Discrepancies between Promised and Actual AI Capabilities in Continuous Vital Sign Monitoring for In-Hospital Patients: A Review of Current Evidence

Samuel Moniz*

Department of Mechanical Engineering, Catholic University of Portugal, Edifício Reitoria, Portugal

Introduction

The integration of artificial intelligence into healthcare has garnered significant attention, particularly in the domain of continuous vital sign monitoring for in-hospital patients. Continuous monitoring systems, augmented by AI algorithms, promise to revolutionize patient care by enabling early detection of clinical deterioration, reducing the burden on healthcare staff, and improving patient outcomes [1]. These systems leverage AI to analyze large volumes of data in real-time, identifying subtle patterns and anomalies that might elude human observation. However, despite these promises, discrepancies often exist between the anticipated capabilities of AI-driven systems and their actual performance in clinical settings. This review critically examines these gaps, highlighting the evidence from current research and real-world applications.

One of the primary promises of AI in continuous vital sign monitoring is the early detection of clinical deterioration, such as sepsis, cardiac arrest, or respiratory failure. AI systems are designed to process streams of physiological data, including heart rate, respiratory rate, blood pressure, and oxygen saturation, using machine learning algorithms to detect deviations indicative of impending clinical events. In theory, these systems can provide actionable alerts with high sensitivity and specificity, reducing delays in intervention and improving patient outcomes. However, evidence from real-world applications often reveals significant limitations. Many AI systems exhibit high false positive rates, leading to alarm fatigue among clinicians. Alarm fatigue, characterized by desensitization to frequent alerts, undermines the very purpose of these systems, as critical warnings may be overlooked amidst a flood of non-critical notifications. Studies have shown that the specificity of AI-driven monitoring systems often falls short of expectations, with many systems failing to balance sensitivity and specificity effectively [2].

Description

A critical challenge in the adoption of AI for continuous vital sign monitoring is the lack of transparency and interpretability of many AI algorithms. Clinicians are often reluctant to rely on AI systems that function as "black boxes," providing outputs without clear explanations of the underlying reasoning. This lack of interpretability can hinder trust and adoption, as clinicians may be unwilling to act on recommendations they do not fully understand. While some progress has been made in developing explainable AI models, many systems still fall short in providing intuitive and clinically meaningful explanations for their outputs. Regulatory and ethical considerations also play a significant role in the gap between promised and actual capabilities. AI systems in healthcare must undergo rigorous validation and approval processes to ensure their safety and efficacy. However, the dynamic nature of AI algorithms, which can evolve and adapt over time, poses challenges for traditional regulatory frameworks. Additionally, concerns about data privacy and security can limit the availability of high-quality datasets for training and validation, further constraining the performance of AI systems. Ethical concerns, such as bias in AI algorithms and the potential for unequal access to advanced monitoring technologies, further complicate their implementation in diverse healthcare settings.

The financial implications of AI-driven monitoring systems cannot be overlooked. While these systems are often marketed as cost-effective solutions, their implementation and maintenance can involve substantial upfront and ongoing costs. Hospitals must invest in infrastructure, training, and system integration, which may strain budgets, particularly in resource-limited settings. Additionally, the return on investment for these systems is not always clear, as the cost savings from improved patient outcomes and reduced length of stay may take time to materialize and depend on the system's reliability and accuracy.

Conclusion

While AI-driven continuous vital sign monitoring holds great promise for in-hospital patient care, significant discrepancies exist between expectations and real-world performance. These gaps stem from challenges related to sensitivity, specificity, generalizability, workflow integration, interpretability, regulatory and ethical considerations, and cost. Addressing these issues requires a multidisciplinary approach that combines technical innovation with practical insights from clinical practice. By focusing on quality, transparency, and collaboration, the potential of AI in continuous monitoring can be fully realized, paving the way for safer, more efficient, and more personalized healthcare

References

1. McQuillan Peter, Sally Pilkington, Alison Allan and Bruce Taylor, et al. "Confidential inquiry into quality of care before admission to intensive care." *Bmj* 316 (1998): 1853-1858.

2. Helen McGloin, R. G. N., Sheila K. Adam and Mervyn Singer. "Unexpected Deaths and Referrals to Intensive Care of Patients on General Wards–Are Some Cases Potentially Avoidable?." *J R Coll Physicians* 33 (1999): 255.

***Address for Correspondence**: Samuel Moniz, Department of Mechanical Engineering, Catholic University of Portugal, Edifício Reitoria, Portugal; E-mail: samueloniz@gmail.pt*