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SPECIAL ARTICLE

Adherence to double verification in the prescription, preparation, and administration of high-risk medications

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Abstract

Introduction: Adverse events in healthcare are a common cause of death and disability, and 80% are preventable. Implementing harm reduction strategies is therefore a priority. High-risk medications (HRMs) are those that, if used incorrectly, are more likely to result in serious or fatal harm. Double-checking by physicians and nurses during prescription, preparation, and administration is an effective safety strategy.

Objective: To increase adherence to double-checking during the prescription, preparation, and administration of HRMs to 20%.

Methods: An improvement methodology study was performed. A prospective, descriptive study with interventions was conducted in the resuscitation area of Garrahan Hospital in Buenos Aires, Argentina, between December 11, 2023, and January 31, 2024. Interventions were implemented through Plan-Do-Study-Act cycles and included educational sessions, dissemination of the HRM list, and reminders via different channels. Double verification (prescription, preparation, and administration) was assessed through double signature checks before and after the interventions.

Results: Adherence to double-checking increased from 0% to 65% by the end of the study.

Conclusion: The interventions led to a significant increase in adherence to double-checking high-risk medications (HRMs), exceeding the initial target. Increasing and maintaining this practice is essential for improving patient safety and quality of care.

ADHERENCIA A LA DOBLE VERIFICACIÓN EN PRESCRIPCIÓN, PREPARACIÓN Y ADMINISTRACIÓN DE MEDICAMENTOS DE ALTO RIESGO

Resumen

Introducción: *Los eventos adversos en la atención sanitaria son una causa frecuente de muerte y discapacidad, y el 80% son prevenibles. La implementación de estrategias de reducción de daños es prioritaria. Las medicaciones de alto riesgo (MAR) son aquellas que, usadas incorrectamente, tienen mayor probabilidad de causar daños graves o mortales. La doble verificación por médicos y enfermeros en su prescripción, preparación y administración es una estrategia efectiva de seguridad.*

Objetivo: *Aumentar la adherencia a la doble verificación en la prescripción, preparación y administración de MAR a un 20%.*

Métodos: *Estudio de metodología de mejora. Se desarrolló un trabajo prospectivo, descriptivo, con intervenciones, en el sector de reanimación del Hospital Garrahan de Buenos Aires, Argentina, entre 11 de diciembre de 2023 y 31 de enero de 2024. Se aplicaron intervenciones en ciclos Plan-Do-Study-Act, incluyendo sesiones educativas, difusión del listado de MAR y recordatorios mediante distintos canales. Se evaluó doble*

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verificación (prescripción, preparación y administración) mediante el control de doble firma antes y después de las intervenciones.

Resultados: *La adherencia a doble verificación pasó de 0% a 65% al finalizar el estudio.*

Conclusión: *Las intervenciones lograron un aumento significativo en la adherencia a doble verificación de MAR, superando el objetivo inicial. Incrementar y sostener esta práctica es importante para mejorar la seguridad y calidad de atención.*

INTRODUCTION

Healthcare-associated adverse events are among the 10 leading causes of death and disability worldwide[1]. These events are preventable in 80% of cases[2], making the implementation of harm reduction strategies a priority across all healthcare settings.

In 2004, the World Health Organization (WHO) established the Global Alliance for Patient Safety to support the development of policies and practices that promote patient safety, based on the principle of "First, do no harm"[3].

Following a collaborative effort between the WHO and The Joint Commission, the "Patient Safety Solutions Preamble" was published in 2007, outlining nine key improvement measures.

Finally, in the same year, the WHO launched the "Medication Without Harm" campaign as a global challenge, aiming to introduce improvements at every stage of the medication process to achieve a 50% reduction in medication errors within five years[4].

Based on WHO recommendations, Argentina promotes the implementation of several lines of action to improve patient safety, including promotion of a culture of safety, safe medication use, prevention and control of healthcare-associated infections, safe surgeries, safe care practices, accurate patient identification, effective communication among healthcare professionals, management of adverse events, and patient involvement in safety efforts[5].

