NARRATIVE REVIEW

The Evolution of Patient Safety Practices Over the Last Two Decades

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Abstract

Patient safety has undergone significant evolution over the past two decades, driven by a shift towards systems-based approaches, the adoption of technological solutions, and a growing global commitment to improving healthcare outcomes. Early milestones (2000-2010) saw the establishment of key safety protocols, including the "To Err is Human" report and the World Health Organisation's global initiatives. The following decade (2011-2020) marked the widespread integration of electronic health records and simulation-based training. The coronavirus disease-2019 pandemic presented unique challenges, including healthcare resource shortages and increased errors, but also accelerated innovations, such as telehealth and clinical decision-support tools. More recently, artificial intelligence has emerged as a powerful tool for enhancing patient safety, offering predictive capabilities and personalised care. However, barriers such as organisational resistance, resource constraints and inconsistent data-collection remain. Looking ahead, fostering a culture of safety, collaboration and continuous innovation is essential to address systemic gaps, and to ensure safer healthcare practices globally.

Keywords: Patient safety; healthcare quality; electronic health records; artificial intelligence; COVID-19 pandemic

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Introduction

Patient safety is defined as the branch of healthcare that focusses on preventing and reducing harm to patients during medical care.[1] It encompasses preventative strategies, human factors engineering, mortality and morbidity reviews, improving communication among healthcare providers and patients, and promoting a culture of safety in hospitals, all with the aim of improving the quality of healthcare and avoiding adverse events.[2,3] Patient safety practices and policies have evolved in the last two decades, signifying an important shift towards better healthcare experiences and practices.

The early 2000s marked a turning point when the importance of patient safety was recognised, leading to its emergence as a distinct discipline within medical care. The 2010s signified a pivotal shift with the widespread adoption of electronic health records (EHRs) replacing paper-based systems. The coronavirus disease-2019 (COVID-19) pandemic brought new challenges and underscored the importance of patient safety in unprecedented ways. Modern patient safety efforts now increasingly incorporate artificial intelligence (AI), which holds the potential to revolutionise healthcare delivery.

The current narrative review was planned to evaluate and summarise the evolution of patient safety practices in the last two decades and its impact on the quality of healthcare globally.

Early Milestones (2000-10): Patient safety initiatives in the early 2000s focussed on adopting a systems based approach to quality improvement as opposed to an individualistic approach, shifting from a malpractice and blame culture towards a culture of safety and reducing errors through surveillance and research for better solutions. Major improvements included implementation of incident reporting systems and standardised infection protocols.

The patient safety movement first gained momentum in 1999, after the publishing of the "To Err is Human: Building a Safer Healthcare System" report by the Institute of Medicine.[4] According to the report, up to 98,000 deaths occurred each year in the United States due to preventable adverse events. In addition to the morbidity and mortality associated with these errors, it also contributed to the financial burden on the healthcare system. It led to a renewed interest in safety practices and the establishment of quality improvement as a separate branch of healthcare.[5] The report called for a 50% reduction in medical errors within the next five years.[6] The patient safety report "An Organisation with a Memory"

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and "The NHS (National Health Service) Plan", both published in 2000, reported similar numbers of preventable adverse events and recommendations for standardised measures, such as mandatory reporting of adverse events and active management of risks.[7]

There was a subsequent increase in safety-related research which aimed at studying long-standing safety hazards and collaborating with multidisciplinary teams to create solutions for safety, largely funded by the Agency for Healthcare Research and Quality (AHRQ)[8] and the National Patient Safety Agency (NPSA).[7]

The World Health Alliance initiative was launched by the World Health Organisation (WHO) in 2004, and provided a global platform for member states to initiate discussions and set goals for patient safety.[9] It addressed major areas of patient safety, including safety solutions, integrating patient feedback, reporting and learning from errors, a research agenda for safety solutions, and the incorporation of technology into quality improvement measures. It led to the creation of several initiatives, such as "Clean Care is Safer Care" and "Safe Surgery Saves Lives", which focused on infection prevention[10] and safer surgical practices,[11] respectively .

