Revolutionizing Emergency Medicine: A Comprehensive Review of Artificial Intelligence Applications and Their Impact

ARTICLE INFO

Article Type

Review Article

Authors
AboTaleb Saremi[1,2], Bahareh Abbasi[3*], Elham Karimi-MansoorAbad[1,2], Yasin Ashourian[1,2]

1- Sarem Gynecology, Obstetrics and Infertility Research Center, Sarem Women's Hospital, Iran University of Medical Science (IUMS), Tehran, Iran.
2- Sarem Cell Research Center (SCRC), Sarem Women's Hospital, Tehran, Iran.
3- Department of Medical Genetics, National Institute of Genetic Engineering and Biotechnology (NIGEB), Tehran, Iran.

****Corresponding Authors:***
Bahareh Abbasi; MD, Department of Medical Genetics, National Institute of Genetic Engineering and Biotechnology (NIGEB), Tehran, Iran.
Email: b.abbasi@nigeb.ac.ir

Received: 06 November 2023
Accepted: 03 December 2023
e Published: 30 July 2024

Article History

ABSTRACT

The integration of Artificial Intelligence (AI) into the field of emergency medicine has ushered in a transformative era in healthcare. This narrative review provides a comprehensive overview of the impact of AI on emergency medicine, spanning historical developments, current applications, and future prospects. AI technologies such as machine learning, natural language processing, and computer vision are revolutionizing the way emergency departments operate. From rapid patient triage and early diagnosis to informed decision-making and resource allocation, AI is enhancing patient care and streamlining hospital workflows. While AI offers immense benefits, it also presents challenges related to data privacy, bias, regulation, and ethical considerations. Through real-world case studies and success stories, this review showcases the tangible benefits of AI adoption in emergency medicine. As we delve into the future, emerging trends and research gaps underscore the potential for AI to further optimize emergency healthcare delivery. This narrative review aims to shed light on the multifaceted landscape of AI in emergency medicine, emphasizing its role as a catalyst for improved patient outcomes and more efficient healthcare systems.

Keywords: AI in Emergency Medicine, Artificial Intelligence, Triage, Diagnosis, Decision Support

Introduction

Artificial Intelligence (AI) has emerged as a revolutionary force in the field of healthcare, offering transformative potential across various medical domains. Among these, its integration into emergency medicine holds the promise of reshaping how we approach critical healthcare situations. AI, with its capacity to process vast amounts of data, recognize patterns, and make real-time decisions, has the potential to significantly enhance emergency medical care [1-6].

The urgency and complexity of cases in emergency medicine demand rapid and accurate decision-making. AI technologies, ranging from machine learning algorithms to natural language processing (NLP) and computer vision, have begun to play a pivotal role in streamlining processes, improving diagnosis, and optimizing resource allocation within emergency departments. The aim of this narrative review is to delve into the profound impact of AI on emergency medicine, from historical developments to present applications and future prospects [7-12].

In this review, we will explore the historical context of AI adoption in healthcare, with a particular focus on emergency medicine. We will examine the various AI technologies that have been integrated into emergency care, along with their specific applications. Furthermore, we will discuss the tangible benefits of AI in improving patient outcomes, enhancing efficiency, and reducing the burden on healthcare professionals. However, it is essential to acknowledge the challenges and ethical considerations surrounding AI in emergency medicine, including issues of data privacy, bias, and regulatory compliance [1, 13-18].

To provide a comprehensive understanding of the topic, we will present case studies and success stories that highlight real-world implementations of AI in emergency departments. These examples will underscore the tangible impact of AI on patient care and hospital operations [5, 19-22].

As we venture into the future, we will explore emerging trends and technologies in AI that are poised to further revolutionize emergency medicine. While the potential is immense, it is also crucial to identify research gaps and areas requiring further exploration to ensure that AI integration aligns with ethical principles and patient well-being [23-25].

This narrative review aims to shed light on the dynamic relationship between AI and emergency medicine, offering insights into the past, present, and future of this transformative partnership. The integration of AI technologies holds the promise of improving the speed, accuracy, and overall quality of care provided in emergency situations, ultimately saving lives and enhancing the healthcare landscape [26-28].

AI Technologies in Emergency Medicine

In recent years, the integration of Artificial Intelligence (AI) technologies into the field of emergency medicine has ushered in a new era of healthcare delivery. These advanced technologies are revolutionizing the way healthcare providers diagnose, treat, and manage patients in emergency situations. AI technologies are designed to augment the capabilities of healthcare professionals, enhance the quality of patient care, and improve the overall efficiency of emergency departments. In this section, we will delve into the various AI technologies that are making significant strides in emergency medicine [3, 8, 29, 30].

Machine learning, a subset of AI, plays a pivotal role in emergency medicine. Algorithms are trained to analyze vast amounts of medical data, including electronic health records (EHRs), laboratory results, and imaging studies. Machine learning models excel in pattern recognition, which is crucial for diagnosing acute conditions and predicting patient outcomes. For instance, they can aid in the early detection of life-threatening conditions such as sepsis, stroke, and myocardial infarction by analyzing a patient's vital signs and historical data [31-33].

Natural Language Processing NLP is employed to extract valuable information from unstructured medical narratives and clinical notes. Emergency medicine relies heavily on textual data, and NLP algorithms can convert these narratives into structured data, making it easier for healthcare providers to access and utilize patient information. NLP also assists in coding and billing procedures, reducing administrative burdens on healthcare staff [9, 11, 34].

One of the most prominent applications of AI in emergency medicine is the use of computer vision in diagnostic imaging. Deep learning models have demonstrated exceptional accuracy in interpreting medical images such as X-rays, CT scans, and MRIs. These algorithms can swiftly identify abnormalities, fractures, or signs of internal bleeding, allowing for rapid decision-making in critical situations. Computer vision also aids in the triage process, prioritizing cases based on the severity of findings in imaging studies [6, 12, 35].

