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Room Layout and Design Predispose Patient Safety

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Abstract

Patient Safety Incidents (IKP) can impact the quality of hospital services. Both globally and nationally, patient safety incidents remain a significant concern. At Prof. HB Saanin Mental Hospital in Padang, the number of patient safety incidents increased from 2022 to 2023. Patient safety incidents should be zero, or there should be no accidents, based on the Decree of the Minister of Health of the Republic of Indonesia number 129/Menkes/II/2008 concerning Minimum Hospital Service Standards. Objective: Analyze the influence of room layout and design on patient safety incidents at Prof. HB Saanin Mental Hospital, Padang. Method: This study used a mixed-methods cross-sectional study of 25 officers involved in patient safety incidents. Bivariate analysis using the Chi-square test was employed to assess the relationship between room layout and design and patient safety incidents, which was further explored through qualitative interviews. Results: The most common type of patient safety incident at Prof. HB Saanin Mental Hospital is unwanted events, accounting for 64% of total incidents and 52% of incidents with high impact. Inappropriate room design was identified in 52% of cases, and inappropriate furniture layout was identified in 84%. Conclusion: Equipment layout and room design influence the occurrence of patient safety incidents in the Prof. HB Saanin Mental Hospital, Padang. Redesigning rooms is a key factor in reducing patient safety incidents at this hospital.

Introduction

Patient safety remains a critical global concern within healthcare systems, as adverse events and safety incidents continue to occur despite advances in clinical practice and quality management frameworks. The World Health Organization (WHO) estimates that millions of patients worldwide experience preventable harm each year during healthcare delivery, making patient safety a core dimension of healthcare quality and system performance (WHO, 2019). Patient safety incidents encompass a wide range of events, including falls, medication errors, self-harm, and environmental hazards, all of which can lead to physical injury, psychological distress, prolonged hospitalization, increased healthcare costs, and even mortality (Vincent et al., 2014; Knipe et al., 2022; Langjord et al., 2023; Fernando et al., 2021; Kim et al., 2022).

Among all patient populations, individuals with mental health disorders represent one of the most vulnerable groups in terms of patient safety. Mental health patients often experience cognitive impairment, emotional instability, impulsive behavior, impaired risk perception, and reduced insight into their own safety needs (Tyson et al., 2012; Aarsland et al., 2014; Cáceda et al., 2014). In addition, the side effects of psychotropic medications such as sedation, dizziness, extrapyramidal symptoms, and orthostatic hypotension can further elevate the risk

of falls, disorientation, and accidental injury (Rivai et al., 2016; Tishler & Reiss, 2009; Onyeaka et al., 2024; Ngcobo, 2025). These clinical and behavioral characteristics create a complex safety profile that requires more than standard medical risk management approaches.

Traditionally, patient safety strategies in mental health services have focused primarily on clinical interventions, staff competencies, and procedural compliance. While these components are undeniably important, growing evidence suggests that such approaches are insufficient if they fail to address the broader care environment in which patients receive treatment. Patient safety is not solely determined by clinical decision-making, but also by the interaction between patients, healthcare providers, and the physical environment of care (Ulrich et al., 2008; Sontakke et al., 2023). This perspective aligns with the systems approach to patient safety, which views adverse events as the result of multiple interacting factors rather than individual failures alone.

The physical environment of healthcare facilities particularly room layout, architectural design, and furniture arrangement has emerged as a critical yet often underestimated determinant of patient safety outcomes. In mental health settings, environmental design plays a pivotal role in either mitigating or exacerbating safety risks such as patient falls, elopement (escape), aggressive behavior, self-injury, and suicide attempts (Shepley et al., 2016). Features such as poor visibility, overcrowded rooms, inappropriate furniture, unsafe fixtures, and inadequate spatial zoning can unintentionally create opportunities for harm, especially among patients with impaired judgment or heightened emotional distress.

Several empirical studies have demonstrated a strong association between environmental design and patient behavior in psychiatric facilities. Poorly designed spaces have been shown to increase anxiety, agitation, and aggressive incidents, while well-designed therapeutic environments can promote calmness, orientation, and emotional regulation (Emma E. McGinty et al., 2017; Shepley & Pasha, 2013). Despite this growing body of evidence, environmental factors are frequently treated as secondary considerations in patient safety management systems, often overshadowed by clinical protocols and administrative indicators. This imbalance reflects a persistent biomedical orientation that undervalues the role of physical space in shaping patient experiences and safety outcomes.

