ARTIFICIAL INTELLIGENCE IN HOSPITAL MANAGEMENT AND ITS IMPACTS ON PATIENT SAFETY: BENEFITS, CHALLENGES, AND FUTURE PERSPECTIVES

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Abstract: Artificial intelligence (AI) has been incorporated into health services to support management, process organization, and patient care. This qualitative, descriptive article brings together and organizes the literature on the foundations of AI, its applications in hospital management, its impacts on patient safety, and the benefits, challenges, and prospects associated with its use. The literature indicates applications in bed management, demand forecasting, staff scheduling, inventory and medication control, logistics, financial management, electronic health records, and indicator dashboards. Regarding patient safety, there is evidence of reduced medication errors and potential for the early identification of sepsis, clinical deterioration, falls, pressure injuries, and healthcare-associated infections. However, outcomes vary depending on the tool, and independent validation, data quality, personal data protection, algorithmic bias, alert fatigue, and staff training condition the benefits. It is concluded that AI should act as a complementary tool, with human supervision and governance, and not as a substitute for clinical judgment and professional responsibility.

Keywords: Artificial intelligence. Hospital management. Patient safety. Adverse events.

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INTRODUCTION

Artificial intelligence (AI) has been incorporated into health services as a tool to support management, process organization, and patient care. Its capacity to analyze large volumes of data and identify patterns assists professionals and managers in decision-making. In Brazil, the use of AI in healthcare facilities is growing, particularly in larger institutions, in both administrative and clinical activities (CETIC.BR, 2026).

In hospital management, AI can improve resource utilization, reduce waste, anticipate demand, and identify situations that pose risks to patients. Patient safety, understood as the prevention of avoidable harm during care, is a central aspect of this discussion. AI systems can recognize risk situations in advance and support patient monitoring, but they do not, by themselves, guarantee the elimination of errors or adverse events, since their outcomes depend on how they are developed, validated, incorporated into routine practice, and supervised by teams (LIMA et al., 2026).

In light of this, this article aims to analyze applications of AI in hospital management and their impacts on patient safety, discussing benefits, challenges, and future prospects. To this end, the text presents the theoretical foundations of AI and its integration into hospital management (Section 3), the main applications in hospitals (Section 4), impacts on patient safety (Section 5), and benefits, challenges, and trends (Section 6), followed by the results and discussion (Section 7) and concluding remarks (Section 8).

METHODOLOGY

This is a narrative literature review with a qualitative approach and descriptive character. The text was based on scientific articles, systematic reviews, documents from official agencies, and national and international technical publications, most of which were published between 2015 and 2026, addressing AI in health care, hospital management, and

patient safety. The content was organized into four areas: (a) the foundations of AI and its integration into hospital management; (b) applications in hospital management; (c) impacts on patient safety; and (d) benefits, challenges, and future prospects. As this is a narrative review, systematic search and selection criteria were not applied, which constitutes a limitation of the study.

FOUNDATIONS OF AI AND ITS INTEGRATION INTO HOSPITAL MANAGEMENT

CONCEPT OF ARTIFICIAL INTELLIGENCE

According to IBM, AI is a technology that enables computers and machines to simulate human capabilities, such as learning, understanding, problem-solving, decision-making, creativity, and autonomy (STRYKER; KAVLAKOGLU, 2024). It is currently widely used because it can understand human language, learn from the information it receives, and produce recommendations in minutes—a task that would take hours or days to complete manually. Its benefits in the workplace include automating repetitive tasks, obtaining information from data more quickly and comprehensively, improving decision-making, reducing human error, providing uninterrupted availability, and reducing physical risks (STRYKER; KAVLAKOGLU, 2024).

KEY TECHNOLOGIES

AI takes different forms. Machine learning (machine learning, ML) relies on training algorithms and tuning models to make them more accurate, and is geared toward identifying patterns and predicting events, such as outbreaks or hospital readmissions. Deep learning (deep learning, DL) seeks to replicate the decision-making power of the human brain through layered neural networks, which extract information from data without direct human intervention, facilitating the identification of patterns and potential errors, including in medical images. Generative AI, based on deep learning models, can create original content,

such as text, images, videos, and audio. Natural language processing (NLP) makes it possible to extract information from texts and electronic health records, while large language models (large language models, LLMs) expand the ability to generate and summarize language with a high degree of sophistication (STRYKER; KAVLAKOGLU, 2024; SOARES; CHIAVEGATTO FILHO, 2026).

