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ORIGINAL ARTICLE

Optimizing the pain assessment, intervention and reassessment cycle: implementing pain clinical pathway in the emergency department

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ABSTRACT

Background: Pain is one of the most common presenting symptoms at the emergency department (ED). Timely and effective analgesia is a key indicator of emergency medical care efficiency. Despite the significant improvement in pain management over time, insufficient pain control still occurs in various emergency care settings.

Objective: Development and implementation of a standardized ED pain management strategy based on the pain assessment, intervention, and reassessment (AIR) cycle to improve timely analgesia and enhance the consistency and reliability of pain relief delivery.

Methods: A prospective, single-center, quality-improvement study was conducted over 8 months from January to August 2025. Data from all eligible patients were collected, including baseline characteristics, pain intensity, triage category, and mean medication administration time (MAT).

Results: The mean MAT was reduced from 25 minutes in January to 8 minutes in August, with 100% compliance across all aspects of the AIR cycle.

Conclusion: This study highlights the significant value of a standardized emergency room pain management clinical algorithm in enhancing pain management practices and improving the quality of clinical care within EDs.

Keywords: Pain AIR, assessment, intervention, reassessment, pain clinical pathway, emergency department.

Introduction

Pain represents the leading cause of patients' complaints at the emergency department (ED). Almost 80% of patients who present to the ED suffer from a pain-related clinical condition [1,2]. Effective and rapid pain control is a key component of emergency medical care, as inadequate pain management is associated with negative consequences in many aspects of patients' quality of life, including prolonged hospital stay, high risk of cardiovascular complications, poor wound healing, and sometimes death [3–5]. Additionally, inadequately treated pain, especially the chronic type, may lead to social isolation and negatively impact patients' professional and family life. Beyond the individual impacts, pain exerts a significant burden on the global economy; millions of dollars are lost each year due to pain-associated reduced productivity and absence from work [6–8]. Therefore, the clinical practice guidelines have emphasized

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the importance of standardized approaches in pain assessment and management. They recommend that rapid pain evaluation and intervention are key elements of high-quality emergency care [9,10]. Sadasivam et al. found that door-to-analgesia time was dramatically decreased from 55.5 minutes to 15 minutes through focused point-of-care quality improvement and Plan-Do-Study-Act cycle methodology [11].

Despite the established value of effective pain management, many EDs fail to administer analgesia promptly, which can potentially affect patients' outcomes. Several studies have identified considerable delays in time to analgesia (TTA) and inconsistent documentation of pain score in routine emergency care [12,13]. A retrospective audit conducted by Silva et al. [13] reported that the median TTA often exceeds the guideline-recommended target. Furthermore, patients with documented pain scores receive management faster than those lacking documentation, highlighting the importance of standardized pain assessment in emergency care.

Multiple obstacles face the medical team and impair the optimum pain management delivery at the ED, including inconsistent implementation of pain scoring tools at triage, variability in clinicians' decisions, and inadequate use of standardized protocols that ensure a prompt and follow-up evaluation [14]. Quality improvement projects implemented by some centers have shown a marked reduction in TTA and better workflow outcomes compared to the baseline measures [11,15]. These projects integrate measures such as triage pain assessment documentation, a fast-track patient pathway, and nurse-driven analgesia protocols.

The application of a structured pain management protocol in everyday clinical practice and electronic healthcare systems offers a promising approach to enhance the reliability of patient care. Clinical strategies that integrate pain assessment tools, rapid intervention, and reassessment can minimize variability in clinicians' decisions, enhance adherence to evidence-based practices, and enable real-time evaluation of the workflow [15].

In response to the recognized gaps in pain management practice within our ED, we aimed to develop and implement a standardized ED pain management strategy based on the pain assessment, intervention, and reassessment (AIR) cycle. This quality project aimed to reduce the TTA and enhance the consistency and reliability of care delivery.

Materials and Methods

Study design and setting

This was a prospective, quality-improvement, single-center study conducted in the emergency department of Care Medical AL Rawabi. We used the IHI quality improvement methodology to integrate the ER triage flow and EHR technology and to enforce the "Reassessment" phase. This project was implemented over a period of eight months from January 1 to August 30 (Phases: Planning/Development, Pilot Testing/Training, and Full-Scale Implementation/Data Collection). We did not perform any retrospective data collection at any stage during the study.

