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A pharmacist-led medication reconciliation and review program in a pediatric ward

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Abstract

Objective: To determine the types of drug discrepancies at different points in the transition of care (admission, transfer, and discharge) and medication errors in hospitalized pediatric patients. **Methods:** This observational study was conducted from April to August 2019 with pediatric patients admitted to a university hospital in Minas Gerais, Brazil. The patients included were aged between 28 days and 12 years, and their guardians were interviewed within the first 48 hours after admission. Based on medication reconciliation, intentional and unintentional discrepancies were assessed at all transitions of care, and medication review was performed according to the Pharmaceutical Care Network Europe guidelines for identifying medication errors. Data were analyzed using the Statistical Package for Social Sciences software. A descriptive analysis of the outcomes and other variables was performed, presenting the frequency and percentage of qualitative variables, as well as the median of quantitative variables of quantitative variables. Pearson's chi-square test was performed for association of variables, with a 95% significance level. **Results:** Sixty-nine patients were included. The majority were male (55.1%; n = 38), with a median age (SD) of 34.09 (3.4) years (variation of 0 to 12). A total of 399 drug discrepancies were identified, with the transfer from the emergency room to hospital care being the interface with the highest rate of undocumented intentional discrepancies (10.0%; p = 0.001). Unintentional discrepancies were more frequent during the transition from home to the emergency room (13.3%; p = 0.001). Regarding medication review, 185 medication errors were identified in 79.7% of patients, 65.3% of which were related to treatment safety. Regarding transitions of care and hospitalization, 40.6% of patients presented unintentional drug discrepancies and medication errors. **Conclusion:** Integrated medication review with medication reconciliation can be effective in reducing harm, promoting treatment safety, and optimizing patient´s pharmacotherapy.

Keywords: pediatrics, medication errors, clinical pharmacy services, drug utilization review, medication reconciliation.

Programa de reconciliação de medicamentos e revisão da farmacoterapia conduzido por farmacêutico em enfermaria pediátrica

Resumo

Objetivo: Determinar os tipos de discrepâncias medicamentosas em diferentes momentos da transição de cuidado (admissão, transferência e alta) e problemas relacionados a medicamentos em pacientes pediátricos hospitalizados. **Métodos:** Este estudo observacional foi realizado de abril a agosto de 2019 com pacientes pediátricos internados em um hospital universitário em Minas Gerais, Brasil. Os pacientes incluídos tinham idade entre 28 dias e 12 anos, e seus responsáveis foram entrevistados nas primeiras 48 horas após a admissão. Com base na reconciliação medicamentosa, discrepâncias intencionais e não intencionais foram avaliadas em todas as transições de cuidado, e a revisão farmacoterapêutica foi realizada de acordo com as diretrizes da Pharmaceutical Care Network Europe para identificar problemas relacionados a medicamentos. Os dados foram analisados usando o software Statistical Package for Social Sciences. Foi realizada uma análise descritiva dos desfechos e demais variáveis, apresentando a frequência e o percentual das variáveis qualitativas, bem como a mediana das variáveis quantitativas. O teste qui-quadrado de Pearson foi realizado para associação das variáveis, com nível de significância de 95%. **Resultados:** Foram incluídos 69 pacientes. A maioria era do sexo masculino (55,1%; n = 38), com mediana de idade de 3 anos (variação de 0 a 12 anos). Foram identificadas 399 discrepâncias de medicamentos, sendo a transferência do pronto-socorro para o atendimento hospitalar a interface com maior taxa de discrepâncias intencionais não documentadas (10,0%; p = 0,001). Discrepâncias não intencionais foram mais frequentes durante a transição do domicílio para o pronto-socorro (13,3%; p = 0,001). Em relação à revisão da farmacoterapia, foram identificados 185 problemas

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relacionados a medicamentos em 79,7% dos pacientes, sendo 65,3% relacionados à segurança do tratamento. Em relação às transições de cuidado e hospitalização, 40,6% dos pacientes apresentaram discrepâncias medicamentosas não intencionais e problemas relacionados a medicamentos. **Conclusão:** A revisão farmacoterapêutica integrada com reconciliação medicamentosa pode ser eficaz na redução de danos, na promoção da segurança do tratamento e na otimização farmacoterapia.

