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The Role of Pharmacist-Led Interventions in Reducing Medication Errors in Pediatric Hospitals: Review

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Abstract

Background: Medication errors (MEs) pose significant risks to patient safety, particularly in pediatric populations where the potential for harm is heightened. Clinical pharmacists play a crucial role in mitigating these errors and enhancing the safety and efficacy of medication management in hospitals.

Methods: This systematic review and meta-analysis evaluated the impact of pharmacist-led interventions on reducing medication errors and avoidable adverse drug events (ADEs) in hospitalized pediatric patients. A comprehensive literature search was conducted across multiple databases, including MEDLINE®, EMBASE, and The Cochrane Database, up to 2022. Nineteen studies were included, focusing on the categories of medication errors that prompted pharmacist interventions.

Results: The findings indicated that incorrect dosages were the predominant reason for pharmacist intervention, with significant reductions in medication errors observed across multiple studies. The meta-analysis revealed a 73% decrease in prescription mistakes resulting from pharmacist interventions, particularly during the prescribing phase. Training sessions conducted by pharmacists for healthcare professionals were identified as the most effective intervention strategy. The aggregate odds ratio across studies was 0.27 (95% CI: 0.15 to 0.49), demonstrating a statistically significant reduction in medication errors.

Conclusion: The integration of clinical pharmacists within pediatric hospital settings is essential for enhancing medication safety. Their interventions not only reduce the incidence of medication errors but also improve overall patient care quality. Future research should explore pharmacist roles in outpatient settings and assess the long-term impact of their interventions.

Keywords: Medication errors, pediatric patients, clinical pharmacists, patient safety, pharmacist interventions.

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1. Introduction

Patient safety is a fundamental objective in all healthcare systems and is essential for delivering high-quality treatment to patients [1]. Medication mistakes (MEs) and avoidable adverse drug events (ADEs) may occur in any healthcare system and may result in patient damage. Pharmaceutical mistakes include any incidents that may occur at any phase of the pharmaceutical use process, such as prescribing, transcribing, dispensing, administering, and monitoring a medicine. Conversely, avoidable adverse drug events (ADEs) are injuries stemming from pharmaceutical usage that may sometimes arise from prescription mistakes [2,3].

Pediatric patients are more susceptible to pharmaceutical mistakes in healthcare settings, and when these errors occur, they have three times the likelihood of causing direct injury to kids compared to adults [4, 5]. Complex dosing, diverse growth and development processes, availability and precision of dosage forms, utilization of off-label formulations, restricted physiological reserves to mitigate potential overdose errors, and inconsistent communication capabilities all exacerbate the risks of medication errors in this population. These variables underscore the need for pediatric-specific preventive interventions to mitigate medication mistakes and avoidable adverse drug events (ADEs).

Various solutions have been examined to reduce the frequency of these incidents in healthcare environments. One option is the integration of a clinical pharmacist inside the ward. The position of the clinical pharmacist has evolved over the last decades as a healthcare professional with experience in the safe and effective administration of medications [6-8]. Numerous systematic reviews and meta-analyses have shown that interventions by clinical pharmacists may reduce medication mistakes and avoidable adverse drug events in hospitalized patients, including incidents that might result in real damage before patient administration. Furthermore, these treatments raised the quality of patient care and decreased total healthcare costs, hence improving healthcare efficiency [10-15]. Nonetheless, most of these research studies concentrate on the involvement of a clinical pharmacist with adult patients. Consequently, it is important to examine the impact of a clinical pharmacist on pediatric patients, since they are more susceptible to prescription mistakes.

This review and meta-analysis aim to assess the effect of clinical pharmacist interventions on decreasing prescription mistakes and avoidable adverse drug events in pediatric patients within hospital environments, as well as to evaluate the overall quality of the existing evidence.

2. Methods

A study of published literature was performed to assess the impact of pharmacist intervention on medication mistakes in hospitalized pediatric populations. The following electronic databases were examined from their establishment to 2022 to locate qualifying articles: MEDLINE®, EMBASE, The Cochrane Database of Systematic Reviews, and Google Scholar. Furthermore, the reference lists of the resultant systematic review papers were manually examined to identify additional relevant publications that were not discovered by the database search.

