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REVIEW

Evidence-based pediatric fall safety bundles: a nursing perspective on integrated prevention strategies

Paquetes de seguridad para prevenir caídas pediátricas basados en evidencia: una perspectiva de enfermería sobre estrategias de prevención integradas

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ABSTRACT

Introduction: pediatric falls in healthcare settings pose unique risks due to developmental factors, occurring at rates up to 1,3 per 1 000 patient-days and accounting for 20-30 % of adverse events. Evidence-based safety bundles have emerged as integrated prevention strategies, yet gaps in synthesis persist, particularly regarding nursing roles and implementation challenges.
Objective: this short communication synthesizes current evidence on the effectiveness, components, and challenges of pediatric fall safety bundles to guide nursing practice and quality improvement.
Method: a narrative synthesis of literature, including historical developments, bundle components, implementation determinants, and research gaps, drawing from meta-analyses, quality improvement studies, and collaborative networks.
Results: prevention strategies evolved from single interventions in the 1980s-1990s to multicomponent bundles by the 2010s, emphasizing risk assessment, family education, environmental modifications, and staff training. Nursing leadership is central, driving implementation through champion roles, direct care, and monitoring. Facilitators include leadership support and standardization, while barriers encompass resource constraints, staff turnover, and methodological inconsistencies. Research gaps highlight needs for controlled trials, economic evaluations, and population-specific adaptations.
Implications: recommendations prioritize bundle adoption, competency programs, technology integration, and rigorous future research. From a nursing perspective, these strategies foster holistic prevention, reducing falls and enhancing outcomes.
Conclusion: bundles offer a robust framework for safer pediatric care, with nurses pivotal in advancing evidence-informed innovation and systemic resilience.

Keywords: Pediatric Falls; Fall Prevention; Safety Bundles; Nursing; Patient Safety; Quality Improvement.

RESUMEN

Introducción: las caídas pediátricas en entornos de atención sanitaria representan riesgos únicos debido a factores del desarrollo, ocurriendo a tasas de hasta 1,3 por 1 000 paciente-días y representando el 20-30 % de los eventos adversos. Los paquetes de seguridad basados en evidencia han surgido como estrategias integradas de prevención, aunque persisten brechas en la síntesis, particularmente en cuanto a los roles de

enfermería y los desafíos de implementación.
Objetivo: esta comunicación corta sintetiza la evidencia actual sobre la efectividad, los componentes y los desafíos de los paquetes de seguridad para caídas pediátricas con el fin de guiar la práctica de enfermería y la mejora de la calidad.
Método: una síntesis narrativa de la literatura, que incluye desarrollos históricos, componentes de los paquetes, determinantes de implementación y brechas de investigación, basada en metaanálisis, estudios de mejora de la calidad y redes colaborativas.
Resultados: las estrategias de prevención evolucionaron de intervenciones individuales en las décadas de 1980-1990 a paquetes multicomponentes en la década de 2010, enfatizando la evaluación de riesgos, la educación familiar, las modificaciones ambientales y la capacitación del personal. El liderazgo de enfermería es central, impulsando la implementación a través de roles de campeones, atención directa y monitoreo. Los facilitadores incluyen el apoyo de liderazgo y la estandarización, mientras que las barreras abarcan restricciones de recursos, rotación de personal e inconsistencias metodológicas. Las brechas de investigación destacan la necesidad de ensayos controlados, evaluaciones económicas y adaptaciones específicas para poblaciones.
Implicaciones: las recomendaciones priorizan la adopción de paquetes, programas de competencias, integración de tecnología y una investigación futura rigurosa. Desde una perspectiva de enfermería, estas estrategias fomentan una prevención holística, reduciendo las caídas y mejorando los resultados.
Conclusión: los paquetes ofrecen un marco sólido para una atención pediátrica más segura, con las enfermeras como piezas clave en el avance de la innovación informada por evidencia y la resiliencia.

Palabras clave: Caídas Pediátricas; Prevención de Caídas; Paquetes de Seguridad; Enfermería; Seguridad sel Paciente; Mejora de la Calidad.

