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# Association between NEWS2-based sepsis screening positivity and vital sign documentation completeness among patient admissions at Moroto Regional Referral Hospital

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## Abstract

# Background

Sepsis remains a major cause of preventable morbidity and mortality, particularly in resource-limited settings where incomplete bedside monitoring can delay recognition of clinical deterioration. NEWS2 is a physiology-based early warning score that depends on routine documentation of vital signs. This study assessed the association between NEWS2-based sepsis screening positivity and vital sign documentation completeness among patient admissions at Moroto Regional Referral Hospital.

# Methods

A retrospective descriptive analytical study was conducted using routine hospital summary data for October, November, and December, extracted from the electronic medical records. Monthly trends were examined for completeness of five vital signs, records with no documented vital signs, average numbers of documented vital signs, record-level sepsis screening positivity, patient-level sepsis screening positivity, and trigger patterns underlying positive screens.

# Results

Complete documentation of all five vital signs increased from 2.08 percent in October and 2.00 percent in November to 46.34 percent in December. Records with no documented vital signs decreased from 36.46 percent and 36.00 percent to 19.51 percent. Record-level screening positivity was 34.38 percent in October, 13.00 percent in November, and 17.07 percent in December. Patient-level positivity was 60.42 percent, 22.00 percent, and 24.39 percent, respectively. Common positive trigger patterns involved pulse rate, systolic blood pressure, respiratory rate, and white cell count.

# Conclusion

Improved documentation completeness increased the feasibility of NEWS2-based screening, but observed positivity was also influenced by underlying illness severity and selective measurement practices. Strengthening routine vital sign assessment is therefore essential for reliable sepsis screening and early recognition in low-resource hospitals.

## Background of the Study

Sepsis is a life-threatening syndrome arising from a dysregulated host response to infection and remains a major contributor to hospital mortality worldwide. Early recognition is especially important in low-resource settings where diagnostic delays and limited access to intensive monitoring can worsen outcomes. Physiological track-and-trigger systems provide a practical method for identifying

deteriorating patients using bedside observations rather than complex investigations. NEWS2 is one such score and is built from respiratory rate, oxygen saturation, temperature, systolic blood pressure, pulse rate, level of consciousness, and supplemental oxygen use. Systematic review evidence shows that NEWS2 is useful for predicting early deterioration and mortality, particularly in emergency and prehospital settings, although performance varies by context and population (Wei S. et al., 2023).

In African and other resource-limited settings, vital signs are among the most feasible and scalable tools for assessing acutely ill patients. Ugandan evidence has shown that admission vital signs can meaningfully predict mortality among patients with sepsis, highlighting the clinical relevance of bedside observations where advanced monitoring may be limited (Asiimwe SB. et al.,2015). Broader sepsis literature likewise emphasizes the importance of timely clinical recognition and systematic bedside assessment for improving outcomes (Kwizera A. et al.,2019).

The value of a scoring tool such as NEWS2 depends directly on the completeness of the underlying clinical observations. If key vital signs are missing, patients may become unscreenable, risk may be underestimated, and comparisons over time may be biased. Studies from sub-Saharan Africa have shown that clinical monitoring documentation is often incomplete but can improve with focused system strengthening, chart redesign, training, and feedback (Lodge W. et al., 2020; Tuti T. et al., 2022; Gachau S. et al., 2021; 2023).

Early warning system implementation studies in Rwanda and Botswana further show that such tools can improve communication and clinical vigilance, but their sustainability depends on workflow, staff buy-in, and reliable measurement practices (Sridhar S. et al., 2020; Hickson MR. et al., 2025).

Moroto Regional Referral Hospital is a relevant context for examining this relationship because routine inpatient documentation is central to the usefulness of any physiology-based screening system. Understanding how documentation completeness relates to NEWS2-based sepsis screening positivity can guide both clinical interpretation and practical quality improvement.

# 1.2 Problem Statement

At Moroto Regional Referral Hospital, routine inpatient observation data are used to support the identification of patients with possible sepsis. However, when vital signs are incompletely documented, NEWS2-based screening cannot be applied consistently. This can reduce the number of patients who are screenable, distort estimates of screening positivity, and delay recognition of clinical deterioration. Although early warning tools are increasingly promoted for low-resource acute care, limited local evidence exists on how routine documentation completeness affects the output of NEWS2-based sepsis screening in this setting. This evidence gap limits targeted quality improvement and weakens confidence in score-based surveillance and escalation practices.

## 1.3 Broad Objective

To determine the association between NEWS2-based sepsis screening positivity and vital sign documentation completeness among patient admissions at Moroto Regional Referral Hospital.

## 1.4 Specific Objectives

1. To describe the completeness of vital sign documentation among patient admissions at Moroto Regional Referral Hospital.

