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### Emergency department crowding: Factors influencing flow

van der Linden, M.C.

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CHRISTIEN VAN DER LINDEN



# EMERGENCY DEPARTMENT CROWDING

FACTORS INFLUENCING FLOW

EMERGENCY DEPARTMENT CROWDING  
FACTORS INFLUENCING FLOW

Christien van der Linden

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Thesis, University of Amsterdam, Amsterdam, the Netherlands

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EMERGENCY DEPARTMENT CROWDING  
FACTORS INFLUENCING FLOW

ACADEMISCH PROEFSCHRIFT

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Emergency department crowding is the elephant standing in the room;  
it is very difficult to describe how heavy he is,  
how bad he smells,  
and just when the floor might give

Pines JM: Moving closer to an operational definition for Emergency Department crowding.  
*Acad Emerg Med* 2007, 14:382-383.





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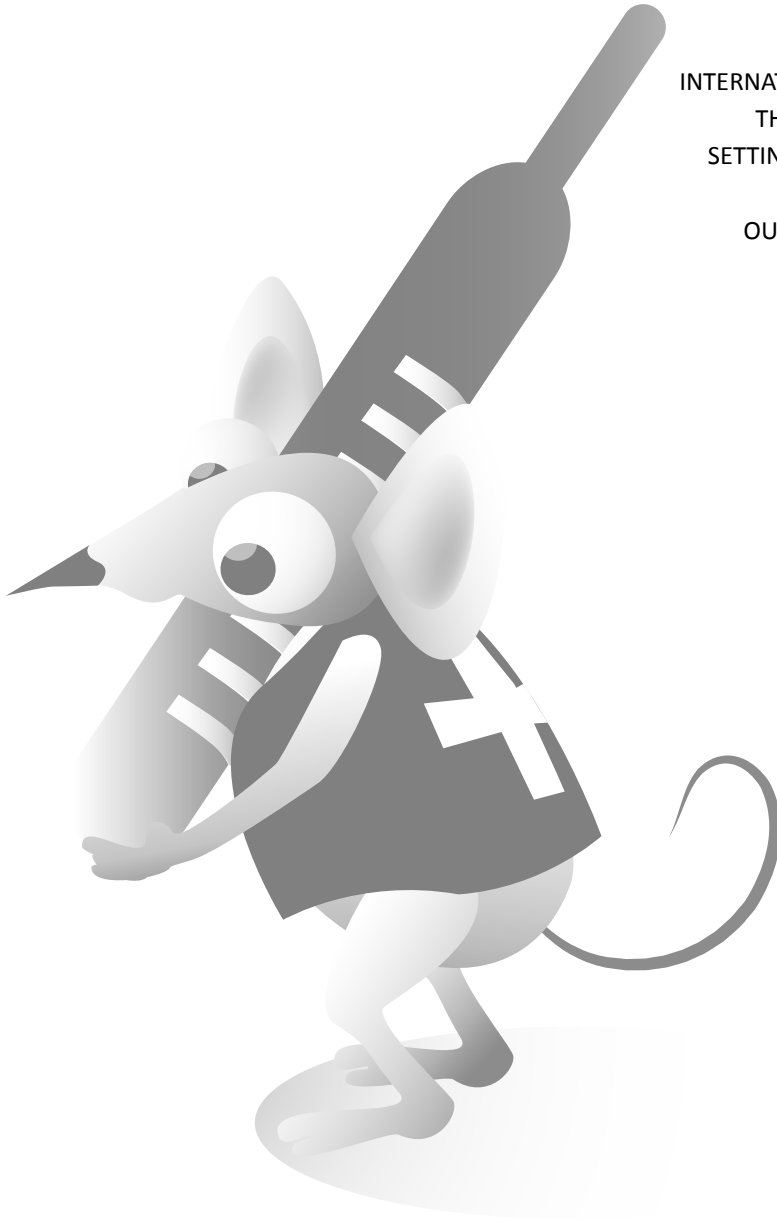
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# Chapter 1

## General introduction

INTRODUCTION  
INTERNATIONAL PERSPECTIVE  
THE DUTCH SITUATION  
SETTING OF THE RESEARCH  
AIM OF THE THESIS  
OUTLINE OF THE THESIS  
REFERENCES





## INTRODUCTION

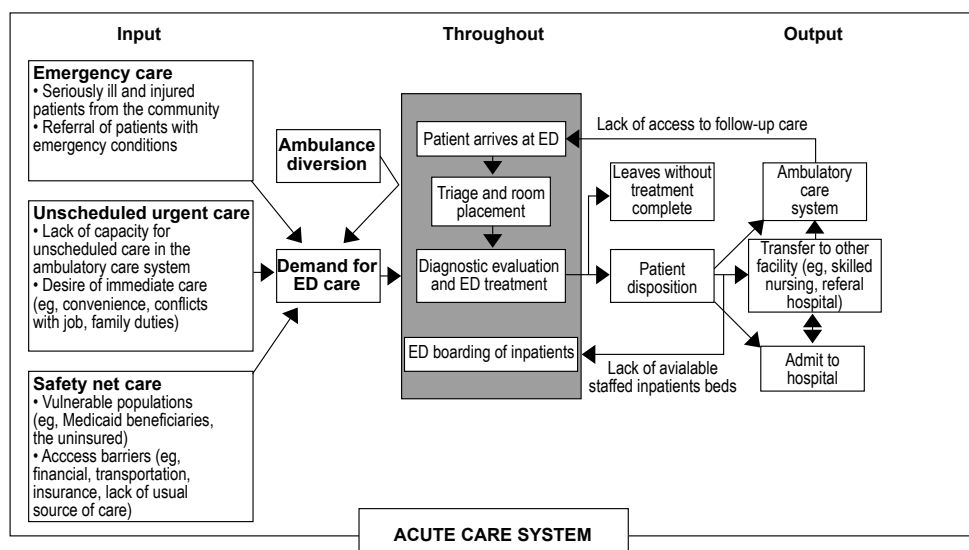
One of the most critical issues affecting emergency department (ED) flow worldwide is crowding. Crowding is described as ‘a situation in which the ED function is impeded by the number of patients waiting to be seen, undergoing assessment and treatment, or waiting for departure, exceeding the physical 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].

### Box 1. International definitions of ED crowding

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].
Canadian Association of Emergency Physicians (CAEP)	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].
Australasian College of Emergency Medicine (ACEM)	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].

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]

Throughput 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.

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# Part I

## CROWDING IN DUTCH EMERGENCY DEPARTMENTS

ChipSoft EZIS.Net / EZIS 5.2 Productie-omgeving  
Bestand Bewerken Beeld Modules Venster Help

Routingschem, Lokatie:...

Klinische wachlijstregistratie  
Agenda: Lijst DBC's van SEH AH  
Agenda: Lijst DBC's van SEH WZ

Patient overdracht  
SEH overdracht WE  
SEH DBC controle AH  
SEH DBC controle WE

Digitaal Dossier  
SEH Medisch Dossier  
Behandeling  
SEH Verpleegkundig dossier  
SEH triage MTS2 + HAP

Inzage Digitaal Dossier  
Inzage SEH dossier

SEH opdrachten  
Radiologievraag SEH (nieuw)

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Aandoeningen  
Aantekeningen  
Afspraken  
Allergieën  
Ambulant-verrichtingen  
Archief dossiers  
Beantwoordingen  
DBC's  
Documenten  
ECG  
KCL  
Medicatie lijst  
MMB  
Operaties  
Persoonlijke data

Routingschem, Lokatie: Westeinde 15-12-2014

**Aangemeld (1)**

T	U	G	Patient	Klacht
	11:10	M		via ha to intern

**Wachtkamer (16)**

T	U	G	Patient	Klacht	H
	16:53	M	7	spaaakverwond	Ja
	16:09	M	85	br ha, t o heekl	Nei
	16:21	V	43	br ha, t o MDL	Nei
	16:23	V	59	br ha, t o intern	Nei
	16:45	M	61	fax ha to intern	Nei
	16:42	V	29	(niet in WK 17	Nei
	16:56	V	50	(zit in observ	Nei
	17:14	M	18	skieen gevalle	Nei
	17:21	M	45	pjn t arm; afvij	Nei
	17:28	V	38	bulgipn; koorts	Nei
	17:29	V	29	tel over gyn; g	Nei
	17:32	M	23	via hap tav int	Nei
	17:35	V	61	benauwd; hoes	Nei
	17:36	M	12	gips laat los	Nei
	17:43	V	23	pjn bij plasse	Nei
	17:46	V	64	retour sehy r v	Nei

**Elders**

T	U	G	Patient	Klacht
	13:25	V		t o kind; loort
	13:40	V		(ambulance gebel
	09:48	V		via ha, t o kind; be
	15:43	M		via A thove t o kind

**Einde SEH**

T	U	G	Spec.	Patient	Klacht
	12:47	M	HEE		via rönt
	13:32	M	HEE		isp sport
	14:30	M	HAP		kattenris
	12:29	V	GAS		via ha, t
	13:33	V	NEU		mgf insu
	14:11	V	HEE		hand ve

**Triage kamer** 58 R  
WZ00, 01  
17:51  
pob; zweet

**Grote traumakamer**  
WZ07, 01

**Kleine traumakamer** 58 R  
WZTR, 01  
12:06  
via ha, t o MDL; o 09A2/0040/4 A  
EA GAS

**CT kamer**  
WZCT, 01

**Cardio kamer** 66 R  
15:32  
voelt zich zwak, j

**afid is gebeld, via OSCC/0080/4 A** 83 R  
WZCA, 02  
14:54  
CAR

**verward** 54 R  
WZ01, 01  
17:13  
A  
NEU

**br ha to heeklun** 84 R  
WZ02, 01  
16:43  
HEE

**collaps** 72 R  
WZ03, 01  
15:53  
CAR

**pijn vastzittend i** 61 R  
WZ05, 01  
14:07  
14:36  
LON

**br ha, t o heeklur** 14 R  
WZ06, 01  
16:18  
17:04  
HEE

**afid gebeld on** 13:37  
WZ04, 04

**Low Care Unit**  
32 R  
15:50  
pijn onderbuik

**via ha, t o inte** 74 R  
WZ09, 01  
16:11  
14:26  
LCU, 02  
LCU, 03

**sub cad eruit na** 74 R  
WZ10, 01  
15:47  
B  
INT

**omwel** 17:10  
LCU, 04

**Spreekkamer**  
WZSK, 01

**afid is gebeld, via OSCC/0080/4 A** 78 R  
WZ09, 01  
16:11  
INT

**somatische screv** 78 R  
WZ09, 01  
16:11  
INT

**br ha to heeklun** 33 R  
WZ06, 01  
12:33  
va HEE

**Familie kamer**  
WZFK, 01

Dagmeldingen (0)

Wijzigen Toevoegen Verwijderen Verversen Behandelaars Personeel Opname Sluiten

maandag 15-12-2014 | CS-EZIS: 5.2 HF223 | Gebruiker: Arts SEH WZ | Lay-out: Arts / Co-ass SEH WZ





# Chapter 2

## Emergency department crowding in the Netherlands: managers' experiences

M. Christien van der Linden  
T.M.A.J. (Resi) Reijnen  
Robert W. Derlet  
Robert Lindeboom  
Naomi van der Linden  
Cees Lucas  
John R. Richards

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## ABSTRACT

### Background

In the Netherlands, the state of emergency department crowding is unknown. Anecdotal evidence suggests that current emergency department patients experience a longer length of stay compared to some years ago, which is indicative of emergency department crowding. However, no multicentre studies have been performed to quantify length of stay and assess crowding at Dutch emergency departments. We performed this study to describe the current state of emergency departments in the Netherlands regarding patients' length of stay and emergency department nurse managers' experiences of crowding.

### Methods

A survey was sent to all 94 emergency department nurse managers in the Netherlands with questions regarding the type of facility, annual emergency department census, and patients' length of stay. Additional questions 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.

### Results

Surveys were collected from 63 emergency department (67%). Mean annual emergency department visits were 24,936 (SD±9,840); mean length of stay for discharged patients was 119 (SD±40) minutes and mean length of stay for admitted patients 146 (SD±49) minutes. Consultation delays, laboratory and radiology delays, and hospital bed shortages for patients needing admission were the most cited reasons for crowding. Admitted patients had a longer length of stay because of delays in obtaining inpatient beds. Thirty-nine of 57 respondents (68%) reported that crowding occurred several times a week or even daily, mostly between 12:00 and 20:00. Measures taken by hospitals to manage crowding included placing patients in hallways and using fast-track with treatment of patients by trained nurse practitioners.

### Conclusion

Despite a relatively short length of stay, frequent crowding appears to be a nationwide problem according to Dutch emergency department nurse managers, with 68% of them reporting that crowding occurred several times a week or even daily. Consultations delays, laboratory and radiology delays, and hospital bed shortage for patients needing admission were believed to be the most important factors contributing to emergency department crowding.

## BACKGROUND

In the Netherlands, major changes in the organisation of emergency care are planned to decrease health care costs. For example, the closure of 40% of the emergency departments (EDs) was recently discussed [1]. This could impact care in emergency departments by causing crowding. Dutch health policy makers and insurance companies plan to integrate general practitioner (GP) cooperatives and emergency departments into one facility to prevent patients from self-referring to the emergency department. Both changes may affect ED patients' length of stay (LOS) and crowding.

Although ED crowding is not yet a major problem in this country according to expert opinion [2], anecdotal evidence suggests that current ED patients experience a longer LOS compared to some years ago, which is indicative of ED crowding. However, no multicentre studies have been performed to quantify LOS and assess crowding at Dutch emergency departments. We conducted this study to describe the current state of emergency departments in the Netherlands, including ED characteristics, patients' LOS, and ED nurse managers' experiences of crowding. To study the effect of the planned changes in the organisation of emergency care on ED patients' LOS and ED crowding, we plan to repeat this study in three years.

## METHODS

### Study setting and study design

In the Netherlands, there are 132 hospital locations. Ninety-nine hospital locations have emergency departments [3], including 91 general hospitals and 8 university hospitals. There are an estimated 2.2 million ED visits annually [4]. Basic health insurance is available to all citizens: half of health care is paid by taxes and employers, half by insurance. Most people are registered with a local GP. The presence of emergency physicians (EPs) is increasing [5]. To date, there are almost 300 trained and registered EPs working in 80% of the emergency departments [6].

A survey study in the Netherlands was performed in November 2012. The survey was addressed to the ED management; it could be completed by a nurse manager, staff nurse, medical manager, or EP. Surveys were returned to the primary investigator. Data were entered into PASW (Predictive Analytics Software, version 20, Chicago, Illinois, USA).

The regional medical research ethics committee and the institutional review board approved the study.

