

## ORIGINAL RESEARCH

# Improving handoff efficiency from emergency department to intensive care

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## ABSTRACT

The emergency department to intensive care unit nurse handoff process was found to be inefficient in a Midwest community hospital, resulting in prolonged admission times. The purpose of this project was to determine if implementation of a standardized bedside nurse handoff process would affect admission efficiency. Efficiency of nurse handoff, efficiency of emergency department to intensive care unit admissions, and rates of intensive care unit patient boarding in the emergency department were examined. A task force composed of staff nurses developed a standardized bedside nurse handoff process following guidelines from the literature. This new handoff process incorporated the evidence-based concepts of bedside report, standardization, and electronic medical record. Stakeholder and staff buy-in were obtained, and the process was implemented. Outcomes were evaluated six months prior to- and one-year post-implementation of the standardized bedside handoff process. Analysis of one-year post-implementation data revealed an improvement in average handoff time by 15 minutes, an improvement in average admission time by 17 minutes, and a reduction in intensive care unit patient boarding by 19.5%. By improving efficiency of the nurse handoff process, and therefore the admission process, the findings of this project have the potential to reduce patient boarding and improve the quality of patient care. This quality improvement project also contributes to a gap in the current body of evidence pertaining to interdepartmental nurse handoffs.

**Key Words:** Nurse handoff, Emergency department, Intensive care unit, Efficiency, Evidence-based, Patient boarding

## 1. INTRODUCTION

### 1.1 Background

The emergency department (ED) to intensive care unit (ICU) admission process was found to be inefficient in a suburban community adult hospital in the Midwestern United States. The average duration from receipt of admission orders to transfer of the patient to the ICU was approximately 1.5 times higher than the targeted time of one hour. This hospital considered any patient held in the ED for greater than one hour after the request of an inpatient bed to be a boarder, and it was found that 65.5% of ICU patients admitted from the ED experienced boarding. According to the American College of Emergency Physicians,<sup>[1]</sup> patient boarding is the

holding of patients in the ED after admission orders have been received.

Patient boarding in the ED is of utmost importance when considering the critically ill patient. It is recommended that emergency nurses caring for critically ill patients for extended periods of time receive additional specialized training in skills such as assessment, monitoring, and ventilator management.<sup>[2]</sup> ICU patients are labor, time, and resource intensive, and their boarding in the ED can result in suboptimal outcomes.<sup>[3-5]</sup> In order to provide the best care to this vulnerable population, reduction of ICU patient boarding, and improved admission efficiency must be prioritized.