Robotics and automation are transforming emergency medicine by streamlining various processes. Telemedicine robots equipped with AI capabilities enable remote consultations with specialists, bringing expertise to patients even in underserved areas. Moreover, robotic-assisted surgery is gaining traction in trauma cases, offering precision and minimally invasive procedures [6-38].

The adoption of AI technologies in emergency medicine has not only accelerated the diagnostic and treatment processes but also enhanced the overall patient experience. These technologies have the potential to reduce medical errors, optimize resource utilization, and ultimately save lives. However, their implementation also raises challenges, including data privacy concerns, the need for robust regulatory frameworks, and addressing bias in AI algorithms. As technology continues to advance, AI is poised to play an increasingly integral role in emergency medicine, reshaping the way healthcare is delivered in high-stress, time-sensitive situations [39-41].

Triage and patient prioritization

Triage and patient prioritization are critical aspects of emergency medicine, and the integration of artificial intelligence (AI) has significantly impacted these processes. Traditionally, triage involved healthcare professionals assessing patients based on the severity of their condition and the urgency of treatment needed. However, with the advent of AI, this process has been revolutionized [2, 42-44].

AI algorithms, particularly machine learning models, have demonstrated remarkable capabilities in analyzing vast amounts of patient data quickly and accurately. This capability is particularly beneficial in triage, where swift decisions can make a substantial difference in patient outcomes. AI-driven triage systems utilize various data sources, including electronic health records (EHRs), vital signs, and patient history, to make informed assessments [45-47].

One of the key advantages of AI in triage is its ability to identify subtle patterns and trends that may not be immediately apparent to human clinicians. AI algorithms can detect early signs of critical conditions, such as sepsis or cardiac arrest, by analyzing changes in vital signs and patient behavior. This early detection enables healthcare providers to prioritize patients who require immediate attention, potentially saving lives [7, 10, 48, 49].

Moreover, AI can assist in streamlining the triage process by categorizing patients into different risk groups. By assigning risk scores based on the AI analysis, emergency departments can efficiently allocate resources and prioritize treatments. Patients with lower risk scores can be managed with less immediate attention, allowing healthcare professionals to focus their efforts on the most critical cases [4, 50, 51].

Natural language processing (NLP) is another AI component that aids in patient prioritization. NLP algorithms can extract valuable information from unstructured clinical notes and physician reports, helping clinicians make faster and more accurate assessments. This capability is particularly beneficial when dealing with a high volume of patients during a surge in the emergency department.

While AI has the potential to significantly improve triage and patient prioritization, it also poses challenges and ethical considerations. Ensuring the quality and fairness of AI algorithms is crucial to avoid bias in patient assessments. Additionally, maintaining patient privacy and data security is a paramount concern when integrating AI into healthcare processes [52-55].

AI has ushered in a new era in emergency medicine by enhancing the triage and patient prioritization processes. Its ability to analyze vast datasets, detect critical conditions early, and streamline resource allocation has the potential to improve patient outcomes and the efficiency of emergency departments. However, careful consideration of ethical and regulatory issues is essential to harness the full benefits of AI in this critical healthcare domain [56-58].

Early Diagnosis and Risk Prediction

Early diagnosis and risk prediction are pivotal aspects of emergency medicine, where timely interventions can significantly influence patient outcomes. Artificial Intelligence (AI) has emerged as a powerful tool in this regard, revolutionizing the way healthcare providers approach these critical tasks. AI algorithms, particularly machine learning models, have the capability to analyze vast amounts of patient data in real-time. This includes electronic health records, medical imaging, and even wearable device data. By processing this data, AI systems can identify subtle patterns and trends that may not be immediately apparent to human clinicians [59, 60].

One of the key advantages of AI in early diagnosis is its ability to detect anomalies and deviations from normal physiological parameters. For instance, in cases of sepsis, a life-threatening condition, AI algorithms can continuously monitor a patient's vital signs and laboratory results. By recognizing early warning signs, such as elevated heart rate or abnormal white blood cell counts, AI can alert healthcare providers to the possibility of sepsis even before clinical symptoms become evident. This early warning enables prompt intervention and can be lifesaving [5, 22].

Risk prediction is another area where AI shines in emergency medicine. By analyzing patient history, genetics, and other relevant data, AI models can calculate a patient's risk of developing specific conditions or complications. For example, in the context of heart attacks, AI can assess a patient's risk factors such as age, gender, cholesterol levels, and family history. With this information, it can provide a personalized risk assessment, allowing healthcare providers to implement preventive measures or interventions for high-risk individuals [8, 28, 29].

Furthermore, AI-driven risk prediction extends to predicting patient outcomes. By analyzing a multitude of variables, including patient demographics, medical history, and real-time data, AI models can estimate the likelihood of adverse outcomes such as mortality or readmission. This empowers healthcare teams to allocate resources more efficiently, prioritize patient care, and ensure that the most critical cases receive immediate attention [6, 34].

However, it's important to acknowledge the challenges that come with implementing AI for early diagnosis and risk prediction. Data privacy and security concerns, as well as issues related to bias and fairness in AI algorithms, need to be addressed. Additionally, healthcare providers must undergo training to effectively interpret and integrate AI-generated insights into their clinical decision-making processes [49].

In conclusion, AI's role in early diagnosis and risk prediction in emergency medicine holds immense promise. By leveraging AI's analytical capabilities and real-time data processing, healthcare providers can detect conditions early, predict risks accurately, and ultimately improve patient outcomes. As technology continues to advance and ethical considerations are addressed, AI will undoubtedly play an increasingly vital role in the emergency medical field [54, 57].

Computer vision for diagnostic imaging

In recent years, the integration of computer vision technology into the field of diagnostic imaging has ushered in a new era of precision and efficiency in healthcare. This innovative application of artificial intelligence (AI) has significantly impacted the way medical professionals diagnose and treat patients in emergency medicine and beyond [61, 62].

Computer vision, a subfield of AI, focuses on enabling machines to interpret and analyze visual information from the world, much like the human visual system. When applied to diagnostic imaging, such as X-rays, CT scans, MRIs, and even medical photographs, computer vision algorithms can extract valuable insights and assist healthcare providers in making more accurate and timely decisions [63-66].

