Summer 2024

Enhancing Communication Efficiency in an Emergency Department by Employing a Visual Communication System for Lab Results Tracking: A Quality Improvement Project

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Enhancing Communication Efficiency in an Emergency Department by Employing a Visual Communication System for Lab Results Tracking: A Quality Improvement Project

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Abstract

**Background:** A Critical Access Hospital in New England faces communication challenges in its Emergency Department, impacting patient flow and safety. The current paper charting system leads to delays and inefficiencies.

**Local Problem:** The communication gap between ordering laboratory tests and providers reviewing results at the patient’s bedside averages 130 minutes, contributing to delays and potential patient safety issues.

**Methods:** Using the Plan-Do-Study-Act model, a visual communication system was implemented. Laminated labels indicating pending lab, CT, and radiology reports were affixed to patient folders. Data was collected pre- and post-intervention to measure time from lab order to provider review.

**Interventions:** Laminated labels with test details and order times were attached to patient folders. Staff tracked the completion of tests using tally marks on the labels. The intervention aimed to reduce the time from ordering tests to provider review by 20%.

**Results:** The intervention led to an average reduction of 11 minutes in the time from ordering tests to provider review, though the reduction was not statistically significant (p=0.39). The visual system increased staff collaboration and awareness but faced challenges during peak periods.

**Conclusion:** While the visual communication system did not achieve statistically significant results, it showed potential for improving workflow efficiency and communication. The intervention highlights the importance of effective communication tools in the ED and suggests potential adaptations for other settings using paper charting systems.

**Keywords:** Communication, Emergency Department, Paper Charting, Visual Communication System, Patient Safety, paper chart*, paper document*, handwritten document*, hand written document*, trad* document*, emergency room, emergency department, emergency medicine, and emergency ward.
Introduction

A critical access hospital located in New England is part of a metasystem including a large medical center to provide comprehensive healthcare services to the local community. The Emergency Department (ED) within the macrosystem has 13-beds along with 1 psychiatric room designated for individuals suffering from mental health issues. According to Hettinger et al. (2020), even in the smallest hospitals, patient safety can be compromised due to communication breakdowns, especially among the healthcare professionals. Emergency department (ED) staff attribute the chaotic environment as the main obstacle to effective interprofessional communication (Hettinger et al., 2020). Communication has been determined to be a problem within the rural New England microsystem. The communication gap between ordering laboratory tests and waiting for all results to be printed off and attached to the patient’s paper chart affects all staff within the ED. This gap occurred between the time laboratory tests were ordered to the time the provider reviewed the results at the patient’s bedside.

A study conducted by Hettinger et al. (2020), stated that nurses would like to be informed, preferably verbally, about any alterations or additions to the patient’s work-up, such as, new orders for medication or completing an orthostatic blood pressure. The same was revealed for providers who would like regular patient updates such as eating, ambulation, and any delays in patient care (Hettinger et al., 2020). After a review of 30 patient’s charts the average time spent from when the laboratory tests are ordered to the time the provider was at the bedside reviewing results was 130 minutes. The purpose of the project was to improve the communication visually within the ED microsystem to ensure timely communication.

Problem Description
Efficient patient flow is critical in any healthcare setting, especially in the Emergency Department (ED), where delays can lead to life-or-death situations. Although there are various situations that lead to extended wait times in the emergency department, the continued use of a paper charting system is one of them. Nursing documentation plays a crucial role in patient safety and providing information to the providers and other healthcare workers (Coffey et al., 2015). According to Akhu-Zaheya et al. (2017), paper charting is time-consuming and in the fast-paced environment such as the ED, timeliness is important. Paper charts are often being misplaced or in the hands of the provider when the nurse needs to continue with documentation.

Challenges of paper charting in the ED include handwriting illegibility, missing information, and documentation delays, which can lead to potential errors and compromised patient safety. The nurse manager highlighted a specific challenge: the wait for all laboratory results to print before placing the patient’s folder in the provider’s rack to signal readiness for further assessment (C. Noble, personal communication, February 26, 2023). The process began with a laboratory requisition form being completed by the provider, which could include, laboratory tests, Computed Tomography scan (CT scan), and X-rays. Then, either the nurse or the Hospital Unit Coordinator (HUC) would order the tests through the hospital’s computerized ordering system. Once the tests have been ordered it typically takes 45 minutes to an hour for laboratory results and 1-2 hours for the CT scan and X-ray results to be sent to a larger facility to be read by a radiologist. Lastly, as results are completed, they print out through a printer in the nurse’s station. All staff, including nurses, Licensed Nursing Assistants (LNAs), and HUCs, bear the responsibility, whether it is their patient or not, to paperclip the printed results to the outside of the respective patient’s folder (C. Noble, personal communication, February 26, 2023). Only
after all laboratory results are paperclipped to the front of the folder is it placed in the provider’s rack to signal that the patient is ready to be seen again.