In the Indonesian context, patient safety has been formally institutionalized through national regulations and hospital accreditation standards. The Indonesian Minister of Health Decree No. 129/Menkes/II/2008 on Minimum Hospital Service Standards explicitly mandates that patient safety incidents should be maintained at zero percent or zero accidents. This regulation underscores the normative expectation that healthcare facilities proactively eliminate preventable harm through comprehensive safety systems. However, the practical implementation of this standard remains challenging, particularly in mental hospitals where patient vulnerability and environmental complexity are significantly higher than in general hospitals (Ningsih & Endang Marlina, 2020; Faissner et al., 2023; Aluh et al., 2023).

National data indicate that patient safety incidents in mental health facilities remain a persistent concern. Studies conducted in Indonesian psychiatric hospitals reveal recurring incidents related to falls, patient escapes, self-harm, and environmental hazards, suggesting gaps between regulatory expectations and operational realities (Rivai et al., 2016; Keliat & Daulima, 2025). These findings highlight the need for contextualized safety strategies that address not only staff performance and clinical procedures, but also the physical conditions of care environments.

This challenge is also evident at the institutional level, as illustrated by the case of Prof. HB Saanin Mental Hospital in Padang. Hospital records indicate an increase in patient safety incidents from 22 cases in 2022 to 25 cases in 2023. Although the numerical increase may appear modest, it is significant in light of national policy mandates that require zero patient safety incidents. More importantly, the persistence of such incidents suggests the presence of

systemic risk factors that have not been adequately addressed through existing safety interventions. Given the specialized nature of mental health care, it is essential to examine whether aspects of the physical environment such as room layout, spatial organization, and furniture design contribute to the occurrence of these incidents.

International research increasingly supports the argument that environmental design should be considered an integral component of patient safety, particularly in psychiatric settings. Ulrich et al. (2008) emphasize that evidence-based design principles can reduce stress, prevent accidents, and improve safety outcomes by aligning physical spaces with patient needs and behavioral patterns. Similarly, Shepley et al. (2016) argue that mental health facility design must prioritize visibility, circulation control, and anti-ligature features to minimize risks of self-harm and unauthorized movement. These insights suggest that neglecting environmental factors may undermine the effectiveness of broader patient safety initiatives.

Despite the growing recognition of environmental design as a safety determinant, empirical studies examining the direct relationship between room layout and patient safety incidents in Indonesian mental hospitals remain limited. Most existing studies focus on nursing performance, medication safety, or incident reporting systems, leaving a critical gap in understanding how physical space contributes to patient safety outcomes. This gap is particularly concerning given Indonesia's diverse healthcare infrastructure and the varying quality of mental health facilities across regions.

Therefore, this study seeks to address this research gap by analyzing the influence of room layout and design on patient safety incidents at Prof. HB Saanin Mental Hospital in Padang. By focusing on environmental factors within a real-world psychiatric care setting, this study aims to generate empirical evidence that can inform more holistic patient safety strategies. Understanding how room design interacts with patient behavior and safety risks is expected to provide practical insights for hospital management, policymakers, and healthcare designers in developing safer and more therapeutic mental health environments.

In doing so, this study contributes to the broader discourse on patient safety by reinforcing the need for an integrated approach that combines clinical excellence with environmental design considerations. Such an approach is particularly crucial in mental health services, where patient vulnerability demands a care environment that not only treats illness but also actively prevents harm.

Methods

This study employed a mixed-methods research approach to obtain a comprehensive understanding of the relationship between room layout, room design, and patient safety incidents in a mental health hospital setting. The mixed-methods design was selected to integrate the strengths of quantitative and qualitative approaches, allowing statistical analysis of measurable associations while also capturing in-depth contextual insights from healthcare personnel. This approach is particularly appropriate in patient safety research, where complex interactions between environmental factors and human behavior cannot be fully explained through numerical data alone.

The quantitative component of the study used a cross-sectional design. Data were collected at a single point in time from officers directly involved in the management or reporting of patient safety incidents at Prof. HB Saanin Mental Hospital in Padang. The study population consisted of healthcare personnel who had firsthand experience with patient safety incidents, including nurses and other relevant staff members. A total of 25 respondents were included in the study, representing all eligible officers who met the inclusion criteria. This total sampling technique was applied to ensure that all relevant perspectives were captured, given the limited number of staff involved in patient safety incident management.

