Patient Safety Events and Additional Hospital Stay and Direct Cost among Pediatric Patients in a Philippine Tertiary Government Hospital

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ABSTRACT

Background. Patient safety events (PSEs) in hospitalized children can lead to increased hospital stays, costs, and mortality. Knowledge of the types and prevalence of PSEs can inform targeted interventions to improve pediatric patient safety.

Objectives. This study aims to (1) determine the prevalence and types of PSEs among hospitalized pediatric patients in a tertiary government training medical center, (2) determine additional hospital days associated with each PSE type, (3) determine additional direct costs incurred due to each PSE type, (4) compare the additional hospital stay and direct costs, and (5) describe corrective and preventative actions for different PSE types.

Methods. This is a review of reports of PSEs from five inpatient service areas of the pediatric department of the hospital from April 1, 2022, to June 30, 2024. Data included additional hospital stay and direct costs sourced from the hospital's electronic health records. The number of admissions was obtained from the Department's census. Reported findings include the prevalence of PSEs, mean, median, standard deviation, and interquartile range for additional hospital stay and direct costs. Common corrective actions identified were reinforced staff training, process improvements (double-checking medications, IV site monitoring protocols), and enhanced communication.

Results. A total of 55 PSEs were identified. Medication errors were the most frequent (61.8%). Corrective and preventative actions included reinforced staff training and double-check procedures. Extravasation injuries had the highest mean additional hospital stay (6.79 days) and the highest mean direct cost (₱1,069.49). Corrective actions and preventive actions focused on improved vascular access management.

Conclusion. Medication errors, extravasation injuries, and falls are common PSEs requiring targeted interventions within the Department of Pediatrics. Targeted initiatives emphasizing staff training, enhanced protocols, and improved communication are critical to reducing these events and improving pediatric patient safety.

Keywords: patient safety events, pediatric patients, prevalence, hospital costs

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INTRODUCTION

Patient safety events (PSEs) in hospitalized pediatric patients encompass any incident or condition occurring within a hospital that could potentially cause or has caused harm to the patient.[1] Such events can lead to increased hospital stays, higher costs, and increased mortality rates.[2] Healthcare providers utilize event reporting systems to report unexpected incidents or events, such as medical errors, near misses, or adverse reactions that compromise patient safety.

Children's unique physiological traits and their dependence on caregivers create a high-risk environment, making them particularly vulnerable to adverse events, especially when hospitalized.[3] This vulnerability necessitates specialized clinical care that significantly differs from that provided to adults. Greve outlined the unique challenges and risks inherent in pediatric healthcare, including the heightened vulnerability of children, the complexities associated with managing chronic conditions in pediatric patients, the substantial costs and emotional impact of medical errors involving children, and the essentiality of proactive risk management and patient safety strategies to prevent harm.[4] A population-level analysis focusing on different age groups reveals that young pediatric patients face elevated risks, encountering more frequent and diverse adverse events.[5]

Studies indicate that 1-9% and as high as 15 to 35% of hospital admissions may experience such events.[6–8] However, precise statistics are scarce due to limited research on the subject. Of significance is extravasation injury, defined as the inadvertent leakage of intravenous (IV) fluids or medications into surrounding tissue, which is a considerable complication in pediatric and neonatal hospital populations.[9] Reported incidences range from approximately 0.16% with chemotherapy up to 11% with general IV fluids in hospitalized pediatric patients; notably, neonates in intensive care have documented incidences approaching 70% for some type of extravasation.[9–11]

Research is likewise scarce regarding which specific pediatric service wards or sections experience the highest number of patient safety events (PSE). However, Kaushal et al. found significantly higher rates of adverse events among neonates admitted to neonatal intensive care units.[12] These events often stemmed from medication errors (79%), mainly related to incorrect dosing (34%) of anti-infective drugs (28%) and intravenous medications (54%), during drug ordering.