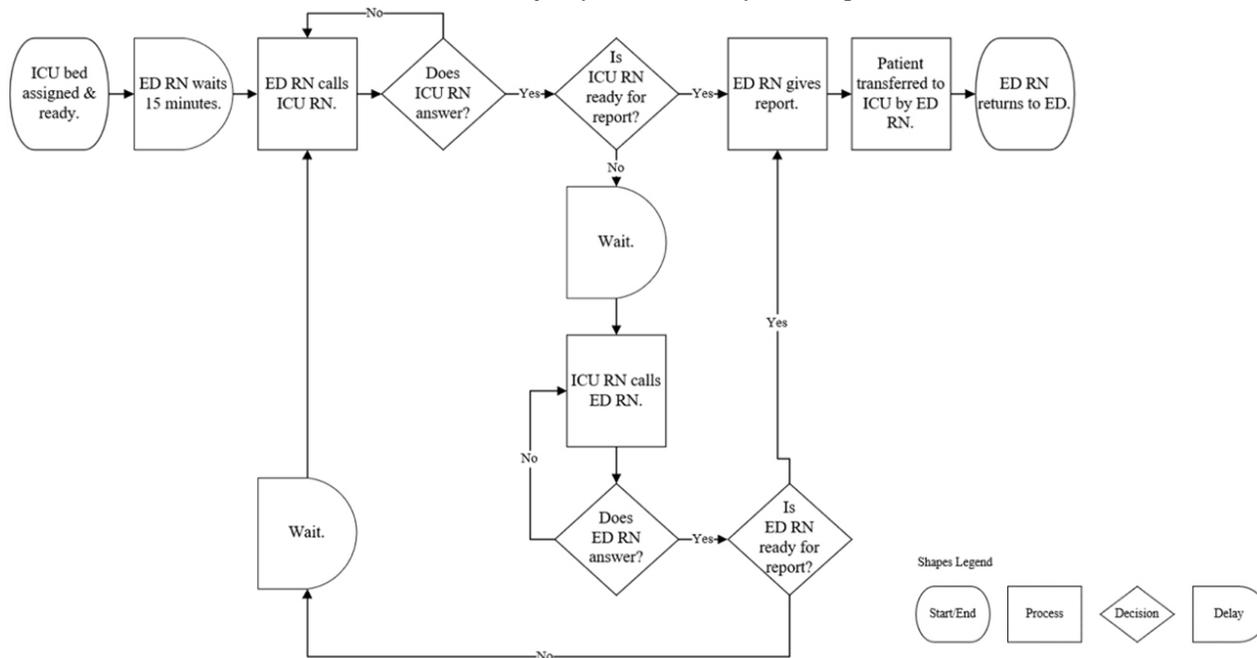
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Improvements in the efficiency of ED to ICU admissions is also beneficial for ED throughput. Patient boarding in the ED results in impaired bed utilization and a decreased capacity to treat ED patients.<sup>[6]</sup> With ICU patients transferred to their inpatient beds more quickly, the ED is able to reallocate resources to evaluate and treat incoming patients sooner. Further, the Centers for Medicare and Medicaid Services (CMS) report and track ED throughput metrics such as “Admit Decision Time to ED Departure Time for Admitted Patients” and “Median Time from ED Arrival to ED Departure for Admitted ED Patients,” so inefficient admission processes can affect hospital standings and reimbursements by CMS.<sup>[7]</sup>

A quality improvement project to evaluate and improve ED to ICU admission efficiency was initiated at a Midwestern suburban community hospital. Six months of ED to ICU admission data were analyzed to determine the extent of the problem. At the hospital, the average duration from receipt of admission orders to transfer of the patient to the ICU was one hour and 28 minutes, approximately 1.5 times higher than the targeted time of one hour. Of ICU patients admitted from the ED, 65.5% were boarders. With the majority of

ICU patients boarded in the ED, this project was initiated to develop and implement a new admission process for these patients.

Evaluation of the admission process resulted in identification of an inefficient nurse handoff process between the ED and ICU. Prior to implementation of the new handoff process, emergency to ICU nurse handoff occurred via the telephone. Telephone handoff introduced a significant amount of waste to the process and delayed transfer of the ICU patient (see Figure 1). Figure 1 demonstrates the original ED to ICU nurse handoff process. In the original process, telephone handoff occurred prior to the transfer of the patient to the ICU. As depicted in Figure 1, telephone handoff introduced inefficiencies to the process, as providing handoff often required multiple calls amongst the emergency and ICU nurses. Therefore, the purpose of this quality improvement project was to determine if implementation of a standardized bedside nurse handoff process affected efficiency of nurse handoff, efficiency of ED to ICU admissions, and rates of ICU patient boarding in the ED. This project was deemed exempt by the university and hospital Institutional Review Boards.



**Figure 1.** Original emergency department to intensive care unit handoff process

*Description: Process map of original emergency department to intensive care unit nurse handoff process.*

**1.2 Literature review**

Evidence was used to guide development of the new handoff process. To examine current evidence on nurse handoff, a comprehensive database search was performed prior to project start. Search terms used were “nurses,” “patient handoff,” “emergency services,” “hospital,” and “patient admission.” In order to be included in the literature analysis, studies had to be published within the previous 5 years and

peer-reviewed. At the time of the intervention development, high-grade evidence was lacking, as only one meta-analysis and no experimental studies on this topic were identified in the literature.<sup>[8]</sup> There was a gap in evidence regarding analysis of interdepartmental nursing handoff, specifically as it pertains to ED to ICU nurse handoff. Three recommendations were identified regarding nurse handoff. These

recommendations include 1) standardization of handoff; 2) bedside handoff; 3) use of multi-modal handoff.

