International Journal of Community Medicine and Public Health
Hawsawi KB et al. Int J Community Med Public Health. 2024 Aug;11(8):3240-3244
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20241984

Review Article

Advancements in health informatics for monitoring perioperative patient data

Khaled B. Hawsawi[1]*, Ahmad M. Faqihi[2], Naif H. Albalaji[2], Ali M. Alsultan[2], Sami H. Alharbi[2], Farrag M. Almeglad[1], Fahad A. Alhajri[1]

[1]Department of Patient Affairs, Prince Sultan Military Medical City, Riyadh, Saudi Arabia
[2]Department of Health Informatics, Prince Sultan Military Medical City, Riyadh, Saudi Arabia

Received: 25 June 2024
Accepted: 16 July 2024

***Correspondence:**
Dr. Khaled B. Hawsawi,
E-mail: khaled_bh_4@hotmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Advancements in health informatics are revolutionizing perioperative care by enhancing patient monitoring, improving clinical decision-making, and promoting patient safety. The integration of electronic health records (EHR) facilitates seamless information flow across all perioperative stages, ensuring up-to-date patient data is accessible to the entire healthcare team. This accessibility reduces errors, improves coordination, and enhances overall patient outcomes. EHR systems also support standardized documentation, reducing variability in record-keeping and ensuring comprehensive patient information is consistently captured. Real-time data analytics and predictive modeling are powerful tools in perioperative settings, enabling clinicians to anticipate and manage potential complications proactively. By analyzing vast datasets, predictive models identify patterns and risk factors associated with adverse outcomes, allowing for targeted interventions and personalized care plans. Real-time analytics provide continuous monitoring of patient status during surgery, offering immediate feedback and enabling prompt adjustments to ensure patient stability. Wearable devices and remote monitoring systems further augment real-time data analytics by continuously tracking physiological parameters throughout the surgical process and into the postoperative period. This continuous data stream allows for ongoing assessment of patient status and early detection of complications, enhancing patient safety and outcomes. Health informatics solutions, including automated alerts and decision support tools, minimize human error and ensure adherence to clinical guidelines. Automated reminders for critical actions, such as timely antibiotic administration, significantly reduce the incidence of surgical site infections. Decision support tools provide real-time, evidence-based recommendations at the point of care, supporting clinicians in making informed decisions and improving patient outcomes. Additionally, health informatics facilitates continuous quality improvement by enabling the collection and analysis of performance data, informing targeted interventions and process improvements. Overall, advancements in health informatics are transforming perioperative care, offering numerous benefits in terms of efficiency, accuracy, and patient safety, ultimately leading to better patient outcomes and higher quality of care. Continued innovation in this field will be essential for maintaining and improving the standards of perioperative care.

Keywords: Perioperative monitoring, Health informatics, EHR, Patient safety

INTRODUCTION

The perioperative period, encompassing preoperative, intraoperative, and postoperative phases, is a critical time for patient care, requiring meticulous monitoring and coordination among healthcare professionals. With the advent of health informatics, the potential to enhance perioperative monitoring has significantly increased, offering improved patient outcomes, operational efficiency, and safety. Health informatics integrates information technology and healthcare to manage and analyze patient data effectively, supporting clinical decisions and optimizing workflows.[1] The traditional methods of perioperative monitoring, often reliant on

manual documentation and fragmented data systems, pose numerous challenges, including data inconsistency, delays in information transfer, and limited data accessibility. These challenges can hinder the timely and accurate assessment of patient conditions, leading to suboptimal clinical decisions and increased risk of adverse events.[2] The integration of health informatics into perioperative care addresses these issues by providing real-time data access, enhancing communication among the care team, and enabling more precise and personalized patient management.

Electronic health records (EHRs) play a pivotal role in modern health informatics, serving as comprehensive repositories of patient information accessible across various healthcare settings. In the perioperative context, EHRs facilitate seamless information flow from preoperative assessments through postoperative recovery, ensuring continuity of care and reducing the likelihood of errors.[3] Advanced EHR systems can integrate with other health informatics tools, such as anesthesia information management systems and surgical dashboards, to provide a holistic view of patient status and streamline perioperative workflows. Real-time data analytics and predictive modeling represent another significant advancement in health informatics for perioperative monitoring. These technologies leverage vast amounts of patient data to generate actionable insights, predict potential complications, and support proactive interventions. For example, predictive analytics can identify patients at high risk for postoperative complications, allowing for targeted monitoring and timely interventions, ultimately improving patient outcomes and reducing healthcare costs.[4] Furthermore, the integration of wearable devices and remote monitoring systems enables continuous tracking of vital signs and other physiological parameters, providing clinicians with real-time data to make informed decisions during and after surgery.

