

# Implementation of the PEWS and NEWS protocols in the post-anesthesia care unit

*Implantação dos protocolos PEWS e NEWS na unidade de recuperação anestésica*

*Implementación de los protocolos PEWS y NEWS en la unidad de recuperación anestésica*

Cristina Silva Sousa<sup>1\*</sup> , Andrea Alfaya Acuna<sup>1</sup> 

**ABSTRACT: Objective:** To describe the development and implementation of the PEWS and NEWS protocols in post-anesthesia recovery using robotic automation. **Method:** Experience report on the development and implementation of clinical deterioration protocols in post-anesthesia recovery in a large philanthropic hospital located in the city of São Paulo, Brazil. The work involved the determination of protocols, construction of operational rules for the system, development of the electronic system and implementation with training of the assistance team. **Results:** Prediction of clinical deterioration was implemented with the PEWS and NEWS protocols in an automated way, and activation was signaled through an iconogram in the panel of the post-anesthesia care unit. **Conclusion:** The implementation of the protocols was successfully completed; the use of robotic automation can simplify workflows and reduce the time to collect vital signs to provide a score. Clinical deterioration protocols help nurses' decision-making in anesthesia recovery, as long as they are applied in conjunction with clinical judgment.

**Keywords:** Clinical deterioration. Recovery room. Perioperative nursing. Protocols. Automation.

**RESUMO: Objetivo:** Descrever a construção e a implantação dos protocolos PEWS e NEWS na recuperação anestésica com recurso da automação robótica. **Método:** Relato de experiência sobre a construção e a implantação de protocolos de deterioração clínica na recuperação anestésica em um hospital filantrópico de grande porte localizado no município de São Paulo. O processo de trabalho envolveu a determinação dos protocolos, a construção das regras operacionais para o sistema, o desenvolvimento do sistema eletrônico e a implantação com treinamento da equipe assistencial. **Resultados:** Foi implantado o processo de deterioração clínica com os protocolos PEWS e NEWS de forma automatizada e sinalizado o acionamento por meio de um iconograma no painel da sala de recuperação pós-anestésica. **Conclusão:** A implantação dos protocolos foi concluída com sucesso; o uso da automação robótica pode simplificar os fluxos de trabalho e o tempo de coleta de sinais vitais para fornecer uma pontuação do escore. Protocolos de deterioração clínica auxiliam na tomada de decisão das enfermeiras da recuperação anestésica, desde que aplicados em conjunto com o julgamento clínico.

**Palavras-chave:** Deterioração clínica. Sala de recuperação. Enfermagem perioperatória. Protocolos. Automação.

**RESUMEN: Objetivo:** Describir la construcción e implementación de los protocolos PEWS y NEWS en recuperación anestésica utilizando automatización robótica. **Método:** Relato de experiencia sobre la construcción e implementación de protocolos de deterioro clínico en la recuperación anestésica en un gran hospital filantrópico de la ciudad de São Paulo. El proceso de trabajo implicó la determinación de protocolos, construcción de reglas de funcionamiento del sistema, desarrollo en sistema electrónico e implementación con capacitación del equipo de asistencia. **Resultados:** Signos de deterioro clínico utilizando los puntajes PEWS y NEWS, lo construimos de forma automatizada e identificamos mediante un signo compuesto por una iconografía en el panel multiprofesional de la unidad, de forma visible para cualquier miembro del equipo. **Conclusión:** La implementación de los protocolos se completó con éxito, el uso de la automatización robótica puede simplificar los flujos de trabajo y el tiempo de recopilación de signos vitales para proporcionar una puntuación. Los protocolos de deterioro clínico auxiliam la toma de decisiones del enfermero en la recuperación anestésica, siempre que sean aplicados en conjunto con el juicio clínico.

**Palabras clave:** Deterioro clínico. Sala de recuperación. Enfermería perioperatoria. Protocolos. Automatización.

<sup>1</sup>Hospital Sírio-Libanês – São Paulo (SP), Brazil.

\*Corresponding author: [cxsousa@icloud.com](mailto:cxsousa@icloud.com)

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## INTRODUCTION

The post-anesthesia care unit is intended to provide immediate assistance to patients under the anesthetic effect of different surgical procedures. The nurse ensures the care of this patient until they regain stable vital signs, consciousness and protective reflexes, considering the surgical procedure as well as the type of anesthesia to which they were subjected, in addition to the individual risks inherent to their previous clinical history<sup>1</sup>.

Patients are approximately one thousand times more likely to die within 30 days after surgery than during surgery<sup>2</sup>, which justifies the significant efforts that have been made in the development and validation of early deterioration systems in wards<sup>3</sup>.