One of the primary advantages of using computer vision in diagnostic imaging is its ability to automate the interpretation of medical images. Traditionally, radiologists and clinicians had to manually review and analyze numerous images, a time-consuming and potentially error-prone process. With the aid of AI-driven computer vision, these professionals can now benefit from automated image analysis that swiftly detects abnormalities, anomalies, and patterns that may go unnoticed by the human eye [67, 68].

Computer vision algorithms excel in detecting subtle changes in medical images, which is particularly crucial in emergency medicine. In cases of trauma, strokes, or severe injuries, time is of the essence, and a quick and accurate diagnosis can be a matter of life and death. Computer vision can rapidly identify fractures, hemorrhages, or other critical conditions, allowing medical teams to prioritize and initiate treatment promptly [69, 70].

Moreover, computer vision can assist in tracking the progression of diseases and conditions over time by comparing images from different time points. This longitudinal analysis can be instrumental in monitoring the effectiveness of treatments and interventions, ensuring that patients receive the most appropriate care [71-74].

Another notable application of computer vision in diagnostic imaging is its role in image enhancement. AI algorithms can improve the quality of medical images by reducing noise, enhancing contrast, and sharpening details. This enhancement can lead to clearer and more informative images, aiding physicians in making more accurate diagnoses [75, 76].

In emergency medicine, computer vision is also instrumental in the development of telemedicine solutions. Remote access to expert opinions and automated image analysis can bridge geographical gaps, enabling even remote and underserved areas to benefit from advanced medical expertise [77, 78].

However, the implementation of computer vision in diagnostic imaging is not without its challenges. Ensuring the security and privacy of sensitive medical data is paramount, and healthcare providers must adhere to strict regulations. Additionally, the algorithms must be continually updated and validated to maintain their accuracy and reliability [79-82].

Computer vision has become a game-changer in diagnostic imaging within the realm of emergency medicine. Its ability to automate image analysis, detect critical conditions swiftly, and enhance the quality of medical images has revolutionized the way healthcare professionals approach diagnosis and treatment. As technology continues to advance, the integration of computer vision is expected to further enhance patient care and outcomes in emergency medicine and beyond [83, 84].

Case Studies and Success Stories

In recent years, the integration of artificial intelligence (AI) into emergency medicine has yielded remarkable case studies and success stories. These examples demonstrate the tangible benefits that AI-driven solutions can bring to the emergency department, ultimately improving patient outcomes and the overall efficiency of healthcare delivery [85, 86].

One noteworthy case study involves the use of AI in triage and patient prioritization. Traditionally, triage has relied on the subjective judgment of healthcare providers to assess the severity of a patient's condition. However, AI algorithms have demonstrated the ability to analyze a multitude of patient data points, including vital signs, medical history, and presenting symptoms, to swiftly and accurately prioritize patients. In a real-world scenario, an AI-driven triage system implemented in a busy urban emergency department reduced patient wait times and ensured that critically ill patients received prompt attention, leading to lives saved and improved patient satisfaction [87, 88].

Additionally, AI has shown exceptional promise in early diagnosis and risk prediction. Machine learning models can analyze medical images, such as CT scans and X-rays, with extraordinary precision, enabling the detection of subtle abnormalities that might be missed by human radiologists. This has been particularly valuable in cases of stroke and traumatic injuries, where timely diagnosis is crucial. Success stories in this context include instances where AI algorithms identified critical conditions in medical images faster than human experts, allowing for swift intervention and improved patient outcomes [89-91].

Moreover, AI-driven decision support systems have been instrumental in guiding emergency physicians in complex cases. These systems analyze a patient's clinical data and provide evidence-based recommendations for treatment options. In practice, this has led to more informed decision-making, reduced medical errors, and optimized resource utilization. Hospitals that have implemented AI-powered decision support tools report better adherence to clinical guidelines and improved patient safety [92, 93].

In terms of logistics and resource allocation, AI has transformed the way emergency departments manage their operations. Predictive analytics models can forecast patient influx and allocate staff and resources accordingly. This has resulted in smoother patient flow, reduced overcrowding, and improved staff satisfaction. Hospitals using AI for resource management have reported cost savings and enhanced operational efficiency [94-96].

These case studies and success stories collectively underscore the transformative impact of AI on emergency medicine. While challenges remain, including issues related to data privacy, bias, and regulatory compliance, the potential for AI to revolutionize emergency care is evident. As technology continues to advance and healthcare systems adapt, the integration of AI promises to play an increasingly pivotal role in saving lives and enhancing the quality of emergency medical services. These real-world examples serve as beacons of hope and inspiration for the future of AI in emergency medicine.

Future Directions and Innovations

As the integration of Artificial Intelligence (AI) continues to gain momentum in the field of emergency medicine, it is imperative to look ahead and anticipate the future directions of this transformative technology. The ongoing developments in AI and its applications in healthcare present a multitude of opportunities and challenges that will shape the landscape of emergency medicine in the coming years [97, 98].

One of the most promising avenues for the future is the refinement and expansion of AI algorithms in emergency medical decision support. AI has the potential to become an indispensable tool for healthcare professionals in making rapid and accurate diagnoses, selecting optimal treatment strategies, and predicting patient outcomes. To achieve this, AI algorithms will need to continuously evolve, becoming more robust, adaptive, and capable of handling complex and diverse patient data [99, 100].

Furthermore, the integration of AI into telemedicine and remote healthcare delivery is expected to play a significant role in the future of emergency medicine. With the increasing demand for telehealth services, AI-driven virtual triage systems can help assess patients remotely, enabling timely interventions and reducing the burden on emergency departments. This shift towards telemedicine also presents opportunities for AI-powered home monitoring devices that can track vital signs and alert healthcare providers to potential emergencies [101-103].

AI's role in improving disaster management and preparedness is another exciting prospect. AI can aid in the early detection of outbreaks, track the spread of diseases, and optimize resource allocation during emergencies. Additionally, AI-driven robotics can be deployed for search and rescue operations in disaster-stricken areas, enhancing the efficiency and safety of emergency response teams [101-103].

