Design of the Academic Emergency Department

Kenneth D. Marshall, MD, MA[a,b,*], Bryan Imhoff, MD, MBA[a], Frank Zilm, DArch[c]

KEYWORDS

• ED design • Throughput • Flow • Crowding • Space • Planning • Architecture

KEY POINTS

- Early clinical input is essential to generating a successful emergency department design.
- Decisions made prematurely in the design process can place severe constraints on the ability to make changes later, so decisions should be made only when necessary.
- It is important to consider which operational flow model(s) will be used when determining capacity needs and selecting designs.
- Different design schemes have inherent advantages and disadvantages, and should be chosen based on goodness of fit to the institution's needs.
- Planning for atypical patient surge events should be incorporated in the design process.

There are few decisions that will have a more significant impact on the operations of an emergency service than those related to its physical design. Over the typical 10-year period in which a health care capital investment is evaluated, safe, efficient, caring services will be provided in an environment that either supports these tasks or makes them more challenging. Staff efficiency will likewise be either enhanced or diminished, and in turn, this environment will influence staff retention, burnout, and turnover.

To the clinician, participation in the planning and design process may present unfamiliar terms, concepts, and decisions. This article outlines some of the major terms, processes, and key decisions that clinical staff will experience as a participant in emergency department (ED) design. To do this, we first explain the overall planning and design process. Second, we describe in depth 2 major process steps, namely identification of required patient capacity and determination of operational flow models. Finally, we describe 3 representative design layouts and cover their strengths and weaknesses. Throughout these discussions, we highlight the importance of

[a] Department of Emergency Medicine, University of Kansas Medical Center, 3900 Rainbow Boulevard, Kansas City, KS 66160, USA; [b] Department of History and Philosophy of Medicine, University of Kansas Medical Center, 3900 Rainbow Boulevard, Kansas City, KS 66160, USA; [c] Institute for Health and Wellness Design, The University of Kansas, 315 Marvin Hall, Lawrence, Kansas, KS 66045, USA
* Corresponding author.
E-mail address: kmarshall2@kumc.edu

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adaptability and safety as key tenets in ED design. Regarding adaptability, we cover strategies, such as identifying opportunities for future expansion and internal reassignments, that will allow the emergency service to respond to changing demands and operational approaches. Regarding safety, we cover topics including establishing appropriate security, isolation needs, and event-scenario strategies to protect staff and respond to high-risk events.

UNDERSTANDING THE PROCESS

The planning and design process typically moves through a series of approximations envisioning future needs, starting with workload and operational assumptions, and progressing into space programming, planning, and design (Fig. 1). As in clinical diagnosis and treatment, initial assumptions are established, tested, revised, and then actions implemented. Each ED design presents a unique set of site-related, demand, and operational conditions, making "evidence-based" methods of study and implementation more difficult than in clinical medicine. Much of the decision-making will rely on expert judgment and trust among the team members (see Fig. 1).

Another major difference from clinical practice is the timescale to complete projects. Planning and design can take months, and in some cases years, to complete. Ironically, many of the key design decisions are made early in the process when the least is known about the final design strategy. It is during these early stages of space programming and design that clinical staff have the most significant opportunity to influence the final design. As the process progresses, plans become more detailed, technical, and hard to modify. It is extremely difficult to change a design once construction has begun.

Critical to the early stages of the process is maintaining an open mind to exploring operational and space alternatives. This divergent thinking process is essential to identifying the most creative solution, and differs from decision making in other contexts, especially clinical medicine. In those situations, decisions are best made as soon as necessary information is available to allow progress. The risk in early stages of design is to make premature decisions that produce irreversible constraints on the project. Thus, decisions should be made only when necessary, suspending actions until they are critical to the overall progress of the project. This allows time for reflection and potential identification of new concepts. Encouraging frank, open discussions is essential.

