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THE DIGITAL TRANSFORMATION OF NURSING PRACTICE: IMPLICATIONS FOR PATIENT CARE

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Abstract

The implementation of digital technology in healthcare, particularly within nursing practice, represents a transformative shift in patient care delivery by enhancing the efficiency, accuracy, and coordination of healthcare services. This shift enables more personalized, timely, and patient-centered care, ultimately improving patient outcomes and overall healthcare experiences. This paper explored the implications of digital transformation in nursing practice, focusing on its impact on patient care outcomes. Drawing upon a comprehensive review of available literature and empirical evidence, this study examines the growth and advancement of the healthcare system, the promotion of efficient, safe, and quality patient care, and the challenges encountered in the process of digital transformation. Through qualitative-descriptive methodology, insights from 15 nurses directly involved in the use of digitalized approaches in healthcare settings are synthesized. Results reveal themes of growth and advancement in the healthcare system, highlighting the positive impact of digital transformation on professional development and patient care delivery. However, challenges such as the complexity of IT networks, data security concerns, and resistance to technological change among healthcare providers and patients are also identified. This study contributes to a nuanced understanding of the multifaceted implications of digital transformation in nursing practice, offering insights for healthcare professionals, policymakers, and technology innovators to navigate and optimize the integration of digital technologies in patient care delivery.

Keywords: digital transformation, nursing practice, patient care outcomes, healthcare system, challenges, professional development

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Introduction

The digital revolution within the nursing profession exemplifies the dynamic nature of healthcare in an era marked by rapid technological advancements (Raymond et al., 2022; Xiong et al., 2023). This paradigm shift is not just a transient trend but a significant transformation with the potential to redefine the core aspects of patient care. As healthcare systems worldwide grapple with escalating patient volumes and increasingly complex medical conditions, the integration of digital technology offers a promising solution. The deployment of electronic health records (EHRs), telehealth services, and advanced diagnostic tools has streamlined many nursing processes, improving efficiency and accuracy in patient care. This technological integration also facilitates better communication and coordination among healthcare providers, ensuring that patient care is both comprehensive and cohesive.

Moreover, the implications of this digital revolution extend far beyond the mere adoption of new technologies; they fundamentally reshape patient experiences and the daily practices of healthcare providers. Patients now have access to more personalized and timely care through telemedicine consultations, remote monitoring, and mobile health applications. These technologies empower patients to actively participate in their own care, enhancing patient engagement and satisfaction. For nurses, digital tools like automated medication dispensers and real-time patient monitoring systems reduce the risk of errors and free up valuable time, allowing them to focus more on direct patient interaction and critical thinking tasks. This shift not only improves the quality of care but also enhances the overall patient experience, making healthcare more patient-centric and accessible.

In addition, the digital revolution in nursing holds significant implications for healthcare provider practices, necessitating continuous professional development and adaptation. Nurses must acquire new skills and competencies to effectively utilize these technologies, which often involves ongoing education and training. This continuous learning curve is essential for ensuring that nurses can leverage digital tools to their full potential, thereby maximizing their benefits for patient care. The integration of artificial intelligence (AI) and machine learning in clinical decision support systems, for example, requires nurses to interpret complex data and apply it in real-time scenarios. As the nursing profession evolves in response to these technological advancements, the emphasis on digital literacy and technological proficiency becomes paramount. This transformation not only enhances the capabilities of nurses but also sets the stage for a more innovative and resilient healthcare system capable of meeting future challenges.

In today's modern era, the ubiquitous presence of various gadgets and electronic devices underscores the pervasive influence of digital innovation (Kakhi et al., 2022; Raymond et al., 2022). Data generation, storage, processing, and transmission have all transitioned into digital realms, streamlining and organizing various aspects of life. This technological advancement inevitably permeates nursing practice and patient care delivery, prompting a reevaluation of traditional methods.

