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Research Article

Health Improvement Through Redesign of Emergency Department: The Case of Public Sector Hospitals

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Running title: Public Sector Hospital ED Redesign

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Abstract

Emergency departments (EDs) in public sector hospitals worldwide receive large influxes of patients with complicated health conditions, resulting in overcrowding, extended waiting times, and suboptimal infection control challenges, leading to reduced patient satisfaction and operational inefficiencies. This paper proposes a redesigned ED model for emergency and accident departments in some public sector hospitals, aiming to decrease waiting times and enhance infection control processes, patient satisfaction, and overall healthcare quality of health services. The proposed redesigned model integrates initial registration and triage, immediate assessment of patients by healthcare professionals, and patient flow. Stakeholder engagement are risk assessment are identified as crucial requirements for successful implementation of the proposed model. The anticipated benefits of the proposed model include earlier diagnosis and treatment for the received cases, improved infection control, enhanced patient satisfaction. The PDSA (Plan-Do-Study-Act) cycle is recommended for piloting the new approach, with a systematic review and performance measurement ensuring continuous improvement. The proposed ED redesign can enhance healthcare delivery and patient outcomes in public sector hospitals.

Keywords: Healthcare quality improvement; Infection control; Emergency department; PDSA

Introduction: Understanding of Current System

Emergency Departments (EDs) have always been particularly overcrowded and problematic environments in modern healthcare services, despite ongoing health improvement efforts to tackle the ubiquitous issues challenging healthcare systems worldwide [1,2]. Some public sector hospitals initiate the processing of triage for ED patients by receptionists entering patients' personal data in the health system, whereby patients are allocated to be seen by an emergency nurse (Figure 1). After providing the ED receptionist with personal and preliminary information about patients' medical condition, the patient is asked to wait in the common waiting room, and is then invited by the emergency nurse to have their vital signs measured and undergo screening processes. Subsequently, the patient is sent back to the waiting room pending further examination by another nurse and/or GP, to decide whether the case needs further ED treatment, discharge, or admission to the relevant department. This system may lead to prolong waiting times, increase ED crowding, violence towards ED staff, and the spread of infection among patients corralled in the waiting area.

Previous research showed that patient satisfaction is directly linked with patient waiting times [2]. Moreover, long waiting times and ED overcrowding could lead to negative consequences like putting patients at risk, increasing pain and suffering, contributing to patient dissatisfaction, increasing the rate of ambulance diversions to other hospitals, reducing healthcare productivity, increased stress on ED staff, increased potential for violence, and increased intention to leave and turnover among healthcare professionals [3]. This paper proposes a new design for emergency and accident departments in order to improve waiting times and infection control, while enhancing overall healthcare quality of service and patient satisfaction.

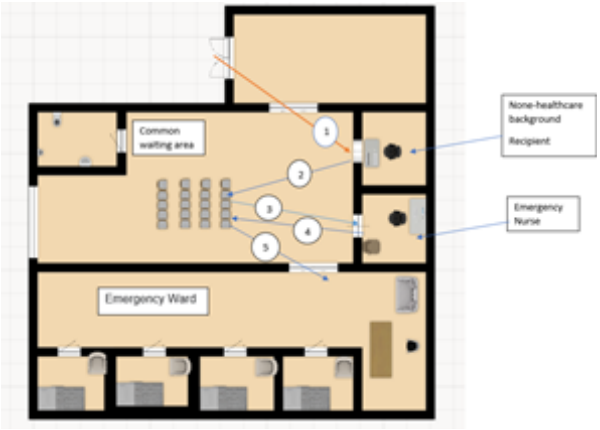

Figure 1: Example of current ED design and process flow. Source: Author

Rationale and Drivers for Improvement

ED is one of the most intensive, important, and densely populated wards in hospitals. It offers healthcare to high-risk emergency cases, and is often the first point of admission for many patients presenting to hospital (including many who do not necessarily require emergency care). Saving the lives of high-risk emergency patients is the top priority of ED, while seeking to process large volumes of general admissions [4]. The practical management of ED to optimize healthcare system resource deployment and process patient's efficiency is a longstanding concern and research issue, seeking to reduce the cost of care, waiting times, and crowding, and to increase quality of service and patient safety [5]. As reported earlier, EDs' operational processes in public hospitals could be enhanced with improved and streamlined management and systems for processing and treating diverse ED patients.

