

IMPROVING RECOGNITION AND TIMELY ESCALATION OF CLINICAL DETERIORATION IN GENERAL MEDICAL INPATIENTS USING NEWS 2 A CLINICAL AUDIT AND PDSA-BASED QUALITY IMPROVEMENT PROJECT

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Abstract

Background: Clinical deterioration in hospitalised medical patients may initially present with changes in routine physiological observations. Timely recognition of these changes and appropriate escalation are therefore important components of safe inpatient care. The National Early Warning Score 2 (NEWS2) provides a standardised method for assessing physiological deterioration and can support communication and escalation within general medical wards. However, its effectiveness in practice depends on complete observation recording, accurate scoring, and recognition of abnormal scores, escalation and a reliable response pathway.

Aim: To improve the recognition and timely escalation of clinical deterioration among adult general medical inpatients at Ayub Teaching Hospital, Abbottabad, through the structured use of NEWS2.

Methods: A prospective before-and-after quality-improvement clinical audit using Plan-Do-Study-Act (PDSA) methodology was conducted in the Medical B Unit of Ayub Teaching Hospital, Abbottabad, Khyber Pakhtunkhwa, Pakistan. The baseline audit was performed from 1 March to 10 May 2025, followed by an intervention phase from 10 May to 31 May 2025 and a post-intervention audit from 10 June to 20 August 2025. The intervention consisted of focused staff and house officers education, standardized NEWS2 documentation, accessible NEWS2 scoring guidance, reinforcement of the escalation pathway, and feedback during implementation. Eligible adult general medical inpatients were assessed using the same predefined audit criteria before and after the intervention. The primary process measure was complete and correctly calculated NEWS2 assessment. Secondary measures included completeness of physiological observations, NEWS2 documentation, and recognition of triggering scores, documented clinical escalation, clinical review, and repeat monitoring. Descriptive statistics and categorical comparisons were used to assess changes between the baseline and post-intervention periods.

Results: A total of 121 patients were included in the baseline audit and 128 in the post-intervention audit. Complete documentation of the physiological observations required for NEWS2 increased from 58.5% to 88.9%, while documentation of a NEWS2 score increased from 45.8% to 83.3% (both

$p < 0.001$). Complete and correctly calculated NEWS2 assessment improved from 39.0% at baseline to 77.8% after the intervention ($p < 0.001$). Among NEWS2 trigger episodes, appropriate recognition increased from 61.8% to 87.2% ($p = 0.012$), while documented appropriate clinical escalation increased from 47.1% to 79.5% ($p = 0.004$). Documentation of clinical review following a trigger improved from 41.2% to 74.4% ($p = 0.004$), and documentation of an appropriate repeat-observation or monitoring plan increased from 35.3% to 71.8% ($p = 0.002$). The predefined target of at least 80% compliance was achieved for complete physiological observations and NEWS2 score documentation, but not for complete NEWS2 assessment or appropriate escalation.

Conclusion: A structured NEWS2-based quality-improvement intervention was associated with substantial improvement in the assessment, documentation, recognition, and escalation of clinical deterioration among general medical inpatients. The findings indicate that combining staff education with standardised documentation, accessible scoring guidance, and a defined escalation pathway can improve key deterioration-recognition processes within a tertiary-care medical ward. However, compliance with complete NEWS2 assessment and appropriate escalation remained below the predefined target, highlighting the need for continued reinforcement, re-audit, and further PDSA cycles to sustain and extend the improvement.

Introduction

Background

Clinical deterioration among hospitalised medical patients is an important patient-safety concern because worsening illness may initially be reflected by subtle changes in routine physiological observations before the development of severe organ dysfunction, cardiac arrest, or the need for critical care. Early recognition therefore depends not only on identifying abnormal vital signs, but also on recording them consistently, recognising clinically important changes over time, and ensuring that abnormal findings lead to an appropriate and timely response. International guidance recommends routine physiological monitoring of acutely ill adults using a structured track-and-trigger system, together with a clearly defined escalation pathway for patients identified as being at increasing risk of deterioration.^{1,2} The National Early Warning Score 2 (NEWS2), developed by the Royal College of Physicians, provides a standardised approach to assessing acute physiological disturbance in adults. It combines respiratory rate, oxygen saturation, systolic blood pressure, pulse rate, temperature, and level of consciousness or new confusion, while

also incorporating whether the patient is receiving supplemental oxygen.¹ By converting routinely measured observations into a single score, NEWS2 provides a common language for communicating severity of illness across nursing and medical teams and can support decisions regarding increased monitoring, urgent clinical review, and escalation of care. The value of such systems, however, depends on accurate measurement and documentation of the underlying observations and on linking abnormal scores to an appropriate clinical response rather than treating the score as a substitute for bedside assessment.^{1,2} There is substantial evidence supporting the prognostic value of early warning scores in adult hospital patients. A systematic review of early warning scores found that these tools generally demonstrate useful discrimination for clinical deterioration, although important methodological differences exist between scores, populations, outcomes, and prediction windows.³ A further systematic review specifically examining NEWS and NEWS2 showed that their ability to predict mortality is strongest over the short term, particularly within 24 hours, and that performance becomes less reliable when used to

predict outcomes over longer periods.⁴ These findings are relevant to ward-based practice because NEWS2 is primarily intended to identify patients who require attention now or in the near term, rather than to determine long-term prognosis. Importantly, clinical deterioration should therefore be considered a dynamic process, with repeated observations and trends potentially providing more information than an isolated score. In a prospective study of 11,331 general ward patients, rising NEWS values over the first three days of admission were associated with subsequent mortality, whereas NEWS values tended to decline among survivors.⁵