Palavras-chave: pediatria, erros de medicação, serviço de farmácia clínica, revisão de uso de medicamentos, reconciliação de medicamentos.

Introduction

Drug-related harms can result from medication errors (MEs), which occur more frequently among polypharmacy patients and during transitions of care, making these situations a priority for patient safety interventions[1]. Furthermore, patients at the extremes of age, such as the pediatric population, are also particularly vulnerable to ME, mainly due to changes in the stages of child development and to pharmacodynamic changes in comparison to the adult population[2-4]. Other factors, such as the dearth of studies on the efficacy and safety of drugs for the pediatric population, and the use of unlicensed or off-label drugs, may increase the risk of ME occurrences, especially at transition of care[5-6].

In view of that, there is a need to implement actions and services that contribute to the safety of pediatric patients in hospital care, with an emphasis on the pharmacists' clinical competence in conducting medication reconciliation and medication review[7]. Medication reconciliation is a process in which the healthcare teams, patients and family members work conjointly to ensure that accurate and comprehensive information about drugs is communicated properly at transitions of care. Medication reconciliation requires that the best possible medication list (BPML) be obtained and aims to identify drug discrepancies[8].

Drug discrepancies are differences between a patient's previous drug therapy and the drugs prescribed at the new care unit, such discrepancies being either intentional (whether or not justified in medical records) or unintentional[9]. Unintentional discrepancies are either way considered as ME and may cause harm to the patient[2,10,11]. A study points out that 67% of adult and pediatric patients admitted to hospitals have discrepancies between their drug lists across transitions in care, which are maintained until hospital discharge[12]. Fuentes et al. found at least one discrepancy during medication reconciliation on admission in 42% of pediatric patients and pointed out omission as the most frequent error (68%)[13].

Medication review, in this vein, is a structured evaluation of a patient's drugs with the aim of optimizing drug utilization and improving health outcomes, and this entails detecting drug-related problems (DRPs) and recommending interventions[14]. A study analyzing 72 prescriptions for pediatric patients in an emergency unit identified the need for intervention in 47.0% of them in order to prevent prescription errors, and in 53% to optimize patients' pharmacotherapy[15].

When considering the integration of services, such as medication reconciliation and medication review, the WHO suggests that patients should receive all the care they need[16-19]. To date, there are no published experimental or observational studies that associate medication reconciliation and medication review in hospitalized pediatric patients.

These different services complement each other to provide rational and safe pharmacotherapy to the patient, and their association is important in different pediatric health services. Reconciliation considers the drugs the patient was taking before being admitted to a department or transferred to another, while medication review assesses the indication, efficacy, safety, and appropriateness of drugs[19,20]. Patricia et al. evaluated the association between medication reconciliation and medication review among patients undergoing hemodialysis and found different medication errors, with drug omission being the most common discrepancy (39.4%) and the indication without drug the most frequent DRP (37.5%)[21].

In this context, the resolution of drug discrepancies in conjunction with medication review has been studied in adult patients[22]; nevertheless, studies that assess the potential impact of these interventions on children are lacking. In view of the above, the aim of the present study was to determine the types of drug discrepancies at the different transition points of care (admission, transfer and discharge) and DRPs that affect hospitalized pediatric patients.

Methods

Study design, research site, and participants

An observational study was conducted with pediatric patients admitted to a university hospital located in the State of Minas Gerais, Brazil. It is a medium to high complexity hospital integrated with the Brazilian Unified Health System (SUS). The pediatric ward has about 90 beds divided into emergency care, inpatient unit and intensive care unit (ICU), assisted by a team of pharmacists and pharmacy residents who participate in clinical meetings, perform medication reconciliation, and carry out drug prescription analysis. The hospital has a computerized medical record system and issues electronic prescriptions.

Data collection was performed prospectively, considering primary data sources, performed directly by the researchers. Data collection took place from April to August 2019, with inpatients aged between 28 days and 12 years, whose drugs were assessed within the first 48 hours after admission to the inpatient unit or emergency room. No exclusion criteria were applied. Adolescent patients were not included due to their particularities compared to other age groups in the pediatric population. To calculate the sample size, the present study was based on Farha et al., whose study considered the frequency of discrepancies found by Coffey et al., resulting in a minimum of 66 patients[23-24]. This study is part of a multicenter study approved by the Research Ethics Committee of the Federal University of Sergipe (CAAE no. 02644318.9.1001.5546).