Regarding the safe use of medications, strategies are proposed to ensure the safe management of HRMs, drugs that, when used incorrectly, are more likely to cause serious or even fatal harm. These strategies include: dissemination of accessible HRM lists for all healthcare personnel, alert identifiers on labels, clearly differentiated storage areas, pre-printed prescription forms, electronic prescribing systems, double-checking during administration, active participation of pharmacists in medical rounds, centralized management in the pharmacy, standardized dilutions, medication reconciliation at care transition points, and actions to educate patients about their active role in the safe use of medications and reconciliation processes[5].

Prior to the administration of HRMs, a final check by two professionals (physician and/or nurse) is recommended to verify the correct patient identification, as well as the pharmaceutical formulation, dose, rate, and route of administration of the medication.

HRMs represent a key area of concern in medication safety and should be prioritized within patient safety programs across healthcare institutions.

The proposed strategies include the double-checking process during the prescription, preparation, and administration of HRMs.

The aim of this study was to evaluate and improve adherence to this process in the Pediatric Emergency Department (PED) of a tertiary-level hospital in Latin America.

METHODS

Context

Pediatric Hospital Prof. Dr. J. P. Garrahan (HPG) is located in Buenos Aires, Argentina. It is a highly complex institution that provides care to children and adolescents from various regions of the country, as well as from neighboring countries.

Approximately 6,100,000 patient visits are received and 12,000 surgeries are performed each year, and more than 28,000 patients are discharged. The hospital has 587 beds, including 132 intensive care beds, 20 operating rooms, 200 outpatient offices, and specialized departments for Transplantation, Neonatology, and Burns, as well as a Comprehensive Care Center for Hematology–Oncology Patients. It also has a Blood, Cells, and Tissue Bank, a Public Umbilical Cord Blood Bank, a Tumor Bank, and 14 laboratories[6].

The HPG receives approximately 120,000 visits per year for acute illnesses and injuries. The PED has 47 observation and short-stay beds, with additional beds added during seasonal peaks, and a resuscitation area (RA) with five beds.

The complexity of the Pediatric Emergency Department (PED), the medications administered, and the high demand for care can contribute to the occurrence of healthcare-related adverse events. Despite advances in the digitalization of healthcare processes, medical orders in our PED are still handwritten.

At HPG, the double-checking process is promoted during both the prescription of HRMs (by physicians) and their preparation and administration (by nursing staff). This verification is documented through double signatures on the medication orders, signed by both medical and nursing personnel.

As part of the "Improvement Methodology Course" offered by Cincinnati Children's Hospital and the Latin American Society of Pediatric Emergency Medicine (SLEPE)[7,8], a prospective, descriptive improvement methodology study was conducted with interventions between December 11, 2023, and January 31, 2024. A team was formed for this

purpose, consisting of three physicians and two nurses from the PED.

Adherence to the double-check and double-signature protocol for selected HRMs among PED staff was assessed. Initial mapping revealed no compliance with the established protocol. A series of interventions were subsequently implemented using the Plan-Do-Study-Act (PDSA)[a] cycle, aiming to improve adherence rates and enhance the quality and safety of patient care in the PED (Figure 1).

Intervention

Adherence of PED staff to the double-checking process was recorded and analyzed through mapping[b].

The study was conducted between February 26, 2023, and January 31, 2024.

For convenience, data collection was limited to the RA, on weekdays, between 08:00 a.m. and 04:00 p.m.

The SMART *Aim*[c] was: To increase the percentage of double-checking, defined as documentation with a double signature, during the prescription (by physicians), preparation, and administration (by nurses) of HRMs on the prescription sheet, from 0% to 20% in patients admitted to the RA on weekdays between 08:00 a.m. and 04:00 p.m., by January 31, 2024.