Locally, there is limited published data on the prevalence of patient safety events, especially among Philippine government hospitals. Pasco et al. investigated medication errors across the main departments of the Philippine General Hospital, a government tertiary and training institution.[13] Their study revealed that pediatric service wards had the highest frequency of errors, averaging 63.3 errors per chart. The most common types of errors were prescribing errors, compliance errors, and administration errors.

Comprehensive reporting and analysis of these incidents offer valuable data to guide quality improvement initiatives and enhance the safety of care provided to this vulnerable population.[14] This study aims to analyze patient safety events among pediatric patients in a Philippine tertiary hospital.

METHODS

Research Design and Data Collection

This descriptive cross-sectional study was conducted at the Department of Pediatrics, University of the Philippines - Philippine General Hospital, involving the review of the online Patient Safety Events (PSE) Reports from April 1, 2022 to June 30, 2024.

All pediatric PSE online reports submitted to Quality Improvement and Patient Safety (QuIPS) from April 1, 2022 to June 30, 2024, forwarded to the Department of Pediatrics, and discussed by the Department of Pediatrics' QuIPS team were included in the review. Access to the electronic medical record (RADISH) of these patients was requested from EHRO to obtain additional hospital stay and additional direct costs related to the PSE.

Data for additional hospital stay and direct costs were retrieved from the hospital's electronic health records (EMR). For all 55 identified Patient Safety Events included in the analysis, complete data were successfully obtained for both additional hospital stay and direct costs. Therefore, specific methods for addressing missing data, such as imputation, were not required for the variables reported.

Data Analysis

Hospital admissions according to service area were noted during the study period, and the prevalence of PSE was obtained using the number of admissions as the denominator. Corrective and Preventive Actions (CAPA) were enumerated for each type of PSE. The mean and standard deviation, as well as the median and minimum and maximum values of the additional hospital stay and additional costs according to PSE type, were reported.

RESULTS

From April 1, 2022 to June 30, 2024, a total of 20,160 children were admitted to the Department of Pediatrics. Over this period, 55 PSEs were reported, accounting for the prevalence of 0.27% or 27 incidents in 10,000 children. The highest frequency was observed in Ward 11, while the lowest occurred in the Pediatric Emergency Room (PER) (Table 1).

With respect to the type of PSE, the most frequent was medication errors (34, 0.17% of total admissions or 17 in 10,000 admissions), followed by extravasation (14 events, 0.07% of admissions or 7 in 10,000 admissions). The least common was fall, with seven events (0.03% of admissions or 3 in 10,000 admissions) (Table 2).

Table 1. Prevalence of Patient Safety Events by Location

Area/Place of Event	Number of PSEs	Number of Admissions	Prevalence, All Types	Prevalence in 10,000 admissions
Ward 9	9	1,365	0.66%	66
Ward 11	13	1,372	0.95%	95
Hema-Onco	7	845	0.83%	83
PER	14	12,434	0.11%	11
NICU	12	4,144	0.29%	29
Total	55	20,160	0.27%	27

Hema-Onco – Hematology-Oncology, PER – Pediatric Emergency Room, NICU – Neonatal Intensive Care Unit

Table 2. Distribution of the PSEs according to Place of Event and Type

Area/Place of Event	Medication Error (n, % of 55)	Extravasation Injury (n, % of 55)	Fall (n, % of 55)	Total (n)
Ward 9	3 (5.45)	6 (10.91)	0	9
Ward 11	5 (9.09)	5 (9.09)	3 (5.45)	13
Hema-Onco	5 (9.09)	1 (1.82)	1 (1.82)	7
PER	12 (21.8)	0	2 (3.64)	14
NICU	9 (16.36)	2 (3.64)	1 (1.82)	12
Total	34 (61.8)	14 (25.4)	7 (12.7)	55

Hema-Onco – Hematology-Oncology, PER – Pediatric Emergency Room, NICU – Neonatal Intensive Care Unit