Evidence also suggests that implementation of an early warning score can alter clinical behaviour, particularly when the score is accompanied by a defined escalation protocol. In a large UK teaching hospital, introduction of NEWS2 and its associated escalation pathway was accompanied by a marked increase in recorded escalations to the registrar.⁶ This is clinically important because recognition without action does not address the underlying patient-safety problem. NICE guidance similarly emphasises that patients with abnormal physiology should have an appropriate graded response, with increased observation, urgent medical assessment, or emergency escalation according to the severity of the abnormality.² Thus, an effective NEWS2 system is not simply a scoring exercise; it is a process linking observation, calculation, interpretation, communication, review, and intervention. At the same time, the evidence should not be interpreted as showing that NEWS2 alone improves outcomes in every setting. A recent systematic review published in 2026 found low-certainty evidence suggesting an association between use of NEWS/NEWS2 and lower in-hospital mortality, while also highlighting substantial heterogeneity and a lack of high-quality intervention studies.⁷ This distinction is particularly important for quality-improvement work, because successful implementation depends on the surrounding clinical system, including staff familiarity with the tool, reliable observation practices, clear escalation thresholds, availability of senior review, and appropriate access to higher levels of care. Recent validation data from a large

tertiary hospital in Singapore demonstrated strong performance of NEWS2 for predicting clinical deterioration and mortality in an Asian general-ward population, while also showing more modest performance for some individual outcomes such as unplanned intensive care admission.⁸

The need for context-sensitive implementation is especially relevant to hospitals in low- and middle-income countries, where evidence regarding early warning systems remains more limited and healthcare resources, staffing structures, monitoring practices, and escalation pathways may differ from those in high-income settings. A 2026 systematic review of adult general-ward patients in low- and middle-income countries found that early warning scores, particularly NEWS and MEWS, generally demonstrated moderate-to-good discrimination for in-hospital mortality, but also highlighted substantial heterogeneity and limited evidence on implementation and clinical effectiveness.⁷ A quality-improvement project from Bangladesh provides a relevant regional example: after training healthcare staff and introducing a NEWS2-based monitoring and response process in a high-dependency setting, the investigators reported improved utilisation of the score and a reduction in unrecognised deterioration associated with cardiac arrest and intensive care transfer.⁹

For a busy tertiary-care general medical service such as the Medical B Unit at Ayub Teaching Hospital, Abbottabad, a structured approach to recognising and responding to physiological deterioration offers an opportunity to standardise an important aspect of routine inpatient care. The present quality-improvement project therefore focuses not simply on introducing NEWS2 as a scoring tool, but on improving the reliability of physiological observation, NEWS2 calculation and documentation, recognition of abnormal or rising scores, and timely escalation to the appropriate clinical team. By examining and improving these linked steps, the project aims to strengthen early recognition of clinical deterioration among general medical inpatients and establish a more consistent escalation process within the ward setting.

Aims and Objectives

Aim

To improve the recognition and timely escalation of clinical deterioration among adult general medical inpatients at Ayub Teaching Hospital, Abbottabad, through the structured use of the National Early Warning Score 2 (NEWS2).

Objectives

1. **To assess the baseline compliance** with recording the physiological observations required for NEWS2 and calculating NEWS2 among adult general medical inpatients.
2. **To improve the completeness and accuracy of NEWS2 documentation** for eligible general medical inpatients through standardised monitoring and ward-based staff and interns' education.
3. **To improve timely recognition and escalation of clinical deterioration** by ensuring that patients with abnormal or rising NEWS2 scores receive the appropriate clinical review according to the agreed escalation pathway.
4. **To measure the effect of the quality-improvement interventions** by comparing NEWS2 documentation, recognition, and escalation compliance before and after implementation.
5. **To achieve a sustained improvement in NEWS2-related practice**, with the aim of reaching at least **80% compliance** with complete NEWS2 assessment and appropriate escalation by the end of the project period.

Methods

Study Design

This project was conducted as a **quality-improvement (QI) project using a prospective before-and-after clinical audit design with iterative Plan-Do-Study-Act (PDSA) methodology**. The project evaluated existing practice, introduced a structured NEWS2-based intervention, and assessed changes in documentation, recognition, and escalation of clinical deterioration following implementation. The reporting of the project was structured in accordance with the principles of the **SQUIRE 2.0**

framework for healthcare quality-improvement studies.¹⁰

The project was divided into three predefined phases: a baseline audit, an intervention phase, and a post-intervention audit. This design was selected because it allowed assessment of the existing ward process, implementation of practical changes within the clinical environment, and subsequent measurement of whether the targeted processes improved.

Setting

The project was undertaken in the **Medical B Unit of Ayub Teaching Hospital (ATH), Abbottabad, Khyber Pakhtunkhwa, Pakistan**. ATH is a large tertiary-care teaching hospital providing inpatient and specialist services to patients from Abbottabad and surrounding districts. The Medical B Unit manages a broad range of adult medical conditions and provides care through a multidisciplinary team comprising consultants, postgraduate residents, medical officers, house officers, nurses, and other healthcare staff.

The project focused specifically on routine care delivered to adult medical inpatients within the Medical B Unit. The ward setting was selected because regular physiological observations, timely recognition of deterioration, communication between nursing and doctors, and appropriate escalation are integral components of safe general medical practice.

Project Population

The target population comprised **adult patients admitted to the Medical B Unit during the defined audit periods**. All eligible patients encountered during the respective audit phases were considered for inclusion using a consecutive sampling approach. Patients were included when they were receiving routine inpatient medical care in the Medical B Unit and had physiological observations/vitals recorded as part of their ward monitoring. Patients were excluded when they were not managed as general medical inpatients in the unit, including patients transferred directly to or from a critical-care area where the NEWS2 ward-based process was not applicable, and cases

in which routine NEWS2 assessment had been formally considered inappropriate as part of an agreed individual care plan. Patients for whom the necessary clinical documentation was unavailable

or insufficient to determine the audit variables were excluded from analysis of the relevant measure rather than assumptions being made about undocumented care.

Audit and project periods

The project was conducted over the following periods:

Phase	Period	Purpose
Baseline audit	1 March 2025 – 10 May 2025	Assessment of existing NEWS2-related practice
Intervention phase	10 May 2025 – 31 May 2025	Implementation of the QI interventions using PDSA methodology
Post-intervention audit	10 June 2025 – 20 August 2025	Assessment of practice following implementation

Standards and operational definitions

❖ The intervention and audit criteria were based primarily on the **NEWS2 framework developed by the Royal College of Physicians uk** and internationally accepted principles for recognizing and responding to acute deterioration in hospitalized adults.^{1,2}

❖ NEWS2 incorporates six routinely measured physiological parameters: respiratory rate, oxygen saturation, systolic blood pressure, pulse rate, temperature, and level of consciousness or new confusion, with additional scoring for supplemental oxygen.¹

❖ For this project, **complete NEWS2 assessment** was defined as documentation of all required physiological parameters together with a correctly calculated total NEWS2 score, including appropriate recording of supplemental oxygen where applicable.