The communication gap lies in the process of waiting for all of the printed laboratory results. As all staff are responsible for transferring laboratory results from the printer to the patient’s chart, the nurse attending to the patient may be unaware if all results have been received. This is because once a lab result is sent to the printer from the lab, anyone can add it to the paper chart without notifying the nurse (C. Noble, personal communication, February 26, 2023). This lack of communication for when the last laboratory test is resulted and paperclipped to the patient’s chart poses a significant challenge for patient care. Without knowing when all laboratory results have been received, nurses cannot effectively update physicians/physician assistants on the patient’s status.

Currently, the average time spent from when the laboratory tests are ordered to the time the provider is at the bedside reviewing results is 130 minutes. This average lag time depends on the acuity of the ED, if others are around to take the lab results off the printer and put them into the paper chart, and how busy the nurse who has the patient is. Moreover, the chart could also be sitting in the wrong spot with all laboratory results completed. This might happen because the nurse and other staff in the ED are unaware that the last laboratory result was already paperclipped to the folder.

Available Knowledge

Efficient communication of patient information, especially within the fast-paced environment of an Emergency Department (ED), is imperative for ensuring patients receive timely and effective care. Within the microsystem of the ED, where healthcare professionals often work under extreme pressure taking care of patient needs, trying to streamline the
communication process is essential. One aspect of this communication process was the timeliness of collecting all laboratory results in order to alert the provider once everything was accessible. This allowed the provider to make diagnostic and treatment decisions and return to the patient’s bedside to inform them of their results, along with any subsequent medical diagnoses and treatments. Traditional practice within the microsystem has been paperclipping lab results to the patient’s folder in a paper-based documentation system. However, this process can be cumbersome, even for the nurse caring for the patient, as checking the lab results against the lab requisition form requires opening the patient’s folder. In an environment where time is of the essence and efficiency is extremely important, the aim of this review of literature is to assess the optimization of workflow to enhance patient care delivery in an ever-demanding environment, such as the Emergency Department. A review of literature was completed to address this question: In healthcare professionals within the Emergency Department (P), how does implementing laminated labels indicating pending lab, CT, and radiology reports on patient folders (I) compared to standard practice of paperclipping results to the front of the folder (C) affect the efficiency of communicating completed results and signaling patient readiness for re-evaluation (O) over a two-week period?

**Search Methods**

A database search of Cumulative Index to Nursing & Allied Health Literature (CINAHL) Complete, MEDLINE, and Google Scholar was conducted based on their relevance to healthcare and medicine. The search strategy incorporated keywords such as, paper chart*, paper document*, handwritten document*, hand written document*, trad* document*, emergency room, emergency department, emergency medicine, and emergency ward. The Boolean operators AND and OR were used to combine different search terms effectively. The three databases
resulted a total of 183 records. The screening process involved removing duplicates (of which there were none) and screening titles and abstracts for relevance. Limitations included full text articles and studies completed within the last 10 years. It proved to be challenging to find relevant studies completed on paper charting within the last 10 years, therefore, revising the criteria to permit publications from the last 20 years was deemed necessary. The inclusion criteria included studies that compared paper charting and electronic health records, and process improvements within the emergency department. The exclusion criteria were minimal, such as articles written in a language other than English, articles limited to electronic health records only, and an evidence level of 6 or 7 according to Melnyk’s hierarchy of evidence (Brunt & Morris, 2024). After screening titles for relevance, 133 reports were assessed by reading the abstracts. Of these, 4 met the inclusion criteria and were included in this literature review.

**Critical Appraisal**

Ortíz-Barrios and Alfaro-Saíz (2020), conducted a systematic review that explored process improvements to address challenges faced in Emergency Departments. These challenges included overcrowding, prolonged wait times, extended lengths of stay, excessive patient flow time, and high rates of patients leaving without being seen (Ortíz-Barrios & Alfaro-Saíz, 2020). Both prolonged wait times and extended lengths of stay are influenced by communication delays, such as those related to the outcome of interest, which is timely communication. The review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to identify 203 scholarly articles (Ortíz-Barrios & Alfaro-Saíz, 2020). Multiple process improvement techniques such as, Plan, Do, Study, Act (PDSA) cycles, continuous quality improvement, lean manufacturing, critical pathways, cohort studies, simulation, experimental design, and six sigma were identified. Computer simulation and lean manufacturing proved to be
the most prominent methods for addressing Emergency Department operational issues such as reducing wait times and length of stay. Conversely, there was scarce information relating to interventions that targeted overcrowding and leaving without being seen. Strengths of this study included strong existing methods, the ability to analyze current performance, pre-test improvement scenarios, and the ability to facilitate user engagement (Ortíz-Barrios & Alfaro-Saíz, 2020). Weaknesses include the lack of hybrid approaches (combining multiple methods) and limited application in real-life scenarios (Ortíz-Barrios & Alfaro-Saíz, 2020). Ultimately, to effectively address Emergency Department challenges there is a need for interventions to target specific issues such as, overcrowding, as well as, addressing non-urgent issues and improve personnel training.