Table 3. Additional Hospital Days and Direct Costs by Patient Safety Event Type

Patient Safety Event Type	N	Mean Additional Days (SD)	Median Additional Days (Min-Max)	Mean Additional Cost (SD)	Median Additional Cost (Min-Max)
Medication Error	34	0.94 (0.92)	1 (0–4)	₱320.29 (614.79)	₱0 (0–2450.00)
Extravasation Injury	14	6.79 (11.12)	1.5 (0–37)	₱1,069.49 (3,075.36)	₱0 (0–11.640.25)
Fall	7	0.7 (0.76)	1 (0–2)	₱ 660.71 (747.57)	₱ 270.00 (0–1,500.00)

CAPA implemented for medication errors included reinforced staff training on accurate medication reconciliation, improved verification protocols, implementation of double-check procedures for medication orders, and enhanced communication between pharmacy and clinical staff. For extravasation injuries, CAPA included training on vascular access management (proper site selection, access, and monitoring), reinforced strict vascular access management protocols, and enhanced monitoring protocols. Initial first aid for extravasation recommended cessation of infusion, elevation, and attempted aspiration of the extravasated substance from the device. The CAPA implemented for falls was an emphasis on supervision through the implementation of protocols for appropriate bed assignment and reinforced use of safety measures through staff training on side rail utilization.

For all identified PSEs, complete data were available for calculating additional hospital stay and direct costs. Extravasation injuries had the highest mean additional hospital stay (6.79 days) and the highest mean direct cost (₱1,069.49) (Table 3).

The CAPA for each of the Patient Safety Reports, as extracted from the minutes of the meeting of the Pediatric QuIPS team, are summarized in Table 4. Highlights were mentioned in the presentation of the results of types of PSE prevalence.

DISCUSSION

This study identified 55 patient safety events (PSEs) within the Department of Pediatrics at Philippine General Hospital between April 2022 and June 2024, revealing key areas for targeted quality improvement interventions. A common thread throughout all PSE types was the need for reinforced staff training on existing protocols and procedures. Process improvements, such as double-checking medications and implementing stricter IV site monitoring, were also frequently identified as essential. Furthermore, enhanced communication between healthcare staff was deemed crucial to preventing future incidents across all categories of PSEs. These findings resonate with other studies that highlight the importance of multifaceted approaches to patient safety.[15,16]

Table 4. Summary of Corrective Actions and Preventive Actions for the Patient Safety Event Type

PSE Type	Corrective Actions	Preventive Actions
Medication Error	Administer missed doses promptly, verify correct doses, administer correct medication to the intended patient, adjust prescriptions, discontinue excess medication, monitor patients closely for adverse effects, and correct medication orders.	Reinforce staff training on medication safety, improve verification protocols, implement double-check procedures, update medication records, establish strict verification protocols, establish protocols for stock monitoring and medication safety, reinforce staff training on accurate medication dosing, implement reminder systems, implement system checks to ensure all medication reorders are updated in RADISH and Medication Supplement Treatment Administration Record (MSTAR), and reinforce training on weight-based dosing calculations.
Extravasation Injury	Stop the transfusion immediately, treat the extravasation injury, remove the IV line, provide wound care, and monitor the site. Recognition and prompt intervention of extravasation injuries to prevent limb ischemia.	Implement protocols for early detection and management, reinforce staff training on proper IV insertion and monitoring, reinforce staff training on vesicant administration protocols, including proper vein assessment, ensure proper fixation and protection of IV sites with suitable dressings, and ensure early recognition and prompt intervention of extravasation injuries to prevent limb ischemia.
Fall	Provide immediate assessment and care and ensure patient safety.	Ensure side rails are always properly raised and monitored, reinforce staff training on patient safety and side rail protocols, enforce watcher orientation, and continuous monitoring to prevent falls.