The evolution of nursing documentation from handwritten files to digital systems reflects this transformative shift. While the conventional approach relied on manual filing systems prone to delays and inefficiencies, digital platforms offer seamless access and organization of patient data. Furthermore, medical equipment and facilities undergo digital transformation, enhancing safety, speed, and quality of care delivery while minimizing waiting times and improving referral systems (Carvalho et al., 2021; Mathur et al., 2023).

Digital transformation in healthcare, encompassing internet-related technologies and innovative therapies, holds the promise of improving healthcare delivery and patient outcomes. It facilitates the collection and analysis of massive datasets, contributing to enhanced patient well-being and cost-effective services. Moreover, digital health empowers patients to actively participate in decision-making regarding their health, leveraging digital resources for informed choices.

Nurses, as integral members of the healthcare system, have embraced Health Information Technology (HIT) to enhance clinical practices and patient outcomes (Fortune et al., 2023; Strittmatter et al., 2023). However, the adoption of technology extends beyond HIT, encompassing a broader spectrum of Digital Transformation Solutions (DTS) that support nursing practice, education, research, and leadership. To navigate this digital landscape effectively, nurses must possess comprehensive understanding and proficiency in utilizing various digital solutions to deliver patient-centered care.

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As healthcare facilities worldwide embrace full digital transformation, procedures become streamlined, and patient information remains secure and confidential. The goal is to transform patient-provider relationships, aligning digital policies with patient-centric concepts to enhance patient satisfaction and foster industry growth. Despite global variations in healthcare challenges, the digital revolution in nursing transcends geographical boundaries, presenting opportunities for improved resource utilization, reduced healthcare inequities, and enhanced patient treatment (Orlando et al., 2023; Tyagi et al., 2023).

This study aimed to contribute to the growing literature on nursing digitization by synthesizing current evidence and providing practical insights into the real-world implications of digital transformation. The study sought to empower healthcare professionals, organizations, legislators, and technology innovators to harness the full potential of digital advancement for improved patient care. As we navigate the complexities of the digital age in nursing, this research sheds light on the transformative impact of technological innovation, paving the way for enhanced patient care delivery through comprehensive evaluation and professional perspectives.

Research Question

The study determined how does the integration of digital technologies in nursing practice influence the quality of patient care and patient outcomes.

Methodology

Research Design. This investigation employed a qualitative-descriptive approach as it explores varied nurses' perspectives and insights with regards to the implications of digital transformation in nursing practice. Qualitative descriptive research translates researcher's concerns to understand the individual human experience in its unique context (Doyle et al., 2020). The characterization of phenomenology as concerned with what experiences are like is now sometimes utilized putatively working within the phenomenological theoretical standpoint. It is common to frame qualitative phenomenological research methodology in terms of uncovering "what experiences are like" (Williams, 2021).

Population and Sampling. Participants have been selected to provide valuable insights and cognizance on the topic of nurses in different departments that are in prevailing use of digital transformation in nursing practice. In this study, purposive sampling technique was utilized as this method is advantageous in selecting qualified and competent participants with respect to their experiences, background, and perspective in relation to digital transformation in nursing practice. Purposive sampling is the better matching of the sample to the aims and objectives of the research, thus improving the rigor of the study and trustworthiness of the data and results (Campbell et al., 2020). To ensure data saturation, a sample size of approximately ten to thirteen nurses from different departments with broad experience in digital application in nursing has been selected, as well as exposed or working with both manuals and experienced the digital transformation of nursing practice through electronic medical systems and other advanced equipment used for patient care. The study was conducted over a one-month period. Furthermore, inclusion criteria include nurses with varying experiences ranging from five to ten years and beyond, with different levels of expertise embodying nursing specialties within their respective institutions and are willing to participate in the study.