**Study protocol**

At the onset of this study, a letter announcing the survey was published on the website of the Netherlands Society of Emergency Nurses (NVSHV) and was also noted by the national press. Surveys were distributed to all ED nurse managers using an address list published by the Ministry of Health [7] combined with an address list obtained from the NVSHV. Included in the e-mail were: a letter explaining the survey, its purpose, and a digital version of the survey. A paper-based version of the survey and a second e-mailing with an online version of the survey were sent to non-respondent emergency departments in January 2013 to increase the response rate.

**Survey content and definitions**

A draft survey was created, and after consultation of experts (two EPs and two ED nurse managers), a final version was provided (Appendix).

The survey included questions regarding type of facility, hospital size, annual ED census (based on year 2011), change in volume of annual ED visits from 2008 to 2012, ED bed capacity, number of ED nurses and physicians per shift, patients' LOS, percentage of self-referred patients (self-referrals), percentage of patients arriving by ambulance, admission rates, and how often ambulance diversion was used. Additional questions included how often crowding occurred, which time periods had the worst episodes of crowding, putative causes of crowding, and what measures had been undertaken to improve patient flow. Respondents chose from a list of causes of crowding and from a list of measures to manage crowding. Respondents were instructed to circle all appropriate answers, creating the possibility of more than one answer per respondent. Respondents were also provided the opportunity to fill in answers other than the answer lists provided. If actual data from hospital databases were not available, respondents were allowed to report estimations. They were also allowed to skip questions.

Length of stay was defined as the interval between patient registration and the moment the patient left the emergency department. Based on previous research, crowding was defined as having more patients in the emergency department than treatment rooms or more patients than staff should ideally care for [8] and overcrowding was defined as dangerously crowded, with an extreme volume of patients in ED treatment areas forcing the emergency department to operate beyond its capacity [9].

### Data analysis

Data were reported as mean and standard deviation and median and ranges, in case of a skewed distribution. To investigate whether differences occurred by type of hospital, we examined the data for the overall group as well as for type of facility separately, using two-tailed *t* tests, Kruskal-Wallis test for ordered categories and Fisher's exact tests where appropriate. Statistical significance was assumed at a level of  $P \leq 0.05$ .

## RESULTS

Surveys were collected from 63 emergency departments (64%); 36 surveys were received after the initial call, and 27 surveys were received after the reminder mail. There were 55 general and 8 university hospitals, which accounted for 56% of total general hospitals and 100% of total university hospitals participating. Respondents were ED nurse managers ( $n = 62$ , 98%) and one ED nurse. Six ED nurse managers were assisted by an EP, ED nurse or staff advisor. Not all respondents answered every question. The total number responding to each question is reported throughout the results and tables.

### Emergency department characteristics

Mean number of annual ED visits ( $\pm$ SD) in 2011 was 24,936 ( $n = 61$ ). Mean number of annual ED visits to general hospitals ( $n = 53$ ; 24,601 was not statistically different from mean number of annual ED visits to university hospitals ( $n = 8$ ; 27,155) (Table 1). Fifty-six respondents (89%) answered the question about change in volume of annual ED visits from 2008 to 2012. Forty-three of them (77%) reported an increase in ED visits between 2008 and 2011, while 13 (23%) reported a decrease.

The characteristics of the emergency departments differed greatly. The mean percentage of ED patients arriving per ambulance (55 respondents) was 17%, varying from 5% to 60%; the mean percentage of self-referrals (58 respondents) was 35%, varying from 3% to 71%; and the mean percentage of ED patients admitted for inpatient care (33 respondents) was 32%, varying from 15% to 55% (Table 1).

### Length of stay

Mean LOS for discharged patients was 119 minutes. Mean LOS for admitted patients was 146 minutes. Eleven respondents estimated undifferentiated LOS only, with a mean LOS of 131 minutes (Table 1). The LOS in university hospitals was not significantly different from the LOS in general hospitals (discharged patients: 140 vs. 117 minutes,  $P = 0.27$ ; admitted patients: 177 vs. 144 minutes,  $P = 0.27$ ).

**Table 1.** Emergency department characteristics<sup>1</sup> (n =63)

	Mean (SD)	Median	Range	Responding hospitals (n, %)
Annual ED visits	24,936 (9,840)	24,000	7,972-52,400	61 (97)
General hospitals	24,601 (10,331)	23,625	7,972-52,400	53 (84)
University hospitals	27,155 (5,535)	26,903	19,487-34,500	8 (100)
No. of ED beds	16 (6)	16	4-28	60 (95)
No. of ED nurses	4,48 (1,56)	4	2-10	60 (95)
Day shift	4,78 (1,89)	4,5	2-12	60 (95)
Evening shift	2,82 (0,97)	3	1-6	60 (95)
Night shift				
No. of physicians	5,71 (3,23)	5	1-14	57 (90)
Day shift	4,90 (2,94)	4	1-12	57 (90)
Evening shift	3,41 (2,47)	2	1-10	56 (89)
Night shift	17 (9)	15	5-60	55 (87)
Percentage of ED visits arriving by ambulance	35 (19)	33	3-71	58 (92)
Percentage of ED visits by self-referrals	486 (287)	365	140-1300	52 (83)
No. of staffed beds in hospital	16 (16)	12	3-88	51 (81)
No. of ICU beds in hospital	7,606 (2,653)	7,267	3,367-13,290	24 (38)
No. of ED patients admitted for inpatient care	32 (10)	33	15-55	33 (52)
Percentage of ED patients admitted for inpatient care	131 (21)	135	90-163	11 (18)
ED LOS undifferentiated, minutes	119 (40)	118	45-220	39 (62)
ED LOS discharged patients, minutes	146 (49)	150	15-217	37 (59)
ED LOS for admitted patients, minutes				
<b>Change in volume of annual ED visits from 2008 to 2012</b>				
<b>Increased ED visits</b>				
General hospitals	1,634 (1,589)	1,042	59-6,477	43 (68)
University hospitals	1,541 (1,469)	1,016	59-5,283	37 (67)
<b>Decreased Visits</b>				
General hospitals	2,206 (2,280)	1,359	500-6,477	6 (75)
University hospitals	2,405 (1,761)	1,566	738-6,376	13 (21)
General hospitals	2,427 (1,902)	1,500	738-6,376	11 (20)
University hospitals	2,281 (1,010)	2,280	1,566-2,995	2 (25)

<sup>1</sup> Estimations and actual data

### Respondents' experiences of crowding

Thirty-nine of the 57 respondents (68%) reported that crowding occurred two or more times a week (Table 2). No difference was found in crowding between university and general hospitals. The emergency departments who reported crowding also reported overcrowding (two or more times a week) in 19 cases (49%) (Table 3). University hospitals suffered from overcrowding significantly more. Sixty percent of the respondents indicated crowding occurred mostly between 12:00 and 20:00. Respondents mentioned consultation delays ( $n = 51$ , 80%) most frequently as a problem contributing to crowding, and radiology and laboratory delays ( $n = 44$ , 70%) also ranked highly (Table 4). Patients referred to the emergency department by GPs were considered to contribute most to crowding, followed by multi-trauma patients (Table 5).

**Table 2.** EDs reporting crowding, by annual ED volume and type of facility ( $n = 57$ )

	Crowding*, $n$ (%)	No crowding, $n$ (%)	$P$
Annual ED volume	39 (68)	18 (32)	0.64 <sup>1</sup>
>40,000 visits	4	1	
30,001-40,000 visits	9	2	
20,000-30,000 visits	16	9	
<20,000 visits	10	6	
Type of hospital			1.0 <sup>2</sup>
General hospital ( $n = 50$ )	34	16	
University hospital ( $n = 7$ )	5	2	

\* Crowding daily or more than twice a week.

<sup>1</sup> Kruskal-Wallis test for ordered categories.

<sup>2</sup> Fisher's exact test.

**Table 3.** Emergency departments reporting crowding AND overcrowding, by annual ED volume and type of facility ( $n = 39$ )

	Crowding and overcrowding*, n (%)	No overcrowding, n (%)	<i>P</i>
<b>Annual ED volume*</b>	19 (49)	20 (51)	0.55 <sup>1</sup>
>40,000 visits	3	1	
30,001-40,000 visits	4	5	
20,000-30,000 visits	7	9	
<20,000 visits	5	5	
<b>Facility type</b>			0.03 <sup>2</sup>
General hospital	14	20	
University hospital	5	0	

\* Overcrowding daily or more than twice a week.

<sup>1</sup> Kruskal-Wallis test for ordered categories.

<sup>2</sup> Fisher's exact test.

**Table 4.** Problems related to crowding according to the respondents ( $n = 63$ )

Problem	<i>n</i> (%)
Consultation delays	51 (81)
Radiology and laboratory delays	44 (70)
Delays for admitted patients / hospital bed shortage	40 (64)
Physician staff shortage	30 (48)
Insufficient ED space	29 (46)
Delays in transfer	21 (33)
Long waits in triage	20 (32)
Nursing staff shortage	15 (24)
Registration delays	3 (5)

**Table 5.** Patients with the most impact on crowding according to the respondents ( $n = 63$ )

Patients	<i>n</i> (%)
Patients referred by a GP, needing admission	27 (43)
Multi-trauma patients	21 (33)
Patients admitted to an inpatient unit	18 (29)
Psychiatric patients	17 (27)
Self-referrals	10 (16)
Geriatric patients	10 (16)
Children	6 (10)

Measures to manage crowding mentioned most frequently included placing patients in hallways ( $n = 25$ , 40%) and implementing fast-track units for patients with minor injuries ( $n = 24$ , 38%) (Table 6). Ambulance diversion policies ranged from having diversion plans to a policy of never diverting patients. Twenty-two of 59 respondents (37%) claimed they never used ambulance diversion. Ambulance diversion of one to six times per year was most common, reported by 24 of the 59 responding institutions (41%) (Table 7).



**Table 6.** Measures for handling periods of crowding (*n* =63)

Measures	<i>n</i> , %
Treating patients in non-treatment areas	25 (40)
Fast-track for minor injuries	24 (38)
Expansion of emergency physician, nursing, and ancillary staff	24 (38)
Expanding inpatient hospital bed capabilities and development of ED observational units	22 (35)
Ambulance diversion	19 (30)
Adapting the number of patients per room	16 (25)
Performing consultations outside the ED area	15 (24)
Rebuilding (parts of) the emergency department	15 (24)
Double triage coverage	12 (19)
Implementation of a GP cooperative at the emergency department	12 (19)
Hiring nurse practitioners or physician assistants	10 (16)
Triaging patients out of the emergency department to the GP or outpatient clinic	9 (14)

**Table 7.** Number of times emergency departments were on ambulance diversion (*n* =59)

	<i>n</i> , (%)
Never	22 (37)
1-6 times per year	24 (41)
7-12 times per year	6 (10)
2-4 times per month	6 (10)
Several times per week	1 (2)

## DISCUSSION

Length of stay at emergency departments in the Netherlands (119 minutes for discharged patients, 146 minutes for admitted patients) is short compared to published LOSs in other countries [10,11]. In the USA, admitted patients may have a LOS of over 24 h during times of severe crowding [12]. Despite this relatively short LOS, frequent crowding appears to be a Dutch problem according to our respondents, with 68% of them reporting that crowding occurred several times a week or even daily, and half of those reporting that, besides crowding, their emergency department was also overcrowded two or more times a week. Our findings are somewhat milder compared to studies performed in the USA more than 10 years ago by the co-authors [13-15] in which 91% of the ED directors in the USA reported crowding to be a problem, probably indicating that crowding is better controlled in the Netherlands. However, if health restructures continue (closure of emergency departments and decreasing inpatient bed capacity), crowding may become more prevalent. Our respondents named several factors they believed to contribute to ED crowding, and their answers were similar to those from other international studies [16-19]: consultation delays, shortages in ED space and beds, admission delays, shortages of acute care inpatient beds, lack of nursing staff, and laboratory and radiology delays.

In the Dutch lay press, it is suggested that the problem of crowded emergency departments is predominantly caused by inappropriate use of emergency services by patients seeking care for non-urgent problems. The same was suggested in the USA in the early 1990s in several position statements [20]. Integration of GP with ED services has had mixed effects: unsuccessful in some hospitals in Australia and New Zealand, while effective in diverting patients in one study from the Netherlands [21,22]. This Dutch study did not measure effects on crowding. Current research on ED crowding suggests that discouraging the use of the emergency department for non-emergency issues will not solve the problem. Rather, the issue of output, for example, inadequate inpatient capacity for a patient population with an increasing complexity and severity of illness, is now believed to be the single most important factor contributing to ED crowding [23]. Our respondents agreed: 64% cite hospital bed shortages as a problem contributing to crowding. Only 16% blamed self-referrals for crowding, while many (43%) believed crowding occurs when too many patients who are referred by the GP or multi-trauma patients present at the emergency department (33%). High patient acuity has been cited as a significant contributing factor to ED crowding [13].

Besides GP cooperatives, numerous measures have been implemented to improve ED efficiency and alleviate crowding in Dutch emergency departments. These measures have been mentioned in the past international literature about ED crowding. Examples include implementing observation units [24] and creating a fast-track unit [25]. A few measures described in the international literature were rarely mentioned in our study, such as ambulance diversion. For many Dutch emergency departments, ambulance diversion is not an option, even when conditions warrant diversion. Most university and major emergency departments have no alternative treatment site, since emergency departments in the Netherlands have special assignments, such as dedicated trauma centre designation. For non-trauma ambulance patients, diversion would be possible; however, hospitals have strong economic pressures to remain open. Only one respondent reported requiring diversion several times per week.

The body of evidence documenting the adverse effects of crowding has grown up to the sky. Crowding not only compromises the quality of care, it also worsens clinical outcomes [26] and has negative effects on staff satisfaction and health [27]. It is apparent most countries have been struggling with ED crowding for many years, and the focus has shifted from identifying causes and consequences to finding solutions. The Dutch are following this trend. Some Dutch emergency departments have implemented fast-track (38%) with or without nurse practitioners (16% of the respondents use nurse practitioners), which has been reported to help decrease LOS [28]. Emergency department nurse managers recognise that the cause and solution to ED overcrowding lie outside the emergency department. They consider

ED crowding as a system-wide problem instead of an ED phenomenon, as seen in other countries. Facilities are increasingly utilizing ED-managed overflow units (acute admission units, transit lounges and flexible beds) to make room for incoming patients. These overflow units mitigate crowding by giving the ED staff a way to control patient outflow to some extent [29,30]. Other important potential solutions, such as expediting discharge from the main wards, were not mentioned by our ED nurse managers.

Future studies in the Netherlands should focus on determining which aspects of restructuring health care are most closely related to ED crowding. The Dutch can learn from what is already known in other countries with severe crowding. Despite environmental, demographic and health care organisation differences between countries, the causes and consequences of crowding appear to be universal, and certain strategies will alleviate crowding wherever they are implemented. From the existing evidence, it is clear that multidisciplinary system-wide support is necessary to solve ED crowding. Introducing quality benchmarks in the Netherlands would be useful. Moreover, emergency departments should start collecting a uniform set of process measures that provides real-time observation of the operation of the department like the crowding measures recently identified by Beniuk et al. [31]. This would facilitate across-facility comparisons to identify best practices that work in our health care system.