The overall frequency of PSEs in this study (0.27%) is within the range of 0.15% to 0.56% reported in the literature for admissions.[17,18]

Medication errors, the most prevalent PSE (62% of the 55 PSEs and occurred in 0.17% of admissions or 17 in 10,000 admissions), were found across all units. These errors encompassed a range of issues, such as incorrect dosing, wrong medication administration, expired medications, and transcription inaccuracies. Factors contributing to these errors include a lack of adherence to weight-based dosing calculations, inadequate verification processes during order transcription and dispensing, communication breakdowns between pharmacy and clinical staff, failure to double-check medication orders before administration, and a lack of proper patient identification.[19] The suggested corrective and preventative actions to address these contributing factors included reinforced training emphasizing accurate medication reconciliation and verification protocols, the implementation of double-check procedures for medication orders, and enhanced communication between pharmacy and clinical staff. Previous research has consistently shown medication errors as a leading cause of preventable harm in pediatric populations.[20,21]

The mean additional cost associated with medication errors is ₱366.03, but this does not provide a comprehensive analysis of the overall economic impact encompassing increased length of stay, as highlighted in other studies.[22,23]

This study identified contributing factors such as a lack of adherence to weight-based dosing calculations, inadequate verification processes, communication breakdowns, failure to double-check medication orders, and improper patient identification. These factors align with previous findings on systemic and human factors, which include high workload, insufficient staffing, distractions, insufficient training, fatigue, and lack of double-checking protocols.[24]

Extravasation injuries accounted for 25.4% of the reported PSEs and 0.07% of total admissions, primarily occurring in Ward 9 and Ward 11. These injuries resulted from infiltration during peripheral intravenous (IV) infusions, particularly with vesicant solutions. Contributing factors included inadequate IV site monitoring and securement, inappropriate vein assessment before infusion, a lack of clear protocols for administering vesicant medications, fragile veins of the patients, immature skin (especially neonates/preterm infants), poor vein condition, and high infusion pressures.[25] To mitigate these contributing factors, training on vascular access management focusing on proper site selection, access, and monitoring was recommended, alongside reinforced strict vascular access management protocols and enhanced monitoring protocols. Intravenous first aid should involve initial cessation of infusion, elevation, and attempted aspiration of the extravasated substance from the device.[11] Due to the high percentage of extravasation injuries, potential complications include skin/tissue necrosis, compartment syndrome, and limb loss.[10,26]

Falls represented 12.7% of the PSEs and 0.03% of total admissions, primarily occurring in the PER, Ward 11, and HO Ward. Key contributing factors included a lack of side rail utilization, inadequate supervision of patients, and medication-related complications.[27] Emphasis on supervision through the implementation of protocols for appropriate bed assignment and reinforced use of safety measures through staff training on side rail utilization were identified as potential solutions.

Relationship between PSEs and Outcomes

The analysis revealed that extravasation injuries had the highest mean additional hospital stays and direct costs. This suggests that such PSE may require more intensive management and lead to longer recovery periods.[28]

Limitations

This study includes all cases reported within the period of study, but it does not necessarily represent all admissions in the department. The study is limited to healthcare worker-reported PSEs within a single institution, specifically those formally reported through online reporting forms submitted to the QuIPS Committee. It does not encompass patient safety event data sourced from chart records or other sources beyond these formal reports.

While the study relied on a total enumeration of reported Patient Safety Events and found complete data for additional hospital stay and direct costs within the electronic medical records for the included events, our protocol did not explicitly detail a strategy for handling potential missing data if it had occurred. However, the comprehensive nature of the EMR system and the consistency of the 'N' values across our reported descriptive statistics suggest that this was not a practical concern for the variables analyzed

CONCLUSION

This study identified key patient safety events (PSEs) within the Department of Pediatrics at Philippine General Hospital (PGH) between April 2022 and June 2024. Medication errors emerged as the most prevalent type of event, followed by extravasation injuries and falls. Extravasation injuries were associated with the longest additional hospital stays and resulted in the highest direct costs. Furthermore, the analysis revealed a common need for reinforced staff training, process improvements (e.g., double-checking medications, IV site monitoring protocols), and enhanced communication between healthcare staff to prevent PSEs. These findings highlight the importance of implementing targeted quality improvement initiatives within the Department of Pediatrics - Philippine General Hospital. This study supports future interventions involving medication safety (emphasizing accurate dosing and double-checks), strict intravenous procedure enforcement (vascular access training and monitoring), and improved patient monitoring (falls prevention through supervision and safety measures). By addressing these critical areas, the department can strive to improve patient safety and reduce the incidence of preventable adverse events.

