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Evaluation of Drug-Related Problems Identified and Pharmaceutical Interventions in the Wards of a Maternity Hospital

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Abstract

Aim: The study aims to identify the profile of Drug-Related Problems (DRP) and pharmaceutical interventions in a Maternity Hospital.

Method: The research was conducted in a Maternity Hospital in Santa Cruz (RN) and adopted a retrospective observational approach. Secondary data were collected from patients hospitalized in wards with clinical pharmacy services between January, 2021 and December, 2021. The analysis included the identification of DRPs, recording of non-compliance rates and evaluation pharmaceutical interventions conducted.

Results: 8.355 prescriptions were confirmed and a total of 38.048 medications prescribed in 2021. Prescription error rates by sector were 15.8% in Women's Assistance Unit (WAU), 10.5% in pediatrics and 3.7% in the Neonatal Intensive Care Unit (NICU). 359 pharmaceutical interventions were carried out, 14.4% were in the WAU, 24.2% in pediatrics and 61.4% in the NICU. The most frequent WAU DRPs included infusion time (43.9%), speed (23.8%) and dilution (17.3%). In pediatrics, they were infusion time (45.3%), dose (20.1%) and interval (15.2%). Finally, those from the NICU included infusion time (39.4%), dose (25.3%) and dosage (19.9%). Accessibility rates for interventions were 77% in Unaccompanied Asylum-Seeking Minors (UASM), 83% in pediatrics and 77% in the NICU.

Conclusion: Our study indicates the critical role of clinical pharmacists and multidisciplinary collaboration in enhancing patient safety. The NICU's lower error rates highlight the benefits of an integrated team, while the WAU reveals the need for better professional interaction to reduce errors and improve intervention acceptance. Implementing dedicated clinical pharmacists and effective multidisciplinary practices across all sectors is important for improving patient care quality and safety.

Keywords: Indicators; Drug safety; Patient safety; Drug related problems; Clinical pharmacy service

Abbreviations: Drug-Related Problems (DRP); Women's Assistance Unit (WAU); Neonatal Intensive Care Unit (NICU); Unaccompanied Asylum-Seeking Minors (UASM); Clinical Pharmacy Services (CPS)

Introduction

In hospital services, patients are exposed to Drug-Related Problems (DRPs), which can be defined as "an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes"[1,2]. Reflecting the magnitude of this scenario, the estimated annual cost of morbidity and mortality related to non-optimized drug therapy is approximately $528.4 billion in the United States of America, equivalent to 16% of the country's health expenditure in the year 2016, contextualizing it for the national scenario, a study showed that the cost of drug-related morbidity would be responsible for almost US$18 billion annually in Brazil [3,4]. Besides being a significant burden on public and private services, DRPs are responsible for about 15% of hospitalizations, with the majority being avoidable [5]. In light of these data, it is evident that Clinical Pharmacy Services (CPS) play an important role in addressing this issue by identifying, monitoring and intervening in DRPs to enhance the safety and effectiveness of healthcare services [6,7].

In this context, studies emphasize the importance of active clinical pharmacy in addressing DRPs, noting that interventions by clinical pharmacists have resulted in better clinical outcomes, including cost reduction, decreased length of hospital stays, fewer adverse events and lower mortality [6-10]. Therefore, considering the importance of the role of CPS, a vital and widely used tool is the analysis of pharmaceutical service indicators that can allow monitoring of the organization's progress towards achieving pre-defined goals and standards of care aimed at achieving improving the quality of care and safety by identifying PRMs an acting to reduce them [11]. These indicators serve to monitor and evaluate the results of activities performed in an institution [12]. They play a fundamental role as a critical analysis tool for pharmaceutical services, allowing the creation of strategies based on collected data to improve service quality.

Thus, the objective of this study was to identify the DRPs in medical prescriptions and pharmaceutical interventions of a Maternity Hospital.

