

## Research Article

# Aligning Facility Changes to Modernize and Improve Emergency Department Care

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## Abstract

**Background:** We sought to implement a series of clinical improvements during a major physical renovation and expansion of our main academic Emergency Department (ED). We identified a series of prioritized improvements in the processes of care, physical design details, expansion of emergency capabilities, patient centeredness, clarifying roles and responsibilities of ED staff members, and the development of specialized zones within an expanded ED.

**Objective of the Review:** The footprint for expansion was set in the ground level interface between the existing ED and a new 21 story clinical tower. Over the course of 5 years, facility design, multidisciplinary clinical operations, major constituency groups, patient experience, emergency oncology, observation services, and behavioral and psychiatric care met within the context of ED nursing, administrative, and physician leadership. Following a series of clinical discussions focused on identification of key challenges, recommendations for prioritized modifications in design and policy implementation were presented for endorsement by organizational leadership. Primary challenges were identified at multiple levels within and related to ED operational and quality improvements. Top challenges included long processing times for both discharged and admitted patients, excessive ED boarding of in-patients, relegation of behavioral health and other patients to hallway beds, and patient experience performance were identified.

**Discussion:** Before and after completed renovations, total ED bed capacity increased from 52 to 109. The daily ED assignment of personnel was driven by the increased volume of ED encounters, hospital and observation admissions, and a desire to reduce left without being seen populations. Another aspect of the intent of the expansion were in the domains of designated, bedded space for cancer care, behavioral and mental health patients, observation care, and preventing patients from being relegated to hallway beds. New and existing personnel roles were modified to enhance arrival functionality in order to reduce undifferentiated waiting times and place patients in treatment spaces expeditiously. However, after 6 years of efforts, multiple metrics failed to show substantial or any improvement (ED length of stay, ED boarding). Subsidiary improvements in interdisciplinary collaborations to standardize and integrate emergency care within the larger health system included co-localization and expansion of our ED observation unit, expansion of critical care rooms, teaming of zoned ED staff together, and integration of key ancillary service providers (radiology, clinical laboratory, respiratory therapy, and others) were advanced. Improved turn-around times for radiology, lab and RT availability was evident.

**Conclusions:** Clinical improvements in hospital metrics were advanced by space expansion, key personnel adjustments, and prioritizing the assessment of delays in the process of emergency care. Unintended consequences associated with increased hospital utilization resulted in a doubling of ED boarding, and an overall inability to meet improved processing times for emergency patients.

**Keywords:** Emergency Department (ED) Design; ED Arrival-Entry; ED Observation; ED Behavioral Health; ED Cancer Care

## Introduction

Modernization and expansion of emergency services in the United States is occurring at a rapid pace. The National Hospital and Ambulatory Care estimates obtained by the Center for Diseases Control and Prevention estimate 2013 calendar year ED encounters at over 140 million and accounting for nearly 50% of total hospital admissions [1]. Hospital and healthcare organizations are investing in improving the functionality and performance of their EDs in order to improve the integration of ED-based care within the context of health systems, hospital performance metrics, the quality and safety of emergency care, and patient experience [2,3]. Growth in ED patient encounters are driven by many factors, and competitive advantage is sought through publicly recognized performance.

In the many interfaces between design, construction, and process improvements, we sought to describe key challenges identified prior to and during renovations of our ED and how we addressed them over the design, build, and intended clinical process improvements. Little information is available for planners and healthcare leadership in updating emergency facilities, despite evidence of continuing ED expansion and increased ED utilization [4]. This report describes the process of identifying and proposing key solutions to the major challenges of our main academic ED. In addition, we report on the before and after state of our academic ED enterprise in terms of satisfying these solutions.

## Methods

### General Methods

Establishing Priorities to Advance During Design and Build: Teams of clinical leadership personnel including nursing, physi-

cian, advanced practice providers, residents, and key collaborating disciplines incorporated facility and operations re-design into their regularly scheduled clinical improvements discussions. Topics for improvement through enhanced, modernized, patient-centric philosophies were identified and vetted through our key ED clinical leadership team [4,5]. These topics were endorsed by institutional leadership at the health system level to ensure adequate funding, policy alignment, and integration. Creating desired clinical flexibility by expanding the facility overall, designated priority areas for expansion, and improving arrival functionality was thought to enhance overall flexibility to avoid the peaks in patient care demand. This was thought to avoid just building a larger and potentially more inefficient ED characterized by chronic over-crowding, delays, long processing times, and poor satisfaction.