The concept of early warning scores (EWS) was proposed by Morgan et al. in 1997, based on changes in vital signs as a warning of risk of deterioration in the patient's health status<sup>4</sup>.

Prior to the coding of early deterioration scoring systems, single-parameter variation in key physiological measures, such as changes in blood pressure, heart rate, or even skin color, were used to identify patients at risk and trigger intervention<sup>5</sup>.

What if a combination of factors could precede a change in a vital sign? These early deterioration scoring systems use a combination of physiological parameters and priority weights to assess the likelihood that a patient is at risk of deterioration<sup>6</sup>.

The National Early Warning Score (NEWS) was published in English by the Royal College of Physicians in the United Kingdom<sup>7</sup>. It was easy to use, did not increase the workload and increased the ability to identify deteriorating patients<sup>8</sup>. In addition, it was based on the parameters respiratory rate, oxygen saturation, oxygen use, systolic blood pressure, pulse, level of consciousness and temperature<sup>9</sup>.

In children, warning signs of clinical deterioration may be present or appear suddenly, and the identification of these signs and early care aim to prevent the progression to worsening of the clinical condition. Among the versions of the Pediatric Early Warning Score (PEWS) is the Brighton Pediatric Early Warning Score (BPEWS) or Monaghan PEWS, published in 2005, built by a nurse at the University of Brighton and translated and adapted to Portuguese. It basically uses three assessment components: neurological, cardiovascular and respiratory, with a score from 0 to 13. From three points, the higher the score, the greater the risk of clinical deterioration<sup>10</sup>.

Both protocols use a table that assigns a pre-defined risk score to each signal measurement. These early deterioration scores are currently applied in the United Kingdom, United States, Canada, Ireland, Norway and Australia<sup>3</sup>, and have been seen in application in Brazil.

Faced with the demand of patients with more comorbidities and the elderly, associated with the concern to identify the early deterioration of patients admitted to post-anesthesia care unit, it is considered opportune to apply these protocols to help the nurse with patient evaluation and decision-making in the post-anesthesia care unit.

## OBJECTIVE

To describe the development and implementation of the PEWS and NEWS protocols in post-anesthesia recovery using robotic automation.

## METHOD

Experience report on the implementation of clinical deterioration protocols (PEWS and NEWS) using the robotic automation feature in post-anesthesia recovery of a large philanthropic hospital located in the city of São Paulo, from September to December 2021.

At the study site, there are 30 post-anesthesia recovery beds in the surgical centers divided into two blocks, on different floors: 17 in block D and 13 in block C.

The average admission capacity in the post-anesthesia care unit is 800 patients per month, with an average stay of one hour.

The initiative to implement clinical deterioration protocols in this unit came from the nursing management of the operating block, as part of the automation project for this block. This project provides for improvements in site processes with the support of information technology, developing products that help clinical practice to make decisions, facilitate the work environment and improve information visualization.

The PEWS and NEWS protocols are currently used for these indicators of early deterioration, and both were selected to meet the demand of the profile of the patient admitted to the post-anesthesia care unit (children, adolescents and adults)<sup>11</sup>. For NEWS, we followed the vital signs table standardized by the NEWS protocol<sup>7</sup> (Chart 1).

The beginning took place at a meeting to discuss business rules with an information technology analyst, systems developer and nursing staff. In this orientation, the following were defined: the iconography to be visualized as protocol identification; the criteria for the icon to appear in the multidisciplinary panel using robotic automation (capture of vital signs recorded in the electronic medical record, which are automatically launched by the vital signs monitor); and the score value system rule based on the combination of vital signs proposed by the NEWS protocol.

For application of the protocol using vital signs in children, it is necessary to bring the PEWS score to the vital signs monitor with automation, instead of a scale filled out by a professional, thereby simplifying workflows. However, to signal clinical deterioration based on children's vital signs, an age group classification and values of these signs were applied to the automation system rule, as done in NEWS, but with the use of the pediatric vital signs table by age group applied in the protocol of another institution<sup>12</sup> (Chart 2).