The Decade of Global Standardisation and Innovation (2011-20): The growing emphasis on global patient safety goals highlights the increasing recognition of patient safety as a fundamental pillar of effective healthcare. A key initiative in this effort is the WHO Global Patient Safety Action Plan 2021-30, which reflects a coordinated international commitment to minimising avoidable harm and enhancing safety across healthcare systems. This plan, adopted after the 72nd World Health Assembly's resolution (WHA72.6) in 2019, offers strategic guidance and actionable recommendations to bolster safety measures and improve outcomes.[12] Additionally, the WHO Surgical Safety Checklist, introduced in 2008 as part of the "Safe Surgery Saves Lives" campaign, exemplifies efforts to enhance surgical safety. Designed to improve communication and teamwork in the operating room (OR), the checklist aims at reducing human errors and adverse events during surgical procedures.[13]

The advancement and integration of technology into healthcare have profoundly enhanced patient safety practices, particularly through the adoption of Electronic Health Record (EHR) systems. A study found that primary care practices utilising EHRs demonstrated significantly higher rates of workflows, policies and practices that prioritise patient safety compared to those relying on paper-based records.[14] The benefits of EHR systems have driven their rapid adoption in the US, with the implementation of basic EHR systems increasing from 6.6% to 81.2% and comprehensive EHR systems rising from 3.6% to 63.2% between 2009 and 2019. Despite this growth, the findings by Jiang et al. highlight ongoing disparities among hospitals, a market heavily concentrated among six vendors controlling 90% of the share, and significant challenges related to maintenance costs.[15]

The COVID-19 Pandemic (2020-23): According to a qualitative study by Schulson et. al, the impact of the COVID-19 pandemic can be broadly classified into two categories: compromised access to healthcare, and impaired delivery of care.[16] The routine delivery of healthcare shifted to telehealth. This change was accompanied by an estimated 45% decrease in weekly emergency room (ER) visits.[17] Due to the surge of disease burden, particularly in the number of infections, there was a shortage of equipment and an increased clinician-to-patient ratio, addressing concerns like exhaustion and increased stress levels among healthcare providers that ultimately contributed to increased rate of preventable errors[16]. Many healthcare facilities reported a rise in central line infections, serious medication errors, urinary tract infections (UTIs), ventilator-associated pneumonia, pressure ulcers, and patient falls.[18] Metersky et al. reported a relative risk of 1.23 (95% confidence interval [CI]: 1.09-1.39, $p<0.01$) for hospitalised patients experiencing adverse events during high periods of COVID-19 disease burden.[19] While the rates of adverse events have decreased since the end of the pandemic, their frequency remains higher than pre-pandemic levels. Additionally, social isolation protocols hindered routine quality improvement measures, including incident reporting, mortality and morbidity reviews, and root cause analyses, further compromising safety and quality improvement efforts.[16] In response to the pandemic, hospitals strengthened the existing surge protocols, including stocking of equipment and proper vaccine storage and allocation.[17] Clinical decision-making tools, such as the digital tool to centralise care protocols for emergency physicians, developed by the University of California, San Francisco, were also rapidly tested and implemented in order to support physicians in making clinical decisions in a short time.[20]

Current Trends and Emerging Strategies (2023 to date): Patient safety practices have undergone significant evolution since their inception in the early 2000s, adapting to the needs of the modern healthcare era. There is a renowned focus on safety culture and improving incident reporting systems: 288,000 events

were reported in the Pennsylvania Patient Safety Reporting System (PA-PSRS) in 2023, signifying a large increase from previous years.[21] Timely and accurate reporting of safety incidents allows for detailed analysis and development of preventative strategies. Furthermore, the integration of AI into safety practices has created numerous opportunities to enhance patient safety. Some examples include the use of machine learning (ML) algorithms to improve clinical decision-making tools, enhancing risk assessment processes for healthcare-associated infections and medical errors, and predictive risk analysis using real-time EHR monitoring.[22] While the implementation of AI has led to a significant improvement in many different aspects of patient safety, some challenges still remain. For example, an AI-based detection system for sepsis was only able to detect 7% of patients with sepsis, leading to a delay in diagnosis and management of the remaining patients.[23] Moving forward, it is essential to focus on validating and advancing AI-based algorithms to enhance their reliability and effectiveness.