❖ **Accurate NEWS2 calculation** was defined as a total score correctly derived from the documented physiological observations using the standard NEWS2 scoring system.

❖ **Recognition of deterioration** was defined as identification and documentation of an abnormal NEWS2 score requiring clinical attention according to the agreed NEWS2 response pathway, together with consideration of the patient's overall clinical condition.

❖ **Appropriate escalation** was defined as documented communication or escalation to the appropriate senior professional or clinical team in response to a NEWS2 trigger, in accordance with the predefined ward escalation pathway.

❖ **Timely escalation** was defined as completion of the required escalation within the urgency category specified by the local NEWS2 escalation pathway. Clinical concern was considered sufficient reason for escalation even where the NEWS2 threshold had not been reached, consistent with the principle that NEWS2 should support rather than replace clinical judgement.¹

Audit standards

The audit criteria were selected to reflect the core steps required for an effective NEWS2-based deterioration pathway. These included:

1. Physiological observations required for NEWS2 were recorded.
2. A NEWS2 score was calculated and documented.
3. The score was calculated accurately from the recorded observations.
4. Abnormal or triggering NEWS2 scores were recognized.
5. The appropriate medical team was informed when escalation was required.

6. Clinical review was documented following a NEWS2 trigger.

7. The frequency of subsequent observations was increased where clinically indicated.

8. The response and escalation were documented clearly in the clinical record/patient progress notes.

The response to a NEWS2 trigger was based on the graded-response principle recommended by the Royal College of Physicians and NICE, with increasing urgency of clinical assessment as the NEWS2 score increased.^{1,2} The local pathway was adapted to the staffing structure and clinical resources of the Medical B Unit while retaining the core NEWS2 trigger thresholds.

Baseline Audit

The baseline audit was performed from **1 March 2025 to 10 May 2025** to establish the existing level of compliance with NEWS2-related practice before any intervention was introduced. During this phase, eligible patient records were reviewed using a structured data-collection proforma. The baseline assessment focused on whether required physiological observations were recorded, whether NEWS2 was calculated and documented correctly, and whether appropriate escalation occurred when abnormal scores were present.

Importantly, the baseline audit was conducted as an assessment of routine clinical practice without introducing changes to the existing ward process before completion of the baseline measurement.

Intervention

❖ The intervention was designed as a practical, ward-based improvement package aimed at addressing the specific gaps identified during the baseline audit. The principal components included:

❖ **Staff education:** Short, focused teaching sessions were provided for doctors and nursing staff regarding the purpose of NEWS2, the physiological parameters included in the score, correct calculation, interpretation of trigger thresholds, and the required escalation response.

❖ **Standardized NEWS2 documentation:** Staff and house officers were encouraged to record the complete set of physiological observations and

the corresponding NEWS2 score in a standardized manner, reducing reliance on informal recognition of individual abnormal observations.

❖ **NEWS2 reference material:** Easily accessible NEWS2 scoring and escalation information was made available, by attaching a proforma to each patient file.

❖ **Escalation pathway:** A clear escalation process was introduced, linking NEWS2 trigger levels with the appropriate clinical response, including notification of the responsible medical team, urgent clinical review, increased observation frequency, and emergency escalation where indicated.

❖ **Staff reinforcement and feedback:** During the implementation period, staff were given direct feedback regarding commonly identified documentation or escalation gaps. Practical reminders were used to reinforce correct NEWS2 assessment and response.

The intervention was intentionally kept simple and feasible within the existing ward structure and did not depend on specialized equipment or major changes in staffing.

PDSA methodology

The intervention was implemented using the **Plan-Do-Study-Act approach**, allowing changes to be introduced, observed, and refined according to the practical experience of staff/house officers in the ward.

❖ **Plan:** Baseline audit findings were reviewed to identify the main gaps in NEWS2 assessment, documentation, recognition of abnormal scores, and escalation. Specific improvement actions were agreed with the clinical team.

❖ **Do:** The agreed interventions were introduced during the intervention period from 10 May to 31 May 2025. Staff and house officer's education, standardized documentation, availability of NEWS2 guidance, and reinforcement of the escalation pathway were implemented within routine clinical practice.

❖ **Study:** Compliance with the targeted processes was monitored during implementation, and practical barriers encountered by nursing staff and house offices were identified. Particular

attention was given to incomplete observations, incorrect NEWS2 calculation, failure to document the score, and delays or omissions in escalation.

❖ **Act:** Feedback from implementation was used to reinforce successful changes and address recurrent problems. Measures that were practical and acceptable to the ward team were continued into the post-intervention period.

Post Intervention Audit

The post-intervention audit was conducted from **10 June 2025 to 20 August 2025** using the same eligibility criteria, audit definitions, and data-collection tool used during the baseline assessment. The purpose of the post-intervention phase was to determine whether the improvement package was associated with better compliance with NEWS2 assessment and documentation and with improved recognition and escalation of clinical deterioration. Using the same audit criteria before and after the intervention reduced the risk that apparent improvement was related to changes in measurement rather than changes in clinical practice.

Outcome and process Measures

The project primarily assessed **process measures**, as these directly reflected the aim of improving recognition and timely escalation of deterioration. The **primary process measure** was the proportion of eligible patient records in which a complete and correctly calculated NEWS2 assessment was documented. Secondary process measures included:

- proportion of required physiological observations recorded;
- proportion of NEWS2 scores calculated correctly;
- proportion of NEWS2 trigger episodes appropriately recognized;
- proportion of patients with a NEWS2 trigger who received the appropriate clinical escalation;
- proportion of triggered episodes in which clinical review was documented; and
- Proportion of triggered episodes in which an appropriate monitoring or observation plan was documented.

For each measure, compliance was calculated as:

Compliance (%) = Number of records/episodes meeting the audit criterion ÷ Total eligible records/episodes × 100

The same definitions and denominator rules were applied during the baseline and post-intervention audits.