EVOLUTION OF AI IN HEALTH CARE

Medical consultations have changed over time. The introduction of administrative processes, such as recording the medical history on a computer during consultations, reduced the connection between physicians and patients and the humanization of care, increasing physician burnout rates and patient dissatisfaction. In this context, AI has emerged as an alternative for automating and supporting administrative processes, reducing bureaucracy and fostering humanized care. Some studies show that the use of chatbots improved administrative efficiency and reduced dissatisfaction and burnout (NUNES; NUNES, 2026).

In Brazil, the Brazilian Artificial Intelligence Plan (PBIA) 2024-2028 provides for an investment of R$ 23 billion by 2028, with the modernization of the Unified Health System (SUS) as one of its central areas.

Planned initiatives include transcribing teleconsultations, using AI in medication purchasing decisions, optimizing diagnoses in the SUS, AI in oral health, and the "well-cared-for older adult" program (NUNES; NUNES, 2026).

HOSPITAL MANAGEMENT

Hospital management can be understood as a comprehensive process of leadership, planning, and decision-making aimed at coordinating the resources, processes, and activities of a hospital institution, with a view to organizational efficiency and the quality of health services (MOTTA, 2004).

CURRENT LANDSCAPE OF AI ADOPTION IN HOSPITALS

The adoption of AI in the SUS has stood out for its ability to automate processes involving epidemiological surveillance records, administrative databases, electronic medical records, medication dispensing systems and, increasingly, mobile devices and social networks (BENKE; BENKE, 2018). Soares and Chiavegatto Filho (2026) identify the following areas of application: epidemiological surveillance, which enhances the ability to predict new viruses and epidemics; service management, through telemedicine and automated triage systems that expand access in remote regions; diagnostic support, with analysis of imaging and laboratory tests capable of anticipating diagnoses and reducing errors; and evidence-based public policymaking, which identifies health inequalities and guides the prioritization of actions. The Ministry of Health, in turn, is developing smart hospital projects that use digital technologies and AI to monitor patients and integrate clinical information (BRASIL, 2026).

APPLICATIONS OF AI IN HOSPITAL MANAGEMENT

BED MANAGEMENT

AI can support bed management by analyzing occupancy rates, average length of stay, discharge forecasts and demand for admissions, making it possible to identify patterns and organize bed availability. This application can reduce overcrowding and waiting times for admission and, by improving patient flow, enhance the quality and safety of care (SOUZA et al., 2025).

PREDICTING PATIENT DEMAND

Systems can analyze historical service data, periods of peak demand and characteristics of the population served to estimate future demand. This enables hospitals to prepare for periods of increased activity by organizing staff, beds, medications and supplies in line with projected needs (SOARES; CHIAVEGATTO FILHO, 2026). However, forecasts

should be checked against local conditions and updated in response to unexpected changes in demand (LIMA et al., 2025).

STAFF SCHEDULING MANAGEMENT

Intelligent systems can take into account the number of staff available, working hours, departments, projected demand and coverage requirements. In nursing, they can help nurse managers identify periods of higher demand and allocate staff across departments. However, scheduling should not be fully delegated to technology: managers' knowledge of team characteristics, staff experience and the needs of each department is essential, and AI should support decision-making rather than replace the professional (ELIAS et al., 2024).

INVENTORY AND MEDICATION MANAGEMENT

Intelligent systems can analyze historical consumption and estimate product replenishment needs, reducing the risk of shortages of essential medications and supplies, as well as waste and excess inventory. The technology can also support medication safety through verification systems and alerts, serving as an additional safeguard against care-related errors. According to Lopes et al. (2025), AI contributes to safe care by helping professionals identify risks and analyze patient information.

