Journal of Pioneering Medical Sciences
Received: September 18, 2025 | Accepted: January 17, 2026 | Published: February 05, 2026
Volume 15, Issue 01, Pages 43-49

DOI https://doi.org/10.47310/jpms2026150106

An Innovative Learning Tool to Reinforce Patient Safety in Nursing Programs by Using the Room of Errors

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Abstract **Background:** This is a fictitious patient room where errors are intentionally introduced. This tool offers healthcare professionals a realistic environment where they can detect these errors, focusing on the different stages of the care process. The errors concern hygiene, medication management, identity vigilance, as well as respectful care. Firstly, this initiative aims to establish a simulation-based educational program in therapeutic administration, tailored to the needs and aspirations of polyvalent nursing students, using the room of errors as a teaching tool. The main objective of the room of errors is to facilitate the analysis of errors, understand their implications and learn from them in order to prevent them from recurring in clinical practice, thereby promoting a culture of safety and a constructive approach to errors among polyvalent nursing students. **Methods:** A quantitative observational study in which it was decided to select 20 errors to be identified by polyvalent nursing students. This selection represented a significant set of themes, allowing each student to find errors based on their own theoretical and practical knowledge and to note them on an "error collection" sheet. **Results:** The analysis of the study revealed a high central tendency, although heterogeneity within the group of learners was moderate, which nevertheless revealed notable differences in performance. Indeed, the average score was 15.08 out of 20, which indicates a good level of error detection. In this respect, more than 60% of the sample exceeded the threshold determined by the educational level, which indicates a relative mastery of the skills identified in the safety section. It is therefore reasonable to consider that the room of errors simulation improves the vigilance of first-year nursing students with regard to error detection skills. By analyzing each major risk theme separately, the results reveal that risks are indeed easily identified. The percentage related to errors concerning hygiene and nutrition is 100% and that related to waste management is 89.5% of the group. Errors related to infection risks and patient safety are the least identified, at 78.9% of the group. The overall assessment of the tool indicated that all participants enjoyed and appreciate the room of errors: 84.2% found this learning method excellent. **Conclusions**: The room of errors is a source of learner engagement and learning is optimized with a view to professional skills. It will allow our learners to train in conditions very close to reality, without consequences for the patient. It broadly addresses technical skills of "know-how" and non-technical skills such as "interpersonal skills" This is a major challenge to better prepare caregivers and improve patient safety.

Key Words Simulation, Room of Errors, Polyvalent Nursing Students, Nursing Care, Patient Safety, Medication

INTRODUCTION

For more than 20 years, healthcare systems have been aware that adverse events associated with care are frequent, often serious and closely linked to human factors [1].

"Medical errors" have been estimated to be the third leading cause of death in the United States [2]. When a medical error leads to the death of a patient, it is important to identify both the physiological cause of death and the problem related to the provision of care [2].

Around the world, numerous studies have been conducted to find safer and more reliable tools for managing healthcare risks in order to identify, analyze, prevent and mitigate the risks associated with patient care [3].

All healthcare facilities must engage in ongoing reflection on the measures to be implemented to prevent medication errors. Potential or confirmed medication errors are subject to internal reporting within the facility. Their analysis must lead to the implementation

of specific preventive measures, common to the entire structure and formalized in writing [4].

Given the significant scale and frequency of adverse events associated with healthcare, it is imperative to prioritize the initial training of students and future nurses. This training should aim to develop their ability to recognize risks in healthcare settings and provide them with the knowledge and skills necessary to implement preventive measures [5].

Accordingly, Bouhoula *et al.* [5], who recently conducted a study on the management of blood exposure accidents, emphasize that traditional teaching approaches based on lectures and written guidelines do not provide the practical skills and reflective decision-making abilities that are essential in real clinical contexts [5].

Simulation-based training environments have therefore become an innovative and effective learning method for ensuring proper incident management. Technological and scientific advances in recent years have greatly facilitated the integration of this type of learning into medical education [6,7]. These advances make it possible to design environments that replicate real clinical situations in a non-stressful setting, where students can safely apply their fundamental knowledge, scientific knowledge and clinical skills in preclinical or clinical learning situations [6,8].

In its practical guide on room of errors, the National Authority for Health (HAS) emphasizes that among the tools for managing healthcare-related risks is healthcare simulation, more specifically room of errors, which can be used in the initial or continuing training of healthcare professionals [9].

In recent years, the room of errors has established itself as a particularly effective educational tool in the field of healthcare. Its development is a continuation of seminal work on patient safety, notably the Institute of Medicine's report “To Err is Human” [10,11].