Data collection

A structured audit proforma was developed before data collection. The proforma captured demographic information required to describe the audit population and the variables directly related to the project objectives. The clinical variables included respiratory rate, oxygen saturation and oxygen requirement, systolic blood pressure, pulse rate, temperature, level of consciousness or new confusion, calculated NEWS2 score, documentation of the score, presence of a NEWS2 trigger, and documented escalation or clinical review where applicable. Data were obtained from routine patient charts, nursing vitals documentation charts, and medical notes and vitals maintained by house officers. Only information necessary for the audit objectives was collected. To improve consistency, the audit team used predefined operational definitions and the same data-collection format throughout all phases of the project. Where a required item was not documented, it was recorded as **not documented** rather than assumed to have been performed.

Data Quality and confidentiality

Data collection was performed using a standardized proforma to minimize variation in interpretation between auditors. Completed data sheets were checked for completeness before entry into the study database. Each patient was assigned a study identification number for analysis. Patient names, hospital registration numbers, and other directly identifying information were not included in the analysis dataset. Electronic data were stored in a password-protected file accessible only to the project team.

Statistical analysis

Data were analyzed using descriptive statistics. Categorical variables were presented as

frequencies and percentages. Baseline and post-intervention compliance were compared for each predefined process measure. Absolute change in compliance was calculated as the difference in percentage points between the baseline and post-intervention periods. Relative improvement was calculated where appropriate. Because this was a ward-based quality-improvement project rather than a controlled clinical trial, statistical significance was not considered in isolation. Greater emphasis was placed on the direction and magnitude of change in the predefined process measures and on whether improvement was consistent across the key stages of the NEWS2 pathway.

Ethical considerations

This project was undertaken as a **quality-improvement and clinical audit activity** with the primary purpose of improving the safety and

reliability of routine inpatient care. No experimental treatment was administered and clinical management remained under the responsibility of the treating team. Patient confidentiality was maintained throughout data collection, analysis, and reporting. Only routinely available clinical information relevant to the audit objectives was reviewed, and results were reported in aggregate without identifying individual patients or healthcare professionals. The project was conducted after approval of the QIP proposal by quality control team of Ayub teaching hospital Abbottabad. Approval number QQC/MTI ATH/428/2025.

National Early Warning Score 2

The National Early Warning Score 2 (NEWS2), developed by the Royal College of Physicians and introduced in 2017, provides a standardised system for identifying and responding to acute clinical deterioration.

Physiological parameter	3	2	1	0	1	2	3
Respiratory rate (breaths/min)	≤8	—	9–11	12–20	—	21–24	≥25
Oxygen saturation, Scale 1 (%)	≤91	92–93	94–95	≥96	—	—	—
Any supplemental oxygen	—	—	—	No	—	Yes (+2)	—
Systolic BP (mmHg)	≤90	91–100	101–110	111–219	—	—	≥220
Pulse (beats/min)	≤40	41–50	51–90	91–110	111–130	≥131	—
Consciousness	—	—	—	Alert	—	—	C / V / P / U
Temperature (°C)	≤35.0	—	35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	—

Results

Study population

During the baseline audit period, 118 eligible general medical inpatients were included, while 126 eligible patients were included in the post-intervention audit. The demographic characteristics of the two groups were broadly

comparable, with a predominance of male patients and a wide age distribution reflecting the general medical inpatient population. The most frequent admission diagnoses included infectious illnesses, cardiovascular disease, respiratory exacerbations, diabetes-related presentations, acute kidney injury, and other acute medical conditions.

Table 1. Demographic and clinical characteristics of patients included in the baseline and post-intervention audit

Characteristic	Baseline audit (n=121)	Post-intervention audit (n=128)
Age, years, mean $\pm$ SD	57.6 $\pm$ 18.1	55.1 $\pm$ 17.4
Age range, years	18–91	19–88
Age $\geq$ 65 years	47 (38.8%)	43 (33.6%)
Male sex	73 (60.3%)	69 (53.9%)
Female sex	48 (39.7%)	59 (46.1%)
<i>Principal admission diagnosis</i>		
Pneumonia / lower respiratory tract infection	24 (19.8%)	27 (21.1%)
Sepsis / other systemic infection	17 (14.0%)	15 (11.7%)
Heart failure / other cardiac illness	14 (11.6%)	16 (12.5%)
COPD or asthma exacerbation	12 (9.9%)	14 (10.9%)
Diabetes / acute metabolic disorder	13 (10.7%)	11 (8.6%)
Acute kidney injury / renal disease	11 (9.1%)	12 (9.4%)
Neurological illness	10 (8.3%)	9 (7.0%)
Gastrointestinal / hepatic illness	8 (6.6%)	11 (8.6%)
Hematological illness	5 (4.1%)	6 (4.7%)
Other medical diagnoses	7 (5.8%)	7 (5.5%)
<i>Admission source</i>		
Emergency department	84 (69.4%)	91 (71.1%)
Outpatient department	25 (20.7%)	21 (16.4%)
Transferred from another ward/unit	12 (9.9%)	16 (12.5%)
Supplemental oxygen at time of assessment	39 (32.2%)	45 (35.2%)
Known chronic comorbidity*	78 (64.5%)	82 (64.1%)

* See main text for definition of chronic comorbidity.

Table 2. Compliance with NEWS2-related assessment and documentation

Audit criterion	Baseline, n/N (%)	Post-intervention, n/N (%)	Absolute change (percentage points)	p value
All required physiological observations documented	69/118 (58.5%)	112/126 (88.9%)	+30.4	<0.001
NEWS2 score documented	54/118 (45.8%)	105/126 (83.3%)	+37.5	<0.001
NEWS2 calculated correctly	46/54 (85.2%)	98/105 (93.3%)	+8.1	0.096
Complete and correctly calculated NEWS2 assessment	46/118 (39.0%)	98/126 (77.8%)	+38.8	<0.001
Triggering NEWS2 score recognised and documented	21/34 (61.8%)	34/39 (87.2%)	+25.4	0.012

Following the intervention, documentation of the physiological observations required for NEWS2 increased from 58.5% at baseline to 88.9% post-intervention. Documentation of a NEWS2 score increased from 45.8% to 83.3%. The proportion

of correctly calculated scores also increased, although this change did not reach conventional statistical significance. Overall, complete and correctly calculated NEWS2 assessment increased from 39.0% to 77.8%.