Methodology

The research was conducted through an observational, retrospective study, using secondary data from patients admitted to neonatal intensive care units, pediatrics, joint lodging and surgical clinics, the latter two also referred to as the Women's Assistance Unit (WAU) in a Maternity Hospital located in Santa Cruz (RN) a medium-sized hospital with 62 hospital beds, 12 in NICU, 32 in WAU and 6 in pediatrics. It had an average annual occupancy rate of 56.8%. The inclusion criteria for this study were patients admitted to all wards with an implemented CPS who had at least one prescription for medication between January, 2021 and December, 2021. Patients who

did not receive any pharmacological treatment during their entire hospitalization were excluded from the study.

The classification of DRPs serves as a set of tools to evaluate, classify and validate them [13]. This instrument aims to prevent potential DRPs, thereby preventing adverse events. Moreover, it plays a significant role as an indicator and monitoring tool for service quality [14,15]. Although there are various classifications, some of the most relevant include PCNE Hepler and Strand and Cipolle [16,17]. Due to the variable nature of practice and each scenario, there is observed variability in classifications. In our study, we used our own classification to assist in identifying DRPs and made more sense within our practical context (Table 1).

Data analysis and collection were daily conducted by the CPS at our hospital, consisting of two clinical pharmacists and four pharmacy residents in which there was always one resident responsible for the NICU and another for pediatrics, with the supervision of exclusive clinical pharmacists, WAU It is a sector that does not have an exclusive clinical pharmacist directed to the sector, so it ends up depending on the incoming demand of new pharmaceutical residents who, for the first 4 months, remain in the sector with the support of a pharmacist who is responsible for another ward. This data was obtained from medical prescriptions available in digital format and analyzed by the CPS to identify DRPs, checking medication errors based on critical analysis of prescriptions. This form included data such as the number of prescriptions, total prescribed medications, errors in concentration, dose, route of administration, dosage, pharmaceutical form, reconstitution, infusion time and infusion speed at which they were evaluated and recorded daily in the form that would feed our database. Additionally, it covered absence of triaged medication at the prescribed dose, presence of non-triaged medication at the prescribed dose, dispensing medication without control documentation, quantitative differences in triage, dose and dispensed medication errors. Administration errors, preparation errors, scheduling errors, medication already dispensed and requested again, relevant physical or chemical incompatibilities and relevant drug. Interventions were recorded based on acceptance, in which they could be classified as accepted, partially accepted, when the professional verbally confirms the intervention but does not confirm it in the prescription and not accepted, the interventions were carried out exclusively with the physician. They were also classified based on the type of intervention and a field to describe the intervention itself.

The analysis of medication incompatibilities was performed using the Trissel's™ 2 IV Compatibility tool available in the Micromedex®

Drug Related Problems (DRPs)	Description
Concentration error or omission	Drug infusion concentration is incompatible with the route of administration or may cause harm to the patient
Dilution error or omission	Caused by omission of dilution or diluent, but also by choosing a diluent that is incompatible with the medication
Dose error	Dose of medication is not indicated for diagnosis or differs from the hospital's clinical protocol
Dosing interval error or omission	If the prescribed dosage is not in accordance with the patient's profile or clinical situation
Drug scheduling error	Medication was scheduled in conjunction with medicines that may cause physicochemical incompatibility or relevant drug interactions
Infusion time error or omission	Infusion time is in disagreement with the instructions for use of the medication provided in the leaflet or extracted from the literature
Infusion rate error or omission	Infusion rate is in disagreement with the instructions for use of the medication provided in the leaflet or extracted from the literature
Physicochemical incompatibility	If the prescription presents medicines that have or possibly have physicochemical incompatibility
Reconstitution error or omission	When there is no reconstitution volume for the medication required, or when it is not a compatible reconstituent or in a volume that is not standardized by the manufacturer
Relevant drug interactions	When the prescription presents an interaction that could cause harm to the patient
Route of administration error or omission	Route of administration not indicated for the medication or pharmaceutical form not indicated for the route of administration that was prescribed
Pharmacotherapy modifications	Insert, modify, or withdraw pharmacotherapy from the patient in a justified manner according to prescription analysis, clinical condition or medication reconciliation
Medication reconciliation	Check whether the medications the patient takes at home are prescribed or indicated for the patient's clinical condition and note discrepancies that may appear and intervene with the physician

Table 1: Drug Related Problems (DRPs) used in our study.

database (Truven Health Analytics, Michigan, USA). Medication interaction analyses were conducted using Lexicomp® Drug Interactions (Waltham, Massachusetts, USA).