We finalized the following as supportable initiatives for design within the designated new ED footprint:

- Improve the patient arrival process (from signage, to parking, to coordination with EMS arrivals, to in-room registration and direct bedding when available, to modest waiting and triage “Slots”, to improving communications between arrival and “The Back”); [4]
- Improve physical space of rooms and proximity to key needs (at arrival, for security, proximate radiology and laboratory services, critically ill and trauma spaces);
- Improve the patient & staff experience:(eliminate routine hallway bed utilization; expand behavioral and mental health capacity and embed psychiatric services within the ED; promote team building and communication within each pod of care,
- Provide a healing environment: (lessen noise and chaos within the ED and project a more quiet, healing environment);

Develop specialized care modules: (especially for psychiatric, cancer, critical care, and geriatric patients and providers) that improve evidence based interdisciplinary standards of practice. Various design-build options were finalized to include sufficient flexibility in meeting all emergency patient needs, while modeling changes in throughput and adjusted staff priorities.

Cultural adjustments were made in advance of project completion: Adjustments included creating a zone or pod of treatment rooms facilitating teaming and leadership to add to the pod-

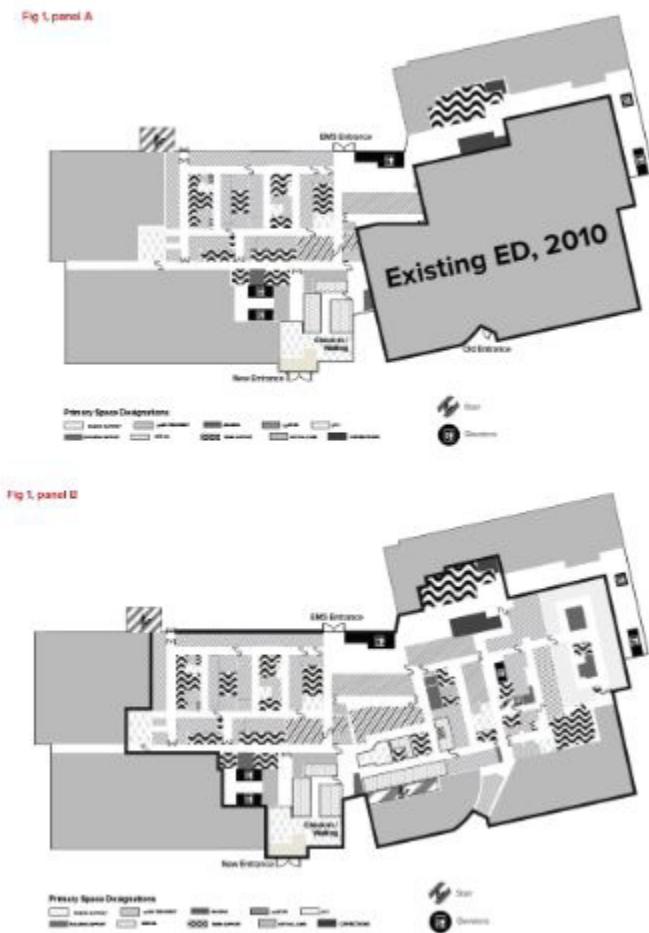
communication enhancements and reduce the excessive burdens placed on singular charge role. Confidence in decentralized leadership built by networking and communicating within each major pod of rooms or functionality. Modeling and educating to those behaviors was begun early, and included a partial, full-scale ED constructed of heavy duty cardboard constructed in a large warehouse to allow exercising and adjustments of concepts. The final pods or zones of activity within the ED included Arrival (security, quick registration, triage, low acuity encounter completion “Up Front”, and space for obtaining 12 lead electrocardiograms and obtaining physiological samples for advanced nursing enabled protocols); transitional care areas (located adjacent to arrival, cancer, and behavioral health zones and containing medical lounge chairs or smaller exam rooms for lower acuity patients) in several areas of the ED to expand capacity capability; critical care zone for high acuity patients needing high levels of provider interface; cancer ED prioritized for patients with active oncologic needs or protection from infectious diseases; expansion of behavioral health space from 6 to 15+, eliminating hallway-bed placement, improved identification of patients needing and cooperating with short term outpatient interventions designed to reduce pressure on constrained in-patient psychiatric beds and decompressing the ED; two core pods of 15 to 18 beds for general purpose ED needs, including an integrated critical care/trauma/stroke complex of 7 large treatment rooms.