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All data collected remain confidential, thus protecting the privacy of the participants. To reduce errors during data collection, researchers were trained and standardized forms and databases were used.

Medication Reconciliation

Within 48 hours of the patient's admission, researchers collected sociodemographic and anthropometric data, the department to which the patient was admitted, and the reason for admission from the admission form previously developed by the research team. Next, a clinical interview was conducted with the patient's caregiver, collecting information on previous allergies (to drugs and foods), as well as the drugs the patient was taking continuously prior to admission. It is important to emphasize that the MHPM was collected upon admission to the pediatric inpatient unit and compared with the drugs prescriptions at admission.

To obtain the BPML, we sought to evaluate all available sources regarding the drugs, such as the caregiver interview, medical records, hospital transfer data (for cases in which the patient was admitted from another hospital), and when the caregiver brought the patient's drugs and previous prescriptions. Subsequently, the researchers recorded the drugs mentioned in the caregiver interview and the patient's first prescription written by the attending physician upon admission. Specifically, regarding drugs, the data collected included the drugs generic name, dose, frequency, duration of therapy, and date of initiation. Subsequently, the patient's medical record was reviewed to obtain the team's medication history based on the following data: the patient's chief complaint, history of previous illnesses, questions about previous medicines and allergies, as well as the attending physician's conduct. Subsequently, discrepancies between the BPML and the patient's admission prescription were assessed.

During transfers between care units (emergency room and inpatient unit), the last prescription from the originating unit was evaluated and compared with the first prescription from the receiving unit to identify drugs discrepancies. The patient's last prescription before discharge and the discharge prescription were also evaluated, allowing for the identification of drugs discrepancies. When the discharge prescription was not available in a computerized system, it was necessary to contact the prescriber by telephone in order to understand their conduct.

Drugs discrepancies were classified as Documented Intentional Discrepancies (DIDs), Undocumented Intentional Discrepancies (UIDs) and Unintentional Discrepancies (UDs)[10] or all transitions of care (admission home-inpatient unit; admission home-emergency care; transfer emergency care-inpatient unit and discharge from the inpatient unit to home). The MEs related to UDs were also classified according to MedTax[25]. To determine discrepancy intentionality, the analysis considered whether any changes in drug, as per the electronic records, had been justified or had been made in accordance with the treatment plan developed for the patient. The analysis considered the extent to which such missing information can lead to MEs as the patient transits across different interfaces of care. To differentiate UIDs from UDs, the researcher's clinical judgment was used, and in cases of doubt in their classification, it was necessary to contact the prescriber.

Medication Review

For the patients whose prescriptions had been reconciled, a medication review, characterized as advanced (type 3), was carried out following the Pharmaceutical Care Network Europe (PCNE) classification system. The medication review was conducted retrospectively from the patients' first day participating in the study and then every 48 hours until hospital discharge.

The drugs previously used by the participants, the clinical interview data, the current prescriptions, and the patients' clinical data were considered for the analysis of aspects related to indication, effectiveness and safety of treatment and for identification of DRPs. The researchers obtained access to the patients' prescriptions and laboratory tests directly in the medical records available in the computerized system used at the institution. A DRP were an event or circumstance that involves drug therapy and that interferes with or can potentially influence the desired health outcomes. The PCNE Classification for Drug-Related Problems Version 9.00 was used to classify the observed DRPs, in the three main domains (treatment effectiveness, treatment safety, and others), and their causes[26].

The study did not evaluate large volume parenteral solutions and intravenous electrolyte solutions due to the dynamics of changes in infusion rates and even in suspensions over the term of the medical prescriptions. Also, dilutions of intravenous drugs, already standardized by the institution's pharmacy division, were not evaluated. Prescriptions for total parenteral nutrition were not analyzed either.

The drugs involved in the discrepancies and DRPs found were grouped according to the Anatomic Therapeutic Chemical (ATC) classification system into pharmacological classes (level 2), proposed by the Norwegian Institute of Public Health, WHO Collaborating Centre for Drug Statistics Methodology.