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Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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REFERENCES

1. World Health Organization. Definitions of key concepts. In: Patient Safety Curriculum Guide: Multi-professional Edition. Geneva; 2011.
2. Miller MR, Elixhauser A, Zhan C. Patient safety events during pediatric hospitalizations. Pediatrics. 2003;111(6):1358-66. doi: 10.1542/peds.111.6.1358. PMID: 12777553
3. Lacey S, Smith JB, Cox K. Pediatric Safety and Quality. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008 Apr. Chapter 15.
4. Greve P. Pediatrics: A unique and volatile risk. J Healthc Risk Manag. 2011;31(2):19-29. doi: 10.1002/jhrm.20084. PMID: 21990199.
5. Luo J, Eldredge C, Cho CC, Cisler RA. Population analysis of adverse events in different age groups using big clinical trials data. JMIR Med Inform. 2016;4(4):e30. doi: 10.2196/medinform.6437. PMID: 27751983.
6. Sakuma M, Ohta Y, Takeuchi J, Yuza Y, Ida H, Bates DW, et al. Adverse Events in Pediatric Inpatients: The Japan Adverse Event Study. J Patient Saf. 2024;20(1):38-44. doi: 10.1097/PTS.0000000000001180.
7. Kirkendall ES, Kloppenborg E, Papp J, White D, Frese C, Hacker D, et al. Measuring adverse events and levels of harm in pediatric inpatients with the Global Trigger Tool. Pediatrics. 2012;130(5):e1206-14. doi: 10.1542/peds.2012-0179. PMID: 23045558.
8. Sharek PJ, Horbar JD, Mason W, Bisarya H, Thurm CW, Suresh G, et al. Adverse events in the neonatal intensive care unit: Development, testing, and findings of an NICU-focused trigger tool to identify harm in North American NICUs. Pediatrics. 2006;118(4):1332-40. doi: 10.1542/peds.2006-0565. PMID: 17015521.
9. Ching D, Wong KY. Pediatric extravasation injury management: A survey comparing 10 hospitals. Pediatr Neonatol. 2017;58(6):549-51. doi: 10.1016/j.pedneo.2016.09.006. PMID: 28411087.
10. Murphy AD, Gilmour RF, Coombs CJ. Extravasation injury in a paediatric population. ANZ J Surg. 2019;89(4). doi: 10.1111/ans.14104. PMID: 28682011.
11. Leo AD, Leung BC, Giele H, Cogswell L. Management of Extravasation Injuries in Preterm Infants. Surg Sci. 2016;7(9):427-32.
12. Kaushal R. Medication errors and adverse drug events in pediatric inpatients. JAMA. 2001;285(16):2114. doi: 10.1001/jama.285.16.2114. PMID: 11311101.
13. Pasco PMD, Caro RM, Cruz CL, Dando NM, Isip-Tan ITC, Panganiban LR, et al. Prevalence of medication errors in admitted patients at the Philippine General Hospital. Acta Med Philipp. 2017;51(2). doi: 10.47895/amp.v51i2.577.
14. Nast PA, Avidan M, Harris CB, Krauss MJ, Jacobsohn E, Petlin A, et al. Reporting and classification of patient safety events in a cardiothoracic intensive care unit and cardiothoracic postoperative care unit. J Thorac Cardiovasc Surg. 2005;130(4):1137.e1-1137.e9. doi: 10.1016/j.jtcvs.2005.06.003. PMID: 16214531.
15. Gazarian M, Graudins LV. Long-term reduction in adverse drug events: an evidence-based improvement model. Pediatrics. 2012;129(5):e1334-1342. doi: 10.1542/peds.2011-1902. PMID: 22473370.
16. Starmer AJ, Sectish TC, Simon DW, Keohane C, McSweeney ME, Chung EY, et al. Rates of medical errors and preventable adverse events among hospitalized children following implementation of a resident handoff bundle. JAMA. 2013;310(21):2262-70. doi: 10.1001/jama.2013.281961. PMID: 24302089.

