

Streamlining Pediatric Emergency Medicine at a Tertiary-care Hospital of a Low- to Middle-income Country

#SALIMA AHMED BHIMANI, *NICK BROWN AND ASAD I MIAN

From Departments of #Biological and Biomedical Sciences, and *Emergency Medicine, Paediatrics and Child Health, The Aga Khan University Hospital (AKUH), Karachi, Pakistan; and Department of Pediatrics, Salisbury District Hospital, Wiltshire, UK.

Correspondence to: Dr Asad Mian, Associate Professor, Department of Emergency Medicine, Paediatrics and Child Health, Aga Khan University, Stadium Road PO Box 3500, Karachi 74800, Pakistan. asad.mian@aku.edu

The factors of integral importance to run any pediatric emergency department efficiently are the ability to process a high volume of patients quickly and a sensitive triage system that identifies the sickest children. Achieving these aims in a low- to middle-income country setting is more complex as a result of scarce resources and data on which to base systems. In this article, we discuss existing models of streamlining pediatric emergency department services that are most applicable to resource-limited countries, and present suggestions for streamlining pediatric emergency care in such countries.

Keywords: Emergency medicine services, LMIC, Triage.

In the past, the development of emergency care delivery systems was often discouraged in low- to middle-income countries (LMICs) on grounds of cost and limited benefits [1]. Recently, the rising burden of acute illnesses and injury, estimated to contribute to 45% of deaths, has changed this attitude. Studies from different parts of the world have consistently shown that children in LMICs are of the order of three times as likely to die due to injuries as their counterparts in high-income countries [2-4]. Studies in Bangladesh and Iran have reported high pediatric injury rates, and in Pakistan, injuries are the third leading cause of death in under-five children. Most deaths occur in rural areas where emergency care is not readily accessible [5].

There are numerous challenges in the provision of pediatric emergency medicine even in high-income countries [6]. There may be pediatric emergency department (PED) systems in place but their effectiveness in meeting needs is uneven. In the US, for example, only 6% of emergency departments are resourced to the levels demanded by the national policy statement [7-9]. Resource-poor countries, on the other hand, suffer greatly from the disparity in provision of emergency services to children *versus* adults, with some hospitals in Africa not employing even a single pediatrician in the emergency room [6]. The overall challenge is to develop a comprehensive program that provides high quality, efficient and empathetic care to all children presenting to the PED in LMICs.

MODELS TO IMPROVE PED PERFORMANCE

Combined PED and In-patient Model

The lack of dedicated pediatric emergency care and on-hand qualified staff is a real concern for resource-limited healthcare settings. By implementing a combined PED and in-patient model, there can be more efficient utilization of limited resources dedicated to any particular service. Using such an approach with traditional pediatric hospitalists, Krugman and colleagues were able to demonstrate a significant improvement in throughput time from 143 minutes to 122 minutes with a concurrent rise in patient satisfaction in the community setting. This was a change from the standard pediatric hospitalist program consisting mainly of in-patient coverage with partial PED coverage [10]. This also resulted in an increase in the average billing rate of pediatric hospitalists, which could serve as an incentive towards the adoption of this model in community hospitals and those in LMICs lacking a dedicated PED with qualified staff. However, in underdeveloped healthcare settings, introducing these changes will likely require a lot of well-orchestrated interim steps because the pediatric hospitalist model is non-existent there.

Split-flow Approach of PED Management

Another evidence-based strategy that has been suggested is the split-flow approach to the emergency department [11,12]. This particular approach revolves around minimizing wait times while simultaneously administering the type of care a patient needs. In this method, triage nurses

and physicians are trained to familiarize themselves to patient inflow stratified into categories of patients with different care process requirements [12]. In a retrospective analysis of over 70,000 emergency department encounters, the split-flow approach demonstrated a 5.9% reduction, from 2.58 to 2.43 hours, in length of stay for discharged patients [11]. Although this particular study was on adult patients, such a model could be made flexible according to each PED's particular type of patient inflow. Since this model takes into account medical personnel's expertise in the triage area as the main intervention, this may be a potentially cost-effective way to improve the efficiency of PEDs in LMICs (**Fig. 1**).

Two Tier Triage Model

Many PEDs have benefitted from a two-tier triage where an initial triage consists of a limited information screen to filter out patients that require urgent medical attention, followed by a more comprehensive triage [13] (**Fig. 1**). Also, increasing the number of individuals performing triage has been shown to expedite patient-care [14]. Similarly, reducing information-gathering to certain essential demographic factors during emergency department registration has been shown to decrease wait times by 35% and hospital stays by a further 10% [15]. A parallel registration process that employs data gathering and insurance verification at the bed-side has proven to be effective at reducing hospital stays by 10% as well [16]. This approach may be employed in tertiary care settings of LMICs where a high volume of patients with acute life threatening issues can be addressed prior to a comprehensive triage and registration, albeit insurance-related time delays are likely not of major relevance.

Fast Tracking System

Another reasonably successful strategy to hasten patient



FIG. 1 Categorizing patients based on acuity of illness and need of resources for low- to middle-income countries.

exodus from the emergency department is the 'fast-tracking' system that uses triage acuity classification to distinguish critical patients requiring urgent medical attention from patients with a less acute presentation (**Fig. 1**). Low-acuity patients who had been fast tracked out of the PED showed a significant drop in turnaround time from 149 minutes to 107 minutes [17]. Such a system adopted for LMICs would not only optimize use of available resources but decrease the cost of healthcare-dispensation and unclog emergency departments in order to make room for individuals with more pressing medical concerns.