First, standardization of handoff was a recurrent recommendation in the literature. Previous research indicated that standardizing the handoff process was an essential characteristic for effective handoffs.<sup>[9,10]</sup> Additional studies demonstrated that standardized handoff was associated with improved clinical performance, positive patient outcomes, greater patient and nurse satisfaction, improved financial outcomes, fewer errors, and increased efficiency.<sup>[11-13]</sup>

The literature also recommended the use of bedside handoff. Bedside handoff was shown to demonstrate a positive association with improved patient and nurse satisfaction, as well as increased patient satisfaction and nurse accountability.<sup>[14,15]</sup> Bedside handoff was also shown to improve patients' confidence in their nursing staff without impeding privacy.<sup>[16]</sup>

Finally, the use of multi-modal handoffs was supported by evidence. Multi-modal handoffs incorporate various modes of information exchange (i.e. face-to-face, written, electronic, telephone). The use of electronic medical record (EMR) as a supplement to bedside report was seen in the literature.<sup>[17,18]</sup> Using multi-modal approaches for nurse handoff was found to increase nurse satisfaction, improve quality and accuracy of handoff, and improve perceived effectiveness.<sup>[17-20]</sup>

Recent publications continue to support these findings. Standardization of the nurse handoff process continues to have a positive impact, with studies showing that standardization is associated with reduced errors, increased efficiency, and perceptions of increased effectiveness.<sup>[21-24]</sup> Recent findings also suggest continued positive impact associated with

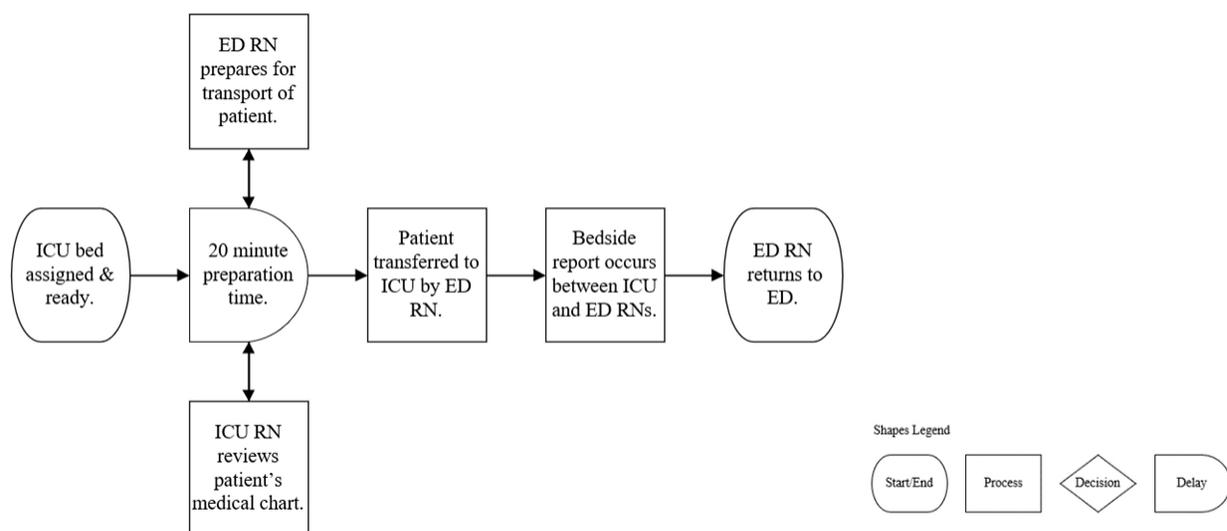
bedside report, including improved perceptions of accuracy of handoff, greater nurse and patient satisfaction, and improved information exchange.<sup>[25-27]</sup> Additionally, incorporation of EMR into the handoff process has been associated with positive outcomes as well, with a recent study showing improvements in admission efficiency after implementation of a standardized EMR nurse handoff process.<sup>[22]</sup> There is still a gap in the literature as it pertains to ED to ICU nurse handoff, and high-grade evidence is still lacking.

