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EXPLORING STRATEGIES TO IMPROVE EMERGENCY DEPARTMENT INTAKE

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☐ **Abstract—Background: The emergency department (ED) is the point of entry for nearly two-thirds of patients admitted to the average US hospital. Due to unacceptable waits, 3% of patients will leave the ED without being seen by a physician. Objectives: To study intake processes and identify new strategies for improving patient intake. Methods: A year-long learning collaborative was created to study innovations involving the intake of ED patients. The collaborative focused on the collection of successful innovations for ED intake for an "improvement competition." Using a qualitative scoring system, finalists were selected and their innovations were presented to the members of the collaborative at an Association for Health Research Quality-funded conference. Results: Thirty-five departments/organizations submitted abstracts for consideration involving intake innovations, and 15 were selected for presentation at the conference. The innovations were presented to ED leaders, researchers, and policymakers. Innovations were organized into three groups: physical plant changes, technological innovations, and process/flow changes. Conclusion: The results of the work of a learning collaborative focused on ED intake are summarized here as a qualitative review of new intake strategies. Early iterations of these new and unpublished innovations, occurring mostly in non-academic settings, are presented.** © **2011 Elsevier Inc.**

☐ **Keywords—emergency department; intake; triage; process improvement; door to physician time**

INTRODUCTION

The modern-day emergency department (ED) is the point of entry for two-thirds of patients admitted to the hospital in the United States, according to the Agency for Healthcare Research and Quality (AHRQ) (1). Coming through this "front door" to the hospital are over 200 visits every minute of every day in the United States, or 40 visits to the ED per 100 citizens every year. Every 2 1/2 years the equivalent of the entire US population passes through ED doors. Almost 40% will wait more than an hour to see a physician, and these unacceptable waits will result in an average of 3% of patients leaving without being seen by a physician (2,3). Thus, ED inefficiencies and delays translate into almost four million patients walking away from health care each year. It is no surprise that the Joint Commission has found that the ED is the most common site for sentinel events in the hospital due to waits and delays in care (4).

Timeliness of care is an issue that is front and center for EDs in the United States. Timeliness of care is among the strongest correlates with patient satisfaction (5). The time it takes to see a physician (door-to-physician time) has the best correlation of all. By moving patients quickly to patient care areas for evaluation, patients perceive that the wait time is acceptable (6–10). As the time from arrival to physician evaluation increases, the rate of patients leaving without being seen increases (11–13). Finally, a growing number of clinical entities require treatment that is "on the clock," with outcomes directly linked to timeliness of care (14–21).

There is innovation occurring in the area of intake strategies, though much of it is unpublished. Unlike clinical care processes, improvement in ED operations often

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occurs in the trenches many years before it reaches the literature (22).

The collaborative model for health care improvement has been used by the Institute for Healthcare Improvement (IHI) since 1995. A learning collaborative (also called a learning system) is a short-term (6- to 15-month) organization that brings together a large number of teams from hospitals or clinics to seek improvement in a focused topic area. Since 1995, IHI has sponsored over 50 such collaborative projects on several dozen topics involving over 2000 teams from 1000 health care organizations (23). Typically, the work of the health care learning collaborative focuses on operational improvement alone or incorporates medical care strategies that have already been proven in traditional medical research trials into new process models. The "IHI ED Collaborative: Operational and Clinical Improvements for the Emergency Department" launched a 2-year program in 2006 that was a good example of this model (23). Thirty-four geographically diverse EDs marched through time working on improvements and sharing ideas.

This learning collaborative and conference created a forum for sharing new ideas and early trials, but does not presume to be presenting the definitive word on these emerging new strategies. Its aim was the diffusion of innovation and the dissemination of ideas. Our learning collaborative comprised ED leaders, policymakers, and front-line workers. It was tasked to identify constraints to intake and innovative solutions to these constraints. Aware that much innovative work in this area never reaches a forum allowing widespread dissemination, the Emergency Department Benchmarking Alliance (EDBA) Board of Directors began an outreach program looking for new but as yet unpublished innovations relative to the intake process. The results of this collaborative were shared at an AHRQ-sponsored summit in February of 2010. This is a summary of the findings presented at that meeting.