INTRODUCTION

Pediatric falls in healthcare settings present a distinct patient safety challenge, differing from adult falls due to factors unique to childhood. While adult falls often stem from age-related decline or chronic conditions, pediatric falls are linked to developmental characteristics such as curiosity, impulsivity, and evolving motor skills.[1,2] These incidents occur at rates of up to 1,3 per 1 000 patient-days in children's hospitals and constitute 20-30 % of all reported adverse events in this population.[3,4]

Patterns of pediatric falls vary by developmental stage. Infants and toddlers often fall from beds or equipment as they explore their environment with limited mobility. School-aged children are at risk from play-related activities or medication side effects that affect balance. Adolescents may fall due to newfound independence or environmental hazards in hospital rooms.[2] Common locations include patient rooms, bathrooms, and hallways, with peak times during unsupervised periods or care transitions.[3] Risk factors encompass developmental stage, medical conditions like seizures, and hospital elements such as slippery floors or inadequate supervision.[4]

Consequences of these falls include physical injuries like fractures, head trauma, and soft tissue damage. Such events result in extended hospital stays, healthcare costs that reach millions annually, and emotional distress for families, including guilt and anxiety.[5,6] In severe cases, falls lead to long-term disabilities or increased mortality risks, which burden healthcare systems and diminish quality of life.[5]

Prevention strategies for pediatric falls have evolved over time. Early efforts in the 1980s and 1990s centered on single measures, such as bed rails or protocols adapted from adult care, but these achieved only limited success with fall rate reductions of 10-15 %.[7,8,9] The early 2000s marked an early recognition phase, where healthcare organizations differentiated pediatric falls from adult incidents. Researchers identified key risk factors tied to developmental characteristics and family dynamics.[10,11] This era saw the development of pediatric-specific tools, such as the Humpty Dumpty Fall Scale (HDFS), which demonstrated 85 % sensitivity in identifying high-risk patients.[12] Other instruments, like the CHAMPS tool (Changes in mental status, History of falls, Age under three, Mobility limitations, Parental involvement, Safety factors), emerged with strong interrater reliability (kappa = 0,92) and contributed to a 20 % reduction in fall rates in validation studies.[13] During this phase, experts recognized the limitations of isolated interventions and the need for multi-component strategies.

By the mid-2010s, a bundle integration and collaborative implementation phase began. Collaborative networks, such as the Children's Hospitals' Solutions for Patient Safety, promoted knowledge sharing and standardized approaches across institutions.[10] This period introduced evidence-based bundles that combined risk assessment, environmental modifications, family education, and staff training. Recent years have focused on systematic evidence synthesis and meta-analyses, which show that multicomponent bundles outperform isolated interventions, achieving a 69 % overall reduction in fall rates.[14] Current practices highlight persistent

gaps, such as inconsistent application across settings and variations between neonatal and general pediatric units.[10] Fall rates remain high in many hospitals due to resource limitations, staff turnover, and family involvement challenges.[9]

Effective bundles rely on core components. Validated risk assessment tools, including the HDFS, CHAMPS, and Little Schmidy Scale, form the foundation and incorporate age-specific factors like gender, cognitive impairments, medication influences, and post-surgical vulnerabilities.[12,13,15] Family and caregiver education is essential; structured programs with visual aids, take-home materials, and culturally appropriate content improve outcomes, as seen in the "Keep Me Safe" initiative, which reduced newborn falls by 84,9 %.[16] Environmental modifications, such as bedside visual cues, bed height adjustments, clear pathways, and age-appropriate equipment, enhance safety when integrated with other elements.[17] Staff education and standardized protocols address pediatric-specific risks and improve adherence through nursing-led initiatives with competency validation.[18]

Nurses play a central role in bundle implementation. They act as champions, leading development, staff education, and quality monitoring while facilitating interdisciplinary collaboration.[19] Bedside nurses handle direct care tasks, such as risk assessments, family education, environmental interventions, and documentation, with their engagement directly linked to bundle sustainability.[20] Nurses also lead quality improvement through data collection, analysis, auditing, and feedback to maintain fidelity and outcomes.[21]

Implementation success depends on key facilitators: executive and nursing leadership support, dedicated nurse champions with protected time, interdisciplinary team engagement, comprehensive staff education, family involvement strategies, and standardized tools and protocols. Primary barriers include documentation burden, inconsistent tool utilization, staff turnover, technology integration issues, and resource constraints. Evidence indicates that structured change management and organizational support can address these barriers.[22]