The implementation of health informatics in perioperative care also enhances patient safety by reducing the incidence of preventable errors. Automated alerts and reminders can prompt timely interventions, medication administration, and adherence to clinical guidelines. Additionally, health informatics supports standardized documentation and compliance with best practices, fostering a culture of safety and accountability within the surgical team. Advancements in health informatics are transforming perioperative patient monitoring, offering numerous benefits in terms of efficiency, accuracy, and patient safety. This study aims to review advancements in health informatics for monitoring perioperative patient data.

REVIEW

The integration of EHR in perioperative care has revolutionized how patient data is managed and utilized. EHRs facilitate the seamless flow of information across different phases of surgery, ensuring that all members of the healthcare team have access to up-to-date patient information. This accessibility helps reduce errors, improve coordination, and enhance overall patient outcomes. Additionally, EHR systems support clinical decision-making by providing relevant patient history, lab results, and other critical data at the point of care.[5]

Real-time data analytics and predictive modeling have emerged as powerful tools in perioperative care, enabling clinicians to anticipate and address potential complications before they occur. By analyzing vast datasets, predictive models can identify patterns and risk factors associated with adverse outcomes. For instance, machine learning algorithms can predict the likelihood of postoperative infections or complications, allowing for proactive management and tailored interventions.[6] This capability not only enhances patient safety but also optimizes resource allocation and reduces healthcare costs.

Health informatics solutions, including automated alerts and standardized protocols, play a crucial role in enhancing patient safety during the perioperative period. Automated systems can generate timely reminders for medication administration, adherence to clinical guidelines, and other critical interventions, thereby minimizing the risk of human error. Furthermore, standardized documentation supported by health informatics ensures consistent and accurate record-keeping, fostering a culture of safety and accountability within surgical teams.[7] These advancements collectively contribute to improved patient outcomes and a higher standard of care.

INTEGRATION OF EHR IN PERIOPERATIVE CARE

The integration of EHR in perioperative care has significantly enhanced the way healthcare professionals manage and utilize patient data. EHRs facilitate seamless information flow across the various stages of surgery—preoperative, intraoperative, and postoperative—ensuring that all relevant patient information is readily accessible to the healthcare team. This comprehensive access helps reduce errors, improve coordination, and ultimately enhance patient outcomes.

One of the primary benefits of EHR integration in perioperative care is the enhancement of clinical decision-making. EHR systems provide healthcare professionals with real-time access to critical patient data, such as medical history, laboratory results, medication records, and imaging studies.[7] This immediate availability of information allows clinicians to make well-informed decisions quickly, which is crucial in the fast-paced perioperative environment. For example, a surgeon can review a patient's allergy information and previous surgical history directly from the EHR, thereby avoiding potential complications during the procedure.[8] Furthermore, EHRs support standardized documentation and data entry, which are vital for maintaining consistent and accurate patient records. Standardization helps reduce variability in documentation practices among different

healthcare providers, ensuring that patient information is complete and up-to-date. This consistency is particularly important in perioperative care, where accurate record-keeping can significantly impact patient safety and surgical outcomes. For instance, standardized templates within EHR systems can guide clinicians in documenting preoperative assessments, surgical procedures, and postoperative care plans, leading to more thorough and reliable records.[9]

Another significant advantage of EHR integration is the improvement in communication and coordination among the perioperative care team. EHRs enable real-time sharing of patient information across different departments and healthcare settings, fostering collaboration and continuity of care. This connectivity ensures that all members of the surgical team, including surgeons, anesthesiologists, nurses, and postoperative care providers, have access to the same patient information. As a result, it reduces the risk of miscommunication and enhances the overall efficiency of perioperative care.[10] For example, an anesthesiologist can review a patient's preoperative assessment and lab results through the EHR, allowing for better planning and management of anesthesia during surgery.

Additionally, EHR systems often incorporate decision support tools, such as alerts and reminders, which can further enhance patient safety in the perioperative setting. These tools can prompt clinicians to perform necessary actions, such as administering prophylactic antibiotics, conducting preoperative screenings, or adhering to best practice guidelines. By providing timely and evidence-based recommendations, decision support tools within EHRs help reduce the incidence of preventable errors and complications.[11] The integration of EHRs in perioperative care offers numerous benefits, including improved clinical decision-making, standardized documentation, enhanced communication, and the use of decision support tools. These advancements collectively contribute to safer and more efficient perioperative care, ultimately leading to better patient outcomes.