HOSPITAL LOGISTICS

Logistics involves patient transportation, the distribution of medications and supplies, the movement of equipment and the organization of internal workflows. AI can analyze these processes and identify more efficient ways to use resources, helping large hospitals reduce delays and improve communication between departments. Well-organized logistics also contributes to patient safety, as delays in examinations, transportation, medication administration or care can compromise service delivery (SOUZA et al., 2025).

SUPPORT FOR FINANCIAL MANAGEMENT

Automated analysis of large volumes of information can help identify expenses, consumption patterns, waste and inconsistencies, providing a basis for better-informed decisions and the allocation of resources to areas of greatest need. Cost reduction, however, should not be pursued in isolation: financial management must be linked to the quality and safety of care, so that cost-saving measures do not compromise service delivery (SOARES; CHIAVEGATTO FILHO, 2026). Administrative applications, such as scheduling, request classification, document analysis and report preparation, can also free up time for direct care activities, provided that data are checked and personal or clinical information is handled in authorized environments (SANTOS et al., 2026).

INTELLIGENT ELECTRONIC MEDICAL RECORD

Intelligent systems can organize patient information, highlight relevant data, facilitate the analysis of clinical history, support documentation, and issue alerts for situations requiring the team's attention. In Brazil, the Ministry of Health is developing smart hospital projects in the SUS, which use digital technologies and AI to monitor patients and integrate clinical information (BRASIL, 2026). However, the information presented by these systems needs to be evaluated by professionals, since AI assists in data analysis but does not replace clinical judgment.

HOSPITAL DASHBOARDS AND INDICATORS

Dashboards make it possible to monitor indicators visually and systematically and, with AI, can automatically analyze data and identify trends or changes that warrant managers' attention. The indicators monitored include occupancy rate, average length of stay, number of visits, readmissions, adverse events, healthcare-associated infections, and falls. The Brazilian Health Regulatory Agency (Anvisa) emphasizes the importance of monitoring information

and indicators for patient safety management (ANVISA, 2026). It is important to remember that an association identified by an algorithm does not, by itself, prove the cause of a problem; the team must assess the context, verify the data, and decide on the appropriate measures, without dispensing with auditing and critical analysis (HIRSCHMANN et al., 2025).

IMPACTS OF AI ON PATIENT SAFETY

PREVENTION OF ADVERSE EVENTS

Patient safety is one of the pillars of quality of care, and adverse events—that is, harm resulting from care rather than the underlying disease—remain one of the main challenges facing health services. In Brazilian hospital nursing, an integrative review identified medication administration errors, failure to perform dressings, and falls as the most frequent events, and also found that fear of punishment leads to underreporting (DUARTE et al., 2015). Recent Brazilian studies indicate that AI can optimize processes, reduce errors, and support complex clinical decisions, although it faces barriers such as professional resistance and a lack of training (DUO; RENÓ; VILAS BOAS, 2025). A dissertation combining a systematic review with the development of software applied to the Nursing Practice-Associated Adverse Events Scale further underscores the relevance of AI in preventing adverse events, while noting that the tool still needs to be validated before widespread use (RIBEIRO, 2023).

MEDICATION ERRORS

Medication errors are among the most common adverse events and can occur during prescribing, dispensing, administration, and monitoring. A systematic review of algorithms and AI in medication management in primary care found that 10 of the 14 studies included (71%) reported a reduction in errors, although the authors noted the small number of studies and their heterogeneity (DAMIANI et al., 2023). In a systematic review of 12 studies on nursing, results indicated error reductions of up to 95% with clinical decision support

systems, approximately 80% in intravenous medication errors with smart infusion pumps, and 55% in prescribing errors with validation tools, as well as a 45% decrease in alerts lacking clinical relevance through AI-based filtering. However, success depends on staff training, integration with systems, and alignment with workflows, and concerns about bias and trust in the system remain (ALQARALEH; ALMAGHARBEH; AHMAD, 2025). Reviews of prescribing support converge on this point: systems reduce prescribing errors, but alert fatigue can compromise their effectiveness (KUSUMADEWI; MILADIYAH, 2023).