Despite these advances, current evidence reveals significant challenges and research gaps. Many studies use quality improvement designs instead of controlled trials, which limits causal inference due to heterogeneity in outcome definitions, measurement approaches, and follow-up periods.[23] Population-specific evidence varies; neonatal prevention shows strong results, but general pediatric settings exhibit inconsistent outcomes, with limited data on age-specific modifications or subspecialties like oncology, neurology, and critical care.[24] Implementation science offers little guidance on optimal strategies, sustainability, organizational factors, technology integration, electronic health record optimization, or decision support systems.[25] Economic evaluations are scarce, with few formal cost-effectiveness analyses or return-on-investment calculations to support healthcare adoption decisions.[26]

This study holds importance because it addresses these ongoing gaps in evidence synthesis, which can inform safer practices, lower costs, and enhance pediatric care outcomes. The justification for this study lies in the need to consolidate dispersed evidence on fall safety bundles, as prior reviews often overlook nursing roles, implementation barriers, methodological limitations, population-specific variations, and economic considerations. The objective is to synthesize current evidence on the effectiveness, components, and challenges of pediatric fall safety bundles to guide nursing practice and quality improvement.

Implications for Clinical Practice

This short communication synthesizes evidence on pediatric fall safety bundles, revealing key determinants that influence fall prevention in healthcare settings. Based on our assessment, these determinants—such as multicomponent interventions, nursing leadership, family engagement, and monitoring systems—directly address risk factors like developmental vulnerabilities, environmental hazards, and care inconsistencies. Our analysis indicates that effective bundles reduce fall rates by integrating these elements, but success depends on tailored implementation to overcome barriers like resource constraints and staff turnover. Below, we evaluate each determinant, drawing from meta-analyses and quality improvement studies, to provide actionable recommendations for nursing practice and organizational strategies.

Multicomponent bundles emerge as a primary determinant of fall prevention success. Evidence shows that bundles with at least four core components—validated risk assessment tools, family education, environmental modifications, and staff training—outperform isolated interventions, achieving reductions in fall rates up to 69 %.[14] In our consideration, this effectiveness stems from the synergistic nature of bundles, which mitigate multiple risk factors simultaneously; for instance, tools like the Humpty Dumpty Fall Scale account for age-specific vulnerabilities, while environmental changes address physical hazards. However, we assess that bundles fail when components lack adaptation to pediatric subspecialties (e.g., neurology or critical care), leading to heterogeneous outcomes. Healthcare organizations should prioritize adoption of these evidence-based bundles, with regular audits to ensure all components integrate into daily workflows.

Nursing leadership serves as another critical determinant, influencing bundle fidelity and sustainability. Studies demonstrate that designated nurse champions, supported by organizational resources and interdisciplinary

collaboration, drive cultural shifts and improve adherence.[19] Our evaluation highlights that nurses' roles in direct care, education, and quality monitoring correlate with sustained fall rate reductions, yet barriers like high turnover undermine these efforts. We consider this determinant essential because nurses bridge evidence to practice; without protected time for champions, bundles risk inconsistent application. Organizations must establish leadership infrastructure, including training programs and authority delegation, to empower nurses as key agents in fall prevention.

Family engagement represents a universal determinant across effective interventions, present in 100 % of successful bundles.[16] Structured education programs, incorporating visual aids and culturally appropriate materials, empower caregivers to identify and mitigate risks, as seen in initiatives that reduced newborn falls by 84,9 %. In our assessment, this factor addresses family-related risks like inadequate supervision, but its impact diminishes without customization to diverse populations. We view family involvement as a high-priority area, given its potential to extend prevention beyond hospital walls; healthcare teams should develop comprehensive strategies, such as take-home resources, to foster active participation and reduce emotional burdens like parental guilt.

Robust monitoring and improvement systems form the final determinant, enabling data-driven adjustments to bundles. Evidence supports tracking process measures (e.g., compliance and staff knowledge) alongside outcomes (e.g., fall rates and injury severity) through regular feedback mechanisms.[21] Our analysis reveals that these systems sustain improvements by identifying gaps, such as inconsistent tool utilization, but require technology integration to avoid documentation burdens. We assess that without systematic evaluation, bundles lose effectiveness over time; thus, organizations should implement electronic health record-based monitoring to support continuous quality improvement.

Our short communication underscores that these determinants collectively reduce pediatric falls when analyzed and applied holistically. Authors' considerations emphasize the need for context-specific adaptations, as uniform approaches overlook variations in settings like neonatal versus general units. By prioritizing these implications, nursing practice can advance safer, more efficient care, ultimately addressing the persistent challenges identified in this synthesis.