Quantitative data were obtained using structured questionnaires that assessed perceptions of room layout and room design, as well as records of patient safety incidents. Room layout variables included spatial organization, visibility, circulation pathways, and accessibility, while room design variables encompassed furniture arrangement, safety features, and environmental suitability for mental health patients. Patient safety incidents were categorized based on hospital records, including incidents such as falls, patient escapes, self-harm attempts, and other environment-related safety events. The data were then analyzed using bivariate analysis with the chi-square test to examine the association between room layout, room design, and the occurrence of patient safety incidents. A significance level of 0.05 was applied to determine statistical relevance.

To complement the quantitative findings, the qualitative component of the study was conducted using in-depth interviews. Key informants were purposively selected based on their roles, responsibilities, and experience in patient safety management and mental health care services. These informants included senior nurses, ward supervisors, and hospital management personnel who possessed in-depth knowledge of environmental conditions and safety practices within the hospital. Semi-structured interview guides were used to explore participants' perspectives on how room layout and design influence patient behavior, safety risks, and incident occurrence.

Qualitative data were analyzed using thematic analysis to identify recurring patterns, meanings, and explanatory factors related to environmental design and patient safety incidents. The integration of quantitative and qualitative findings was conducted during the interpretation stage, allowing the qualitative data to explain and contextualize the statistical results. This triangulation enhanced the credibility and validity of the study findings by providing a more holistic understanding of how physical environmental factors contribute to patient safety incidents in a mental hospital setting.

Result and Discussion

Dependent Variable

Table 1.Patient Safety Incident (IKP) Based on Type, Grading and Impact

Variables	f	%
Types of IKP		
Sentinel	1	4%
KTD	12	48%
KNC	10	40%
KPCs	0	0%
KTC	2	8%
Incident Grading		
Extreme (red)	1	4%
High (yellow)	11	44%
Moderate (green)	6	24%
Low (blue)	7	28%
Impact		
Low	12	48%
Tall	13	52%

*IKP (Patient safety incidents), KTD (unwanted event), KNC (near miss event), KTC (non-injury event), KPCs (significant potential injury event) Based on the table above, the most frequent type of IKP at Prof. HB Saanin Mental Hospital is KTD, accounting for 64% of the total number of incidents and 52% of the high-impact incidents.

Independent Variables

Table 2. Frequency Distribution of Respondents' Descriptions of Room Layout and Design

Variables	f	%
Patient Room Design		
Appropiate	12	48%
Inappropiate	13	52%
Patient Room Layout		
Appropiate	4	16%
Inappropiate	21	84%

Table 2 above shows that more patient room designs are inappropriate (52%) than appropriate. The layout of equipment in patient rooms is more inappropriate (84%) than appropriate.

Table 3. Association between Room Layout and Design with IKP

Variables	IKP				Total		OR	P Value
	Low		High					
	f	%	f	%	f	%		
Patient Room Design								
Appropiate	11	91.7%	1	8.3%	12	100%	132.00 (7,336 – 2375,184	0,000*
Inappropiate	1	7.7%	12	92.3%	13	100%		
Equipment Layout								
Appropiate	4	100%	0	0%	4	100%	-	0.039*
Inappropiate	8	38.1%	13	61.9%	21	100%		

Based on the Chi-square test results, there is an association between the layout (p = 0.039) and room design (p = 0.000) with the occurrence of IKP at Prof. HB Saanin Mental Hospital, Padang.

From the results of in-depth interviews with several informants, it was explained that the design of psychiatric inpatient rooms still does not meet the standards of room design, having hidden corners, obstructed visibility by furniture, patient beds that are not yet embedded in the floor, placement of chairs and tables that can hinder evacuation. There are still chairs with sharp corners. For the design of patient rooms, some things do not meet the standards, such as horizontal and vertical trellis elements, windows made of glass, doors that are starting to rot, and the distance from the floor to the attic that is still not high enough so that it is easy for patients to climb through the trellis. The following are the observations results of the room design:

Based on the research findings through secondary data from incident reports from each unit and medical records, it was found that the most frequent type of IKP was KTD at 48% of 25 incidents, KNC was in second place at 40% sentinel and KTC (8%), while Significant Potential Injury Incidents (KPCs) were not found.

A sentinel event is an incident that requires special attention. In this study, there was one sentinel event: a patient committed suicide. The presence of a sentinel incident confirms that, although rare, the risk of a fatal incident remains, and existing systems need to be strengthened to prevent it (Lestari et al., 2019; Wianti et al., 2021).

The incident type with the most incidents in this study was KTD (12 incidents). The high prevalence of KTD indicates frequent patient injuries or doing undesirable things. KTD at Prof. HB Saanin Mental Hospital, Padang, consisted of one incident of a patient running by climbing the attic and only being found after more than 3 x 24 hours, one incident of a patient being injured while being transferred to the isolation room because he suddenly went berserk and

resisted the officers when being transferred to the isolation room, and 10 incidents of patients falling.