Based on the recommendations found in the literature, an opportunity to revise the current handoff practices among emergency and ICU nurses at this hospital was identified. Nursing leadership supported this initiative through creation of a task force composed of emergency and ICU nurses. The task force was challenged to improve efficiency of emergency to ICU handoff while incorporating recommendations from the literature.

## 2. METHODS

### 2.1 Process development

A task force composed of emergency and ICU staff nurses was formed. Three nurses from each department volunteered to participate in the task force. The task force met bi-weekly for three months. Nursing leadership served as a resource for the task force as needed. After first identifying areas of inefficiency in the original handoff process (see Figure 1), members of the task force collaborated to develop a mutually agreed upon standardized bedside handoff process developed from literature recommendations. Figure 2 depicts the new standardized bedside handoff process. As can be seen in Figure 2, telephone handoff was removed from the process.



**Figure 2.** Standardized bedside handoff process

*Description: Process map of standardized bedside nurse handoff process implemented for emergency department to intensive care unit admissions.*

The new standardized process dictates that the emergency nurse transfers the patient to the ICU 20 minutes after the ICU bed has been assigned. The duration of 20 minutes was chosen by the task force because it allows time for the ED team to prepare the patient for transfer and the ICU nurse to prepare for receipt of the patient. During the 20 minutes before transfer of the patient, the ICU nurse reviews the ED documentation in the EMR. This EMR review provides the ICU nurse with details surrounding the incoming patient so the room can be prepared accordingly. Once the patient is brought to the ICU by the emergency nurse, bedside report occurs following Situation Background Assessment Recommendation (SBAR) format.<sup>[28]</sup> The emergency nurse then returns to the ED after bedside report occurs. This process incorporates the evidence-based concepts of bedside report, standardization, and EMR, while also minimizing waste and inefficiency associated with telephone based handoff.

**2.2 Process implementation**

Successful implementation of the intervention required stakeholder buy-in and sufficient nursing education. Nursing leadership approved the process prior to implementation. Face-to-face staff education, led by nurse task force members, occurred in the ED and ICU during staff meetings. Education was reinforced through email distribution and unit rounds by the nurse task force members. Additionally, process flow maps and SBAR resources were placed throughout the ED and ICU. Continuous outcome evaluation was conducted throughout the implementation process. Staff re-education was performed intermittently as needed for 6 months post implementation, until sustainment was achieved. Task force members served as experts for their corresponding departments to address questions or concerns. The task force continued to meet as needed after implementation of the process to evaluate outcomes and plan staff re-education.

**2.3 Process outcomes**

The outcomes evaluated in this quality improvement project were handoff time, admission time, and rate of ICU patient boarding in the ED. These outcomes directly measured the efficiency of ED to ICU handoff and admission. Data were extracted from the hospital’s bed management software. To ensure robust analysis of intervention impact, data from all ED to ICU admissions during the six months prior to and one year after intervention implementation were included.

Handoff time was defined as the time from bed assignment to the time of transfer of the patient to the ICU. Admission time was defined as the time from ICU bed request to transfer of the patient to the ICU. ICU patient boarding rate was the percentage of ICU patients who remained in the ED for

greater than one hour after the ICU bed was requested.

**3. RESULTS**

Process outcomes were evaluated six months prior to and one year after the intervention implementation. Results are summarized in Table 1. Additionally, delays to the admission process were identified through chart audits and are discussed.

Table 1 presents average results for the six months prior to intervention implementation and one year after intervention implementation.