Instrumentation and Data Collection. To mediate and broaden the subject matter and acquire a deeper sense of the research study, it is imperative for the researchers to establish a systematic interview guide. In this research study, an interview guide was utilized as the data gathering tool, wherein a series of questions based on the topic were asked to the participants to collect data. In addition to this, the chance to elaborate and broaden the answer about the subject matter is open through follow-up questions. Semi-structured interview provides users an opportunity to raise new issues (DeNisco, 2024; Goudreau & Smolenski, 2023). They are useful when working with complex issues since researchers can use probes and spontaneous questions to explore, deepen understanding, and clarify answers to questions. On top of that, acquire diverse responses can be acquired that exhibit the nurse's subjective perspective. Moreover, data gathering was conducted and collected in a recorded face-to-face manner utilizing a semi-structured interview within a 5–10-minute span. The interview was repeated until such answers were persistently mentioned by the participants which signifies data saturation.

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Data Analysis. To gain an understanding of the digital transformation of nursing practice and its implications for patient care, the study utilized content analysis, a systematic research method to make inferences from text and other forms of qualitative information. It further allows the qualitative data collected in research to be analyzed systematically and reliably so that generalizations can be made in relation to the categories of interest to the researcher (Dang et al., 2021; Ropero-Padilla et al., 2022).

Results

Theme 1: Growth and Advancement in the Healthcare System. The advent of digital transformation in nursing and its implications for rendering quality patient care have transformed the healthcare system in a positive way, hence the growth that is apparent in today's healthcare system. Innovation in digitalization adds a support system that offers an evidence-based guideline that helps in the decision-making of the healthcare team in giving timely disposition for patient care, thus increasing the chance of patient survival, decreasing patient waiting time, and therefore increasing patient satisfaction. Nurses saw and emphasized the ease and efficiency with which the healthcare system was growing from the old system to becoming an advanced and highly futuristic, innovative system. As the healthcare system advances, it allows and pushes our healthcare individuals to keep up and grow with the system. Furthermore, nurses achieve professional growth and a sense of achievement in their work by being up-to-date and continuously learning and developing themselves. Exposure to different kinds of newly established innovations, digital equipment, and facilities that will help in rendering quality patient care gives a strong sense of personal growth and achievement.

Theme 2: Efficient, Safe, and Quality Patient Care. Nurses feel ease and efficiency in patient documentation, wherein access is safely available for the healthcare team across the facility, and systematic orders and data collections are taken from patients that can be reviewed anytime by nurses and other healthcare personnel for reference. Thus, enhanced communication helps nurses to work more efficiently. Moreover, the digital nursing platform assists nurses in improving patient data management in medication, including dosage calculation and drug interaction, which reduces the risks of medication errors and thus ensures safe medication administration. In addition to that, patient tracking and timely disposition are being given to patients, thus increasing patient satisfaction and, most importantly, early diagnosis, which can lead to giving patients quality treatment and patient care.

Theme 3: Challenges in Digital Transformation. Utilizing a digitalized healthcare approach comes with challenges, as experienced by nurses. Firstly, there are tasks that cannot be transcended through technology, such as nurse-patient interaction, building trust, and providing emotional support to patients. This is discerned by minimum nurse-patient interaction due to the presence and ease of having the monitors connected from the patient to the nurse station or directly to the patient's electronic record. Secondly, patient information and data are available on computers and in the cloud are more susceptible to threats. On top of that, older staff have difficulty adapting to the new technology. This can be countered with frequent exposure and training for healthcare personnel and needed updates and training regarding the advancement of clinical settings.

Discussion

This research explores nurses' lived experiences of using digitalized approach in healthcare setting and how it affects nurses and patient care outcome. Several themes have been derived which emphasize the effect of digital transformation in nursing practice and its implication for patient care, from professional growth, advancements to its challenges.

Theme 1: Growth and Advancement in Healthcare System. The theme of growth and advancement in the healthcare system, particularly driven by digital transformation (DX), underscores the profound impact of technological innovation on patient care and organizational efficiency. Like other industries, healthcare has reaped substantial benefits from embracing new technologies, ushering in a new era of secure and high-quality patient care delivery. Key technological advancements such as Electronic Health Records (EHR), digital imaging, e-prescription services, and enterprise resource planning systems have been seamlessly integrated into the extensive IT infrastructure of numerous healthcare organizations.

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These innovations not only streamline administrative processes but also enhance clinical decision-making and patient outcomes (Javaid et al., 2023; Woznowski et al., 2015).