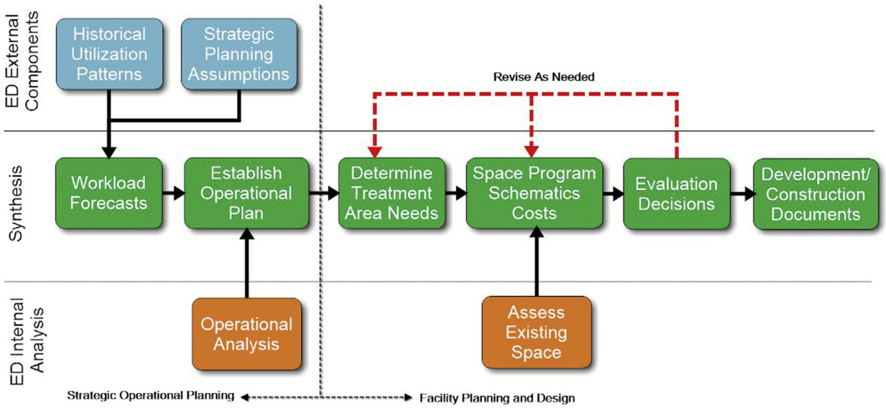


Fig. 1. Design process diagram.

Team members bring different and unique skills. Designers can be great visionaries of new ideas, but may not be skilled in quantitative techniques or clinical process needs. Clinical staff can bring important insights into care needs, but may have limited exposure to new operational and design concepts. Administration can provide strategic and financial insights but may not appreciate the impact of variability and peak demands on an emergency service. Success in the planning process is dependent on open, trusting dialogue among the team members. Site visits to other EDs early in the process can provide both valuable insights and opportunities to establish team unity.

The planning and design process typically moves through 5 phases:

- *Strategic planning:* Workload forecasts, strategic goals, identification of space elements, and basic organizational concepts are developed during this phase. Critical strategic considerations include 5-year to 10-year visit volume forecasts, throughput length of stay assumptions, anticipated operational models of care (see later in this article), and unique operational/care needs. This may be undertaken with the design architect participating or with the assistance of a planning consultant.
- *Space programming:* The insights from the strategic planning phase are used to establish key room requirements, including the number and room sizes (referred to as net square feet). The anticipated overall size of the department is also developed (departmental gross square footage [dgsf]). Target project budgets are established along with identification of major equipment purchases.
- *Schematic design:* Simple ("single line") drawings of alternative layouts of the space program with the building site are undertaken, typically relying on 2-dimensional or simple 3-dimensional drawings. Meeting budget targets are confirmed or adjusted based on these tests. A preferred concept is established during this phase.
- *Design development:* During this stage, detailed layouts of the schematic design are developed, including accurate wall and corridor dimensions, and location of headwalls, outlets, and charting areas. Full scale mock-ups of key rooms may be used to garner clinical staff input and confirmation of concepts. This is functionally the last major opportunity for clinical staff to influence the design.
- *Construction documents:* These are technical drawings and specifications primarily to solicit construction bids by outside contractors. Modifications to the ED layout or room configuration are extremely difficult to undertake, potentially risking time delays and additional professional fees.

The first 2 phases of the process require active leadership by a consistent, core clinical team. Although it is desirable to encourage participation by all interested parties, a small working group of 5 to 10 members offers an opportunity for a diverse knowledge base and the ability to meet as needed. A typical core working group should include medical, nursing, administration, facilities planning, and finance members.

Establishing a project budget during the programming and planning phase places key parameters on the project that may be difficult to change. There are 2 elements that comprise a project budget: the *construction budget* for the "brick and mortar" and the *non–construction-related costs* for equipment, site development, professional services, state reviews, and other activities. It is not uncommon for these nonconstruction budget components to equal to a quarter to a third of the project budget, particularly if major imaging equipment, such as computed tomography (CT) or MRI scanners, are in the project.

DETERMINING CAPACITY

Establishing the required number of treatment spaces for each operational component of the ED is the most significant task in the early stages of the planning and programming process. The primary challenge is identifying the impact of variability to establish peak period needs. Anticipated patient arrival patterns, treatment space needs, and length of stay must be assessed for each patient area. Dividing the problem into variables that are outside the direct control of the ED (exogenous variable) and those that are within the operational control of the service (endogenous variables) provides a logical way to manage the process.

