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Integrating Electronic Health Records, Health Analytics, and Workforce Management for Hospital Quality Improvement and Patient Safety: A Narrative Literature Synthesis

Integrasi Rekam Kesehatan Elektronik, Analitik Data Kesehatan, dan Manajemen Tenaga Kesehatan dalam Meningkatkan Mutu Rumah Sakit dan Keselamatan Pasien: Sintesis Literatur Naratif

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Abstract

Hospital digital transformation requires the integration of technology, healthcare processes, and organizational capacity to improve healthcare quality and patient safety. This study aims to develop a socio-technical framework that integrates the key components of hospital digital transformation through a narrative literature synthesis. The study synthesized five peer-reviewed articles published between 2023 and 2025 covering Electronic Health Records (EHRs), Big Data Analytics, process mining, medication safety, and workforce management. The findings demonstrate that EHRs serve as the foundation for integrated clinical data, Big Data Analytics transforms data into actionable insights for risk identification and evidence-based decision-making, process mining evaluates real-world healthcare workflows to identify process inefficiencies, and medication safety applies these improvements to high-risk stages of patient care. Furthermore, organizational factors, particularly workforce management, staffing, workload, and system usability, determine the sustainability of digital transformation. This study contributes by proposing an integrated socio-technical framework that connects technological, process, and organizational dimensions, providing a conceptual reference for hospitals to align digital investments with continuous improvements in healthcare quality, patient safety, operational efficiency, and workforce sustainability.

Keywords: Electronic Health Records; Big Data Analytics; Process Mining; Medication Safety; Hospital Digital Transformation

Abstrak

Transformasi digital rumah sakit memerlukan integrasi antara teknologi, proses pelayanan, dan kapasitas organisasi untuk meningkatkan mutu layanan serta keselamatan pasien. Penelitian ini bertujuan mengembangkan kerangka sosio-teknis yang mengintegrasikan komponen utama transformasi digital rumah sakit melalui pendekatan *narrative literature synthesis*. Penelitian dilakukan dengan mensintesis lima artikel *peer-reviewed* yang diterbitkan pada periode 2023–2025 dan membahas *Electronic Health Records* (EHR), *Big Data Analytics*, *process mining*, *medication safety*, serta manajemen tenaga kesehatan. Hasil penelitian menunjukkan bahwa EHR berperan sebagai fondasi penyedia data klinis terintegrasi, *Big Data Analytics* mengubah data menjadi informasi untuk mendukung identifikasi risiko dan pengambilan keputusan, *process mining* mengevaluasi alur pelayanan aktual untuk menemukan ketidakefisienan proses, sedangkan *medication safety* menerapkan hasil evaluasi pada tahapan pelayanan yang berisiko tinggi. Selain itu, faktor organisasi, terutama manajemen tenaga kesehatan, *staffing*, beban kerja, dan *system usability*, menentukan keberlanjutan transformasi digital. Penelitian ini berkontribusi dengan mengusulkan kerangka sosio-teknis yang menghubungkan dimensi teknologi, proses, dan organisasi sebagai acuan konseptual bagi rumah sakit dalam menyelaraskan investasi digital dengan peningkatan mutu layanan, keselamatan pasien, efisiensi operasional, dan keberlanjutan tenaga kesehatan.

Kata Kunci: Rekam Medis Elektronik; Analisis Big Data; Penelusuran Proses; Keamanan Penggunaan Obat; Transformasi Digital Rumah Sakit



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INTRODUCTION

The increasing demand to improve healthcare quality, patient safety, operational efficiency, and the sustainability of healthcare systems has driven hospitals to accelerate digital transformation.¹ Digitalization is no longer viewed merely as the adoption of information technology but as a strategic effort to develop a healthcare system that is more effective, safer, and patient-centered. In practice, hospitals are expected to manage clinical data effectively, support timely decision-making, control service-related risks, and foster a working environment that enhances healthcare professionals' performance.² Therefore, the success of digital transformation depends not only on the availability of technology but also on the organization's ability to integrate technology, healthcare processes, and human resources into a cohesive system.