Key Drivers[d] were identified to guide the development of effective interventions, and Knowledge Discovery in Databases (*KDD*)[e] was applied to analyze the planned interventions (Figure 2).

A baseline measurement was taken, followed by the implementation of interventions and subsequent reassessments.

- Baseline measurement: a pilot study was conducted between February 26 and April 27, 2023, through a retrospective review of written prescriptions for an HRM (intravenous (IV) 25% magnesium sulfate – $MgSO_4$). Following this initial evaluation, it was decided to include the most commonly used HRMs in the area, based on the epidemiological profile of patients treated in our RA(9), including insulin, IV electrolyte corrections, inotropes, and IV $MgSO_4$. Medical prescriptions were then evaluated prospectively from September 12 to October 27, 2023.
- First intervention: in December 2023, informational sessions were conducted on safety culture, the HRM list, and the double-check and double-signature procedure. Baseline measurement results were shared with the team. Simultaneously, informational posters were placed in medication preparation areas, the nursing station, physicians' office, and the RA. Reminders were delivered regularly, both in person and through multiple communication channels.

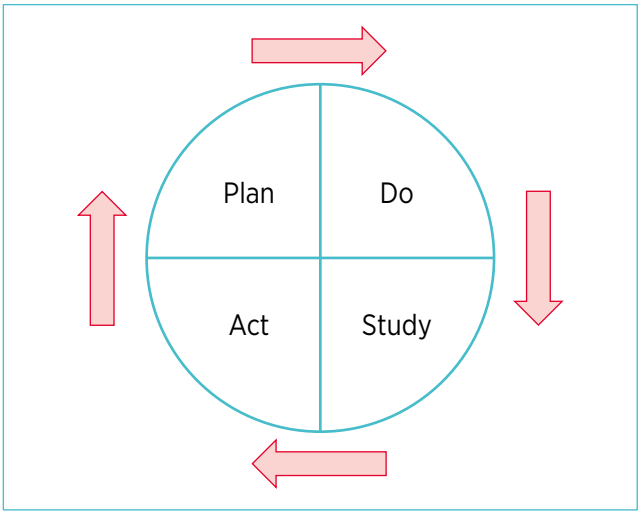


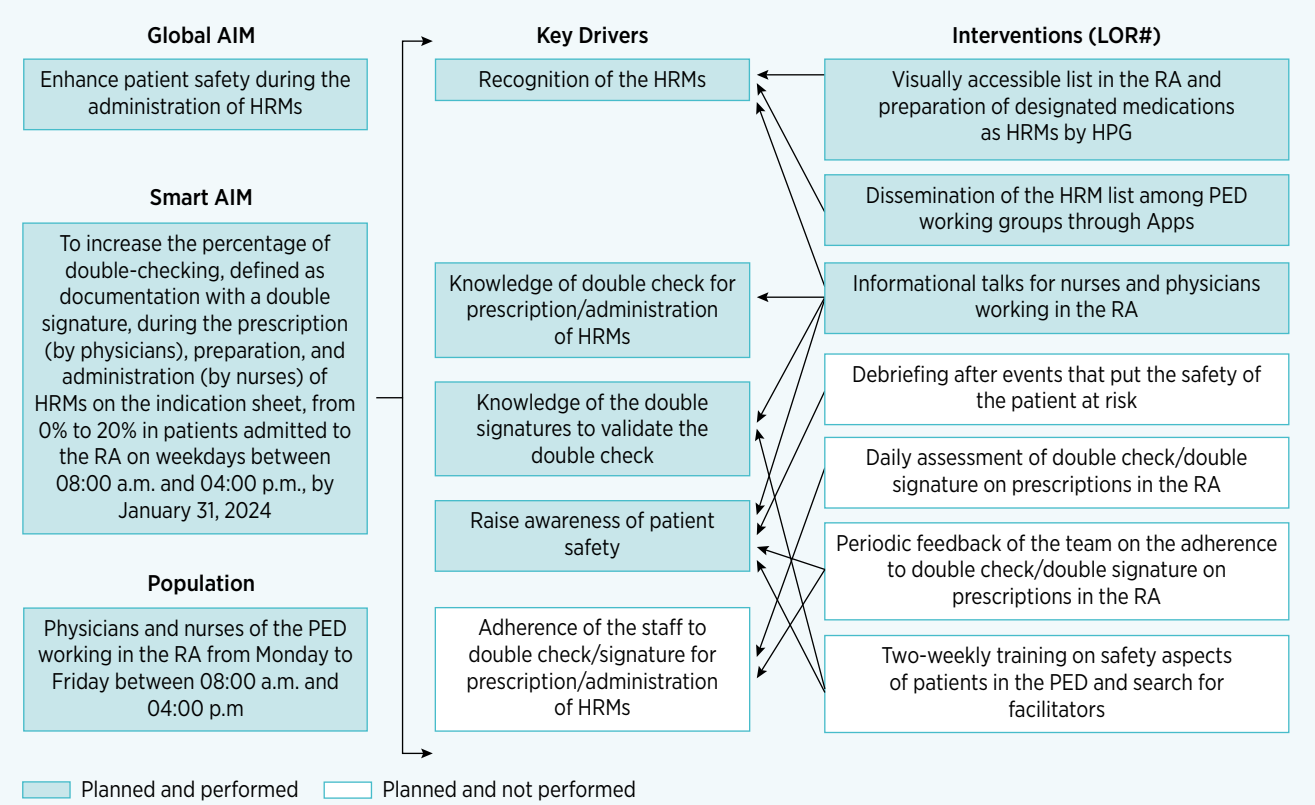
FIGURE 1. Plan-Do-Study-Act (PDSA) cycle.