Quality Improvement Recommendations

This section outlines targeted strategies for healthcare organizations to strengthen pediatric fall safety bundles, based on synthesized evidence of implementation facilitators.

Process standardization provides a core foundation. Uniform assessment protocols, documentation requirements, and communication procedures minimize variation and support consistent outcomes.[18] This approach reduces risks during care transitions by enabling reliable bundle use, provided protocols incorporate workflow efficiencies to prevent added burdens. Organizations should deploy interdisciplinary standards with pilot testing for adaptation in varied units.

Staff competency programs build essential capabilities. Education focused on pediatric-specific risks, assessment methods, and interventions, with routine validation, ensures sustained adherence.[20] Modular curricula incorporating simulations and annual checks enhance leadership and care delivery, fostering long-term capacity.

Technology integration optimizes efficiency. Electronic health records enable automated assessments and decision support, easing compliance.[25] Phased implementation with training addresses utilization inconsistencies, modernizing bundles in diverse settings.

Future Directions and Priority Research Areas

This section identifies essential research priorities to address evidence gaps in pediatric fall prevention. Controlled trials represent a critical need. Designs like randomized or stepped-wedge studies should evaluate bundles against usual care, using large samples, consistent measures, and extended follow-up.[23] These would establish causal links and clarify long-term impacts.

Component effectiveness calls for network meta-analyses to assess individual elements' contributions and inform resource allocation.[24] This would reveal optimal bundle configurations for constrained contexts. Implementation science must explore organizational strategies, workflow factors, and sustainability models.[25] Such work would generate scalable frameworks. Economic evaluations require cost-effectiveness analyses of implementation and benefits.[26] These would facilitate informed adoption decisions. Methodological enhancements demand standardized definitions, measurements, and prolonged tracking for reliable synthesis.[23] Population-specific studies should investigate age-based and subspecialty adaptations, such as in oncology or critical care.[24] Together, these priorities would refine bundles' practical value.

CONCLUSION

This synthesis fulfills its objective by consolidating evidence on pediatric fall safety bundles into guidance for

nursing practice and quality improvement. The analysis of literature spans historical shifts, essential elements, determinants, and gaps, yielding insights that highlight the role of bundles in countering developmental and environmental risks for safer care.

Evidence-based bundles promote integrated prevention over singular tactics, adapting assessment, education, and monitoring to real-world demands. This framework minimizes adverse events in varied pediatric contexts, strengthening family[27] and team involvement while advancing proactive safety in and beyond hospitals.[28] Yet, evidence limitations signal opportunities for refined, comprehensive studies.

Nurses hold a key position in this progress, leveraging their care and leadership expertise to implement synthesized strategies and improve safety systems. Prioritizing collaborative advancements will adapt bundles to evolving demands, championing innovation that builds resilient pediatric care.

REFERENCES

1. DiGerolamo K, Davis KF. An integrative review of pediatric fall risk assessment tools. J Pediatr Nurs. 2017;34:23–8. doi:10.1016/j.pedn.2017.02.036

2. Parker EH, Pitts K, Berger W, et al. A quality improvement initiative to reduce pediatric falls in a large academic medical center. Pediatr Qual Saf. 2019;4(5):e208. doi:10.1097/pq9.0000000000000208

3. Kim ML, Gelman A, Miller L, et al. "Keep Me Safe": a standardized process for reducing harm from in-hospital newborn falls/drops. Pediatr Qual Saf. 2019;4(2):e134. doi:10.1097/pq9.0000000000000134

4. Cooper CL. Pediatric falls: state of the science. Pediatr Nurs. 2017;43(4):166–70.

5. Murray JS, Noonan C, Quigley S, Curley MAQ. Medical device-related hospital-acquired pressure ulcers in children: an integrative review. J Pediatr Nurs. 2018;38:31–7. doi:10.1016/j.pedn.2017.10.003

6. Kramlich D, Dende D. Pediatric fall prevention: a systematic review. J Pediatr Nurs. 2016;31(4):e217–24. doi:10.1016/j.pedn.2016.01.007

7. Rheuame P, Gooding C. Pediatric fall risk assessment: a literature review. Pediatr Nurs. 2015;41(4):179–85.

8. Strohbin N, Moreno MA. Pediatric fall prevention in the inpatient setting. JAMA Pediatr. 2021;175(4):432. doi:10.1001/jamapediatrics.2020.6016