The number of near misses (KNC) ranks second, with 10 incidents, after adverse events (KTD). Near misses are incidents that nearly resulted in injury due to intervention, or are considered warning signs before an adverse event (KTD) or sentinel events. These near misses consist of four incidents due to medication errors, two incidents where patients attempted to escape but were noticed by staff, two incidents where patients attempted to hit other patients but were observed by staff, and two incidents due to errors in patient diet administration.

There were two non-injury incidents (NCI): a patient ran from the room and was found by staff still in the hospital grounds, and a patient's laboratory examination did not comply with the DPJP doctor's request. No Potential Significant Injury Incidents (PBIs) were found, which may indicate the effectiveness of the early reporting system or a lack of staff understanding of this type of incident.

Based on the impact of incidents on patients, 52% of incidents had a high impact, while 48% had a low impact. This is consistent with the high proportion of adverse events (KTD) found. A high risk grading indicates that the incident has the potential to cause serious injury. The high number of adverse events and the predominance of falls are caused by the patient's physical environment, namely the layout of furniture and equipment, and room design, which can encourage escape or be a catalyst for suicide attempts.

Minister of Health Regulation Number 40 of 2022 concerning Technical Requirements for Hospital Buildings and Infrastructure and reinforced by the Decree of the Director General of Health Services Number HK.02.02./2/I/3305/2022, concerning the arrangement of the layout of equipment and furniture in patient rooms, especially in mental health services, must meet the principles of safety, security, and prevention of injury risks as part of the patient safety system.

The analysis of the relationship between the layout of equipment in the patient's room and the incidence of IKP showed that 61.9% of high IKP cases were due to inappropriate equipment and furniture layout (p-value = 0.039), which means there is an association between the equipment layout factor in the patient's room and the incidence of IKP. The inappropriateness of the room's furniture layout has a significant association with the incidence of IKP, especially in patients with mental disorders who are vulnerable to self-harm and injury due to environmental stimuli. Therefore, the application of psychiatric safety-based interior design must be a priority in improving the quality of psychiatric hospital services.

Based on the provisions of the Decree of the Director General of Health Services Number HK.02.02./2/I/3305/2022 concerning Mental Health Service Standards and the technical principles of infrastructure in Minister of Health Regulation Number 40 of 2022, the layout of equipment and furniture in psychiatric inpatient rooms must prioritize safety and injury risk prevention. Inadequate ergonomics in the placement of medical equipment can lead to delays in patient care, increased risk of falls, procedural errors, and potential cross-contamination. Although the results are not significant, this still requires attention to prevent incidents that can be prevented through improved room layout. Consideration should be given to the equipment and furniture in this room, for example, using tables and chairs made of strong materials that are not easily damaged by patients and are sturdy, with non-sharp edges and surfaces, and attractive or brighter colors, as any equipment and furniture can be used by patients to injure themselves. Eating utensils should be made of unbreakable materials (melamine or safe plastic). Patient toiletries should be stored by staff with a clear name in a specific place that is not easily accessible to patients to avoid inappropriate use or as a means of suicide or a specific weapon to injure roommates (Naderi et al., 2019; Agustina, Lia., 2022; Minister of Health Regulation, 2022).

In addition to furniture safety, room layout must also be designed to be safe and support the care process. Furniture should be placed at sufficient distance to minimize the risk of falls and allow staff to provide optimal supervision. Tables, chairs, and beds should not obstruct evacuation routes or prevent staff from providing care. In the dining room, tables and chairs should be arranged away from walls to create a more open feel, reduce the potential for injury, and facilitate patient mobility and supervision (NSW, 2019; Zamani et al., 2023).

In mental health care, patient room design plays a crucial role because it directly impacts the safety of patients, healthcare workers, and the surrounding environment. This study reveals that an appropriate room design accounts for only 8.3% of IKP cases, while an inappropriate design accounts for 92.3%.

The results of the chi-square test in this study showed that the p-value = 0.000, indicating an association between room design factors and the incidence of IKP at Prof. HB Saanin Mental Hospital, Padang. The OR of 132.00 indicates that inappropriate room design is associated with a 132-fold increased risk of IKP compared with appropriate room design. Inappropriate room design that fails to meet standards can disrupt medical personnel's workflow and negatively impact patient safety (Soori, 2024; Bayramzadeh & Chiu, 2022; Vanbelleghem et al., 2025). Such standards include inadequate lighting, limited access to patient rooms, insufficient ventilation, and layouts that hinder movement.