- Second intervention: in January 2024, the PED staff received feedback on the progress made following the initial intervention. Previously shared information was reinforced, accompanied by reminders delivered in multiple formats.

RESULTS

- Baseline measurement: thirty-six patients with a diagnosis of asthma exacerbation and an indication for IV MgSO4 were included. In none of the cases, whether during prescription, preparation, or administration, was a double signature by medical and/or nursing staff recorded. After expanding the evaluation to include other HRMs, eight additional patients were enrolled, and adherence to the double-checking process remained at 0%.
  Interventions were subsequently implemented to improve adherence to double-checking during the prescription, preparation, and administration of HRMs.
- Results following the first intervention: as shown in Figure 3, during the four weeks following the intervention, prescriptions of 14 patients were evaluated.
  Adherence to the double-checking process increased, with the median increasing from 0% to 35%, exceeding the 20% target established in the SMART Aim.
  However, by week 9, a decline in adherence below the target was observed, leading to the implementation of a second intervention.

[a]*PSDA*: developing a plan to test the change (Plan), carrying out the test (Do), observing, analyzing, and learning from the results (Study), and determining what modifications to make for the next cycle, if applicable (Act). This is an iterative strategy for evaluating and analyzing changes within a system and should be applied to every planned change strategy.
[b]Process mapping: planning tool that allows for the visual representation of the people and actions involved in a process from start to finish.
[c]SMART Aim: a goal that is Specific, Measurable, Achievable, Realistic, and Time-bound.
[d]Key Drivers: the key conditions or factors necessary to achieve the desired goal.
[e]KDD: a process for identifying valid, novel, useful, and understandable patterns in data, aimed at discovering new knowledge.



HRM: High/risk medications; RA: Resuscitation Area; PED: Pediatric Emergency Department; HPG: Hospital de Pediatría "Prof. Dr. J.P. Garrahan".

FIGURE 2. *Knowledge Discovery in Databases* (KDD).