The adoption of Electronic Health Records (EHR) stands out as a hallmark of digital transformation in healthcare. EHR systems digitize patient information, facilitating comprehensive documentation of medical histories, treatment plans, and outcomes. This centralized repository of data enables healthcare providers to access critical patient information promptly, enhancing care coordination and continuity across various healthcare settings. Moreover, EHRs promote interoperability, allowing seamless exchange of patient data among different healthcare providers, thus ensuring comprehensive and integrated care delivery. Digital imaging technologies have revolutionized diagnostic practices within healthcare institutions. Advanced imaging modalities such as MRI, CT scans, and digital X-rays offer unparalleled insights into patients' anatomical structures and physiological processes (Zatout, 2012; Zhumayeva et al., 2023).

The advent of e-prescription services represents a significant advancement in medication management and patient safety. Electronic prescribing systems streamline the prescription process, minimizing errors associated with illegible handwriting and dosage discrepancies. Integration with EHR platforms enables healthcare providers to access patients' medication histories and allergy profiles, enabling informed decision-making and personalized treatment plans. Furthermore, e-prescription services enhance medication adherence and compliance by enabling electronic transmission of prescriptions to pharmacies, expediting medication dispensing and reducing waiting times for patients (Berenbrok et al., 2022; Hastings et al., 2020).

Enterprise resource planning (ERP) systems play a pivotal role in optimizing healthcare operations and resource allocation. These integrated management platforms streamline administrative processes, including inventory management, financial planning, and human resource allocation, thereby enhancing organizational efficiency and cost-effectiveness. Overall, the integration of ERP systems contributes to improved financial sustainability and operational performance within healthcare institutions (Falconer et al., 2019; Geeson et al., 2019).

Theme 2: Efficient, Safe, and Quality Patient Care. Theme 2 focuses on the significant impact of digital technology on enhancing the efficiency, safety, and quality of patient care within the healthcare system. The integration of digital technology and medical devices heralds a new era in healthcare, characterized by improved delivery of services, enhanced quality control, and cost reduction. This transformation is driven by the digitalization of healthcare systems, which enables streamlined workflows, seamless data exchange, and advanced clinical decision support systems. As a result, healthcare providers can deliver more personalized and evidence-based care to patients, leading to better health outcomes and patient satisfaction.

The implementation of monitoring technologies represents a key aspect of digital transformation in healthcare, offering several benefits in terms of patient safety and staff efficiency. These technologies encompass a wide range of tools and devices, including wearable sensors, remote monitoring systems, and smart medical devices, which enable continuous tracking and surveillance of patients' vital signs, physiological parameters, and health status. By automating data collection and analysis, monitoring technologies reduce the burden on healthcare staff and enhance patient safety by enabling early detection of clinical deterioration and timely intervention (Kaufmann et al., 2018; Roten et al., 2020). Furthermore, remote monitoring allows for real-time access to patient data, facilitating remote consultations and collaboration among healthcare providers, ultimately leading to more coordinated and effective patient care.

Studies have shown that the implementation of monitoring technologies is associated with improved patient outcomes, reduced hospital readmissions, and lower healthcare costs. For example, a study demonstrated that the use of remote monitoring systems in patients with chronic diseases led to better adherence to treatment regimens, earlier detection of complications, and reduced hospitalizations (Clarke et al., 2023). Similarly, another study found that the digitalization of healthcare systems resulted in improved quality control measures, such as standardized protocols, automated alerts for medication errors, and real-time feedback mechanisms, leading to enhanced patient safety and satisfaction (Hickson et al., 2019; Wanis & Yi, 2023).

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Overall, the integration of digital technology and monitoring systems in healthcare has the potential to revolutionize patient care delivery by optimizing workflows, improving clinical outcomes, and reducing costs. By harnessing the power of data and technology, healthcare providers can provide more personalized, efficient, and safe care to patients, thereby advancing the overall quality of healthcare services. As the digitalization of healthcare continues to evolve, it is essential for healthcare organizations to prioritize investments in digital infrastructure, staff training, and data security measures to fully leverage the benefits of digital technology in patient care (Yuliati & Andriani, 2021).