**Chart 1.** National Early Warning Score (NEWS), 2020.

Physiological parameter	Score						
	3	2	1	0	1	2	3
Respiratory rate (per minute)	≤8		9–11	12–20		21–24	≥25
Oxygen saturation 1 (%)	≤91	92–93	94–95	≥96			
Oxygen saturation 2 (%)	≤83	84–85	86–87	88–92 ≥93 in room air	93–94 with oxygen	96–96 with oxygen	≥97 with oxygen
Air or oxygen?		Oxygen		Room air			
Systolic blood pressure (mmHg)	≤90	91–100	101–110	111–219			≥220
Pulse (per minute)	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			Alert, Confused, Responds to voice, Responds to pain, Unconscious
Temperature	≤35		35.1–36	36.1–38	38.1–39	≥39	

**Chart 2.** Pediatric Early Warning Score (PEWS), 2020.

Physiological parameter	Age	Score						
		3	2	1	0	1	2	3
Heart rate (per minute)	< 3 m	≤ 89			90–159		180–219	≥220
	3 m–1 year	≤89			90–149		170–209	≥210
	1–4 years	≤89			90–139		160–199	≥200
	5–11 years	≤89			90–129		150–189	≥190
	12–15 years	≤69			70–99		130–169	≥170
Respiratory rate (per minute)	< 3 m	≤25			30–59	60–74	≥79	
	3 m–1 year	≤20			25–49	59–63	≥69	
	1–4 years	≤15			20–39	49–53	≥59	
	5–11 years	≤15			20–29	39–48	≥49	
	12–15 years	≤5			10–19	29–38	≥39	
Behavior				Normal	Sleepy	Irritable	Confused, Lethargic, Reduce response to pain	

## RESULTS

The multidisciplinary panel consists of a 43-inch monitor mounted on the wall, close to the nursing station, with identification of each patient in card format. Subsequently, the scores and vital signs used for calculation were understood, as well as the identification of these records and the registration fields in electronic medical records. Subsequently, the development of the system and the applicability of tests for simulation began.

During the tests, in the months of October and November, vital signs were manually entered in the electronic medical records and thus automated once the automatic entry of vital signs via a monitor to the electronic medical record was worked on. Once the development on a test basis was completed, the publication of the rules and the system on a production basis was planned, with the start of their application on December 23, 2021.

The training of the nursing team took place in the first half of December, in person, and was conducted by the corporate education nurse, with the explanation of the concept of protocols, vital signs, records and visualization in a multidisciplinary panel, as well as the care conduct to be adopted. The protocols were already known to the anesthesiology team, so it was not included in the training with the nursing team.

It was defined that after viewing the iconography in the multidisciplinary panel, the patient is first evaluated by the nurse to rule out possible interference from the vital signs monitor and, later, by the anesthesiologist on duty, for the adoption of conduct. This service is documented by nursing. To expand the automated protocols, the project was presented to the management of the inpatient units on December 22nd.

At the first orientation meeting in September 2021, the nurse manager, senior automation project nurse, senior information technology business analyst, and systems developer defined the concept of protocols, the use of electronic medical record and the place to record this data, and the system configuration needs as well.

For NEWS, the business rule was applied for patients 16 and older, based on the manual capture of vital signs every 15 minutes, or automatically every five minutes, and the programming to appear in the iconography in the multidisciplinary panel on the basis of the calculation of the score five reflected by the combination of vital signs that comprise the protocol. For PEWS, patients aged 0 to 15 years, 11 months and 29 days, the rule was based on capturing vital signs, as established for NEWS, but with the rule of registering changes in vital signs by age group, and these, when combined, categorize the score five.

Both are presented with the initial letter of the protocol, being N for NEWS and P for PEWS, and each patient in the post-anesthesia care unit has a card in the multidisciplinary panel, where the information is visualized: name initials, sex, date of birth, age, bed of origin and destination and risks. The protocol icon is displayed in the white box, which corresponds to pending patient follow-up. When a clinical deterioration is perceived by the system (on the basis of the construction of a combination of vital signs in an automated way), the patient's card is colored red to draw the care professional's attention, and the icon disappears and the card returns to white as soon as a normal vital sign is recorded, as shown in Figure 1.



**Figure 1.** Multidisciplinary post-anesthesia recovery panel, with presentation of each patient in card format and signaling of the PEWS and NEWS protocols. 2021.

Twenty-seven team professionals (14 nurses and 13 nursing technicians) were trained in person in the three work shifts (morning, afternoon and night). For these professionals exclusively working in post-anesthesia recovery, their importance in the clinical judgment associated with the protocol as an important component for nursing care was reinforced.

There were some questions about conduct in case of inadequate monitoring, noting that communicating with the physician on duty was a routine activity in clinical practice. The nurses also felt the need to physically maintain, in the post-anesthesia care unit, the vital signs tables standardized by the NEWS and PEWS protocols to familiarize themselves with the reference values for the calculation of the automatic score and the recognition of possible monitoring failure more quickly.

With the completion of the steps, the changes in the multidisciplinary panel in production were published and the identification of early deterioration in post-anesthesia recovery began in an automated way in December 2021.

## DISCUSSION

Early deterioration protocols have the benefit of identifying the patient at risk and intervening before the severity increases, in addition to allowing the adaptation of the destination unit<sup>11</sup>. With the application of robotic automation, when the first signs of deterioration are identified, they are visually signaled on the panel for identification of any team member, providing autonomous and faster assessment.