Electronic Health Records (EHRs) serve as the foundation of hospital digital transformation by providing integrated and accessible clinical data for healthcare professionals.³ The implementation of EHRs enhances documentation quality, strengthens interdisciplinary coordination, improves access to patient information, and increases service efficiency. However, the availability of data within EHRs does not automatically translate into improved healthcare quality or better patient outcomes.⁴ Clinical data must be transformed into meaningful information that supports both clinical and managerial decision-making. Consequently, analytical capabilities become an essential component of digital transformation, enabling hospitals to convert raw data into actionable insights for continuous quality improvement.

This role is fulfilled by *Big Data Analytics* (BDA), which processes large volumes of clinical data to identify patterns, monitor risks, and support evidence-based decision-making.⁵ The resulting insights can then be further explored through *process mining*, which reconstructs healthcare processes using *event logs*, identifies process variations, detects *bottlenecks*, and evaluates whether clinical workflows comply with established procedures. These findings provide the basis for interventions at high-risk stages of care, such as implementing *medication safety* measures during patient transitions from the *Intensive Care Unit* (ICU) to general wards.⁶ Nevertheless, the effectiveness of these digital initiatives depends heavily on workforce readiness, adequate staffing, responsive leadership, and workload management to ensure that technology implementation does not increase *burnout* or compromise the quality of care.

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- 1 Domenico Bevere and Nicola Faccilongo, "Shaping the Future of Healthcare: Integrating Ecology and Digital Innovation," *Sustainability* 16, no. 9 (May 2, 2024): 3835, <https://doi.org/10.3390/su16093835>.
 - 2 Michael Sony, Jiju Antony, and Olivia McDermott, "The Impact of Healthcare 4.0 on the Healthcare Service Quality: A Systematic Literature Review," *Hospital Topics* 101, no. 4 (October 2, 2023): 288–304, <https://doi.org/10.1080/00185868.2022.2048220>.
 - 3 Gayatri Gopal et al., "Digital Transformation in Healthcare – Architectures of Present and Future Information Technologies," *Clinical Chemistry and Laboratory Medicine (CCLM)* 57, no. 3 (February 25, 2019): 328–35, <https://doi.org/10.1515/cclm-2018-0658>.
 - 4 Alvin Rajkomar et al., "Scalable and Accurate Deep Learning with Electronic Health Records," *Npj Digital Medicine* 1, no. 1 (2018), <https://doi.org/10.1038/s41746-018-0029-1>.
 - 5 Awais Ahmed et al., "Harnessing Big Data Analytics for Healthcare: A Comprehensive Review of Frameworks, Implications, Applications, and Impacts," *IEEE Access* 11 (2023): 112891–928, <https://doi.org/10.1109/ACCESS.2023.3323574>.
 - 6 Richard S. Bourne et al., "Improving Medication Safety for Intensive Care Patients Transitioning to a Hospital Ward: Development of a Theory-Informed Intervention Package," *BMC Health Services Research* 24, no. 1 (November 26, 2024): 1476, <https://doi.org/10.1186/s12913-024-11627-3>.

Hospital digital transformation should therefore be understood as an integrated system that connects technology, healthcare processes, risk management, and human factors.⁷ EHRs provide the data infrastructure, *Big Data Analytics* generates actionable insights for decision-making, *process mining* evaluates the actual delivery of healthcare services, and *medication safety* represents the practical application of quality improvement in high-risk clinical settings. The successful implementation of these interconnected components requires effective workforce management to ensure that digitalization extends beyond administrative efficiency and contributes to sustainable improvements in healthcare quality and patient safety.

Research has shown that the implementation of *Electronic Health Records* improves information accessibility, documentation quality, care coordination, and workflow efficiency, although its impact on patient outcomes remains inconsistent.⁸ Other studies have demonstrated that *Big Data Analytics* contributes to healthcare quality by enhancing risk identification and monitoring, while *process mining* enables the reconstruction of real-world clinical workflows and the identification of process variations and *bottlenecks* affecting service efficiency.⁹ Research has also indicated that *medication safety* interventions and effective workforce management play critical roles in reducing healthcare errors and supporting the successful implementation of digital transformation.¹⁰ However, these studies have examined each component independently and have not yet developed a comprehensive socio-technical framework that integrates *Electronic Health Records*, *Big Data Analytics*, *process mining*, *medication safety*, and workforce management into a unified system for improving hospital quality and patient safety.