This review significantly contributes to the understanding of communication delays in the ED, particularly in the context of prolonged wait times. Extended waiting periods in the ED can lead to patient dissatisfaction, delayed admissions of new patients, increased severity of complications, and elevated morbidity rates (Ortíz-Barrios & Alfaro-Saíz, 2020). Moreover, ensuring smooth patient flow within the ED is also, crucial. Addressing obstacles and making improvements to factors that impede emergency care throughout a patients journey in the ED is important. Ortíz-Barrios and Alfaro-Saíz (2020) list issues such as, the layout of the department and placement of equipment, inadequate staffing, and insufficiencies in supporting processes operating concurrently.

A study conducted by Kobayashi et al. (2011), aimed to improve the physical charting system in an Emergency Department through the use of Human Factors Engineering (HFE) principles. The purpose behind this study was to recognize that chart organization systems can be potentially hazardous to patient safety due to errors in chart location, identification, and minimal
differentiation amongst charts (Kobayashi et al., 2011). The study was conducted in a high-volume academic medical facility that experienced approximately 143,000 Emergency visits on an annual basis (Kobayashi et al., 2011). The chart organization system was examined over 10 sessions (50 patient charts) in order to identify any deficiencies fixable by HFE interventions. Thus, an experimental chart revision was developed and implemented. The revision included a 12-color spectrum for the binders, prominent labeling, and color-coded location assignments (Kobayashi et al., 2011). A comparative analysis was used for pre- and post-intervention datasets using Fisher’s exact statistical test (Kobayashi et al., 2011). Pre-intervention assessments revealed deficiencies in the existing chart system such as, approximately 10% of the charts either misplaced or in the wrong location. Post-intervention, a significant reduction in chart-binder misplacement was noticed at 4% ($p < 0.01$), indicating improvements in the chart organization system was effective. The strengths of this study include the use of comparative analysis and its focus on addressing an important patient safety issue within the Emergency Department. However, some limitations include the small sample size of 50 charts and absence of formal provider feedback on the intervention’s effectiveness (Kobayashi et al., 2011). This study highlighted the importance of addressing deficiencies in chart organization in order to enhance patient safety and clinical operations.

A retrospective cohort study by Berkowitz et al. (2021), examines strategies for patient surges in a low-acuity pediatric Emergency Department with influenza like illness by comparing documentation using a paper bundle versus electronic medical records. This study takes place from January to March in 2018. Patients included within the study had to be 21 or younger. Within the January to March timeframe 1,710 patients met the low-acuity inclusion criteria and of those 1,710 patients, 119 were excluded due to the lack of a time stamp when the provider was
at the bedside. Of the 1,591 included in this study, 404 were documented using paper bundles. Paper documentation results showed a 21% shorter median time from when the provider was at the patient’s bedside to discharge compared to the electronic medical record documentation. Let it be known that the overall length of stay for the patients with paper documentation was not shorter than those with electronic medical records, as providers tended to utilize the paper bundle during high volume time and patients often had longer triage wait times (Berkowitz et al., 2021). Strengths of this study include the large sample size and a detailed analysis of visit characteristics/acuity. Limitations include the studies retrospective design which is impacted by chart completeness/data completeness. Ultimately, this study suggests the use of a paper bundle during influenza-related surges can improve pediatric ED efficiency without the compromise of patient safety. This literature investigates different documentation methods and their impact on efficiency and patient care delivery, particularly in the context of timeliness.

In a randomized control trial, St-Onge-St-Hilaire et al. (2024), studied how paper-based charting, which is often used in documenting resuscitation events, might fail to capture important data accurately. Resuscitation teams can struggle with completing tasks in a timely manner, which can ultimately impact patient outcomes. This study explored the effectiveness of electronic charting by comparing the completeness and accuracy to paper-based charting. A simulation-based randomized controlled trial, which included staff from the pediatric intensive care unit and emergency department, was comprised of one team leader, two individuals providing the CPR, and one nurse for charting (St-Onge-St-Hilaire et al., 2024). The intervention group used a handheld digital tablet with a specific application for cardiac arrest documentation, and the control group used standard paper charting (St-Onge-St-Hilaire et al., 2024). The sample size consisted of 20 charts in each group. The main outcomes to identify were charting
completeness and accuracy, which was assessed under predefined critical tasks and time differences between charted and actual task performance, respectively. Charts were scored on a scale of 0-2. A score of 0 was assigned if performance tasks had zero documentation, a score of 1 if the task was partially documented, and a score of 2 if all documentation was completed (i.e., Epinephrine - dose, route, and time). Study results revealed charting completeness was higher in the paper charting group, although the digital charting group captured all critical tasks. However, digital charting resulted a higher accuracy in time intervals between charted and actual task performance. Ultimately, both groups documented tasks within clinically acceptable time frames. The findings seem to align with previous research which shows that digital charting, with its time-stamped data points, tend to capture tasks more consistently, due to the fact that visual identification of missing fields alerts the recorder to complete the information (St-Onge-St-Hilaire et al., 2024). Strengths of this study included its simulated environment, standardized scenarios, and a focus on a specific clinical event. However, limitations include the use of a specific digital application, limited generalizability, and potential bias due to differential training between groups.