### **Limitations**

First, our survey has not been validated yet. As in most surveys, our results are subject to reporting errors, non-response, and incomplete responses. In the Netherlands, several different patient information systems are used, and hospitals use different definitions for the data that are tracked. For example, referral source and transport were used interchangeably at different sites: in some emergency departments, all patients brought in by ambulance were documented as 'ambulance patients', while in other emergency departments patients who were referred by a GP but transported by an ambulance were not registered as such. In some Dutch emergency departments, visits are not tracked, so a few respondents presented estimations instead of actual data. Although this data collection is far from ideal, we believe the benefits of multicentre participation outweighed the weaknesses of variation in operational data. We do not know if the characteristics of non-responding emergency departments were similar or systematically different from those of responding emergency departments. However, our purpose was not to assess the population as a whole but rather to describe the current status of emergency departments, current LOS, and ED nurse managers' experiences of crowding.

Another major limitation is that no standard definition of ED crowding exists [16,32]. Several factors associated with crowding were included in the survey, but no standard method was used for actually defining crowding. Emergency department crowding assessment tools (e.g. EDWIN [33], NEDOCS [34]) are not yet used routinely in the Netherlands. Some metrics that define patient throughput, such as ambulance diversion hours [35] or the number of patients leaving without being seen [36], are used as surrogate markers of crowding in the absence of a widely accepted definition [37]. Measuring crowding with hours on ambulance diversion or with the percentage of patients leaving without being seen will not give a true picture of ED conditions in the Netherlands, since both circumstances are rare. As with other studies [33,38], we used staff perceptions of crowding. Although subjective, ED managers' sense of how their emergency departments operate was the closest accurate measure of current crowding. After national implementation of crowding measures into the ED information system in the Netherlands, further studies assessing ED crowding will be necessary, using empirical data to quantify ED nurse managers' experiences.

## CONCLUSION

Despite a relatively short LOS, frequent crowding appears to be a nationwide problem according to Dutch ED nurse managers, with 68% of them reporting that crowding occurred several times a week or even daily. Almost half of the crowded emergency departments experienced overcrowding two or more times a week. Delays in consultations and laboratory and radiology services contributed to the problem. Admitted patients had a longer LOS because of delays in obtaining inpatient beds.

## APPENDIX

### The 2012 emergency department survey

Questions used for the article 'Emergency department crowding in the Netherlands: managers' experiences' by M.Christien van der Linden, TMAJ (Resi) Reijnen, Robert W. Derlet, Robert Lindeboom, Naomi van der Linden, Cees Lucas and John R. Richards.

1. Name and location of the hospital
2. Function of the applicant (ED nurse manager; ED nurse; EP; other)
3. Type of facility (general or university hospital)
4. Number of staffed beds in hospital
5. Number of ICU beds in hospital
6. Annual ED visits in 2008
7. Annual ED visits in 2011
8. Number of ED beds
9. Number of ED nurses and physicians per shift
10. Patients length of stay (LOS), undifferentiated
11. LOS for treat-and-release patients
12. LOS for admitted patients
13. Number and/or percentage of ED visits by self-referred patients
14. Number and/or percentage of ED patients arriving by ambulance
15. Number and/or percentage of patients admitted
16. How often does crowding occur? (Never; 1-6 times per year; 7 to 12 times per year; 2 to 4 times per month; several times per week; daily).
17. How often does overcrowding occur? (Never; 1-6 times per year; 7 to 12 times per year; 2 to 4 times per month; several times per week; daily).
18. Which time period has the worst episodes of crowding? (24-4 h; 4-8 h; 8-12 h; 12-16 h; 16-20 h; 20-24 h).
19. Causes of crowding (consultation delays; radiology and laboratory delays; delays for admitted patients / hospital bed shortage; physician staff shortage; insufficient ED space; delays in transfer; long waits in triage; nursing staff shortage; registration delays; other)
20. Which patients have the most impact on crowding? (patients referred by a GP, needing admission; multi-trauma patients; patients admitted to an inpatient unit; psychiatric patients; self-referred patients; geriatric patients; children; other)

21. Measures to manage crowding (treating patients in non-treatment areas; fast-track for minor injuries; expansion of EP, nursing, and ancillary staff; expanding inpatient hospital bed capabilities and development of ED observational units; ambulance diversion; adapting the number of patients per room; performing consultations outside the ED area; rebuilding (parts of) the emergency department; double triage coverage; implementation of a GP cooperative at the emergency department; hiring nurse practitioners or physician assistants; triaging patients out of the emergency department to the GP or outpatient clinic; other).
22. How often ambulance diversion is used (Never; 1-6 times per year; 7 to 12 times per year; 2 to 4 times per month; several times per week; daily).

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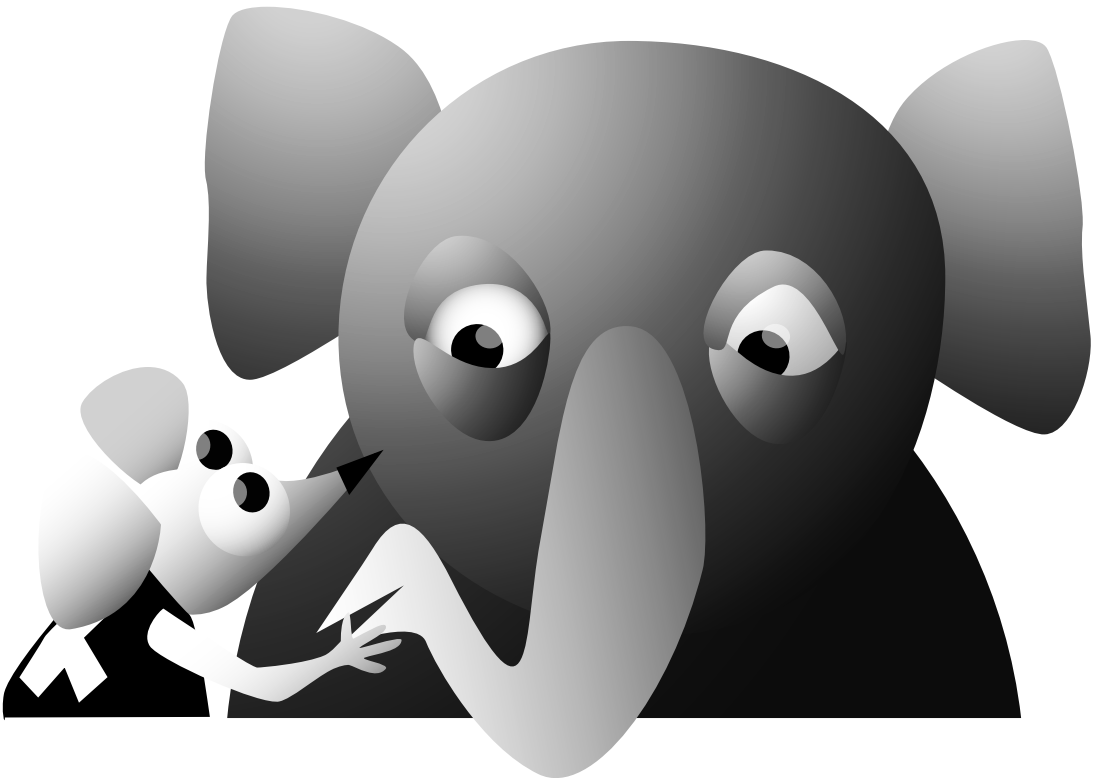
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# Part II

## INPUT OF THE EMERGENCY DEPARTMENT





# Chapter 3

## **Self-referring patients at the emergency department: appropriateness of emergency department use and motives for self-referral**

M. Christien van der Linden  
Robert Lindeboom  
Naomi van der Linden  
Crispijn L. van den Brand  
Rianne C. Lam  
Cees Lucas  
Rob J. de Haan  
J. Carel Goslings

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## ABSTRACT

### Background

Nearly all Dutch citizens have a general practitioner, acting as a gatekeeper to secondary care. Some patients bypass the general practitioner and present to the emergency department. To make best use of existing emergency care, Dutch health policy makers and insurance companies have proposed the integration of emergency departments and general practitioner cooperatives into one facility. In this study, we examined emergency department use and assessed 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.

### Methods

A descriptive cohort study was conducted in a Dutch level 1 trauma centre. Differences in patient characteristics, time of presentation and need for hospital emergency care were analysed using  $\chi^2$  tests and *t* tests. A patient was considered to need hospital emergency care when he/she was admitted to the hospital, had an extremity fracture and/or when diagnostic tests were performed. Main determinants of self-referral were identified via logistic regression.

### Results

Of the 5,003 consecutive emergency department patients registering within the 5-week study period, 3,028 (60.5%) were self-referrals. Thirty-nine percent of the self-referrals had urgent acuity levels, as opposed to 65% of the non-self-referrals. Self-referrals more often suffered from injuries (49 vs. 20%). One third of the self-referrals presented during office hours. Of all self-referrals, 51% needed hospital emergency care. Younger age; non-urgent acuity level; chest pain, ear, nose or throat problems; and injuries were independent predictors for self-referral. Most cited motives for self-referring were 'accessibility and convenience' and perceived 'medical necessity'.

### Conclusions

A substantial part of the self-referrals needed hospital emergency care. The 49% self-referrals who were eligible for general practitioner care presented during out-of-hours as well as during office hours. This calls for an integrative approach to this health care problem.

## BACKGROUND

Nearly all Dutch citizens have a general practitioner (GP), acting as a gatekeeper to secondary care. Some patients bypass the GP and present to the emergency department (ED). If the patient bypasses the GP, there are no direct financial repercussions for the GP or patient. However, all Dutch residents have a mandatory own risk or excess of at least 360 euros per year for their health insurance. For GP care, the excess does not apply. If a patient goes to the hospital, this visit may result in the patient paying the costs up to 360 euros, unless the patient has already paid the excess that year for other treatments. Approximately one third of the ED visitors in the Netherlands are self-referred, while in large inner-city hospitals, up to 70% of the ED visitors present at the emergency department on their own initiative [1,2]. Some of these self-referrals can be treated by a GP [3], which would decrease the workload on a crowded emergency department. To make best use of existing emergency care, Dutch health policy makers and insurance companies have proposed the integration of emergency departments and GP cooperatives (GPCs) into one facility. Most of these integrated settings are out-of-hours centres, operating from 5.00 p.m. to 8.00 a.m. on weekdays and 24 hour a day during the weekends. During office hours, patients ideally have to attend to their own GP first.

Most studies focus on self-referrals presenting out-of-hours. However, emergency departments are also confronted with self-referrals during office hours. Knowing self-referrals' characteristics, their chief complaints, time of presentation and motives to present to the emergency department may help policy makers in making decisions on how to organise delivery of primary and emergency care in inner-city emergency departments.

The objectives of this study were therefore to examine the appropriateness of ED use and to answer the following questions: (1) Are there differences in patient characteristics and need for hospital emergency care between self-referrals and non-self-referrals? (2) Are there differences in patient characteristics and need for hospital emergency care between self-referrals presenting to the emergency department during office hours and during out-of-office hours? (3) Why do self-referrals seek hospital emergency care?

## METHODS

### Research design and setting

A cross-sectional observational study was conducted between 1 November 2010 and 6 December 2010 in an inner-city, level 1 trauma centre, the Hague, the Netherlands with an annual census of approximately 52,000 ED patient attendances. In the study setting, there was no GPC at the time of this study.

**Procedure**

Patients' age, sex and mode of arrival were recorded by the ED registration desk. The patients were categorised by the desk clerk in patients who were referred by their GP, patients who arrived by ambulance, patients who were referred by another hospital or by a medical specialist and patients who presented to the emergency department on their own initiative. The latter were considered self-referrals, while the others were considered non-self-referrals. After registration, triage nurses assigned a level of acuity [4]. Acuity levels ranged from 1 to 5, which were dichotomised into 'urgent' (levels 1 to 3; immediate, very urgent or urgent) and 'non-urgent' (levels 4 and 5; standard or non-urgent) for the analysis. We assessed the relation between acuity level and the need for hospital emergency care. A patient was considered to need hospital emergency care if he/she fulfilled one or more of the following criteria: having an extremity fracture needing plaster, admitted to the hospital and when certain diagnostic tests were performed. These diagnostic tests were seven procedures not commonly performed during GP care: blood analysis, X-ray, electrocardiogram (EKG), computerised tomography (CT) scan, magnetic resonance imaging (MRI), ultrasound and lumbar puncture. For patients arriving with an extremity problem, the records were reviewed retrospectively to assess the presence of a fracture. The criteria of 'needing hospital care' were based on consensus of the authors (MCL, CLB, RCL).

Additional information was collected from the patient records: day and time of presentation, chief complaint, presenting with an injury and follow-up. We defined hours from 8:00 a.m. to 5:00 p.m. during weekdays as office hours. Chief complaints were based on the triage flow charts chosen by the triage nurse. Follow-up care was the discharge code as registered in the patient record. Patients referred to the children's hospital were considered as discharged from our emergency department.

In the weekly ED newsletter, ED nurses were asked to contribute to the study, and 12 nurses (27% of the nursing staff) agreed. After triage, these ED nurses asked consecutive self-referrals why they had chosen to come to the emergency department instead of going to their own GP (during office hours) or to a stand-in GP (during out-of-hours). The ED nurses were instructed to interview all self-referrals during their shift and record the exact answer of the respondents. They were aided in doing so systematically through a mandatory field in the electronic nursing records of the self-referrals. In case of a minor, the parent (or caretaker) was interviewed.

Based on previous studies [5,6], patients' motives to visit the emergency department instead of the GP were categorised into seven categories: accessibility and convenience, perception of need, not thought about GP, not having a regular GP, familiarity, dissatisfaction with GP and referral by non-professionals. Categorisation was performed by two researchers (MCL, RCL) working independently of each other, reviewing the patient records and blinded to

the other researcher's opinion. If no agreement between the two researchers was noted in the assigned categorisation, the case was reviewed by a third researcher (NL) who was blinded to the opinion of the other two researchers. The category on which two of the three researchers agreed was recorded for analysis. Two categories were added during the categorisation: 'no reason' (if the nurse was not able to obtain an answer) and 'language barriers' (if the nurse could not understand the patients' answer).

The study was registered and approved by the regional medical research ethics committee (METC) under number 2011-011. Informed consent of individual patients was waived by the local institutional review board. The patient dataset contained no individual identifiers to maintain anonymity of subjects.