Psychiatric rooms and wards are generally designed to be safer than general care rooms or emergency rooms, as they serve both as therapeutic and protective spaces. Cuomo (2021) states that the structure of psychiatric wards plays a crucial role in patient safety, where replacing hazardous elements with safer ones can prevent self-harm, aggression toward other patients, and injury to staff. Areas such as bathrooms, closets, bars, beds, attics, and hidden corners are frequently used by patients for self-harm, suicide, or escape, and therefore require careful supervision and safe design (Al Ishaq et al., 2023; Cuomo et al., 2021).

Normatively, the findings of this study are in line with the Decree of the Director General of Health Services Number HK.02.02./2/I/3305/2022 concerning Mental Health Service Standards, which states explicitly that psychiatric inpatient wards must be designed with a safety approach, preventing self-harm, suicide, and escape attempts.

The colors in a building's interior design can influence users' psychology and their perception of how cool or hot a room feels. Ideally, the interior colors used should be soft, non-striking paint or wallpaper to help the patient feel comfortable and relaxed, allowing them to focus on their concerns during the consultation. Furthermore, walls painted with a calming, cool color can reduce patient aggression.(Luqyana & Arie Edytia, 2022).

Even patients in treatment rooms who have calmed down may also consider escaping through unbarred windows or through the attic by climbing onto a bed turned upside down to reach the ceiling. Therefore, the ceiling height from the floor surface should not be just 2.5-3.0 meters, but rather 3.5-4 meters. The attic should also be constructed from sturdier materials, with a light steel or iron frame, so it cannot be easily broken through by patients attempting to escape. In addition to turning the bed upside down, patients can also escape through the attic by using the bathtub as a foothold and climbing over a cross-shaped trellis.(Bilhairini et al., 2023; Lendombela et al., 2017; Indonesian Ministry of Health, 2022).

Trellises play a crucial role in room design, designed with vertical or slightly diagonal motifs and as close together as possible in intensive care units. In maintenance rooms, the spacing between the trellises is slightly wider (15-20 cm) and cannot be passed through by patients, ensuring safety. The material used for trellises must be hard, strong, and resistant to damage, as patients could potentially escape or injure themselves or others. These trellises should not feel closed in or create a feeling of tension. Windows are made of materials that are 3-5 times stronger than ordinary glass for bending and impact resistance. Glass shards should be small,

blunt, and safe (not sharp, pointy, or dangerous). Windows should not feel closed in or isolated; they should be strong, light-colored, and equipped with locks or bolts on the outside to prevent patients from escaping at night. Windows should be wide enough to let in plenty of light.(Bilhairini et al., 2023; RI Ministry of Health, 2022; Rifqi et al., 2003). Some of the bars installed in the intensive care unit of Prof. HB Saanin Mental Hospital are in accordance with standards, while others are still horizontal. In this study, there were cases of patients who committed suicide by hanging their clothes on the window bars and also escaped by climbing the bars (Al Ishaq et al., 2023, Ministry of Health of the Republic of Indonesia, 2022).

Bathroom floors should be made of non-slip rubber matting with a slight slope to allow water to drain more quickly. Urinals should be placed at the edge or corner of the room, with the shortest possible distance from the drain pipe. Bedroom floors should also be made of a non-slip, easy-to-clean material to minimize the risk of falls or slips. Beds

should have blunt edges, not sharp edges, to reduce the risk of injury and be permanently anchored (the legs of the bed should be securely screwed into the floor or directly anchored to the floor) to minimize the risk of being overturned or shifted by the patient. There should also be no sharp edges on the bed.(Al Ishaq et al., 2023, Minister of Health Regulation, 2017).

The room door should have bars, a gap made of tempered safety glass for monitoring the patient, and a sliding door made of strong material in a soft or light color. It should not open outwards or inwards, as a swinging door can pose a risk to the patient. The door should be equipped with an additional lock or latch on the outside of the patient's room to reduce the risk of escape.

Conclusion

Room design and furniture layout contribute to patient safety incidents in psychiatric hospitals. Physical environments that do not meet psychiatric safety principles increase the risk of patient injury and dangerous behavior. The magnitude of the influence of furniture and equipment layout on IKP makes room redesign one of the factors to be considered to reduce the patient safety incident rate in mental hospitals, Prof. HB Saanin Padang.

Recommendation for hospital management: evaluate and adjust room design and furniture layout to meet psychiatric safety standards. Integrating physical environmental aspects into patient safety programs and improving service quality are crucial steps to reduce the risk of patient safety incidents.

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