Based on this research gap, the present study employs a *narrative literature synthesis* approach to develop a socio-technical framework integrating *Electronic Health Records*, *Big Data Analytics*, *process mining*, *medication safety*, and workforce management into a single conceptual model. The proposed framework is expected to contribute conceptually by explaining the interrelationships among the key components of hospital digital transformation and to provide practical guidance for hospital managers in aligning digital investments with improvements in healthcare quality, patient safety, operational efficiency, and workforce sustainability.

Method

This study employed a *narrative literature synthesis* approach to integrate empirical findings on hospital digital transformation into a comprehensive conceptual framework.¹¹ The literature was identified through searches in the Scopus and Google Scholar databases using the keywords *Electronic Health Record*, *Big Data Analytics*, *process mining*, *medication safety*, *workforce management*, *hospital quality*, and *patient safety*. The initial search yielded 37 articles published between 2023 and 2025. After removing duplicate records and screening titles, abstracts, and full texts for

7 Sascha Kraus et al., “Digital Transformation in Healthcare: Analyzing the Current State-of-Research,” *Journal of Business Research* 123 (2021): 557–67, <https://doi.org/10.1016/j.jbusres.2020.10.030>.

8 Mohammad Faleh Alharbi, “Does Electronic Health Record Implementation Enhance Hospital Efficiency and Patient Outcomes? A Comprehensive Systematic Review,” *Sage Open* 15, no. 3 (July 29, 2025), <https://doi.org/10.1177/21582440251359791>.

9 Muhammad Imran Razzak, Muhammad Imran, and Guandong Xu, “Big Data Analytics for Preventive Medicine,” *Neural Computing and Applications* 32, no. 9 (May 16, 2020): 4417–51, <https://doi.org/10.1007/s00521-019-04095-y>.

10 Fatema Saleh AlDhaen, “AI-Powered Transformation of Healthcare: Enhancing Patient Safety Through AI Interventions with the Mediating Role of Operational Efficiency and Moderating Role of Digital Competence—Insights from the Gulf Cooperation Council Region,” *Healthcare* 13, no. 6 (March 12, 2025): 614, <https://doi.org/10.3390/healthcare13060614>.

11 Marco Pautasso, “The Structure and Conduct of a Narrative Literature Review,” in *A Guide to the Scientific Career* (Wiley, 2019), 299–310, <https://doi.org/10.1002/9781118907283.ch31>.

relevance, five *peer-reviewed* articles were selected for the final synthesis. These articles were purposively chosen because each represents one of the five key domains of hospital digital transformation, namely *Electronic Health Records* (EHRs), *Big Data Analytics*, *process mining*, *medication safety*, and workforce management. This study did not adopt a *systematic literature review* design or the PRISMA protocol because its objective was to develop a conceptual synthesis rather than estimate effect sizes or conduct a meta-analysis.

The unit of analysis in this study was the individual research article. Data extracted from each article included the research focus, study design, context, sample characteristics, intervention components, key findings, limitations, and contributions. The analysis was conducted in four stages: (1) identifying and understanding the main findings of each article, (2) categorizing the findings according to the relationships among technology, healthcare processes, risk management, and human factors, (3) comparing and integrating the findings to identify complementary conceptual patterns, and (4) developing a socio-technical framework together with its operational implications for improving hospital quality and patient safety. The findings are presented as a conceptual synthesis emphasizing the interrelationships among the key components of hospital digital transformation and are therefore not intended to produce statistical generalizations or establish new causal relationships.

RESULTS AND DISCUSSION

Integration of Technology and Processes in Hospital Digital Transformation

Hospital digital transformation is a comprehensive process that integrates multiple technologies and managerial approaches to improve healthcare quality and patient safety. Its success depends not only on the implementation of digital technologies but also on the ability of hospitals to connect data management, information analysis, process evaluation, and clinical interventions into an integrated system.¹² Based on the literature reviewed in this study, the five selected articles represent the major stages of hospital digital transformation. The characteristics of these studies are presented in Table 1.