Variables and Statistical Analysis

The study also collected data on: sociodemographic (sex and age); drug use (drug and food allergies, and adverse drug reactions); reason for hospitalization; medication reconciliation (drug, dose, presentation, dosage, route of administration, documented and undocumented intentional discrepancy, unintentional discrepancy); and medication review (drug, dose, indication, interval, contraindication, effectiveness, safety, drug interaction, drug-nutrient interaction, and DRPs).

The data obtained were compiled in Microsoft Excel® spreadsheets and analyzed using the SPSS software (IBM; Armonk, USA), version 24. After analyzing the sample normality using the Shapiro-Wilk and Kolmogorov-Srminov methods, a non-normal distribution of the sample was identified.

Descriptive analysis of outcomes and other variables was performed, presenting the frequency and percentage of qualitative variables, as well as the median and variation for quantitative variables. Analyzes of association between variables were performed using Pearson's chi-square test, for the following variables: care transition point and discrepancy; type of medication error and intentionality of the discrepancy; type of mediation error and care transition point; type of DRP and discrepancies. A significance level of 95% was considered, and results were considered statistically significant when $p < 0.05$. The confidence interval for discrepancies per care transition unit and unintentional discrepancies per unit was calculated using Excel®, considering a significance level of 95% and α 0.05%.

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Results

During the study period, 69 patients met the eligibility criteria and were included. Most patients were male (55.1%; n = 38), with a median age (SD) of 4.093 (3.4) years (variation of 0 to 12 years) (Table 1). The patients stayed in hospital for on median 7,5 days (variation of 2 to 60 days) and used on average (SD) 6.4 (2.6) drugs per day of hospitalization.

During medication reconciliation, 1072 drugs were analyzed, 399 drugs discrepancies were identified, with a mean (SD) of 5.8 (3.3) discrepancies per patient (Table 2). Transfers from emergency care to inpatient unit represented the highest UID rate identified (p = 0.001), when compared to the UID of admission to emergency care or home and discharge.

Table 1. Baseline characteristics of pediatric patients in Belo Horizonte, 2019

Variables	n (%)
Sex	
Female	31 (44.9)
Male	38 (55.1)
Age	
5 years	50 (72.5)
> 5 years	19 (27.5)
Reason for hospitalization	
Surgery	14 (20.3)
Chemotherapy	13 (18.8)
Diagnostic investigation	13 (18.8)
Cystic fibrosis	9 (13.0)
Other respiratory problems*	7 (10.2)
Infection	3 (4.4)
Others**	10 (14.5)
Previous adverse drug reaction	13 (18.8)
Previous allergies	
Drugs	5 (7.2)
Foods	10 (14.5)

*Bronchiolytic crisis; respiratory distress; worsening of respiratory pattern. **Opening of surgical wound; adenotonsillectomy; abdominal pain; tracheostomy removal; colostomy closure; vomiting.

It was observed that 17 (24.6%) patients had at least one UD, therefore a mean (SD) of 1.3 (1.7) per patient. The frequency of UDs varied significantly between the interfaces of care, being higher when the patient was transferred from home to an emergency room (p = 0.001). There were 52 different drugs involved in UDs and the main drugs involved belonged to the class of vitamins (Table 3).

Regarding UD, the omission by the patient of a drug previously used was the most frequent MEs in all transitional care units (Table 4). Regarding medication review, 185 DRPs were found in 79.7% (n = 55) of the patients, and the mean (SD) of DRPs was 3.0 (3.2) per patient. Of the identified DRPs, 130 (65.3%) were related to treatment safety (P2.1), 33 (16.6%) to treatment effectiveness (P1.1 and P1.2) and 22 (11.1%) to unnecessary drug-treatment (P3.2) (Table 5). The main drugs involved in DRPs belonged to the class of antimicrobials (20.0%), followed by analgesics (19.5%) and vitamins (9.2%).

The use of off-label and unlicensed drugs was frequent. Of the 130 DRPs related to treatment safety, 44 (33.8%) were related to off-label dose, 5 (3.8%) related to off-label presentation, 5 (3.8%) related to off-label indication, 5 (3.8%) related to off-label dose interval (very frequent dosing regimen), 5 (3.8%) off-label routes of administration, and 24 (18.4%) related to unlicensed drugs for pediatric use.