Theme 3: Challenges in Digital Transformation. This theme delved into the challenges associated with digital transformation in healthcare, highlighting issues related to data security, IT infrastructure complexity, and barriers to technology adoption among both healthcare providers and patients. While digitalization offers numerous benefits, such as improved access to patient data and enhanced communication among healthcare professionals, it also presents significant challenges that need to be addressed to ensure the successful implementation and adoption of digital technologies.

One of the primary challenges in digital transformation is ensuring the security of patient data and IT networks. With the increasing digitization of healthcare systems, there is a growing concern about the risk of data breaches, cyberattacks, and unauthorized access to sensitive medical information. The complexity of IT networks in healthcare organizations further exacerbates these security challenges, as maintaining robust cybersecurity measures requires constant vigilance and investment in advanced technologies and personnel training. Failure to adequately address these security concerns can undermine patient trust and compromise the integrity and confidentiality of healthcare data.

Moreover, the sheer volume of data generated and transmitted within healthcare systems poses another significant challenge. Healthcare providers have access to vast amounts of patient data, including electronic health records, medical imaging, genomic data, and wearable sensor data. Managing and analyzing this data requires sophisticated data storage, processing, and analytics capabilities, as well as interoperable systems that enable seamless data exchange among different healthcare providers and institutions. However, the complexity and diversity of healthcare data present challenges in standardization, integration, and data governance, hindering the effective use of data to drive clinical decision-making and improve patient outcomes.

In addition to technical challenges, digital transformation in healthcare is also hindered by socio-cultural factors, such as illiteracy, lack of technological know-how, and resistance to change among patients and healthcare providers. Many patients may lack the digital literacy skills necessary to navigate electronic health records, access online health services, or use mobile health applications effectively. Similarly, healthcare providers may face challenges in adapting to new technologies, workflows, and documentation systems, particularly older or less tech-savvy professionals who may be resistant to change or unfamiliar with digital tools (Saxby et al., 2019; Suggett & Marriott, 2020).

Addressing these challenges requires a multi-faceted approach that involves investment in cybersecurity infrastructure, data governance frameworks, and user training and education programs. Healthcare organizations must prioritize the development of robust cybersecurity protocols and data encryption technologies to protect patient privacy and prevent unauthorized access to sensitive medical information. Additionally, efforts should be made to enhance digital literacy among patients and healthcare providers through training programs, educational resources, and user-friendly interfaces that facilitate technology adoption and usage (Alhammad et al., 2024; Heaton et al., 2022).

Furthermore, fostering a culture of innovation and collaboration within healthcare organizations can help overcome resistance to change and promote the adoption of digital technologies. By involving frontline healthcare workers in the design, implementation, and evaluation of digital solutions, organizations can ensure that technology meets the needs of users and enhances rather than disrupts clinical workflows. Ultimately, addressing the challenges of digital transformation in healthcare requires a concerted effort from all stakeholders, including policymakers, healthcare providers, technology vendors, and patients, to create a supportive environment for innovation and technology adoption in healthcare (Abbasi et al., 2023; Rohani & Yusof, 2023).

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Conclusions

In conclusion, this research has provided a comprehensive exploration of nurses' experiences with digitalized approaches in healthcare settings and their impact on patient care outcomes. Through the analysis of various themes, including growth and advancement in the healthcare system, efficient, safe, and quality patient care, and the challenges in digital transformation, several important implications have emerged. The integration of digital technologies such as Electronic Health Records (EHR), digital imaging, e-prescription services, and enterprise resource planning systems has significantly enhanced the delivery of healthcare services, promoted secure and high-quality patient care while drove greater organizational efficiency. These innovations streamline administrative processes, facilitate clinical decision-making, and improve patient outcomes by enabling personalized and evidence-based care delivery. Likewise, the implementation of monitoring technologies has ushered in a new era of digital healthcare, characterized by improved patient safety, staff efficiency, and clinical outcomes. Monitoring technologies, including wearable sensors and remote monitoring systems, enable continuous tracking and surveillance of patients' vital signs and health status, facilitating early detection of clinical deterioration and timely intervention. Moreover, these technologies promote real-time access to patient data, enhancing collaboration among healthcare providers and ensuring more coordinated and effective patient care delivery. However, alongside these benefits, significant challenges in digital transformation have been identified, particularly related to data security, IT infrastructure complexity, and barriers to technology adoption among both healthcare providers and patients. Addressing these challenges requires a multi-faceted approach, involving investment in cybersecurity infrastructure, data governance frameworks, and user training and education programs. Fostering a culture of innovation and collaboration within healthcare organizations is essential to overcoming resistance to change and promoting the adoption of digital technologies.