REAL-TIME DATA ANALYTICS AND PREDICTIVE MODELING IN SURGICAL SETTINGS

Real-time data analytics and predictive modeling are transforming perioperative care by enabling clinicians to anticipate and address potential complications before they occur. These technologies harness vast amounts of patient data to generate actionable insights, identify patterns, and predict outcomes, thereby supporting proactive decision-making and enhancing patient safety. The application of these advanced analytics in surgical settings provides significant benefits, including the ability to improve surgical outcomes, optimize resource allocation, and reduce healthcare costs.

Predictive modeling leverages historical and real-time patient data to forecast potential perioperative risks and complications. By analyzing various data points such as patient demographics, medical history, laboratory results, and intraoperative parameters, predictive models can identify patients at high risk for adverse outcomes. For instance, models can predict the likelihood of postoperative infections, venous thromboembolism, or respiratory complications, allowing clinicians to implement targeted interventions and personalized care plans.[12] This proactive approach helps mitigate risks, reduce the incidence of complications, and improve overall patient outcomes. Real-time data analytics, on the other hand, enables continuous monitoring of patient status during surgery. Advanced monitoring systems collect and analyze data from various sources, including vital signs, anesthesia parameters, and surgical instruments. This real-time analysis provides immediate feedback to the surgical team, allowing for prompt adjustments and interventions as needed.[13] For example, if a patient's vital signs indicate potential hemodynamic instability, real-time analytics can alert the surgical team, prompting timely corrective actions to stabilize the patient. This immediate response capability is crucial in the dynamic and high-stakes environment of the operating room.

The integration of wearable devices and remote monitoring systems further enhances the capabilities of real-time data analytics in perioperative care. Wearable sensors can continuously track physiological parameters such as heart rate, oxygen saturation, and body temperature, providing valuable data throughout the surgical process and into the postoperative period. This continuous data stream allows for ongoing assessment of patient status, early detection of complications, and timely interventions, thereby improving patient safety and outcomes.[14] Moreover, predictive analytics can support surgical scheduling and resource management by forecasting patient needs and optimizing the allocation of surgical resources. By analyzing trends and patterns in surgical data, predictive models can help hospitals anticipate surgical volumes, allocate staff and equipment efficiently, and reduce delays and cancellations.[15] This optimization not only enhances operational efficiency but also improves the overall patient experience by minimizing wait times and ensuring timely access to surgical care. Real-time data analytics and predictive modeling are revolutionizing perioperative care by providing clinicians with powerful tools to anticipate, monitor, and manage patient outcomes. These technologies enhance patient safety, improve surgical outcomes, and optimize resource utilization, ultimately contributing to higher quality and more efficient perioperative care.

ENHANCING PATIENT SAFETY AND OUTCOMES THROUGH HEALTH INFORMATICS SOLUTIONS

Health informatics solutions have become integral to enhancing patient safety and outcomes in perioperative care. By leveraging advanced technologies, automated systems, and standardized protocols, health informatics

minimizes human error, improves compliance with clinical guidelines, and ensures consistent, high-quality care. These solutions support healthcare providers in making evidence-based decisions and delivering optimal patient care throughout the perioperative period. One of the primary ways health informatics enhances patient safety is through the implementation of automated alerts and reminders. These tools can notify clinicians of critical actions that need to be taken, such as administering prophylactic antibiotics, performing necessary screenings, or adhering to best practice protocols. For instance, automated reminders for timely antibiotic administration have been shown to significantly reduce the incidence of surgical site infections.[16]

By ensuring that essential steps are not overlooked, automated alerts help mitigate risks and improve patient outcomes. In addition to automated alerts, health informatics supports standardized documentation and data entry, which are crucial for maintaining accurate and comprehensive patient records. Standardized protocols and templates within EHRs guide clinicians in documenting all relevant patient information consistently. This reduces variability in documentation practices and ensures that critical information is captured uniformly across different care providers and settings.[17] Consistent and complete documentation is vital for effective communication and coordination among the perioperative care team, ultimately enhancing patient safety.