The systemic paradigm of ED displayed in Figure 2 shows ED suppliers, input, process, outcome, and customers (SIPOC) for

public sector hospitals. This approach was developed by Ortiz-Barrios and Alfaro-Saiz [6] to harmonize the two stages of registration and admission into one, by optimising the deployment of healthcare practitioners for emergency cases and untangling bureaucratic and general care tasks from dedicated emergency requirements. As illustrated in Figure 3, the system enables patients to be seen as soon as they arrive at the ED to undertake vital signs and other necessary examinations, in order to subsequently correctly allocate the case. This enables high-risk patients to be seen as early as possible, with dedicated waiting areas separate from the general waiting room. This minimizes crowding, and avoids the spread of infection, which is a particularly important concern highlighted during the Covid-19 pandemic [7].

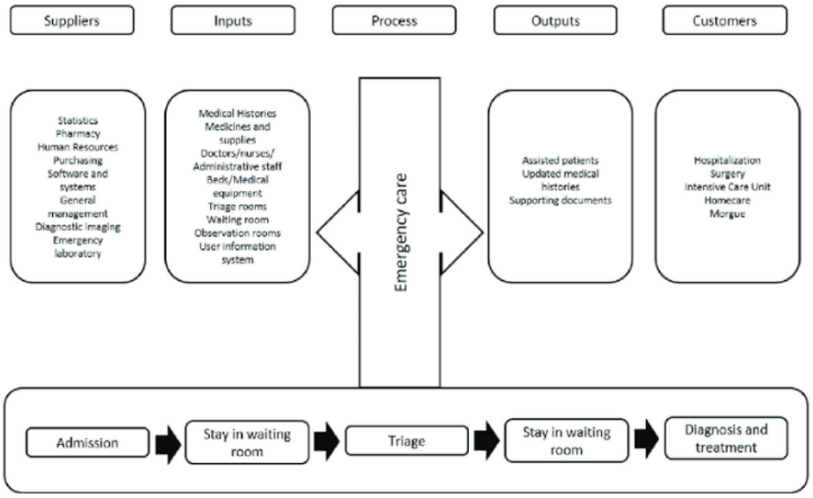

Figure 2: SIPOC diagram for current emergency department [6].

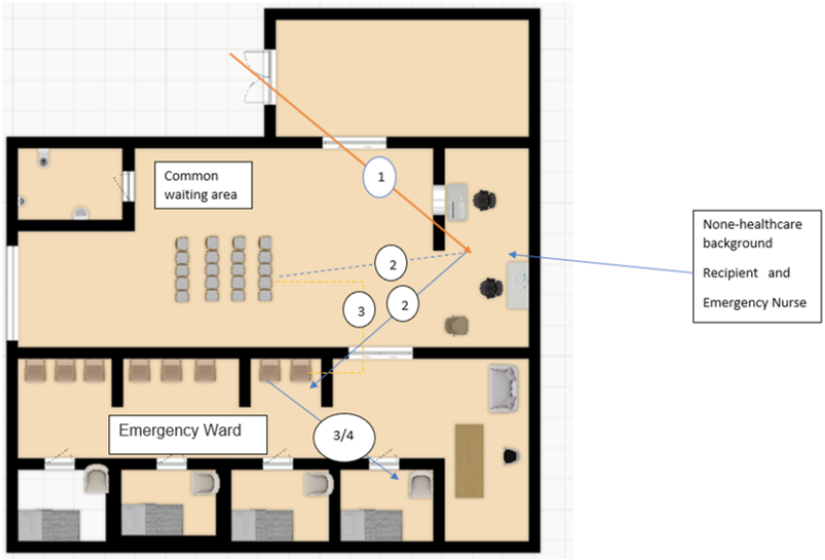

Figure 3: Proposed ED design and process flow. Source: Author

This approach is targeted to reduce waiting times (as well as overcrowding), and thereby contributes significantly to improving service user satisfaction. Patients feel more comfortable and satisfied after they have been initially seen/ screened by a healthcare professional, even if they subsequently have to wait to receive follow-up care [8].

Stakeholder Analysis and Engagement Plan

The successful implantation of the proposed model depends on the involvement and engagement of diverse stakeholder groups concerned with the scope of the proposed intervention. The wider the stakeholder engagement, the more likely the model is to be successful. This is due to including pertinent and relevant needs at the heart of project design and execution, thereby avoiding pitfalls and blind spots; and to reduce inertia and antagonism to the change by including and valuing inputs from all concerned groups [9]. To achieve the best impacts, stakeholder analysis mechanisms identify key stakeholders and their roles and importance for model success [10]. Stakeholder analysis is widely used in the public and private sectors, including healthcare [11]. The outcomes from stakeholders and answers can be summarized on Table 1, which shows the importance of each stakeholder group concerning ED redesign.

