

Are we ready to adapt artificial intelligence for early sepsis detection?

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Madam, Sepsis is a condition which entails life threatening organ dysfunction due to poorly regulated host response to infection¹. It is a common cause of both morbidity and mortality¹. Males and females both are at risk of death from sepsis, with males being at an increased risk². The cause is variable but respiratory tract and urinary tract infections commonly lead to sepsis in Pakistan². The

composite and optimum score, higher scores being associated with increased mortality³. SOFA score is complex and time taking prompted the development of a quick SOFA (or qSOFA) for the earlier diagnosis of sepsis which includes respiratory rate of 22 breaths/minute or more, Glasgow coma scale score of less than 15, and systolic blood pressure of 100 mm of Hg or less. Patients

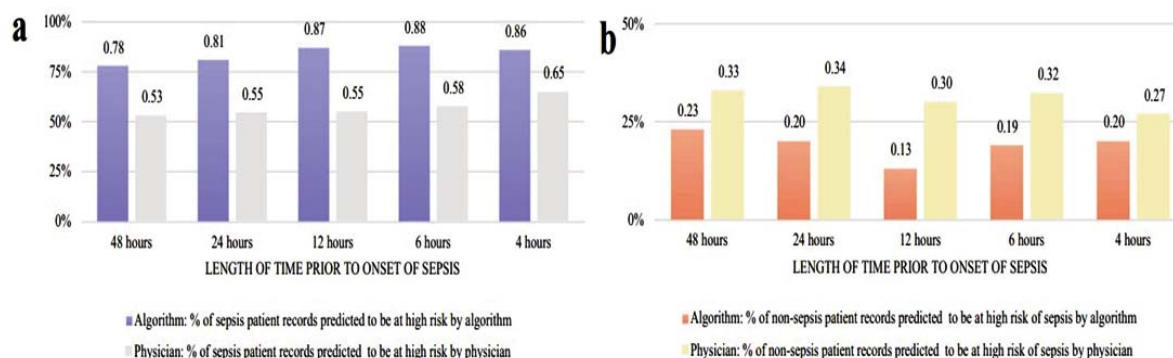


Figure: Comparing the performance of the SERA algorithm vs. physician. (a) The bars represent the percentage of sepsis patient records correctly flagged as having a high risk of sepsis (likely to have sepsis) by either the algorithm or physicians. The chart compares the true positive rate of the algorithm's prediction at different lengths of time before the onset of sepsis against the true positive rate of physicians' prediction in the hospital. (b) The bars represent the percentage of non-sepsis patient records erroneously flagged as having a high risk of sepsis (likely to have sepsis) by either the algorithm or physicians. The chart compares the false-positive rate of the algorithm's prediction at different lengths of time before the onset of sepsis against the false-positive rate of physicians' prediction in the hospital.

diagnosis of sepsis has always been a challenge to physicians, internists, and critical care specialists. According to more recent guidelines, sepsis can be diagnosed by a combination of suspected infection and two or more points in the Sequential Organ Failure Assessment (SOFA) score¹. SOFA assigns 1 to 4 points to each system working in the body, such that 24 is a

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having met any two of the qSOFA criteria along with suspected infection can be managed for sepsis¹.

Recent advances in biomedical computation potentiate early sepsis detection through Artificial Intelligence (AI) by granting computers and machines power to simulate the problem-solving and decision-making capabilities of the human mind by utilizing computer science and robust datasets. These datasets are mainly available as structured and unstructured clinical data in the Electronic Medical Record (EMR)⁴. Structured data (such as heart rate, systolic blood pressure, diastolic blood pressure) and unstructured data (such as free-form clinical notes or radiological

images) registered by nurse, lab reports and prescribed medications are inputted as data streams are used to create Machine Learning Algorithms such as “Sepsis early risk assessment (SERA)” algorithm developed by K Huat Goh et al.⁴ and “Early Warning System (EWS 2.0)” derived and validated by H M. Giannini et al.⁵ which allows both early detection and diagnosis of Sepsis. SERA algorithm potentially flags patients with sepsis that physicians may have overlooked in stressful hospital environments, therefore effectively flagging 21–32% more patients than clinicians 4-48 hours before sepsis onset with fewer chances of false positive results, as seen in figure⁴.

Sepsis affects 30 million people yearly, causing around six million deaths, with mortality rates reported as high as 30-40% in South East Asia⁶. Many of our population fluxes into public sector health care manage their illnesses. Provided the huge burden on the health sector, sepsis and its consequences remain a frequent cause of death, especially in medicine wards and intensive care units. Surviving Sepsis Campaign (SSC) guidelines provide a standardized approach to sepsis management⁷; however, diagnosis and early detection of sepsis is often an undervalued life-saving dimension where potential research investment such as in AI Detection Systems could generate clinically significant outcomes i.e. it will help our health care settings not only in early diagnosis but also aid in the prompt recognition of critical downfalls during the management of sepsis to prevent significant morbidity

and mortality.

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