Table 3. Recognition and escalation of patients with NEWS2 trigger episodes

Process measure	Baseline, n/N (%)	Post-intervention, n/N (%)	Absolute change (percentage points)	p value
NEWS2 trigger episodes identified	34	39	—	—
Trigger episode appropriately recognised	21/34 (61.8%)	34/39 (87.2%)	+25.4	0.012
Appropriate clinical escalation documented	16/34 (47.1%)	31/39 (79.5%)	+32.4	0.004
Clinical review documented after trigger	14/34 (41.2%)	29/39 (74.4%)	+33.2	0.004
Appropriate repeat-observation/monitoring plan documented	12/34 (35.3%)	28/39 (71.8%)	+36.5	0.002

A total of 34 NEWS2 trigger episodes were identified during the baseline period compared with 39 during the post-intervention period. Appropriate recognition of triggering scores

increased from 61.8% to 87.2%. Documented escalation improved from 47.1% at baseline to 79.5% after implementation. Similar

improvement was observed in documentation of subsequent clinical review and repeat monitoring.

Table 4. Nature of escalation documented following NEWS2 triggers

Escalation response	Baseline, n (%)	Post-intervention, n (%)
Review by responsible medical officer/resident	8 (50.0%)	12 (38.7%)
Senior/registrar or consultant review	5 (31.3%)	10 (32.3%)
Increased frequency of observations	2 (12.5%)	5 (16.1%)
Transfer/escalation to higher level of care	1 (6.3%)	4 (12.9%)
Total episodes with documented escalation	16 (100%)	31 (100%)

The recorded escalation responses varied according to the clinical circumstances and severity of the trigger. The majority of episodes

involved review by the responsible medical team, while a smaller proportion required senior review or escalation to a higher level of care.

Table 5. Achievement of the predefined QI target

Outcome	Baseline	Post-intervention	Target	Target achieved
Complete and correctly calculated NEWS2 assessment	39.0%	77.8%	≥80%	No
Complete physiological observations	58.5%	88.9%	≥80%	Yes
NEWS2 score documented	45.8%	83.3%	≥80%	Yes
Appropriate escalation following trigger	47.1%	79.5%	≥80%	No

The project demonstrated substantial improvement across the principal NEWS2-related processes. The predefined target of at least 80% compliance was achieved for complete physiological observations and documentation of

a NEWS2 score. Complete and correctly calculated NEWS2 assessment and appropriate escalation improved considerably but remained slightly below the 80% target during the post-intervention audit.

Pictorial depictions of results

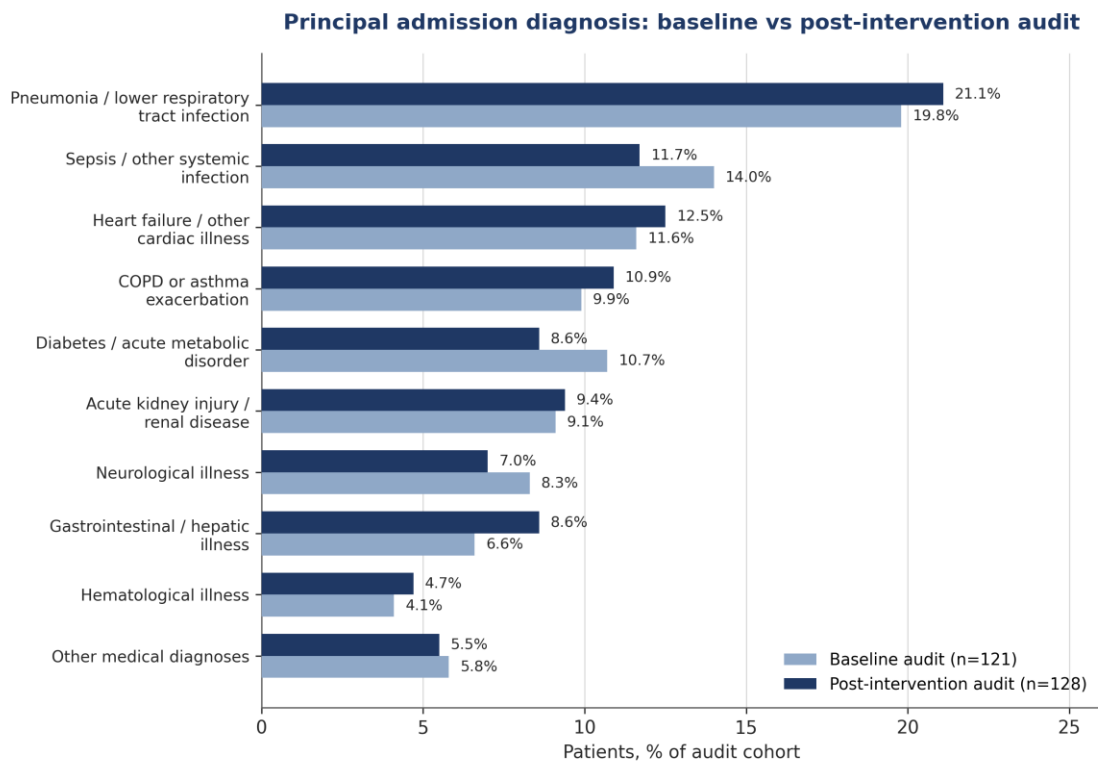


Figure 1. Principal admission diagnosis in the baseline and post-intervention audit cohorts.

Bars show the percentage of patients within each audit cohort assigned each principal admission diagnosis (Table 1; baseline n = 121, post-

intervention n = 128). Diagnostic categories and case counts are unchanged between audits and are shown for descriptive comparison only.