The data obtained through medication reconciliation and medication review allowed observing that 28 (40.6%) patients had both UDs and DRPs while hospitalized, revealing the complementarity of the two services and in the care of pediatric patients. Additionally, 95 (47.7%) drugs involved in discrepancies were also associated with DRPs. Both results were not statistically significant.

Discussion

The findings of this study demonstrate that hospitalized pediatric patients are exposed to MEs – especially regarding unplanned admissions – and to drug treatments with the potential to negatively impact the scope of clinical outcomes during hospitalization. Although it is expected that the pediatric population be vulnerable to these problems, to the best of our knowledge, only one study associating the medication review with medication reconciliation has been carried out so far, therefore it is necessary to better understand the factors involved in such integration in order to develop strategies and improvements in the care process[27].

Table 2. Drug discrepancies identified during medication reconciliation in pediatric patients in Belo Horizonte, 2019.

	From home to emergency room n (%)	From home to inpatient unit n (%)	From emergency room to inpatient unit n (%)	From inpatient unit to discharge n (%)	Total by type of drug discrepancy in (%)
Documented*, intentional	12 (3.0)	10 (2.5)	20 (5.0)	181 (45.4)	223 (55.9)
Undocumented*, intentional	20 (5.0)	1 (0.3)	40 (10.0)	21 (5.3)	82 (20.6)
Documentation not evaluated*	0	0	1 (0.3)	0	1 (0.3)
Unintentional*	53 (13.3)	14 (3.5)	5 (1.3)	21 (5.3)	93 (23.2)
Total by care transition*	85 (21.3)[a]	25 (6.3)[b]	66 (16.6)[c]	223 (55.9)[d]	399 (100)[e]

*p<0,001; [a]IC [15.80-26.70]; [b]IC [4.60-7.90]; [c]IC [12.25-20.75]; [d]IC [35.55-75.95]; [e]IC [77.69-121.81].

Table 3. Main classes of drugs according to the ATC classification (2nd level) involved in unintentional discrepancies by transition interface of care in Belo Horizonte, 2019

	From home to emergency room n (%)	From home to inpatient unit n (%)	From emergency room to inpatient unit n (%)	From inpatient unit to discharge n (%)	Overall n (%)
Vitamins (A11)	11 (11.9)	2 (2.1)	1 (1.0)	3 (3.2)	17 (18.2)
Antibacterials for systemic use (J01)	2 (2.2)	3 (3.2)	-	5 (5.4)	10 (10.7)
Antiepileptics (N03)	7 (7.6)	-	-	1 (1.0)	8 (8.6)
Other drugs*	33 (35.5)	9 (9.7)	4 (4.3)	12 (12.9)	58 (62.3)

*Drugs with frequency <8,0%: Drugs for obstructive airway diseases; Antineoplastic agents; Antiepileptic; Metabolism disorders; Urological agents; Psycholeptics; Nasal preparations; Ophthalmological preparations; Biliary and liver therapy; Iron preparations; Solution additives; Antidepressants; Corticosteroids; Antiemetics and antinauseants; Mineral supplements; Loop diuretics; Anti-infectives and antiseptics, excluding combinations with corticosteroids; Antithrombotic agents; Class I and III antiarrhythmics; Antiadrenergic agents; Selective beta-blockers; Selective calcium channel blockers; Topical antifungals; Corticosteroids for systemic use; Corticosteroids for systemic use; Direct-acting antivirals; Immunosuppressants; Non-steroidal anti-inflammatory and antirheumatic products; Centrally acting muscle relaxants; Medications that inhibit the production of uric acid; Antihistamine for systemic use.

Table 4. Unintentional drug discrepancies by transition of care, according to the MedTax classification in Belo Horizonte, 2019*

	From home to emergency room n (%)	From home to inpatient unit n (%)	From emergency room to inpatient unit n (%)	From inpatient unit to discharge n (%)	Overall n (%)
1.0 Omission of drug used*	24 (25.9)	7 (7.6)	3 (3.2)	18 (19.3)	52[a] (56.0)
2.0 Route of administration*	19 (20.4)	4 (4.3)	-	1 (1.1)	24[b] (25.8)
2.2 Dose of drug **	9 (9.7)	3 (3.2)	1 (1.1)	2 (2.1)	15[c] (16.0)
2.2 Frequency of drug***	1 (1.1)	-	1 (1.1)	-	2[d] (2.2)

*p<0,001; [a]IC [10.67-15.33]; [b]IC [3.87-8.12]; **p>0,05 ; [c]IC [2.89-4.61]. ***p<0,007; [d]IC [0.36-0.84].