The “room of errors” is a “fun and educational” healthcare simulation tool designed to improve the quality and safety of care. It allows participants to visualize and identify errors deliberately inserted into a healthcare scenario [12]. The main objective of the error room is to promote a culture of safety and a positive attitude towards errors among healthcare professionals.

After a briefing stage reminding learners of the educational objectives, they are then asked to identify the errors, typically between 7 and 20, hidden in different parts of the room. After this “simulator session,” which takes between 10 and 20 minutes, learners are asked to debrief the errors with the trainers. Best practices are corrected during the debriefing phase. Participants leave the error room with the “right messages” delivered by the facilitators/experts [12].

This study aims to demonstrate how the “Room of Errors” simulation method can be an effective teaching tool for improving learners’ knowledge by confronting them with errors, assessing their ability to identify them and encouraging them to learn constructive lessons.

METHODS

Study Design

This research utilized a descriptive cross-sectional design incorporating a simulated "room of errors" scenario to evaluate learners' skills in identifying medication and safety-related mistakes. The simulation targeted first-year undergraduate nursing students, recognizing their heightened vulnerability to unsafe practices due to limited clinical experience and incomplete mastery of safety protocols.

Study Location

The study took place at the nursing training institution's simulation center, where the error room scenario was conducted under controlled conditions.

Study Duration

Data collection occurred within a single simulation session, during which all participants completed the activity under uniform conditions.

Sample Size

Thirty-eight first-year nursing students participated, all of whom were novice learners enrolled in the initial year of their undergraduate nursing program.

Study Tool

In order to encourage participants to report errors encountered during the study, a form was created to allow them to record identified errors, but it was impressed upon them that the form would be anonymous so they would feel comfortable recording any error they observed.

At the end of the debriefing, students were invited to complete an anonymous satisfaction questionnaire on a voluntary basis, validated and contextualized from a study conducted in Tunisia(5). This survey was designed to gather participants' opinions on the “error room,” as well as their comments on the various aspects of the simulation session at its different stages. Responses were recorded using a 5-point Likert scale, rating the simulation as : Inadequate, Insufficient, Adequate, Good or Excellent.

Procedure and Methodology

A structured clinical simulation, named the room of errors, was developed featuring 20 deliberately introduced errors spanning prescription, medication storage and administration, infection prevention, patient identification, waste management and safety procedures. The scenario was validated by a panel of expert professionals and, when possible, pretested by practicing healthcare providers before implementation. Upon entering, participants were instructed not to physically interact with any items but to carefully observe and document detected errors on an anonymous answer sheet. Participants worked in groups of three, with each group given 15 minutes to complete the task. A facilitator greeted each group, provided a briefing lasting 3-5 minutes, distributed materials, monitored timing and ensured

Figure 1: Photos taken on the day of entry into the room of errors

Table 1: Errors staged in the room of errors

Types of errors	Errors to be staged
Hygiene and Nutrition	• Unprotected food left on the patient's bedside table • A spare sheet left under the patient's bed • The mask is not worn correctly by the patient • Beanbag placed on the top shelf of the treatment trolley • Cotton wool cup is soiled
Waste management	• Following the patient's insulin injection, the syringe was left on the patient's bedside table rather than in a sharp's container • The sharps container was filled beyond its maximum capacity • Used gloves were kept in the tray for reuse • A used syringe was left on the trolley • A waste sorting bin was missing
Risk of Infection and Patient Safety	• Very sweet food brought for a diabetic patient (presence of a packet of chocolate on the patient's bedside table) • Visitor present in the room during care • The sheet is not clean • The patient is not properly positioned in bed • Tourniquet left tightened on the patient's arm
Medication Management and Identity Vigilance	• Medication left in front of the patient outside the refrigerator • Treatment with a medication containing penicillin in a patient allergic to penicillin • Use of expired medication • The care file contained a prescription that did not match the patient's name • Medication left open in front of the patient

confidentiality. The clinical vignette described a 62 years old male patient, Mr. Ahmed, diagnosed with type 1 diabetes and known penicillin allergy, admitted for rheumatic fever. The errors were categorized into four key areas: Hygiene and Nutrition, Waste Management, Infection Risk and Patient Safety and Medication Management with Identity Vigilance (Table 1). After each session, answer sheets were collected, followed by a structured debriefing to review the errors identified and reinforce best practices based on evidence.