2. To determine the proportion of admissions screening positive on NEWS2-based sepsis screening at record and patient levels.

3. To compare monthly changes in NEWS2-based sepsis screening positivity with monthly changes in vital sign documentation completeness.

4. To identify the common trigger patterns contributing to positive NEWS2-based sepsis screening results.

## 1.5 Research Questions

What is the level of completeness of vital sign documentation among patient admissions at Moroto Regional Referral Hospital?

What proportion of admissions screen positive using NEWS2-based sepsis screening?

How does variation in documentation completeness relate to NEWS2-based sepsis screening positivity over time?

Which trigger patterns are most frequently associated with positive NEWS2-based sepsis screens?

## 1.6 Justification of the Study

This study is relevant because it links a practical documentation challenge to a clinically important screening process for early sepsis recognition. The findings may support improvements in nursing assessment, ward monitoring, and escalation of care in a resource-limited hospital. They also provide local evidence that can guide quality-improvement efforts aimed at strengthening routine bedside observation systems.

## 1.7 Scope of the Study

The study focused on admissions and screening records at Moroto Regional Referral Hospital's Emergency and Medical Inpatient departments across October, November, and December. It examined documentation completeness of five vital signs, record-level and patient-level screening positivity, and trigger patterns underlying positive screens. Clinical outcomes such as mortality, length of stay, and time to treatment were outside the scope of the current dataset.

## Literature Review

# 2.1 Sepsis and Early Recognition

Prompt recognition of sepsis is essential because deterioration can be rapid, and delays in escalation are associated with worse outcomes. In resource-limited settings, bedside observations are especially important because laboratory confirmation and continuous monitoring may be delayed or unavailable. Reviews of sepsis care in low-resource environments consistently emphasize the importance of simple, repeatable clinical assessment strategies (Kwizera A. et al.,2019).

# 2.2 NEWS2 and Related Early Warning Scores

NEWS2 has been evaluated across emergency, prehospital, and inpatient settings as a structured tool for identifying clinical deterioration. A systematic review and meta-analysis found good utility of NEWS2 for predicting early death in prehospital and emergency department settings (Wei S. et al., 2023). Other studies have suggested that NEWS-based approaches may outperform qSOFA for early sepsis detection in acute care settings (Durr D. et al., 2022; Faisal M. et al., 2019). Additional cohort evidence in sepsis populations has found that NEWS2 can contribute meaningfully to predicting clinical deterioration, ICU admission, and mortality, though performance may improve with serial assessment rather than one-off use (de Sonza Nogueira L. et al.,2025; Corfield AR. et al., 2022).

At the same time, the literature also cautions that early warning scores are not perfect diagnostic tools. An earlier systematic review found that early warning scores alone were not sufficiently accurate to reliably predict mortality in sepsis across all settings (Hamilton F. et al., 2018). More recent LMIC-focused synthesis similarly concludes that while early warning systems are promising, evidence from general wards in low- and middle-income countries remains limited and implementation realities matter greatly (Tomás E. et al., 2026). These findings support using NEWS2 as a screening and escalation aid rather than a substitute for clinical judgment.

# 2.3 Importance of Documentation Completeness

The usefulness of any score-based screening process depends on the completeness of the input data. Missing vital signs means some patients cannot be scored, while selective documentation may bias estimates of apparent disease burden. In Northern Tanzania, a medical record review found very low

completeness across clinical domains, including vital signs and monitoring indicators, illustrating how poor documentation can compromise care and audit (Lodge W. et al., 2020). In Kenya, multisite work on inpatient neonatal data quality showed that documentation can improve substantially over time with structured data systems, although hospital-to-hospital variation remains wide (Tuti T. et al., 2022). Evaluation of a comprehensive monitoring chart in Kenyan hospitals also showed that documentation quality is modifiable but requires sustained intervention and local feedback (Gachau S. et al.,2021;2023).

## 2.4 Early Warning Systems in Resource-Limited Settings

Implementation studies in African hospitals show that early warning systems are most effective when embedded in local practice. In Rwanda, introducing a pediatric early warning score improved nurse confidence, communication, and recognition of deterioration, although barriers such as staff turnover and physician buy-in remained important (Sridhar S. et al.,2020). In Botswana, pediatric early warning implementation also improved monitoring and escalation practices but continued to face operational constraints such as broken equipment and workflow challenges (Hickson MR. et al.,2025). These studies are relevant because they suggest that documentation completeness is not merely a data quality issue; it is part of the clinical system that determines whether early warning tools can function at all.