Frequencies and percentages were analyzed using Microsoft Excel (2019). This study received approval from the Research Ethics Committee of FACISA/UFRN, with protocol number 5.107.176, according to the guidelines of the National Health Council (NHC) in its resolution 466/12. Due to the use of patient secondary data, the need for Informed Consent Form was waived.

Results

Data was collected from a total of 8.355 prescriptions analyzed by the CPS between January, 2021 and December, 2021. Of the prescriptions analyzed, 69.0% (5.763) were from WAU, 12.6% (1.054) from pediatrics and 18.4% from NICU. A total of 5.085 prescribed medications were identified with some DRP, considering the total number of prescribed medications (38.048), approximately 13.6% of the medications analyzed were prescribed inappropriately, according to (Table 2).

The individual error rate of each sector was 15.8% for the WAU, 10.5% in pediatrics and 3.7% in the NICU. Another data shown in Table 2 is the number of pharmaceutical interventions, there were 359 in total, 52 in the WAU (14.4%), 87 in pediatrics (24.2%) and 220 in the NICU (61.4%). Another point we can observe is that despite the large number of DRPs identified in the prescription, a small number of interventions are still carried out. We observed that the most prevalent Drug-Related Problems (DRPs) in prescriptions were errors and/or omissions of infusion time (43.9%), errors and/or omissions of infusion speed (23.8%) and errors and/or omissions of dilution (17.3%). When analyzing the profile of interventions, we found that the most frequent interventions involved pharmacotherapy modifications (30.8%), followed by infusion time (17.3%). The third most common issues were dilution, dose errors and reconstitution, each accounting for 11.5%. Another important aspect to highlight is the acceptance rate of interventions. Each sector exhibited different profiles. Specifically, in the WAU, of the 52 interventions carried out 46 (77%) were classified as accepted, 10% were partially accepted and 13% were not accepted. A closer examination of the data obtained from WAU is presented in (Figure 1).

Indicators	WAU	Pediatrics	NICU	Total
Prescriptions analyzed	5.763 (69.0%)	1.054 (12.6%)	1.538 (18.4%)	8355
Number of prescribed medications	28750 (75.6%)	2743 (7.2%)	6555 (1.2%)	38048
Number of medication prescriptions and errors	4555 (89.6%)	289 (5.6%)	241 (4.8%)	5085
Pharmaceutical interventions	60 (20.2%)	71 (23.9%)	166 (55.9%)	297

Table 2: Data obtained from clinical pharmacy indicators.