Statistical Analysis

Descriptive statistical analysis was performed using SPSS software and Excel, focusing on two quantitative measures:

- Number of Errors Identified (0-20)
- Overall Score (0-20)
- Percentage % of errors detected in the room of errors
- Evaluation satisfaction of the Simulation Session

The analysis included minimum, maximum, mean, standard deviation and variance. Additional metrics -range and skewness with standard errors- were calculated to assess data symmetry and variability.

A boxplot was created to visually compare the distribution and spread of both variables. It highlights medians, interquartile ranges, overall range and possible outliers, offering insights into data symmetry and learner performance variability (Figure 1).

RESULTS

Types of Errors

Mr. Ahmed is a 62-year-old patient with known type 1 diabetes and penicillin allergy, who was admitted to hospital 36 hours ago for a rheumatic fever. The caregiver must make the bed.

Errors created in the room of errors are classified according to their type (Table 1).

Results of Errors Detected in the Room of Errors

This study reports a descriptive analysis using SPSS software of the performance of a sample of 38 learners, assessed on a standardized scale from 0 to 20. Two main quantitative indicators are examined: identified errors and overall score obtained (Table 2).

The results of this study will detail the central characteristics of the distributions, their dispersion and shape. Additional elements, such as confidence intervals and score ranges, are presented to assess the robustness of the estimates and the observable variability within the group.

Descriptive analysis using SPSS

To obtain an initial overview of the dataset, descriptive statistics were computed using SPSS (Table 3). These indicators minimum and maximum values, mean, standard deviation and variance provide a comprehensive summary of the distribution and central tendency of the variables under study. They enable an assessment of data dispersion and help identify potential patterns or anomalies before conducting inferential analyses. Table 3 presents the descriptive results for the two variables.

To further characterize the distribution of the variables, additional descriptive statistics were computed using SPSS, including range, mean and skewness with their corresponding standard errors. These measures provide deeper insight into the central tendency and the shape of the data distribution, allowing for an assessment of symmetry and potential deviations from normality. Table 4 summarizes these distributional characteristics for the two variables analysed.

To visually explore the distribution and variability of the two measured variables, a boxplot was generated using SPSS. This graphical representation provides a clear summary of the central tendency, dispersion and potential skewness of the data. By displaying the median, interquartile range and extreme values, the boxplot allows for an immediate comparison between the variables Erreurs Identifiées and Scores, highlighting similarities or differences in their overall distribution. Figure 2 illustrates these distributional patterns.

The box plot provides a concise representation of the central characteristics and dispersion associated with the performance measured on the two indicators. It highlights the median and quartiles, as well as the total range and any extreme values, allowing for a visual assessment of the variability among learners. This representation facilitates the assessment of the symmetry or asymmetry of the distribution (Figure 3).

Table 2: Results of errors detected in the room of errors

Student	Errors identified/20	Score/20
1	12	12
2	10	10
3	18	18
4	17	17
5	15	15
6	10	10
7	16	16
8	19	19
9	18	18
10	12	12
11	18	18
12	19	19
13	18	18
14	6	6
15	9	9
16	16	16
17	19	19
18	17	17
19	12	12
20	17	17
21	18	18
22	7	7
23	20	20
24	15	15
25	16	16
26	15	15
27	17	17
28	17	17
29	15	15
30	17	17
31	8	8
32	10	10
33	17	17
34	20	20
35	11	11
36	16	16
37	7	7
38	19	19

Table 3: Descriptive statistics

Parameters	n	Min.	Max.	Moyenne	Ecart type	Var.
Errors identified	38	7.00	20.00	15.0789	3.75882	14.129
Scores	38	7.00	20.00	15.0789	3.75882	14.129
N valid (list)	38	-				

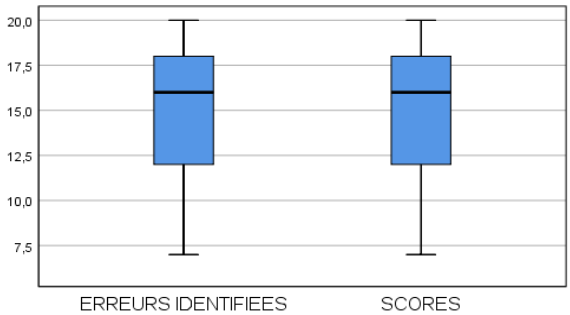

Figure 2: Box showing errors detected in the room of errors and the scores obtained

DISCUSSION

The central tendency of the results shows that the average score is 15.08 out of 20, while the median is slightly higher at 16. This suggests that the distribution of scores is generally