EARLY IDENTIFICATION OF SEPSIS

In sepsis, the time to recognition and initiation of treatment directly affects outcomes, prompting the development of early warning systems based on machine learning. The most extensively studied is the Targeted Real-time Early Warning System (TREWS), prospectively evaluated in five hospitals: professionals' interaction with the alert was associated with better outcomes, including lower mortality, with 82% sensitivity, a lead time of 5.7 hours over clinical recognition, and 89% professional adherence (ADAMS et al., 2022; HENRY et al., 2022). A smaller randomized clinical trial also associated a severe sepsis prediction algorithm with reduced mortality and shorter stays in the intensive care unit (SHIMABUKURO et al., 2017).

The results require caution. The TREWS study is observational: it compared alerts confirmed or not confirmed by the care team within three hours, rather than randomized patients, which led to methodological criticism regarding the conclusion that mortality was reduced. Moreover, external validation of the Epic Sepsis Model, deployed in hundreds of U.S. hospitals, showed performance below that reported by the manufacturer: area under the curve of 0.63, sensitivity of 33%, and positive predictive value of 12%; the model generated alerts for 18% of hospitalized patients and failed to identify 67% of sepsis cases (WONG et al., 2021). Thus, AI can enable earlier recognition of sepsis, but its benefit depends on independent validation, local calibration, and a timely response from the care team.

PREDICTION OF CLINICAL DETERIORATION

Clinical deterioration, defined in many studies as death on the ward or transfer to the intensive care unit within 24 hours, affects up to 5% of hospitalized patients, and delays in escalating care are associated with higher mortality and longer hospital stays. Early warning scores, such as the National Early Warning Score (NEWS), calculated from vital signs, are being supplemented by machine learning models that incorporate laboratory tests, demographic data, and changes in variables over time (EDELSON et al., 2024).

In a cohort study of 362.926 ward admissions comparing three proprietary AI-based scores and three simple scores, the eCARTv5 model showed the best performance, with positive predictive values ranging from 17,3% to 23,3%, depending on the threshold. The Epic Deterioration Index had one of the worst results, while NEWS, which does not use AI, ranked second (AUROC of 0,831). The authors conclude that the wide variation in accuracy justifies greater transparency and oversight of these tools (EDELSON et al., 2024). Therefore, not every AI tool outperforms simpler alternatives, and selection should be based on comparative evidence.

FALL PREVENTION

About 15% of hospitalized patients experience a fall during their hospital stay, and risk assessment tools used in practice frequently lack accuracy. Traditional scales, such as Morse and STRATIFY, are based on one-time assessments and do not incorporate the dynamics of the clinical condition (SYSTEMATIC REVIEW AND META-ANALYSIS, 2025). Machine learning models that use electronic health record data seek to overcome this limitation by continuously updating risk. A systematic review of 13 studies published between 2017 and 2025 indicates that predicting falls among hospitalized older adults using machine learning is an emerging and promising area (LEE; LEE, 2026), and other reviews show good overall predictive performance across different algorithms in acute care hospitals, with no clear advantage for any particular method (GOTO et al., 2024). The evidence

predominantly concerns model development and validation; studies demonstrating an actual reduction in falls following the implementation of these systems are lacking.

PRESSURE INJURY

Hospital-acquired pressure injury is an adverse event sensitive to nursing care, and the performance of scales used to predict it is still considered unsatisfactory. A systematic review of 23 studies on machine learning models, with samples ranging from 149 to 75.353 patients and prevalence ranging from 0,5% to 49,8%, showed good model performance but identified shortcomings in data handling, preprocessing, and validation (ZHOU et al., 2023). Another review, covering 27 articles on hospitalized adults, highlights that machine learning uses the large volume of electronic health record data to estimate risk and can help nurses identify an injury before visible skin changes occur (BARGHOUTHI et al., 2023). AI therefore has the potential to make risk stratification earlier and more individualized, provided that models are externally validated and integrated into nursing workflows.