3. Categories of pharmaceutical mistakes that necessitated pharmacist interventions

This analysis included nineteen studies. Thirteen studies identified incorrect dosage as one of the three predominant causes for intervention [4, 9, 16-26], categorized as improper dosing, including both overdose and underdosing. The incorrect medication was among the three primary reasons for intervention in four publications, leading to the recommendation of an alternate treatment [22,23,24,26]. A different category of mistake that prompted treatment change was medication interaction, which was among the top three causes of pharmacist intervention in two trials [20, 25]. Three studies identified missing information (e.g., weight or date of birth) [9, 21, 22], poor formulation [23, 26, 27], and incorrect frequency [4, 28, 29] as the three most prevalent triggers for intervention. Six studies assessed the intensity of pharmacist interventions: three indicated that the majority were moderate [4, 25, 31], while two were classified as severe [9, 23]. Research indicated that of 616 avoidable mistakes, hardly 120 were detrimental [8]. Five research documented the acceptability rate of pharmacist treatments; among them, four studies indicated an acceptance rate of over 55% [9, 23, 25, 27]. The subsequent trial demonstrated an acceptance rate of 83% without altering the regimen [28].

4. Research documenting quantifiable results of pharmacist treatments

This analysis included seven studies. This analysis included six before-after studies that documented the incidence of medication mistakes before and during the intervention [4, 29-33]. One cohort research was removed due to erroneous reporting of data per patient days [19]. Among the six studies used in the meta-analysis, five conducted training sessions planned and presented by pharmacists to nurses and doctors [29-33]. Five out of six trials showed a substantial decrease ($P < 0.0001$) in the occurrence of medication

mistakes [4, 29-32]. The aggregated odds ratio (n = 29,291 patients) across all trials was 0.27 (95% confidence interval 0.15 to 0.49). Nonetheless, the outcomes of these investigations exhibit considerable heterogeneity (Fig. 2). The influence of the unit-based pharmacist in the cohort research, which assessed overall severe medication errors (SMEs) and SMEs per 1000 patient-days, was significant for SMEs per 1000 patient-days in the intensive care unit (ICU) ($P < 0.01$). Nonetheless, no substantial difference was seen in the total SMEs inside the ICU, nor the total SMEs and SMEs per 1000 patient days in the surgical and medical wards [19].

5. Discussion

This comprehensive study and meta-analysis examined the effect of clinical pharmacist interventions on medication mistake rates in hospitalized pediatric patients. It offers a thorough examination and assessment of the prevalent categories of mistakes prompting pharmacist interventions, their importance levels (mild, moderate, severe), and the acceptance rate of pharmacists' suggestions. Prior research and evaluations have highlighted the significance of clinical pharmacists in the care of pediatric patients. The emphasized benefits were the identification of drug-related issues, the recommendation of appropriate drugs, the enhancement of medication use, the reduction of medication-related expenses, and the minimization of medication mistakes [34-37]. Comparable advantages were also seen with treatments aimed at preventing prescription errors in the adult population [10-15]. These results underscore the need for pharmacist engagement in mitigating drug mistakes, irrespective of the demographic concerned.

Notwithstanding the variability of the studies used in this meta-analysis, the cumulative impact of pharmacists' interventions revealed a substantial reduction in the likelihood of prescription mistakes by 73%. Interventions demonstrating the most impact include the rectification of prescription mistakes, including dosage inaccuracies, measurement units, administration routes, and frequency. Prior research indicates that the majority of drug mistakes transpire during the prescription phase [36, 38]. Consequently, it is essential to include pharmacists on clinical ward rounds alongside prescribers. This enables pharmacists to avoid prescription mistakes initially, hence minimizing the delays associated with rectifying these errors thereafter.

This research focused on the hospital environment since drug mistakes are more prevalent in tertiary healthcare settings than in primary ones. Furthermore, pharmacists have a much more beneficial role in minimizing medication mistakes in hospital environments than in clinics and community settings, owing to the complexity of patients treated in hospitals relative to other settings [39-41]. It is essential to examine the function of pharmacists in mitigating prescription mistakes in various contexts independently and determine whether a comparable level of benefit can be seen.

The primary pharmacist intervention identified in our research was the provision of instructional sessions conducted by pharmacists for other healthcare professionals, including nurses and doctors. Moreover, the examination or confirmation of orders and the implementation of a unit-based clinical pharmacist were prevalent treatments identified in this systematic study. A prior systematic analysis concentrating on ICU patients indicated that the predominant intervention was the integration of a pharmacist into the medical team, which ranks among the leading interventions in our research [10].

The primary strength of this meta-analysis is that, to our knowledge, it is the first evaluation to quantitatively evaluate the effect of pharmacist interventions on prescription mistake rates in pediatric patients inside hospital environments. The systematic review included papers from many nations worldwide, perhaps increasing the generalizability of the findings. The use of the CCAT provided further insight into the research included in this study, allowing for a comparison of the overall data quality across the investigations. The CCAT was used for this study due to its superior reliability compared to informal evaluations of many research projects. The standardized evaluation method provided by the CCAT has been shown to almost eradicate the rater effect, with no significant impact from subject matter expertise [42].