METHODS

EDBA is a not-for-profit organization comprising 367 EDs representing over 14 million ED visits annually. EDBA was founded in 1997 as an alliance of performance-driven EDs. It operates as a not-for-profit quality improvement and learning community, sharing performance data and operational strategies to identify best practices. EDBA has developed a benchmarking database and educational programs focusing on ED operations and performance and disseminates new ideas and innovations through conferences and publications (24–34). For execution of the AHRQ grant, EDBA partnered with Intermountain Institute for Health Care Delivery Research. The Institute is an internationally acknowledged leader in quality improvement and patient safety founded by Brent James, MD, MSTAT (35–38). In December 2008, EDBA, in collaboration with the Intermountain Institute for Health Care Delivery Research, submitted a small conference grant proposal to AHRQ titled "Summit Exploring Emergency Department Intake Strategies." The goals of this learning collaborative and conference are summarized below:

1) To provide a venue for sharing the newest ideas on intake
2) To inform health care policymakers of top performing strategies in this area
3) To move emergency medicine forward into the realm of operations management
4) To provide a shared learning experience

A steering committee was formed composed of the Board of Directors of the EDBA and research scientists from the Intermountain Institute for Health Care Delivery Research. Our learning collaborative was formed by invitations from the steering committee. These invitations were extended to individuals targeted for expertise, interest, and influence, and for their associations with critical stakeholder organizations. The American College of Emergency Physicians maintains a roster of health care leaders and policymakers for their work on quality and performance committees. Many of the invited individuals were contacted through this roster. Our learning collaborative was organized around three workgroups: 1) Constraints to Intake; 2) Innovations at Intake; and 3) Definitions, Terminology, and Measures. The workgroups met through conference calls and an eventual face-to-face meeting at the collaborative summit meeting and crafted a comprehensive whitepaper on ED intake, which has been presented to AHRQ. One unique feature of this learning collaborative is that it brought together front-line innovators with health care leaders and policymakers to share the work being done by both segments of the collaborative.

During early planning of our collaborative, the steering committee crafted an informational flyer promoting an Innovator Competition, with the intent of showcasing ideas and innovations that resulted in improvements of the intake process into the ED. The steering committee also developed an electronic abstract submission process for the competition. The only requirement was that measurable results showing improvement be included in the abstract. Figure 1 is a sample of the simple abstract submission form. Upon notification that the grant had been awarded, the steering committee began an intensive networking and outreach effort to solicit abstracts describing successful improvement projects involving intake processes. Abstracts were solicited from the following organizations:

Symposium on New Intake Models for the Emergency Department

Organization: _____
Author(s):_____
Presenting Author: _____
Email/Phone:_____

Title:

Summary of New Model:

Results:

Lessons Learned:

Figure 1. Abstract submission form.

- ACEP (The American College of Emergency Physicians)
  - The Quality and Performance Committee
  - The Practice Committee
  - The Quality Improvement and Patient Safety Interest Group
- SAEM (The Society for Academic Emergency Medicine)
  - Patient Safety Interest Group
- IHI (The Institute for Healthcare Improvement)
  - Operational and Clinical Improvement in the ED Learning Community
- EDPMA (Emergency Department Practice Management Group)
- EDBA membership
- Intermountain Healthcare Intensive Clinical Medicine Programs
- EMP (Emergency Medicine Physicians)
- Premier Health Care
- The Schumacher Group
- The California ED Diversion Project

These organizations were asked to consider but not be limited to the following elements of ED patient intake as areas of innovation for the competition:

1) Patient Identification
2) Initial Clinical Assessment
3) IT Support of Intake Workflow
4) Staffing Models
5) Documentation
6) Advanced Triage Protocols

Abstracts were accepted from April 1, 2009 through September 30, 2009. Abstracts were scored by members of the steering committed using a four-point scale (1, 2, 3, or 4, for fair, good, very good, and excellent, respectively) for each of five parameters: 1) creativity, 2) clarity, 3) applicability to varying ED types, 4) inclusion of measureable results, and 5) innovative impact. Figure 2 is an example of the scoring form used. Although the original plan had been to select the top 10 abstracts, due to scoring ties and the inclusion of more than one creative idea in the improvement process, 15 abstracts were selected to be presented at the "Summit Exploring New Intake Models." Because some innovations were trialed at more than one site, the steering committee identified 13 meritorious innovations for summary herein.