External factors include the projected annual patient visit volume (ideally at least 5 years into the future), the demographics of the patient population and resulting treatment needs, the mix of admitted patients, and the impact of federal and local health care policies. Rather than lock into a single assumption regarding these complex issues, it is common to establish scenarios that forecast 2 or 3 potential combinations of factors. Capacity and design solutions should be evaluated against these alternative scenarios to determine the ability to meet the projected needs.

Current management concepts of LEAN[1] and Goldratt's Theory of Constraints[2] focus on identifying elements of a complex system that are impeding flow and "production." Applying this perspective to ED planning, the focus should be on arrivals and service patterns during peak periods of demand. If a department possesses enough treatment capacity to accommodate these peak periods, then meeting demand during nonpeak periods will require down-staffing to demand. At nonpeak times, space will not be the constraining variable on patient flow.

Peak period capacity can be estimated as the product of the hourly arrival rates and length of stay. This demand is then divided into the estimated available time for an appropriate treatment space, which is a function of the time (typically 1 hour) and the achievable occupancy percentage.

$$\text{Treatment room needs} = \frac{\text{peak arrivals per hour X treatment room length of stay (minutes)}}{\text{Treatment room capacity (60 minutes * occupancy \%)}}$$

At least 3 data points should be used to adjust the annual visit forecast into peak hour demand.

1. Seasonality. Five years, or more, of historical data should be reviewed to determine if there are consistent seasonal peaks in demand. An adjustment index should be developed to incorporate identified peak seasonal demand.
2. Day of week variations. Currently many emergency services experience a Monday spike in demand for adult patients and a Sunday spike for pediatrics. As with seasonality, an index factor should be developed to adjust the daily arrivals for the peak day of week.
3. Time of day. Depending on the adult and pediatric mix of patients, there are almost universal arrival patterns that start with declining arrival per hour until early morning, increasing to a peak rate in late morning and early afternoon, and then slowly declining through the rest of the day. It is not uncommon for pediatric patient arrivals to experience 2 peaks in late morning and early evening. An example calculation:

Annual visits = 36,500

Average daily visits 36,500/365 = 100 patients

Adjustment for seasonal peak 100 × 1.06 = 106

Adjustment for day of week 106 × 1.10 = 117

Peak period of arrival (10 AM to 7 PM) = 117 × 60% of total = 70

Peak period arrivals per hour 70/10 = 7

In this example, if the assumed average treatment room length of stay is 2 hours (120 minutes), then the peak period demand would be 840 minutes.

Establishing the treatment room capacity must be evaluated against the queuing implications resulting from random variations in the arrivals and service time. To assume that treatment space can achieve 100% average utilization guarantees intervals in which demand will exceed capacity, resulting in potentially high-risk patients waiting for care, “hall beds,” and the potential of frustrated patients leaving without being seen. Establishing too low a utilization target can result in excess capacity and potentially misallocation of capital resources.

Three approaches can be used to estimate capacity. The simplest is to rely on expert judgment regarding occupancy targets. This typically ranges from 80% for low-acuity treatment spaces to 50% for trauma and higher-acuity areas. If we assumed an 80% capacity target, the required number of treatment rooms would be 18.

$$\frac{\text{840 minutes per hour demand}}{(\text{60 minutes} * \text{80\%})\text{capacity}} = \text{18 treatment spaces}$$

The most significant problem with this approach is that there is no information regarding possible waiting times and queues associated with an occupancy assumption. Conversely, there is no way to know if the target utilization percentages will result in underuse of expensive space.

Two alternative methods for addressing this project are the application of queuing theory models and stochastic simulation.[3] Queuing theory mathematical techniques were developed in the early 1900s to estimate the possible size of a queue, the wait times, and the resource utilization for systems experiencing random arrivals and service time, a common characteristic of emergency environments. There are several spreadsheet models available on the Internet to perform these calculations.