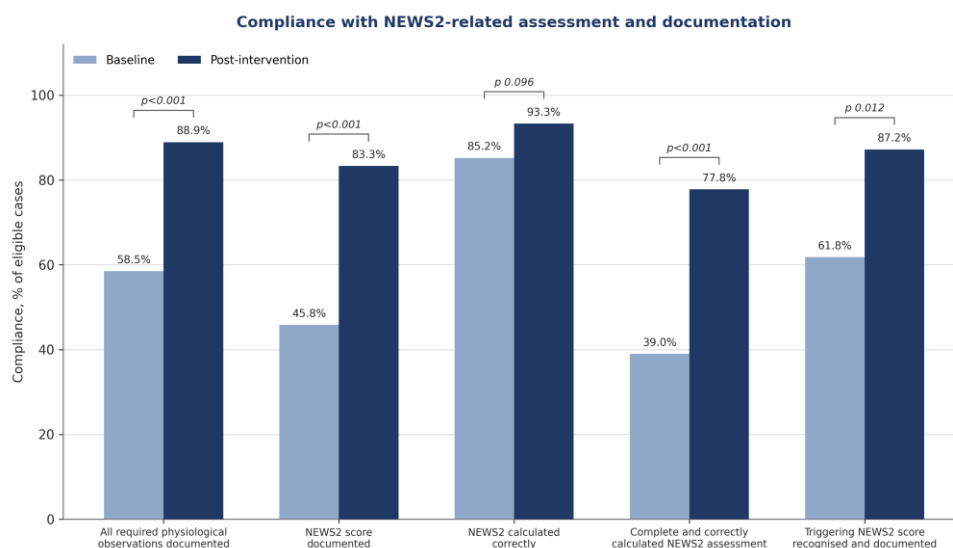


Figure 2. Compliance with NEWS2-related assessment and documentation before and after the intervention

Bars show the percentage of eligible cases meeting each audit criterion at baseline and post-intervention. Brackets show the p value for each comparison

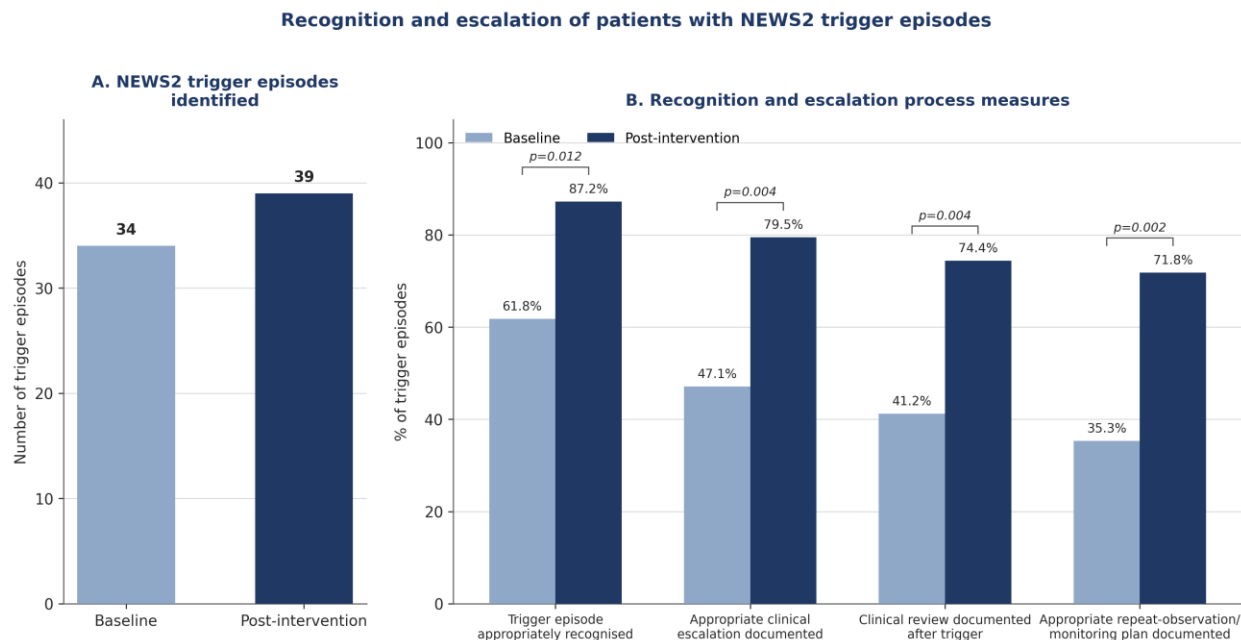


Figure 3. Recognition and escalation of patients with NEWS2 trigger episodes.

(A) Number of NEWS2 trigger episodes identified in each audit period.

(B) Percentage of trigger episodes with appropriate recognition, escalation, clinical review, and repeat-observation/monitoring plan documented, with p values.

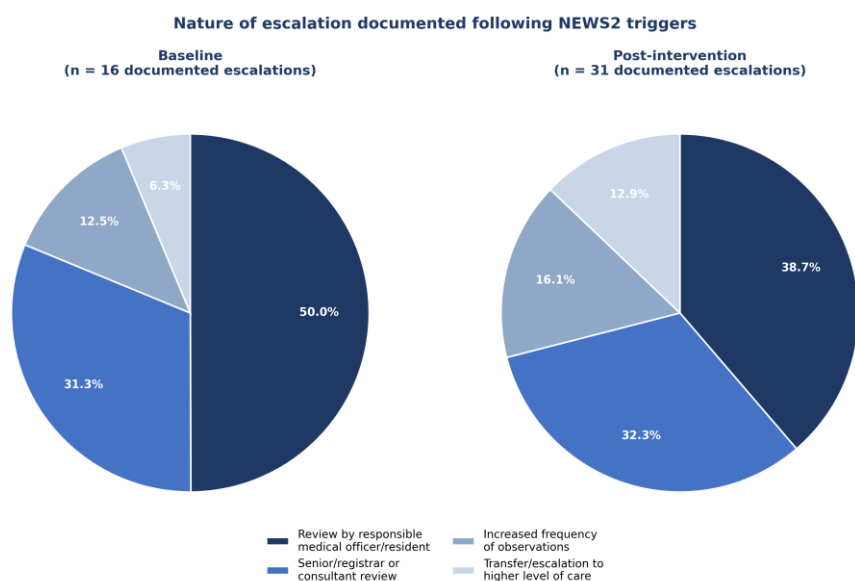


Figure 4. Nature of escalation documented following NEWS2 triggers. Proportional distribution of documented escalation responses among episodes with a recorded escalation, shown separately for the baseline (n = 16) and post-intervention (n = 31) audits (Table 4).