Table 1. Characteristics of the Synthesized Articles

Author	Main Findings
Alharbi (2025)	The implementation of <i>Electronic Health Records</i> improves information accessibility, documentation quality, care coordination, and <i>workflow</i> efficiency, although its impact on patient outcomes remains inconsistent.
Basile et al. (2024)	<i>Big Data Analytics</i> enhances healthcare quality by strengthening risk identification and monitoring as part of hospital risk management practices.
Schuster et al. (2024)	<i>Process mining</i> reconstructs actual healthcare processes, identifies process variations, and detects <i>bottlenecks</i> affecting service efficiency.
Bourne et al. (2024)	<i>Medication safety</i> interventions are required to reduce <i>medication transition errors</i> during patient transfers from the ICU to general wards.
Aiken et al. (2023)	The success of digital transformation is influenced by staffing adequacy, workload, work environment, and healthcare professionals' <i>burnout</i> .

Source: Compiled by the authors (2026)

12 Ana-Maria Ștefan et al., “Empowering Healthcare: A Comprehensive Guide to Implementing a Robust Medical Information System—Components, Benefits, Objectives, Evaluation Criteria, and Seamless Deployment Strategies,” *Applied System Innovation* 7, no. 3 (June 14, 2024): 51, <https://doi.org/10.3390/asi7030051>.

Table 1 demonstrates that each study examines a different aspect of hospital digital transformation while collectively illustrating a coherent progression of improvement. The process begins with data generation through *Electronic Health Records* (EHRs), followed by the use of *Big Data Analytics* (BDA) to convert clinical data into actionable information. This information is subsequently evaluated through *process mining* to understand how healthcare services are actually delivered, and the findings are translated into *medication safety* interventions at high-risk points of care. Together, these stages indicate that digital transformation is a sequential and interconnected process in which each component provides the foundation for the next.

As the cornerstone of hospital digital transformation, *Electronic Health Records* provide the digital infrastructure for storing and managing integrated clinical information. Alharbi explained that EHR implementation improves documentation quality, strengthens interdisciplinary communication, enhances care coordination, and increases *workflow* efficiency.¹³ Integrated patient information enables healthcare professionals to access comprehensive medical records promptly, thereby facilitating more efficient clinical decision-making and continuity of care. Consequently, EHRs should be viewed not merely as electronic documentation systems but as the fundamental infrastructure supporting data-driven healthcare delivery.

Despite these advantages, improvements in documentation quality do not necessarily translate into better patient outcomes. Alharbi found that evidence regarding the impact of EHR implementation on mortality reduction, *length of stay*, and patient recovery remains inconsistent. These findings suggest that the availability of clinical data alone is insufficient to improve healthcare quality unless the data are effectively utilized to support clinical decision-making. This argument is reinforced by Aiken et al., who reported that many physicians and nurses spend considerable time interacting with EHR systems and frequently experience frustration due to poor system usability and inadequate integration with *clinical workflows*.¹⁴ As a result, healthcare professionals often devote more time to documentation than to direct patient care. These findings indicate that the effectiveness of EHR implementation depends not only on the presence of digital technology but also on system usability and its compatibility with routine clinical practice.

The limitations of EHRs highlight the need to transform stored clinical data into meaningful information that supports evidence-based decision-making. At this stage, *Big Data Analytics* plays a pivotal role in hospital digital transformation. Basile et al. demonstrated that BDA capabilities improve healthcare quality by strengthening risk management, particularly through more effective risk identification and monitoring.¹⁵ By processing large volumes of clinical data, BDA enables hospitals to recognize patterns of care, detect anomalies at an early stage, and implement preventive actions before risks develop into patient safety incidents. Therefore, the value of BDA lies not merely in its computational capacity but in its ability to generate actionable insights that support continuous quality improvement.

