

# Overcrowding in the Emergency Department: Could a Patient-centred Mobile App Change This Paradigm?

Inês Margarido<sup>1</sup>, Ntumba Kasonga Alpha<sup>2</sup>, Nduami Junior<sup>3</sup> and Jan Marin<sup>4</sup>

<sup>1</sup>Faculty of Medicine of University of Lisbon, Portugal

<sup>2</sup>Institut Supérieur d'Ingénieurs de Franche-Comté, Université de Bourgogne, Besançon, France

<sup>3</sup>Biomedical Department, Ecole Centrale de Lille, Villeneuve d'Ascq, France

<sup>4</sup>School of Design, Zagreb, Croatia

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**Abstract:** Overcrowding in the emergency department has been a growing worldwide problem. Some solutions have been put forth in the several points of the patient's path mostly in order to provide a more efficient flow of patients within the ED. We propose, in this paper, a mobile app that could integrate real-time information of patients, emergency departments, medical emergency teams and general practitioners. This could help scatter the non-linear flow of patients before they arrive and ultimately improve not only quality of care but also better patient outcomes.

## 1 INTRODUCTION

Emergency Department (ED) overcrowding has been described as both a patient safety issue and a global healthcare issue (Pines and Griffey 2015). There is much debate as to the causes of the phenomenon, leading to difficulties in developing successful, targeted solutions. Approximately half of EDs all over the world report operating near or above maximum capacity.

Some definitions of ED overcrowding have been put forth, but in its simplest form, overcrowding exists when there is no space left to meet the timely needs of the next patient requiring emergency care (Salway et al. 2017). If the care of urgent problems is delayed due to congestion, then overcrowding exists.

This can occur due to the volume of patients waiting to be seen (*input*), delays in assessing or treating patients already in the ED (*throughput*), or impediments to patients leaving the ED once their treatment has been completed (*output*) (Asplin et al. 2003).

Consequently, there are likely to be many different causes of overcrowding, depending on when and where in the patient journey the crowding occurs.

## 2 WHAT ARE THE CAUSES AND CONSEQUENCES OF OVERCROWDING?

### 2.1 Causes

In order to address this issue and provide the right solutions, we must see at which point of the cascade of functioning in the ED is the problem.

In the input of patients, we can point out a non-linear presentation flow or presentations with more urgent and complex care needs (Aboagye-Sarfo et al. 2015), increase in presentations by the elderly, high volume of low-acuity presentations (Bond et al. 2006), limited access to primary care or diagnostic services in community (Cowling et al. 2013).

During their time in the department, several causes can be addressed like ED healthcare staff shortages, presence of junior medical staff, delays in receiving test results and delayed disposition decisions (Van Der Linden et al. 2017).

When it comes to the output of patients some of the reasons pointed out were the slow administrative procedure to discharge patients and the unavailability for admission of certain specialities in public hospitals (Dunn 2003).

## 2.2 Consequences

This ED crowding leads to several consequences that can be divided in whether patient, staff or system related.

Effects on patients include delays in being assessed and in receiving required care, increased frequency of exposure to error, reduced patient satisfaction, increased inpatient length of stay (IPLOS) and poorer outcomes such as increased inpatient mortality and risk of readmission (Jo et al. 2015).

When it comes to the staff, the negative effects include increased stress and exposure to violence and non-adherence to best practice guidelines during times of ED overcrowding, such as increased time to assessment of pain and/or delays in the administration of analgesics or delayed administration of antibiotics during ED crowding (Tsai et al. 2016).

System-level consequences identified were those that led to 'bottle-necks' in the system, namely increases in length of stay (LOS), both within the ED itself (EDLOS) and for those patients admitted to the hospital (IPLOS) and ambulance diversion. Again, these could also be viewed as consequences for patients.

## 3 WHAT HAS BEEN DONE?

Several solutions have been put forward. We can also divide these solutions according to the point of journey in the ED.

On the issue of the input of patients some of the studied and suggested solutions are a co-located general practitioner (GP) in the ED (Anantharaman 2008), extended GP opening hours, choice of ED (Sharma and Inder 2011) and social interventions including education campaigns, financial disincentives, redirection.