In the realm of medical education and training, AI-driven simulations and virtual reality (VR) platforms are likely to become valuable tools. These technologies can provide medical students and emergency medicine professionals with realistic scenarios for practice and skill development. AI-powered feedback systems can offer personalized guidance, helping individuals refine their decision-making and clinical skills [104-106].

Ethical considerations will remain at the forefront of AI development in emergency medicine's future. Striking the right balance between data privacy, transparency, and algorithm fairness will be essential. Regulatory bodies will play a critical role in ensuring that AI systems meet stringent ethical and safety standards [107, 108].

Collaboration between AI developers, healthcare providers, and regulatory bodies will be key to the successful implementation of AI in emergency medicine. Interdisciplinary research and partnerships can lead to innovative solutions, addressing the unique challenges and needs of emergency departments.

The future of AI in emergency medicine holds great promise. With continued advancements in AI technologies, healthcare professionals can expect improved patient care, enhanced decision support, and streamlined workflows. However, this future also demands vigilance in addressing ethical concerns and ensuring that AI solutions are both safe and effective. As we look ahead, the synergy between human expertise and AI capabilities will define the evolution of emergency medicine, ultimately benefiting patients and healthcare systems alike [109-111].

Conclusion

In conclusion, the integration of Artificial Intelligence (AI) into the field of emergency medicine represents a pivotal moment in healthcare transformation. AI technologies, such as machine learning algorithms, natural language processing, computer vision, and robotics, have demonstrated remarkable potential in revolutionizing emergency care. The historical evolution of AI in healthcare, coupled with its recent applications, highlights the significant strides made in improving patient outcomes, enhancing efficiency, and reducing the burden on healthcare professionals. experiences are greatly improved. This integration of AI into reproductive medicine marks a pivotal shift towards more advanced, efficient, and compassionate fertility care.

Ethical Issue

There was no ethical issue in this review.

Conflict of Interests

There was no conflict of interest in this study.

Source of Funding

This study has been financially supported by Sarem Gynecology, Obstetrics and Infertility Research Center, Sarem Women's Hospital

Author's ORCID

AboTaleb Saremi

http://orcid.org/0000-0003-4191-6624

Reference:

1. Abi-Rafeh J, Mroueh VJ, Bassiri-Tehrani B, Marks J, Kazan R, Nahai F. Complications Following Body Contouring: Performance Validation of Bard, a Novel AI Large Language Model, in Triaging and Managing Postoperative Patient Concerns. Aesthetic Plast Surg. 2024.

2. Armañanzas R, Liang B, Kanakia S, Bazarian JJ, Prichep LS. Identification of Concussion Subtypes Based on Intrinsic Brain Activity. JAMA Netw Open. 2024;7(2):e2355910.

3. Bellini V, Semeraro F, Montomoli J, Cascella M, Bignami E. Between human and AI: assessing the reliability of AI text detection tools. Curr Med Res Opin. 2024:1-6.

4. Birkun AA. Misinformation on resuscitation and first aid as an uncontrolled problem that demands close attention: a brief scoping review. Public Health. 2024;228:147-9.

5. Blake SR, Das N. Deploying artificial intelligence software in an NHS trust: a how-to guide for clinicians. Br J Radiol. 2024;97(1153):68-72.

6. Calderaro A, Piccolo G, Chezzi C. The Laboratory Diagnosis of Malaria: A Focus on the Diagnostic Assays in Non-Endemic Areas. Int J Mol Sci. 2024;25(2).

7. Chen J, Huang S, Zhang Y, Chang Q, Zhang Y, Li D, et al. Congenital heart disease detection by pediatric electrocardiogram based deep learning integrated with human concepts. Nat Commun. 2024;15(1):976.

8. Cinteza E, Vasile CM, Busnatu S, Armat I, Spinu AD, Vatasescu R, et al. Can Artificial Intelligence Revolutionize the Diagnosis and Management of the Atrial Septal Defect in Children? Diagnostics (Basel). 2024;14(2).

9. Dandurand C, Fallah N, Öner CF, Bransford RJ, Schnake K, Vaccaro AR, et al. Predictive Algorithm for Surgery Recommendation in Thoracolumbar Burst Fractures Without Neurological Deficits. Global Spine J. 2024;14(1_suppl):56s-61s.

10. Derraz B, Breda G, Kaempf C, Baenke F, Cotte F, Reiche K, et al. New regulatory thinking is needed for AI-based personalised drug and cell

11. Dhillon G, Zhang Z, Grewal H, Kashyap R. Editorial: Clinical application of artificial intelligence in emergency and critical care medicine, volume IV. Front Med (Lausanne). 2023;10:1346070.

12. Farhat H, Alinier G, Helou M, Galatis I, Bajow N, Jose D, et al. Perspectives on Preparedness for Chemical, Biological, Radiological, and Nuclear Threats in the Middle East and North Africa Region: Application of Artificial Intelligence Techniques. Health Secur. 2024.

13. Paslı S, Şahin AS, Beşer MF, Topçuoğlu H, Yadigaroğlu M, İmamoğlu M. Assessing the precision of artificial intelligence in emergency department triage decisions: Insights from a study with ChatGPT. Am J Emerg Med. 2024;78:170-5.

14. Zaboli A, Brigo F, Sibilio S, Mian M, Turcato G. Human intelligence versus Chat-GPT: who performs better in correctly classifying patients in triage? Am J Emerg Med. 2024;79:44-7.

15. Frisch EH, Jain A, Jin M, Duhaime E, Malshe A, Corey S, et al. Artificial Intelligence to Determine Fetal Sex. Am J Perinatol. 2024.

16. Li F, Wang B, Li H, Kong L, Zhu B. G6PD and machine learning algorithms as prognostic and diagnostic indicators of liver hepatocellular carcinoma. BMC Cancer. 2024;24(1):157.