HEALTHCARE-ASSOCIATED INFECTIONS

Healthcare-associated infections (HAIs) are among the most common and largely preventable adverse events, and epidemiological surveillance is the foundation of their prevention. Manual surveillance, however, is labor-intensive, expensive, and poorly standardized. A systematic review of 27 studies on machine learning models for HAI detection, most of them concerning surgical site infections, concluded that there is moderate evidence of performance equal to or better than that of approaches not using machine learning, and found only one randomized clinical trial (SCARDONI et al., 2020).

The most recent review, comprising 35 studies, showed that AI models can identify HAIs early or prevent them through individualized risk factors; among the few studies involving real-world implementation, one observed an almost 85% reduction in manual workload, and another, a decrease in HAI incidence from 1.31% to 0.58%. Adoption is

limited by costs, technological constraints, and professional resistance (RADAELLI et al., 2024).

CLINICAL DECISION SUPPORT FOR THE MULTIDISCIPLINARY TEAM

Clinical decision support systems span the areas discussed above, as they provide the team with information and alerts at the point of decision-making. A rapid review of 21 studies in hospital nursing concluded that they can reduce variability, improve the standardization of decisions, prioritize tasks, and promote medication safety, but also identified usability issues, a tendency to ignore recommendations, alert fatigue, low interoperability, and variable uptake (BERKHOUT et al., 2025). Alert fatigue is one of the main risks: when the volume of irrelevant alerts is high, professionals begin to ignore them, undermining their safety purpose; adjustments to interaction design and tailoring alerts to each professional's role can reduce the problem (HUSSAIN; REYNOLDS; ZHENG, 2019). The impact of AI on patient safety therefore depends not only on algorithm accuracy, but also on independent validation, governance, training, and integration into team workflows, with the final decision remaining the responsibility of professionals.

BENEFITS, CHALLENGES, AND FUTURE PERSPECTIVES

BENEFITS

The literature identifies the main benefits of AI as early risk identification, support for professionals' decision-making, reduction of errors in specific processes, improved organization of resources and bed management, monitoring of quality indicators, support for medication safety, monitoring of adverse events, and faster analysis of information.

Examples include the SUS Smart ICUs, which use connected technologies to monitor patient information and assist teams, serving as an additional layer of safety (BRASIL, 2026; LOPES et al., 2025).

COSTS, IMPLEMENTATION, AND TECHNOLOGICAL BARRIERS

AI adoption is limited by implementation costs and technological constraints (RADAELLI et al., 2024). Incomplete, outdated, duplicated, or inconsistently recorded data impair results, while hospital systems that do not communicate with one another hinder information integration and generate rework. Before implementation, it is important to assess data sources, standardize records, define responsibilities, and test the tool in situations similar to those at the institution (LIMA et al., 2025; HIRSCHMANN et al., 2025).

ETHICAL ISSUES, DATA PRIVACY, AND LGPD

Health information is sensitive personal data and requires adequate protection, in compliance with institutional rules and applicable legislation, particularly the General Personal Data Protection Law (Law No. 13.709/2018). This entails access controls, secure storage, clear definition of purposes, and care to avoid entering identifiable data into unauthorized platforms, as well as attention to the risks of unauthorized access, data breaches, unanticipated secondary use, and attacks on systems. Technology adoption must be accompanied by information governance and security, not merely the acquisition of a program. Studies on the bioethical implications of AI in healthcare also point to concerns regarding privacy, security, trust, autonomy, explainability, and bias (ELIAS et al., 2024).

ALGORITHMIC BIAS AND TRANSPARENCY

Algorithms can reproduce distortions present in the data used in their development: if certain patient profiles are underrepresented, performance may be unequal across groups, and unrecorded events may lead the system to fail to recognize important risks. Difficulty understanding why a tool produced a particular recommendation undermines trust and makes evaluation by professionals more difficult. Institutions should therefore assess accuracy, limitations, and potential biases before use, monitor performance over time, and establish

procedures for challenging or correcting inappropriate results (LIMA et al., 2026).

ROLE OF THE NURSE AND MANAGER

Professionals and managers remain responsible for reviewing alerts, communicating risks, documenting decisions, and following applicable protocols. AI can provide an additional layer of support, but it must be integrated into an institutional culture that values incident reporting, learning from failures, and continuous improvement, while preventing excessive trust in the system from diminishing clinical observation or the ability to question automated recommendations (SANTOS et al., 2026; LIMA et al., 2026).