## Results

A Before and After (construction) Description.

### Physical Footprint and Expansion

We expanded the physical footprint of the existing ED (Figure 1, Panel A) within the identifiable planning limitations associated with building a new comprehensive cancer tower and re-purposing the existing ED (Figure 1, Panel B). These renovations largely were accomplished while continuing full operation over an approximately 5-year period. The overall net square footage increased by 78% (gross square foot increase of 25,564 sq ft), with space designated to match additional patient demands including those designated for cancer, critical care, behavioral health, and significantly decreasing reliance on patient designation to hallway stretcher utilization.



**Figure 1:** Illustration of overall footprint prior to (panel A) and upon completing ED renovations (panel B). The footprint of the existing ED is overlaid to the fully renovated ED (panel B). Details of primary space designations include shared support for ED and collaborating staff, building support (technology and security), arrival zone areas (for ambulatory and designated for lower acuity patients), imaging (equipment and personnel, including professional interpretation spaces), team support for ED administrative, clinical and education members, cancer designated, critical care designated, corrections designated, main ED treatment areas, and the Clinical Decision/Observation services area.

Quantitatively, annual ED encounters rose by 5,783 (8.1% increase compared to CY12), while hospital admissions and observation placements continued to climb (Table 1). A proportion of expected hospital admissions was managed by ED-based observation expansion, while ED boarding increased substantially, more than doubling during the last 4 years of renovations. Total organizational capacity continues to be challenging to optimize, even though referral and extended ED management in observation care results in approximately 80% of that population achieving discharge status in an average of 14 to 15 hours of observation ED care (Table 2).

Parameter	CY10	CY16
ED footprint, gross square feet	32,633	58,197
ED treatment sites	51	109
Designated areas:		
Arrival zone	None	16*
Cancer care	None	19*
Observation unit	7 (variable)	20
Behavioral unit	6	12*
Critical care	3	9
Corrections	3 <sup>+</sup>	3+
Core areas	32	30
Encounters completed	69,964	79,399
Hospital admissions (% encounters)	18,331 (26)	29,029 (36)
Observation placements (% encounters)	5987 (8.6)	6,771 (8.5)

\*These areas have associated transitional care areas for partial expansion and flexibility of usage.

<sup>+</sup>These areas have one to two flexible stretcher spaces each.

**Table 1:** Outcomes of Renovations and Designated Improvement Efforts.

Parameter	CY12	CY16
ED encounters	70,921	79,399
Hospital admissions (% encounters)	19,592 (28)	29,029 (36)
ED Observation placements (% encounters)	6,028 (8.5%)	6,711 (8.5)
Designated priorities:		
Arrival zone (% encounters)	260 (0.4)	9,168 (12)
Behavioral health (% encounters)	-	5,521 (7.0)
Cancer care (% encounters)	-	13,279 (17)
ED Length of stay, admit (hr)	8.5	11.4
ED LOS, discharge (hr)	4.8	7
Arrival to triage (min)	8.8	12.5
Arrival to bed (min)	53.8	58.5
Bed to doctor (min)	16.5	11.4
Discharge order to ED departure (min)	49	40
Admit to ED departure (min)	250	362
ED boarding of inpatients (hrs)	26,125	73,623
Left without being seen (% encounters)	2,679 (3.8)	3,264 (4.1)

**Table 2:** During and After Renovation Metrics for ED Patients.

## **Arrival Functionality - Before**

Ambulatory patients parked across the street from the main entrance which was poorly lit, unsecured, and shared space with arriving ambulances. A “Quick Look” desk was located at the end of the entry portal where full triage was often performed. Patient arriving by EMS went through a separate doorway past the nursing station where room assignments or waiting locations were assigned. Security presence was intermittent during rounding and no EMS patients were scanned for metallic objects. Patients frequently waited with EMS staff before ED bed availability was provided. All placement decisions were made by ED charge nurse.