RESULTS

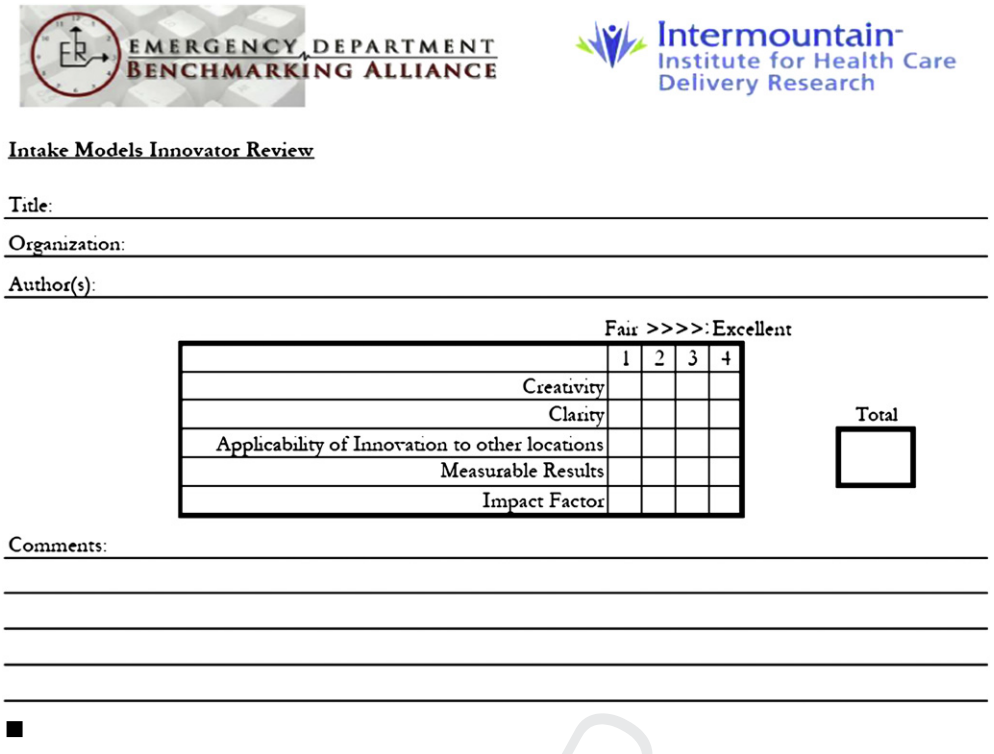
Submitted abstracts were organized into three thematic categories: Physical Plant Changes, Technological Changes, and Process/Flow Changes.

Physical Plant Changes

Physician Cubicles
Triage Pod
Recliner Intake Area
Internal Waiting Area

Physician Cubicles. At Arrowhead Regional Medical Center in California, in response to a census that doubled in 5 years to 120,000 visits and left without being seen (LWBS) rates that had reached 20%, the staff trialed a physician-in-triage model made possible by bringing in furniture modules that created small cubicles in which physicians could see patients. Because this change was implemented by bringing in modular furniture and without alteration of the physical building structure, the innovation was inexpensive and required no building permits. The new model involved patients being seen by a provider first. Using this model, ED staff found that half of patients could be discharged from the cubicles, 30% required some laboratory or X-ray diagnostics, and only one in five patients needed bed placement when the provider made the first contact. As a result, more beds became available in the ED and there was an unexpected reduction in nurse staffing. The LWBS dropped from 20% to 1%, and the time to see a physician was reduced from 4 h to 31 min.

Triage Pod. Methodist Hospital in Sacramento was underbedded. Over 40,000 visits annually were being managed in a 19-bed ED. The staff created a six-bed "triage pod" area using simple room dividers, for team assessment of



web 4C/FPO

Figure 2. ■■■ Q9

patients and rapid intake. The change in the physical space was married to a process change. The team, composed of one physician, two physician assistants, and four nurses, worked the triage pod with the goal of moving each patient to an appropriate area in < 15 min. Patients were then transferred to one of three areas: the waiting room, the main ED, or a monitored higher-acuity ED bed. Many patients were sent right to the waiting room to await discharge or further diagnostics done as ambulatory patients. The already under-bedded department was reduced from 19 beds to 13 beds, but with new processes in place they have smarter bed utilization. Only the sicker patients occupy ED beds after passing through the triage pod. Methodist has seen the LWBS rates drop from 5% to 1%.