Our main objectives were to reduce the average time to analgesic administration from 25 minutes to 15 minutes, increase documentation of pain reassessment (within 60 minutes) to 95% compliance, and increase patient satisfaction with pain control to 75%.

Study population

All adult and pediatric patients presented to the ED with acute pain (pain score of ≥4/10 at triage). They were included if they had acute pain as the chief complaint and if they were able to provide informed consent. Exclusion criteria were all patients aged ≥ 14 years.

Exclusion criteria: patients under the age of 14, individuals with documented allergies to the pathways' pain medications, patients who had received paracetamol within the last 6 hours, and those who had received a Methoxyflurane inhaler or Diclofenac within the last 12 hours.

Intervention

We implemented a standardized, evidence-based Pain Clinical Pathway integrated into the Electronic Health Record (EHR) and ED triage process. Patient routing was strictly dictated by the initial visual triage score. Patients with severe pain were shifted directly to the resuscitation room for immediate physician assessment. Patients with moderate pain were directed to the triage area, where ER staff nurses allocated a bed and facilitated registration. While patients with mild pain were routed primarily through standard registration.

The standardized clinical pathway guides immediate pharmacological interventions based on pain severity. For patients presenting with severe pain (7–10), management is initiated with Paracetamol 1g IV STAT. If IV access was difficult, alternative routes included a Methoxyflurane (Penthrox) Inhaler or Diclofenac 75 mg IM stat, taking into account the patient's reference for the route of administration. Pain levels were then reassessed until the score decreased to ≤3/10. Patients with mild to moderate pain were similarly managed with tailored pharmacological and non-pharmacological methods as per physician orders.

We used this pathway to apply the pain AIR cycle in clinical practice, incorporating rapid pain assessment at triage, prompt analgesic administration, and enforced pain reassessment (within 60 minutes).

The key components of our pathway were:

1. It was developed based on the best clinical practice.
2. All the staff were subjected to obligatory training.

3. Mandatory EHR Hard-Stops/Alerts were used to prevent clinicians from moving to the next task without documenting the 60-minute reassessment.
4. Real-time dashboard monitoring was used as a visual safety net to highlight patients who missed any step of the protocol.

We applied the protocol throughout all ED shifts and into the routine clinical care to limit the variation in practice and reduce pain management delays.

Outcome measures and data collection

The primary outcomes:

1. The average time between the first pain assessment and analgesic administration.
2. Proportion of patients who underwent pain reassessment within 60 minutes.

The secondary outcomes:

1. Patient satisfaction level with pain control measurements.

The pain severity was recorded according to standardized pain assessment tools as per hospital policy, primarily the Wong-Baker Faces Pain Rating Scale and the Numerical Rating Scale (NRS). These scales are validated instruments that allow for a consistent categorization of pain intensity into mild, moderate, or severe, ensuring a tailored clinical response for each patient. Additional data included age, sex, pain etiology, and its site, triage priority level, the specific analgesic intervention provided, and the documented pain score upon reassessment to ensure the target threshold of ≤ 3/10 was achieved.

