Emergency department crowding: Factors influencing flow
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Chapter 1

General introduction
INTRODUCTION

One of the most critical issues affecting emergency department (ED) flow worldwide is crowding. Crowding is described as ‘a situation in which the ED function is impeded by the number of patients waiting to be seen, undergoing assessment and treatment, or waiting for departure, exceeding the physical or staffing capacity of the department’ [1]. Sometimes quality of care is added to the description: ‘an emergency department is crowded when inadequate resources to meet patient demands lead to a reduction in the quality of care’ [2, 3]. Three international emergency medicine societies [2, 4, 5] have published definitions of crowding or overcrowding (box 1) and many more are used in the literature. Often, the terms crowding and overcrowding are used interchangeably, both referring to the same problem [6].

| American College of Emergency Physicians (ACEP) | Crowding occurs when the identified need for emergency services exceeds available resources for patient care in the emergency department, hospital, or both [4]. Emergency department overcrowding occurs when the demand for emergency services exceeds the ability of an emergency department to provide quality care within appropriate time frames [2]. Emergency department overcrowding refers to the situation where ED function is impeded primarily because the number of patients waiting to be seen, undergoing assessment and treatment, or waiting for departure exceeds the physical bed and/or staffing capacity of the emergency department [5]. |
| Canadian Association of Emergency Physicians (CAEP) |
| Australasian College of Emergency Medicine (ACEM) |

Emergency department crowding has been associated with poor quality of care, including increased length of stay for patients in the emergency department [7], patient dissatisfaction with emergency care [8], ambulance diversions [9-11], patients leaving the emergency department without treatment [12-14], delay in treatment [15-17], an increase in medical errors [18, 19], higher complication rates and patient mortality [1, 17, 20, 21]. Crowding also affects staff and is associated with absenteeism, staff sickness and decreases in physician productivity, staff morale and satisfaction [22]. Crowding may result in experienced staff leaving the emergency department and compromises resident and student education [23, 24]. A crowded emergency department also creates problems beyond that department. Patients admitted through crowded emergency departments have longer hospital stays [25], leading to less inpatient capacity, further worsening access to emergency care [26]. Ambulance crews are unable to unload their patients. This reduces resilience and the capacity of ambulance services to respond to calls [27] and increases mortality [11]. In short, crowding worsens outcomes and compromises quality of care [28].
Although there is a general lack of agreement as to what constitutes crowding [6, 29], the conceptual model of Asplin (Figure 1) is helpful in understanding the problem of ED crowding. In this model the causes of crowding are broken down into input, throughput and output factors, illustrating the stages that can lead to ED crowding [30]. Input factors refer to conditions, events or system characteristics that contribute to the demand for ED services, including the volume, the acuity and type of patients. Contributing factors to the increase in ED presentations include rising community expectations regarding access to emergency care in acute hospitals [31], non-urgent visits [32-34], frequent flyer patients (patients attending the emergency department seven or more times per year) [35], the influenza season [36, 37], and the ageing population.

**Figure 1.** The input-throughput-output conceptual model of ED crowding [30]

Throughout factors refer to activities within the emergency department that can hinder patient flow. These include inadequate numbers of medical and nursing staff [38, 39], waiting time for triage, waiting time for the physician’s examination, waiting time for blood work [40], time away for radiological investigations, and poor ED design.

Output factors are believed to be an important cause of ED crowding [11]. Time spent by ED providers to arrange appropriate follow-up undermines the efficiency of care and prolongs ED length of stay [30]. Both admitted and discharged patients staying longer than 6 hours are associated with ED crowding [41]. Lack of hospital capacity may result in a mismatch between the time inpatient beds become available and the time that the patients requiring those beds present to the emergency department [25, 29]. Boarding admitted patients until inpatient beds are available reduces the emergency departments’ capacity to care for new
incoming patients [30]. Shortage of critical care beds leads to high acuity patients remaining in the emergency department. Boarding of inpatients in the emergency department has been cited as the most important determinant of ambulance diversion [39]. Contributing factors to ED crowding exist within each component of the input-throughput-output conceptual model. The relative importance of these contributing factors may vary across hospitals and regions [30].

**INTERNATIONAL PERSPECTIVE**

Emergency department crowding is an increasingly recognised problem that affects hospitals all over the world.