The nurse manager, in particular, should use technology to support decision-making while preserving their knowledge of the team and departments (ELIAS et al., 2024). Implementation requires training so that professionals understand the tool's purpose, interpret its results, and recognize when they should not follow them. Resistance to change may stem from a lack of familiarity, fear of job displacement, or an increase in tasks required to feed data into systems; worker participation from the planning stage, transparent communication, and ongoing training help integrate technology into routines (SANTOS et al., 2026; HIRSCHMANN et al., 2025).

FUTURE TRENDS

AI is expected to be increasingly incorporated into predictive analytics, decision-support, and administrative task automation tools, helping anticipate operational needs, plan resource use, and flag situations that warrant attention with regard to patient safety. However, the expansion of these applications must be accompanied by scientific evaluation, appropriate regulation, transparency, and professional training, since benefits are not automatic and depend on responsible implementation, monitoring, and adaptation to the context of each service (LIMA et al., 2025; SANTOS et al., 2026).

RESULTS AND DISCUSSION

The literature review makes it possible to organize the main findings into three points. First, AI has a wide range of applications in hospital management, particularly in resource planning, demand forecasting, and indicator monitoring, with expected benefits for efficiency and quality of care. Second, in patient safety, the evidence is more robust for medication errors and more heterogeneous or still under development for sepsis, clinical deterioration, falls, pressure injuries, and HAI, as summarized in Table 1. Third, the challenges are cross-cutting: data quality, privacy, bias, explainability, alert fatigue, costs, technological integration, and team training.

Table 1 – Summary of evidence on AI in patient safety

Area of care	Main findings	Caveats	Source
Medication errors	Reduction in errors in 10 of 14 studies (71%); up to 95% with decision support	Few studies, heterogeneity, alert fatigue	Damiani et al. (2023); Alqaraleh, Almagharbeh e Ahmad (2025)
Sepsis	TREWS: sensitivity of 82% and lead time of 5,7 h	Observational study; Epic Sepsis Model with sensitivity of 33%	Adams et al. (2022); Wong et al. (2021)
Clinical deterioration	eCARTv5 with the best performance; NEWS in second place	Wide variation in accuracy across tools	Edelson et al. (2024)
Falls	Emerging and promising area	Studies on the effective reduction of falls are lacking	Lee e Lee (2026); Goto et al. (2024)
Pressure injury	Good model performance	Failures in preprocessing and validation	Zhou et al. (2023); Barghouthi et al.

			(2023)
HAI	Moderate evidence of equal or better performance; decrease from 1,31% to 0,58% in one hospital	Only one randomized trial; costs and resistance	Scardoni et al. (2020); Radaelli et al. (2024)

Source: prepared by the authors based on the literature reviewed (2026).

It is clear that the benefits of AI do not arise from the technology itself, but from the combination of independent validation, quality data, governance, integration into the workflow, and human oversight.

The examples of the Epic Sepsis Model and the Epic Deterioration Index, which performed worse than reported or than simple scores, show that adoption without local evaluation can create a false sense of security. It is also evident that a large proportion of studies describe the development and validation of models, with little evidence of an actual reduction in adverse events in practice, indicating the need for implementation and impact research.

FINAL CONSIDERATIONS

Artificial intelligence has the potential to support hospital management through data analysis, resource planning, process organization, and risk identification, potentially contributing to more informed decisions and strengthening quality and patient safety initiatives. However, the findings in the literature show that this potential is constrained by limitations related to data quality, privacy, bias, technological integration, costs, and professional training.

AI should therefore be adopted as a tool that complements the knowledge and experience of teams, without replacing clinical judgment and professional responsibility. Human oversight, information protection, ongoing evaluation of results, and professional

participation are essential conditions for technology to contribute safely, ethically, and sustainably to health services, always placing patient safety and care as priorities.

It is recommended that future studies assess the actual impact of AI on safety indicators and investigate the role of nurses and managers in the governance of these tools.

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