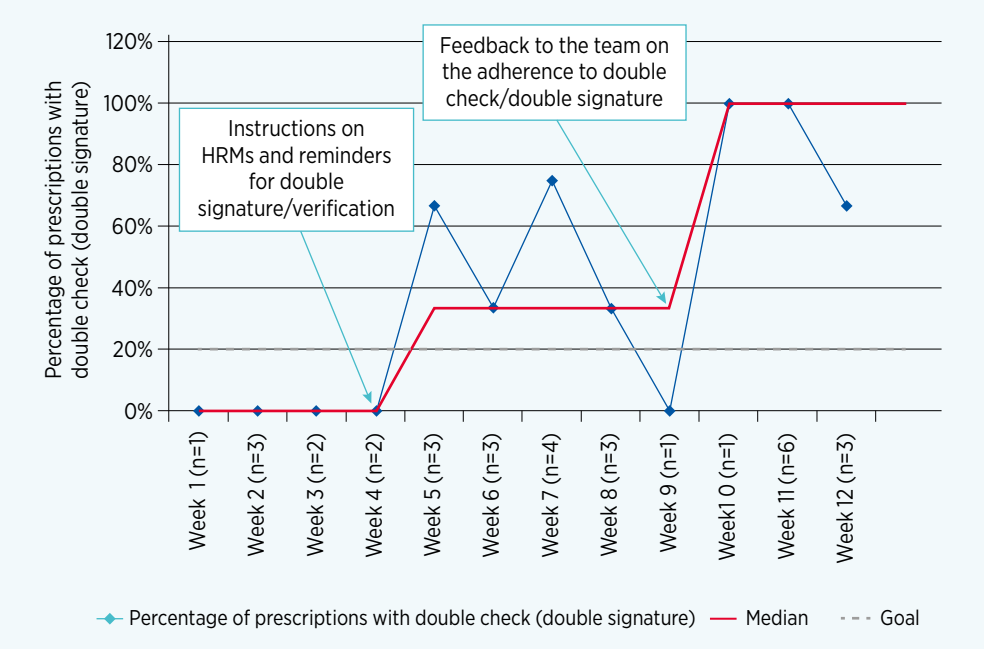


FIGURE 3. Run Chart[f].

- Results following the second intervention: Figure 3 shows that, during the three weeks following the intervention, prescriptions for 10 patients were analyzed. Toward the end of the study, an increase in adherence was observed, reaching levels between 60% and 100%.

[f]*Run Chart*: a visual tool that shows how data changes over time. A way to monitor the evolution of a process or variable to detect trends and/or patterns. It can help identify whether improvements are occurring or if there are special causes of variation that need to be investigated.

DISCUSSION

Despite recommendations that PEDs should implement continuous quality improvement plans through regular reviews and improvement cycles[10], a 2019 survey of 105 PEDs in Latin America found that only 41% reported having an improvement program in place[11].

Continuous improvement plans should include measures that improve patient safety.

At our hospital, as part of the safe medication use framework, double-checking during the prescription, preparation, and administration of HRMs is promoted as a key safety strategy.

Although double-checking medication administration has been a common practice in pediatric hospitals worldwide for decades, evidence of its effectiveness in reducing errors or harm remains limited and conflicting[12-15].

In our study, educational talks, promotion of a safety culture, dissemination of the HRM list, placement of informational posters in medication preparation areas, the nursing office, physicians' office, and the RA, together with periodic reminders shared through multiple communication channels and the dissemination of intervention results, were all associated with a clear improvement in adherence to the double-check strategy.

The implementation and monitoring of multidisciplinary programs—including safety measures such as prescribing system alerts and double-checks by two healthcare professionals—are key actions to optimize the safe use of HRMs[16].

The use of technological systems, pharmacist involvement, effective communication, nursing interventions, and adherence to medication safety guidelines are essential components of safe medication practices, especially in pediatric and neonatal populations[17].

CONCLUSION

Interventions focused on staff education regarding patient safety culture, dissemination of the HRM list, reinforcement of the double-check and double-signature procedure, and periodic reminders contributed to improved compliance with double-checking and signing during the prescription, preparation, and administration of HRMs.

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