A case review conducted by Katz et al. (2013), defines key phases and issues of the laboratory testing process and identifies common errors, in an effort to standardize policies and improve communication among healthcare professionals and patient safety. The detailed case review summarized the care of a patient with diabetes and renal failure who experienced a critical event due to the miscommunication surrounding a possibly contaminated, abnormal test result (Katz et al., 2013). The laboratory clinician cancelled the test results in the EMR due to the need for a re-draw of the patients’ blood in order to test again. Ultimately, the healthcare worker could not retrieve another specimen due to difficulties and later patient refusal. Due to the lack of
direct communication between the laboratory staff and the provider, the cancelled labs were never retested. Consequently, the critically ill patient was discharged back to the long-term care living facility. However, he returned to the ED just two hours later, requiring cardiopulmonary resuscitation. Following the incident, a root cause analysis was implemented, leading to the development and implementation of a new protocol for communication. The strengths of the study included a thorough analysis of a critical incident case, which allowed for understanding of the events that led to the implementation of a new protocol. This enhances the relevance for improved communication and patient safety. Also, the involvement of multiple departments represents a collaborative effort in addressing patient safety concerns. Weaknesses included that the study was conducted at a single hospital, therefore reducing transferability to other hospital settings and a potential bias as the outcome does not address potential drawback or consequences.

Evidence Synthesis

Process improvement methods play a crucial role in addressing operational challenges in Emergency Departments. These operational challenges can contribute to communication challenges, as well as compromise patient safety. By implementing different improvement process within the emergency department, hospitals can increase operational efficiency through improved communication and as a bi-product increase patient safety. The evidence synthesized from multiple studies provides insights into different approaches for addressing challenges that can impact communication and patient safety in Emergency Departments.

Ortiz-Barrios and Alfaro-Saiz (2020) conducted a systematic review, identifying process improvements for Emergency Departments, focusing on the importance of interventions in addressing operational challenges. Ortíz-Barrios & Alfaro-Sáiz (2020), discussed how patient
flow times impact patient safety due and patient satisfaction. This study supports the fact that any improvements opportunities that support improved patient flow will enhance communication, patient safety, and satisfaction, fostering a more efficient and effective environment.

Kobayashi et al. (2011) addressed patient safety concerns by improving chart organization in the Emergency Departments through Human Factors Engineering (HFE) principles. Although this study is an evidence level 5 on Melnyk’s evidence level, it addresses deficiencies in chart organization systems and demonstrated the effectiveness of HFE interventions in reducing chart misplacement, ultimately improving patient safety within the Emergency Department. After implementation of HFE interventions such as color-coding, larger font labeling on chart binders, etc., a reduction in chart location problems was reached by approximately 4% (p < 0.01).

The case review by Katz et al. (2013), while level 5 evidence on Melnyk’s hierarchy of evidence, exposes issues in the laboratory testing process and a need to enhance communication among healthcare professionals. This study highlights where miscommunication can lead to critical events, compromising patient safety. However, improvement processes such as standardizing communication protocols can enhance workflow efficiencies through improved communication, thus increasing patient safety.

Both Berkowitz et al. (2021) and St-Onge-St-Hilaire et al. (2024), conducted a retrospective cohort study and a randomized controlled trial, respectively, under specific emergent events. They both compared paper charting to electronic health records identifying completeness, accuracy, and timeliness of each method. Berkowitz et al. (2021) findings suggest that utilizing a paper bundle during high-volume periods can improve efficiency without
compromising patient safety. While St-Onge-St-Hilaire et al. (2024) findings showed a higher accuracy in digital charting and paper charting exhibited more completeness.

**Implications for Quality Improvement**

The review of literature highlights the important role of process improvements in addressing operational challenges within the Emergency Department. Efficient communication and timely access to patient information are of utmost importance in such a fast-paced environment. The identified area of improvement within the microsystem was the communication of laboratory results to healthcare providers. Traditional methods, such as paper charting, often lack efficiency and can lead to delays in the delivery of care.

The implementation of a quality improvement used to communicate more efficiently within the microsystem was identified. Improving lab result communication aligns with the finding from the reviewed studies, indicating that addressing operational challenges through process improvements can significantly improve patient safety, communication, and patient satisfaction.

Emergency Department microsystems can streamline communication processes, reduce delays in accessing critical information, and ultimately enhance the overall quality of patient care. Moreover, the evidence synthesized from the literature review supports the premise that optimizing workflow through targeted interventions can lead to improvements in operational efficiency and patient outcomes within the Emergency Department.

**Rationale**

For this quality improvement project, the Plan-Do-Study-Act (PDSA) model was used to guide the implementation of an intervention for reducing the time between the ordering of laboratory test and the provider’s presence at the patient’s bedside within the ED microsystem.
The plan phase went underway in the spring of 2024 by conducting an assessment of the Purpose, Patients, Professionals, Process, and Patterns (5Ps). This process started with interviewing the nurses and the nurse manager to order to identify a problem and then, conducting a review of literature. The planning stage included a comprehensive assessment in the delays of communication regarding placing the patient’s paper chart in a specific rack to alert the provider that the patient is ready to be seen again. To address this, a visual communication system was used and affixed to all exam room folders (Appendix A). The visual reference affixed to the exam room folders included the type and number of tests ordered along with the time. Noting the time tests were ordered was crucial in identifying delayed results and could be utilized as a prompt to contact the laboratory staff to identify any disparities. In June of 2024, once the proposal was accepted, the change idea was implemented as part of the “Do” phase. Data was then collected on the time between the laboratory tests being ordered and the time the provider was at the patient’s bedside to review the results. This data was studied as part of the “Study” phase. Lastly, the plan was either modified, abandoned, or tried on a larger scale as part of the “Act” phase along with the dissemination of the project results (Nelson et al., 2007). By following the PDSA model, the aim was to test and implement interventions to improve communication and workflow efficiency within the ED microsystem.

