Graduate Students, Population, Health & Wellness

The Impact of Pharmacist Interventions on Reducing Medication Errors in Pediatric Patients: A Systematic Review and Meta-analysis

Lina Naseralallah¹, Tarteel Hussain¹, Myriam Jaam², Shane Pawluk²

¹Student, College of Pharmacy, QU Health, Qatar University ²Faculty, College of Pharmacy, QU Health, Qatar University

Background

- Medication errors (MEs) are events that can occur at any stage of the medication use process including prescribing, transcription, dispensing, administration and monitoring¹
- Preventable adverse drug reactions (ADRs) are medication-related injuries that arises as a result of an error¹
- MEs and preventable ADRs are avoidable events that can result in significant patient harm¹
- Clinical pharmacists play an integral role in preventing MEs and preventable ADRs in adults²
- Pediatric patients are more prone to MEs which have three times the potential to cause harm as compared to adults³

Objectives

- To qualitatively and quantitatively assess the effectiveness of pharmacist interventions on reducing medication errors for pediatric patients in hospital settings
- To explore types of MEs that prompted pharmacist interventions in hospitalized pediatric patients

Methods

Table 1. Study Methodology

Study Design	Systematic review and meta- analysis following the PRISMA checklist					
Protocol Registration	PROSPERO registration number: CRD42019126541					
Search Engines	PubMed, Embase, Cochrane, Google Scholar					
Search Terms	 Search categories: Population: "pediatrics"[MeSH] Intervention: "pharmacists"[MeSH] Outcome: "medication errors"[MeSH] 					
Eligibility Criteria	 Inclusion: Hospital settings Pediatrics (birth-18 years) Medication error rate Exclusion: Intervention not solely made by pharmacist 					
Selection and Data Extraction	Two reviewers (independently)					
Data Items Extracted	 Author(s) Year of publication Country of the study Study design Study site(s) Population characteristics Description of pharmacist intervention Medication error rate 					
Meta-analysis	 Review Manager Forest plot Random effect model Odds ratio Heterogeneity (I²) 					
Quality Assessment	 Crowe Critical Appraisal Tool (CCAT) Intraclass correlation coefficient (ICC) via SPSS software 					

Results

Out of 606 citations, 19 were included in the qualitative synthesis and 6 in the meta-analysis (**Figure 1**)

Studies design:

- Retrospective or prospective cohort studies (n = 11)
- Before-after studies (n = 6)
- Cross-sectional studies (n = 2)

Departments included:

- Various departments within the hospital (n = 8)
- Neonatal intensive care unit (n = 3)
- General medical ward (n = 3)
- Pediatric intensive care unit (n = 2)
- Surgery department (n = 1)
- Unspecified (n = 2)

Clinical pharmacist intervention:

- Educational sessions (n = 5)
- Review or order validation (n = 5)
- Various unit-based activities (n = 4)
- Multiple pharmacist interventions (n = 3)
- Attending rounds (n = 2)
- Main types of MEs provoking clinical pharmacist interventions:
- Wrong dose
- Wrong formulation

Wrong frequency

Drug interaction

Figure 1. PRISMA flow diagram of the study

Records after duplicates

Records title and abstract

Full text articles

assessment (n = 67)

Studies included in

qualitative synthesis

(n = 19)

Studies included in

quantitative synthesis

(n = 6)

screened (n = 559)

removed (n = 559)

Records identified through

database searching (n = 598)

selection process

Additional records identified

through other sources (n = 8)

Records excluded

(n = 492)

Full text articles

excluded

(n = 48)

No numerical evaluation of

Not isolation of pediatric

Not hospital settings (n = 9)

- Outcome other than ME or

intervention not clear (n = 6)

preventable ADE (n = 8)

Impact pf pharmacist

outcome (n = 16)

results (n = 9)

- Wrong administration rate
- Quality assessment: the overall quality of included studies is moderate (27.9/40) with high similarity between raters (ICC range, 0.948 to 0.997)
- Meta-analysis:

Wrong drug

- o The pooled odds ratio across 6 studies was 0.27 (95% CI 0.15 to 0.49), favouring the pharmacist intervention
- Results of these studies are substantially heterogeneous (Figure 2)

Figure 2. Forest plot of clinical pharmacist (RPh) effect on medication errors

	RPh Contro			rol	Odds Ratio			Odds Ratio			
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		M-H, Random, 95% CI			
Ahmed 2017	3134	7995	6718	8179	17.0%	0.14 [0.13, 0.15]	•				
Alagha 2011	391	1097	1107	1417	16.8%	0.16 [0.13, 0.19]	-	_			
Campino 2009	47	1512	868	4182	16.4%	0.12 [0.09, 0.17]					
Chedoe 2012	104	284	159	311	16.2%	0.55 [0.40, 0.77]					
Chua 2017	496	1401	852	1284	16.9%	0.28 [0.24, 0.33]		-			
Fawaz 2017	224	693	312	936	16.7%	0.96 [0.77, 1.18]			<u> </u>		
Total (95% CI)		12982		16309	100.0%	0.27 [0.15, 0.49]	-				
Total events	4396		10016								
Heterogeneity: Tau ² = 0.54; Chi ² = 371.70, df = 5 (P \leq 0.00001); l ² = 99%						0.1	 	+ +		10	
Test for overall effect: $Z = 4.31$ (P < 0.0001)						0.1	Favours [RPh]	Favours	[control]	10	

Limitations

- The overall quality of included studies is considered low to moderate
- There is a high heterogeneity amongst studies as a result of the variations in settings (departments within the hospital) and types of pharmacist intervention (e.g. educational sessions, attending rounds, etc.)

Future studies

- Conduct a subgroup analysis on the outcomes of the current study to evaluate the impact of pharmacist on particular MEs (e.g. administration errors)
- Assess the impact of clinical pharmacist interventions in primary healthcare clinics and community pharmacy settings
- Evaluate clinical pharmacist impact on other health outcomes (e.g. mortality, length of stay, emergency department visit) related to MEs

Conclusions

- Dosing errors are the most common type of ME in pediatric patients
- Pharmacist involvement through different types of interventions decreases the rate of ME occurrence, as compared to no pharmacist interventions for pediatric patients admitted to hospital

References

- 1. Morimoto T. Adverse drug events and medication errors: detection and classification methods. Quality and Safety in Health Care. 2004;13(4):306-314.
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- Costello JL, Torowicz DL, Yeh TS. Effects of a pharmacist-led pediatrics medication safety team on medication-error reporting. American journal of health-system pharmacy: AJHP: official journal of the American Society of Health-System Pharmacists. 2007;64(13):1422-6