Recliner Intake Area. Carolinas Medical Center redesigned their intake area putting recliners and supplies within reach of the physician and team. Like Arrowhead, they found that 45.5% of patients could be discharged by the physician from this intake area. This is an effective way to off-load the main department when at overcapacity. These data are in line with the findings of other departments that put a physician out front. Carolinas has seen improvement in the intake time from 58 min to 35 min.

Internal Waiting Room. At Massachusetts General Hospital, a complex new ED flow process was implemented that began with the categorizing patients (also called patient segmentation) by acuity and resources required. The so-called START program (Supplemental Triage and Rapid Assessment) involved process changes coupled with physical space changes. An important change in the physical plant to support this process involved the creation of an internal waiting room called the "post-screening area." The internal waiting room allows less acute patients to remain vertical, instead of occupying bed space, while awaiting test results. The sum of these changes to the physical plant and patient flow resulted in an 8% decrease in length of stay (LOS) and a drop in LWBS rate from 4.1% to 2.4%.

Technological Changes

Self-populating Triage Tool
Palmar Scanning
Telemedicine Triage
Radio/Communication Devices

Self-populating Triage Tool. The ED at the University of California San Diego (UCSD) has explored ways that technology can facilitate intake. The staff developed an informatics tool that immediately populates the fields of the electronic health record in the triage note. For instance, medications, allergies, and past medical history are automatically pulled forward to the current health record if a patient has ever been in the UCSD system before.

This self-populating tool shortened intake time by 20 min and led to improved provider satisfaction.

Palmar Scanning. At Carolinas Medical Center, the ED has streamlined the intake process by using palmar scanning to create a biomedical identification. Like retinal scanning, a palm print is used to generate an immediate identifier for a patient and tied to an identification (ID) number. Later the ID can be associated with demographic data. In < 15 s, the patient is identified through this methodology, allowing treatment to begin. The device can ensure that a patient is associated with the right medical record number. In addition to preventing identity fraud and mismatched records, the device can quickly identify unconscious or "altered mental status" patients who have previously been scanned. Since the implementation of this high-tech patient ID method, the door-to-physician time is now being measured in seconds instead of minutes and is now 45 s at Carolinas Medical Center.

Telemedicine Triage. The Medical College of Georgia ED is situated in close proximity to a handful of nursing homes and extended-care facilities. On a daily basis, the staff found that they were inundated by low-acuity patient transfers that were costly and resulted in high utilization of Emergency Medical Services (EMS) resources. The Medical College of Georgia has begun trials using telemedicine to avoid such transfers to the ED. The telemedicine technology allows the physician who is off site to see and hear the patients, family members, and staff. There is a stethoscope that allows the physician to hear breath sounds and heart sounds remotely; there is also a remote otoscope and ophthalmoscope. A physical examination can be carried out remotely with the technology. Using this technology, the ED and nursing home staff can often address low-acuity medical problems without transport to the hospital. Also, the physician can often identify acutely ill patients and recommend transport with "lights and sirens" while the ED prepares to treat such a patient in an expeditious manner. Each patient not transferred to the ED saves between $404.00 and $662.00 (Basic Life Support non-emergent vs. Advanced Life Support emergent) in EMS one-way transport charges in that community.

Radio/Communication Devices. The use of a radio communication device has been shown to improve processes at intake. At St. Rose Dominican Siena Campus outside of Las Vegas, the 42,000-visit ED used radios to call a physician to triage to assess each patient and begin the work-up. All Emergency Severity Index (ESI) 1 and 2 patients are immediately placed in a bed. All ESI 3, 4, and 5 patients have a physician assessment to direct the work-up and care. With this small process change, facilitated by inexpensive radio communication, the LWBS rate fell from 12% to 1.5%. Staff satisfaction by survey is also at an all-time high.

Process/Flow Changes

Scribe Program
Low Flow/High Flow Process
Physician in Triage
Patient Streaming/Segmentation
The Philadelphia EMS Admission Rule (PEAR)

Scribe Program. At Cortland Regional Medical Center, the emergency physicians were concerned about increasing clerical and documentation tasks. Despite increases in patient acuity, reimbursements and physician satisfaction had fallen. The 32,000-visit department began a scribe program and has seen improvement in documentation, reimbursement, productivity, and patient satisfaction. Throughputs have also improved as the scribes have begun facilitating data collection, freeing up the physician for other tasks.