## **After**

Maintaining arrival function is necessary including during peak arrival hours when the ED has reached a saturation point. Patients are all screened, placed into a resuscitation/critical care room, or taken into a proximate, secondary arrival zone area where initial history and brief exam can be performed by a qualified medical professional. A physician or Advanced Practice Provider (APP, nurse practitioner or physicians’ assistant) is available to help guide initial evaluation and treatment, including enhanced placement into an appropriate pod. After the initial evaluation, patients are moved forward into a multiuse area where other testing such as specimen collection, electrocardiograms, or initial testing is initiated. Patient’s requiring x-ray or advanced radiologic imaging can be moved to those appropriate areas under the guidance of the provider in the arrival zone that day. If the patient does not require any further treatment, patients with low to moderate complexity can complete their encounter in the arrival zone area. Advanced Practice Providers who historically functioned only incident to the EM physician, were trained to independently evaluate lower acuity patients (i.e. Emergency Severity Index levels 4 and 5). After a brief run-in phase, APPs provide independent treatment for 22% of ED arriving patients.

Low acuity patients could also be served in the adjoining Arrival Zone Extension space. This area is made up of 7 individual rooms with a results waiting area made up of 4 large reclining chairs referred to as Transitional Care Area (TCA). The TCA has a small private room to provide private results and counseling. Patients in the arrival zone extension are seen quickly and dispositioned for low complexity complaints. Moderate complexity patients (ESI level 3) can be seen in this area, but require staffing by the APP with the attending provider [6-10].

## **Cancer/Hematologic Care - Before**

No formal ED procedure for identifying oncologic patients and their needs was available. The original plans (2006) called for relocating the existing James Cancer Hospital’s ambulatory Immediate Care Center from the 11th floor of the hospital cancer complex, to the first floor of the new Cancer and Critical Care Tower.

After many discussions, the concept of integrating the emergency care of oncologic patients into the expanded ED were endorsed and approved.

## **After**

Fifteen treatment beds, a rapid exam/secondary triage bay, a private waiting cove for immunosuppressed patients or accompanying family members, and isolation capabilities were approved. Conceptually the full integration of the cancer ED into the general ED allows optimum flexibility for all patients, while further protecting the needs of oncologic-hematologic patients. The goals of the specific area were to provide expert care to the growing and unique field of Oncologic and Hematologic Emergencies. Nursing staff from the James cancer program with significant training in hematology, oncology, bone marrow transplant and/or critical care were provided rigorous personalized emergency medicine education and orientation.

Centralization of the care team, placing all the providers in the same zone, allowed enhanced efficiency, patient flow and team communication. Significant emphasis was placed on building relationships between experts and across disciplines in emergency medicine, hematology, and oncology. Prior to opening intensive planning retreats were held to ensure key stakeholders were involved in the decision-making process. This interaction and constant communication was critical to the success launch of the first fully integrated, hematology and oncology focused emergency department.

The incidence and prevalence of time sensitive oncologic and hematologic conditions were identified and researched during design. Initial areas of focus included recognition and treatment of chemotherapy side effects, fever and neutropenia, sepsis, spinal cord compression, and pain crisis in patients with Sickle Cell Disease. Triage protocols and plans were adjusted and built into the electronic medical record specifically for these emergencies. Guidelines for treatment of common oncologic and hematologic conditions were imbedded into training for all clinical staff and providers.

## **Behavioral & Mental Health Before**

Significant numbers of patients express behavioral and mental health concerns (7% arrivals and increasing), necessitating prompt evaluation, medical clearance, formal psychiatric assessment, and dispositioning. Many of these patients were historically placed in hallway stretchers for care of clinical presentations such as suicidal thoughts or attempts, psychosis, severe depression, and some addictions. Patients, their families and their providers uniformly found this state widely unacceptable, noisy, lacking in decent privacy, reducing satisfaction by routine or unpredictable outbursts, and associated safety concerns for all. The former state of the ED included a 5-treatment bay area for psychiatric patients, de-