Stakeholder	Influence	Importance	Role
Emergency doctors (consultants)	High	High	Effective planning to implement and maintain teamwork environment with best patient, nurse, and physician relationships
GPs	High	Medium	Provide treatment for common health conditions and refer patients to other departments for further specialist treatment when needed
Emergency nurses	High	High	Evaluate patients' health through vital signs assessment and other case information from patients. Establish the health condition, and allocate the patient to the right place to get the suitable care for their condition at the right time
Head nurse	Medium	High	Establish patient health conditions and needs for specific nursing care
Charge and registered nurses	Medium	Low	Provide necessary patient-centred care for all patients based on their cases
Patients	Medium	High	Provide suitable care for conditions at the right time
Receptionist	Medium	Medium	Gather patient information, facilitating ward work and processes, and observing the waiting list

Table 1: Stakeholder analysis for ED redesign. Source: Author

Risk Analysis

Risk assessment is very important in order to identify potential factors that might hinder the success of the model [12]. Table 2 shows the three key risks that might face the new ED design. Optimum risk assessment requires broad stakeholder engagement, as a single and myopic view (e.g., that of one healthcare specialty or other individual stakeholder) can be ignorant of the existence of relative importance of phenomena that other stakeholders are more deeply aware of and familiar with [13]. Therefore, it is important that risk assessment entails communication and consultation of wide range of stakeholders to provide better management. Patients and their families should be among the stakeholders consulted, and should be part of any initiatives in order to minimize risks.

Risk level	Risk	Effect	Mitigation
Low	Administrative issues	Poor healthcare management can subject patients to more complex situations [14].	Using multi-disciplinary management style to improve quality of care [14].
Medium	Possible increase in number of people visiting ED, due to shorter waiting times (i.e., avoiding local GP waiting)	Impact on resources and number of available beds [15].	Regular data gathering for decision making Increased trainee doctors and nurses Transfer to inhospitable GP departments
High	Possible increase of pressure on emergency team	Impact on staff retention [16].	Keep good patient-to-nurse ratio [16] Training Motivation

Table 2: Risk analysis. Source: Author

Expected Benefits

Better and earlier diagnosis of high-risk cases

The key idea of the new model is to bring two stages into one stage of registration by healthcare professionals, with prioritization of emergency practitioner care for high-risk patients. Under this system, all patients are seen as soon as they arrive at the ED (i.e., as early as feasible), during which their vital signs and other required screening examinations can be undertaken, in order to enable the right allocation of the case. This accelerates treatment for high-risk patients and the speed of care provision in general, so all patients can be seen as soon as possible, with priority care for those with greatest need [17].

Shorter waiting times

The redesign of ED services can lead to reduced waiting times, especially for those with more critical needs or at higher risk of more serious complications [17].

Better infection control

Using a common waiting room for minimal use and the distribution of waiting parties in other available spaces can minimize crowding in the main waiting rooms and prevent the spread of infections (such as Covid-19) [18].

Increased patient satisfaction

Since the new system will allow patients to be seen immediately after their arrival at the ED, they will only have to wait for the person in front of them, and they will be by met by health professionals at the same place where they are doing the registration, which is linked to improving satisfaction [8] Moreover, the ancillary impacts of shortening waiting times and seeing a less crowded waiting room also improve patient satisfaction [19].

Minimized verbal and physical abuse

The new approach achieves better distribution of people between the common waiting room and other waiting areas to minimize crowding. In addition, having healthcare professionals in the reception area will help accelerate the admission of high-urgency cases, reducing the need for friends and family members to wait with patients in the common area (as in the legacy system), which will reduce overcrowding and tensions, and thus the abuse of staff and other patients [20].

Minimized number of people leaving without being seen (because of long waiting times)

Some patients decide to leave ED without receiving treatment when they see the common waiting room is really overcrowded or they are asked to wait for prolonged period, which puts their health at risk and which can ultimately make their treatment less efficient (e.g., their conditions may worsen, and require more expensive and complicated treatment downstream) [21]. The new approach will minimize the number of people leaving before being seen, as people will have the chance to directly speak with a healthcare professional as soon as they arrive in the ED, whereas in the traditional approach the registration and waiting times before being seen by healthcare professionals are major deterrents to remaining in the ED (or even going to hospital at all).

Utilized Model for Improvement

It is essential that the right methodology is being used to achieve the intended goal from redesigning processes within the ED. The simple and well-known PDSA cycle is ideal to test the effectiveness of localized, small-scale changes or interventions (such as ED redesign in this case) prior to wider deployment or diffusion [22]. Its eponymous components are plan, do, study (or check), and act, as displayed in Figure 4 and described below. PDSA is widely used within healthcare settings worldwide [11].