Based on the results obtained, it can be observed that the rate of DU at admission was higher than that reported by Alcântara et al. in pediatric patients receiving hospital care[28]. This difference may be associated with the profile of patients with chronic diseases treated and the complexity of pharmacotherapy at the institution studied, as well as the type of admission, since in our study, medication reconciliation was performed in both unplanned (via emergency department) and planned admissions[28-29]. Furthermore, the variability in discrepancy and ME rates between studies occurs mainly due to the different ways in which medication discrepancies are identified and classified, as well as their intentionality. Medication discrepancies can be classified according to their intentionality (intentional or unintentional), by type of error (e.g., omission, incorrect dose, incorrect frequency), or by severity and potential harm (low, medium, or high risk). These possible classifications generate a diversity in the results presented by the studies[25,30,31]. Therefore, in the present study, we chose to use MedTax, a validated method, to classify discrepancies, which yields reliable and standardized results[25].

Omission of drug used was the most frequent discrepancy at all transition points of care, the same as in other studies with the pediatric population[27,28,32]. These discrepancies have the potential to cause harm to patients, reinforcing the need for early identification and resolution[33]. The main drug classes associated with drug discrepancies were vitamins, systemic antimicrobials, and anticonvulsants.

When omitted during admission, transfer, or discharge, these drugs can cause harm to patients' health, exposing them to seizures, prolonged hospital stays, harm, and even death. It is important to emphasize that, depending on the drug involved in a discrepancy or medication error, the harm to the patient can be even more significant, such as discrepancies involving vitamins and those involving anticonvulsants.[8]

Table 5. Types of problems and causes of DRPs identified during medication review in hospitalized pediatric patients in Belo Horizonte, 2019

DRPs primary domain	Causes of DRPs (PCNE code)	n (%)
Treatment safety	Drug dose too high, off-label (C3.2)	44 (23.8)
Treatment effectiveness	Drug dose too low (C3.1)	29 (15.7)
Treatment safety	Unlicensed drug for pediatric use (C1.1)	24 (13.0)
Unnecessary drug-treatment	No indication for drug (C1.3)	22 (11.9)
Treatment safety	Route of administration not informed (C9.2)	11 (5.9)
	Other causes	55 (29.7)

DRPs: Drug-related problems.

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These results reinforce the need to obtain a BPML as close as possible to the patient's information in the admission records. Thereafter, the patient needs to be reassessed, checking the drug currently used and the need for continuation. All of this information needs to be documented and communicated to the health team receiving the patient[34]. Although this process is successful under the leadership of the pharmacist, there is still a need for health services to systematize interprofessional communication at the time of transfers and define standardized medication reconciliation procedures, with emphasis on the multidisciplinary role of the health team[35].

In this regard, the absence of adequate documentation caused UIDs mainly in patient internal transfers. Assessments of medication reconciliation in this interface of care have been little described in scientific literature, especially in pediatrics. The study conducted by Alcântara et al., for example, observed a higher frequency of UDs during internal transfers of pediatric patients, although they considered the lack of documentation as well as a discrepancy[28-29]. Unjustified discrepancies are not an ME, as some may be intentional but not documented by the prescriber, but they can lead to one whenever the patient is taken care of by various care providers[34,36,37].

Dannan and Ellahham managed to reduce prescriptions with discrepancies from 8.98% to 3.90% in internal transfers of pediatric patients, thus reinforcing the need for a project to improve the quality of the medication reconciliation so far implemented[38]. Combining these authors' data with the data from the present study, it is possible to observe that the implementation of MedRec in internal transitions can reduce discrepancies and contribute to pediatric patient safety.

Another transition point of care that drew attention in the present study was hospital discharge, where a rate of 22.5% of unintentional discrepancies was found. Huynh et al. arrived at a similar rate, and omissions of drug used was the third largest discrepancy identified[39]. Nevertheless, the study by Wong et al. points out that the lack of information on prescriptions of discontinued or continued drugs at hospital discharge can be sources of discrepancies[40]. In order to avoid such errors, the patient's entire medication history needs to be properly documented and informed to the patient/caregiver, and drug therapy information needs to be shared with the next care providers[30,36].