Low Flow/High Flow Process. At Thomas Jefferson University, the busy urban teaching hospital dubbed their new innovation the "Low Flow/High Flow" process model. In this model, the intake process varies with the volume of arrivals to the ED. When the ED is at low census with open beds, the process is a "pull to full" approach, with immediate bedding of patients and intake processes occurring at the bedside. As the ED reaches capacity, it shifts into the "High Flow" process. In this model, a processing area is opened and a team using protocol-guided treatment plans begins the work-up in the processing area. The first pilot of the new High Flow model showed a decrease in LOS from 653 min to 158 min. LWBS rates fell from 11% to 6%. Exit surveys of patients involved in the pilot showed extremely high patient satisfaction scores: 4.5 on a scale of 5 for satisfaction.

Physician in Triage (PIT). The most frequently trialed innovation in our learning collaborative was the placement of a physician at the front end of the ED visit. Many variations on this theme were trialed by the innovators. Memorial Hospital in York, Pennsylvania used a variation of the Physician in Triage (dubbed the "PIT Process"). York begins the intake process with a podium nurse doing a quick look before the PIT team assesses the patient. For 10 h a day the PIT physician makes an initial rapid medical assessment of each patient, a process that takes < 3 min. Standardized order sets are begun in triage for ESI 2 and 3 patients. ESI 1 patients are immediately bedded. ESI 4 and 5 patients are assigned to a physician assistant in the fast track. York documented a decrease in

the LWBS patients from 6% to 0.4% in the first trial of the project. Door-to-physician times were reduced from 65 min to 32 min. The physicians also reported they felt that bed utilization improved with the new model.

Patient Streaming/Patient Segmentation. At Banner Health System in Arizona, a similar "quick look" of patients followed by patient segmentation was employed in a new intake model. The Banner staff called this process D2D SPF (Door to Doc Split Patient Flow). In this model, less sick patients are not undressed or bedded, but rather treated as though they were in a clinic setting. The sickest patients are seen in an expedient manner and treatment begun. Banner implemented this new process across eight different EDs with varying volumes and saw reductions in the LWBS rates of 30–60% across the board. Other abstracts depicting patient segmentation models were submitted by ultra-high-volume EDs, Christiana Care in Wilmington, Delaware and Beaumont in Royal Oaks, Michigan. Abstracts using variations of the patient streaming/patient satisfaction concept were the second most frequent process change seen in the learning collaborative and competition.

The Philadelphia EMS Admission Rule (PEAR). The University of Pennsylvania developed a tool for EMS use to help predict whether or not a transported patient would be admitted from the ED. The PEAR rule uses routine information obtained at dispatch to predict the likelihood of admission for a patient. An aggregate score between 0 and 14 is generated based on the presence or absence of chest pain, dyspnea, dizziness, or syncope, age over 60 years, diabetes, or cancer. The model was first trialed at one site and then repeated at multiple locations. The area under the receiver operator curve for the PEAR tool in discriminating between admission and discharge was 0.83 at six hospitals. Patients with a PEAR score of 9 or higher had a near 100% chance of being admitted.

DISCUSSION

We used the learning collaborative model for health care improvement to convene a group of ED leaders, policymakers, and innovators for the purpose of studying strategies for improving ED intake. In a unique implementation of the collaborative model, we brought innovators together with leading health care authorities to exchange ideas around this topic. The innovators compared and competed with their ideas in a competition, and a survey of new ideas is presented here as a review. This is not definitive work, but early iterations of the new models are showcased.

The concept that the physical space in the ED can be transformed to improve work flow is not new. In 2002, Spaite et al. found that changes made to the physical plant, combined with process changes, resulted in decreased wait times and improved patient satisfaction, though these changes were accomplished at considerable expense (39). At the other extreme, Morgan created subwaiting spaces to facilitate changes in flow and did this simply by moving banks of chairs into hallways (40).

