

REVIEW

Development of an Easy-to-Use Tool for the Assessment of Emergency Department Physical Design

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Abstract

Physical design of the emergency department (ED) has an important effect on its role and function. To date, no guidelines have been introduced to set the standards for the construction of EDs in Iran. In this study, we aim to devise an easy-to-use tool based on the available literature and expert opinion for the quick and effective assessment of EDs in regards to their physical design. For this purpose, based on current literature on emergency design, a comprehensive checklist was developed. Then, this checklist was analyzed by a panel consisting of heads of three major EDs and contradicting items were decided. 178 crude items were derived from available literature. The Items were categorized in to three major domains of Physical space, Equipment, and Accessibility. The final checklist approved by the panel consisted of 163 items categorized into six domains. Each item was phrased as a "Yes or No" question for ease of analysis, meaning that the criterion is either met or not.

Key words: Emergency department; facility design and construction; checklist; hospital planning

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Introduction:

Designing an emergency department (ED) is a complex and time consuming effort (1). A proper design should consider facilitating treatment processes and workflow, future development, changes in target population, and natural disasters; while attending to important issues such as safety, security, privacy, accessibility, costumer expectations, and aesthetic attractiveness is crucial. The design is affected by the number of people expected to work and receive services in each space (2). Emergency design is also an integral part of any attempt at improving patient flow. More and more ED expansions focus on increasing the number of beds without attention to the workflow. This is not always an efficient tactic. It appears that designing smaller functional units within a larger department may be a better design strategy. Such units should include a place for physicians and nurses station, a secretary work station, space for lab specimens, a portal for the tube system, a medication room, a viewing area for radiology results, and both clean and dirty utility rooms (3). While many countries have introduced guidelines to clarify the minimum requirements in this process (2, 4), Iran has yet to embrace such a document. Generally, before designing an ED one

must have a vision of the magnitude of services to be provided. This can be achieved by attaining indices such as annual census of patients and their demographics, average daily admissions, peak admissions, peak times, triage system in place, rate of patients requiring critical care and monitoring, average times of stay in the ED, and plans for future development (2). Such static quantitative and quantitative estimates have been the basis for planning ED expansions, but the use of a qualitative dynamic systems is offering new information to planners and designers (5). Another emerging concept is evidence-based design in which the effects of ED design on patient satisfaction, functionality, medical errors, and side effects. In this type of design energy consumption is studied and the results guide future design plans (6). In this study, we aim to devise an easy-to-use tool based on the available literature and expert opinion for the quick and effective assessment of EDs in regards to their physical design.

Methods:

This was a qualitative developmental study aimed at improving the tools for assessment of the physical aspects of ED design and offering exact suggestions for improvement. Initially a search for current literature on emergency design was conducted using the following string on PubMed, Google scholar, and Google search engines: "Emergency department" AND "physical design" OR design OR "architectural design". A snowball

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method was then used to further expansion of literature using references of search results. The obtained information was then reviewed and data was rewritten as short clear items. The items were reviewed, and repeated items were omitted. Contradicting items from different sources were marked and listed as a single item. Next the items were classified into general domains to help organized the checklist. In the second step of the study, this checklist was analyzed by a panel consisting of heads of three major EDs. The experts reviewed the items and domains. Contradicting items were decided upon based on the version most applicable to the current situation of EDs in Iran. Some items irrelevant to the Iranian landscape were deleted and others were adjusted to fit better with domestic needs. Other items were better clarified and in rare occasions, new items were added to address issues not covered in the literature.

Results:

178 crude items were derived from available literature. The Items were categorized in to three major domains of Physical space, Equipment, and Accessibility. The preliminary checklist was then referred to the panel of expert where it was modified to fit the current Iranian needs and resources. The final checklist approved by the panel consisted of 163 items categorized into six domains (Table 1). Each item was phrased as a “Yes or No” question for ease of analysis, meaning that the criterion is either met or not.