signed to observe patients from a single staffing station and which was separated from other ED treatment areas. Like many other general hospital EDs, OSUWMC experiences long ED Lengths of Stay (LOS) for psychiatric patients, with some patients boarding for a several days prior to admission to an inpatient psychiatric bed. As a result, the number of psychiatric patients frequently exceeded the capacity of the designated 5-bed area and would overflow into other ED areas. This presented a challenge not only because other treatment areas were often full occupied, but also because suicidal patients are required to be observed by staff at all times. "Hallway Beds" became the by-design, overflow areas for psychiatric patients, as hallways enabled a single designated sitter to view several patients at once and kept other rooms available for acute medical treatment. But use of hallway beds was undesirable for a number of reasons: patients in hallways are deprived of basic privacy; hallways are bright, loud, and over-stimulating, which can exacerbate an underlying mental illness; routes of egress were visible, tempting some patients to elope; and some patients would become agitated and disruptive to the treatment of other patients. The desire to move patients out ED hallways and to raise the quality of care for psychiatric patients motivated a series of changes that were implemented as a part of the ED redesign process.

#### **After**

In 2013 and in partnership with the Department of Psychiatry, we opened an 8-bed psychiatric assessment and observation unit called CALM (Crisis Assessment Linkage and Management). CALM provided a new, intermediate level of behavioral health care and disposition not previously offered here. Located within the psychiatry building and not the ED, CALM is staffed by PES clinicians and psychiatrists. When CALM beds are available, ED patients who are medically and behaviorally stable and in need of psychiatric assessment can move from the ED to CALM for further evaluation. In the six months following CALM's opening, median ED length of stay (LOS) for psychiatric patients decreased by 23.7%, as compared to the same six months a year prior (manuscript submitted for publication).

The care environment for the behavioral health population requires special considerations, including good visibility of patients and consideration of environmental risks such as ligature points and sharp objects that might be used for self-harm. As a part of ED expansion, the ED treatment area designated for patients in behavioral health crisis expanded its capacity from 5 to 13 patients. Adjacent ED rooms that had previously been used for "Fast-Track" patients were converted into a psychiatric treatment area for 7 more patients, with significant renovations required to ensure the safety of the environment. A seclusion room was also added for patients who cannot be safely maintained elsewhere. Direct observation of patients was enhanced with the addition of multiple video-cameras installed in patient care areas, with staff assigned to watch the cameras on a rotating two-hour schedule. Prior to

the redesign, staffing for the ED psychiatric care area was drawn from the general pool of ED staff. To improve staff competency and elevate the standard of care, a designated group of nurses and technicians with a mix of ED and psychiatry backgrounds were selected.

#### **Observation Care - Before**

Being early adopters of emergency observation care, there were ongoing efforts to improve the utilization, quality, metrics, standards of practice and intended measurements of success. With an increasing organizational capacity need for short-term observation and the competition those observation cases represent for in-patient beds, the leadership determined that enhancements for observation care begun during emergency visits should be increased. First, appropriate space was re-engineered to be in contiguous space with ED, and emergency physicians provided direct attending care and decision making for all cases and 24/7 in order to enhance efficiencies. Starting from 7 physically separate beds, 4 attendings, and 8 protocols, the future was cast in terms of organizational needs. Desired organizational improvement metrics included: improve the overall accuracy of disposition decision making for ED patients; improve ED bed capacity and throughput, reduce left without being seen populations, reduce the proportion of observation cases requiring admission during the same encounter, improve the case-mix index for inpatients, reduce 1-day admission denials by payors, reduce 30 day readmissions, and overall cost savings comparing hospitalization for like patients. During CYs 14 and 15 the ED observation unit was physically moved during ED renovations to another hospital floor and reduced to a maximum of 7 beds. Following final renovations, ED observation services have re-expanded physically and more protocol driven cases are treated there (CY16 6,771).

#### **After**

There was a rapid and sustained increase in the number and medical complexity of ED patients admitted to ED observation care. The observation pod was staffed with general EM faculty, an APP, and ED nurses expressing a desire for participation in this service. With this new 20 beds unit the ED team expanded accordingly, and 36 protocols were developed and adopted for utilization. The APP service created the 24/7 practitioner back-bone, while EM attendings examined, refined, and dispositioned patients, often throughout the course of a typical day, but always for patients requiring a cross-shift period of observation. Regular ED patients are seen in empty observations rooms, especially in the afternoon and evening hours.