Barriers to Sustained Progress: Over the last two decades, efforts have been made towards sustaining improvement in patient safety practices. One of the major obstacles to this would be organisational resistance due to simple organisational cultures where existing workflows would be favoured over new safety protocols. Healthcare professionals frequently resist changes due to concerns about inadequate managerial support, increased workload, and unclear communication regarding the benefits of safety measures.[24] This resistance can result in poor implementation and sustainability of safety programmes.

Another challenge is the variation in the perception of safety culture among healthcare workers. Some show a moderate understanding of safety practices, while others report a lack of managerial support to promote a strong safety culture.[25] This inconsistency weakens efforts towards standardisation and embedding safety practices within organisations. Evidence has shown that organisations with strong leadership and visible commitment to safety achieve better outcomes.[26]

Besides, variability in the adoption of safety practices, along with the diverse nature of regions and health systems, is also a reason for slow progress. While some systems have been able to incorporate broad-ranging safety programmes, others lag behind due to resource variations and regional policy issues. Benchmarking studies indicate that better outcomes are realised in hospitals using systematic strategies, but this inconsistent application argues for standardisation.[27] For example, resource constraints largely hinder the implementation of safety protocols in low- and middle-income countries (LMICs).[28]

Challenges in measuring and benchmarking patient safety outcomes also remain widespread. Inconsistent data-collection and the absence of standardised reporting frameworks impede the proper assessment of progress.[29] The OECD (Organisation for Economic Co-operation and Development) stresses that robust measurement frameworks are required to assess patient harm.[30] Benchmarking combined with feedback loops and peer learning mechanisms has been demonstrated to improve safety efforts.

Future Directions: To strengthen patient safety, an innovative strategy is needed that combines risk management and advanced technology, and ensure patients' involvement. One of the major aims is to introduce proactive risk management. Historically, patient safety has been dealt with by responding to the analysis of negative events in a retrospective manner. In future, the focus should be on risk prevention and avoidance of adverse events. This requires effective risk management, continuous feedback on risk factors, and forecasting risk in service delivery processes. These proactive approaches should be implemented into the daily clinical practice in order to minimise the risk, and enhance the safety culture in organisations delivering healthcare.[31] The incorporation of digital health and big data analytics into healthcare can also help in improving patient safety. Technologies, such as EHRs, smart gadgets and AI, can store and utilise huge sets of information almost in real-time, allowing healthcare practitioners to identify developing threat situations.[32] Large-scale data analysis software provide an opportunity to identify patterns, relationships or problems which would not have been otherwise identified, thus providing a basis for focused approaches. For instance, ML algorithms can enable prediction of patient's worsening condition, decrease medication error, or improve better resource management, making patient safety measures from curative to preventative.[33] Another equally important aspect is broadening the scope of patients in assuring safety as active participants. Involving patients in their own care enhances understanding, responsibility and trust between a patient and a doctor.[34] Shared decision-making, health literacy and patient outcomes help in understanding safety issues and establishing specific measures. Patient advisory councils and feedback systems are also closer to meeting the needs and expectations of patients during the continuum of care.[35] Implementing these proactive strategies into the system

structure would ensure that healthcare systems are not only fit for the purpose of safety issues at hand, but also are able to understand and to deal with future threats over the long run.

Conclusion

Over the past two decades, patient safety has become a key focus in healthcare, emphasising harm prevention and improving care quality. Initial efforts addressed safety as a systemic concern, leading to reforms like standardised protocols, reporting systems, and global initiatives. Technological advancements, particularly EHR and digital tools, further streamlined processes and reduced errors. The challenges posed by the COVID-19 pandemic highlighted the importance of adaptable safety measures and spurred innovation in telehealth and decision-support tools, while also exposing areas requiring improvement. Emerging technologies, such as AI, are now being applied to predict risks, enhance diagnostics, and personalise care, though challenges like validation and ethical concerns remain. Continued progress in patient safety depends on fostering a culture of continuous improvement, collaboration and innovation. By refining systems, integrating advanced technologies, and addressing systemic gaps, healthcare systems can ensure safer and more effective care for all.