The second approach is simulation, which has the advantage of allowing to test more robust models of patient flow and arrival patterns, policy decisions regarding treatment, and the provision of detailed queuing and resource utilization patterns. Implementing this approach requires significant time and background data.

One common benchmark used in the early planning of space is the ratio of annual visits to treatment spaces. Organizations, such as the ED Benchmarking Alliance, report operational statistics for a large sample of US EDs. One of the data points is the ratio of current annual visits to treatment spaces. This ratio is computed for groups of EDs based on increments of 20,000 annual visits. The most recent ratios of visits to treatment space reports ratios ranging from 1300 to 1600 visits per treatment space.[4] It is important to remember that this is a ratio of “what is,” not “what should be.” Many EDs are currently experiencing overcrowding and significant peak queuing at the ratios reported in study. A review of 30 recent ED planning studies by one of the authors of this article found a ratio in the 1300 to 1400 visits as a target, with significant differences between teaching/trauma center and general community EDs (F. Zilm, unpublished data, 2019).

Once the number of treatment spaces is established, other areas, including waiting, triage, imaging, charting, supplies, and staff areas, should be developed into a comprehensive list of net square footage areas. Consideration of space to accommodate key diagnostic and support services, including imaging, laboratory, and pharmacy, should be undertaken in this phase. The most significant space, capital, and operational cost component is typically imaging. Radiographic imaging has been a standard component of emergency services. Inclusion of CT must be considered based on demand and the physical proximity to CTs located in other services. Most emergency services with 50,000 or more annual visits has CT capability within the department. Diagnostic ultrasound may also be provided within the ED. A less common element, but important for stroke and other patients, is MRI. At this point in time it is not common to include dedicated MRI capability within the ED, but shell and/or plans for addition of this service through an addition to the department should be addressed during the design.

Clinical laboratory services considerations should include the quick transport of specimens to the appropriate “stat” or other laboratory components and for the accommodation of expanding “point-of-care” testing. A staging area for pneumatic tube links to the laboratory, inclusion of satellite laboratory instruments, and “point-of-care” testing equipment and supplies. This is typically not a large area, but should including sinks, counter space, and computer access.

Inclusion of satellite pharmacies has become a more common component of a large visit volume ED. This can provide a base for a clinical pharmacologist, the delivery medications to the ED, and for the provision of “first dosage” prescriptions for patients. Patient medication dispensing machines can also be provided to supply initial patient doses.

Finally, total nontreatment space needs are added to treatment space needs (estimated by one of the methods listed previously) to yield a net usable space requirement. This sum of net usable space, is then converted into an estimate of the total dgsf needed through the application of “grossing factor” multiplier. Samples of recently completed departments have found that this ratio average 1.6.[5] If a space program listing identifies 10,000 total net square feet of usable space, the resulting estimated departmental gross area would be 16,000 dgsf. Analyses of recent EDs have shown an average of 750 dgsf per treatment space.[6]

All health care facilities must obtain approval for their architectural plans from the designated agency in their state. This agency is often referred to as the “Authority Having Jurisdiction,” or AHJ. Most states use a version of space guidelines and minimum standards developed by the Health Facilities Guideline Institute.[7] These guidelines identify minimum room sizes, components that must be included in the department, and basic proximities of space elements. Some states also have a Certificate of Need program that may require applicants to meet target use goals, such as visits per treatment space. The AHJ can approve variations from the space standards if a compelling argument can be presented. Each department should evaluate special needs, such as behavioral care, isolation of infectious patients, unique surge event demands, and other requirement to determine if unique characteristics justify appealing for special space needs.