References

Abbasi, R., Alavi, N. M., Farzandipour, M., Gong, Y., & Nabovati, E. (2023). Using pharmacy surveillance information systems to monitor the dispensing practice of under-controlled drugs: A qualitative study on necessities, requirements, and implementation challenges. *Informatics in Medicine Unlocked*, *38*, 101198. https://doi.org/10.1016/j.imu.2023.101198

Alhammad, A., Yusof, M. Mohd., & Jambari, D. I. (2024). Towards an evaluation framework for medical device-integrated electronic medical record. *Expert Review of Medical Devices*, *21*(3), 217–229. https://doi.org/10.1080/17434440.2024.2315024

Berenbrok, L. A., Tang, S., Gabriel, N., Guo, J., Sharareh, N., Patel, N., Dickson, S., & Hernandez, I. (2022). Access to community pharmacies: A nationwide geographic information systems cross-sectional analysis. *Journal of the American Pharmacists Association*, *62*(6), 1816-1822.e2. https://doi.org/10.1016/j.japh.2022.07.003

Carvalho, R., Lobo, M., Oliveira, M., Oliveira, A. R., Lopes, F., Souza, J., Ramalho, A., Viana, J., Alonso, V., Caballero, I., Santos, J. V., & Freitas, A. (2021). Analysis of root causes of problems affecting the quality of hospital administrative data: A systematic review and Ishikawa diagram. *International Journal of Medical Informatics*, *156*, 104584. https://doi.org/10.1016/j.ijmedinf.2021.104584

Clarke, R., Colleran, M., Melanophy, G., & Bermingham, M. (2023). Enhancing the clinical pharmacy service of a large teaching hospital: Development of a new clinical prioritisation tool. *Exploratory Research in Clinical and Social Pharmacy*, *12*, 100335. https://doi.org/10.1016/j.rcsop.2023.100335

Dang, D., Dearholt, S. L., Bissett, K., Whalen, M., & Ascenzi, J. (2021). *Johns Hopkins evidence-based practice for nurses and healthcare professionals: Model & guidelines* (Fourth edition). Sigma Theta Tau International.

DeNisco, S. M. (Ed.). (2024). *Advanced practice nursing: Essential knowledge for the profession* (Fifth edition). Jones & Bartlett Learning.

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April-May 2024
ISSN: 2815-1879
DOI: 10.5281/zenodo.11445206

Falconer, N., Nand, S., Liow, D., Jackson, A., & Seddon, M. (2019). Development of an electronic patient prioritization tool for clinical pharmacist interventions. *American Journal of Health-System Pharmacy*, *71*(4), 311–320. https://doi.org/10.2146/ajhp130247

Fortune, N., Bailie, J., Gordon, J., Plunkett, K., Hargrave, J., Madden, R., & Llewellyn, G. (2023). Developing self-report disability questions for a voluntary patient registration form for general practice in Australia. *Australian and New Zealand Journal of Public Health*, *47*(2), 100032. https://doi.org/10.1016/j.anzjph.2023.100032

Geeson, C., Wei, L., & Franklin, B. D. (2019). Development and performance evaluation of the Medicines Optimisation Assessment Tool (MOAT): A prognostic model to target hospital pharmacists' input to prevent medication-related problems. *BMJ Quality & Safety*, *28*(8), 645–656. https://doi.org/10.1136/bmjqs-2018-008335

Goudreau, K. A., & Smolenski, M. C. (Eds.). (2023). *Health policy and advanced practice nursing: Impact and implications* (Third edition). Springer Publishing.