Health informatics solutions enable the integration of decision support tools that provide real-time, evidence-based recommendations at the point of care. These tools analyze patient data and offer guidance on clinical decisions, helping clinicians choose the best course of action based on current evidence and best practices. For example, decision support systems can assist in selecting appropriate anesthesia plans, managing pain, and monitoring vital signs during surgery.[18] By supporting informed decision-making, these tools contribute to better patient outcomes and reduced complications. The use of health informatics also facilitates continuous quality improvement by enabling the collection and analysis of performance data. Healthcare organizations can track key performance indicators, such as surgical outcomes, complication rates, and adherence to clinical guidelines, to identify areas for improvement. Data-driven insights from health informatics systems can inform targeted interventions, staff training, and process improvements, leading to enhanced patient safety and overall quality of care.[19]

Health informatics solutions play a critical role in enhancing patient safety and outcomes in perioperative care. Through automated alerts, standardized documentation, decision support tools, and continuous quality improvement, these technologies help mitigate risks, ensure consistent and high-quality care, and support evidence-based clinical decision-making. As the healthcare landscape continues to evolve, the integration of advanced health informatics will remain essential for delivering safe, efficient, and effective perioperative care.

CONCLUSION

Advancements in health informatics, including the integration of EHRs, real-time data analytics, and predictive modeling, have significantly enhanced perioperative patient monitoring and safety. These technologies support informed decision-making, improve coordination, and reduce the risk of complications, leading to better patient outcomes. Continued innovation in health informatics will be essential for maintaining and improving the quality of perioperative care.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Kim E-Y. Patient will see you now: The future of medicine is in your hands. Healthcare Informatics Res. 2015;21(4):321-3.
2. Blumenthal D, Tavenner M. The "meaningful use" regulation for electronic health records. N Engl J Med. 2010;363(6):501-4.
3. Donaldson MS, Corrigan JM, Kohn LT. To err is human: building a safer health system. National Academy of Sciences; 2000.
4. Bates DW, Saria S, Ohno-Machado L, Shah A, Escobar G. Big data in health care: using analytics to identify and manage high-risk and high-cost patients. Health Affairs. 2014;33(7):1123-31.
5. Wright A, McCoy AB, Hickman TT, Hilaire DS, Borbolla D, Bowes III WA, et al. Problem list completeness in electronic health records: a multi-site study and assessment of success factors. Int J Med Informatics. 2015;84(10):784-90.
6. Lee CH, Yoon H-J. Medical big data: promise and challenges. Kidney Res Clin Practice. 2017;36(1):3.
7. Classen DC, Bates DW. Finding the meaning in meaningful use. In. Volume 365: Mass Medical Soc. 2011;855-8.
8. Miller RA, Waitman LR, Chen S, Rosenbloom ST. The anatomy of decision support during inpatient care provider order entry (CPOE): empirical observations from a decade of CPOE experience at Vanderbilt. J Biomed Informatics. 2005;38(6):469-85.
9. Kauffman YS, Schroeder AE, Witt DM. Patient specific factors influencing adherence to INR monitoring. Pharmacotherapy. 2015;35(8):740-7.
10. Kuperman GJ, Gibson RF. Computer physician order entry: benefits, costs, and issues. Ann Int Med. 2003;139(1):31-9.
11. Berner ES. Clinical decision support systems. Volume 233. Springer; 2007.
12. Keshtkar L, Rashwan W, Abo-Hamad W, Arisha A. A hybrid system dynamic, discrete event simulation

and data envelopment analysis to investigate boarding patients in acute hospitals. Operations Res Health Care. 2020;26:100266.
13. Fihn SD, McDonell MB, Diehr P, Anderson SM, Bradley KA, Au DH, et al. Effects of sustained audit/feedback on self-reported health status of primary care patients. Am J Med. 2004;116(4):241-8.
14. Morris AH. Developing and implementing computerized protocols for standardization of clinical decisions. Ann Int Med. 2000;132(5):373-83.
15. Kuo M-H. Opportunities and challenges of cloud computing to improve health care services. J Med Internet Res. 2011;13(3):e1867.
16. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Committee HICPA. Guideline for prevention of surgical site infection, 1999. Infect Control Hospital Epidemiol. 1999;20(4):247-80.
17. Shekelle PG, Morton SC, Keeler EB. Costs and benefits of health information technology. Evidence Report/Technol Assessment. 2006(132):1-71.
18. Garg AX, Adhikari NK, McDonald H, Rosas-Arellano MP, Devereaux PJ, Beyene J, Sam J, Haynes RB. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. JAMA. 2005;293(10):1223-38.
19. Bates DW, Kuperman GJ, Wang S, Gandhi T, Kittler A, Volk L, et al. Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality. J Am Med Inform Assoc. 2003;10(6):523-30.

Cite this article as: Hawsawi KB, Faqihi AM, Albalaji NH, Alsultan AM, Alharbi SH, Almeglad FM, et al. Advancements in health informatics for monitoring perioperative patient data. Int J Community Med Public Health 2024;11:3240-4.