The innovators in our learning collaborative used creative means to change the physical space to improve processes. Front-line practitioners with a solid understanding of operations and processes should and can be able to help their departments adapt the physical space to accommodate workflow. In the improvement projects described, the use of modular furniture to create physician examination cubicles, recliners to create a processing area, and movable room dividers to create a triage pod are all examples of low-cost changes to the physical space to accommodate process changes and innovations. Some of the most dramatic improvements were seen when changes to the physical plant were married to process changes.

Technology has been shown to have a role in improving intake and flow. In 2005, Chan et al. used a series of process changes involving new technology to improve intake (41). They dubbed these changes the REACT project: Rapid Entry and Care at Triage. Their technological innovations included the bar-coding of laboratory specimens and patient IDs, the ability to access old medical records at intake to help create an identifier for the patient, and information technology (IT) interfaces to allow access to all available medical information at intake. The innovations were associated with significant improvements in overall LOS and LWBS (41).

Innovators in our learning collaborative employed similar technology, improving on previous work by creating an IT tool with self-populating data fields to expedite intake. In an even more futuristic model, the Carolinas Medical Center is using palmar scanning to create a unique ID for each patient. This allows diagnostic testing and treatments to be ordered before a patient has been formally registered. The use of communication devices, including radios, wearable devices, and electronic tracking systems to enhance communication, has been associated with mixed results (42–46). However, one innovative team found that by simply using radios to alert the physician of a patient arrival in triage, they moved the physician encounter earlier in the patient's visit and saw dramatic improvement in LWBS rates. Perhaps the ultimate use of technology was demonstrated by the Medical College of Georgia. Telemedicine enabled them to do the intake assessment while the patient was in another location.

Traditional triage typically involves eight or nine redundant steps occurring in series that have limited value to patient care (Figure 3). The use of process change to