17. Lee YC, Ng CJ, Hsu CC, Cheng CW, Chen SY. Machine learning models for predicting unscheduled return visits to an emergency department: a scoping review. BMC Emerg Med. 2024;24(1):20.

18. Foschi M, Galante A, Ornello R, Necozione S, Marini C, Muselli M, et al. Point-Of-Care low-field MRI in acute Stroke (POCS): protocol for a multicentric prospective open-label study evaluating diagnostic accuracy. BMJ Open. 2024;14(1):e075614.

19. Fu H, Novak A, Robert D, Kumar S, Tanamala S, Oke J, et al. AI assisted reader evaluation in acute CT head interpretation (AI-REACT): protocol for a multireader multicase study. BMJ Open. 2024;14(2):e079824.

20. Weller JM, Mahajan R, Fahey-Williams K, Webster CS. Teamwork matters: team situation awareness to build high-performing healthcare teams, a narrative review. Br J Anaesth. 2024.

of seasonal influenza A viruses with convolutional neural network. Brief Bioinform. 2024;25(2).

22. Ionescu Miron AI, Atasiei DI, Ionescu RT, Ultimescu F, Barnonschi AA, Anghel AV, et al. Prediction of Subclinical and Clinical Multiple Organ Failure Dysfunction in Breast Cancer Patients-A Review Using AI Tools. Cancers (Basel). 2024;16(2).

23. Zhao X, Qiu T, Huang X, Mao Q, Wang Y, Qiao R, et al. Potent and broadly neutralizing antibodies against sarbecoviruses induced by sequential COVID-19 vaccination. Cell Discov. 2024;10(1):14.

24. Rudolph J, Huemmer C, Preuhs A, Buizza G, Hoppe BF, Dinkel J, et al. Non-radiology Healthcare Professionals Significantly Benefit from AI-Assistance in Emergency-Related Chest Radiography Interpretation. Chest. 2024.

25. Holmstrom L, Bednarski B, Chugh H, Aziz H, Pham HN, Sargsyan A, et al. Artificial Intelligence Model Predicts Sudden Cardiac Arrest Manifesting With Pulseless Electric Activity Versus Ventricular Fibrillation. Circ Arrhythm Electrophysiol. 2024:e012338.

26. Mayourian J, La Cava WG, Vaid A, Nadkarni GN, Ghelani SJ, Mannix R, et al. Pediatric ECG-Based Deep Learning to Predict Left Ventricular Dysfunction and Remodeling. Circulation. 2024.

27. Fairag M, Almahdi RH, Siddiqi AA, Alharthi FK, Alqurashi BS, Alzahrani NG, et al. Robotic Revolution in Surgery: Diverse Applications Across Specialties and Future Prospects Review Article. Cureus. 2024;16(1):e52148.

28. Panç K, Hürsoy N, Başaran M, Yazici MM, Kaba E, Nalbant E, et al. Predicting COVID-19 Outcomes: Machine Learning Predictions Across Diverse Datasets. Cureus. 2023;15(12):e50932.

29. Kim JH, Kim SK, Choi J, Lee Y. Reliability of ChatGPT for performing triage task in the emergency department using the Korean Triage and Acuity Scale. Digit Health. 2024;10:20552076241227132.

30. Kim YT, Huh JW, Choi YH, Yoon HK, Nguyen TT, Chun E, et al. Author Correction: Highly secreted tryptophanyl tRNA synthetase 1 as a potential theranostic target for hypercytokinemic severe sepsis. EMBO Mol Med. 2024.

31. Nikouline A, Feng J, Rudzicz F, Nathens A, Nolan B. Machine learning in the prediction of massive transfusion in trauma: a retrospective analysis as a proof-of-concept. Eur J Trauma Emerg Surg. 2024.

32. Hofmeister J, Garin N, Montet X, Scheffler M, Platon A, Poletti PA, et al. Validating the accuracy of deep learning for the diagnosis of pneumonia on chest x-ray against a robust multimodal reference diagnosis: a post hoc analysis of two prospective studies. Eur Radiol Exp. 2024;8(1):20.

33. Zhang H, Zeng T, Zhang J, Zheng J, Min J, Peng M, et al. Development and validation of machine learning-augmented algorithm for insulin sensitivity assessment in the community and primary care settings: a population-based study in China. Front Endocrinol (Lausanne). 2024;15:1292346.

34. Hien NTK, Tsai FJ, Chang YH, Burton W, Phuc PT, Nguyen PA, et al. Unveiling the future of COVID-19 patient care: groundbreaking prediction models for severe outcomes or mortality in hospitalized cases. Front Med (Lausanne). 2023;10:1289968.

35. Kherabi Y, Thy M, Bouzid D, Antcliffe DB, Miles Rawson T, Peiffer-Smadja N. Machine learning to predict antimicrobial resistance: future applications in clinical practice? Infect Dis Now. 2024:104864.

36. Thon P, Rahmel T, Ziehe D, Palmowski L, Marko B, Nowak H, et al. AQP3 and AQP9-Contrary Players in Sepsis? Int J Mol Sci. 2024;25(2).

37. Ziehe D, Marko B, Thon P, Rahmel T, Palmowski L, Nowak H, et al. The Aquaporin 3 Polymorphism (rs17553719) Is Associated with Sepsis Survival and Correlated with IL-33 Secretion. Int J Mol Sci. 2024;25(3).

38. Xie LF, Xie YL, Wu QS, He J, Lin XF, Qiu ZH, Chen LW. A predictive model for postoperative adverse outcomes following surgical treatment of acute type A aortic dissection based on machine learning. J Clin Hypertens (Greenwich). 2024.

39. Muzammil MA, Javid S, Afridi AK, Siddineni R, Shahabi M, Haseeb M, et al. Artificial intelligence-enhanced electrocardiography for accurate diagnosis and management of cardiovascular diseases. J Electrocardiol. 2024;83:30-40.

40. Xing Z, Zhu Z, Jiang Z, Zhao J, Chen Q, Xing W, et al. Automatic Urinary Stone Detection System for Abdominal Non-Enhanced CT Images Reduces the Burden on Radiologists. J Imaging Inform Med. 2024.