However, although BDA effectively identifies emerging risks, it provides limited explanations of how those risks develop throughout healthcare processes. Statistical analyses can reveal that

13 Mohammed S Alharbi, "Digital Transformation and EFL Anxiety: A Mixed-Methods Study on the Impact of Online Learning on the Language Acquisition Psychology of Saudi Arabian Students," *Social Sciences & Humanities Open* 12 (2025): 101721.

14 Linda H. Aiken et al., "Physician and Nurse Well-Being and Preferred Interventions to Address Burnout in Hospital Practice," *JAMA Health Forum* 4, no. 7 (July 7, 2023): e231809, <https://doi.org/10.1001/jamahealthforum.2023.1809>.

15 L.J. Basile et al., "The Role of Big Data Analytics in Improving the Quality of Healthcare Services in the Italian Context: The Mediating Role of Risk Management," *Technovation* 133 (May 2024): 103010, <https://doi.org/10.1016/j.technovation.2024.103010>.

a risk exists but cannot clearly identify the stages of care where deviations occur or explain the mechanisms responsible for those deviations. Consequently, decision-making based solely on analytical outputs may focus primarily on outcomes rather than the underlying causes of process inefficiencies. This limitation underscores the need for complementary approaches capable of examining healthcare processes in greater detail.

Such a complementary approach is provided by *process mining*, which utilizes *event logs* extracted from EHR systems to reconstruct healthcare processes based on actual clinical activities. Schuster et al. explained that the *incremental process discovery* approach simplifies complex process models while preserving clinically relevant information, allowing process variations to be interpreted within their appropriate clinical context.¹⁶ Through this approach, hospitals can identify *handoffs*, *rework*, waiting times, and *bottlenecks* that are often overlooked by conventional statistical analyses. Consequently, *process mining* extends beyond identifying the existence of risks by revealing how those risks emerge throughout the care delivery process.

The insights generated through *process mining* subsequently provide the foundation for interventions targeting the most vulnerable stages of healthcare delivery. One of the most critical examples is the transition of patients from the *Intensive Care Unit (ICU)* to general wards, a process frequently associated with *medication transition errors*. Bourne et al. demonstrated that these errors can be reduced through comprehensive *medication reviews*, improved interdisciplinary communication, standardized documentation, and clearly documented medication plans.¹⁷ Within this integrated framework, EHRs provide complete medication histories, BDA identifies patients at elevated risk, and *process mining* verifies whether medication reconciliation procedures are performed according to established protocols. These findings indicate that improvements in patient safety result not from a single technological solution but from the coordinated integration of multiple digital and organizational components.

Overall, the evidence reviewed in this study indicates that hospital digital transformation should be understood as a systemic and continuous process rather than the implementation of isolated technologies. *Electronic Health Records* establish the data infrastructure, *Big Data Analytics* converts data into meaningful information, *process mining* evaluates healthcare delivery based on real-world clinical activities, and *medication safety* represents the practical implementation of quality improvement at high-risk stages of care. The relationships among these components demonstrate that sustainable improvements in healthcare quality cannot be achieved through fragmented technological investments. Instead, hospitals must integrate data management, information analysis, process evaluation, and clinical interventions into a continuous quality improvement cycle. This integrated perspective provides the foundation for the subsequent discussion on the role of organizational factors and workforce management in ensuring the long-term success of hospital digital transformation.

Organizational Dimensions and the Socio-Technical Framework of Hospital Digital Transformation

The success of hospital digital transformation ultimately depends not only on the sophistication of digital technologies but also on the organization's ability to manage the healthcare workforce responsible for operating those technologies. The implementation of *Electronic Health Records* (EHRs), *Big Data Analytics* (BDA), *process mining*, and *medication safety* initiatives relies heavily on healthcare professionals' competencies, effective leadership, organizational culture, and a

16 Daniel Schuster et al., "Analyzing Healthcare Processes with Incremental Process Discovery: Practical Insights from a Real-World Application," *Journal of Healthcare Informatics Research* 8, no. 3 (September 24, 2024): 523–54, <https://doi.org/10.1007/s41666-024-00165-6>.