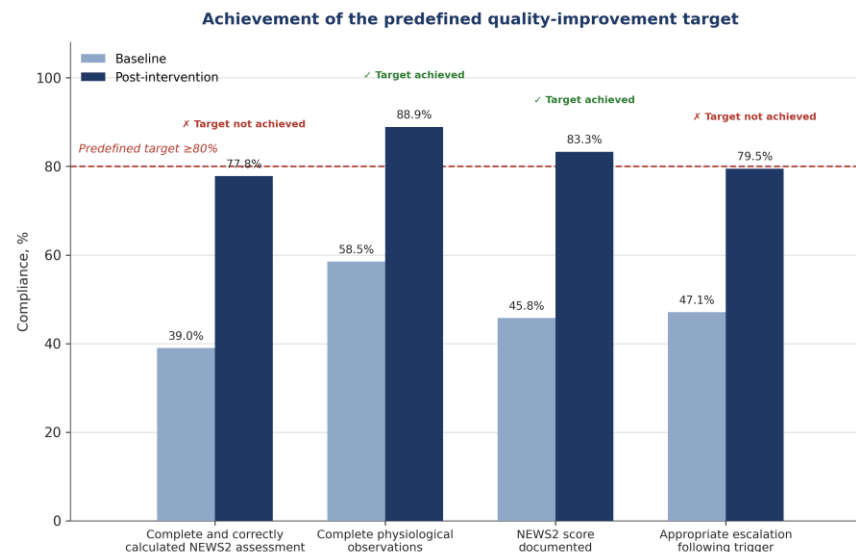


Figure 5. Achievement of the predefined quality-improvement target across key outcome measures.

Bars show baseline and post-intervention compliance for each outcome measure against the predefined target of $\geq 80\%$ (Table 5). The dashed line marks the 80% target threshold; annotations indicate whether the target was achieved post-intervention.

Discussion

Principal findings

This quality-improvement project assessed whether a structured NEWS2-based approach could improve the recognition and escalation of clinical deterioration among general medical inpatients in the Medical B Unit of Ayub Teaching Hospital. Following a focused package of nursing staff and Interns education, standardised NEWS2 documentation, accessible scoring guidance, and reinforcement of the escalation pathway, there was a clear improvement across the main process measures. Complete documentation of the physiological observations required for NEWS2 increased from 58.5% at baseline to 88.9% after the intervention, while documentation of a NEWS2 score increased from 45.8% to 83.3%. The proportion of patients with a complete and correctly calculated NEWS2 assessment increased from 39.0% to 77.8%.

Among NEWS2 trigger episodes, appropriate recognition increased from 61.8% to 87.2%, and documented clinical escalation increased from 47.1% to 79.5%.

The main finding is therefore not simply that NEWS2 was used more frequently, but that improvement occurred across several linked stages of the deterioration pathway. This is relevant because an early warning score is most useful when physiological observations are complete, the score is correctly interpreted, and an appropriate clinical response follows. Previous work has similarly shown that introduction of NEWS2 together with an escalation protocol can alter clinical practice, including increasing documented escalation to senior clinicians.^{6,11}

Interpretation of the findings

The relatively low baseline compliance with complete NEWS2 assessment suggests that the principal problem was not necessarily the absence of physiological observations themselves, but the lack of a consistently standardised process for converting those observations into an overall assessment of deterioration. Before intervention, more than half of patients had the required physiological observations documented, but fewer

than half had a NEWS2 score recorded, and complete NEWS2 assessment was documented in only 39.0% of cases. This gap is clinically understandable in a busy general medical ward, where individual observations may be recorded routinely while calculation, documentation, and escalation are less consistently incorporated into the workflow. The improvement after intervention supports the practical value of combining education with a simple standardised process. Staff and House officers education alone may increase awareness, but the addition of bedside reference material and a defined escalation pathway reduced the number of steps that depended on individual memory or interpretation. This approach is consistent with the broader quality-improvement literature, in which structured changes to clinical processes are more useful when they are adapted to the local workflow rather than introduced as isolated educational interventions.^{12,13} The improvement in recognition of triggering NEWS2 scores was accompanied by an increase in documented escalation and clinical review. This is particularly relevant to the purpose of the project. A warning score has limited practical value if a trigger is identified but does not result in action. Forster and colleagues reported a marked increase in recorded registrar escalations following implementation of NEWS2 and its associated escalation protocol in a large UK teaching hospital, although their study also demonstrated that increased escalation has implications for clinical workload.⁶ Our findings are consistent with the process component of that experience, while remaining appropriately cautious about drawing conclusions regarding patient outcomes. The findings are also broadly consistent with experience from a resource-limited South Asian setting. Anam et al. reported that introduction of NEWS2, accompanied by training of doctors and nurses and adaptation to the local clinical environment, was associated with improved utilisation and reduced episodes of unrecognised deterioration in a high-dependency unit in Bangladesh.¹⁴ Although the Bangladeshi project was conducted in a different clinical setting and included outcome measures that were not assessed

in the present project, it provides useful regional evidence that structured early-warning processes can be incorporated into routine practice outside highly resourced healthcare systems.

Relevance to general medical wards and resource-limited settings

The present project was conducted in a tertiary-care medical unit where patients have varied diagnoses and may deteriorate because of infection, respiratory disease, cardiovascular illness, metabolic disorders, renal dysfunction, and other acute medical conditions. In such an environment, a standardised physiological scoring system can provide a common framework for communicating changes in patient condition between nurses, house officers, post graduate residents, medical officers, and senior clinicians.