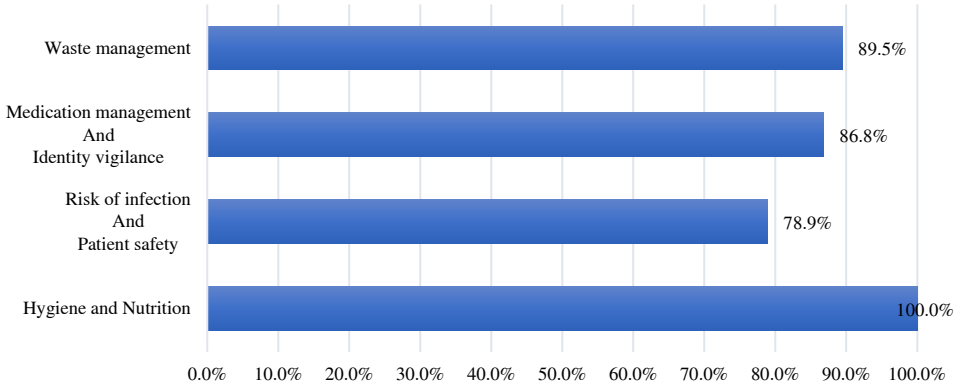

Figure 3: Percentage of errors detected in the room of errors

Table 4: Descriptive analysis using SPSS

	n	Plage	Moyenne		Coefficient skewness	
Parameters	Statistics	Statistics	Statistics	Standard Error	Statistics	Standard Error
Errors identified	38	13.00	15.0789	0.60976	-0.819	0.383
Scores	38	13.00	15.0789	0.60976	-0.819	0.383
n valid (list)	38	-				

Table 5: Evaluation satisfaction of the room of errors session using a 5-Point Likert Scale by Participants (n = 38)

Items	Inadequate	Insufficient	Adequate	Good	Excellent
Document to Review	-	1 (2.6)	5 (13.2)	7 (18.4)	29 (76.3)
Presentation of the introduction	3 (7.9)	-	-	13 (34.2)	26 (68.4)
Orientation to the simulator	-	-	4 (10.5)	5 (13.2)	29 (76.3)
General organization of the simulation room	1 (2.6)	-	1 (2.6)	4 (10.5)	32 (84.2)
Mannequin	-	5 (13.2)	2 (5.3)	3 (7.9)	28 (73.7)
Patient monitor	-	1 (2.6)	3 (7.9)	5 (13.2)	29 (76.3)
Quick reference guide	-	-	3 (7.9)	4 (10.5)	31 (81.6)
Provided medication	1 (2.6)	-	2 (5.3)	5 (13.2)	30 (78.9)
Audio visual equipment	2 (5.3)	-	-	10 (26.3)	26 (68.4)
Overall realism of the simulation environment	-	1 (2.6)	4 (10.5)	4 (10.5)	29 (76.3)
Realism of the scenarios	-	-	6 (15.8)	2 (5.3)	30 (78.9)
Realism of visual cues	-	2 (5.3)	3 (7.9)	6 (15.8)	27 (71.1)
Realism of auditory cues	-	1 (2.6)	1 (2.6)	7 (18.4)	29 (76.3)
Realism of actors or standardized patients in the scenarios	2 (5.3)	-	1 (2.6)	5 (13.2)	30 (78.9)
Scenario's ability to highlight technical skills		-	5 (13.2)	2 (5.3)	31 (81.6)
Scenario's ability to highlight attitudes and behaviors	1 (2.6)	1 (2.6)	3 (7.9)	3 (7.9)	29 (76.3)
Overall quality of the scenarios	-	1 (2.6)	4 (10.5)	7 (18.4)	26 (68.4)
The debriefing clarified specific elements	-	1 (2.6)	2 (5.3)	4 (10.5)	31 (81.6)
The debriefing provided constructive feedback	1 (2.6)	1 (2.6)	-	4 (10.5)	32 (84.2)
The debriefing allowed for a review of demonstrated technical skills	-	1 (2.6)	2 (5.3)	6 (15.8)	29 (76.3)
The debriefing allowed for a review of demonstrated attitudes and behaviors	-	1 (2.6)	4 (10.5)	5 (13.2)	28 (73.7)
Overall quality of the debriefing	-	-	6 (15.8)	2 (5.3)	30 (78.9)
Instructors created a welcoming learning environment	-	-	5 (13.2)	5 (13.2)	28 (73.7)
Instructors facilitated the debriefing effectively	-	1 (2.6)	3 (7.9)	4 (10.5)	30 (78.9)
Instructors' enthusiasm	-	-	2 (5.3)	5 (13.2)	31 (81.6)
Overall quality of the instructors' work	-	-	4 (10.5)	5 (13.2)	29 (76.3)
General impressions	-	-	6 (15.8)	-	32 (84.2)

centred around high values, indicating that the majority of learners perform well on the assessment.