Hastings, T. J., Ha, D., Fox, B. I., Qian, J., Lakin, J., & Westrick, S. C. (2020). Assessing barriers and increasing use of immunization information systems in independent community pharmacies: Study protocol for a randomized controlled trial. *Research in Social and Administrative Pharmacy*, *16*(7), 987–992. https://doi.org/10.1016/j.sapharm.2019.10.007

Heaton, P. C., Altstadter, B., Hogea, C., Poston, S., & Ghaswalla, P. (2022). The impact of community pharmacy utilization of immunization information systems on vaccination rates: Results of a clustered randomized controlled trial. *Journal of the American Pharmacists Association*, *62*(1), 95-103.e2. https://doi.org/10.1016/j.japh.2021.09.010

Hickson, R. P., Steinke, D. T., Skitterall, C., & Williams, S. D. (2019). Evaluation of a pharmaceutical assessment screening tool to measure patient acuity and prioritise pharmaceutical care in a UK hospital. *European Journal of Hospital Pharmacy*, *24*(2), 74–79. https://doi.org/10.1136/ejhpharm-2015-000829

Javaid, M., Haleem, A., Singh, R. P., & Suman, R. (2023). 5G technology for healthcare: Features, serviceable pillars, and applications. *Intelligent Pharmacy*, *1*(1), 2–10. https://doi.org/10.1016/j.ipha.2023.04.001

Kakhi, K., Alizadehsani, R., Kabir, H. M. D., Khosravi, A., Nahavandi, S., & Acharya, U. R. (2022). The internet of medical things and artificial intelligence: Trends, challenges, and opportunities. *Biocybernetics and Biomedical Engineering*, *42*(3), 749–771. https://doi.org/10.1016/j.bbe.2022.05.008

Kaufmann, C. P., Stämpfli, D., Mory, N., Hersberger, K. E., & Lampert, M. L. (2018). Drug-Associated Risk Tool: Development and validation of a self-assessment questionnaire to screen for hospitalised patients at risk for drug-related problems. *BMJ Open*, *8*(3), e016610. https://doi.org/10.1136/bmjopen-2017-016610

Mathur, S., Antony, J., Olivia, M., Fabiane Letícia, L., Shreeranga, B., Raja, J., & Ayon, C. (2023). An empirical study into the use of 7 quality control tools in higher education institutions (HEIs). *The TQM Journal*, *35*(7), 1777–1798. https://doi.org/10.1108/TQM-07-2022-0222

Orlando, N., Edirisinghe, C., Gyacskov, I., Vickress, J., Sachdeva, R., Gomez, J. A., D'Souza, D., Velker, V., Mendez, L. C., Bauman, G., Fenster, A., & Hoover, D. A. (2023). Validation of a surface-based deformable MRI-3D ultrasound image registration algorithm toward clinical implementation for interstitial prostate brachytherapy. *Brachytherapy*, *22*(2), 199–209. https://doi.org/10.1016/j.brachy.2022.11.011

Raymond, L., Castonguay, A., Doyon, O., & Paré, G. (2022). Nurse practitioners' involvement and experience with AI-based health technologies: A systematic review. *Applied Nursing Research*, *66*, 151604. https://doi.org/10.1016/j.apnr.2022.151604

Rohani, N., & Yusof, M. Mohd. (2023). Unintended consequences of pharmacy information systems: A case study. *International Journal of Medical Informatics*, *170*, 104958. https://doi.org/10.1016/j.ijmedinf.2022.104958

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April-May 2024
ISSN: 2815-1879
DOI: 10.5281/zenodo.11445206