### Statistical analysis

Patient characteristics were summarised using descriptive statistics. Differences between self-referrals and non-self-referrals and between self-referrals presenting during office hours and out-of-hours, regarding age, sex, acuity level (urgent or non-urgent), chief complaint, type of health problem (injury or no injury), diagnostic tests performed, follow-up care, having an extremity fracture and the need for hospital emergency care, were analysed using  $\chi^2$  tests (categorical variables) and *t* tests (continuous variables). We assessed the relation between the need of hospital emergency care and acuity level using a  $\chi^2$  test.

Independent patient characteristics, in terms of age, sex, acuity level, chief complaint and injury, predicting self-referral were identified via multivariate logistic regression using a backward elimination strategy on all patient characteristics with  $P > 0.05$  as elimination criterion. PASW (Predictive Analytics Software, version 18, Chicago, Illinois, USA) was used for the quantitative analyses. Effect sizes were expressed in odds ratios (ORs) with their 95% confidence limits. We used qualitative content analysis to summarise the motives for self-referral [7]. In qualitative content analysis, language is examined intensely for the purpose of classifying large amounts of text data into an efficient number of categories [8,9].

In view of the descriptive nature of this study, we did not adjust for multiple comparisons [10].

## RESULTS

### Number of patients and their time of presentation

During the 5-week study period, there were 5,003 new ED patient attendances: 3,028 (61%) were self-referrals and 1,975 (39%) were not. Of these 1,975 non-self-referrals, 597 patients (30%) were referred by the GP, 618 patients (31%) were brought in by the ambulance service and 760 patients (39%) were referred by another hospital or by a medical specialist. Of the self-referrals ( $n=3,028$ ), 33% ( $n=990$ ) presented during office hours (Table 1).

**Table 1.** Patient characteristics

	<b>Self-referrals</b> ( <i>n</i> =3,028)	<b>Non-self-referrals</b> ( <i>n</i> =1,975)
<b>Age</b> [mean (SD)] (years)	32.3 (18.6)	48.5 (22.1)
<b>Age categories</b> [ <i>n</i> (%) ] (years)		
0 to15 y	543 (17.9)	107 (5.4)
16 to 35 y	1,310 (43.3)	512 (25.9)
36 to 55 y	783 (25.9)	590 (29.9)
56 to 75 y	343 (11.3)	501 (25.4)
≥75 y	49 (1.6)	265 (13.4)
<b>Sex, male</b> [ <i>n</i> (%) ]	1,636 (54.0)	951 (48.2)
<b>Urgent acuity level<sup>a</sup></b> [ <i>n</i> (%) ]	1,174 (38.8)	1,281 (64.8)
<b>No triage</b> [ <i>n</i> (%) ]	151 (5.0)	123 (6.2)
<b>Chief complaint</b> [ <i>n</i> (%) ]		
Limb problems	898 (29.7)	266 (13.5)
Wounds and local infections and abscesses	396 (13.1)	153 (7.7)
Eye/ear/nose problems and sore throat	216 (7.1)	33 (1.7)
Headache and head injury	119 (3.9)	97 (4.9)
Shortness of breath	85 (2.8)	141 (7.1)
Abdominal pain	302 (10.0)	262 (13.3)
Chest pain	203 (6.7)	191 (9.7)
Patient feeling unwell	102 (3.4)	191 (9.7)
Psychiatric problem	21 (0.7)	54 (2.7)
Other	686 (22.7)	587 (29.7)
<b>Injury</b> [ <i>n</i> (%) ]	1,476 (48.7)	386 (19.5)
<b>Time of registration during office hours</b> [ <i>n</i> (%) ]	990 (32.7)	1,073 (54.3)
<b>Diagnostic tests performed<sup>b</sup></b> [ <i>n</i> (%) ]	1,461 (48.2)	1,522 (77.1)
<b>Follow-up care</b> [ <i>n</i> (%) ]		
Discharge without follow-up appointment	1,363 (45.0)	396 (20.1)
Hospital admission	207 (6.8)	667 (33.8)
Discharge, appointment with specialist care	822 (27.1)	704 (35.6)
Left without being seen by a professional	37 (1.2)	24 (1.2)
Referred to children's hospital	49 (1.6)	4 (0.2)
Discharge, appointment with GP	550 (18.2)	180 (9.1)
<b>Suffering from an extremity fracture</b>	336 (11.1)	204 (10.3)
<b>Needing hospital emergency care<sup>c</sup></b>	1,539 (50.8)	1,597 (80.9)

SD = standard deviation. <sup>a</sup>Urgent, very urgent or immediate. <sup>b</sup>Includes blood analysis, EKG, X-rays, CT-scan, MRI, ultrasound and lumbar puncture. <sup>c</sup>Hospital admission and/or suffering from an extremity fracture and/or diagnostic tests performed. All differences in patient characteristics in relation to type of referral were significant at the  $P < 0.01$  level, except for 'no triage' ( $P = 0.06$ ) 'left without being seen' ( $P = 0.98$ ) and 'suffering from an extremity fracture' ( $P = 0.39$ ).

### Self-referrals versus non-self-referrals

The results described are also presented in Table 1. Self-referrals were younger (32 years vs. 49 years), more often male (54% vs. 48%) and less urgent (39% vs. 65% urgent). Self-referrals also differed in the type of chief complaint; they more often presented with limb problems (30% vs. 14%), wounds (13% vs. 8%) and eye, ear, and nose problems or a sore throat (7%



vs. 2%), and were more often injured (49% vs. 20%). Furthermore, they needed diagnostic tests less often (48% vs. 77%) and were admitted less often than non-self-referrals (7% vs. 34%). All differences were significant at  $P < 0.01$  except for the proportion of patients with no triage ( $P = 0.06$ ), patients leaving the ED without being seen ( $P = 0.98$ ) and the proportion with an extremity fracture ( $P = 0.39$ ).

Multivariate logistic regression with age, sex, acuity level, chief complaint and injury as reason for presentation as explanatory variables in the model showed that younger age (OR 0.97); being non-urgent (OR 0.49); presenting with chest pain (OR 1.79); presenting an eye, ear, nose or throat problem (OR 4.73); and having an injury (OR 2.91) were independent predictors for self-referral (Table 2).

**Table 2.** Independent factors related to self-referral to the emergency department

	<b>B (SE)</b>	<b>Odds Ratio (95% CI)</b>	<b>P</b>
<b>Age</b>	-0.03 (0.002)	0.97 (0.96, 0.97)	<0.001
<b>Urgent acuity level*</b>	-0.72 (0.07)	0.49 (0.42, 0.56)	<0.001
<b>Injury</b>	1.07 (0.08)	2.91 (2.50, 3.39)	<0.001
<b>Chief complaint</b>			
Eye/ear/nose problems and sore throat	1.55 (0.20)	4.73 (3.18, 7.03)	<0.001
Chest pain	0.58 (0.12)	1.79 (1.42, 2.26)	<0.001

B, the coefficient for the constant; SE, standard error around the coefficient for the constant; CI, confidence interval. \*Urgent, very urgent or immediate

### Self-referrals presenting during office hours versus out-of-office hours

Self-referrals presenting during office hours ( $n = 990$ ) were not notably different from self-referrals presenting during out-of-hours ( $n = 2,038$ ), except that they were more likely to be injured (59.9% during office hours vs. 43.3% during out-of-hours,  $P < 0.01$ ) and to suffer from a limb problem (36.9% during office hours vs. 26.2% during out-of-hours,  $P < 0.01$ ).

Of the self-referrals, 51% actually needed hospital emergency care. During office hours, 55% of the self-referrals needed hospital emergency care; during out-of-office hours, this was 49%. The need for hospital emergency care was not limited to patients with urgent complaints: 47% of the self-referrals needing hospital emergency care had non-urgent complaints. For example, patients diagnosed with a fracture of the finger (needing X-ray and cast) or an Achilles tendon rupture (needing surgical repair) may be triaged as non-urgent but need hospital emergency care.

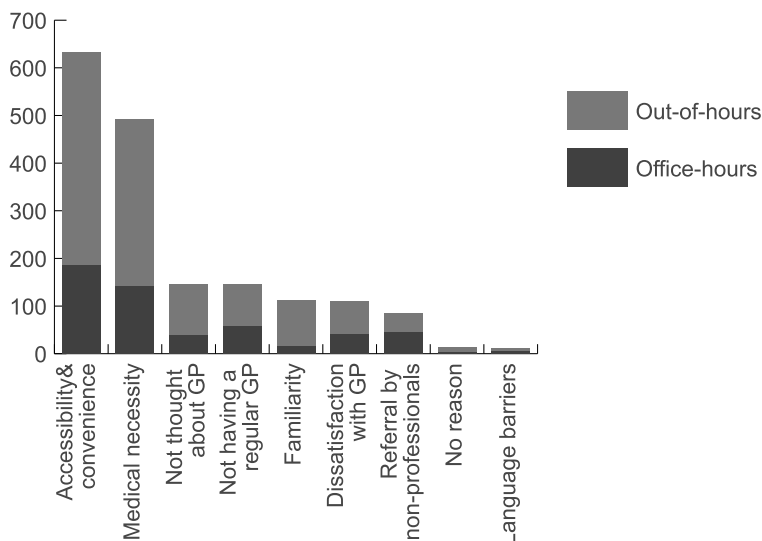
### Patients' motives to visit the emergency department instead of the GP

During their shifts, the 12 ED nurses asked 1,751 self-referrals (58% of the total group) to answer the question why they had chosen to bypass the GP and visit the emergency department. Of these 1,751 self-referrals, 295 (16.8%) were minors accompanied by a parent or caretaker.

Interviewed self-referrals were not different from the self-referrals not interviewed, with respect to age, sex and follow-up. However, interviewees less often presented with an injury (45% vs. 53%,  $P < 0.001$ ) and were less often registered during office hours (30% vs. 35%,  $P = 0.001$ ).

Some patients had two different reasons for presenting to the emergency department instead of to their GP, resulting in 1,842 answers given by 1,751 patients.

The results are shown in Figure 1. The theme that was mentioned by the respondents most often was 'accessibility and convenience' (632 times, 34%). Examples of answers given by participants that were placed in this category were 'easy because the emergency department is always open' and 'not having to make an appointment', 'inability to get through to the physician by telephone or get a timely appointment', 'close to home', 'quick service' and 'more flexible openings hours'. Another reason frequently mentioned was 'perceived medical necessity' (492 times, 27%): the perceived severity or acuity of the problem ('too sick to go elsewhere', 'emergent condition') or the expectation that an X-ray was necessary.



**Figure 1.** Categories of motives for choosing the ED instead of the GP

'Accessibility and convenience' and 'familiarity' were slightly more often cited as motives during out-of-hours than during office hours (36.8% vs. 34.8%,  $P < 0.001$  and 7.9% vs. 3.0%,  $P < 0.001$ , respectively). During office hours, more patients were referred to the emergency department by family, school, colleagues or friends (8.5% vs. 3.3%,  $P < 0.001$ ) or stated that they had no regular GP (10.7% vs. 7.3%,  $P = 0.018$ ).

## DISCUSSION

In this inner-city hospital, 60% of the ED patients were self-referrals bypassing their GP because of the emergency departments' easy access and because they believed hospital emergency care was necessary for their complaint. They presented during out-of-hours as well as during office hours. A part of the self-referrals had medical problems eligible for GP care, and a part of them had medical problems needing hospital emergency care. Multivariate analysis indicated that the 'typical' self-referral was relatively young, with a non-urgent acuity level, presenting with chest pain, eye, ear and nose or throat problems, or having an injury.

Compared to previously published data varying from 3%-76 % [1,11,12], our self-referral rate was high, probably explainable by the location of the inner-city hospital. It has been shown that patients living in highly urbanised areas more commonly bypass their GPs before attending the emergency department [13].

In comparison with other studies, we had a lower percentage of self-referrals presenting with an injury [14,15], and our self-referrals more often had urgent medical problems [14]. Although self-referrals are believed to present with problems that should be treated by their GP and cause 'inappropriate' attendance [16], both findings indicate that this is not true for all self-referrals. 'Inappropriate' attendance in the emergency department has been the subject of many studies [5,17-22]. According to the literature, between 20% and 80% of ED visits are 'inappropriate' [22,23]. The variability in these numbers can be explained by the variable definitions used to determine 'inappropriateness'. The definitions of 'emergency', 'urgency' and 'needing hospital emergency care' are widely debated, and medical professionals and patients differ in what they consider an 'emergency' and 'appropriate visit' [21,22,24,25]. Given the proportion of self-referred patients in our study who did require hospital emergency care - 51% - it seems that many patients are quite capable of assessing their own need for hospital emergency care.

While the medical problems of the self-referrals in this inner-city hospital differ from those in other studies, their motives for seeking hospital emergency care are quite similar

[5,6,18,26-29]. 'Accessibility and convenience' was a major theme in our patients' decisions to bypass the GP, which could indicate a perceived and/or actual block to GP care access in the minds of the patients, even during office hours when their own GP is available.

Still, many non-urgent self-referrals and a part of the urgent self-referrals were eligible for GP care, during office hours as well as during out-of-hours. In the light of the proposed integration of emergency departments and GPCs into one centre, identifying patients eligible for GP care is a major challenge. A patient can be non-urgent but need complex care and a patient can be high-urgent but low complexity [30]. For example, many GPs would consider a child with fever, triaged as urgent, eligible for GP care, while they would refer a patient with a fracture of the finger, triaged as non-urgent, to the emergency department for an X-ray and treatment. While an integrated emergency department and GPC might facilitate efficient referral between the GP and the emergency department, concerns have been voiced that time- and money-consuming double contacts will occur for a part of the self-referrals. Instead of diverting all self-referrals from the emergency department to the GP, regardless of their medical complaint or acuity level, it would be more cost-effective and patient-centred to identify self-referrals in need of hospital emergency care by triage. Ensuring that patients are treated in the appropriate setting would prevent part of the double contacts. According to van der Straten et al. [31], the Manchester Triage System can be used to identify non-urgent and some more urgent patients who can be treated by the GP, although triaging non-urgent patients with extremity problems to either the GP or the emergency department needs further elaboration.

With the high percentage of self-referrals with urgent medical complaints and the rates of self-referrals presenting during office hours, other models of health care delivery than the proposed out-of-hours-emergency department and GPC should be considered. For inner-city hospitals with many self-referrals presenting during office hours, an integrated emergency department and GPC which functions 24 h a day, 7 days a week, might work. Other options are GPs working in the emergency department, or the combination of emergency nurse practitioners (ENPs) with emergency physicians. Non-urgent self-referrals can be handled by ENPs via a separate stream for minor injuries and minor illnesses. For more complex problems, an emergency physician or a GP is available, and for self-referrals with major trauma or needing specialist care, emergency physicians are available.

In order to allow for such alternative models of acute care delivery, tariffs for acute care should be independent of the provider of care. This enables efficient deployment of GPCs, independently contracted GPs, ENPs or other professionals tailored to the patient population and health care setting at hand.

We recommend further research into different models of care, their clinical outcomes and cost-effectiveness, and in ways to discriminate between patients needing hospital emergency care and patients who can be managed by the GP. Based on the findings in this study, 'self-referral' as an indicator for eligibility for GP care is not useful.