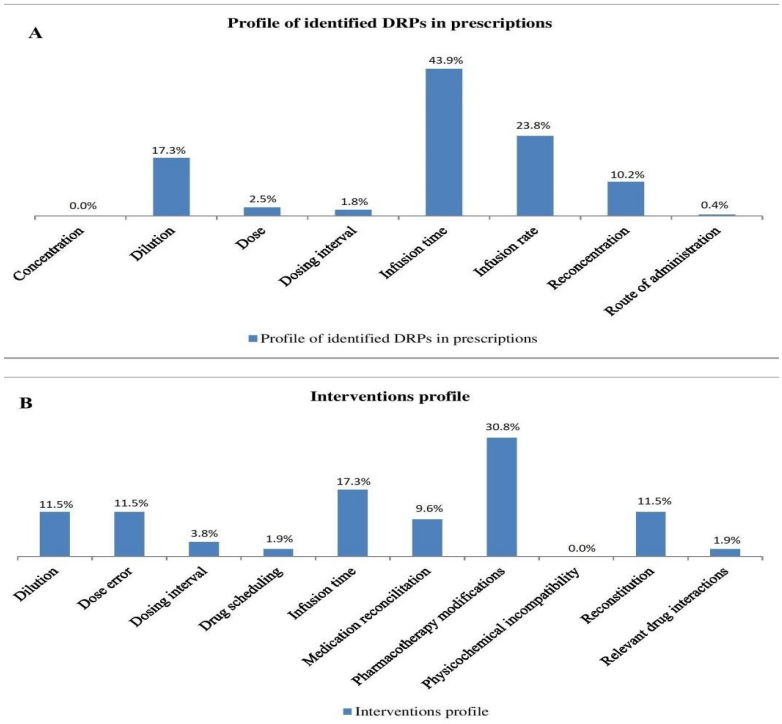

Figure 1: Indicators of non-compliance in prescriptions and the interventions profile at WAU, **Note:** A) Profile of identified DRPs in prescriptions; B) Interventions profile.

The most prevalent Drug-Related Problems (DRPs) among the 2,743 identified in the 1,054 analyzed prescriptions (Table 2) were, respectively, errors and/or omissions of infusion time (45.3%), dose errors (20.1%) and errors and/or omissions of dose interval (15.2%). In the profile of interventions, we can highlight dose errors at 32.2%, pharmacotherapy modifications at 20.5% and dilution at 12.3% of the 87 interventions carried out in the sector. In these interventions, 83% were accepted, 13% were partially accepted and 4% were not accepted. Data on the profile of interventions and prescription errors in pediatrics are shown in (Figure 2).

Finally, we have the NICU, the sector with the lowest rate of prescription errors (3.7%), the most prevalent DRPs being error and/or omission of infusion time (39.4%), dose error (25.3%) and error and/or omission of dosage (19.9%), these data are shown in (Figure 3).

The NICU had a greater volume of interventions, the main ones were a modification of pharmacotherapy (22.4%), error dose (20.5%) and physicochemical incompatibilities (12.3%). Of the 220 interventions that were carried out in the sector, 77% were accepted, 17% were partially accepted and 6% were rejected.

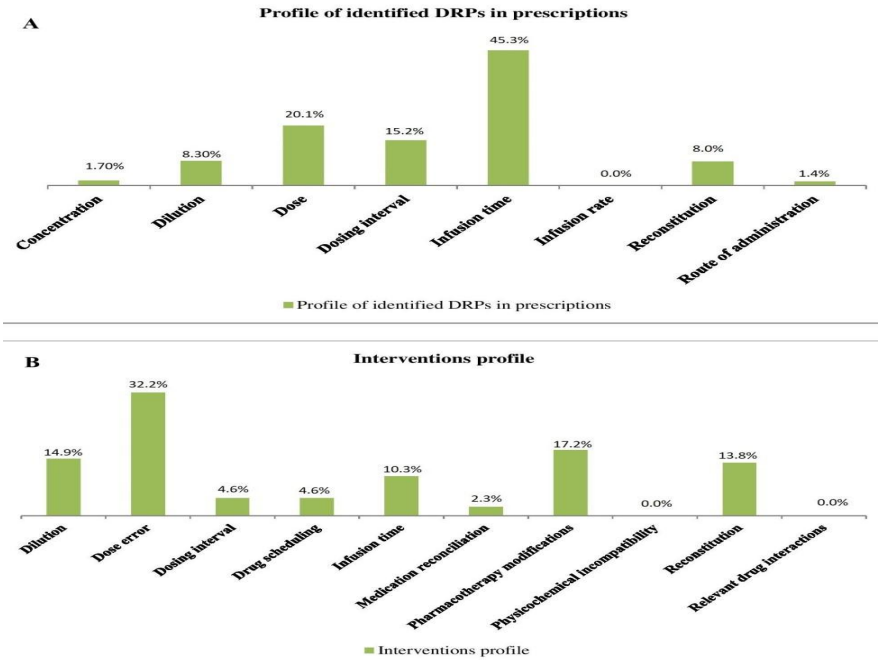

Figure 2: Indicators of non-compliance in prescriptions and the intervention profile at pediatrics, **Note:** A) Profile of identified DRPs in prescriptions; B) Interventions profile.