Discussion:

Access to healthcare is a constitutional right for all patients and the ED serves as a gateway to treatment services. The importance of a well-functioning ED is reflected in the fact that 30 to 40% of hospital admissions come through the ED, while over three-quarters of patients base their impression of a hospital on an ED experience (7). The ED is often host to a wide range of patients and personnel who’s optimal functionality relies on a proper physical design (8). An ED should be designed and equipped in a way that is accessible, provides a safe environment for the patients, respects patient privacy, and incorporates complementary services such as laboratory and radiology units (9). To optimize ED functionality good processes must be merged with good design (3, 10). In this regard several suggestions have been made (1, 2, 5, 11). Although every ED requires a unique design scheme, guidelines have been introduced to clarify the minimum requirements for a functional department (2). These guidelines are often lengthy and while helpful in guiding design, they lack the simplicity required for quick assessment of working EDs. In Iran and other countries in the Middle East, great attention is being aimed at improving currently working EDs and optimizing their functionality. We believe that the results of this study give healthcare man-

agers the tool needed for fast and precise decision-making regarding ED expansions and development. Assessment with the devised checklist was able to bring attention to some major flaws within the emergency design. The hallmark of ED design is congruency between infrastructure and patient load. The Emergency Department Benchmarking Alliance (EDBA) has suggested that new EDs should have the capacity to treat 1500 patients per year in each treatment area (10). Other guidelines indicate 50m² of ED area for every 1000 patients, or 145m² for every 1000 patients admitted (whichever is more) (2). Patient and personnel privacy was another concept emphasized by the expert panel. Research has shown that 5% of patients withhold important information in the history because they feel their privacy might be breached (8). Many personnel also believe that patient privacy is often breached within the ED (12). Improving physical design is one way to improve patient privacy whenever possible (13). The traditional ED design incorporates the concept that all patients must be within eyesight of the station. This includes patients with different levels of acuity. Recent studies have suggested that creating patient tracks based on acuity will help alleviate such conditions for the “not so sick” patient. Therefore such a design should only be used for more acute patients (3).

New emergency physicians are graduating each year and are taking over EDs around the country. This has led to a wave of reform within EDs. EDs are being upgraded to meet with increasing demands of both patients and management. In this setting, lack of a national guideline for design of EDs is confusing and complicates the process of assessment and auditing of these important institutions. The development and finalization of a quick and easy-to-use checklist for the assessment of EDs can help simplify the task of planning physical expansion of EDs by focusing attention on the criteria that will have the greatest effect. We believe that the results of this study can be the initial step towards composing such a document.

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Conflict of interest:

The authors have no conflicts to declare

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Table 1: Suggested checklist for assessment of emergency department design 		
Accessibility	Yes	No
1. Is the emergency department located within the main hospital building?		
2. Is the ED entrance the most easily accessed entrance of the hospital?		
3. Is the ED easily accessed from the parking?		
4. Are there special parking areas reserved for on call physicians close to the entrance?		
5. Is the entrance to the emergency department clearly visible and marked?		
6. Is there separate entrance ports for EMS and walk-in patients?		
7. Is the walk-in entrance easily visible for public?		
8. Is the triage room clearly visible and in the path of walk-in patients entrance?		
9. Is the way to the triage room clearly depicted by lines or lights?		
10. Is there a line system to guide patients to different areas of the ED?		
11. Is the emergency reception area (EMS, walk-in, waiting room) easily recognized?		
12. Are the entrance ports and the waiting area in direct observation field of the triage nurse?		
13. Is the treatment easily and quickly accessible from the reception area?		
14. Is a cardiac resuscitation area quickly accessible from the emergency entrance?		
15. Is the critical care area in direct access of the treatment area, waiting room, and the reception area?		
16. Is access to a trauma care area quickly feasible from the entrance?		
17. Is there easy access to the CCU, ICU, and OR from the ED?		
18. Is the access to the OR and ICU possible without passing through crowded or unroofed areas?		
19. Are dedicated elevators available if these facilities are not in the same level as the ED?		
20. Is there easy access to main hospital hallways for ease of patient transport to floors?		
21. Are the orthopedic examination and casting rooms away from the main treatment areas?		
22. Are the orthopedic examination and casting rooms close to the radiology suite?		
23. In ED with more than 50000 annual admissions, does the imaging area have different entrance ports for ED patients and patients referred from the rest of the hospital?		
24. Is there a scrub station close to the trauma or orthopedic rooms?		
25. Is there direct access to the imaging suite, and the resuscitation room from the treatment area?		
26. Is the emergency lab easily accessible from all treatment areas?		
27. Is there a different window for delivery of emergent lab samples at the laboratory?		
28. Is there access to the psychiatric ward within the same building as the ED?		
29. Is there a psychiatric room close to the EMS entrance?		
30. Is the nurses' station located in a manner to oversee all patients either directly or indirectly?		
31. Is the nursing station integrated and free of any major obstacles?		
32. Is the equipment in the nursing station readily and easily accessible to the nursing staff?		
33. Is patient access to treatment equipment properly limited?		
34. Have all objects of more than 1m height been removed from the observation field of the nurse's station?		
35. Is direct observation of the pediatric care area by treatment staff possible at all times?		
36. Are there washrooms close to isolated treatment rooms such as the obstetrics and gynecology (OB-GYN) room?		
37. Are the fire exits easily accessible and clearly depicted?		
38. Are all doors in the ED at least 1.5m wide?		
39. Do the reception and waiting areas have direct access to the hospital for outpatient referral?		
40. Are the outpatient care, ophthalmology, and otolaryngology areas adjacent to the entrance?		
41. Does the security station have a 360° view of the immediate emergency department?		
42. Is the police station equipped with CCTV cameras to oversee every part of the emergency department?		
Physical spaces, structures, and equipment		
1. Is the ED building able to endure a severe earthquake?		
2. Is the total area of the ED sufficient relative to annual patient admissions?		