17. Manias E, Cranswick N, Newall F, Rosenfeld E, Weiner C, Williams A, et al. Medication error trends and effects of person-related, environment-related, and communication-related factors on medication errors in a paediatric hospital. J Paediatrics Child Health. 2019;55(3):320-6. doi: 10.1111/jpc.14193. PMID: 30168236. PMCID: PMC7379618.
18. Ross LM. Medication errors in a paediatric teaching hospital in the UK: five years operational experience. Arch Dis Child. 2000;83(6):492-7. doi: 10.1136/adc.83.6.492. PMID: 11087283. PMCID: PMC1718567.
19. Manias E, Street M, Lowe G, Low JK, Gray K, Botti M. Associations of person-related, environment-related, and communication-related factors on medication errors in public and private hospitals: a retrospective clinical audit. BMC Health Serv Res. 2021;21(1):1025. doi: 10.1186/s12913-021-07033-8. PMID: 34583681. PMCID: PMC8480109.
20. Alghamdi AA, Keers RN, Sutherland A, Ashcroft DM. Prevalence and nature of medication errors and preventable adverse drug events in paediatric and neonatal intensive care settings: a systematic review. Drug Saf. 2019;42(12):1423-36. doi: 10.1007/s40264-019-00856-9. PMID: 31410745. PMCID: PMC6858386.
21. D'Errico S, Zanon M, Radaelli D, Padovano M, Santurro A, Scopetti M, et al. Medication errors in pediatrics: Proposals to improve the quality and safety of care through clinical risk management. Front Med. 2022;8:814100. doi: 10.3389/fmed.2021.814100. PMID: 35096903. PMCID: PMC8795662.
22. Elliott RA, Camacho E, Jankovic D, Sculpher MJ, Faria R. Economic analysis of the prevalence and clinical and economic burden of medication error in England. BMJ Qual Saf. 2021;30(2):96-105. doi: 10.1136/bmjqs-2019-010206. PMID: 32527980.
23. Senst BL, Achusim LE, Genest RP, Cosentino LA, Ford CC, Little JA, et al. Practical approach to determining costs and frequency of adverse drug events in a health care network. Am J Health Sys Pharm. 2001;58(12):1126-32. doi: 10.1093/ajhp/58.12.1126. PMID: 11449856.
24. Izadpanah F, Nikfar S, Bakhshi Imcheh F, Amini M, Zargaran M. Assessment of frequency and causes of medication errors in pediatrics and emergency wards of teaching hospitals affiliated to Tehran University of Medical Sciences (24 Hospitals). J Med Life. 2018;11(4):299-305. doi:10.25122/jml-2018-0046. PMCID: PMC6418340. PMID: 30894886.
25. Devsi J, Paquette V, Carr R. Describing Intravenous Extravasation Injuries in Children (DIVE2 Study). Can J Hosp Pharm. 2024;77(2). doi: 10.4212/cjhp.3525. PMCID: PMC11146302. PMID: 38868325.
26. Dufficy M, Takashima M, Cunninghame J, Griffin BR, McBride CA, August D, et al. Extravasation injury management for neonates and children: A systematic review and aggregated case series. J Hosp Med. 2022;17(10):832-42. doi: 10.1002/jhm.12951. PMCID: PMC9804918. PMID: 36039964.
27. Brás AMR, Quitério MMDSL, Nunes EMGT. Nurse's interventions in preventing falls in hospitalized children: scoping review. Rev Bras Enferm. 2020;73(suppl 6):e20190409. doi: 10.1590/0034-7167-2019-0409. PMID: 33263672.
28. Bahl A, Haddad L, Hoerauf K, Mares A, Alsbrooks K. The clinical and economic burdens of infiltration and extravasation with peripheral intravenous catheters: a contemporary narrative review. Int J Nurs Health Care Res. 2023;6:1436. doi:10.29011/2688-9501.101436.