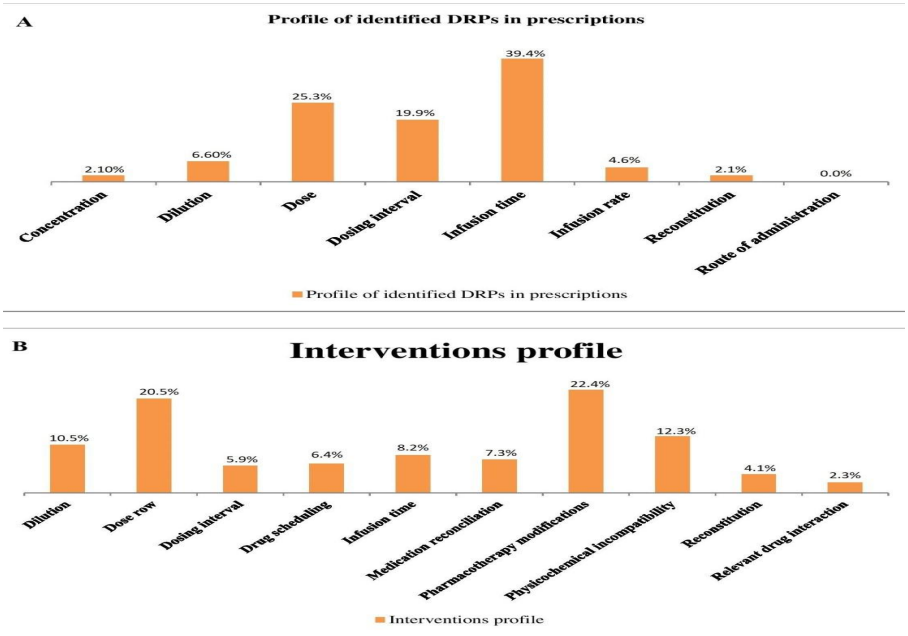

Figure 3: Indicators of non-compliance in prescriptions and the intervention profile at NICU, **Note:** A) Profile of identified DRPs in prescriptions; B) Interventions profile.

Discussion

The errors in the prescription rate are serious and strongly impact patient's quality of life and treatment efficacy. Our results highlight the prescription error rates that occur in the three sectors (WAU, Pediatrics, NICU) and how the difference between them can be shaped by their context. Pediatrics and WAU had a 10.5% and 15.8% occurrence ratio, respectively, of the medications prescribed with some DRPs, whereas the NICU had a lower percentage around 3.7%. One possible explanation for this notary difference is that the NICU has a more integrated multidisciplinary team and its decision-making regarding medical prescriptions and patient follow-up is based on sectorial actions such as clinical discussions held in the sector and multidisciplinary discussions. In the year 2021, the pediatrics sector implemented similar actions as in the NICU, however, since it is a ward and not an independent sector, there is no medical interdisciplinary team full-time, consequently a higher rate is still observed when comparing them. Regarding the management of DRPs in the WAU, first, it is an infirmary therefore having a lower proportion of health professionals per hospital bed, furthermore multi-interdisciplinary actions are not standard protocol. Yet, there is no clinical pharmacist exclusively in the WAU as in the other two sectors, which can explain the higher error rate (15.8%).

Analyzing this scenario, the pharmacist's participation contributes to patient safety, as highlighted in the systematic review of [18]. Which highlights the formation of multidisciplinary teams containing a pharmacist to limit or prevent adverse drug events, which we could extrapolate to our current scenario. Furthermore, the clinical pharmacist present in the sector was able to develop tools to have better pharmacotherapeutic monitoring, as is the case of neonatal and pediatric, pharmaceutical monitoring forms that are carried out in the respective sectors in which they help to monitor clinical aspects, check doses and incompatibilities and other DRPs [19]. Our results show the difference in the scenarios and we can observe that the differences that were highlighted between the sectors can be influenced, as the absence of an exclusive clinical pharmacist and an engaged multidisciplinary team at WAU, which may have contributed to a high DRP ratio.