### Limitations

Firstly, because participating nurses only interviewed patients in their own shift, 42% of the self-referrals could not be asked for their motives for presenting to the emergency department. Nurses were instructed to include all self-referrals presenting during their shifts. However, participating nurses worked more often during out-of-hours, resulting in more interviewed self referrals during out-of-hours than during office hours and in more non-injured self-referrals than injured self-referrals being interviewed. Subgroup analysis showed some differences in percentages of the motives given during office hours and out-of-hours; however, overall conclusions were not influenced and the order of frequency was unchanged. The oral interviewing allowed patients who would have been unable to fill out a questionnaire due to illiteracy to participate. With over 1,700 answers, it is unlikely that collecting additional interviews would have revealed other themes.

Furthermore, we believe that both major motives ('accessibility and convenience' and 'medical necessity') would rather increase than decrease when more self-referrals presenting with injuries were asked for their motives. This suggests our results underestimate the importance of these motives.

Our criterion 'needing hospital emergency care' is not validated. Misclassification can go both ways: some patients classified as needing hospital emergency care might be equally well managed in primary care, and some patients might need hospital emergency care but did not fit in our criteria of needing hospital emergency care. An example of the first possibility is a patient with a headache, classified as 'needing hospital emergency care' based on having a CT-scan performed to rule out brain haemorrhage. This patient was discharged home after excluding a brain haemorrhage. However, the GP might not have referred this patient to the emergency department for a diagnostic test to begin with. An example of the second possibility is a patient with a minor arterial bleeding, requiring surgical wound care. This patient is neither admitted nor suffering from an extremity fracture, does not need any diagnostic test and would thus be considered 'not needing hospital emergency care' in our definition.

We considered patients arriving by ambulance as non-self-referred, actually needing emergency care, because Dutch ambulance nurses are trained to assess whether a subject should be presented to the emergency department. It is therefore less likely that there were patients 'suitable for GP care' among the patients arriving by ambulance.

Finally, our study was conducted in a single inner-city institution; therefore, the results may not be generalizable to hospitals with a different ED patient case mix.

## **CONCLUSIONS**

In this inner-city hospital, 60% of the ED patients were self-referred. A substantial part of these patients needed hospital emergency care. Another part could have been treated by a GP, for many non-urgent as well as several urgent problems during office hours as well as out-of-hours.

We advocate for a health care system that is the same 24 h a day, 7 days a week, with one access point to medical care. Provision of acute care should be tailored to the patient population and health care setting. This includes efficient use of medical personnel (GPs, ENPs, emergency physicians, etc.) skilled to evaluate and/or treat the problem at hand, be it urgent, acute, complex, nocturnal or none of the above.

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# Chapter 4

## Unscheduled return visits to a Dutch inner-city emergency department

M. Christien van der Linden  
Robert Lindeboom  
Rob J. de Haan  
Naomi van der Linden  
Ernie R.J.T. de Deckere  
Cees Lucas  
Steven J. Rhemrev  
J. Carel Goslings

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## ABSTRACT

### Objectives

Unscheduled return visits to the emergency department may reflect shortcomings in care. This study characterised emergency department return visits with respect to incidence, risk factors, reasons and post-emergency department disposition. We hypothesised that risk factors for unscheduled return and reasons for returning would differ from previous studies, due to differences in health care systems.

### Methods

All unscheduled return visits occurring within 1 week and related to the initial emergency department visit were selected. Multivariable logistic regression was conducted to determine independent factors associated with unscheduled return, using patient-information available at the initial visit. Reasons for returning unscheduled were categorised into illness-, patient-, or physician-related. Post-emergency department disposition was compared between patients with unscheduled return visits and the patients who did not return.

### Results

Five percent ( $n = 2,492$ ) of total emergency department visits ( $n = 49,341$ ) were unscheduled return visits. Patients with an urgent triage level, patients presenting during the night shift, with a wound or local infection, abdominal pain or urinary problems were more likely to return unscheduled. Reasons to revisit unscheduled were mostly illness-related (49%) or patient-related (41%). Admission rates for returning patients (16%) were the same as for the patients who did not return (17%).

### Conclusions

Apart from abdominal complaints, risk factors for unscheduled return differ from previous studies. Short-term follow-up at the outpatient clinic or general practitioner for patients with urgent triage levels and suffering from wounds or local infections, abdominal pain or urinary problem might prevent unscheduled return.

## BACKGROUND

Unscheduled return visits to the emergency department (ED) are visits of patients who were seen in the emergency department and then return for an unscheduled visit for the same complaint. Unscheduled return visits may reflect a failure of the patients' treatment or discharge plan [1]. Different numbers of unscheduled return visits have been reported, ranging from 2 to 5% of the patients returning to the emergency department within 2 to 8 days after their initial visit [2-9]. The reasons for unscheduled return are frequently grouped into illness-related factors (such as disease progression), patient-related factors (such as patients who left against medical advice during their initial visit) and physician-related factors (such as medical errors) [3,6,7]. Unscheduled return visits are more common in patients who lack access to primary care [10] and in patients with no health insurance [11]. Unscheduled return is associated with frequent ED use [12] and a greater risk of adverse events and an increased mortality risk [13].

In order to reduce unscheduled return visits, researchers have focused on risk factors that could help identify patients at risk for unscheduled return [11,14-19]. Most of these studies have been performed in Canada and the USA and reported acute triage category [14,16], arrival in the evening [14] and a respiratory diagnosis [19] as risk factors for paediatric unscheduled return. A digestive diagnosis was reported as risk factor for unscheduled return in patients 65 years of age or older [17,18]. Having no insurance, a low triage category and suffering from dermatologic conditions [11] were risk factors for unscheduled return in a mixed (adults and children) population.

In the Netherlands the incidence of unscheduled ED return is unknown. We expect however that the incidence is lower than described in previous studies. Because all Dutch citizens have a general practitioner (GP) and GP services are available 24/7, patients should present at their GP instead of at the emergency department when they have ongoing complaints. We also hypothesise that the type of risk factors associated with unscheduled return differs from other studies, given the difference in health care systems. Health insurance is compulsory for all Dutch citizens, and health insurers are obliged to accept anyone who applies for standard health insurance.

The objectives of this study were to determine the incidence of unscheduled ED return visits, to identify the risk factors for these return visits, to assess the reasons for unscheduled return and to describe the post-ED disposition of patients at their return visit.

## METHODS

The study was conducted between 1 October 2009 and 30 September 2010 at the emergency department of Medical Centre Haaglanden, the Hague, the Netherlands, an urban, 380-bed trauma centre. The annual volume in the emergency department is approximately 52,000 visits, with a 17 % admission rate.

The following are the methods of measurement used for each objective.

1. To determine the incidence of ED return visits, we performed a database search of the patients' records. Emergency department return visits were included if they took place within 1 week of the initial visit and concerned the same complaint or its direct consequences. Scheduled return visits (visits of patients who were told to come back to the emergency department) were excluded.
2. To identify factors associated with unscheduled return, we manually reviewed all individual patient charts and compared patients with unscheduled return visits with patients who did not return. We examined factors (available at the initial visit) that were associated with unscheduled return in previous research, including age [14,20], sex [17,20], lacking health insurance [11], lacking a GP [10], triage level [11,14,16,20], arrival time [14,21], length of stay (LOS) [22] and medical complaints [11,15,18]. Medical complaints for which a patient visited the emergency department were retrieved by the triage flow charts recorded by the triage nurse.
3. Reasons for returning unscheduled were categorised into illness-related, patient-related or physician-related (Table 1), based on examples from previous studies [6,9,23]. Categorisation was independently done by two researchers (MCL and NL). In case of no agreement, the case was reviewed by a third researcher (ERJTD) and assigned to the category on which two of three researchers agreed.
4. Post-ED dispositions were the discharge codes after the patients' treatment at the emergency department, comprising discharge, discharge against medical advice or left without being seen, hospital admission to a regular ward or admission to a special care unit (intensive care, coronary care or stroke unit).

All variables were obtained from the hospital electronic database and the medical records. The analysed patient dataset contained no individual identifiers, maintaining anonymity of subjects. This study was approved by the regional medical research ethics committee and the institutional review board.

**Table 1.** Reasons for unscheduled return and definitions

	Definition
<b>Physician-related return</b>	
No painkillers prescribed	The disease or injury warranted pain medication but no prescription was given. The patient returned primarily because of continued pain
Treatment error	The physician made the right diagnosis during the initial visit, but made an error in treatment
Misdiagnosis	Medical record review reveals a diagnosis or problem missed by the physician who saw the patient on the initial visit
<b>Patient-related return</b>	
Left against medical advice	The patient was seen by a physician and left the emergency department against medical advice
Non-compliance	There is evidence in the medical records that the patient did not follow instructions
Psychiatric disorder and/or substance abuse	The patient has a psychiatric disorder and/or uses drugs or alcohol, which causes him/her to repeatedly visit the emergency department for the same or similar problems. Mentally, the patient is in a chronic stable state
Left without being seen	The patient was registered in the emergency department but left before being seen by a physician
Patient was instructed to visit own GP	The patient was instructed to return to the GP for re-evaluation but did not go
Worrying about health	The patient’s anxiety caused him/her to return to the emergency department for the same or similar problem. No ancillary diagnostics were performed and medical management consisted of reassurance only
<b>Illness-related return</b>	
Recurrent disease process	The patient has a disease that tends to have recurrent exacerbations (i.e. asthma, sickle cell disease). The patient was treated appropriately during the initial ED visit, with resolution of symptoms, but later returned with a second exacerbation of the disease
Complication	The patient was treated appropriately during the initial ED visit but returned to the ED because of a complication of the disease or unpredictable side effect of treatment (e.g. allergic drug reaction)
Progression of disease	The medical records reveal that the patient was treated appropriately at the initial visit and that admission was not indicated. Appropriate follow-up was arranged, but the patient’s disease or problem got worse, and he/she returned to the emergency department as instructed
Ancillary diagnostics performed, no change in diagnosis	The patient presented with the same or similar problem, ancillary diagnostics were performed but there was no change in the initial diagnosis or treatment

### **Analysis**

Patient and clinical characteristics were summarised using simple descriptive statistics. The  $\chi^2$  test and unadjusted odds ratios (ORs) were used to assess the univariate association between age, sex, lacking health insurance, lacking a GP, triage level, arrival time, LOS and medical complaints on the one side and unscheduled return within 1 week on the other side.

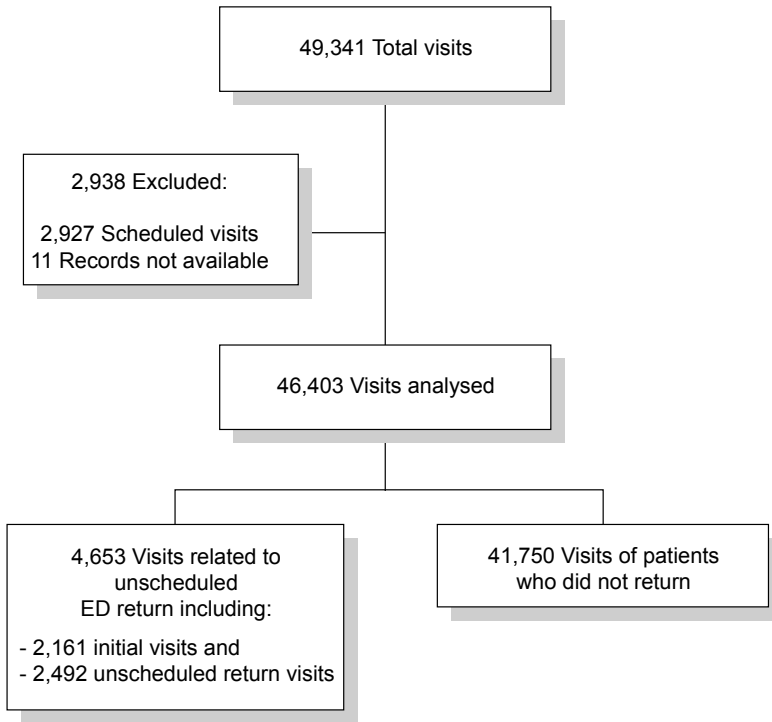
Additionally, all variables that were univariately associated with unscheduled return at  $\leq 0.05$  were entered into a multivariate logistic regression model. We also did the analysis with a <72-h unscheduled return. Effect sizes were expressed in adjusted ORs. The calibration and overall discriminative ability of the model was assessed with the Hosmer-Lemeshow test and the area under the receiver operating curve (AUC ROC) analysis, respectively [24]. In all analyses statistical uncertainty was expressed in a 95% confidence interval (CI). Statistical analyses were performed in PASW (Predictive Analytics Software, version 18, Chicago, Illinois, USA).

## **RESULTS**

### **Return rate**

During the study year, a total of 49,341 ED visits were recorded, of which 4,653 visits were related to unscheduled return (Figure 1). In total, 2,161 patients returned unscheduled to the emergency department within a week of their initial registration. Since some of them returned more than once, there were 2,492 associated unscheduled return visits, comprising 5.1 % of the total ED visits (2,492/49,341).

During the first 72 h after the initial visit, 1,279 patients made 1,330 return visits out of 49,341 total ED visits for an overall 72-h return rate of 2.7 %.



**Figure 1.** Flowchart: number of visits and return visits

**Factors associated with unscheduled return**

Table 2 shows the univariate and multivariate associations between patient/clinical characteristics available at the initial visit and unscheduled ED return within 1 week. Logistic regression showed that the following factors had an independent impact on within-week unscheduled return: ‘urgent triage level’, ‘arrival during the night’, ‘LOS >1 h’ and the medical complaints ‘wound or local infections’, ‘abdominal pain’ and ‘urinary problems’ at the initial visit. Patients suffering from ‘chest pain’, ‘feeling unwell’ and children triaged with the category ‘sick baby’ were less likely to return unscheduled. The goodness of fit of the logistic model was moderate ( $P = 0.75$ ), whereas the AUC demonstrated a weak discriminative ability (0.57; 95% CI 0.56 to 0.59).

Sub-analysis of 72-h return showed that associated factors were the same as for within-week return (data not shown).