Nearly half of the emergency departments in the USA report operating at or above capacity and 9 out of 10 hospitals report holding or boarding admitted patients in the emergency department while they await inpatient beds [42, 43]. In the USA, approximately 500,000 ambulances per year are diverted away from the closest hospital because of ED crowding [42]. In 2009, a Government Accountability Office report concluded that since 2003, when crowding was found to affect most hospitals in the USA, ‘crowding continues to occur and some patients wait longer than the recommended time frames’ [44]. In 2004, the average length of stay for ED patients in the USA was 3.3 hours, but 9.7% of the patients spent more than 6 hours in the emergency department [45].

Emergency department crowding has also been reported in many countries outside the USA. In 2006, the Canadian Agency for Drugs and Technology in Health reported that 62% of ED directors regarded crowding as a significant problem [46]. In Australia, 76% of all major emergency departments experienced access block [47]. A recent study describing emergency care systems and the extent of crowding across 15 countries outside of the USA [48] found that for most included countries (Australia, Canada, France, India, Iran, Italy, Saudi Arabia, Spain) there is evidence of increased ED visit rates and ED crowding.

**THE DUTCH SITUATION**

Although ED crowding is not yet a major problem in the Netherlands according to expert opinion [48], anecdotal evidence suggests that current ED patients experience a longer ED length of stay compared to some years ago, which is indicative of ED crowding.

The Dutch health care system with its well-organised primary health differs from USA and Australian models. Most Dutch inhabitants are registered with a local general practitioner. General practitioners are obliged to organise a 24-hour care system of availability, in which
both regular and acute care is provided during office hours and only acute care after hours. Half of health care is paid by taxes and employers, half is paid by insurance. All residents are obliged to have basic health insurance. They are free to take out additional coverage. Hospitals are required to provide emergency care for all patients, including the uninsured and illegal. Emergency care in the Netherlands is currently provided by four health care providers: (1) general practitioners, (2) emergency departments, (3) ambulance services, and (4) the mental health service. In this thesis, we focus on the emergency department, where patients can present on their own initiative (self-referrals) or arrive by ambulance, after general practitioner referral, or after being referred from clinics within the hospital or from other hospitals.

There are 132 hospital locations in the Netherlands. Ninety-nine hospital locations have emergency departments [49], including 91 general hospitals and eight university hospitals. No precise figures are available on the use of emergency departments in the Netherlands, but there are an estimated 2.2 million ED visits annually [50]. Major changes in the organisation of emergency care are planned to improve the quality of emergency care and to decrease health care costs. The closure of 40% of the emergency departments was discussed [51] and dividing emergency departments into three different categories (ranging from basic emergency medical care in smaller hospitals, to more specialised care in larger teaching hospitals, to full emergency medical care in university medical centres and trauma centres) are expected.

General practitioners have reorganised out-of-hours primary care from small practices into large general practitioner cooperatives. Nowadays, an increasing number of co-locations of general practitioner cooperatives within emergency departments are seen, to prevent patients from self-referring to the emergency department. The closure and the categorisation of emergency departments as well as the co-location of general practitioner cooperatives within emergency departments may affect ED waiting times in the Netherlands.

We do not know if ED crowding is a problem in the Netherlands. We were not able to identify any published studies measuring ED crowding or focusing on ED crowding in the Netherlands. Because of differences in health care systems, figures from overseas may not be similar to the Netherlands.
SETTING OF THE RESEARCH

The research in this thesis was performed mainly at the Medical Centre Haaglanden (MCH) in the Netherlands. The MCH includes two hospitals, Antoniushove and Westeinde. The emergency department in MCH Antoniushove with 24,000 patient visits annually is located in Leidschendam. The emergency department in MCH Westeinde, an inner-city hospital in the Hague, is the largest emergency department in the Netherlands with 52,000 patient visits annually. The ED patients of MCH Westeinde are assessed at a 20-bed department. Although mean waiting times and mean length of stay at this emergency department are short in comparison with international standards, during peak hours there is a shortage of treatment rooms.