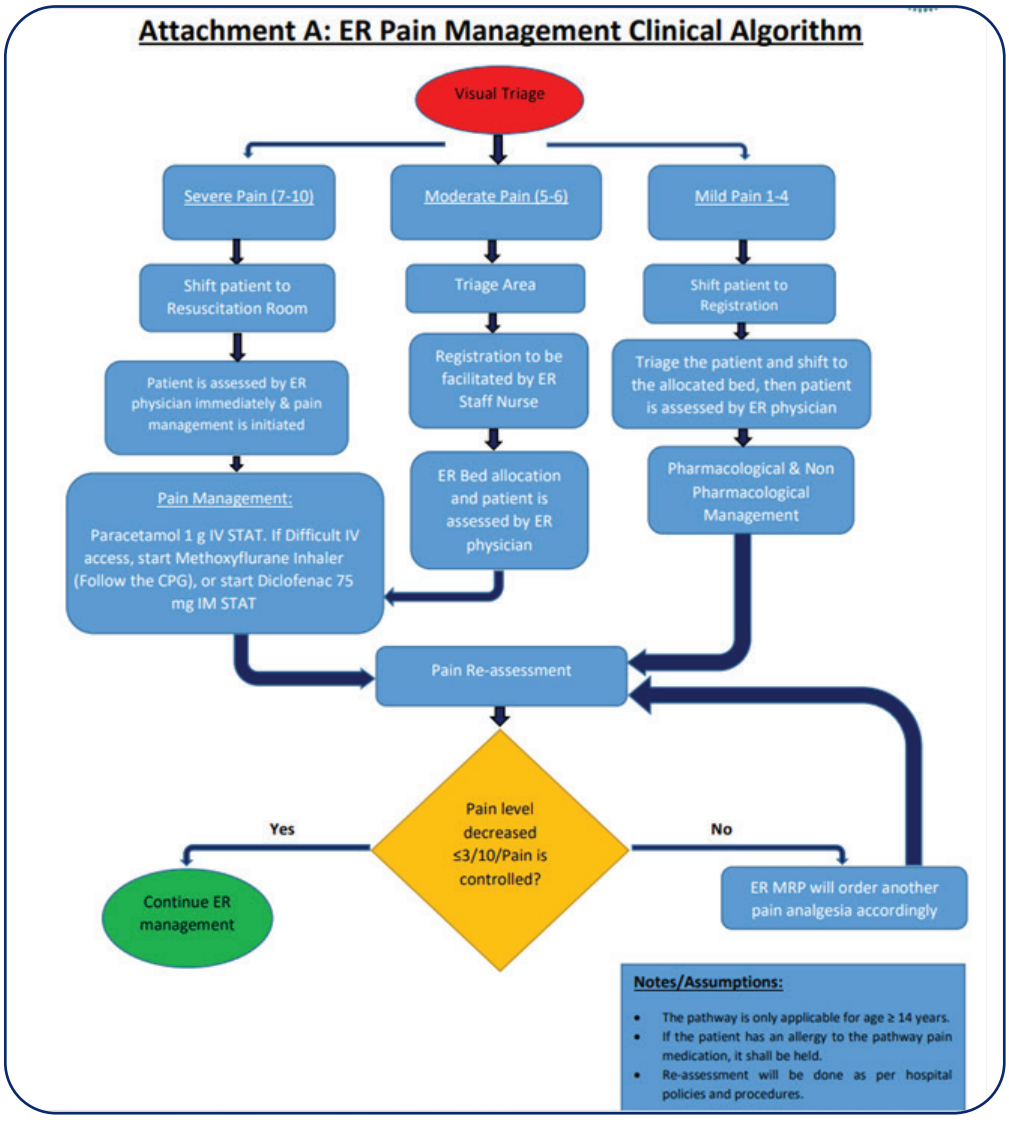

Figure 1. *ER pain management clinical algorithm.*

Statistical analysis

We conducted the statistical analysis using SPSS version 27 software. Patient characteristics and demographics were summarized using descriptive statistics. Frequencies and percentages were used for qualitative data, while chi-square tests or Fisher's exact were used for comparative analysis of continuous data. *P*-values of <0.05 were considered significant.

Ethical considerations

This was a quality improvement initiative study. All the treatments followed institutional and national guidelines on pain management, and no experimental intervention was used.

Results

Patients characteristics

Age and gender: The cohort included patients aged ≥ 14 years. Descriptive statistics were used to summarize the distribution of age and sex across the study period.

Pain severity at triage: Patients were categorized based on their initial pain scores (≥4/10), with cases distributed among severe pain (7-10), moderate pain (5-6), and mild pain (4/10) categories.