**Table 2.** Characteristics associated with unscheduled ED return: univariate and multivariate analysis

	Patients who did not return ( <i>n</i> = 41,750)	Patients with unscheduled return visits ( <i>n</i> = 2,161)	Unadjusted odds ratio <sup>ab</sup> (95% CI), <i>P</i>	Adjusted odds ratio <sup>abc</sup> (95% CI), <i>P</i>
Age [Mean, Standard Deviation]	38,2 (22.3)	39,3 (20.7)	1.00 (1.00, 1.00), 0.03	- <sup>e</sup>
Sex, male [n, %]	21,572 (51.7)	1,155 (53.4)	1.07 (0.99, 1.17), 0.11	-
Lacking health insurance [n, %]	1,714 (4.1)	97 (4.5)	1.01 (0.89, 1.35), 0.38	-
Lacking a GP [n, %]	3,255 (7.8)	155 (7.2)	0.91 (0.77, 1.08), 0.29	-
Triage level [n (%)]				
Level 1 and 2 Immediate and very urgent	6,482 (16.1)	298 (14.2)	1.00 (0.88, 1.15), 0.96	1.13 (0.97, 1.32), 0.12
Level 3. Urgent	13,324 (33.1)	859 (41.0)	1.41 (1.28, 1.55), <0.01	1.40 (1.26, 1.55), <0.01
Level 4 and 5 Standard and non-urgent	20,428 (50.8)	936 (44.7)	1	1
No triage <sup>c</sup> [n (%)]	1,516 (3.6)	68 (3.1)	0.86 (0.67, 1.10), 0.24	-
Arrival time [n (%)]				
Day, 7.30 a.m.-3.29 p.m.	17,844 (42.7)	882 (40.8)	1	1
Evening, 3.30 p.m.-10.59 p.m.	18,193 (43.6)	925 (42.8)	1.03 (0.94, 1.13), 0.56	1.03 (0.94, 1.14), 0.54
Night, 11 p.m.-7.29 a.m.	5,713 (13.7)	354 (16.4)	1.25 (1.10, 1.42), <0.01	1.24 (1.09, 1.41), <0.01
Length of stay [n (%)]				
<1 hour	9,918 (23.8)	435 (20.1)	1	1
1-2 hours	11,966 (28.7)	648 (30.0)	1.24 (1.09, 1.40), <0.01	1.25 (1.09, 1.42), 0.00
2-3 hours	8,804 (21.1)	452 (20.9)	1.17 (1.02, 1.34), 0.02	1.16 (1.00, 1.34), 0.05
3-4 hours	5,001 (12.0)	283 (13.1)	1.29 (1.11, 1.50), <0.01	1.26 (1.06, 1.48), 0.01
>4 hours	6,061 (14.5)	343 (15.9)	1.29 (1.12, 1.49), <0.01	1.24 (1.05, 1.45), 0.01
Medical complaint [n (%)]				
Extremity-related complaints	9,789 (23.4)	498 (23.0)	0.98 (0.88, 1.08), 0.67	-
Wounds and local infections	4,726 (11.3)	281 (13.0)	1.17 (1.03, 1.33), 0.02	1.34 (1.17, 1.54), <0.01
Other <sup>d</sup>	4,480 (10.7)	225 (10.4)	0.97 (0.84, 1.11), 0.64	-
Abdominal pain	3,597 (8.6)	269 (12.4)	1.51 (1.32, 1.72), <0.01	1.38 (1.20, 1.59), <0.01
Chest pain	3,547 (8.5)	146 (6.8)	0.78 (0.66, 0.93), <0.01	0.78 (0.64, 0.94), 0.01
Feeling unwell	3,124 (7.5)	131 (6.1)	0.80 (0.67, 0.96), <0.01	0.75 (0.62, 0.91), 0.00
Eye/ear/nose problems and sore throat	2,317 (5.5)	107 (5.0)	0.89 (0.73, 1.08), 0.24	-
Shortness of breath	2,085 (5.0)	99 (4.6)	0.91 (0.74, 1.12), 0.39	-
Headache and head injury	1,943 (4.5)	98 (4.7)	0.97 (0.79, 1.20), 0.80	-
Back pain	826 (2.0)	37 (1.7)	0.86 (0.62, 1.20), 0.39	-
Trauma, severe	771 (1.8)	32 (1.5)	0.80 (0.56, 1.14), 0.22	-
Psychiatric problem	685 (1.6)	44 (2.0)	1.25 (0.92, 1.70), 0.16	-
Rashes	660 (1.6)	32 (1.5)	0.94 (0.66, 1.34), 0.72	-
Urinary problems	641 (1.5)	59 (2.7)	1.80 (1.37, 2.36), <0.01	1.72 (1.31, 2.26), <0.01
Sick baby	524 (1.3)	12 (0.6)	0.44 (0.25, 0.78), <0.01	0.47 (0.27, 0.84), 0.01
No medical complaint registered	2,035 (4.9)	91 (4.2)	0.86 (0.69, 1.06), 0.16	-

<sup>a</sup> Categorical variables (triage level, arrival time and categorised LOS) were entered as 'dummy' variables.

<sup>b</sup>  $\chi^2$  test, OR>1 indicates an increased risk of unscheduled return.

<sup>c</sup> Adjusted for included variables (age, triage level, arrival time, LOS, medical complaint) by logistic regression model, based on 42,327 observations (40,234 visits of patients who did not return and 2,093 unscheduled return visits) due to missing values on triage level (*n* = 1,584).

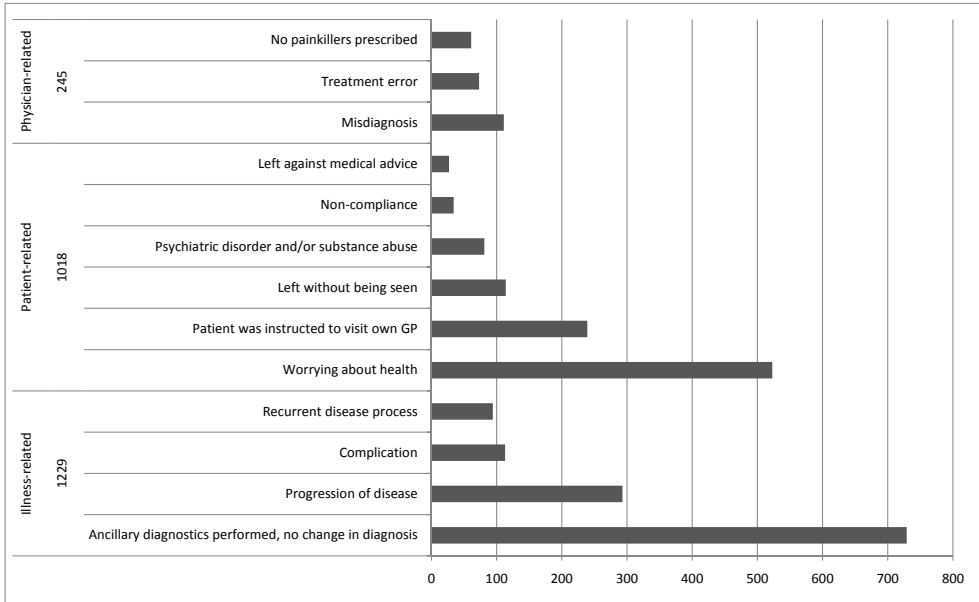
<sup>d</sup> Medical complaints occurring less than 500 times per year (including allergy, dental problems, diabetes, exposure to chemicals, fits, neck pain, pregnancy, sexually acquired infections, testicular pain and vaginal bleeding) were categorised as 'Other'.

<sup>e</sup> Not in multivariable model.



**Reasons for unscheduled return**

The most common reasons for unscheduled return were illness-related ( $n = 1,229$ ; 49%), followed by patient-related ( $n = 1,018$ ; 41%) and physician-related reasons ( $n = 245$ ; 10%) (Figure 2).



**Figure 2.** Reasons for unscheduled return ( $n = 2,492$  visits)

Within the 1,229 illness-related unscheduled return visits, ‘patients in whom ancillary diagnostics was performed while their diagnosis remained unchanged’ was the largest subgroup ( $n = 729$ ; 59%). Within the 1,018 patient-related return visits, patients ‘worrying about health’ represented the most frequently occurring reason for return (523 visits, 51%). Within the physician-related return visits, 111 patients (45%) had ‘wrong or delayed diagnoses’ during their initial visit, which resulted in their return. In 73 physician-related return visits (30%) a ‘treatment error’ was made during the initial visit, such as patients returning with ongoing complaints because a foreign body in a wound was only removed partially. Sixty-one visits (25%) were caused by a ‘lack of a prescription of painkillers’ at the patients’ initial visit.

**Post-ED disposition**

No differences in post-ED disposition were found between patients with unscheduled return visits and patients who did not return (Table 3). Sixteen percent of the unscheduled return visits resulted in admission, versus 17% of the visits of patients who did not return.

**Table 3.** Post-ED destination

	Post-ED destination after a visit of a patient who did not return (n =41,750)	Post-ED destination after an unscheduled return visit (n =2,492)	P <sup>a</sup>
Discharge [n, %]	33,770 (80.9)	2,037 (81.7)	0.29
Hospital admission, regular ward [n, %]	7,145 (17.1)	401 (16.1)	0.19
Hospital admission, special care <sup>b</sup> [n, %]	76 (0.2)	2 (0.1)	0.24
Discharge against medical advice or LWBS <sup>c</sup> [n, %]	727 (1.7)	52 (2.1)	0.20
Morgue [n, %]	32 (0.1)	0	0.17

<sup>a</sup>  $\chi^2$  test

<sup>b</sup> Special care: intensive care unit, coronary care unit or stroke unit

<sup>c</sup> LWBS: patients left the emergency department without being seen by a physician

## DISCUSSION

Our results showed that unscheduled within-week return accounted for 5% (2,492/49,391) of our ED visits, implying an unscheduled return rate of over 200 visits a month.

Despite the Dutch health care system with universal access to primary care, our within-week unscheduled return rate (5%) was higher than in another study using a cut-off point of a week, in which 3.8% unscheduled return [25] was observed. One plausible explanation of our high unscheduled return rate may be that patients not always realise that they have access to a GP 24 h a day. Furthermore, patients with chronic conditions may present to the emergency department despite the 24-h access to the GP.

Comparison of return visit rates among studies is complicated by the different time frames used. Many studies use 72-h return visits [2,7,9-11,14,16,21] while others have used a 30-day delay between the two visits [26,27]. Applying the 72-h time frame in our results, our percentage of unscheduled return visits (2.7%) compares well with published 72-hour return rates, ranging from 2.2% to 5.5% [2,7,9-11,14,16,21]. However, our sub-analysis showed that a 72-h cut-off point would have excluded 47% of the unscheduled return visits, while factors were the same as those associated with unscheduled return visits within 1 week.

Some patients with an unscheduled return visit returned more than once during the week after their initial visit. They may have become ‘frequent flyers’: patients with high ED utilization, defined as patients visiting the emergency department 7 or more times per year [28]. We did not follow-up on our patients with unscheduled return visits, so we cannot present actual numbers on who became a frequent flyer in the 12 months after the initial visit. Frequent ED utilization, in particular by the homeless or substance abusers, seems less a problem in our emergency department [29] than outlined in international literature [30].

When interpreting our medical complaint categorisation as proxy measure for diagnosis, our results support the finding in a previous study [18] that a digestive diagnosis is a risk factor for unscheduled return. Return visits related to 'abdominal pain' might be explained by the difficulty of diagnosing abdominal disorders, which has a wide range of possible causes [10]. Emergency physicians should be particularly cautious when a patient present with a 'high risk for return' diagnosis, such as abdominal pain, and consider a follow-up appointment.

When using the medical complaint 'rashes' as proxy for dermatologic condition, our study contradicts the results in the study of Pham et al [11] as 'rashes' was no risk factor for unscheduled return in our study. Our physicians often refer patients with rashes to the patients' GP. When these patients suffer persisting problems, they will probably return to their GP instead of to the emergency department.

Patients presenting with chest pain or feeling unwell were less likely to return unscheduled. These complaints often indicate cardiac problems. Probably these patients are either admitted at their initial visit or receive an appointment for the outpatient clinic. Parents with a sick baby were also less likely to return. These parents are advised to go to the children's hospital in case of ongoing complaints.

In our study, over 4% of the patients lacked health insurance. Lacking health insurance was not a risk factor for unscheduled return, contradicting previous findings [11]. Our hospital is a regional centre for treatment of people living illegally in the Netherlands. Appointments at the outpatient clinics are arranged for anyone who needs further medical assessment after an ED visit, regardless of insurance status. Therefore, unscheduled return visits are prevented for insured and uninsured patients alike.

In previous research, conflicting findings regarding the association between triage level and unscheduled return are reported. Two studies concerning a paediatric population found that children with a high triage level were more likely to return unscheduled [14,16], while in a study concerning a mixed population, returning patients had low triage levels [11]. In our study, patients with urgent triage levels (at their initial visit) were more likely to incur an unscheduled return visit. Possibly, patients with low triage levels were advised to return to their GP in case of persisting complaints.

Urgent triage levels may reflect a sicker patient in need for continued medical care. The longer LOS of our returning patients as compared with the LOS of patients who did not return may also indicate a sicker patient. However, our post-ED disposition data showed no sign that returning patients were more seriously ill: returning patients had similar hospital

admission rates as the patients who did not return. Future studies should examine outcomes of these patients in more detail.

The percentage of illness-related reasons for unscheduled return in our study (49%) compares well with the 48% to 81% in other studies [3,7,9]. Ten percent of our unscheduled return visits were due to physician-related factors, as compared to 3% to 8% in other studies [7,9]. Patient-related reasons accounted for 41% of the unscheduled return visits in our study, as compared to 11% to 53% in other studies [6,7,9]. Most patient-related returns involved patients 'worrying about health', indicating suitability for assessment and reassurance by the GP.

### **Limitations and strengths**

This study conveys the experience of a single institution and may have limited generalizability because of the social and cultural characteristics of our population and differences in health care delivery in our country. Our findings should be validated in other emergency departments.

Second, we used routinely collected data. This had the advantage of examining data of large numbers of patients. The disadvantage was that we were not able to account for socio-economic factors that are known to influence the probability of ED return visits, such as marital status, socio-economic status (SES), alcohol consumption and homelessness [11,18,31]. The weak discriminative capacity of our identified predictors for unscheduled return indicates that a future prospective study is needed to include these additional risk factors. However, such a study design should take into account the reliability issues associated with measuring SES and alcohol consumption in ED patients.

The categorisation of the reasons of unscheduled return based on retrospective patient documentation was a limitation of our study, which we tried to limit by using explicit criteria for the categories based on previous research [6,9,23].

Another limitation is that not only patients who 'lack health insurance' or 'lack a GP' are registered as such. When it is unclear whether the patient has a health insurance and/or when the patient does not know the name of his/her GP, the patients are also registered as 'lacking health insurance' and/or 'lacking a GP'. Therefore, patients might have been wrongly classified to the 'lack health insurance' or 'lack GP' group, thereby diluting a possible association between health insurance/GP-status and unscheduled return.

The strengths of this study include its complete data collection. The 11 patient records that were unavailable concerned only one patient, so selection bias was negligible. However, patients may have visited other hospital emergency departments after their visit to the study setting which may have led to some cases not identified.