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References

1. Emanuel L, Berwick D, Conway J, Combes J, Hatlie M, Leape L, et al. What Exactly Is Patient Safety? In: Henriksen K, Battles JB, Keyes MA, Grady ML, eds. Advances in Patient Safety: New Directions and Alternative Approaches: Vol. 1. Rockville, MD: Agency for Healthcare Research and Quality; 2008.
2. Mistri IU, Badge A, Shahu S. Enhancing Patient Safety Culture in Hospitals. Cureus 2023;15:e51159. doi: 10.7759/cureus.51159.
3. Carayon P, Wood KE. Patient safety - the role of human factors and systems engineering. Stud Health Technol Inform 2010;153:23-46.
4. Institute of Medicine (US) Committee on Quality of Health Care in America. In: Kohn LT, Corrigan JM, Donaldson MS, eds. To Err is Human: Building a Safer Health System. Washington, DC: National Academies Press (US); 2000.
5. Stelfox HT, Palmisani S, Scurlock C, Orav EJ, Bates DW. The "To Err is Human" report and the patient safety literature. Qual Saf Health Care 2006;15:174-8. doi: 10.1136/qshc.2006.017947.
6. Neuhaus C, Grawe P, Bergström J, St Pierre M. The impact of "To Err Is Human" on patient safety in anesthesiology. A bibliometric analysis of 20 years of research. Front Med (Lausanne) 2022;9:e980684. doi: 10.3389/fmed.2022.980684.
7. Burnett S, Vincent C. Patient Safety in the United Kingdom: Evolution and Progress. [Online] 2007 [Cited 2026 January 24]. Available from URL: https://psnet.ahrq.gov/perspective/patient-safety-united-kingdom-evolution-and-progress
8. Bates DW, Singh H. Two Decades Since To Err Is Human: An Assessment Of Progress And Emerging Priorities In Patient Safety. Health Aff (Millwood) 2018;37:1736-43. doi: 10.1377/hlthaff.2018.0738.
9. Donaldson LJ, Fletcher MG. The WHO World Alliance for Patient Safety: towards the years of living less dangerously. Med J Aust 2006;184:S69-72. doi: 10.5694/j.1326-5377.2006.tb00367.x.
10. Pittet D. The World Health Organization (WHO) clean care is safer care promotion campaign, 2005-2018. Int J Infect Dis 2018;73:3-98. doi:10.1016/j.ijid.2018.06.063.
11. Venneri F, Brown LB, Cammelli F, Haut ER. Safe Surgery Saves Lives. In: Donaldson L, Ricciardi W, Sheridan S, Tartaglia R, eds. Textbook of Patient Safety and Clinical Risk Management. Cham, Switzerland: Springer, 2021; pp 177-88. Doi: 10.1007/978-3-030-59403-9_14
12. World Health Organization (WHO). Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care. Geneva, Switzerland: World Health Organization; 2021.
13. Ambulkar R, Ranganathan P, Salunke K, Savarkar S. The World Health Organization Surgical Safety Checklist: An audit of quality of implementation at a tertiary care high volume cancer institution. J Anaesthesiol Clin Pharmacol 2018;34:392-8. doi: 10.4103/joacp.JOACP_328_17.
14. Tanner C, Gans D, White J, Nath R, Pohl J. Electronic health records and patient safety. Appl Clin Inf 2015;6:136-47. Doi:.10.4338/ACI-2014-11-RA-0099.
15. Jiang JX, Qi K, Bai G, Schulman K. Pre-pandemic assessment: a decade of progress in electronic health record adoption among U.S. hospitals. Health Aff Sch 2023;1:qxad056. doi: 10.1093/haschl/qxad056.
16. Schulson L, Bandini J, Bialas A, Huigol S, Timmins G, Ahluwalia S, et al. Gidengil C. Patient safety and the COVID-19 pandemic: a qualitative study of perspectives of front-line clinicians. BMJ Open Qual 2024;13:e002692. doi: 10.1136/bmjoq-2023-002692.
17. Stocking JC, Sandrock C, Fitall E, Hall KK, Gale B. AHRQ PSNet Annual Perspective: Impact of the COVID-19 Pandemic on Patient Safety. [Online] 2021 [Cited 2026 January 24]. Available from URL: https://psnet.ahrq.gov/perspective/ahrq-psnet-annual-perspective-impact-covid-19-pandemic-patient-safety
18. Lake ET, Pascale A, Warshawsky NE, Smith JG, Staiger D, Rogowski JA. COVID-19 Pandemic Increases in Nursing-Sensitive Quality Indicators. Nurs Res 2024;73:490-5. doi: 10.1097/NNR.0000000000000771.
19. Metersky ML, Rodrick D, Ho SY, Galusha D, Timashenka A, Grace EN, et al. Hospital COVID-19 Burden and Adverse Event Rates. JAMA Netw Open 2024;7:e2442936. doi: 10.1001/jamanetworkopen.2024.42936.
20. Stark N, Kerrissey M, Grade M, Berrean B, Peabody C. Streamlining Care in Crisis: Rapid Creation and Implementation of a Digital Support Tool for COVID-19. West J Emerg Med 2020;21:1095-1101. doi: 10.5811/westjem.2020.7.48537.
21. Kepner S, Jones R. Patient Safety Trends in 2023: An Analysis of 287,997 Serious Events and Incidents From the Nation's Largest Event Reporting Database. Patient Saf 2024;6. doi:10.33940/001c.116529.
22. Ferrara M, Bertozzi G, Di Fazio N, Aquila I, Di Fazio A, Maiese A, et al. Risk Management and Patient Safety in the Artificial Intelligence Era: A Systematic Review. Healthcare (Basel) 2024;12:549. doi: 10.3390/healthcare12050549.
23. Ratwani RM, Bates DW, Classen DC. Patient Safety and Artificial Intelligence in Clinical Care. JAMA Health Forum 2024;5:e235514. doi: 10.1001/jamahealthforum.2023.5514.
24. Mrayyan MT. Predictors and outcomes of patient safety culture: a cross-sectional comparative study. BMJ Open Qual 2022;11:e001889. doi: 10.1136/bmjoq-2022-001889.
25. Leape LL, Berwick DM. Five years after To Err Is Human: what have