**Specific Aims**

The global aim was to improve communication and workflow efficiency in the Emergency Department. The process began with ordering the labs and the process ended with the provider at the patient’s bedside reviewing lab results. By working on this process, the expectation was to reduce delays related to waiting for all printed lab results. According to van Moll et al. (2023), diagnostic mistakes and delays are a frequent source of patient harm. Thus, it
was important to work on this now because this process will improve communication, efficiency, and patient safety. The specific aim for this quality improvement project was to reduce the average time between laboratory tests being ordered and the provider being at the patient’s bedside by 20% by July 26, 2024.

**Methods**

**Context**

A Critical Access Hospital (CAH) located in a rural region within New England is currently utilizing paper charting within the Emergency Department (ED) microsystem. This 13-bed microsystem, if necessary, stabilizes critically ill patients before transferring them to a larger hospital that is more equipped to care for such critically ill individuals. An assessment of the microsystem was completed using the 5Ps. During this assessment, an interview was conducted with the nursing manager to determine gaps within the paper charting processes that needed improvements. It was determined that the process of moving a patient’s chart from one rack (the rack where a patient’s chart rests while awaiting lab results) to another (the rack which indicates to the provider that all labs have been resulted and the patient is ready to be seen again) was often delayed.

According to Ali (2022), some difficulties with paper charting can include, challenges in sharing information, timely manual process in retrieving information, and paper charts can get lost or misplaced in the shuffle. Poor communication within the ED can impact several aspects of all parties involved within the microsystem. Poor communication can impact patient safety, satisfaction, and can contribute to misunderstandings between patient and the healthcare team (Blackburn et al., 2019). According to Darraj et al. (2023), treatment delay is the timeframe from symptom onset to treatment initiation. This delay can lead to adverse effects and may exacerbate
the patient’s condition. Furthermore, these factors can lead to inefficiencies and higher operational expenses which stem from extended patient length of stay (Darraj et al., 2023). According to the ED director within the microsystem, the average cost of a day Length of Stay (LOS) is $2,500 (personal communication, W. Riley, May 13, 2024).

The current process of identifying when all lab results are completed can be cumbersome in an environment where time is pressured and demanding. This cumbersome process may discourage some nurses from helping out the team. This can lead nurses to overlook patient lab results that are sitting on the printer. Alternatively, they may simply attach the lab results to the patient’s chart without realizing that it’s the final result and the chart is incorrectly positioned. By implementing this QI project, the visual communication system will allow anyone within the microsystem to see when last lab result is complete without having to open up the patient’s chart, saving time and reducing pressure.

**Cost-Benefit Analysis**

The potential benefits of the intervention include improved communication, workflow efficiency, and reduced time spent on managing and organizing patient information manually by staff members. The cost for implementation of a laminated label affixed to the outside of the patient’s folders is minimal while the potential benefit is significant. The only cost for this intervention will be the purchase of fine-tip Expo markers with magnetic caps for a total of $6.99 and double-sided adhesive strips to adhere the labels to the folder for a total of $6.99. The hospital already has supplies for laminating, so that will be of no extra cost to anyone. The time spent by staff utilizing the materials provided will be of minimal impact thus, have no real cost effect. Hospitals that explore effective strategies to expedite treatment, enhance care quality and
reduce costs associated with prolonged length of stay and complications (Darraj et al., 2023). Efficient measures assist in efficient workflow.

**Intervention**

During an interview with the nurse manager within the microsystem, a problem was identified. The problem identified was a delay in a patient’s folder being moved from one rack (indicates the patient is awaiting lab results) to another rack (indicates to the provider all lab results are in and the patient is ready to be seen again). The current procedure is simply paperclipping the lab results to the outside of the patient’s folder as the results come through on the printer. There is no knowledge of how many labs were ordered or how many lab results are currently paperclipped to the front. Ultimately, there is no way to determine how many labs are still needed before all results are completed without opening up the folder and reconciling the current lab results with the lab requisition form. In order to streamline this process, a visual representation affixed to the outside of the patient’s folder will alleviate the cumbersome process of opening each patient’s folder in order to be informed.