17 Bourne et al., "Improving Medication Safety for Intensive Care Patients Transitioning to a Hospital Ward: Development of a Theory-Informed Intervention Package."

supportive work environment.¹⁸ Therefore, digital transformation should be understood as a comprehensive organizational change rather than merely the adoption of healthcare information technologies. In this context, human factors serve as the critical link between technological innovation and improvements in healthcare quality.

Aiken et al. demonstrated that high levels of *burnout* among healthcare professionals represent one of the greatest challenges to successful digital transformation.¹⁹ Their study reported that approximately 32% of physicians and 47% of nurses experienced high levels of *burnout*, while intentions to leave their jobs reached 23% among physicians and 40% among nurses. These conditions not only affect workforce well-being but also increase the likelihood of medical errors, reduce the quality of interdisciplinary communication, and weaken adherence to patient safety protocols. These findings suggest that sustainable digital transformation cannot be achieved without organizational strategies that support the well-being and stability of healthcare professionals as the primary users of digital systems.

The relationship between technology and the healthcare workforce is also reciprocal. Digital systems that fail to meet users' needs may increase administrative workload and contribute to occupational fatigue.²⁰ Alharbi explained that although EHR implementation improves documentation efficiency and access to clinical information, these benefits may be diminished when system *usability* is inadequate.²¹ This finding is consistent with Aiken et al., who reported that healthcare professionals spend a substantial amount of time interacting with EHR systems, thereby reducing the time available for direct patient care. These findings indicate that poorly designed technologies may exacerbate *burnout*, while increased *burnout* can subsequently reduce the quality of clinical data that forms the foundation of downstream analytical processes.

These consequences extend beyond EHR implementation and influence the effectiveness of every stage of hospital digital transformation. Incomplete or inaccurate clinical data reduce the ability of *Big Data Analytics* to identify healthcare risks accurately.²² As a result, analytical outputs become less reliable, limiting the effectiveness of *process mining* in identifying inefficiencies and generating appropriate recommendations for process improvement. Ultimately, the implementation of *medication safety* interventions also depends on the availability of accurate information and the consistent adherence of healthcare professionals to established clinical procedures. Therefore, each stage of digital transformation is interconnected, and weaknesses at one stage inevitably affect the performance of subsequent stages.

Based on these relationships, hospital digital transformation can be conceptualized as a socio-technical system integrating technology, healthcare processes, and organizational factors within a continuous quality improvement cycle.²³ Within this framework, EHRs serve as the foundation

18 Chonghui Guo and Jingfeng Chen, "Big Data Analytics in Healthcare: Data-Driven Methods for Typical Treatment Pattern Mining," *Journal of Systems Science and Systems Engineering* 28, no. 6 (December 11, 2019): 694–714, <https://doi.org/10.1007/s11518-019-5437-5>.

19 Aiken et al., "Physician and Nurse Well-Being and Preferred Interventions to Address Burnout in Hospital Practice."

20 Olufisayo Olakotan et al., "Usability Challenges in Electronic Health Records: Impact on Documentation Burden and Clinical Workflow: A Scoping Review," *Journal of Evaluation in Clinical Practice* 31, no. 4 (2025), <https://doi.org/10.1111/jep.70189>.