Adjunctive Considerations

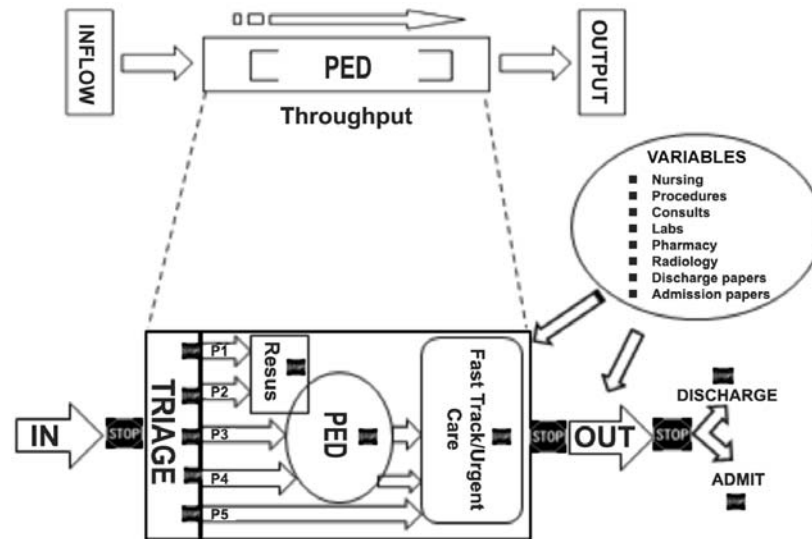
While in the emergency department, it is imperative that the individual's eventual disposition be decided upon as soon as emergency care is initiated and the patient is found to be stable. To this end, the relevant biomedical literature recommends avoidance of interventions in the emergency department that can easily be performed in the wards [18]. Similarly employing ancillary staff such as interpreters and language services, and establishing a separate queue for low acuity patients can prove to be indispensable tactics at streamlining flow of patients in the PED [19-21].

SUGGESTIONS TOWARDS AN EFFICIENT PED

The following PED-specific parameters need to be considered in order to enhance PED throughput in LMICs:

1. Is there a solitary PED model that fully accommodates the needs of LMICs or is the choice of launching a model affected by a myriad of demographic factors?
2. How to increase the number of patients being seen?
3. How to decrease the 'left without being seen' number?
4. How to decrease length of stay in the PED without compromising quality of care by using throughput and outcome data as surveillance tools for quality improvement?

One solution may be to develop a model in which one can match the inflow with the throughput and outflow along a continuum of care in a flexible manner (**Fig. 2**). This figure indicates potential hurdles shown as stop signs at various junctures of the above continuum. Identifying the hurdles also paves the way to potential solutions. What the figure also indicates is that simultaneous interventions at various steps can potentially be more efficient and that any model to streamline pediatric emergency medicine in LMICs might not be very sustainable if the PED is dealt with in isolation. The problems fall into one of three categories: systems, human resource and communication issues. To improve efficiency without compromising quality, the workforce can be streamlined by using PED management protocols at each level. These though are only



PED: Pediatric emergency department; Resus: Resuscitation

FIG. 2 Hurdles that could impede efficiency of pediatric emergency department at multiple levels. Potential barriers are shown as stop signs at various junctures along the pediatric emergency department continuum. The figure also indicates potential solutions using a systems-based approach to overcome some of those barriers. P1 to P5 indicate the priority levels per the emergency severity index, with P1 being most critical (high acuity) and P5 least critical (low acuity).

effective if there is a multi-pronged approach to the PED, with stakeholders in other areas such as pediatric surgery and allied sub-specialties. Such a systems-based approach can utilize overlapping domains of an academic pediatric emergency medicine program, namely, clinical service, education and research.

A number of models are being utilized for PED, but not all of these are applicable to LMICs. Objective comparison of these models is difficult and premature to make, as all four models have not been experimented for similar outcomes simultaneously in a single physical setting. However, of the approaches, one of the more appropriate and relevant ones would be the development of a fast track clinic and/or an urgent care center. This can be very effective to rapidly increase the number of patients being triaged and seen, specifically P4 and 5 (low acuity) patients per the emergency severity index.

These models can also potentially increase individual patient- and family-satisfaction because of the positive effect on numbers of patients being seen; and overall better quality of care. A separate waiting area for children with dedicated pediatric nurses assigned to provide basic care like antipyretics and analgesics will also factor into patient-centered compassionate care. These nurses should have superb communication skills to help relieve undue parental anxiety. Dedicated and adequately trained nursing staff for the pediatric area of the emergency department, including pediatric triage, will lead to clearly defined roles and

responsibilities of the individuals in the PED team. This becomes particularly important for resource-limited settings. Simple distraction tools like toys may be a worthwhile intervention to consider in improving patient-satisfaction in high volume PEDs, like those often encountered in LMICs. Finally, early disposition of patients in the emergency department can be facilitated by contextually relevant evidence-based protocols for commonly encountered problems [22].

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