the pharmacist did not participate in the medical visit. Thirty-one percent of PIs was performed during medical rounds, and one intervention took place during the admission of a patient [Table 1].

Drug-related problems detected

The main detected DRPs were noncompliance with recommendations (24.1%), overdose (21.1%), and underdosing (13.8%). Drug–drug interactions accounted for only 2.6% of the detected DRPs [Table 2].

Drugs involved in pharmaceutical interventions

The pharmacotherapeutic groups most concerned by PIs were antibiotics (36.2%) and antianemia drugs (22.4%). The active ingredients most concerned were iron salts (18.1%) and amoxicillin (9.5%) [Table 3].

Profile of pharmaceutical interventions performed and their reception

Dose adjustment was the most performed PI (31.8%) followed by the accuracy of drug administration modalities (29.3%). Proposals of therapeutic choice accounted for 27.6% of PIs and consisted of proposals for drug discontinuation (15.5%), adding drug (6.9%), and drug substitution (5.2%) [Table 4].

Table 1: Brief characteristics of patients and context of identification of drug-related problems

Characteristics of patients and context of identification of DRPs	Average or *n*(%)
Age (months), average±SD	54.2±32.9
Pediatric category, *n* (%)	
Infants (28 days to 23 months)	32 (42.1)
Children (2-11 years)	19 (25)
Teens (12-18 years)	25 (32.9)
Total	76 (100)
Gender, *n* (%)	
Male	40 (52.6)
Female	36 (47.4)
Total	76 (100)
Context of identification of drug-related problems, *n* (%)	
Medical round	36 (31)
Patients' records	79 (68.1)
Patient admission	1 (0.9)
Total	116 (100)

SD: Standard deviation, DRPs: Drug-related problems

Proposals for therapeutic choice consisted of discontinuing an unjustified combination therapy based on artemisinin derivate (negative thick blood smear) or discontinuing folic acid administered over several days, while the management protocol for malnutrition showed a single dose or discontinuing ofloxacin in an 11-year-old patient with severe joint pain and locomotive difficulties. Adding drug proposals can be illustrated by the demand for a prescription of acyclovir-based cream for the treatment of *herpes labialis* initially treated by oral route and the prescription of iron salts in a patient after a clinical examination indicating very pale connective blades.

Dose adjustment in our study involved both cases of overdose and underdosing. A pharmaceutical opinion on the iron salt administration at optimal doses (6–10 mg/kg/day) instead of a dose of 41 mg/kg/day used in a child of 20 kg and a dose of 2.8 mg/kg/day in a child of 6 kg. The doses of element iron based on children and infants body weights are specified in the summary of product characteristics of iron salts.

PIs also consisted in clarifying the procedures of drug administration, for example, the spacing out of drug taking of at least 2 h between the iron salts and quinolones (risk of reduction of intestinal absorption of quinolones by iron salts); the administration of metronidazole by injection in 30 min and not 15 min, the reminding of the administration of ceftriaxone as direct intravenous injection in 2 min at least and not in 15 s or the administration of amoxicillin-clavulanic acid in 3 min at least and not in 15 s.

Table 2: Drug-related problems detected

Drug-related problems	*n* (%)
Noncompliance with recommendations/contraindications	28 (24.1)
Untreated indication	5 (4.3)
Underdosing	16 (13.8)
Overdose	25 (21.5)
Medication not indicated	8 (6.9)
Drug–drug interaction	3 (2.6)
Adverse event	8 (6.9)
Route/inappropriate administration	4 (3.4)
Treatment not received	10 (8.6)
Understanding of the prescription by patient's parents	5 (4.3)
Caregiver's question with educative purpose	3 (2.6)
Self-medication	1 (1)
Total	116 (100)

Table 3: Drugs involved in pharmaceutical interventions

Drugs involved in pharmaceutical interventions	*n* (%)	Total
Antianemics		
Iron salts	21 (18.1)	26 (22.4)
Folic acid	5 (4.3)	
Antibiotics		
Amoxicillin	11 (9.5)	42 (36.2)
Amoxicillin + clavulanic acid	9 (7.7)	
Ceftriaxone	8 (7)	
Netilmicin	5 (4.3)	
Others	9 (7.7)	
Antiparasitics-antimycotics-antivirals		
Miconazole	5 (4.3)	19 (16.4)
Acyclovir	4 (3.4)	
Metronidazole	3 (2.6)	
Others	7 (6)	
Antimalarial drugs		
Artemether-lumefantrine	3 (2.6)	7 (6)
Artemether	2 (1.7)	
Quinine salts	2 (1.7)	
Other pharmacotherapeutic groups (anti-inflammatory, anticonvulsant, antiseptic…)	22 (19)	
Total	116 (100)	

The majority of PIs was accepted (94.8%) [Table 4].