On the question of the throughput of patients there are shown results in installing a fast-track, bedside registration, ED nurse flow coordinator, nurse-initiated protocols, increased ED bed numbers and staff (Tenbenschel et al. 2017), shorter turnaround-times for laboratory tests, etc.

Solutions looking at output factors include measurements such as active bed management (Burley et al. 2007), leadership programs, implementation of nationally mandated (Sullivan et al. 2014), timed patient disposition targets, admitting team prioritising ED admissions and increased inpatients beds and staff.

Even if all these initiatives could be implanted, hospitals are not immune to issues of overcrowding and poor coordination of patient admissions, transfers, and discharges. None of these has been proved as the perfect solution.

## 4 HOW WE GOT HERE

In a systematic review (Morley et al. 2018), there was a mismatch between proposed solutions and found causes of ED overcrowding. Most of the solutions presented are focused on an efficient patient flow within the ED but a larger part of causes was associated with the amount and type of people attending the ED.

To tackle the problem at its origin, we believe that a greater focus must be given to the upstream part of the process, this meaning that our focus point are the incoming patients. Thus, we plan on educating the patients and reorient them towards sites capable of hosting them depending on their need by focusing on patients who direct themselves to the ED by personal choice.

Indeed, and according to the *Panorama des ORU, activité des structures d'Urgence 2016*, from FEDORU (Fédération des Observatoires Régionaux des Urgences), about 75% of the arrivals to the emergency department were made by personal choice. From 2015 to 2016 there was an increase of approximately 4% in the visits to the ED. When it comes to the hospitalizations, only 21% of them are admitted to the hospital. The age mean of patients going to the ED is 39 years old and only 13% of the total of patients are more than 75 years old or less.

Another study group found that between 41.2 to 51.9% of self-referred patients in a Dutch ED visited the ED inappropriately (Kraaijvanger et al. 2016).

### 4.1 Self-referrals at the ED

Taking these statistics into consideration, one must investigate the reasons that motivate patients to visit the ED directly, especially those with a non-urgent condition.

A considerable number of studies has been made in order to characterize these factors. Reasons such as expecting investigations and wanting to see a doctor and have tests or further research done in the same place have been identified. The convenience of ED, for example, convenience of access, ED nearby or the idea that the patient could get help earlier at the ED is also described as a major factor that influences this kind of behaviour (Kraaijvanger et al. 2017).

## 5 THE APP

We believe that in order to solve this problem of input patients the solution that to be put forward must combine multiple functionalities. Our approach would put the decisions of the patient in its own hands.

With the amount of information available online, it's difficult to consider only trustworthy information, especially if one has not got a clear understanding about the area. Therefore, there is a pressing need to educate the population with the right knowledge in order to prevent inappropriate trips to the ED.

By promoting health literacy, we are confident that perhaps it could decrease the number of unnecessary trips to the ED that end up causing congestion on the first steps of the patient pathway (for example the registration and triage).

Another feature of the app would be the localization of the nearest emergency departments and its respective waiting time. This would lead to a more scattered flow of patients. In this way, the most central hospitals could decrease their congestion of ED while the outer hospitals could improve their own flow.

There is also an urgent need to keep the emergency medical teams updated in real-time about the availability of the different EDs. The several ways that patients can get to the ED must be taken into account in order to make everything work together through a better and faster communication with the common purpose of redirecting correctly them to the place where they can have the better care provided.

As we mentioned, a lot of the self-referrals on the ED could simply be treated at a GP. This said, by providing the availability of the local GPs we believe that a small part of the flow could be redirected to primary care.

## 6 HOW IT WORKS?

We trust that the first step to reduce the number of non-vital patient visits in EDs, or direct them to a primary care facility, is through a simple yet sufficient education of the population. In this way, they would use a device to educate themselves. The mobile-app provides simple guidelines and information about some medical topics that the users can access to inform themselves about their own pathologies, to comprehend how urgent is their problem, if that is the case, or just to keep updated about hot topics of the world medicine. The

guidelines used would be adapted from NICE guidelines (National Institute of Health and Care Excellence) or BMJ Best Practices Medicine guidelines (British Medical Journal) for different symptoms.