SPECIAL CONSIDERATIONS: ACADEMIC AND TERTIARY CENTERS

Some special considerations apply when designing an ED for an academic medical center, or a tertiary medical center. Academic medical center EDs provide training to a variety of medical learners, including residents, fellows, and students from medical, advanced practice, nursing, social work, pharmacy, and other schools. Additional workspace beyond what would be planned for a community site should be incorporated to accommodate these medical learners, which may include charting workstations at bedside and in staff collaboration areas. In addition, ED rooms, particularly resuscitation bays and trauma bays, may need to be sized larger than their community equivalents to accommodate medical learners. Moreover, because of the teaching function of these treatment spaces, throughput time may be slower than in an otherwise comparable community hospital, and so capacity determination should factor in this possibility. Classroom, workrooms, lockers, and break space also may be affected by the scale of educational activities. Similarly, design of EDs at tertiary medical centers should also take into account the workspace and treatment space needed for multidisciplinary care of complex or high-acuity patients.

CONSIDERING ALTERNATIVE OPERATIONAL MODELS

In addition to fundamental parameters such as projected patient volumes, staffing requirements, and institutional space and budget constraints, ED design must also take into account the operational models anticipated for the new space. Traditional ED workflows processed patients sequentially for patient flow: patients were checked in, registered, and triaged, then waited until a room and provider were available, and then taken to a room. Traditional ED design tended to reflect this processing model, with discrete spaces for check-in and registration, triage, waiting, and sometimes uniform treatment spaces for all patient types. Persistent difficulties with ED crowding[8–10] has led to renewed emphasis on strategies to increase care efficiency by using novel operational models.[11,12] These new models, along with technical innovations, such as mobile registration workstations, have introduced considerable variability between EDs in how patients are processed, particularly during early phases of care. The design of an ED should consider the flow model that is anticipated to be used, while also allowing for flexibility for future potential process model changes.

Of note, adopting any of the operational models listed in the following sections will directly impact variables that drive the calculation of treatment room capacity. For example, including a discharge lounge in the design will reduce the treatment room length of stay. Also, including a provider-in-triage will reduce the patient arrivals per hour needing a treatment room (as a subset will be discharged from the triage space). As such, the steps of determining capacity and adopting alternative operational models should be considered iterative. Each process step directly affects the other.

Split Flow

Split flow patient processing, or streaming, is an ED management model whereby patients are stratified based on their anticipated needs into different care pathways that are designed to optimize efficient care for patients of varying needs.[12,13] The most common type of split flow processing is a fast-track system, which divides patients by Emergency Severity Index (ESI) levels, with ESI 4 and 5 patients (for example) being routed to a fast track, and other ESI levels being routed into the main ED. Other types of split flow systems use the need for a bed (eg, ESI 4, 5, and "vertical ESI 3s" comprising one stream), the need for diagnostic testing, or the need for advanced imaging. Split flow has been shown to reduce wait times and lengths of stay, and particularly in the form of fast-track systems, has now been widely adopted in EDs in the United States.[14]

Design of contemporary EDs should thus consider whether a split flow system will be used, and if so, what form it will take. Key principles among split flow systems are that the space and resources of a nurse-staffed bed should not be used for patients who do not benefit from them, that patients who do not require an ED bed (as opposed to a chair or wheelchair) actually receive less-efficient care if they are placed in a bed, and that proximity to frequently used resources (eg, plain radiography) and the ED point of entry/exit are important to optimize efficiency along the patient stream requiring fewer resources.

It bears mentioning that as urgent care centers and standalone EDs have emerged in recent years, patient populations presenting to full-service EDs, particularly academic and tertiary care centers, appear to have skewed toward sicker patients with higher average resource needs.[15,16] Workflow planning and ED design should anticipate this trend, with flexibility for any low-resource split flow space to serve the needs of sicker patients should the future needs of the ED require it.

Immediate Bedding

A second major development in recent years has been the adoption of immediate bedding (also known as "direct bedding," "pull-'till-full," or "closing the waiting room"), wherein patients are taken immediately to an ED room or treatment space on check-in, and are triaged, registered, and evaluated in the treatment space.[17–20] There may be design implications from this process model, in that there is potentially less need for triage evaluation rooms. However, whether this is so depends on the match between projected patient input and the capacity of the ED being designed. Even in well-functioning EDs using immediate bedding, there may be times when patient demand outstrips available ED rooms, in which case a space for triage is necessary.