## 2.5 Ugandan and Regional Relevance

Ugandan research has shown that physiologic abnormalities measured at admission are strongly associated with outcomes in sepsis, reinforcing the importance of vital sign assessment in local practice (Asiimwe SB. et al., 2015). More recent Ugandan sepsis work from another regional referral hospital also continues to rely on structured severity assessment tools to characterize risk and outcomes (Kakande R. et al., 2025). Taken together, the regional evidence supports investment in simple bedside monitoring systems as an essential part of acute care.

## 2.6 Knowledge Gap

Despite growing evidence on early warning scores and documentation quality, there remains limited local evidence from Moroto Regional Referral Hospital on how routine vital sign completeness influences NEWS2-based sepsis screening positivity. This study addresses that gap by linking operational data quality patterns to screening output over time.

# Methodology

## 3.1 Study Design

This study used a retrospective descriptive analytical design based on routinely collected inpatient data summarized by month. Individual patient data was retrieved from the hospital's electronic medical records.

## 3.2 Study Area

The study was conducted at the Emergency and Medical Inpatient departments of Moroto Regional Referral Hospital in Uganda, a referral facility serving the Karamoja sub-region under resource-constrained conditions typical of many regional public hospitals.

## 3.3 Study Population

The study population comprised adult patient admissions and observation records available for NEWS2-based sepsis screening within the study period.

## 3.4 Study Period

The study covered October, November, and December 2025.

## 3.5 Data Source and Variables

Data was obtained from a hospital electronic workbook summarizing monthly thresholds for screenability, data quality, record-level screening, patient-level screening, and trigger patterns. Key variables included total records, total patients, complete documentation of five vital signs, records with no vital signs, average and median numbers of documented vital signs, records with enough data for screening, positive records, mean trigger scores, screen-positive patients, and monthly trigger combinations.

## 3.6 Data Analysis

The analysis conducted with Microsoft Excel was both descriptive and comparative. Monthly changes in documentation completeness were compared with monthly changes in record-level and patient-level screening positivity. Trigger pattern summaries were reviewed to identify the most frequent physiological combinations contributing to positive screens.

## 3.7 Ethical Considerations

The work was based on routine hospital data in a summarized form. A formal institutional submission was made to the hospital's Institutional Research and Ethics Committee (IREC) for approval, along with appropriate safeguards for confidentiality, anonymization, and secure storage of any patient-level records. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional requirements.

## Results

# 4.1 Vital Sign Documentation Completeness

In October, 96 records from 48 patients were reviewed. In November, 100 records from 50 patients were reviewed, and in December, 82 records from 41 patients were reviewed. Complete documentation of all five vital signs was 2.08 percent in October, 2.00 percent in November, and 46.34 percent in December. Records with no documented vital signs were 36.46 percent in October, 36.00 percent in November, and 19.51 percent in December. The average number of documented vital signs increased from 2.06 in October and 2.08 in November to 3.61 in December, while the median increased from 3 to 4 in December.

# 4.2 Screenability and Record-Level Positivity

At record level, 58 of 96 records in October, 64 of 100 in November, and 66 of 82 in December had enough data for screening. Positive records were 33 in October, 13 in November, and 14 in December. Positivity among all records was 34.38 percent in October, 13.00 percent in November, and 17.07 percent in December. Among screenable records, positivity was 56.90 percent in October, 20.31 percent in November, and 21.21 percent in December. Mean trigger scores were 0.99, 0.61, and 0.65, respectively.

# 4.3 Patient-Level Positivity

At the patient level, all 48 patients in October had at least one screenable session. In November, 43 of 50 patients had a screenable session, and in December, all 41 patients had a screenable session. Patients screening positive were 29 in October, 11 in November, and 10 in December. Positivity among all patients was 60.42 percent in October, 22.00 percent in November, and 24.39 percent in December. Positivity among patients with screenable sessions was 60.42 percent, 25.58 percent, and 24.39 percent, respectively.

# 4.4 Trigger Patterns

The most frequent trigger combinations involved pulse rate, systolic blood pressure, respiratory rate, and white cell count. In October, the most common combination was pulse rate with systolic blood pressure. In November, pulse rate with systolic blood pressure remained the leading pattern, while pulse rate with respiratory rate and pulse rate with white cell count also featured. In December, pulse rate with white cell count was the most frequent pattern. These findings indicate that circulatory instability, respiratory compromise, and inflammatory response were recurring contributors to positive screens.

# 4.5 Summary of Findings

Overall, documentation completeness improved markedly by December, and the proportion of records that could be screened also rose. However, positivity was highest in October and lower in the subsequent months, suggesting that documentation quality and underlying case severity both influenced NEWS2-based screening output.