Table 2: Continue...		
	Yes	No
3. Are the number of beds sufficient relative to the number of annual admissions?		
4. Are there sufficient number of isolated treatment rooms relative to annual admissions?		
5. Are the number of beds for low-acuity patients sufficient relative to the number of annual patient load?		
6. Is the overall size of the department at least one and half times the emergent and low-acuity treatment areas?		
7. Are there sufficient number of washrooms relative to the number of treatment beds?		
8. Are there areas within the ED, which can be transformed to treatment areas in order to improve surge capacity?		
9. Is there a decontamination area and shower adjacent to the entrance?		
10. Are there electrical outlets and service panels available outside the ED entrance?		
11. Is there a specific room for patients' triage?		
12. Is the triage designed in a way to allow two nurses to conduct triage simultaneously?		
13. Is the triage and reception area large enough relative to the number of annual admissions?		
14. Are there dedicated examination rooms for pediatric patients?		
15. Is there a Fast Track area in the ED?		
16. Is there an isolated OB-GYN room for treatment?		
17. Is the OB-GYN room acoustically isolated and equipped properly?		
18. Is there a dedicated washroom available within the OB-GYN room?		
19. Is there an orthopedics and casting room in the ED?		
20. Is there a procedure or minor operating room designated in the ED?		
21. Is the procedure room equipped properly with monitory devices, lights, etc.?		
22. Is security stationed in the ED located at the entrance?		
23. Is there a treatment area for walk-in patients?		
24. Is there a pharmacy in the ED or near it?		
25. Is there men and women washrooms in the reception area?		
26. Is there an area with access to medical information in the reception area?		
27. Is there an isolated room for treatment of infectious disease?		
28. Is there a Lab and blood bank in the emergency department?		
29. Is there a room for ENT treatment?		
30. Is the ENT room equipped properly?		
31. Is there a room for ophthalmologic examination and treatment?		
32. Is the ophthalmology room equipped properly?		
33. Is there a waiting area?		
34. Is there a dedicated area in the core areas for changing gowns, gloves, masks and wash up?		
35. Is there a head nurse room in the ED?		
36. Is there a burn care room in the ED?		
37. Is there a grief room in the ED?		
38. Is there a department head office in the ED?		
39. Is there a designated administration area away from the treatment areas?		
40. Is there a silent or counseling room designated within the ED?		
41. Is the counseling room acoustically isolated from the treatment areas?		
42. Is there a morgue?		
43. Are gurneys available at the ED entrance?		
44. Are gurney heights 75cm?		
45. Is there at least 11.15m ² dedicated to each bed in the treatment area?		
46. Is there at least 7.43m ² dedicated to each low-acuity bed?		
47. Are there outpatient care areas of 0.5 to 2.3m ² areas?		
48. Is the trauma room at least 23×23 m ² ?		
49. Is the critical care and CPR room at least 23×23 m ² ?		