Advanced Triage and Provider-In-Triage

Advanced triage and provider-in-triage are strategies that have been adopted to smooth patient flow by maximizing the utility of the patient experience at the beginning of the visit. Advanced triage refers to the ability of triage nurses to begin workups (eg, laboratory tests, radiologic studies) or initiate focused treatment (eg, breathing treatments) based on established protocols. Provider-in-triage extends this technique by placing a physician or advanced practice provider to provide an initial evaluation simultaneous to triage, potentially allowing expedited workups or discharge from triage and shortening average length of stay.[21,22] The design implication from this process model is to have a triage space that allows for private evaluations and space to perform treatments, phlebotomy, electrocardiograms, and the like.

Results-Waiting Rooms/Discharge Lounges

A final development used to enhance patient flow is the use of ED "results-waiting" rooms or "discharge lounges." These are spaces for patients who require results before they can be safely discharged, but do not require a bed or ongoing treatment or monitoring. Use of such spaces allows new patients to be evaluated in the treatment space before results have returned. Ideally, such spaces will be separate from the waiting space for new patients (although this is not required), and will be in close proximity to providers to allow them to communicate results and discharge instructions once results are available.

COMPARING 3 TYPICAL DESIGN CONCEPTS

The ideal design solution should reflect the anticipated operational model for the service. The proposed site, proximity to other key services, and the potential reuse of existing space will impact the ability to match space to operations.

The difficulty in forecasting workloads and potential future changes in operational models can compromise subdividing spaces into discrete services, such as fast track, pediatric, or senior care. This is a "goodness-of-fit" dilemma. Designing for adaptability and change should be considered along with custom solutions for the initial operational plan. Universal examination room sizes and layouts, eliminating isolated clusters of treatment space, and positioning "soft space," such as administrative areas, to allow future growth of treatment areas are concepts that should be tested in the early schematic phases of design. Simple cardboard mockup of rooms and clusters of spaces should be used to test divergent solutions to the space program elements.

There are currently 3 typical organizational models for medium to large (more than 40,000 annual visits) emergency services: the "ballroom," "pods," and "inner core" design.

The Ballroom

This general design concept wraps as many treatment spaces as possible around a central work area. This was a common design used in the early development of EDs. A primary anticipated advantage of this approach is the visibility into the treatment spaces from charting and work areas. As treatment areas have moved from open bay configurations to larger individual patient rooms, the ability to see into more than 14 to 16 treatment areas from a single work zone becomes compromised. A second common problem in ballroom configurations is the amount of space in the central core area as the number of rooms increase. This can impact the ability of a design to fit within the targeted departmental gross square feet. Possible solutions to these problems include the development of multiple ballroom clusters and subdividing the configuration into 2 or more core workstation areas.

One significant operational advantage of this configuration is the ability to incrementally staff up and down to respond to the daily flow of patients into the service and to assign the treatment areas into groupings that match team staffing patterns. A logical expansion of this concept to meet future growth should be considered in the initial planning (**Table 1**).

Pods

One alternative to the ballroom layout is clustering treatment rooms into pods of 8 to 12 rooms. Major advantages of this approach are the ability to balance support spaces to the treatment areas, reduce staff walking distances, and the ability to maintain visibility into the treatment spaces. Pods can be designated to focus on specific services, such as pediatrics, senior care, and low-acuity patients. From an operational perspective, there are key issues that should be considered in approach. Among the most significant are the strategies for opening and closing individual pods throughout the day. Maintaining a balanced nurse-to-patient ratio is difficult during transition periods in patient census. Territoriality in a service can also potentially interfere in achieving full utilization, particularly in an academic teaching hospital environment. A third issue is avoiding duplication of supplies and equipment (**Table 2**).