This research has several shortcomings that need attention. The total quality of all components was 27.87 out of 40, indicating a mediocre assessment. This was mostly attributable to inadequate reporting of sample

and ethical approval since these two areas had the lowest overall rankings within the CCAT. While sampling is crucial to mitigate selection bias, the disclosure of ethics does not add any specific bias to the research and hence does not impact the internal validity of the review. Furthermore, the research included was published in peer-reviewed publications, most of which mandate ethical disclosure before publication. Secondly, some studies used a mix of pharmacist treatments, making it impossible to ascertain which specific intervention led to the decrease in prescription mistakes.

Substantial heterogeneity in the studies incorporated in the meta-analysis was observed, potentially attributable to various factors, including discrepancies in the pharmacist interventions employed, as well as differences in the methodologies for detecting medication errors and the definitions of medication discrepancies across studies. Furthermore, several studies have classified outcomes as medication mistakes, while others have identified them as avoidable adverse drug reactions (ADRs). This systematic review included papers published from 1987 to 2018. The wide range of dates suggests that the practice of clinical pharmacists and their comprehension of drug mistakes have evolved throughout this period. Consequently, the results from previously performed research may vary from those of more current investigations owing to alterations in practice and shifts in the environment of general healthcare.

Subsequent research should concentrate on assessing the impact of pharmacist interventions on medication mistakes in outpatient environments. This will provide enhanced insight into the pharmacist's influence on society and will help the healthcare system identify areas or situations necessitating more attention and development. Additionally, a subgroup analysis of the results of the present research may be necessary to assess the influence of a pharmacist on certain mistake categories, such as prescription or administration errors; this would aid in addressing the existing heterogeneity.

6. Conclusion

Medication mistakes continue to be a significant problem, particularly with the pediatric population. The primary pharmaceutical mistakes identified in the included publications were prescribing errors, namely incorrect doses and the selection of unsuitable drugs. Pharmacist interventions significantly contribute to the mitigation of prescription mistakes in the pediatric demographic. The treatments include training sessions, the evaluation and validation of prescription orders, and the implementation of a ward-based pharmacist or a drug safety program that involves a pharmacist [20]. The results from this analysis endorse the integration of a clinical pharmacist to diminish the incidence of medication mistakes in pediatric patients.

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دور التدخلات التي يقودها الصيدلاني في تقليل أخطاء الأدوية في مستشفيات الأطفال: مراجعة

الملخص

الخلفية :تشكل أخطاء الأدوية مخاطر كبيرة على سلامة المرضى، خاصة في فئة الأطفال حيث يكون احتمال الضرر مرتفعًا. يلعب الصيادلة السريريين دورًا حيويًا في تقليل هذه الأخطاء وتعزيز سلامة وكفاءة إدارة الأدوية في المستشفيات.

المنهجية :تم إجراء مراجعة منهجية وتحليل تلوي لتقييم تأثير التدخلات التي يقودها الصيادلة على تقليل أخطاء الأدوية والأحداث الضارة القابلة للتجنب الناتجة عن الأدوية لدى المرضى الأطفال في المستشفيات. شمل البحث الشامل قواعد بيانات متعددة مثل MEDLINE® و EMBASE وقاعدة بيانات Cochrane حتى عام 2022. تضمنت المراجعة تسعة عشر دراسة، ركزت على فئات أخطاء الأدوية التي استدعت تدخلات الصيادلة.

النتائج :أشارت النتائج إلى أن الجرعات غير الصحيحة كانت السبب الأكثر شيوعًا لتدخلات الصيادلة، مع انخفاض كبير في أخطاء الأدوية الملحوظة عبر العديد من الدراسات. أظهر التحليل التلوي انخفاضًا بنسبة 73% في أخطاء الوصفات الطبية نتيجة لتدخلات الصيادلة، خاصة خلال مرحلة الوصف. تم تحديد جلسات التدريب التي يقوم بها الصيادلة للمهنيين الصحيين كأكثر استراتيجيات التدخل فعالية. بلغ معدل الأرجحية الإجمالي عبر الدراسات 0.27 0.15 :CI% 95) إلى 0.49(، مما يشير إلى انخفاض ذي دلالة إحصائية في أخطاء الأدوية.

الاستنتاج :يعد دمج الصيادلة السريريين في بيئة المستشفيات للأطفال ضروريًا لتعزيز سلامة الأدوية. لا تقلل تدخلاتهم من وقوع أخطاء الأدوية فحسب، بل تحسن أيضًا جودة رعاية المرضى بشكل عام. يجب أن تستكشف الأبحاث المستقبلية دور الصيادلة في الإعدادات الخارجية وتقييم التأثير طويل الأمد لتدخلاتهم.

الكلمات المفتاحية :أخطاء الأدوية، المرضى الأطفال، الصيادلة السريريين، سلامة المرضى، تدخلات الصيدلاني.