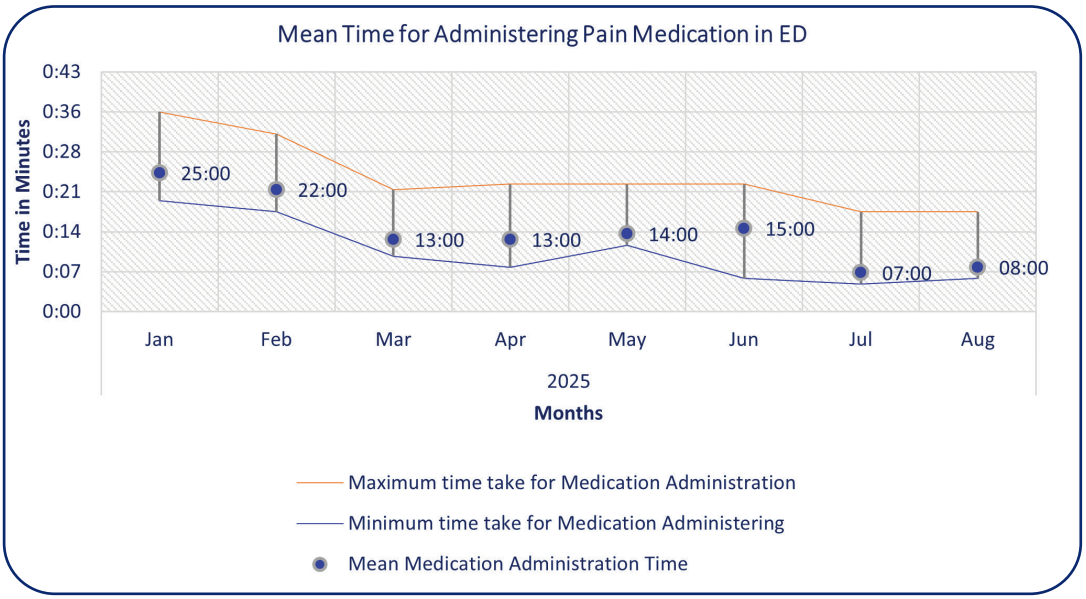

Figure 2. *Mean time for administering pain medication in ED.*

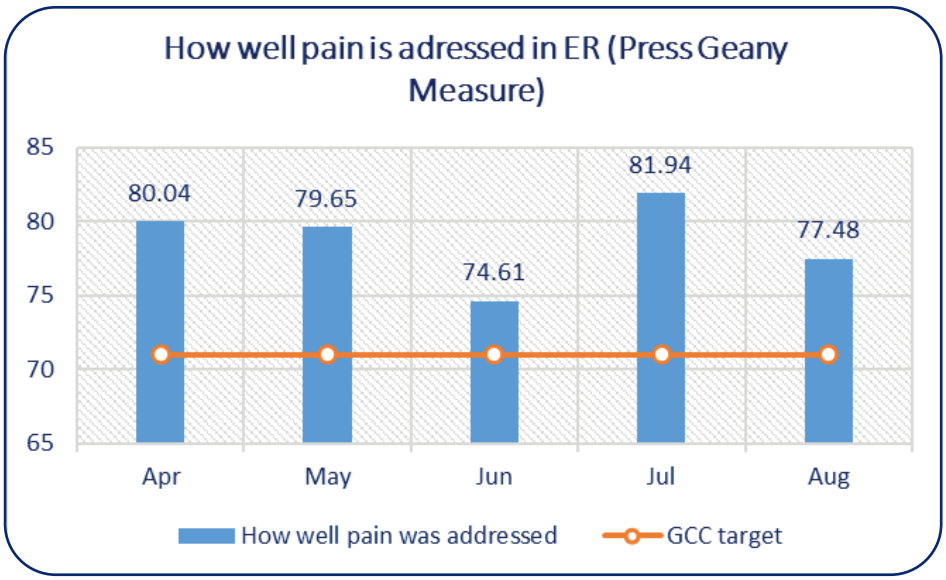

Figure 3. *How well pain is addressed in ER.*

Triage category: Patients were further classified by their triage priority, including those assigned to resuscitation, ER Beds, or Registration, based on the severity of their condition and pain level.

Emergency room (ER) pain management clinical algorithm

Figure 1 shows the pain management clinical algorithm used in the ER. Based on the pain severity score and visual triage, patients were categorized into three groups: mild pain (1–4), moderate (5–6), or severe (7–10). Within each group, patients were managed following a predefined clinical pathway that encompassed patient flow, physician assessment, structured pain management strategies, including pharmacological and non-pharmacological interventions, and mandatory pain reassessment to identify cases requiring further analgesia.

Mean medication administration time (MAT)

The mean MAT progressively decreased over the study duration, from 25 to 8 minutes (Figure 2). At the beginning, the mean MAT was 25 minutes in January, followed by 3 minutes reduction in February, then a marked reduction was recorded throughout March and April, where the mean MAT reached 13 minutes. A slight increase of 2 minutes was observed in May and June, which was followed by another marked reduction, where the mean MAT reached its shortest score in July (7 minutes) and August (8 minutes).

Patient satisfaction level with pain control measurements

Below satisfaction chart for pain

Throughout the implementation period, the department maintained scores significantly above the GCC target of 71%, demonstrating the success of the clinical pathway integration (Figure 3).

Staff compliance

100% compliance was achieved across all components of the AIR cycle, including sustained pain assessment, intervention, and reassessment compliance.