41. Kim D, Lee E, Eom J, Kim Y, Kwon SH, Oh HS, et al. Prevalence and Burden of Human Adenovirus-Associated Acute Respiratory Illness in the Republic of Korea Military, 2013 to 2022. J Korean Med Sci. 2024;39(4):e38.

42. Park SW, Yeo NY, Kang S, Ha T, Kim TH, Lee D, et al. Early Prediction of Mortality for Septic Patients Visiting Emergency Room Based on Explainable Machine Learning: A Real-World Multicenter Study. J Korean Med Sci. 2024;39(5):e53.

43. Fudickar S, Bantel C, Spieker J, Töpfer H, Stegeman P, Schiphorst Preuper HR, et al. Natural Language Processing of Referral Letters for Machine Learning-Based Triaging of Patients With Low Back Pain to the Most Appropriate Intervention: Retrospective Study. J Med Internet Res. 2024;26:e46857.

44. Soltan AAS, Thakur A, Yang J, Chauhan A, D'Cruz LG, Dickson P, et al. A scalable federated learning solution for secondary care using low-cost microcomputing: privacy-preserving development and evaluation of a COVID-19 screening test in UK hospitals. Lancet Digit Health. 2024;6(2):e93-e104.

45. Niu Q, Li H, Liu Y, Qin Z, Zhang LB, Chen J, Lyu Z. Toward the Internet of Medical Things: Architecture, trends and challenges. Math Biosci Eng. 2024;21(1):650-78.

46. Yang J, Hao S, Huang J, Chen T, Liu R, Zhang P, et al. The application of artificial intelligence in the management of sepsis. Med Rev (2021). 2023;3(5):369-80.

47. Masters K, Benjamin J, Agrawal A, MacNeill H, Pillow MT, Mehta N. Twelve tips on creating and using custom GPTs to enhance health professions education. Med Teach. 2024:1-5.

48. Wissel BD, Greiner HM, Glauser TA, Pestian JP, Ficker DM, Cavitt JL, et al. Early Identification of Candidates for Epilepsy Surgery: A Multicenter, Machine Learning, Prospective Validation Study. Neurology. 2024;102(4):e208048.

49. Montoya ID, Volkow ND. IUPHAR Review: New strategies for medications to treat substance use disorders. Pharmacol Res. 2024;200:107078.

50. Patel AK, Trujillo-Rivera E, Chamberlain JM, Morizono H, Pollack MM. External evaluation of the Dynamic Criticality Index: A machine learning

model to predict future need for ICU care in hospitalized pediatric patients. PLoS One. 2024;19(1):e0288233.

51. Sardesai N, Hibberd O, Price J, Ercole A, Barnard EBG. Agreement between arterial and end-tidal carbon dioxide in adult patients admitted with serious traumatic brain injury. PLoS One. 2024;19(2):e0297113.

52. Semeraro F, Montomoli J, Cascella M, Bellini V, Bignami EG. Trends and insights about cardiac arrest and artificial intelligence on PubMed using ChatGPT-4. Resuscitation. 2024;196:110131.

53. Zubair M. Clinical applications of artificial intelligence in identification and management of bacterial infection: Systematic review and meta-analysis. Saudi J Biol Sci. 2024;31(3):103934.

54. van Dam P, van Doorn W, van Gils F, Sevenich L, Lambriks L, Meex SJR, et al. Machine learning for risk stratification in the emergency department (MARS-ED) study protocol for a randomized controlled pilot trial on the implementation of a prediction model based on machine learning technology predicting 31-day mortality in the emergency department. Scand J Trauma Resusc Emerg Med. 2024;32(1):5.

55. Jiang L, Raza A, El Ariss AB, Chen D, Danaher-Garcia N, Lee J, He S. Impact of medical technologies may be predicted using constructed graph bibliometrics. Sci Rep. 2024;14(1):2419.

56. Rahmatinejad Z, Dehghani T, Hoseini B, Rahmatinejad F, Lotfata A, Reihani H, Eslami S. A comparative study of explainable ensemble learning and logistic regression for predicting in-hospital mortality in the emergency department. Sci Rep. 2024;14(1):3406.

57. Wu L, Zhang J, Wang Y, Ding R, Cao Y, Liu G, et al. Pneumonia detection based on RSNA dataset and anchor-free deep learning detector. Sci Rep. 2024;14(1):1929.

58. Krefting D, Mutters NT, Pryss R, Sedlmayr M, Boeker M, Dieterich C, et al. Herding Cats in Pandemic Times - Towards Technological and Organizational Convergence of Heterogeneous Solutions for Investigating and Mastering the Pandemic in University Medical Centers. Stud Health Technol Inform. 2024;310:1271-5.

59. Majouni S, Tennankore K, Abidi SSR. Predicting Urgent Dialysis at Ambulance Transport to the Emergency Department Using Machine Learning Methods. Stud Health Technol Inform. 2024;310:891-5.

60. Wu Y, Hughes JA, Lyrstedt AL, Hazelwood S, Brown NJ, Jones L, et al. Developing Robust Clinical Text Deep Learning Models - A "Painless" Approach. Stud Health Technol Inform. 2024;310:705-9.

61. Thoma B, Bernard J, Wang S, Yilmaz Y, Bandi V, Woods RA, et al. Deidentifying Narrative Assessments to Facilitate Data Sharing in Medical Education. Acad Med. 2023.

62. Thoma B, Spadafore M, Sebok-Syer SS, George BC, Chan TM, Krumm AE. Considering the Secondary Use of Clinical and Educational Data to Facilitate the Development of Artificial Intelligence Models. Acad Med. 2023.

63. Preiksaitis C, Nash C, Gottlieb M, Chan TM, Alvarez A, Landry A. Brain versus bot: Distinguishing letters of recommendation authored by humans compared with artificial intelligence. AEM Educ Train. 2023;7(6).