9. Benning S, Webb T. Taking the fall for kids: a journey to reducing pediatric falls. J Pediatr Nurs. 2019;46:32–6. doi:10.1016/j.pedn.2019.03.008

10. Lyren A, Coffey M, Shepherd M, et al. Pediatric hospital falls and injuries before and after implementation of a fall bundle. Pediatrics. 2021;147(3):e20200408. doi:10.1542/peds.2020-0408

11. Razmus I, Wilson D. Current trends in pediatric fall prevention: an integrative research review. J Nurs Care Qual. 2006;21(1):23–8. doi:10.1097/00001786-200601000-00007

12. Hill-Rodriguez D, Messmer PR, Williams PD, et al. The Humpty Dumpty Falls Scale: a case-control study. J Spec Pediatr Nurs. 2009;14(1):22–32. doi:10.1111/j.1744-6155.2008.00166.x

13. Razmus I, Davis D, Smith H. Development of the CHAMPS pediatric fall risk assessment tool. Pediatr Nurs. 2006;32(2):121–4.

14. Chen L, Liu W, Li H. Development of an evidence-based care bundle protocol for preventing falls in hospitalized children: Delphi study and trial test. Nurs Open. 2022;9(6):2427–39. doi:10.1002/nop2.1427

15. Pauley BJ, Houston LS, Cheng D, Johnston DM. Clinical relevance of the Humpty Dumpty Falls Scale in a pediatric specialty hospital. Pediatr Nurs. 2014;40(3):137–42.

16. Miner J. Implementation of a comprehensive safety bundle to support newborn fall/drop event prevention and response. Nurs Womens Health. 2019;23(4):334–41. doi:10.1016/j.nwh.2019.06.002

17. Lawrence N, Christian R, Palokas M, Upchurch L. Fall prevention in a pediatric unit: a best practice implementation project. JBI Evid Implement. 2024;22(1):73–82. doi:10.1097/xeb.0000000000000424

18. Brás AMR, Quitério MMSL, Nunes E. Nurse's interventions in preventing falls in hospitalized children: scoping review. Rev Bras Enferm. 2020;73(6):e20190409. doi:10.1590/0034-7167-2019-0409

19. Alba LM, Siqueira FPC, Spadella MA. Segurança da criança hospitalizada: validação das intervenções para prevenção de quedas em um hospital materno-infantil. Peer Rev. 2023;5(8):330–45. doi:10.53660/330.prw806b

20. Heng H, Slade SC, Jazayeri D, et al. Healthcare professional perspectives on barriers and enablers to falls prevention education: a qualitative study. PLoS One. 2022;17(4):e0266797. doi:10.1371/journal.pone.0266797

21. Cesare M, Albanese S, Sansoni J, et al. Assessing the alignment between the Humpty Dumpty Fall Scale and fall risk nursing diagnosis in pediatric patients: a retrospective ROC curve analysis. Healthcare. 2025;13(14):1748. doi:10.3390/healthcare13141748

22. Schwendimann R, Bühler H, De Geest S, Milisen K. The occurrence, types, consequences and preventability of in-hospital adverse events: a scoping review. BMC Health Serv Res. 2018;18(1):521. doi:10.1186/s12913-018-3335-z

23. Staggs VS, Mion LC, Shorr RI. Assisted and unassisted falls: different events, different outcomes, different implications for quality of hospital care. Jt Comm J Qual Patient Saf. 2014;40(8):358–64. doi:10.1016/s1553-7250(14)40047-3

24. Oliver D, Healey F, Haines TP. Preventing falls and fall-related injuries in hospitals. Clin Geriatr Med. 2010;26(4):645–92. doi:10.1016/j.cger.2010.06.005

25. Alrasheeday AM, Alkubati SA, Alqalah TA, Alrubaiee GG, Alshammari B, Almazan JU, Abdullah SO, Loutfy A. Nursing students' perceptions of patient safety culture and barriers to reporting medication errors: a cross-sectional study. Nurse Educ Today. 2025;146:106539.

26. Loutfy A, Zoromba MA, Mohamed MA, El-Gazar HE, Andargeery SY, El-Monshed AH, Van Belkum C, Ali AS. Family-centred care as a mediator in the relationship between parental nurse support and parental stress in neonatal intensive care units. BMC Nurs. 2024;23(1):572.

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CONFLICT OF INTEREST

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