The patients will also have the possibility to check the nearest GP and their availability with the option to book an appointment if desired. This would be a choice made by the patient if decides to do so. Besides, the app would provide also the availability and waiting times of the nearest EDs, if the patient chooses to truly make use of the department. A map would then be provided, and the best option of ED will be recommended based on distance and waiting times even though the patient can choose another one that could be more suitable to his situation.

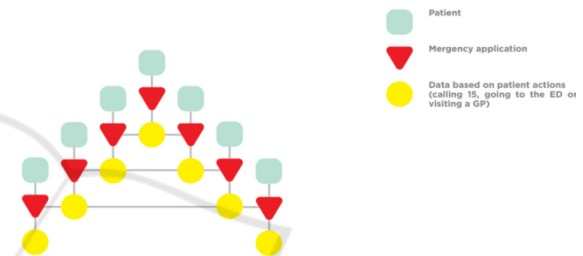


Figure 1: Decision making tree of the patients on our app.

By pressing the start button in the map, patient's data would be sent to the choosing ED and real time updating of the arrival of patient would be done using GPS tracking of their device. It will be, therefore, possible to trace the patient and record their data throughout the whole process. It is necessary to mention that the data needed here has no other purpose than tracing so in other words no name or other type of personal data is needed for our goal.

During registration, already in the ED, patient's data will be converted and quantified to number of patients in the ED and recorded both from the patient using our app and those coming by their own.

These data will be redirected to emergency medical teams in order to provide them with real-time availability of each ED and therefore help by improving the effectiveness and speed of reallocation of different patients to different hospitals.

## 7 IMPLEMENTATION

This software is not a medical device as its intended purpose is purely informative based on collected data and international medical guidelines, it is not planned

to serve as a diagnostic tool, a therapeutic tool nor a measuring instrument.

This type of software has many features and each of them must be clinically tested to validate the safety of the product and to have more credibility on the market. A clinical investigation must be done in order to evaluate not only the effectiveness and efficiency of the international medical guidelines contained in the application but also the effectiveness in its purpose of scattering the flow of the EDs.

A pilot study would have to be performed in the form of a randomized single-blinded, control trial with a quantitative and qualitative prospective evaluation of the effectiveness and efficiency of the medical guidelines contained in this software on 150 participants for 6 months. Our purpose is to evaluate the app, if it is useful and if it promotes efficiency but further work is needed to find the best way to evaluate this kind of application.

## 8 CHALLENGES

This idea was thought out in the emergency department with the insights of experienced doctors and experts of the medical emergency teams, but it lacked the patient's point of view on this subject. Therefore, a questionnaire or a study must be done taking into consideration whether the patients would be interested and make use of an app of this kind.

To make it operational and, since it is built on its utilization by users, this mobile app must be greatly diffused in the community, in order to reach a great number of users. It is crucial that the dissemination of the app is done in a rightful way.

Also, another drawback of this idea is that the app needs to be adapted into each city, town or country individually because the health organisation structure could be different from one city to the other even in the same country.

Other possible challenge would be the willingness of the several hospitals to redirect patients to other structures. This possibility requires a tough negotiation with the several directions of the hospitals of the area.

The most important challenge of this app would be necessity to ensure that patients with a life-threatening condition do not make the wrong decision. Our app would only advise patients and provide them with the necessary information for them to make a conscious and informed decision on whether or which ED to go to. Therefore, the question of the responsibility of the application information

regarding the risks linked to the medical information provided must be addressed.

## 9 CONCLUSIONS

It is undeniable that the problem of overcrowding must be addressed. According to literature, there's a lack of solutions when it comes to the inflow of patients therefore we strongly believe that this idea embodies the most economical and most profitable solution to the issue of overcrowding in the EDs, as it gives patients the power to regulate their inflow with the help of emergency medical teams.

We are convinced that if we give the patient the possibility to make an informed and well-thought choice, we could somehow manipulate the pathway of the less-urgent patients.

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