#### **Reducing Noise and Chaos, Improving Safety – Before**

The judgment of the emergency leadership team was that we maintained a highly chaotic, sometimes unsafe, and non-patient centric environment. While contributing factors included historical

culture, growth in ED encounters, long processing times, aging and undersized facility, there were recognizable areas that we sought to change. We set goals which included improving the patient experience from arrival to ED departure, expanding the options available for movement to appropriate ED bed/treatment areas, coordinating evidence based guidelines that began with the ED encounter and extended to hospital unit and discharge service for out-patient follow up, eliminate the routine use of hallway beds, expand internal psychiatric capability and capacity, and other features highlighted in other sections of the present manuscript.

## **After**

An immediate and sustained reduction in noise and perceived chaos occurred once we settled into the new facility. Hallway bed use essentially is zero, with rare exception for ED super-crowding and mass casualty incidents. Compartmentalizing patients with behavioral health needs, has reduced their likelihood of escalation and the occasionally truly disruptive individual is controlled physically and chemically to promote safety.

## **Teaming of Providers - Before**

Proximity and interaction of team members seems critical to optimizing ED care. At issue, was how previous efforts at multi-disciplinary interaction and communication could be enhanced by design, seating arrangements, and pods/zone operational concept elements. In other segments of the working world, teaming of employees has been thought to be important to cross positional collaboration, communication, efficiency, and employee satisfaction (insert reference). With the advent of a much larger physical platform across a very horizontally distributed footprint, multiple treatment pods/zones, inter-disciplinary communication and interaction was a significant concern of the leadership team. One of our initial strategies to this end focused on where our team members would physically sit and do their work. In planning and simulation efforts, we found this issue to be a significant concern of our staff who liked their pairings and separation as noted above. We felt this would be highly problematic in our new space, so as a part of simulation and roll out efforts actually went as far as to label computers and seats with a role to "Inter-Mix" staff. One such intentional pairing was having the charge nurse sit directly next to our charge attending physician in the main high acuity core of our Department. Additional pairings included having our trainee physicians sit next to bedside nursing colleagues more proximal to patient care.

Critical to the above was the need to interact frequently with our electronic medical record to provide and document care. As such counter space and physical seating layout became critically important for multi-disciplinary collaboration. Unlike our older ED, each treatment space had an associated mounted computer; thus enabling staff to document and do clinical work at the bedside. With that said, there was the expressed desire and need to

have "off stage" space in which to document, discuss patient care, and interact. Further, during space planning efforts nearly 6 years prior to opening of the ED, specific nursing, doctor, and segmented spaces had been planned. As a result, we had to modify seating arrangements in these areas to enhance multi-disciplinary communication. For instance, our primary physician work areas and spaces initially did not include places for the charge nurse for our main ED core or our observation unit core of the Department. As we rolled out the new ED space, inclusion of nursing staff and other providers (such as Case Management) were active considerations.

## **After**

It should be noted that in the modern ED, the issue noted above about computing and counter space should not be underestimated. The workflow for providers and staff often is iterative related to seeing patients and then seeking out "Their" computer to document. We did find that ED staff (typical of human nature) are possessive of their space and tend to identify a certain location as "Theirs." This extended to "Their" computer or "Their" counter space and even physical seat. This didn't seem to vary across job type or position description in our Department. Despite our desire to "Inter-Mix" staff, a constant struggle when we first opened our ED was to encourage providers not to revert to their exclusive groupings but to trial multi-disciplinary groupings. This was moderately successful. As noted above, we enlisted labeling of spaces and even distributed a "Seating Chart" to help encourage positive multi-disciplinary seating and special arrangements. After our go live, we also were able to utilize a number of other computing concepts such as computers on wheels for more mobile team members to utilize while on the go and seeing patients (for instance registration staff, respiratory therapy staff, pharmacy staff, etc.). Today if you entered our ED observers would see both exclusive and multi-disciplinary groupings. None-the-less, this to some degree was inevitable and we currently have spaces in the ED that support both concepts. One final space consideration included considerations for undergraduate and graduate medical education trainees. In our academic ED, trainees often are the initial providers to interact with patients. Once their initial history and physical exams were completed, they needed to document their encounters, place orders in the EMR, and then discuss the patient they had seen with a supervising senior trainee physician and/or faculty member. As a result of inevitable counter space and computer space limitations, our initial seating arrangements was not as conducive for making presentations to our faculty or to hearing other teaching points discussed about other patients and their care. Over time, we modified some seating arrangements to allow for more trainees to sit in physician specific workspace areas while still incorporating multi-disciplinary seating. For instance, our physician workspace are in the main section of our resuscitation core includes an attending physician senior resident physician, and perhaps as many as 3 additional junior trainee physicians. Non-physician providers in