Figure 4: PDSA cycle [11].

Plan: One fully defines the change and its goal to establish the parameters for successful implementation, involving the contributions and views of diverse stakeholders, who thereby have a sense of ownership of the initiative [23]. Stakeholders within the ED and other departments pertinent to the project need to be involved.

Do: The rollout of the change in a small-scale pilot project enables identification of barriers to implementation, facilitators of success, and actual performance outcomes in alignment with the organizational goals and the intended targets of the initiative. This must be implemented over a meaningful period (typically about one year for clinical contexts such as ED) to gather meaningful data [24].

Study: The study stage is contemporaneous with the "do" stage, and involves gathering comprehensive data from all parties involved in driving and implementing the change in order to monitor success, failure, and other lessons. Different stakeholders need to articulate their experiences and project management observations must be analysed to enable informed reflections, to decide how effective the change was and how it could be implemented in a sustainable manner on a wider scale. It troubleshoots problems and helps formulate tactics to overcome challenges and optimize outcomes, avoiding repeating mistakes in subsequent implementation and wider rollout [25].

Act: The act state is the deployment of the mechanism at a wider scale after correctly applying the earlier three stages [26], which in this case equates to confidence that the evidence-based practice (EBP) for ED redesign can be implemented at different EDs at other hospitals.

Evaluation of Plan

In order to measure the success of the proposed model, it is important that an accurate evaluation mechanism is implemented, which will be useful to evaluate success and provide enough data to enhance or align the project mechanisms. Therefore, it is essential that the evaluation plan should be affordable and comprehensive [27]. Hence the following means of evaluation for the newly proposed approach are suggested.

Performance measurement

Performance measurement is a process that can be used to evaluate the effectiveness and efficiency of organization, system, component, project, program and initiative. It involves systematic methodologies to collect, analyse, and assess whether the organization, system, component, project, program and initiative is going on right direction to achieve its intended outcomes [29]. This can be done by comparing data on key performance indicators, such as waiting times and number of patients who leave before being seen, to identify changes between the previous approach and the new one. This enables statistical analysis in order to be able to see if the new approach can significantly reduce ED waiting times. Piloting the system over a trial period (e.g., one year) at one candidate hospital can generate data for such comparison as a basis for rollout of the approach as EBP at other hospitals.

Patient satisfaction

As this approach will directly affect patient satisfaction, it is essential to measure patient satisfaction in itself, and compare it with historical data of when the other system was in use, in order to perform statistical analysis and to identify if alignment and adjustment is needed for enhancement. Patient satisfaction data is a core indicator of modern healthcare provision in general, including to address inequalities in healthcare systems and to establish courses of action for quality improvement, aside from improving quality of care *per se* [10]. It is important to use the new approach for a sufficient period of time to allow the collection of representative date that can enable meaningful insights [30]. Expediently collecting such data from service users entails consideration of interpersonal approaches and methods to elicit the genuine opinions of patients and their family members [31].

Measurement for improvement

This method evaluates the new approach through number of stages and strategies, though setting relevant, and achievable guidelines, to measure project success in delivering tangible improvement. Based on the data from small-scale deployment; the PDCA cycle allows assessment of the impacts of changes implemented. Therefore, it important to carry on with ongoing monitoring, to detect changes and enhance the overall process [3]. This also helps in communicating the outcomes the change implemented in ED and its impacts. Moreover, improvements achieved in the whole system can be analysed for further deployment in other EDs, using analysis to evaluate risks and gains from the new approach. Therefore, clinical audit is the most appropriate method to be used [32].

Conclusion

The proposed ED redesign promises to improve the efficiency and quality of emergency healthcare services in public hospitals. Piloting in a controlled setting and gathering robust data will support its expansion to other hospitals, establishing it as EBP that effectively enhances patient care and operational efficiency across the healthcare system. Stakeholder engagement is critical for success in the modern care care paradigm. Involving a diverse group in planning, implementation, and evaluation can address challenges and secure support for broader deployment. Continuous monitoring and adjustment based on feedback will maintain high standards of care for sustainable improvements.

Author Contribution Statement

Designed research: Z.H, L.J.; performed Z.H, L.J; research : Z.H, L.J; Z.H, L.J;; Writing original draft: Z.H, L.J; Z.H, L.J, AZ.; review & editing: All. All authors have read and agreed to the published version of the manuscript.

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No ethical approval was required for this research.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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