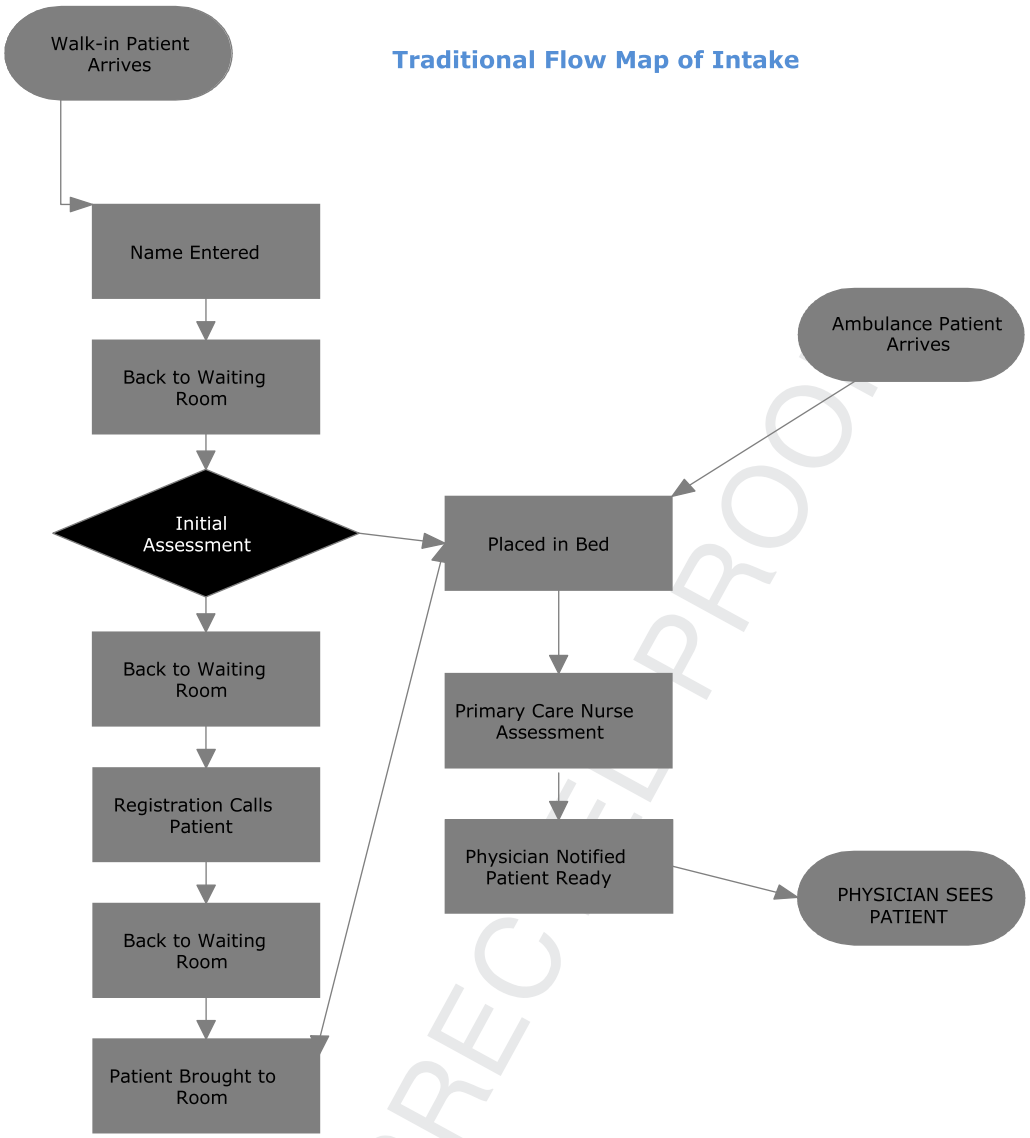


Figure 3. ■■■ Q10

streamline this intake process is being explored in both small and large EDs. In particular, variations on the use of physicians in triage and team triage are becoming trialed. There is evidence of success using either model (47–51).

There are ample data to support the placement of the highest level of training at intake. Paramedics correctly predict whether or not patients will need to be admitted from the ED 62% of the time (52). Kosowsky et al. reported that nurses predict a patient's disposition with slightly better accuracy than paramedics (53). On the other hand, there is a growing body of evidence demonstrating that physicians' assessments of outcome and disposition are highly reliable, with 85–95% accuracy (54–57). Dedicating a physician to the ED intake has a number of advantages. Studies have shown that placing a physician in triage decreases LOS, decreases LWBS rates, and increases staff satisfaction, and that one-third or more of patients can be rapidly discharged using few or no resources (58–60).

In our learning collaborative, models that moved the physician encounter earlier in the patient intake process, either as physician triage or team triage, seemed to be the most common area of process change. Another idea incorporated into the new models is that of placing patients into categories based on acuity and anticipated resource utilization, often termed "patient streams" or "patient segmentation." This approach has yielded notable improvement in length of stay, LWBS, and diversion times (61). It is effectively an expansion of the "fast track" concept, one of the most successful strategies used in emergency medicine to improve patient flow (62–66). The

third concept woven into many of the abstract models in the collaborative competition is that of "team care," a concept that has a history of effectiveness in hospital-based care (67–69).

Limitations

The results presented by the innovators were not statistically tested. The abstracts were presented as self reports without oversight or review. Even the definitions of the performance metrics used were not standardized. The innovations presented here may not be reproducible elsewhere, and may not hold up under intense statistical analysis, but they represent the early trials of a wide variety of institutions struggling to improve on a process that is recognizably faulty.

CONCLUSIONS

Although there may be little Class 1 evidence to direct ED leaders and practitioners regarding front-end operations, the innovation continues with energy and creativity (70). Each ED faces similar problems regarding capacity, limited resources in an era of growing public expectations, boarding, ancillary service delays, and staffing and space constraints.

Innovations involving intake and the front end are occurring in three main areas: changes to the physical space, integration of technology to improve process, and process/flow re-design. Whether or not such innovation needs to be vetted using the traditional medical research model is a question worth considering. Our work supports the learning collaborative as a model for sharing new innovations and disseminating successful ideas in their earliest iterations.

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ARTICLE SUMMARY

1. Why is this topic important?

More than three-quarters of emergency departments spend part of everyday over capacity (more patients than treatment spaces). When this happens they need strategies for seeing the backlog of patients.

2. What does this study attempt to show?

Unlike clinical progress, operational progress is occurring at the front lines, in non-academic settings. These innovations are being trialed around the country and the ideas are being aired before they reach the literature.

3. What are the key findings?

The waits and delays at intake may be addressed through three main approaches: Changing the physical plant, changing the process, or changing the technology. The best results were seen with marriages of the three types of innovation.

4. How is patient care impacted?

Moving patients more quickly to the encounter with a provider improves the ability to treat the time-dependent clinical entities appropriately, improves patient outcomes, and decreases patients leaving without being seen.

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