Discussion

This was a prospective, quality improvement study aimed at developing a new standardized ED pain management strategy according to the pain AIR cycle to address the gaps in clinical practice and enhance the consistency of care delivery. A total of patients were included in our study. Of these presented with mild pain, some with moderate pain, and some with severe pain. Our results showed that the application of the pain management clinical algorithm at the ER was associated with a marked reduction in the mean medication administration time throughout the study period. The mean administration time was reduced from 25 minutes in January to 8 minutes in August, suggesting improved pain management efficiency. Also, 100% compliance was achieved in each component of the AIR cycle, demonstrating that the developed clinical pathway is successfully maintaining comprehensive, consistent pain management.

Various quality improvement projects have targeted TTA as a key indicator of pain management efficiency in the ER. Previous literature demonstrated that systemic strategies such as pain scoring tools, standardized protocols, and nurse-initiated analgesia (NIA) can substantially affect the quality and timing of pain management in the ER environment [16–18]. A recent Canadian study conducted across two tertiary care hospitals (Victoria General Hospital, Royal Jubilee Hospital) found that the implementation of a triage protocol enabling nurse-initiated opioid administration significantly reduced the median time to opioid administration by 45.6% and 62.5% at each hospital, respectively. Also, they found that pain score documentation increased to >50% compared to <10% reported in the previous audit conducted in 2019 [15]. Likewise, an Ethiopian quasi-experimental study reported that empowering frontline staff through activation of the NIA protocol significantly reduced TTA and increased patient satisfaction compared with the standard practice [19]. These results align with what was reported by previous literature [20,21] emphasizing the value of NIA protocols in reducing delays in pain control at emergency settings. Another study from the Sydney metropolitan ED found that NIA was associated with lower median TTA compared to doctor-prescribed analgesia, and that triage pain-score documentation contributed to shortened delays. However, they also reported that there was a substantial number of patients who still experienced delay beyond the recommended benchmarks due to a lack of standardization and inconsistent pain assessment and documentation [13].

Quality studies and systematic reviews have repeatedly reported that pain is the chief complaint of many ER-presenting patients [1,14,22]. Yet rapid analgesic delivery remains challenging across many settings. A multi-center study conducted over 50 EDs showed that pain severity assessment was done in 90% of patients, and only 48% of them underwent pain reassessment. Moreover, initial therapy was provided in just 74% of patients within 60 minutes [23]. This delay in pain management was attributed to the ED volume, patients' underlying disorders, insufficient triage nurses, and initial pain severity score. Another systematic review found that the mean or median of TTA was more than 60 minutes in six out of nine included studies, and they found that TTA was influenced by the type of pain and its intensity [22]. In this context, the marked reduction observed in our results to 7 or 8 minutes indicates remarkable progress compared to the standard benchmarks mentioned in previous literature.

Strengths and limitations

One of our strengths is the prospective nature of our study, and the fact that the implemented strategy

was developed based on best clinical practice. In addition, all the staff members were subjected to obligatory multidisciplinary training. Also, mandatory EHR Hard-Stops/Alerts were used to enhance the 60-minute pain reassessment step, and real-time dashboard monitoring was used as a visual safety net to highlight patients who missed any step of the protocol. Moreover, we managed to achieve a 100% compliance among all components of the AIR cycle and a sustained improvement in timing analgesia over the study duration. However, we had several limitations that must be reported, such as the lack of randomization and a control group, which can potentially impact the causality relationship between the clinical algorithm and the observed outcomes. Also, there was a limitation in patient-reported outcomes; despite our focus on MAT as the chief performance indicator of pain management strategy, we lacked other important outcomes such as pain intensity after treatment, adverse events related to the delayed medication or over-medication, patient quality of life, and functional outcomes, including mobility, sense of comfort, and ability to sleep.

Conclusion

The implementation of a standardized ER pain management clinical algorithm significantly reduced the mean medication administration time and limited variability in analgesic delivery over a period of 8 months. This aligns with previous literature emphasizing the value of structured quality improvement strategies in enhancing pain management practices in the ER. These improvements highlight the importance of incorporating assessment, intervention, and reassessment cycles into routine clinical workflows with potential benefits for patient satisfaction and quality of care. Future studies should build on these strategies and link them to direct patient clinical outcomes, including pain severity progression and functional outcomes. Moreover, the evaluation should be extended to include various emergency care settings and explore obstacles facing the physicians and patient perceptions.

List of Abbreviations

ED	Emergency department
MAT	Mean medication administration time
NRS	Numerical Rating Scale
TTA	Time to analgesia

Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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