Clinical impact of the accepted pharmaceutical interventions

The majority of PIs (67.3%) was assessed as having significant clinical impact and 16% very significant clinical impact [Table 5].

DISCUSSION

During the development of the methodology of our study, we made two choices. First, an observation step with a fixed period that did not precede the practical phase of PIs as done by Leape *et al*.[27] However, a period between the start of the study and the effective performance of PIs was necessary to facilitate the integration of the pharmacist and allow better control of drug prescription practices in the care unit. In fact, we did not analyze prescriptions at the pharmacy, but several studies have shown that the PI acceptance rate was correlated with the effective presence of the pharmacist in the care unit.[28,29] Second, unlike the study of Tanguy-Goarin and Mugnier[1] wherein the rating of the clinical impact of PIs was done by a pharmacist and a physician, in our study this rating was done by the physician who wrote the drug prescription as in that of Fernández-Llamazares *et al*.[30]

DRPs detected in our study were mainly overdose, noncompliance with recommendations, and underdosing. The lack of written therapeutic protocols would have favored health-care gaps. Noncompliance

Table 4: Profile of pharmaceutical interventions performed and their reception

	n (%)	Total
Types of PIs		
Proposals of therapeutic choice		32 (27.6)
Adding drug	8 (6.9)	
Drug discontinuation	18 (15.5)	
Drug substitution		
Simpler alternative proposal	5 (4.3)	
More economical alternative proposition	1 (0.9)	
Choice of administration route or more suitable dosage form	3 (2.6)	
Dose adjustment	37 (31.9)	
Proposals of effectiveness and security monitoring parameters		
Clinical monitoring	1 (0.9)	5 (4.3)
Biological monitoring	4 (3.4)	
Accuracy of administration modalities	34 (29.3)	
Drafting of a plan of drug taking or administration	1 (0.9)	
others	4 (3.4)	
Total	116 (100)	
Reception of PIs		
Accepted	110 (94.8)	
Nonaccepted	6 (5.2)	
Total	116 (100)	

PIs: Pharmaceutical interventions

Table 5: Assessment of the clinical impact of the accepted pharmaceutical interventions

Clinical impact of pharmaceutical interventions	*n* (%)
PI_0 (without direct clinical impact)	17 (15.4)
PI_1 (with significant clinical impact)	74 (67.3)
PI_2 (with very significant clinical impact)	18 (16.4)
PI_3 (with vital clinical impact)	1 (0.9)
Total	110 (100)

PI: Pharmaceutical intervention

concerned the administration of injectable amoxicillin/clavulanic acid 50 mg/kg/day in direct intravenous injection due to a twice daily administration instead of a thrice daily administration for a dose of 100 mg/kg/day. It was also administered in less than a minute instead of 3 min minimum. This could explain the sharp pain felt by children during administration. Gaillard *et al*.[31] reported a rate of "noncompliance with standards" of 56% after analysis of prescriptions. Grangeasse *et al*.[32] in a study of the anticancer prescription review reported that noncompliance with existing protocols was also the main reason for PI (31.2%). In our study, the context of frequent calculation of dose to be administered based on body weight in pediatrics explains the high rate of overdose and underdosing observed. Several studies have confirmed that doses errors are medication errors most encountered in pediatrics.[6,33-41] In the study of Folli *et al*.[2] carried out in two children's hospitals, overdose was the most encountered dose error, and antibiotics were the most concerned by this DRP. In our study, overdose was also the most important dose error, but the antianemia drugs (iron salts) were the most concerned drugs.