Improving communication and following protocols are constant challenges for hospitals, and implementing an automated system to signal early deterioration and support decision-making can help with more effective measures in patient care in post-anesthesia recovery, compared to a manual score calculation system<sup>3</sup>.

A systematic review of deterioration scores identified statistically significant improvements in mortality, serious adverse events, hospital admissions, frequency of observation, and intensive care unit/high dependency unit admission when an early deterioration protocol is applied<sup>13</sup>.

The agility and practicality of the automatic alert in the NEWS and PEWS protocols related to vital signs drew the attention of nursing to new assessments when the protocol was activated by the icon in the multidisciplinary panel, even if it originated from a potential monitoring failure.

In a UK study with automation of vital signs and comparison of the application of the NEWS score in clinical and surgical patients, it was demonstrated that a score greater than three points occurred in more clinical patients, but the risk observed in surgical patients was greater, and this increased risk leads to more outcomes of intensive care unit admission than increased risk of death or cardiac arrest<sup>14</sup>.

Although the institution's inpatient units already use MEWS, it was decided to implement NEWS because it is considered more sensitive; that is, its assessment is based on more vital data than MEWS. In another study comparing protocols, different scores were obtained in postoperative patients, and it was found that the seven-item NEWS outperforms the six-item MEWS in detecting potential adverse events<sup>15</sup>.

Initially, a score of three points was determined, which indicates the first early warning signal for both protocols; however, with the first days of use, many activations were registered on the panel, most resulting from the fall of the thermometer, when the patient woke up and produced an erroneous temperature below 35°C, considered three points in NEWS.

Thus, we changed the score to five points, a parameter applied in another study of perioperative patients, in which an approximate score of early warning in the perioperative period was observed, with a sensitivity of 82% and specificity of 80%. This threshold had a missed adverse event rate of 18% and a non-event rate of 96%, with a 24-hour mortality rate of 1%<sup>16</sup>.

A score of five points should trigger an urgent assessment of the patient by a physician, and a NEWS of seven points or more should lead to an emergency assessment<sup>14</sup>.

In a study on the application of the PEWS protocol in post-anesthesia recovery in the US, the use of this tool in pediatric perioperative patients helped nurses to give objectivity to the subjectivity of the patient's acuity and encouraged multidisciplinary collaboration to provide adequate resources to the patient with greater acuity<sup>17</sup>.

In UK NHS hospitals, NEWS applies to all areas of adult patients, considering an average NEWS score (equivalent to five points) for invasive procedures, including interventional radiology, operating room and endoscopy, and in the post-anesthesia care unit, the protocol is evaluated upon admission and discharge of patients<sup>18,19</sup>.

In Brazil, the application of the NEWS and PEWS protocols at a Rio Grande do Sul hospital was presented at the 2021 congress of the Brazilian Association of Surgical Center Nurses and published in its proceedings<sup>20</sup>.

## CONCLUSION

Another narrative review of these protocols in the perioperative period reinforces that we must be aware and associate clinical judgment with the protocol, as early deterioration scores can facilitate the escalation of care for patients at risk of adverse events, as well as being used in surgical and post-operative patients, but high non-event rates and practical implementation issues can restrict their usefulness<sup>6</sup>.

The process of implementing the protocols in an automated way was well received by the nursing team, who, in face-to-face training, understood the criteria and how the system works with the alert icon in the multidisciplinary panel. This good reception was evidenced by the agreement of professionals and few doubts during training and practical application during the observation period. It was clear to the team that there is a need for manual recording of the level of consciousness and vital signs when the team does not obtain automatic recording by the monitor, and this was considered a practice of the unit.

The association of clinical judgment with the automated determination of protocols was referred to as understood during implementation and applied in practical observation during this period. Findings similar to the study on nurses' perceptions related to PEWS suggested the need to pay attention to nurses' perceptions of clinical judgment and PEWS as essential to provide these professionals with information about patients' conditions; otherwise, the risk of not recognizing their deteriorating conditions will remain<sup>21</sup>.

The protocol implementation phases were successfully completed as the use of robotic automation simplified workflows and vital sign collection time to provide a score, excluding potential manual score calculation errors. Clinical deterioration protocols help nurses' decision-making in post-anesthesia recovery, as long as they are applied in conjunction with clinical judgment.

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None.

## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests.

## AUTHORS' CONTRIBUTIONS

**CSS:** project management, formal analysis, conceptualization, data curation, investigation, methods, writing – original draft, validation and visualization. **AAA:** project management, formal analysis, features and writing – review and editing.

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