A medication review revealed the presence of problems related to drugs safety, effectiveness, and unnecessary drugs. As in the literature, one of the main causes of effectiveness problems is incorrect doses. The results of this study regarding the main classes involved in medication errors are like those described by Ramadaniati et al.[41-44]. Concerning the use of off-label drugs in pediatrics, the most common reason for DRPs was related to dosing, which was also the most frequent problem reported by Czarniak et al. their study revealed that more than a third of studied pediatric patients were being prescribed drugs outside the terms of the product license[42]. Saiyed et al. pointed out that the use of off-label drug in children increases the chance of adverse drug reactions by 30% and recommended that when there is no data on the safety and efficacy of a given drug, the prescriber needs to make prudent therapeutic decisions and evaluate the risk-benefit ratio individually[43]. Ideally, patients should be followed up and monitored, with the pharmacist being a key player in this regard.

The results of this study show that various pediatric patients can have both MEs and DRPs, therefore highlighting the importance of implementing medication reconciliation and medication review as complementary services, focusing on the comprehensive care of pediatric patients. Bjeldbak-Olesen et al., considering the adult population, compared findings of medication reconciliation with those of medication review and observed that the errors identified in these two practices varied in terms of number, type and severity, where reconciliation showed a larger number of errors, as in the present study, while medication review revealed severer errors[44]. The authors attribute these findings to the fact that discrepancies are easier to identify, since they arise from a comparison between BPML and prescription, while a medication review is more complex as it assesses the quality of the patient pharmacotherapy[43].

The data from this study reinforce that medication reconciliation is useful for revealing discrepancies and, especially, drugs omissions that may be necessary for the patient's pharmacotherapy during care transitions. Furthermore, the next point of care that will see the patient can gain clarity on the pharmacotherapy the patient has received and provide even safer care. However, only a medication review can determine whether the drugs being used by the patient are indicated, effective, safe, and appropriate. Therefore, these services are complementary and do not cancel each other out. Ideally, they should be combined in all care transitions, including for pediatric patients[43].

In this way, the findings of the present study emphasizes that pediatric patients can benefit from receiving medication reconciliation and medication review services, both for the beneficial integration of care and for the possibility of identifying different preventable medication errors[18]. After medication reconciliation, the child can be referred for a medication review, contributing to the rational use of drugs and patient safety[45].

Among the limitations of the present study is a possible bias regarding the caregiver/guardian's memory in the interview, given the tension caused by the hospitalization of a loved one, as well as the possibility that one or more caregivers/guardians of the child might not have been present during the clinical interview. Moreover, there were difficulties in obtaining the BPML of some patients in cases when only the interview with the caregiver/guardian and the prescriber's notes in medical records were available. Another limitation was the difficulty in performing medication reconciliation at hospital discharge due to faulty communication between the pharmacy team and the other professionals responsible for this service. It is important to note that the results of this study may not reflect the reliability of other health services; however, due to the scarcity of publications covering pediatric patients, the present study is relevant and current.

Another important limitation is the absence of an assessment of the clinical impact on patients. The findings of this study are process outcomes (discrepancies and problems related to drugs). To affirm that a pharmaceutical service or intervention is truly effective, safe, and/or efficient, it would be necessary to evaluate the associations with clinical, humanistic, and/or economic outcomes.

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Conclusion

This study demonstrated that pediatric patients are subject to intentional and unintentional drug discrepancies at different points in the care transition, highlighting the need to implement medication reconciliation at these interfaces. Clinical care documentation was also deficient during care transitions, highlighting the need to improve clinical records. However, medication review revealed medication errors demonstrating that its integration with medication reconciliation can be an effective strategy for reducing preventable medication errors, this increasing patient safety. It is important to note that the data found are related to the study sample. Therefore, further studies are needed to assess the clinical impact of these services on pediatric patients.

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Collaborators

Conception and planning of the research project (ARL, CC, GAM, DLJ); obtaining data (ARPL, MRF, RLMJ, LMDSL); analyzing and interpreting data (ARL, CC); initial writing of the scientific article (ARL); critical review (ARL, MRF, RMJ, LDL, BDF, DLJ, GAM, CC).

Conflicts of interest

The authors declare that there is no conflict of interest.

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