## CONCLUSIONS

Unscheduled within-week return accounted for 5% of the ED visits. Most associated factors (an urgent triage level, arriving during the night, suffering from a wound or local infection, or a urinary problem) differ from previous studies, except for abdominal complaints, which was found to be a risk factor in many other studies. The reasons for ED return were comparable with studies from other countries: most often illness-related, then patient-related and least often physician-related reasons (e.g. ongoing complaints because of a foreign body left behind in a wound or lack of prescription of pain killers) prompted the patient back to the emergency department. Short-term follow-up at the outpatient clinic or GP for patients with urgent triage levels and suffering from wounds or local infections, abdominal pain or urinary problem might prevent unscheduled return.

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# Chapter 5

## **Rate, characteristics, and factors associated with high emergency department utilization**

M. Christien van der Linden  
Crispijn L. van den Brand  
Naomi van der Linden  
A.H.J.H. (Annelijn) Rambach  
Caro Brumsen

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## ABSTRACT

### Background

Patients with high emergency department utilization account for a disproportionate number of emergency department visits. The existing research on high emergency department utilization has raised doubts about the homogeneity of the frequent emergency department user. Attention to differences among the subgroups of frequent visitors and highly frequent visitors is necessary in order to plan more effective interventions.

In the Netherlands, the incidence of high emergency department utilization is unknown. The purpose of this study was to investigate if the international well-documented high emergency department utilization also exists in the Netherlands and if so, to characterise these patients. Therefore, we assessed the proportion of frequent visitors and highly frequent visitors; compared age, sex, and visit outcomes between patients with high emergency department utilization and patients with single emergency department visits; and explored the factors associated with high emergency department utilization.

### Methods

A 1-year retrospective descriptive correlational study was performed in two Dutch emergency departments, using thresholds of 7 to 17 visits for frequent emergency department use, and greater than or equal to 18 visits for highly frequent emergency department use.

### Results

Frequent visitors and highly frequent visitors (together accounting for 0.5% of total emergency department patients) attended the emergency department 2,338 times (3.3% of the total number of emergency department visits). Frequent visitors and highly frequent visitors were equally likely to be male or female, were less likely to be self-referred, and they suffered from urgent complaints more often compared to patients with single visits. Frequent visitors were significantly older than patients with single visits and more often admitted than patients with single visits. Several chief complaints were indicative for frequent and highly frequent emergency department use, such as shortness of breath and a psychiatric disorder.

### Conclusions

Based on this study, high emergency department utilization in the Netherlands seems to be less a problem than outlined in international literature. No major differences were found between frequent visitors and highly frequent visitors, they presented with the same, often serious, problems. Our study supports the notion that most patients with high emergency department utilization visit the emergency department for significant medical problems.

## BACKGROUND

Patients with high emergency department (ED) utilization also called 'frequent visitors' (FV) account for a disproportionate number of ED visits [1,2]. Patients with high ED utilization are a well-studied group in the literature [1-17]. The definition of high ED utilization is debatable, ranging from 2 to more than 12 visits per year [2]. Contrary to popular belief, FV are more likely to be admitted and more likely to die in the emergency department, suggesting that frequent visitors are generally sicker than infrequent visitors [1,2,7]. Frequent visitors represent severe psychosocial and medical vulnerability [5] and they are often heavy users of other health and social services [18].

The existing research on high ED utilization has raised doubts about the homogeneity of the FV [15,19,20]. Although FV are known to be a vulnerable population with a poor health status [14], the opposite may be true for the highest frequency visitors. Highly frequent visitors (HFV), defined as patients with 20 or more visits per year, were found to be less ill or injured than patients with single visits [15]. Attention to differences among the subgroups of FV and HFV is necessary in order to plan more effective interventions [20].

### Importance

In the Netherlands, the incidence of high ED utilization is unknown. The purpose of this study was to investigate whether the well-documented international high ED utilization also exists in the Netherlands and if so, to characterise these patients.

Therefore, we assessed the proportion of FV and HFV; compared age, sex, and visit outcomes between patients with high ED utilization and patients with single ED visits; and explored the factors associated with high ED utilization.

## METHODS

A retrospective, descriptive, correlational study was performed in two ED locations in the Netherlands: a level one emergency department in an inner-city trauma centre and a level three emergency department in a hospital located in a small city. High ED utilization was defined according to thresholds developed by Doupe et al. [6]: patients with 7 to 17 visits in 2012 were considered to be FV and those with 18 or more visits in 2012 were considered to be HFV.

Variables collected from the hospitals' database were based on previous research regarding high ED utilization and included age [2,12,21], sex [21], arrival time, arrival transport mode (ambulance or not) [21], referral source (self-referred or non-self-referred), chief complaint [3,10,13,16], triage level [2,17], and visit outcome (admission, leaving without being seen by a doctor (LWBS), or death at the ED) [3,10,21]. Arrival time was categorised in three shifts: day shift (7.30 to 15.29 h), evening shift (15.30-22.59 h) and night shift (23.00 to 7.29 h). Chief complaints were identified from the triage notes for each visit. Chief complaints occurring at least 500 times per year were categorised as such, while chief complaints occurring less than 500 times were categorised as 'Other'. Triage levels were assigned according to the 5-level Manchester Triage System, where: 1. immediate, 2. very urgent, 3. urgent, 4. Standard, and 5. non-urgent [22]. In the analysis, triage levels were combined because of small numbers of patients with levels 1 and 5, to immediate/very urgent, urgent, and standard/non-urgent. The regional medical research ethics committee and the institutional review board approved the study.

### *Analysis*

The proportions of FV and HFV were summarised using descriptive statistics. Age, sex, visit outcomes, and triage level were compared between the patients with high ED utilization (FV and HFV) and patients with a single ED visit, using *t* tests (age) and  $\chi^2$  tests (sex, hospital admission, LWBS, death, triage level). The associations of visit characteristics with the presence of frequent ED use and highly frequent ED use were analysed using logistic regression. The variables included in the models were: arrival time (reference: day shift), arrival with ambulance, self-referral, chief complaint (each medical complaint versus rest of the patients), and triage level (reference: immediate/very urgent).

Two separate logistic regression models were developed, comparing frequent ED use with single ED use, and highly frequent ED use with single ED use. In both models, the ED visit was used as unit of analysis. Adjusted odds ratios (ORs) are provided with their 95% confidence intervals (CIs) to indicate the likelihood of frequent use or highly frequent use for each explanatory variable adjusted for the other variables. The calibration and overall discriminative capacity of the final models were assessed with the Hosmer-Lemeshow test and the area under the receiver operating curve (AUC ROC) analysis, respectively [23]. Data were analysed using Predictive Analytics Software, version 18 (Chicago, Illinois, USA).

## RESULTS

During the 1-year study period, 71,565 consultations were registered at the two emergency departments, of which 50,155 were at the level one emergency department and 21,410 consultations at the level three emergency department. These visits were paid by 51,272 different individuals. Of these 51,272 patients, 38,959 patients visited the emergency department a single time during the study period.

### The proportion of frequent visitors and highly frequent visitors

During the study year, 244 patients attended the emergency department 7 times or more (Table 1): 95% of them ( $n = 232$ ) attended 7 to 17 times on 2,075 occasions and were considered FV.

The remaining 12 patients attended the emergency department 18 times or more during the study year and were categorised as HFV (attending the emergency department on 263 occasions). FV and HFV (together accounting for 0.5% of total ED patients) attended the emergency department 2,338 times (3.3% of the total number of ED consultations).

**Table 1.** Number of ED visits ( $n = 244$  patients representing 2,338 ED visits)

No. of ED visits	<i>n</i> (total 244)	%	Cumulative %
7	90	36.9	36.9
8	39	16.0	
9	36	14.8	
10	22	9.0	76.6
11	12	4.9	
12	12	4.9	
13-17	21	8.6	95.1
18	2	0.8	
20	4	1.6	
22	2	0.8	
23	3	1.2	99.6
34	1	0.4	100

### Patient characteristics and visit outcomes

Results are presented for both emergency departments together, since no statistically significant differences in the results were found between the two emergency departments.

Patient characteristics are shown in Table 2. Frequent visitors were equally likely to be male or female and were significantly older than patients with single visits (mean age 47.5 vs. 39.0 years,  $P < 0.001$ ). Among FV, most patients ( $n = 75$ , 32.3%) were in the age category of 45 to 64 years (data not shown). No differences were found in sex and mean age and between the HFV and the patients with single visits.

**Table 2.** Patients with one ED visit ( $n=38,959$ ) compared with patients with high ED utilization ( $n=244$ )

	Patients with one ED visit ( $n=38,959$ )	Patients with high ED utilization ( $n=244$ )	<i>P</i>
<b>Frequent visitors (<math>n=232</math>)</b>			
Sex, male ( $n, \%$ )	19,788 (50.8)	128 (55.2)	0.183
Age (mean, standard deviation)	39.0 (23.1)	47.5 (20.5)	<0.001
<b>Highly frequent visitors (<math>n=12</math>)</b>			
Sex, male ( $n, \%$ )	19,788 (50.8)	7 (58.3)	0.601
Age (mean, standard deviation)	39.0 (23.1)	48.3 (17.9)	0.161

Visit outcomes are shown in Table 3. Consultations of FV ended in admission significantly more often than consultations of patients with single visits (24.5% vs. 15.9%,  $P < 0.001$ ). LWBS occurred more often during visits of FV. No differences in visit outcomes were found between HFV and patients with single visits. There was no mortality in the patients with frequent or highly frequent ED use.

**Table 3.** Disposition of patients with high ED utilization (compared with single visit patients ( $n=38,959$ ))

	Visits of patients with a single visit ( $n=38,959$ )	Visits of FV ( $n=2,075$ )	<i>P</i> Single visits – visit of FV*	Visits of HFV ( $n=263$ )	<i>P</i> Single visits – visits of HFV*
<b>Admitted</b> [ $n$ (%)]	6,189 (15.9)	509 (24.5)	<0.001	49 (18.6)	0.225
<b>LWBS</b> [ $n$ (%)]	404 (1.0)	46 (2.2)	<0.001	1 (0.4)	0.294
<b>Died</b> [ $n$ (%)]	31 (0.1)	0	-	0	-

\*  $\chi^2$  tests

### Factors associated with high ED utilization

Factors associated with high ED utilization are shown in Table 4 (attendances of FV) and Table 5 (attendances of HFV). Because no notable differences were found between the two emergency departments in factors associated with high ED utilization, results are presented for both emergency departments combined.

Most of the FV and HFV arrived during the day shift or evening shift. However, when corrected for other variables, arriving during the night shift was indicative for high ED utilization. Self-referral was less likely to occur among FV and HFV compared to the patients with single visits. Several chief complaints were indicative for frequent and highly frequent ED use, namely shortness of breath, abdominal pain, urinary tract problems, and psychiatric disorders. HFV arrived by ambulance more often than patients with single visits.

Both FV and HFV were assigned to the non-urgent or standard triage level significantly less often than patients with single visits (42.1% of the FV were non-urgent or standard and 32.8% of the HFV were non-urgent or standard, compared with 54.9% of the patients with single visits,  $P < 0.001$ ).

The Hosmer-Lemeshow goodness-of-fit test  $P$  value for the FV model was significant, indicating that the model is not well calibrated and not useful in predicting FV. The Hosmer-Lemeshow goodness-of-fit test  $P$  value for the HFV model was 0.14. Accuracy of the model as obtained by the AUC ROC was 0.79 (95% CI, 0.76 to 0.82).

**Table 4.** Factors associated with frequent ED use

	Frequent ED use (n =2,075)	Single ED visits (n =38,959)	OR (95% CI) <sup>a, b</sup> Frequent ED use	OR (95% CI) <sup>a, b</sup> Final model, Frequent ED use <sup>c</sup>
<b>Arrival time</b>				
Day shift	888 (42.8)	17,100 (43.9)	Reference	Reference
Evening shift	812 (39.1)	17,078 (43.8)	1.02 (0.92, 1.13)	1.00 (0.90, 1.10)
Night shift	375 (18.1)	4,781 (12.3)	1.42 (1.24, 1.62)	1.38 (1.21, 1.57)
<b>Arrival with ambulance</b>				
	339 (16.3)	4,736 (12.2)	0.91 (0.79, 1.05)	-
<b>Self-referred</b>				
	1,108 (53.4)	26,643 (68.4)	0.70 (0.63, 0.78)	0.70 (0.64, 0.77)
<b>Chief complaint [n (%)]</b>				
Limb problems	235 (11.3)	10,028 (25.7)	0.48 (0.39, 0.59)	0.46 (0.39, 0.54)
Wounds and local infections	147 (7.1)	4,977 (12.8)	0.60 (0.48, 0.76)	0.58 (0.48, 0.70)
Ear, nose problems and sore throat	14 (0.7)	895 (2.3)	0.33 (0.19, 0.57)	0.31 (0.18, 0.54)
Shortness of breath	176 (8.5)	1,376 (3.5)	2.32 (1.84, 2.92)	2.15 (1.79, 2.59)
Abdominal pain	402 (19.4)	3,208 (8.2)	2.36 (1.94, 2.87)	2.21 (1.92, 2.55)
Chest pain	220 (10.6)	2,784 (7.1)	1.46 (1.16, 1.83)	1.37 (1.16, 1.62)
Unwell patient	126 (6.1)	2,146 (5.5)	1.08 (0.84, 1.38)	-
Headache and head injury	56 (2.7)	1,919 (4.9)	0.56 (0.41, 0.77)	0.52 (0.39, 0.69)
Psychiatric disorders	110 (5.3)	541 (1.4)	3.36 (2.55, 4.41)	3.03 (2.41, 3.83)
Back pain	36 (1.7)	705 (1.8)	1.04 (0.72, 1.52)	-
Severe trauma	9 (0.4)	753 (1.9)	0.21 (0.11, 0.42)	0.19 (0.10, 0.37)
Rashes	21 (1.0)	522 (1.3)	0.82 (0.51, 1.31)	-
Urinary tract problems	60 (2.9)	447 (1.1)	2.61 (1.90, 3.59)	2.46 (1.84, 3.27)
Worried parent	2 (0.1)	346 (0.9)	0.12 (0.03, 0.47)	0.11 (0.03, 0.45)
Eye problems	10 (0.5)	901 (2.3)	0.24 (0.13, 0.46)	0.23 (0.12, 0.43)
Pregnancy problems	21 (1.0)	412 (1.1)	1.02 (0.64, 1.63)	-
Other	201 (9.7)	2,901 (7.4)	1.32 (1.06, 1.64)	1.26 (1.05, 1.49)
<b>No triage</b>				
	229 (11.0)	4,098 (10.5)	-	-
<b>Triage level</b>				
Immediate and very urgent	403 (20.2)	5,286 (14.0)	Reference	-
Urgent	752 (37.7)	11,749 (31.1)	0.95 (0.83, 1.10)	-
Standard and non-urgent	840 (42.1)	20,768 (54.9)	1.01 (0.87, 1.19)	-
No triage	80 (3.9)	1,156 (3.0)	-	-

<sup>a</sup> Adjusted for other variables by logistic regression, OR > 1 indicate an increased risk of frequent visit.