Table 1
Design concept: "Ballroom" core layout

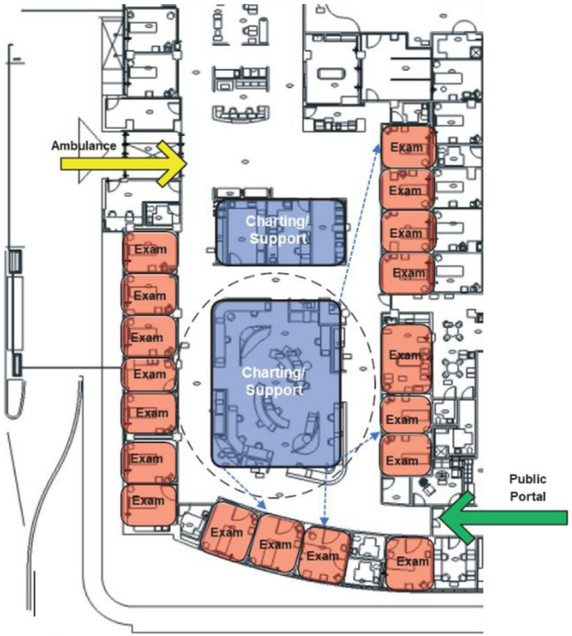
Design Concept: "Ballroom" Core Layout	Advantages	Disadvantages
	Good visibility into examination rooms Centralization of supply/utilities Ability to monitor public/emergency medical services entries	Loss of visualization into rooms in configurations of more than 16 rooms Large central "core" areas disproportionate to needs Inability to cohort-isolate infectious patients

Table 2
Design concept: "pod" configuration

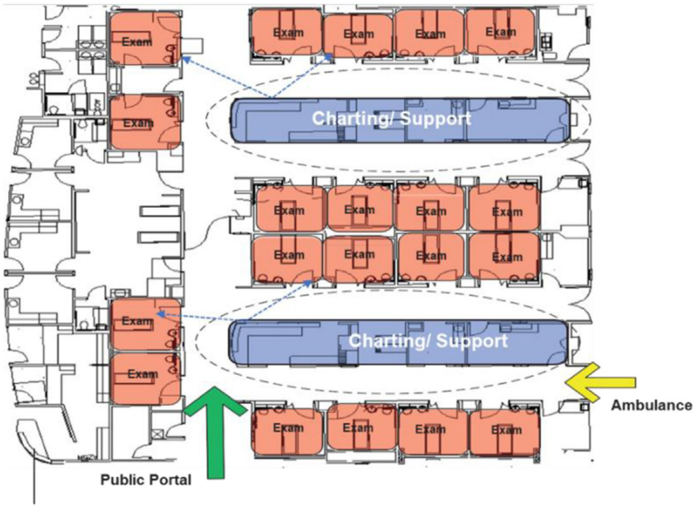
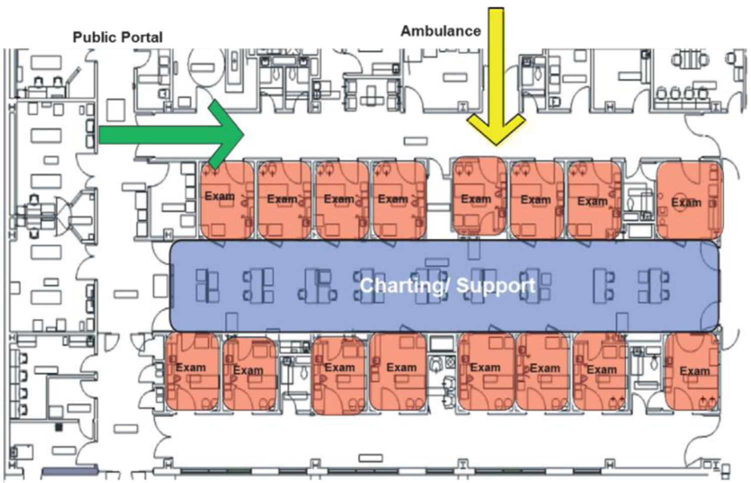
Design Concept: "Pod" Configuration	Advantages	Disadvantages
	Short walking distances to examination rooms Balance of support space to patient care areas Potential subspecialization of pods to patient care needs Ability to cohort-isolate patients	Complex staffing during daily visit cycles Duplication of support services in pods Limited visualization between pods Limited control of patient/family movement