In terms of performance dispersion, the standard deviation is 3.76, indicating moderate variation among learners. The coefficient of variation, estimated at 0.25, shows relative homogeneity of results around the arithmetic mean, despite some dispersion.

The distribution shows a slight left skew with a skewness coefficient of –0.64, meaning that a minority of learners achieve lower scores while the majority are around or above the average. This moderate skew reflects a concentration of performance at the top of the scale.

More than 60% of learners exceeded the educational threshold set at 15/20, which is favourable and indicates an overall satisfactory mastery of the skills assessed.

Finally, the scores are fairly widely spread, with a range of 14 points (from 6 to 20), which highlights significant variability in learners' ability to detect errors. The results presented indicate an overall satisfactory performance within the sample of 38 students, with a high mean and

median and moderate dispersion. The slightly left-skewed distribution and the notable range of scores highlight a minority of individuals with significantly lower performance, while the majority are clustered around the central values. More than 60% of learners exceed the educational threshold of 15/20.

The results are consistent with other studies that highlight the importance of error rooms and have systematically evaluated the effectiveness of this approach. A meta-analysis of 8 clinical studies (n = 4,582 participants) revealed an average improvement of 38% in error detection skills after room of errors training (95% CI (32-44), p <0.001) [13]. These results are corroborated by a French multicentre study conducted in 15 university hospitals, showing reduce medication errors that implemented this training (OR 0.55, 95% CI 0.17 to 1.74; I^2 = 28%; 3 studies, 379 participants; low-certainty evidence, probably reduces adverse drug events (ADEs) (OR 0.38, 95% CI 0.18 to 0.80; I^2 = 69%; 3 studies, 1336 participants; moderate-certainty evidence [14].

With regard to the most frequently identified errors, it can be said that students demonstrate complete and perfect mastery of basic protocols, particularly in the areas of hygiene and nutrition (100.0%). Waste management (89.5%) is also very well recognized, validating the acquisition of fundamental knowledge in healthcare safety.

Despite the overall performance, there is some variation in vigilance, with the lowest rate relating to the recognition of Infection Risk and Patient Safety (78.9%), suggesting difficulties in identifying more subtle or multifactorial risks that require constant and comprehensive vigilance in the healthcare environment.

The evaluation of the simulation session of Table 5 reveals a very high overall level of satisfaction, with the majority of students giving a rating of “Good” or “Excellent” to the various elements, particularly the quality of the scenarios, the educational relevance of the debriefing and the professionalism of the supervisors. On a human level, students perceive a welcoming and safe learning environment that encourages them to express their difficulties, engage in critical thinking and consolidate their technical and non-technical skills. However, some reservations were expressed regarding certain material or organizational aspects (mannequins, audiovisual equipment, reference material), which remain satisfactory overall but could be improved in order to limit logistical irritants and further optimize the simulation experience. The evaluation in this study concluded that not only did students place a high emphasis on the learning method used during the Room of Errors, but also expressed an appreciation for the debrief held directly following the Room of Errors session. Similarly, an observational study among medical students [15,16], the feedback that was given to them was valued and encouraged an open and honest environment so that everyone felt comfortable giving constructive feedback. They appreciated the opportunity to be able to develop their skills through the debriefing process. Additionally, they found the feedback provided by professional actors helpful in enhancing the learning experience overall.

By adopting this proactive approach, we can hope to reduce medication errors, improve clinical outcomes and ensure safer and more effective patient care.

CONCLUSIONS

In conclusion, current data confirm the potential of the room of errors as a healthcare training tool. This study has validated the crucial role of integrating the room of errors into education and continuing education programs for healthcare professionals. It is imperative to extend the use of the room of errors to all sectors of healthcare, as it represents an interesting opportunity to reinforce good practices and improve compliance with safety protocols, but also to promote a culture of reporting and vigilance in clinical settings in order to ensure high-quality care.

Conflicts of Interest

Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Ethical Statement

All collected data were anonymized before analysis. Participation was voluntary and the study adhered to confidentiality and respect for learners' rights. The Research Ethics Committee of the Multidisciplinary Faculty of Taroudant approved the study protocol (Approval No. 02/REC/24).

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