Ropero-Padilla, C., González-Chordá, V. M., Mena-Tudela, D., Roman, P., Cervera-Gasch, Á., & Rodriguez-Arrastia, M. (2022). Root cause analysis for understanding patient safety incidents in nursing student placements: A qualitative content analysis. *Nurse Education in Practice*, *65*, 103462. https://doi.org/10.1016/j.nepr.2022.103462

Roten, I., Marty, S., & Beney, J. (2020). Electronic screening of medical records to detect inpatients at risk of drug-related problems. *Pharmacy World & Science*, *32*(1), 103–107. https://doi.org/10.1007/s11096-009-9352-6

Saxby, K. J. E., Murdoch, R., McGuinness, J., Steinke, D. T., & Williams, S. D. (2019). Pharmacists' attitudes towards a pharmaceutical assessment screening tool to help prioritise pharmaceutical care in a UK hospital. *European Journal of Hospital Pharmacy*, *24*(6), 315–319. https://doi.org/10.1136/ejhpharm-2016-001074

Strittmatter, A., Schad, L. R., & Zöllner, F. G. (2023). Deep learning-based affine medical image registration for multimodal minimal-invasive image-guided interventions – A comparative study on generalizability. *Zeitschrift Für Medizinische Physik*, S0939388923000715. https://doi.org/10.1016/j.zemedi.2023.05.003

Suggett, E., & Marriott, J. (2020). Risk Factors Associated with the Requirement for Pharmaceutical Intervention in the Hospital Setting: A Systematic Review of the Literature. *Drugs - Real World Outcomes*, *3*(3), 241–263. https://doi.org/10.1007/s40801-016-0083-4

Tyagi, M., Tyagi, P. K., Singh, S., Sathpathy, S., Kant, S., Gupta, S. K., & Singh, R. (2023). Impact of application of queuing theory on operational efficiency of patient registration. *Medical Journal Armed Forces India*, *79*(3), 300–308. https://doi.org/10.1016/j.mjafi.2021.06.028

Wanis, M., & Yi, W. (2023). Fusion cooking with pharmacy information systems. In *Pharmaceutical Care in Digital Revolution* (pp. 199–225). Elsevier. https://doi.org/10.1016/B978-0-443-13360-2.00007-1

Woznowski, P., Fafoutis, X., Song, T., Hannuna, S., Camplani, M., Tao, L., Paiement, A., Mellios, E., Haghighi, M., Zhu, N., Hilton, G., Damen, D., Burghardt, T., Mirmehdi, M., Piechocki, R., Kaleshi, D., & Craddock, I. (2015). A multi-modal sensor infrastructure for healthcare in a residential environment. *2015 IEEE International Conference on Communication Workshop (ICCW)*, 271–277. https://doi.org/10.1109/ICCW.2015.7247190

Xiong, Z., Gong, M., Hong, J., Zhang, L., Jiang, L., & Xu, Z. (2023). Correlation analysis of the gradation design parameters and mechanical performance of semi-flexible pavement. *Construction and Building Materials*, *404*, 133206. https://doi.org/10.1016/j.conbuildmat.2023.133206

Yuliati, V., & Andriani, H. (2021). Implementation of Lean Kaizen to Reduce Waiting Time for the Indonesian Health Social Security Agency Prescription Services in Hospital Pharmacy InstallationImplementation of Lean Kaizen to Reduce Waiting Time for the Indonesian Health Social Security Agency Prescription Services in Hospital Pharmacy Installation. *Open Access Macedonian Journal of Medical Sciences*, *9*(E), 1495–1503. https://doi.org/10.3889/oamjms.2021.7610

Zatout, Y. (2012). Using wireless technologies for healthcare monitoring at home: A survey. *2012 IEEE 14th International Conference on E-Health Networking, Applications and Services (Healthcom)*, 383–386. https://doi.org/10.1109/HealthCom.2012.6379443

Zhumayeva, M., Dautov, K., Hashmi, M., & Nauryzbayev, G. (2023). Wireless energy and information transfer in WBAN: A comprehensive state-of-the-art review. *Alexandria Engineering Journal*, *85*, 261–285. https://doi.org/10.1016/j.aej.2023.11.030