we learned? JAMA 2005;293:2384-90. doi: 10.1001/jama.293.19.2384.
26. Singer SJ, Vogus TJ. Safety climate research: taking stock and looking forward. BMJ Qual Saf 2013;22:1-4. doi: 10.1136/bmjqs-2012-001572.
27. Willmington C, Belardi P, Murante AM, Vainieri M. The contribution of benchmarking to quality improvement in healthcare. A systematic literature review. BMC Health Serv Res 2022;22:139. doi: 10.1186/s12913-022-07467-8.
28. Harrison R, Cohen AW, Walton M. Patient safety and quality of care in developing countries in Southeast Asia: a systematic literature review. Int J Qual Health Care 2015;27:240-54. doi: 10.1093/intqhc/mzv041.
29. Farley DO, Ridgely MS, Mendel P, Teleki SS, Damberg CL, Shaw R, et al. Assessing Patient Safety Practices and Outcomes in the U.S. Health Care System. [Online] 2009 [Cited 2026 January 24]. Available from URL: https://books.google.com.pk/books/about/Assessing_Patient_Safety_Practices_and_O.html?id=nXW_4lv21noC&redir_esc=y
30. Agency for Healthcare Research and Quality (AHRQ). Measurement of patient safety. [Online] 2024 [Cited 2026 January 24]. Available from URL: https://psnet.ahrq.gov/primer/measurement-patient-safety.
31. Montella E, Iodice S, Bernardo C, Frangiosa A, Pascarella G, Santalucia I, Triassi M. Integrated System for the Proactive Analysis on Infection Risk at a University Health Care Establishment Servicing a Large Area in the South of Italy. J Patient Saf 2023;19:313-22. doi: 10.1097/PTS.0000000000001141.
32. Flott K, Maguire J, Phillips N. Digital safety: the next frontier for patient safety. Future Healthc J 2021;8:e598-601. doi: 10.7861/fhj.2021-0152.
33. Batko K, Ślęzak A. The use of Big Data Analytics in healthcare. J Big Data 2022;9:3. doi: 10.1186/s40537-021-00553-4.
34. Sarkhosh S, Abdi Z, Ravaghi H. Engaging patients in patient safety: a qualitative study examining healthcare managers and providers' perspectives. BMC Nurs 2022;21:374. doi: 10.1186/s12912-022-01152-1.
35. Faiman B, Tariman JD. Shared Decision Making: Improving Patient Outcomes by Understanding the Benefits of and Barriers to Effective Communication. Clin J Oncol Nurs 2019;23:540-2. doi: 10.1188/19.CJON.540-542.