Dose adjustments constituted the bulk of PIs performed. In our study, they were more important than those reported by Krupicka *et al*.[42] (31.8% vs. 28%) in a pediatric intensive care. As well as those reported by Gaillard *et al*.[31] (31.5% vs. 11%) and Tanguy-Goarin and Mugnier[1] (35.5% vs. 14.4%). Proposals of treatment discontinuation were less important than those observed by Gaillard *et al*.[31] (26.7% vs. 15.5%) but more important than those observed in other studies in which they ranged from 6% to 14%.[43-45] All these differences observed could be explained by the wide variability of medical and therapeutic context of PIs.

Antimicrobials are often the group of drugs most commonly prescribed and it is not surprising that they are the therapeutic group (antibiotics, antiparasitics, antimycotics, and antivirals) with the largest number of PIs (52.6%). Our results are consistent with other studies that have found that antibiotics are most commonly associated with DRPs.[30,36,39] In our study, the antianemia drugs were concerned by DRPs to 22.4%. In this group, iron salts are the most concerned by DRPs. This is related to the diversity of pharmaceutical products used with different iron element dosages.

PIs in our study had a high rate of acceptance (94.8%). This fact shows the important role pharmacists can play in the management of pediatric inpatients. This high acceptance rate of PIs is comparable to those reported by Strong and Tsang (95.8%)[46] and by Blum *et al*. (90.4%).[47] These results show the relevance of PIs performed and a good integration of the pharmacist in the health-care team. The high rate of acceptance is also a reflection of the confidence of physicians to PIs. Brudieu *et al*. reported that the physician changed all his prescription more easily since the problem detected by the pharmacist was unknown to him.[48] Some nonaccepted PIs were related to evidence-based medicine according to the experience of some practitioners. PIs were ranked as PI_1 for 67.3% of them that is to say with a significant clinical impact. PIs ranked PI_1 meant that the intervention increased the efficacy and/or safety of the patient and/or improved the quality of life of the patient. These PIs performed were well appreciated by practitioners as they allowed them to take better care of inpatients in the care unit. In the studies of Fernández-Llamazares *et al*.[30] and Virani and Crown,[49] PI_1 accounted for 78.6% and 14% of PIs, respectively. In these studies, the methodological approach was the same as that used in ours. The rating concerned all PIs accepted by physicians. This was not the case for the study of Guignon *et al*.[25] in which not all interventions were not subjected to rating. In the study of Chedru and Juste,[24] the methodology specified that only the interventions with probable clinical impact for the patient were selected and submitted to rating. PI without significant clinical impact (PI_0), highly significant (PI_2), and vital (PI_3) accounted for, respectively, 15.4%, 16.4%, and 0.9% of PIs. Our results differed from those of Virani and Crown[49] who identified 5% of PI_0, 59% of PI_2, and 14% of PI_3. The PI rate that has had a direct clinical impact compared to care given to patients (PI_1, PI_2, and PI_3) in our study was 86.6% comparable to that of Virani and Crown (86%).[49]

This study has several limitations. Each PI was submitted to the physician, prescribing and/or following the patient. Therefore, the clinical impacts of PIs were assessed by different physicians, which may have varied based on how one physician felt about that particular event. The clinical impact of accepted PIs was not correlated to patient health-care outcomes but was based only on physicians' points of view and on the type of rating. Only one pharmacist was available for prescription reviews; therefore, because of time scarcity, many drug prescriptions were not reviewed. To provide more time per patient and per prescription, more pharmacists would be needed. The study was conducted with the descriptive method in one pediatric inpatient department of Cote d'Ivoire, which may restrict generalization of the profile of DRPs and PIs.

CONCLUSION

The study allowed to assess the advantages of a clinical pharmacy activity in a pediatric inpatient department in Cote d'Ivoire. This was a pilot study that was carried out over a relatively short period but that has shown very encouraging results for the establishment of a permanent activity of clinical pharmacy in such a care unit. PIs performed were varied and relevant. They had had a high acceptance rate and significant medical clinical impact. PI performed participated in the therapeutic optimization and prevention of iatrogenic events. In the context of the quality of healthcare provided to patients in a pediatric inpatient department, pharmacists should no longer be limited to conventional activities of management and dispensation of drugs. The pharmacist should aim to be a key figure within the health-care team in the medical management of patients at risk such as children in Cote d'Ivoire.

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Conflicts of interest

There are no conflicts of interest.

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