**Table 1.** Results summary

	<b>Pre-Intervention (n = 509)</b>	<b>Post-Intervention (n = 938)</b>
Handoff Time	66 minutes	51 minutes
Admission Time	88 minutes	71 minutes
Boarding Rate	65.5%	46.0%

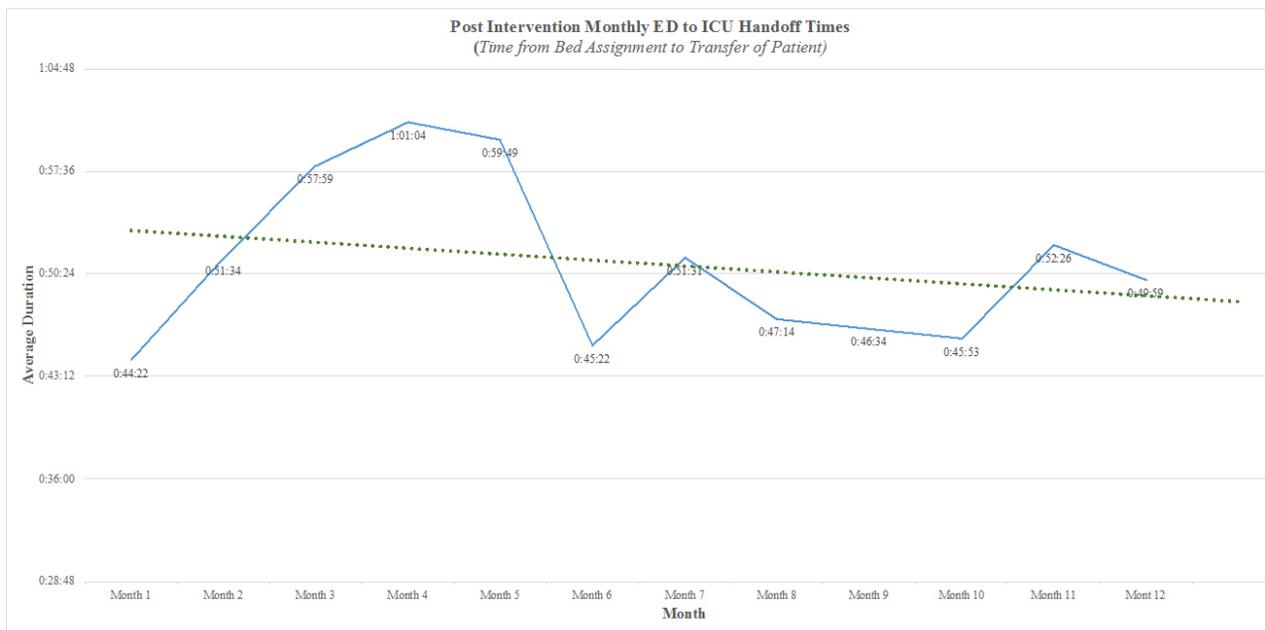
**3.1 Handoff time**

Prior to implementation of the standardized bedside handoff process, nurse report occurred via telephone. During the six months prior to implementation of the intervention, the average handoff time was 1 hour and 6 minutes (SD = 34 min; n = 509). During the six months after intervention implementation, the average handoff time was 54 minutes (SD = 36 min; n = 466), a 12-minute improvement in comparison to the six months prior to implementation. Analysis of one-year post-implementation data revealed an average handoff time of 51 minutes (SD = 28 min; n = 938). This is a 15-minute reduction in average handoff time one-year post implementation in comparison to the six months prior to intervention implementation. This is a 22.7% reduction in average handoff time one-year post intervention. The trend line for the average monthly ED to ICU handoff times shows continuous reduction in duration for handoff times during one-year post implementation (see Figure 3).