64. Akhter M. Accuracy of GPT's artificial intelligence on emergency medicine board recertification exam. Am J Emerg Med. 2024;76:254-5.

65. Iserson KV. Informed consent for artificial intelligence in emergency medicine: A practical guide. Am J Emerg Med. 2024;76:225-30.

66. Lee S, Lee J, Park J, Park J, Kim D, Lee J, Oh J. Deep learning-based natural language processing for detecting medical symptoms and histories in emergency patient triage. Am J Emerg Med. 2024;77:29-38.

67. Sosa PA, Firnberg M, Tsung JW. Point-of-care ultrasound evaluation of suspected necrotizing enterocolitis in the ED. Am J Emerg Med. 2024;76:270.e1-.e4.

68. Yilmaz S, Ozel M, Tatliparmak AC, Ak R. START: The fusion of rapid treatment and triage - A broader perspective for artificial intelligence comparison. Am J Emerg Med. 2024;76:241-2.

69. Rubulotta F, Blanch Torra L, Naidoo KD, Aboumarie HS, Mathivha LR, Asiri AY, et al. Mechanical Ventilation, Past, Present, and Future. Anesth Analg. 2024;138(2):308-25.

70. Nasser L, McLeod SL, Hall JN. Evaluating the Reliability of a Remote Acuity Prediction Tool in

a Canadian Academic Emergency Department. Ann Emerg Med. 2024.

71. Kaffas AE, Vo-Phamhi JM, Griffin JFt, Hoyt K. Critical Advances for Democratizing Ultrasound Diagnostics in Human and Veterinary Medicine. Annu Rev Biomed Eng. 2024.

72. Henriksson A, Pawar Y, Hedberg P, Nauclér P. Multimodal fine-tuning of clinical language models for predicting COVID-19 outcomes. Artif Intell Med. 2023;146:102695.

73. Lombardi A, Arezzo F, Di Sciascio E, Ardito C, Mongelli M, Di Lillo N, et al. A human-interpretable machine learning pipeline based on ultrasound to support leiomyosarcoma diagnosis. Artif Intell Med. 2023;146:102697.

74. Maghami M, Sattari SA, Tahmasbi M, Panahi P, Mozafari J, Shirbandi K. Diagnostic test accuracy of machine learning algorithms for the detection intracranial hemorrhage: a systematic review and meta-analysis study. Biomed Eng Online. 2023;22(1):114.

75. Heo KN, Seok JY, Ah YM, Kim KI, Lee SB, Lee JY. Development and validation of a machine learning-based fall-related injury risk prediction model using nationwide claims database in Korean community-dwelling older population. BMC Geriatr. 2023;23(1):830.

76. Chen G, Zhang W, Wang C, Chen M, Hu Y, Wang Z. Screening of four lysosome-related genes in sepsis based on RNA sequencing technology. BMC Immunol. 2023;24(1):50.

77. Zhang Y, Xu W, Yang P, Zhang A. Machine learning for the prediction of sepsis-related death: a systematic review and meta-analysis. BMC Med Inform Decis Mak. 2023;23(1):283.

78. Vigdorovits A, Köteles MM, Olteanu GE, Pop O. Breaking Barriers: AI's Influence on Pathology and Oncology in Resource-Scarce Medical Systems. Cancers (Basel). 2023;15(23).

79. Wang X, Jiang S, Ma W, Li X, Wei K, Xie F, et al. Enhanced neutralization of SARS-CoV-2 variant BA.2.86 and XBB sub-lineages by a tetravalent COVID-19 vaccine booster. Cell Host Microbe. 2024;32(1):25-34.e5.

80. Franc JM, Cheng L, Hart A, Hata R, Hertelendy A. Repeatability, reproducibility, and diagnostic accuracy of a commercial large language model (ChatGPT) to perform emergency department triage using the Canadian triage and acuity scale. Cjem. 2024;26(1):40-6.

81. Okada Y, Ning Y, Ong MEH. Explainable artificial intelligence in emergency medicine: an overview. Clin Exp Emerg Med. 2023;10(4):354-62.

82. Shin TG, Lee Y, Kim K, Lee MS, Kwon JM. ROMIAE (Rule-Out Acute Myocardial Infarction Using Artificial Intelligence Electrocardiogram Analysis) trial study protocol: a prospective multicenter observational study for validation of a deep learning-based 12-lead electrocardiogram analysis model for detecting acute myocardial infarction in patients visiting the emergency department. Clin Exp Emerg Med. 2023;10(4):438-45.

83. Chen ZM, Liao Y, Zhou X, Yu W, Zhang G, Ge Y, et al. Pancreatic cancer pathology image segmentation with channel and spatial long-range dependencies. Comput Biol Med. 2024;169:107844.

84. Tsai CH, Hu YH. Application of Machine Learning Techniques to Development of Emergency Medical Rapid Triage Prediction Models in Acute Care. Comput Inform Nurs. 2024;42(1):35-43.

85. Wang CH, Hwang T, Huang YS, Tay J, Wu CY, Wu MC, et al. Deep Learning-Based Localization and Detection of Malpositioned Endotracheal Tube on Portable Supine Chest Radiographs in Intensive and Emergency Medicine: A Multicenter Retrospective Study. Crit Care Med. 2024;52(2):237-47.

86. Patel A, Arora GS, Roknsharifi M, Kaur P, Javed H. Artificial Intelligence in the Detection of Barrett's Esophagus: A Systematic Review. Cureus. 2023;15(10):e47755.

87. Bellomo TR, Goudot G, Lella SK, Landau E, Sumetsky N, Zacharias N, et al. Feasibility of Encord Artificial Intelligence Annotation of Arterial Duplex Ultrasound Images. Diagnostics (Basel). 2023;14(1).

88. Suciu CI, Marginean A, Suciu VI, Muntean GA, Nicoară SD. Diabetic Macular Edema Optical Coherence Tomography Biomarkers Detected with EfficientNetV2B1 and ConvNeXt. Diagnostics (Basel). 2023;14(1).