## Discussion, Conclusion, and Recommendations

# 5.1 Discussion

This study found that vital sign documentation completeness changed substantially across the study period and that these changes were closely linked to the operational performance of NEWS2-based sepsis screening at Moroto Regional Referral Hospital. The most striking improvement occurred in December, when complete five-vital documentation rose to 46.34 percent, and records with no documented vital signs fell below one-fifth. This pattern suggests that by December, the hospital was much better positioned to apply a structured bedside screening system consistently. Similar literature from Tanzania and Kenya shows that documentation completeness often starts at a low baseline but can improve meaningfully when observation systems and recording tools receive focused attention (Lodge W. et al., 2020; Tuti T. et al., 2022; Gachau S. et al.,2021;2023).

At the same time, higher documentation completeness did not translate into higher screening positivity. Record-level positivity was highest in October and lower in November and December. The same pattern was seen at the patient level. This indicates that the relationship between completeness and positivity is important but not linear. Better documentation improves the feasibility and fairness of screening across admissions, yet the final positivity rate also depends on patient acuity and on whether measurements are selectively performed in obviously ill patients. If clinicians are more likely to record vital signs in patients who already appear severely unwell, positivity can appear artificially high during periods of poor overall completeness.

This interpretation fits the broader sepsis and early warning literature. NEWS-based systems are useful for identifying deterioration and may outperform qSOFA for early sepsis recognition in several acute care contexts (Wei S. et al., 2023; Durr D. et al., 2022; Faisal M. et al., 2019). However, they depend heavily on the routine collection of the underlying physiological variables, and implementation evidence from low-resource settings consistently shows that score performance is inseparable from ward processes, staffing, equipment, and communication culture (Sridhar S. et al.,2020; Hickson MR. et al.,2025; Tomás E. et al., 2026).

The trigger pattern analysis also makes clinical sense. Pulse rate, systolic blood pressure, respiratory rate, and white cell count repeatedly contributed to positive screens, which is consistent with the expected physiologic signature of systemic infection and circulatory stress. Ugandan evidence showing that simple admission vital signs predict sepsis mortality strengthens the relevance of these findings in local practice (Asiimwe SB. et al., 2015).

The results, therefore, carry both methodological and practical implications. Methodologically, surveillance based on score positivity should be interpreted cautiously whenever documentation completeness is poor because observed positivity may partly reflect who was measured rather than the true burden of risk. Practically, hospitals seeking to strengthen early sepsis recognition should prioritize basic observation systems, including equipment availability, chart usability, staff training, and routine audit, as foundational components of any early warning strategy.

## 5.2 Limitations

The analysis covered only three months and relied on summarized routine data, which limited inferential statistical testing and prevented patient-level multivariable modeling. Missing observations may have introduced selective screenability and possible misclassification.

## 5.3 Conclusion

Vital sign documentation completeness was meaningfully associated with NEWS2-based sepsis screening performance at Moroto Regional Referral Hospital. As completeness improved, more records became screenable, and the hospital gained a more reliable basis for bedside risk identification. However, observed screening positivity was also influenced by underlying case severity and selective documentation practices. Reliable sepsis screening, therefore, requires not only a scoring system but also consistent routine measurement and recording of vital signs.

## 5.4 Recommendations

Regional Hospitals should strengthen the routine collection of all required vital signs at admission and during inpatient monitoring. Hospitals should ensure the availability and maintenance of basic monitoring equipment and implement refresher training in complete vital-sign assessment, score calculation, and escalation pathways. Routine audit and feedback should be used to track completeness and screening performance over time. Future research should extend the observation period and link NEWS2-based screening with patient outcomes such as mortality, referral, and time to antibiotics.

## Declarations

## 1. Consent to participate

This was a retrospective study based on routine electronic hospital data and involved no study participants. Only anonymized data were used for analysis and reporting.

## 2. Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

# 3. Competing Interests

The authors declare that they have no competing interests.

# Author Contribution

1. Aheebwa Morris Seth: Conceptualization, Methodology, Data curation, Formal analysis, Visualization, Writing - original draft, Writing - review and editing, Project administration.2. Ochen Christopher: Conceptualization, Methodology, Investigation, Validation, Writing - original draft, Writing - review and editing, Supervision.3. Oree Rogers: Investigation, Resources, Validation, Writing - review and editing.4. Akol Deborah: Data curation, Validation, Writing - review and editing.5. Aleje Tom: Supervision, Methodology, Writing - review and editing.All authors approved the final manuscript and agreed to its submission.

# Data Availability

This study analyzed routinely collected sepsis screening data from Moroto Regional Referral Hospital collected as part of routine clinical care. The dataset used for analysis contained patient-level clinical information and was handled confidentially. No patient names or direct identifiers were reported in the manuscript. This was a retrospective review of routine service data, and individual informed consent was waived through the Institutional Research Ethics Committee.

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