Table 3: Continue...		
	Yes	No
50. Is the nursing station counter at least 1 meter in height?		
51. Is there an emergency backup electricity supply for the ED?		
52. Is there a proper and separate air-cycling system installed for each treatment area?		
53. Is there a separate air-cycling system for each isolated treatment room?		
54. Are there separating wooden panels from ceiling to the floor available in the treatment area?		
55. Can the panels be removed to increase the available treatment area?		
56. Is there sufficient lighting in the examination and treatment areas?		
57. Is there an examination table available in the outpatient treatment areas?		
58. Is continuous monitoring of the isolated treatment rooms possible?		
59. Is there a central O2 supplying system with outlets available at least for every high-acuity bed?		
60. Are suction equipment (fixed or portable) available for each bed in the treatment area?		
61. Is there a sanitation sink available in each treatment area?		
62. Is there access to multiple phone lines in the nurses' station?		
63. Is there access to the internet in the ED?		
64. Is there access to a phone line in the waiting area?		
65. Is there a telecom system installed in the ED?		
66. Are the washrooms equipped with functioning call-for-help systems?		
67. Is there a CPR paging system in place?		
68. Is there a fire alarm system installed in different areas of the ED?		
69. Are fire extinguishers available in all ED spaces?		
70. Are enough electrical outlets available in each treatment area?		
71. Are the electrical outlets properly placed at a height of 36cm?		
72. Is there a danger alarm to call in security in the ED?		
73. Is there a portable x-ray available in the CPR room?		
74. Is the lab equipped for routine lab tests (CBC, electrolytes, blood glucose, Urinalysis, urea, creatinine, pregnancy test, blood gas analysis)?		
75. Is there facilities for continuous security monitoring of the different treatment and working areas?		
76. Is there proper storages for clean and dirty equipment within the ED?		
Patient accommodations		
1. Is there sufficient waiting area relative to the annual number of admissions?		
2. Is there assistance available at reception for patients unable to care for themselves?		
3. Is there a functioning air-conditioning system in the waiting area?		
4. Is there a drinking fountain in the reception area?		
5. Are there sufficient seats in the waiting area relative to the annual number of admissions?		
6. Is there a public phone in the reception?		
7. Are reading materials available in the reception area?		
8. Is there entertainment available in the waiting area?		
9. Is there a functioning air-conditioning system in the treatment areas?		
10. Is there a nurse paging system available for each bed?		
11. Does the acute treatment area have a high ceiling?		
12. Does the waiting area enjoy abundant lighting, and natural colors?		
13. Does the low-acuity treatment area have a lower ceiling, lower lights, acoustic instillations, and light colors?		
14. Is the waiting area equipped with sufficient accessories?		
15. Is there a system available within the ED to supply patients with their personal needs?		
16. Is there a playroom for pediatric patients?		
17. Are seats available for persons accompanying patients in the treatment areas?		
18. Is there a prayer room with access to the waiting area for patients and people accompanying them?		



Table 4: Continue...		
	Yes	No
Personnel accommodations		
1. Is there a dedicated area for viewing imaging results?		
2. Is there a distinct physicians resting area?		
3. Is there a resting room area sufficient relative to the number of personnel?		
4. Is there air-conditioning available in the resting area?		
5. Is there easy access to the restroom and lockers from the resting area?		
6. Is the personnel resting area close to the core areas?		
7. Is the resting area equipped with washrooms?		
8. Is the resting area equipped with a personnel shower?		
9. Is the resting area equipped with refrigerators, sink, and microwave?		
10. Is the resting area equipped with proper communication facilities such as phone and internet?		
11. Is there a dining area located within the resting area?		
12. Is there a sleeping area located within the resting area?		
13. Is there sufficient lighting in the resting area?		
14. Is there a praying room designated within the resting area?		
Patient privacy		
1. Is there a discrete physical examination area designated?		
2. Is the patients' visual, auditory, and olfactory privacy securable within each treatment area?		
3. Is the path to the elevator separate from the main crowded areas?		
4. Is there a designated area for storing patient files away from other patients' reach?		
5. Does the OB-GYN room have a fully private setup in the more secluded parts of the ED?		
6. Is there an area suitable for discrete exchange of information between the staff?		
7. Is there a designated area for confidential patient-doctor interactions?		
Personnel privacy		
1. Is the personnel working area properly isolated from the patients care area?		
2. Are the changing and locker areas away from patient care areas?		
3. Is the resting area away from patients' sight?		
4. Is there a proper area for storing the staff's personal belongings?		
5. Is there a designated area for confidential doctor-doctor conversations both in person and by phone?		
6. Is there a separate entrance and exit for staff?		