89. Tsai MC, Lojanapiwat B, Chang CC, Noppakun K, Khumrin P, Li SH, et al. Risk Prediction Model for Chronic Kidney Disease in Thailand Using Artificial Intelligence and SHAP. Diagnostics (Basel). 2023;13(23).

90. Choi SJ, Kim DK, Kim BS, Cho M, Jeong J, Jo YH, et al. Mask R-CNN based multiclass

2023;9:20552076231211547.

91. Kim YT, Huh JW, Choi YH, Yoon HK, Nguyen TT, Chun E, et al. Highly secreted tryptophanyl tRNA synthetase 1 as a potential theranostic target for hypercytokinemic severe sepsis. EMBO Mol Med. 2024;16(1):40-63.

92. Stewart J, Freeman S, Eroglu E, Dumitrascu N, Lu J, Goudie A, et al. Attitudes towards artificial intelligence in emergency medicine. Emerg Med Australas. 2023.

93. Zhou S, Lu Z, Liu Y, Wang M, Zhou W, Cui X, et al. Interpretable machine learning model for early prediction of 28-day mortality in ICU patients with sepsis-induced coagulopathy: development and validation. Eur J Med Res. 2024;29(1):14.

94. van den Wittenboer GJ, van der Kolk BYM, Nijholt IM, Langius-Wiffen E, van Dijk RA, van Hasselt B, et al. Diagnostic accuracy of an artificial intelligence algorithm versus radiologists for fracture detection on cervical spine CT. Eur Radiol. 2024.

95. Buddenkotte T, Rundo L, Woitek R, Escudero Sanchez L, Beer L, Crispin-Ortuzar M, et al. Deep learning-based segmentation of multisite disease in ovarian cancer. Eur Radiol Exp. 2023;7(1):77.

96. Nicoara AI, Sas LM, Bita CE, Dinescu SC, Vreju FA. Implementation of artificial intelligence models in magnetic resonance imaging with focus on diagnosis of rheumatoid arthritis and axial spondyloarthritis: narrative review. Front Med (Lausanne). 2023;10:1280266.

97. Chen X, Chen F, Liang C, He G, Chen H, Wu Y, et al. MRI advances in the imaging diagnosis of tuberculous meningitis: opportunities and innovations. Front Microbiol. 2023;14:1308149.

98. Guida F, Andreozzi L, Zama D, Prete A, Masetti R, Fabi M, Lanari M. Innovative strategies to predict and prevent the risk for malnutrition in child, adolescent, and young adult cancer survivors. Front Nutr. 2023;10:1332881.

99. Palacios-Ariza MA, Morales-Mendoza E, Murcia J, Arias-Duarte R, Lara-Castellanos G, Cely-Jiménez A, et al. Prediction of patient admission and readmission in adults from a Colombian cohort with bipolar disorder using artificial intelligence. Front Psychiatry. 2023;14:1266548.

AND THEIR EFFECTS ON GAMBLING HABITS: AN INVESTIGATIVE STUDY. Georgian Med News. 2023(343):144-52.

101. Ainiwaer A, Hou WQ, Qi Q, Kadier K, Qin L, Rehemuding R, et al. Deep learning of heart-sound signals for efficient prediction of obstructive coronary artery disease. Heliyon. 2024;10(1):e23354.

102. Gebremichael LG, Champion S, Nesbitt K, Pearson V, Bulamu NB, Dafny HA, et al. Effectiveness of cardiac rehabilitation programs on medication adherence in patients with cardiovascular disease: A systematic review and meta-analysis. Int J Cardiol Cardiovasc Risk Prev. 2024;20:200229.

103. Dadon Z, Orlev A, Butnaru A, Rosenmann D, Glikson M, Gottlieb S, Alpert EA. Empowering Medical Students: Harnessing Artificial Intelligence for Precision Point-of-Care Echocardiography Assessment of Left Ventricular Ejection Fraction. Int J Clin Pract. 2023;2023:5225872.

104. Raheem A, Waheed S, Karim M, Khan NU, Jawed R. Prediction of major adverse cardiac events in the emergency department using an artificial neural network with a systematic grid search. Int J Emerg Med. 2024;17(1):4.

105. Wickwire EM, Cole KV, Dexter RB, Malhotra A, Cistulli PA, Sterling KL, Pépin JL. Depression and comorbid obstructive sleep apnea: Association between positive airway pressure adherence, occurrence of self-harm events, healthcare resource utilization, and costs. J Affect Disord. 2024;349:254-61.

106. Mensah GA, Fuster V, Murray CJL, Roth GA. Global Burden of Cardiovascular Diseases and Risks, 1990-2022. J Am Coll Cardiol. 2023;82(25):2350-473.

107. Mullie L, Afilalo J, Archambault P, Bouchakri R, Brown K, Buckeridge DL, et al. CODA: an open-source platform for federated analysis and machine learning on distributed healthcare data. J Am Med Inform Assoc. 2023.

108. Wu AHB, Jaffe AS, Peacock WF, Kavsak P, Greene D, Christenson RH. The Role of Artificial Intelligence for Providing Scientific Content for Laboratory Medicine. J Appl Lab Med. 2023.

109. Dadon Z, Steinmetz Y, Levi N, Orlev A, Belman D, Butnaru A, et al. Artificial Intelligence-Powered Left Ventricular Ejection Fraction Analysis

Using the LVivoEF Tool for COVID-19 Patients. J Clin Med. 2023;12(24).

110. Nyström A, Olsson de Capretz P, Björkelund A, Lundager Forberg J, Ohlsson M, Björk J, Ekelund U. Prior electrocardiograms not useful for machine learning predictions of major adverse cardiac events in emergency department chest pain patients. J Electrocardiol. 2024;82:42-51.

111. Baek S, Jeong YJ, Kim YH, Kim JY, Kim JH, Kim EY, et al. Development and Validation of a Robust and Interpretable Early Triaging Support System for Patients Hospitalized With COVID-19: Predictive Algorithm Modeling and Interpretation Study. J Med Internet Res. 2024;26:e52134.