A laminated label measuring 1 inch by 3 inches will be affixed to the top left-hand side of all patient folders. Each laminated label included the test ordered and the number of each ordered, along with the time (T) the tests were actually ordered. The laminated labels included Laboratory tests (Labs), Add on Laboratory tests (Add on’s), Urinary Analysis (UA), X-radiation (Xray), and Computed Tomography Scan (CT scan). Each test will have empty parenthesis directly after them which will indicate the place to write the number of respective tests ordered. There will also be empty parenthesis directly after the (T) which will indicate the time each test was ordered. Having the time each test was ordered visible on the outside of the folder is helpful as human error can occur. It has been witnessed by the author of this paper when a laboratory
test has been ordered, a timeframe of one and a half hours has gone by without any lab results coming to fruition. The typical timeframe for lab results to be completed ranges from 30 minutes to 1 hour (with the exception of cultures). Prompted by the extended wait time, a call was made to the laboratory staff inquiring about the lab results for a particular patient, and the laboratory staff either did not receive such orders or simply overlooked the order. Thus, having the time on the outside of the folder enables multiple individuals to be aware of any potentially delayed situations. The label will be filled in using a fine-tip Expo marker.

Upon the completion of filling in the laminated label with the number of tests ordered and the time each test was ordered, the folder will then sit in a rack awaiting the results of all ordered tests. As the results are printing off of the printer, the individual paperclipping the results to the front of the folder will then use an Expo marker and write a tally mark underneath the respective test. For example, if 6 laboratory tests were ordered and 4 of the laboratory reports just printed off of the printer, any individual in the vicinity with available time would paperclip the lab results to the front of the correct patient’s folder and mark 4 tally marks under labs. Now, anyone can see that 4 of the 6 labs have completed results.

In order to ensure the success of this project, an interdisciplinary team was needed to be involved. This team included the writer of this paper as the project lead, the microsystem nurse manager, nurses, hospital unit coordinator (HUC), paramedics, and licensed nursing assistants (LNA). The emergency department director was aware of the intervention and has noted his availability and eagerness to assist with retrieval of information and dissemination of information as necessary.

**Study of the Intervention**
In order to assess the impact of the quality improvement project, data will be collected during the day shift for both pre- and post-intervention. The data collection process will include the time laboratory tests were ordered, the time all lab results are completed and placed in the patient’s folder, and the time the provider is at the patient’s bedside going over the lab results and treatment process with them. A decrease in the average time between when laboratory tests were ordered and provider at bedside reviewing results with a p score of $p \leq 0.05$, will indicate the significance of the quality improvement project.

**Measures**

The time spent in each stage of the process was quantified by comparing the average time before and after the intervention. A reduction in the average time from when labs are ordered and provider at the patient’s bedside would indicate increased efficiency of the new visual communication system. The operational definitions refer to the pre-intervention average time taken for the traditional process of paperclipping the lab results to the front of the folder and the post-intervention average time taken for the new process using the laminated label. The validity was established by direct observation and time tracking.

**Analysis**

The time data was assessed using both descriptive, as well as, inferential statistical analysis. The descriptive statistical analysis for this quality improvement project was categorized by shift and day of the week. This continuous data was then analyzed inferentially using a paired t-test in order to compare the mean time spent before the intervention and after the intervention. This would include calculating the mean difference, the standard deviation of the differences, and then using the t-test formula with the given information. Microsoft Excel will be utilized in
calculations of data. A p-value of less than or equal to 0.05 would represent a statistical significance.

**Ethical Considerations**

The proposal was reviewed by the Department of Nursing at the University of New Hampshire to determine that it is, in fact, a quality improvement project, which is exempt from full Institutional Review Board (IRB) review. However, the ethical considerations that was adhered to include, staff being informed about the intervention, its purpose, and its potential impact. Consent was obtained from the staff within the microsystem for their participation in the quality improvement project. Furthermore, no one was forced to participate in the project. The data collected was kept confidential and will only be shared with individuals involved in the project.

**Results**

**Initial Steps of the Intervention**

The implementation of the visual communication system for lab results tracking in the ED was conducted in several phases; pre-implementation data collection, implementation, and post-implementation data collection. The data collection process and implementation were completed over 12 days. A timeline of the process is shown in Table 1.

**Table 1**

*Timeline of Implementation Process*

<table>
<thead>
<tr>
<th>Date</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/30/24</td>
<td>Created and laminated labels.</td>
</tr>
<tr>
<td>5/31/24</td>
<td>Met with nurse manager to create a layout plan on rolling out project. Created email for</td>
</tr>
</tbody>
</table>
the nurse manager to disseminate to the staff on how to use the labels.

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/3/24 – 6/7/24</td>
<td>Pre-implementation data collection</td>
</tr>
<tr>
<td>6/10/24 – 6/14/24</td>
<td>Implementing QI project and collecting post-implementation data</td>
</tr>
</tbody>
</table>

**Process Measures and Outcomes**

**Process Measures**

The descriptive statistical analysis for this quality improvement project included measuring the frequency and distribution of the following variables: the number of tests ordered, the time each test was ordered, and the completion status of each test. Additionally, it involved tracking the time taken for the folder to move from the nurse’s rack to the providers rack and assessing any changes in this process after the intervention. During the data collection process, the project lead was at the clinical site noting the time stamps for each patient on:

- Time labs were ordered
- Time the last lab result was printed and paperclipped to the patient’s folder
- Time the folder was moved to the provider’s re-assessment rack
- Time provider was at the patient’s bedside review lab results with patient

The pre-data collection process occurred over the course of one week between the hours of 9 am and 2 pm, Monday through Friday. The pre-implementation data was analyzed and compared with the post-implementation data collected from 9 am to 3 pm, Monday through Friday, to ensure consistency with the working hours and number of staff present.