Regardless of the structural differences between each subsector, the infusion time of drugs was the most prevalent DRP. There were also specific prescription errors in each sector due to its intrinsic characteristics such as the different patient profiles. In the WAU sector, for instance, the dilution and infusion rate of drug errors were prevalent, due to the absence of this information in the prescription. The lack of that information can lead to significant adverse events and cannot be neglected [20,21]. This is a resulting problem of the structural organization mentioned above but also the non-standardization of medication prescriptions, even though the service has a computerized system. Standardization of the medication prescriptions given the specific needs of each sector is a possible solution that can lead to a positive impact on reducing DRPs encountered [22]. The data from pediatrics and NICU showed similar DRPs, mainly related to dose due to rapid weight changes. This happens given the characteristics of both pediatric and neonatal patients. Leading to a constant need for dose adjustments, a challenge for the CPS.

Those results point to how the presence of a pharmacist can positively influence the proper prescription and administration of medications. For example, the NICU a sector with four times more pharmaceutical interventions than the WAU, has a lower error rate. One of the reasons for that is the frequent presence of the pharmacist in the NICU, making it an important safety barrier to preventing and monitoring DRPs [23]. Therefore, one of the strategies to ensure better quality and safety at WAU would be the current insertion of an exclusive clinical pharmacist, which plays an important role in intervening in daily sectorial failures and errors [24,25].

Regarding physicochemical incompatibility, the NICU was the only sector that identified and carried out interventions (Figure 3). The identification of those incompatibilities is important to avoid compromising drug therapy, once they could lead to ingredient inactivation, precipitation, hydrolysis and in some cases, loss of venous access, posing a risk to the patient. Neonates in the NICU require close monitoring, but due to their delicate and small structure, they often have only one venous access, allowing the mixing of medications in the same lumen. Identifying these incompatibilities are important for patient safety [26,27].

Based on the absence of an engaged multidisciplinary team at WAU, more PRM identified in prescriptions and a higher rejection of interventions than other sectors. In the NICU and pediatrics, multidisciplinary meetings and case discussions improve communication and interaction between professionals in the sector. An improvement in communication may be associated with more interventions carried out and their acceptance [28-30]. Moreover, one of the strategies to be considered for better quality and safety at WAU would be the inclusion of an exclusive clinical pharmacist, the pharmacist plays an essential role in intervening in daily sector failures and errors [26,27].

Therefore, our results outstand the critical role played by a clinical pharmacist. In our current context, clinical pharmacists employ tools to conduct pharmacotherapeutic monitoring, pharmaceutical evolution, medication reconciliation and educational activities, among other duties, which results in recognition from managers, other professionals and patients. The current challenge would be to expand to the three sectors equally due to their different profiles and because they are special audiences and require specialized attention. Our study had limitations due to the possible bias of the professional who was collecting the data, such as the limitations of possible errors or omissions in the recording that may have occurred during the study. There are also limitations to the method used that cannot be validated, which may reduce the reliability of the results, in addition to making comparisons with other studies difficult.

Conclusion

The analysis of prescription error rates and interventions in different health sectors highlights the importance of the presence of the clinical pharmacist and a critical look at possible changes to improve the safety of the sectors. The NICU, with lower rates of prescription errors, exemplifies the benefits of a well-integrated multidisciplinary team, while the WAU reveals the need for greater interaction between professionals, especially the pharmacist, to reduce errors and increase acceptance of interventions. The inclusion of dedicated clinical pharmacists across all sectors, combined with effective multidisciplinary practices, is essential to improving the quality of patient care, reducing medication-related problems and promoting a safer and more reliable clinical environment.

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