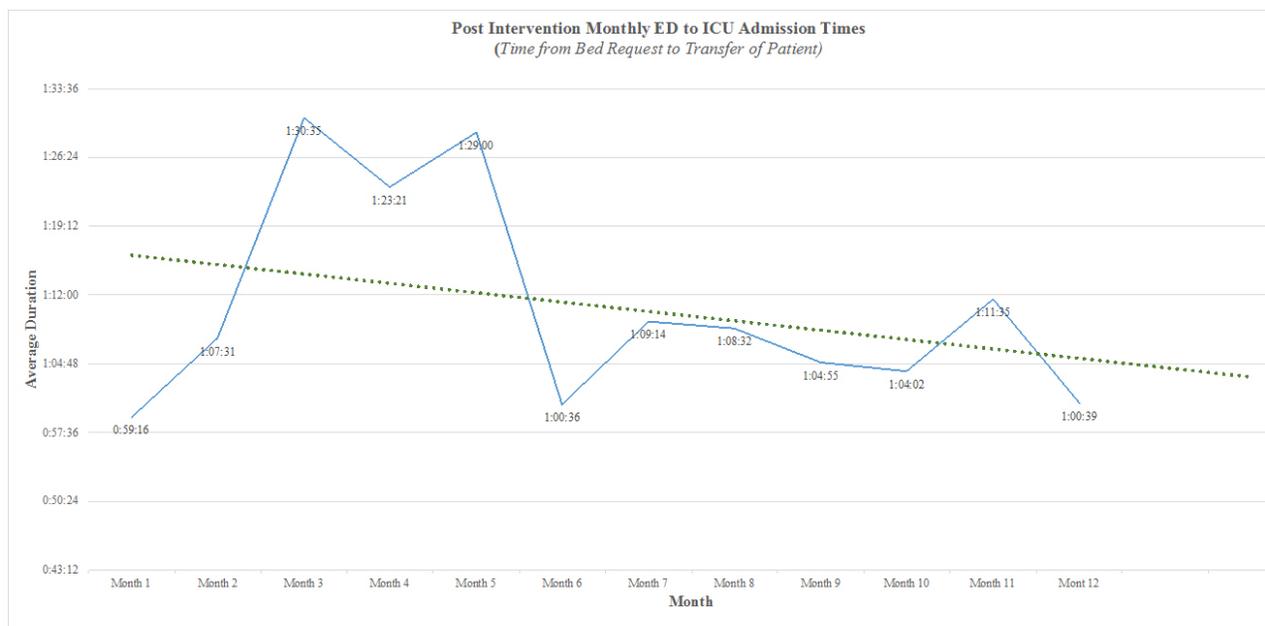
**3.2 Admission time**

During the six months prior to implementation of the intervention, the average admission time was 1 hour and 28 minutes (SD = 52 min; n = 509). During the six months after intervention implementation, the average admission time was 1 hour and 16 minutes (SD = 48 min; n = 466), a 12-minute improvement in comparison to the six months prior to implementation. Analysis of one-year post-implementation data revealed an average admission time of 1 hour and 11 minutes (SD = 44 min; n = 938). This is a 17-minute reduction in average admission time one-year post implementation in comparison to the six months prior to intervention implemen-

tation. This is a 19.3% reduction in average admission time one-year post intervention. The trend line for the average monthly ED to ICU admission times shows continuous reduction in duration for admission times during one-year post implementation (see Figure 4).



**Figure 3.** Post intervention monthly ED to ICU handoff times  
 Description: Line chart depicting post intervention emergency department to intensive care unit nurse handoff times.



**Figure 4.** Post intervention monthly ED to ICU admission times  
 Description: Line chart depicting post intervention emergency department to intensive care unit admission times

**3.3 Boarding rate**

During the six months prior to implementation of the intervention, the average ICU patient boarding rate was 65.5%

(n = 509). During the six months after intervention implementation, the average ICU patient boarding rate was 49.1% (n = 466), a 16.4% improvement in comparison to the

six months prior to implementation. Analysis of one-year post-implementation data revealed an average ICU patient boarding rate of 46.0% (n = 938). This is a reduction of 19.5% in ICU patient boarding one-year post implementation in comparison to the six months prior to intervention implementation.