**Outcomes**
A t-test was conducted to compare the time from when labs were ordered to the provider at the bedside reviewing results with the patient before and after the intervention. The analysis included 30 data points of pre- and post-intervention. A visualization is represented in Figure 1.

**Figure 1**

*Illustration of the Pre- and Post-Intervention Data*

**Pre-Intervention Vs Post-Intervention Data**

The mean difference in times between the pre-intervention and post-intervention phases was calculated to be -11.93 minutes, which indicates a reduction in time after the intervention. A visualization is represented in Figure 2.

**Figure 2**

*Illustration of Mean Time Pre- and Post-Intervention*
The standard deviation of the differences was 75.07 minutes. This shows the variability in time differences across the sample. The paired t-test had a t-score of 0.87 and a p-value of 0.391. A p-value of 0.39 is greater than the commonly used significance level of $\leq 0.05$, showing that the difference is not statistically significant.

**Contextual Elements**

The microsystem within the hospital uses a traditional paper charting system. Thus, some key contextual elements that were taken into consideration with the intervention include the staff’s comfort and familiarity with the existing paper charting system which could influence the acceptance and integration of the new visual communication system. Ultimately, the involvement of the nurses, HUCs, paramedics, and LNAs was critical for successful
implementation. Lastly, the small, 13-bed microsystem allowed for a more controlled environment to observe the intervention.

**Observed Associations**

The introduction of the laminated labels was to facilitate more efficient communication of lab results. This was especially relevant in the fast-paced environment of the ED, where timely access to information is critical. Although the statistical analysis did not show a significant reduction in delays (p=0.391), the observed mean difference in times showed a slight reduction from when labs are ordered to when the provider is at the bedside reviewing results. The intervention encouraged a collaborative approach among staff, as it was observed that LNAs and other nurses were placing patients’ charts into the provider’s rack, even if the patients were not assigned to them.

**Unintended Consequences**

**Unexpected Benefits**

The visual system increased awareness among staff about the status of lab test, even for patients that were not assigned to them. This potentially ensured timely follow-ups, if necessary, as the time labs were ordered were written down. Any labs over an hour or images over 2 hours could be followed up on by anyone or brought to the attention of the assigned nurse or paramedic.

**Unexpected Problems**

As with all change, some staff embraced it and some staff did not partake. Utilizing an expo marker for tally marks and placing the patient’s folder in the respective rack was a change from keeping all the assigned patient’s folders by their side at the desk instead of in the rack. Also, there was a risk for potential human error. It was observed that when a provider was
ENHANCING COMMUNICATION WITH A VISUAL TOOL

utilizing the patients chart their finger while holding the chart wiped off some of the tally marks. It was noted that after patients were discharged, the empty folder was placed in the rack without the visual communication label being wiped clean. These errors could affect the accuracy of the communication system and potentially be placed in the provider’s rack with incomplete lab results.

**Missing Data**

There was no missing data for this quality improvement project. Thirty data points were collected during pre-intervention data collection and thirty data points were collected during post-intervention data collection.

**Discussion**

**Summary**

**Key findings**

The goal of the quality improvement project was to enhance communication and workflow efficiency in the ED by implementing a laminated label on the outside of a patients’ folders to track laboratory results. The key findings of the project include a reduction in time between ordering laboratory tests and the provider at the patient’s bedside review the results. Although the paired t-test results showed a p-value of 0.391, which is not statistically significant, the intervention still had a mean time reduction of 11.93 minutes. The intervention contributed to collaboration, as evidenced by LNAs and nurses placing patients’ charts in the provider’s rack, even if the patient was not assigned to them. Also, the visual communication label streamlined the process of identifying when all lab results were completed, due to the reduction in the need to open a patient’s folder repeatedly.

*Relevance to Rationale and Specific Aims*
The findings aligned with the project’s rationale and specific aims through the use of the PDSA model. The model guided the implementation, which focused on reducing delays and improving communication within the ED microsystem. The intervention targeted the identified problem of delays in moving patient charts, thereby enhancing overall workflow. The quality improvement project aimed to reduce the average time between ordering lab tests and the provider being at the patient’s bedside by 20% by July 26, 2024. The reduction (8%) was not statistically significant, yet the project showed potential for improving efficiency and communication in the ED.

**Project Strengths**

The strengths of the project included a collaborative effort among team members. Although, the ED already fosters a collaborative environment with staff helping each other out when needed, this project highlighted that skill. The cost associated with implementing the project was minimal. This involved the purchase of fine-tip Expo markers and double-sided adhesive strips. The use of existing laminating supplies helped in cost reduction. Ultimately, the visual communication system was simple and useful without requiring significant changes to the existing workflow within the microsystem.