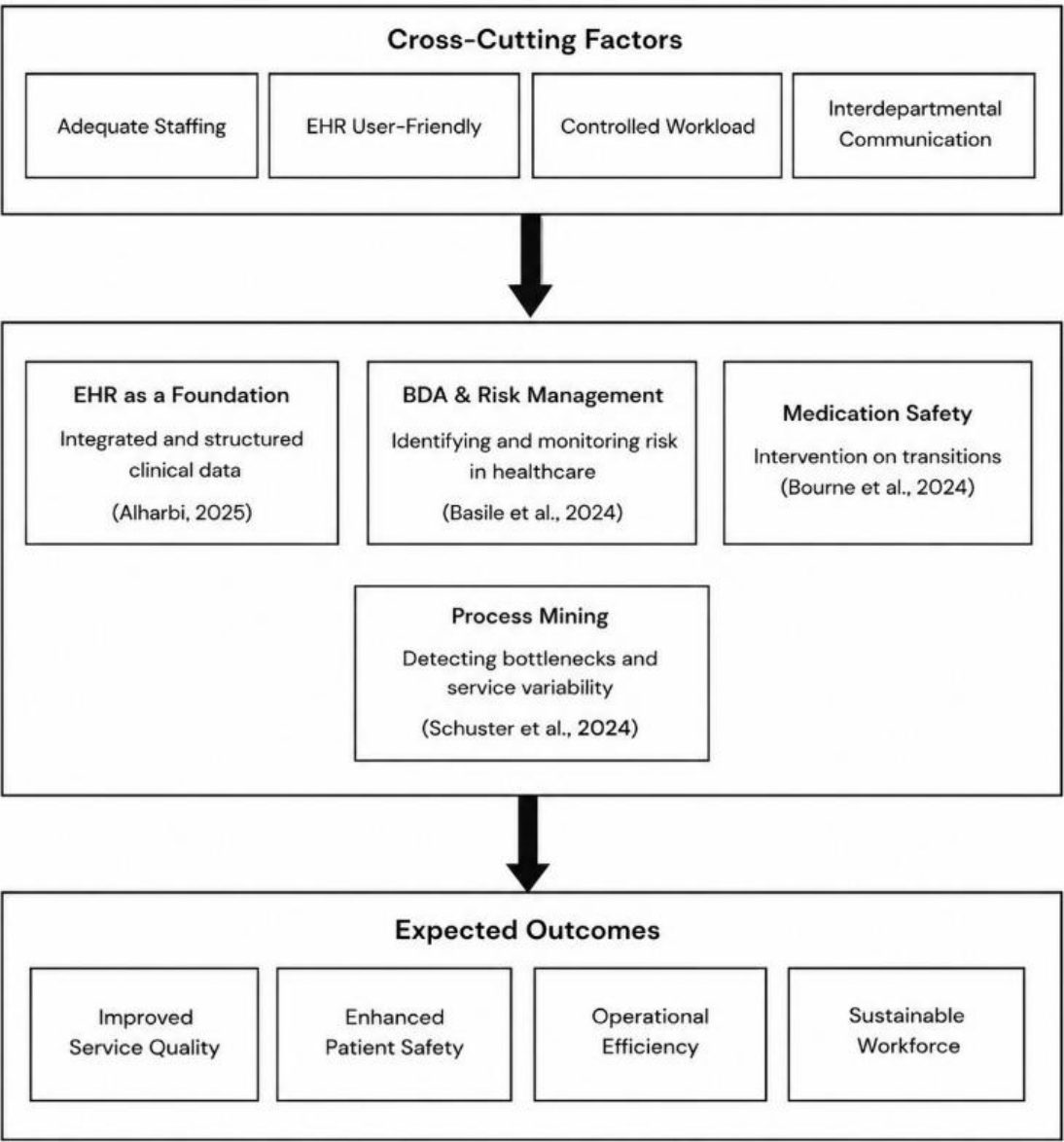
21 Alharbi, "Digital Transformation and EFL Anxiety: A Mixed-Methods Study on the Impact of Online Learning on the Language Acquisition Psychology of Saudi Arabian Students."

22 Xue Yang et al., "Biomedical Big Data Technologies, Applications, and Challenges for Precision Medicine: A Review," *Global Challenges* 8, no. 1 (January 20, 2024), <https://doi.org/10.1002/gch2.202300163>.

23 Daniele Binci, Gabriele Palozzi, and Francesco Scafarto, "Toward Digital Transformation in Healthcare: A Framework for Remote Monitoring Adoption," *The TQM Journal* 34, no. 6 (November 29, 2022): 1772–99, <https://doi.org/10.1108/TQM-04-2021-0109>.

for clinical data collection, while *Big Data Analytics* transforms those data into actionable information that supports evidence-based decision-making. The resulting insights are subsequently evaluated through *process mining* to identify process variations, *handoffs*, and *bottlenecks* affecting service efficiency. The findings are then translated into *medication safety* interventions targeting high-risk stages of patient care. Throughout this process, effective workforce management supports the successful implementation of each component and ensures the sustainability of digital transformation.