### 3.4 Identification of admission delays

Despite these improvements in efficiency of the handoff and admission process, overall admission time at one-year post-implementation was still 1 hour 11 minutes, 11 minutes greater than the organization's goal. After evaluation of outcomes, chart audits were performed on all ICU patients with admission times greater than one hour during the six months after implementation (n = 229). The purpose of the chart audits was to identify other variables that may contribute to prolonged admission times for ICU patients. It was found that potential delays to the admission process were complex and multifactorial. Chart audits revealed the leading contributors to total admission time greater than one hour to be delayed bed assignment (52.0%), order completion prior to transfer (24.4%), environmental services (13.5%), and patient status/acuity changes (11.4%). Chart audits were limited by information provided in the EMR. Moving forward, factors contributing to delayed transfer of patients to their inpatient unit could be a source of further research and action.

## 4. DISCUSSION

### 4.1 Discussion of results

Analysis of outcomes from this project revealed improvements in average handoff time and average admission time that translated into a reduction of ICU patient boarding by 19.5%. By one year post-implementation, the practices of the new handoff process showed evidence of sustainment, indicated by sustained outcomes without continued need for staff re-education.

These results are consistent with other findings in the literature. One study evaluated ED to general medical unit admission efficiency with the use of a standardized electronic handoff process and reported improved efficiency outcomes.<sup>[22]</sup> Although the intervention and patient population differ, the findings are congruent with results of this quality improvement project.

Overall, significant improvements were seen in average handoff time, average admission time, and patient boarding rates for ICU patients after implementation of the standardized bedside handoff process. Specifically, average admission time improved by 17 minutes one-year post implementation. By improving the average ED to ICU admission time by

17 minutes, the ED is able to more quickly accommodate incoming patients and reallocate resources to the care of other critical patients.<sup>[6]</sup> Further, the patient receives the specialized level of care provided by the ICU sooner.<sup>[3]</sup> Finally, CMS metrics such as "Admit Decision Time to ED Departure Time for Admitted Patients" are positively affected.<sup>[7]</sup>

### 4.2 Limitations

It should be noted that data were not analyzed for statistical significance, which is a limitation of the study. Additionally, this was a quality improvement project and therefore lacks generalizability.

### 4.3 Impact

This project has the potential to bring value to patients and the healthcare community. By improving efficiency of the nurse handoff process, and therefore the admission process, the findings of this project have the potential to reduce patient boarding and improve the quality of patient care.

While this exact handoff process may not be transferrable to every organization, the process to obtaining such favorable outcomes is one that is reproducible. Through the creation of a nurse-led task force for the evaluation of the organization's ED to ICU handoff process, the organization was able to target areas of waste to create a process that reduced inefficiencies, made pragmatic sense for the organization, and was grounded in the evidence. Furthermore, these significant improvements were seen without major financial investment from the organization.

Finally, this quality improvement project contributes to the current body of evidence. There is a gap in the literature as it pertains to efficiency outcomes associated with nurse handoff between ED and ICU. Moving forward, it is important to generate further evidence on the efficiency of nurse handoff processes. There is also a need for higher grade evidence on nurse handoff. Additionally, there is potential for further investigation regarding the results of the chart audits, specifically as it pertains to the variables identified as contributors to prolonged or delayed admissions.

## 5. CONCLUSION

The critically ill patient population is extremely vulnerable, and if boarded in the ED, requires specialized care.<sup>[2]</sup> Through evaluation of the ED to ICU admission process at this Midwestern suburban community hospital, it was determined that the ED to ICU nurse handoff process was inefficient and contributed to ED boarding of critically ill patients. An evidence-based solution was developed to improve efficiency of ED to ICU nurse handoff in an effort to improve admission efficiency and reduce ICU patient boarding in the

ED.

Implementation of a new standardized bedside handoff process for ED to ICU patient admissions resulted in improvements in handoff efficiency as measured through handoff times, admission times, and ICU patient boarding rates. This quality improvement project also demonstrates how significant improvements in efficiency can be achieved by a team of

staff nurses with relatively minor resource investment from the organization. Organizations can use evidence from this quality improvement project to strive for similar successes of their own.

## CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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