**Interpretation**

**Association Between the Intervention and Outcomes**

The intervention aimed to reduce the time between ordering laboratory tests and the provider at the bedside reviewing results. By utilizing laminated labels affixed to patient’s folders, the goal was to create a visual cue for any staff member in the area to notice all results are back and prompt them to place the folder in the provider’s rack. Thus, enhancing communication and reducing delays. The association between the intervention and outcomes was
evaluated using pre- and post-intervention data and analyzed through a paired t-test. The results showed a reduction in time, although, not a statistically significant reduction. However, this does indicate a potential positive association between the intervention and improved workflow efficiency.

**Comparison of Results**

The literature reviewed for this project highlight several studies focusing on improving communication and reducing delays in the ED setting. For example, a study by Kobayashi et al. (2011), found that using visual aids in organizing patients charts reduced wait times in the ED as well as, increased patient safety due to a decrease in chart misplacements. Similarly, another study by van Moll et al. (2023) highlighted the importance of effective communication tools in preventing diagnostic errors and improving patient safety. This project aligns with these finding, suggesting that visual communication tools can positively impact workflow. However, unlike these studies, this intervention did not give statistically significant results, possibly due to unique contextual factors of a rural ED setting.

**Impact of the Project on People and Systems**

The QI project had multiple impacts on the microsystem and staff. The visual communication system facilitated better communication among the staff and led to a more efficient workflow. The project lead observed staff members utilizing the visual label to track laboratory results which helped track laboratory results more effectively during the less busy hours. However, during peak times, some staff reverted to their familiar practice, which indicates a challenge in maintaining the new intervention under stress.

**Reasons for Differences Between Observed and Anticipated Outcomes**
The anticipated outcome was a significant reduction in the time between ordering lab tests and the providers at the patient’s bedside reviewing results. Although there was a reduction, it was not statistically significant. Several contextual factors could explain this discrepancy. The rural ED setting, with its varying patient volumes and limited resources could have affected the outcome. Also, the staff’s tendency to revert back to their old practices during busy periods suggests a hardier implementation strategy is needed.

**Cost of Project**

The project incurred minimal costs related to the production and implementation of the laminated labels. However, the opportunity costs, such as the temporary disruption of familiar workflows, time spent on training, and balancing the immediate needs of patients were considerable. The project’s success during less busy hours suggests potential for cost savings through reduced delays, but the benefits were not fully actualized due to the inconsistent use during peak times. The anticipated outcome was a 20% reduction in time between ordering lab tests and the provider’s presence at the patient’s bedside reviewing results. The actual outcome was a reduction of 8%, which is not as significant as expected. This could be attributed to several factors, such as, staff adherence during busy periods and the inherent variability within the ED microsystem.

**Limitations**

**Limits to Generalizability**

The study was conducted in a rural microsystem, which has unique factors that could impact the generalizability of the project. These factors include limited resources, smaller patient volume, and possibly different patient demographics compared to urban microsystems. The rural
microsystem might be significantly different from an urban microsystem, which could potentially influence the applicability of the project and results.

Factors Impacting Validity

There is a potential for selection bias as the study focused on nurses and patients in the ED during the hours of 9 am – 3 pm, Monday through Friday. This may not represent the broader population including overnights and weekends. Also, the data collection process, which involved staff tallying lab results on the visual label might have been influenced by the staff’s perception or attitude towards the new intervention. The reliance on manual data collection for tracking lab results has the potential for human error and inconsistency. Lastly, the sample size of 30 data points is relatively small which limits the statistical power of the project and the ability to detect significant differences or effects.

Efforts Made to Minimize Limitations

The mitigation strategies made to adjust for these limitations included sending out an email to all staff on how to use the tally system on the visual aid. The project lead was at the clinical site during the implementation for any staff to ask questions and address any issues.

Conclusion

Usefulness of the Work

The statistical insignificance of the reduction in time from ordering labs to the provider at the patient’s bedside reviewing the results shows the visual label may not be essential. However, it did appear beneficial in improving workflow. This visual system allowed other staff not directly involved with the patient quick access to how many lab results were pending before the provider would be in to see the patient again. This information is useful for giving a rough estimate of a time frame. Patients often inquire about the remaining wait time, and this system
allows all staff to quickly provide a rough estimate to either patients or their loved ones at the bedside.

**Sustainability**

The sustainability of this project relies on continued staff engagement and consistency in utilizing the visual labels. The macrosystem has a goal of switching to electronic medical records (EMR) by the end of 2024, making the visual labels unnecessary once the new system is fully implemented. Despite this, the minimal cost and the simplicity of the intervention makes it feasible for implementation up until the new system has begun full time.

**Potential for Spread to Other Contexts**

This intervention has the potential to be adapted in other healthcare settings utilizing paper charting systems. In settings without paper charting systems, this intervention is not necessary.

**Implications for Practice and Further Study**

This project highlights the importance of effective communication tools in improving workflow efficiency. Since most macrosystems use EMRs, future studies could explore the integration of digital solutions to complement the visual system, potentially reducing human error and increasing accuracy.

**Suggested Next Steps**

Implementation of the visual label system to track lab results during the interim of waiting for the EMR system to launch would be beneficial. Offering the system as an optional tool for those who find it beneficial promote the usage without imposing it on those who are more comfortable with their current methods.
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Appendix A