this space include the ED charge nurse and case manager (during peak business hours to facilitate discharge planning efforts). We found the considerations could be accommodated based on time of day and day of week.

One additional consideration to our teaming efforts included off stage space such as breakrooms, locker access, and an “Administrative Hallway.” Break rooms were dispersed throughout the ED and all team member had access to them unlike our old ED where break room activities were exclusive of either provider or staff space. The administrative hallway was a design element that allowed for offices for our ED leadership to be in close proximity to the clinical footprint, but be contained beyond it to allow for private conversations. The manager officers were also physically close to break rooms allowing for interaction with staff and other team members as they entered and exited their shifts.

In summary, we feel and would advocate for careful consideration of teaming of staff in any ED environment. While acknowledging the need for like parties to be in close proximity and having affinity for grouping together, our goal was successfully implemented to incorporate multi-disciplinary mixing of our staff. We feel this has enabled critical patient care conversations and enabled modest efficiency in overall emergency care.

## What Worked and What Didn’t?

We sought to improve overall quality, efficiency, and capacity of emergency care. The team perceived or data supports the ability of our ED to increase capacity (but much of this was increased ED boarding), reposition patients out of the compromised hallway stretchers (this was completely met except on rare, high acuity, and temporary surge incidents), provide some level of enhanced privacy for behavioral and mental health patients (we applaud the willingness and ability of our psychiatric nurses and colleagues to work collaboratively to improve this patient centered approach), provide support and operation for an expanded observation facility to handle otherwise lower acuity, short term hospitalizations (in recent months ED observation has been persistently full and at capacity, managing approximately 25 to 27 patients per day), developing, staffing and utilizing the oncologic ED (which has resulted in many qualitative and quantitative aspects of oncologic emergency management). Teaming amongst ED providers and sharing nursing on-site workload has been enhanced by creating zone leadership.

## Conclusion

We describe a before and after series of prioritized results from our academic ED over a 5 year period. We found that re-characterizing space in terms of modernized functionality may improve ED capability and capacity, and better align with specialized needs of populations of patients requiring emergency care, such as

behavioral health and cancer care. While all healthcare organizations that undergo renovations have strategies and expected outcomes, our observations are relatively unique in providing insights to ongoing changes that occur, related or not to ED renovations. We found that a significant space expansion allowed re-characterization of and sometimes improvements in observation, cancer, behavioral health, and arrival functionality. However, our throughput metrics continue to be compromised by diminished hospital bed availability and worsening of ED boarding of in-patients. Qualitatively, improvements in the stress and chaos of ED care, were unable to be immediately associated with increases in patient satisfaction. The characterization and changes that were present prior to and following completion of these extensive renovations are presented in tabular format for directly measurable outcomes, but we continue to work on facility and operational improvements, as well as health system leadership in making achievable improvements.

A major renovation and expansion of our academic ED was performed on budget and on time in order to allow further expansion of clinical services. Specific objectives of modernization and improvement were incorporated into design and subsequent operations. Despite continuing capacity management challenges, the performance characteristics accommodated an 8% increase in encounters, a doubling of ED boarding, and an integrated expansion of ED observation services. Qualitative improvements in teaming of ED members, reducing dependency on hallway stretchers, and creating a calming atmosphere were detected.

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## Article Summary

- Why is this topic important? May provide guidance for others renovating or expanding their academic EDs.
- What does this review attempt to show? How we established priorities and modernized the functional capability and quality of care in the ED
- What are the key findings? Expansion and modernization can occur, but does not necessarily improve throughput metrics in a growing healthcare organization.
- How is patient care impacted? Direct bedding and arrival planning, expanded ED observation care, and improved teaming are possible, but further development following facility changes are needed.

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