This is particularly relevant in settings where care is delivered by a busy multidisciplinary team and where electronic observation systems or automated alerts may not be routinely available. Recent evidence from low- and middle-income countries suggests that early warning scores generally have useful prognostic performance, but implementation and outcome evidence remains limited and highly dependent on local context.^{15,16} A 2023 systematic review specifically examining early warning scores in adult general-ward patients in low- and middle-income countries found moderate-to-good discrimination for mortality with several commonly used scores, but highlighted substantial heterogeneity and a limited implementation evidence base.¹⁵ Another recent systematic review found that implementation of vital-sign-based early warning systems in low- and middle-income countries has not consistently demonstrated reductions in mortality or serious adverse events, reinforcing the importance of not interpreting successful process improvement as proof of improved clinical outcomes.¹⁶ The present project therefore adds value primarily at the level at which it was designed: improvement of ward processes. The findings suggest that a relatively low-complexity intervention can improve the reliability of deterioration recognition and escalation without requiring major technological or structural

changes. This is a practical consideration for many public-sector and resource-constrained hospitals.

Why the intervention may have worked

Several features of the intervention are likely to have contributed to the observed improvement. First, the intervention addressed more than one point of failure. Staff and house officers were taught how to calculate NEWS2, but they were also provided with a clearer documentation process and an explicit escalation pathway. This linked the score to a clinical action rather than presenting NEWS2 as an additional documentation requirement.

Second, the intervention was introduced within the existing ward structure rather than through a separate specialist service. The approach therefore required staff and house officers to incorporate NEWS2 into routine observations and clinical review rather than creating an entirely new workflow.

Third, the use of feedback during implementation provided an opportunity to identify recurring gaps and reinforce the intended process. This is consistent with the rationale for PDSA methodology, in which changes are tested in the real clinical environment and modified in response to what is actually observed.^{11,12} However, published assessments have also shown that PDSA is frequently reported without sufficient evidence of genuine iterative testing.¹¹ The present project used the PDSA framework primarily to organise implementation and refinement of the intervention rather than to claim that PDSA itself was responsible for the observed improvement.

Areas where improvement remained incomplete

Despite substantial improvement, the predefined target of at least 80% compliance was not achieved for complete and correctly calculated NEWS2 assessment or for appropriate escalation following a trigger. This is an important finding rather than simply a failure to reach the target. The remaining gap suggests that introducing NEWS2 improved practice but did not eliminate all barriers to reliable implementation. Complete documentation requires every physiological

parameter to be recorded, the score to be calculated correctly, and the result to be incorporated into clinical decision-making. Similarly, escalation depends on recognition of the trigger, communication with the appropriate clinician, clinical review, and documentation of the subsequent plan. These steps occur within a busy ward environment and can be affected by workload, staffing, handover practices, competing clinical priorities, and variation in familiarity with the system.

It is therefore unlikely that a single educational intervention would be sufficient to produce permanent compliance. Continued reinforcement, periodic re-audit, feedback at ward meetings, induction teaching for newly rotating staff, and further PDSA cycles are likely to be needed to maintain and extend the gains achieved in this project. The importance of continued measurement and iterative refinement is a recognised principle of healthcare improvement.^{11,12}

Implications for practice

The project provides a practical model for strengthening recognition of deterioration in a general medical ward. The most important lesson is that NEWS2 should be implemented as part of a **complete clinical response pathway**, rather than as a standalone score. Observation, scoring, recognition, communication, clinical review, and escalation need to function as connected steps.

The remaining gap in escalation compliance also indicates that future improvement should focus not only on recording the score but on what happens after a trigger is generated. Further work could examine specific causes of missed or delayed escalation, strengthen handover communication, reinforce senior review criteria, and incorporate NEWS2 teaching into routine orientation of new medical and nursing staff. Any subsequent intervention should remain proportionate to the resources and workflow of the unit.

Strengths

❖ A strength of this project was its focus on clearly defined and directly measurable clinical processes. The same audit criteria and data-

collection approach were used before and after the intervention, allowing meaningful comparison of practice over time. The intervention was also designed around routine ward processes and did not require major technological or financial resources.

❖ Another strength was the inclusion of both documentation and escalation measures. This provided a broader assessment of the deterioration pathway than simply measuring whether NEWS2 was calculated. The project also addressed a clinically relevant problem within the actual context in which care was delivered, which is an important component of healthcare improvement work.

Limitations

❖ Several limitations should be considered when interpreting these findings. First, the project used a single-centre, single-unit before-and-after design. Improvements may therefore have been influenced by factors other than the intervention, including changes in staff composition, workload, case mix, or other local practice changes occurring during the study period.

❖ Second, the project measured process outcomes rather than patient-centred clinical outcomes. Although better recognition and escalation are desirable components of safe inpatient care, this project was not designed to establish whether the intervention reduced mortality, cardiac arrest, intensive care admission, or length of stay. This distinction is important.

❖ Third, the post-intervention observation period was relatively short, so the extent to which improvement would be maintained over a longer period cannot be determined from the present project. In addition, reliance on clinical documentation means that some aspects of care may have been performed but not recorded, while the audit itself may have influenced staff behaviour.

❖ Finally, the project was undertaken in one medical unit within a tertiary-care hospital, and the findings may not be directly generalisable to other hospitals with different staffing levels, patient populations, documentation systems, or escalation resources.

Future improvement

The next phase of improvement should focus on sustaining the gains already achieved rather than introducing a substantially more complex system. Regular re-audit, feedback of performance data to the ward team, incorporation of NEWS2 into induction and routine teaching, and continued reinforcement of the escalation pathway would be reasonable next steps. A subsequent project could also examine NEWS2 compliance at more frequent intervals using run charts or statistical process-control methods to determine whether improvement is sustained and whether recurrent periods of reduced compliance can be identified early. Future multicentre work in Pakistani hospitals would be valuable because evidence regarding the implementation of early warning systems in local general medical wards remains limited.

Conclusion

This quality-improvement project demonstrated that a structured NEWS2-based intervention was associated with substantial improvement in the documentation of physiological observations, NEWS2 calculation, recognition of triggering scores, and documented clinical escalation among general medical inpatients. The improvement was most meaningful at the level of clinical process, with better linkage between physiological assessment and escalation of care. However, the failure to reach the predefined 80% target for complete NEWS2 assessment and appropriate escalation indicates that implementation was not yet fully reliable. Further iterative improvement and longer-term monitoring are therefore required. The findings support the feasibility of integrating NEWS2 into routine general medical practice in a tertiary-care hospital in Pakistan, while recognizing that the effectiveness of NEWS2 ultimately depends on the wider clinical system in which it is used.

Additional Information

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