In the past years, several initiatives were introduced to improve the throughput of patients: a minor injury and minor illnesses unit was developed and emergency nurse practitioners were educated to handle non-urgent patients. Furthermore, advanced triage (allowing nurses to order tests at triage) is used and a flexible acute admission unit was implemented to improve outflow of admitted patients. Recently, a general practitioner cooperative was implemented at the emergency department.

AIM OF THE THESIS

Crowding is caused by multiple factors, varying according to country and hospital status [25]. Different socioeconomic circumstances, including differences in health care organisation, hamper the generalization of findings in the literature. For example, the hours that an emergency department is ‘on ambulance diversion’, which is a consequence of ED crowding, is often used to measure ED crowding in the USA. Diverting ambulances happens rarely in the Netherlands, even when emergency departments struggle with a shortage of treatment rooms.

This thesis focuses on different aspects of ED crowding and patient flow at the emergency department. Understanding ED processes that are related to ED crowding and comparing our findings regarding patient flow (input-, throughput- and output factors) with international evidence might support health care professionals and hospital management in the process of recognising and mitigating ED crowding in the Netherlands.
OUTLINE OF THE THESIS

The studies presented in this thesis underscore that ED crowding is a multi-faceted problem and focus on input, throughput and output of the emergency department.

**Part I: CROWDING IN DUTCH EMERGENCY DEPARTMENTS**

In *Chapter 2* issues on crowding in Dutch emergency departments are described including patients’ length of stay and ED nurse managers’ experiences of crowding. A survey was sent to all ED nurse managers in the Netherlands regarding type of facility, annual ED census and patients’ length of stay. Key topics included whether crowding was ever a problem at the particular emergency department, how often it occurred, which time periods had the worst episodes of crowding, and what measures the particular emergency department had undertaken to improve patient flow.

**Part II: INPUT OF THE EMERGENCY DEPARTMENT**

In *Chapter 3* emergency department use is examined and the characteristics of self-referrals and non-self-referrals, their need for hospital emergency care, and self-referrals’ motives for presenting at the emergency department are assessed.

*Chapter 4* reports on a chart review characterizing ED return visits. All return visits related to the initial visit, occurring within one week were selected. We identified independent factors associated with unscheduled return. Reasons for returning unscheduled were categorised into illness-, patient-, or physician-related. Admission rates and mortality rates were compared between patients with unscheduled return visits and the general ED population.

In *Chapter 5* the characteristics of frequent ED visitors (7-17 ED visits per year) and highly frequent visitors (greater than or equal to 18 visits per year) are described. The rate and the factors associated with high ED utilization were assessed.

**Part III: THROUGHPUT OF THE EMERGENCY DEPARTMENT**

In *Chapter 6* the reorganisation of the triage practice in order to prevent long waits for patients with less urgent conditions is described. An adapted version of the Manchester Triage System (triage streaming system) was developed to allow trained emergency nurse practitioners to assess, treat, and discharge patients with minor injuries or illnesses autonomously.
Chapter 7 reports on the validity of the triage streaming system, by assessing correlation between the triage streaming system and patients’ injury severity and resource utilization.

Chapter 8 concerns a study in which emergency nurse practitioners were compared with junior doctors/senior house officers regarding incidence and severity of missed injuries and inappropriately managed cases, waiting times, and length of stay of patients with minor injuries and minor illnesses.

Part IV: OUTPUT OF THE EMERGENCY DEPARTMENT

In Chapter 9 a 4-month population-based cohort study is described, in which the characteristics of patients who leave the emergency department without treatment (walkouts) were assessed. The purpose of this study was to assess the walkout rate and to identify influencing patient- and visit characteristics on walkout. Furthermore, a follow-up telephone interview was conducted to assess reasons for leaving and medical care needed.

Chapter 10 concerns a qualitative evaluation of the flexible acute admission unit. The objective of this unit was to increase throughput of acute patients. The admission unit consists of 15 inpatient beds located on different wards that are set aside for patients from the emergency department when all of the beds on specialty wards are being used. Emergency department nurses were sent a query by e-mail and participated in a focus group.

Chapter 11 reports on a before-and-after interventional study, assessing the effects of the flexible acute admission unit on transfers to other hospitals and patient throughput times.
REFERENCES


44 United States Government Accountability Office. Hospital Emergency Departments: Crowding continues to occur, and some patients wait longer than recommended time frames. GAO-09-347. 2009.