Figure 1. Socio-Technical Framework of Hospital Digital Transformation



Source: Developed by the authors from the synthesized literature.

Figure 1 illustrates that the relationships among the components of hospital digital transformation are dynamic rather than linear. EHRs provide the clinical data that serve as input for *Big Data Analytics*, while analytical outputs become the basis for evaluating healthcare processes through *process mining*. The insights generated from process evaluation are subsequently translated into *medication safety* interventions aimed at improving patient safety

outcomes.²⁴ Simultaneously, the quality of every stage is influenced by organizational readiness, including adequate staffing, responsive leadership, a strong patient safety culture, and lower levels of workforce *burnout*. Consequently, workforce management functions as a cross-cutting factor that determines the effectiveness of the entire digital transformation process.

The proposed framework also demonstrates that technological investments alone are unlikely to achieve optimal outcomes when implemented in isolation. Establishing EHR systems without sufficient analytical capabilities merely results in the accumulation of clinical data, whereas implementing *Big Data Analytics* without systematic process evaluation may produce decisions that fail to address the root causes of healthcare inefficiencies. Likewise, *medication safety* initiatives cannot be sustained without adequate organizational support, including appropriate staffing levels and a supportive work environment. Hospitals should therefore adopt digital transformation strategies that integrate technological investments with organizational capacity building to ensure that digital innovations translate into measurable improvements in healthcare quality and patient safety.

In addition to its practical implications, this conceptual framework provides directions for future research. Most existing studies continue to examine the components of hospital digital transformation independently, resulting in limited empirical evidence regarding the relationships among these components. Future studies should develop integrated analytical models that combine operational EHR data, analytical capabilities, process performance indicators, *medication safety* outcomes, and workforce well-being within a single conceptual framework. Such an approach is expected to generate more comprehensive evidence regarding the mechanisms through which digital transformation contributes to healthcare quality improvement.

Overall, the findings indicate that successful hospital digital transformation emerges from the interaction among technology, healthcare processes, and organizational factors. Technology provides the infrastructure and analytical capabilities, whereas organizational support ensures that these technologies are effectively utilized by healthcare professionals in routine clinical practice. Consequently, digital transformation should not be viewed solely as an investment in information systems but as a comprehensive organizational strategy that integrates people, technology, and healthcare processes to achieve sustainable improvements in healthcare quality and patient safety.

CONCLUSION

This study demonstrates that hospital digital transformation should be understood as an integrated socio-technical system rather than as the isolated adoption of digital technologies. The findings indicate that *Electronic Health Records* (EHRs) provide the foundational clinical data, *Big Data Analytics* transforms these data into actionable insights for risk identification and decision-making, *process mining* evaluates real-world healthcare workflows to identify process inefficiencies, and *medication safety* translates these insights into targeted interventions at high-risk stages of care. However, the effectiveness of this transformation ultimately depends on organizational readiness, particularly workforce management, system usability, and supportive working conditions. Therefore, improvements in healthcare quality and patient safety are achieved not through technology alone but through the integration of technological infrastructure, analytical capabilities, process optimization, and organizational support within a continuous quality improvement cycle.

24 Fatemeh Bakhshi et al., "Behavioural Changes in Medication Safety: Consequent to an Action Research Intervention," *Journal of Nursing Management* 29, no. 2 (March 21, 2021): 152–64, <https://doi.org/10.1111/jonm.13128>.

This study contributes to the literature by proposing a socio-technical conceptual framework that integrates key dimensions of hospital digital transformation into a unified perspective, thereby extending previous studies that have predominantly examined these components independently. The framework offers practical guidance for hospital managers in aligning digital investments with organizational capacity to achieve sustainable improvements in healthcare quality and patient safety. Nevertheless, this study is limited by its reliance on a narrative literature synthesis based on five selected articles, which may not capture the full breadth of evidence available in this rapidly evolving field. Future research should empirically validate the proposed framework using quantitative, qualitative, or mixed-method approaches across diverse healthcare settings to examine the relationships among digital technologies, organizational factors, and healthcare outcomes.

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