Table 3
Design concept: linear inner core configuration

Design Concept: Linear Inner Core Configuration	Advantages	Disadvantages
	Accommodates daily incremental fluctuations in treatment space demand Staff workstations located near examination rooms Ability to isolate "end" of examination area for cohorting infectious patients	Long walking distances to end of linear layout Distribution of physicians limits interaction and support Larger examination rooms required for "inner" core layout

Inner Core

A third model that has been adopted is a linear strategy that places treatment spaces with dual room entry wrapped around an interior work corridor, with patients and family accessing the treatment rooms along an outside corridor and staff accessing treatment space through the staff work area. A variation of this concept is to abandon the interior work area and have a linear layout with corridors and work spaces similar to the ballroom concept.

This approach has the advantage of allowing incremental growth in census with less potential staffing miss-matches, as in the pod design. With proper site planning, this approach also allows for a future expansion that is consistent with the overall organization of the service. Minimizing cross-traffic of patients, family, and staff can also provide a barrier to cross contamination and the ability to cohort high-risk infectious patients. A major disadvantage of the inner core version of this concept is the need to have larger treatment rooms because of the dual entries. A second concern expressed by facilities that have implemented this approach is the isolation of the staff from other activities in the ED. Finally, this layout may also result in significant staff walking distances if workstations are intentionally consolidated for collaboration or education (**Table 3**).

INCORPORATING EVENT-SCENARIO PLANNING

An important potential emergency service demand that is frequently overlooked during the planning and design process is the impact of man-made or natural events that can create surges in volume, security risks, or other unique considerations.[23] Each department should work with their appropriate safety team to assess potential risks and determine how future plans could respond. The range of events will vary by geographic region, urban settings, and other variables. Examples of strategies that have been used include the following:

- Provision of dual headwalls in treatment spaces to accommodate potential surge volume events.
- The ability to segregate a cluster of treatment stations, with direct access from the outside, to provide “cohort” management of high-risk infectious patients.
- Oversizing the ambulance entry area to serve as a triage receiving point for surge, or security needs, events.
- The ability to quickly convert the ambulance entry, garage, or other adjacent space into a mass decontamination zone.
- Provision of concealed medical gas outlets in consultation, office, and waiting area for patient care use in a major event.
- Site access control points to restrict public vehicular access during major events presenting security or volume control needs for the emergency service.
- Blast mitigation design strategies.

SUMMARY

A doctor can bury his mistakes, but an architect can only advise his clients to plant vines.

—Frank Lloyd Wright

ED design affects more than just physical space. A well-executed design improves clinical efficiency, facilitates the provision of medical care, and can accommodate unforeseen changes in department needs. Delivering such a design can seem to be a daunting task, requiring leaders to envision department needs 5 to 10 years in the future, find solutions that accommodate competing needs and priorities, and work within practical financial and space constraints.

Early clinical input is important to generating a successful final design. Key operational considerations, such as split flow, immediate bedding, provider-in-triage, and discharge lounges drive physical design considerations. As design moves through the 5 major phases (strategic planning, space programming, schematic design, design development, and creation of construction documents), plans become more detailed, technical, and difficult to modify. During the early stages of the process, clinical staff has the most significant opportunity to incorporate novel ideas and influence the final design.

There is no ideal ED design solution. Rather, the solution should be tailored to the anticipated operational model for the specific department, and will be a function of the proposed site, the proximity to other key services, and the potential reuse of existing space. This article presents several design concepts (ballroom, pod, inner core), each with potential advantages and disadvantages.

ED design is neither easy nor simple. However, following a rigorous design process can mitigate the need for a department to “plant vines” to mask the clinical inefficiencies, operational work-arounds, unforeseen space needs, or rising patient volumes that will invariably arise.

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