<sup>b</sup> Model based on 39,798 observations due to 1,236 missing values.

<sup>c</sup> Hosmer-Lemeshow test <0.001, AUC ROC 0.70 (0.69 to 0.71).



**Table 5.** Factors associated with highly frequent ED use

	Visit of HFV (n =263)	Visits of patients with one ED visit (n =38,959)	OR (95% CI) <sup>a, b</sup> Highly frequent ED use	OR (95% CI) <sup>a, b</sup> Final model, Highly frequent ED use <sup>c</sup>
<b>Arrival time</b>				
Day shift	102 (38.8)	17,100 (43.9)	Reference	Reference
Evening shift	97 (36.9)	17,078 (43.8)	1.05 (0.79, 1.40)	1.05 (0.79, 1.40)
Night shift	64 (24.3)	4,781 (12.3)	1.73 (1.24, 2.42)	1.71 (1.23, 2.40)
<b>Arrival with ambulance</b>	78 (29.7)	4,736 (12.2)	2.02 (1.43, 2.85)	1.97 (1.40, 2.79)
<b>Self-referred</b>	119 (45.2)	26,643 (68.4)	0.68 (.050, 0.93)	0.67 (0.49, 0.91)
<b>Chief complaint [n (%)]</b>				
Limb problems	25 (9.5)	10,028 (25.7)	0.55 (0.29, 1.04)	-
Wounds and local infections	27 (10.3)	4,977 (12.8)	1.22 (0.65, 2.28)	-
Ear, nose problems and sore throat	1 (0.4)	895 (2.3)	0.25 (0.03, 1.92)	-
Shortness of breath	41 (15.6)	1,376 (3.5)	4.49 (2.48, 8.11)	9.17 (6.10, 13.78)
Abdominal pain	42 (16.0)	3,208 (8.2)	2.22 (1.24, 3.98)	4.47 (3.01, 6.65)
Chest pain	30 (11.4)	2,784 (7.1)	1.87 (0.99, 3.53)	3.88 (2.43, 6.19)
Unwell patient	8 (3.0)	2,146 (5.5)	0.46 (0.19, 1.09)	-
Headache and head injury	2 (0.8)	1,919 (4.9)	0.16 (0.04, 0.70)	-
Psychiatric disorders	20 (7.6)	541 (1.4)	3.49 (1.75, 6.96)	7.23 (4.22, 12.40)
Back pain	0	705 (1.8)	-	-
Severe trauma	0	753 (1.9)	-	-
Rashes	1 (0.4)	522 (1.3)	0.41 (0.05, 3.09)	-
Urinary tract problems	36 (13.7)	447 (1.1)	14.68 (8.04, 26.81)	29.43 (19.25, 44.98)
Worried parent	0	346 (0.9)	-	-
Eye problems	1 (0.4)	901 (2.3)	0.27 (0.04, 2.06)	-
Pregnancy problems	0	412 (1.1)	-	-
Other	12 (4.6)	2,901 (7.4)	0.73 (0.35, 1.55)	-
<b>No triage</b>	17 (6.5)	4,098 (10.5)	-	-
<b>Triage level</b>				
Immediate and very urgent	53 (20.2)	5,286 (14.0)	Reference	Reference
Urgent	123 (46.9)	11,749 (31.1)	1.42 (0.99, 2.02)	1.48 (1.04, 2.11)
Standard and non-urgent	86 (32.8)	20,768 (54.9)	1.05 (0.68, 1.61)	1.16 (0.76, 1.76)
No triage	1 (0.4)	1,156 (3.0)	-	-

<sup>a</sup> Adjusted for other variables by logistic regression, OR > 1 indicate an increased risk of frequent visit.

<sup>b</sup> Model based on 38,065 observations due to 1,157 missing values.

<sup>c</sup> Hosmer-Lemeshow test 0.14, AUC ROC 0.79 (0.76 to 0.82).

## DISCUSSION

Since no univocal definition of high ED utilization exists in the literature [2], we used the thresholds recently developed by Doupe et al.[6]. They suggested that patient characteristics changed meaningfully at a breakpoint of 7 ED visits per year, thereby providing an objective threshold [6].

We assessed 244 individual frequent and highly frequent visitors (244 of 51,272=0.5% of total ED patients in one year), who presented to the two emergency departments on 2,338 occasions (2,338 of 71,565=3.3% of total ED consultations in one year). Frequent visitors and HFV together in this study are a low percentage (0.5%) compared to another study using the same thresholds, where FV composed 2.1% of users and 9.9% of ED visits, whereas HFV composed 0.2% and 3.6% of users and visits, respectively [6]. It is possible that the strong primary care network in the Netherlands prevents part of the ED visits. Since practically all Dutch citizens have a general practitioner (GP) and GP services are available 24/7, patients may present to their GP instead of at the emergency department.

Frequent visitors were significantly older than patients with single visits (47.5 vs. 39.0 years), but HFV were not. Comparing our findings with other studies is difficult: we found a study indicating that the common FV is 35 years of age [10], as well as a study claiming that as individuals get older, the risk of high ED utilization increases slightly [12]. In our study, FV were equally likely to be male or female. Results in the existing literature are equivocal; in some studies, women were disproportionately associated with high ED utilization [1,2,24] but the contrary has also been observed [6,8,11]. Besides age and gender, literature also shows some variation in presenting complaints observed by study site. Coinciding with our findings, abdominal complaints [10], shortness of breath [4,9,21] and mental illness [1,5,7,21] tend to be the most common. Psychiatric morbidity has been found to be a significant predictor of high ED utilization [1,5,6,8,9,13,21]. In our study, the odds of being a FV or a HFV (versus a patient with one ED visit) were about 3 to 7-fold greater for patients attending with a psychiatric problem as the chief complaint.

In other studies, most frequent visits occurred during the evening or night shifts [3,10]. In our study, most of the FV and HFV arrived during the day or evening shift. However, when corrected for other variables, arriving during the night shift was indicative for high ED utilization. Frequent ED use during so called off-hours is sometimes thought to be indicative of inadequate primary care [10]; however, in the Netherlands most people are registered with a local GP and out-of-hours GP cooperatives are available 24/7.

Although heterogeneity is assumed amongst the subgroups of FV and HFV, in our study, HFV were not very different from FV: they presented with the same problems and both were less likely to be self-referred compared with patients with single visits. We found differences mainly in admission rates and ambulance-use; HFV were more often brought in by ambulance but less often admitted for further analysis. However, the validity of our conclusions regarding the HFV, being a very small group of patients ( $n = 12$ ), may be unreliable and differences between FV and HFV and between HFV and patients with a single visit should be further examined using a larger sample of HFV.

Most studies indicate that patients with high ED utilization are usually sick patients with chronic illness associated with high admission rates [1,2,7]. To corroborate this, our FV and HFV were less often assigned to the non-urgent or standard triage level than patients with single visits, and they were less likely to be self-referrals and FV had higher admission rates compared to patients with single visits. These findings suggest that FV present with more alarming symptoms. We recommend building alerts into the ED information system, drawing attention of the treating physician when a patient presents to the emergency department for the seventh time within a year. If hospital admission is not indicated for that particular patient, at least an appointment at the outpatient clinic should be considered.

### **Limitations**

First, we were not able to account for some of the socio-economic factors that are known to influence high ED utilization, such as race, alcohol dependence, homelessness, and insurance coverage [3,5,10,17,21]. More work is needed to search for other potential risk factors not captured in this study.

Second, the finding that FV had higher admission rates than patients with single visits should be considered with great caution and warrants further investigation. When patients present for the third or fourth time within a few days, physicians tend to admit this patient for further analysis, so bias by frequency of presentation is possible.

Third, we had no data on our patients' medical diagnoses and thus we were not able to compare our findings regarding psychiatric co-morbidity with other studies. Instead of diagnoses, we used chief complaints based on the triage flow charts. The use of chief complaints was sufficient for our purpose (identifying factors associated with high ED utilization) and certainly more feasible than using medical diagnoses.

Fourth, we had no data on patients' use of other emergency departments in the surrounding area. FV and HFV are prone to use more than one health care service [18], so the rate of their ED use may in fact be an underestimation.

Finally, our findings may have limited generalizability because of cultural, social and health care delivery characteristics of our population.

## CONCLUSIONS

Based on this two-ED study, in the Netherlands high ED utilization seems to be less of a problem than outlined in international literature. No major differences were found between FV and HFV. Both presented with shortness of breath, abdominal pain, urinary tract problems, or psychiatric disorders more often compared to patients with single ED visits. Frequent visitors were more likely to be admitted than patients with single visits. Our study supports the notion that most patients with high ED utilization visit the emergency department for significant medical problems.

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# Part III

## THROUGHPUT OF THE EMERGENCY DEPARTMENT





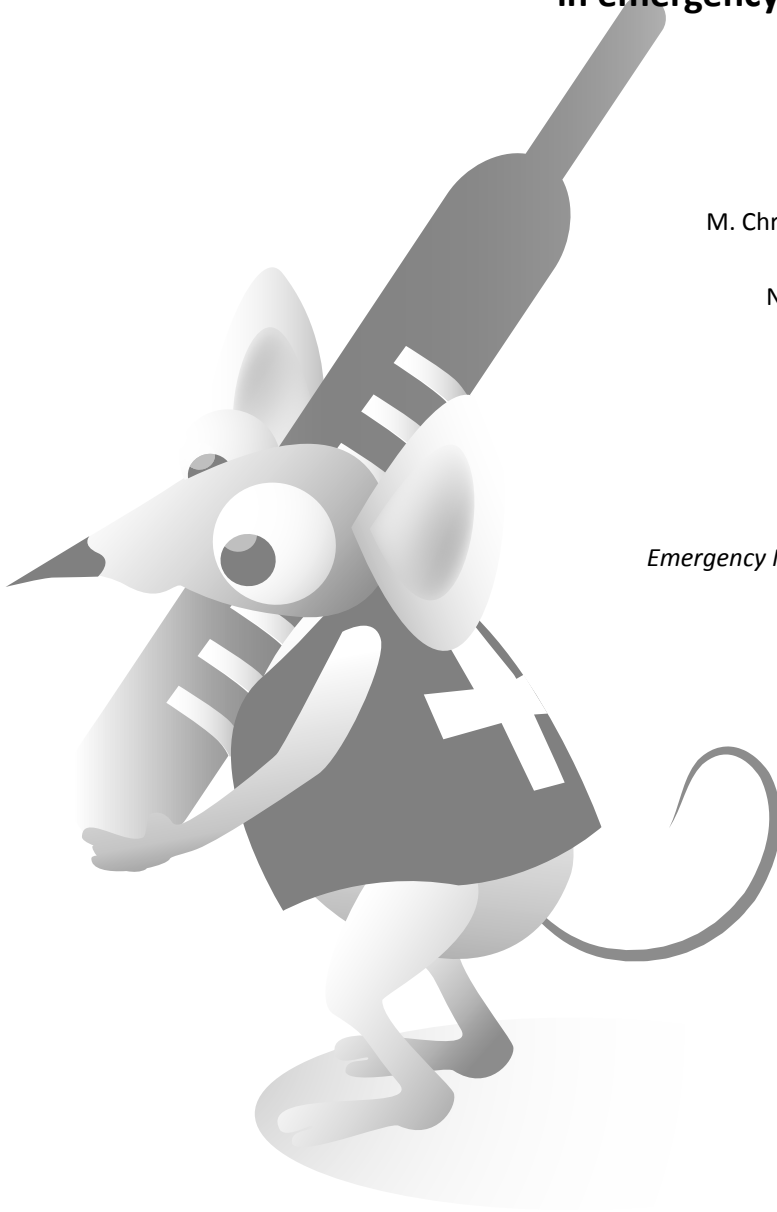


# Chapter 6

## Refining a triage system for use in emergency departments

M. Christien van der Linden  
Robert Lindeboom  
Naomi van der Linden  
Cees Lucas

*Emergency Nurse*, 2011, 19: 22-4



## SUMMARY

This article reports on the implementation of an adapted version of the Manchester Triage System [1] in a Dutch hospital to allow trained emergency nurse practitioners to treat patients with minor injuries or illnesses, and to assess, treat and discharge patients autonomously. The project has helped to prevent long waits in emergency departments for patients with less urgent conditions.

## INTRODUCTION

Each year in the Netherlands, about 1.8 million people seek emergency care in 93 emergency departments (EDs) [2]. This high demand is one of the causes of overcrowding, which leads to long waiting times and patient dissatisfaction [3].

Many Dutch hospitals have introduced triage systems to prioritise patients according to the severity of their conditions; others have introduced fast-tracking systems for patients with minor injuries, such as simple fractures or suturing of wounds [4].

Both of these systems have been introduced at the authors' hospital, the Medical Centre Haaglanden, in the Hague, to improve patient flow. In 2002, the medical centre successfully implemented the Manchester Triage System (MTS) [1].

Soon afterwards, it introduced a fast-track system that allows specially trained emergency nurses to treat patients with non-life-threatening conditions and so ensure that patients with less urgent conditions need not wait too long. Both systems were used by triage nurses.

The use of both systems had disadvantages for the emergency department, however. Patients experienced delays between registration and assessment, particularly when several patients arrived at the same time. Meanwhile, the combination of triage and a fast-track system took a long time to introduce and the emergency department struggled to meet the triage operational standard of assessing new patients within ten minutes of arrival.

In addition, some triage nurses did not think they were competent enough to make autonomous clinical decisions about treatment, investigations and discharge, and fast tracking was interpreted differently by individual members of staff.

It was decided, therefore, that fast tracking should not be performed during patients' initial triage when workload was high. Instead, some emergency nurses were retrained as emergency nurse practitioners (ENPs) to manage the fast tracking of patients with injuries or illnesses that were not life-threatening, and to assess, treat and discharge patients autonomously.

## EMERGENCY NURSE PRACTITIONERS

In the Netherlands, advanced ENPs work autonomously within a defined scope of practice and are skilled in the diagnosis and management of patients. They are registered emergency

nurses with master's degrees in advanced nursing practice, which prepare nurses for the role over two years by helping them to deepen and broaden their basic skills, learn new competencies and expand their scope of practice. During a period of internship, the knowledge and skills they need to care for specific categories of patients are taught by senior medical staff.

Local protocols allow ENPs to diagnose and treat patients with a wide range of defined non-life-threatening injuries and illness, including simple fractures, wounds requiring suturing, burns, foreign objects in skin or body cavities and blunt limb trauma, as well as infections in the eye, ear or throat. They can also initiate diagnostic imaging and pathology testing, prescribe and admit and discharge patients.

Because ENPs manage patients with a wide range of conditions, the risk of incorrect decision making is increased, so they must initially undergo close supervision by emergency physicians. Their competence is then assessed by teams of specialists who undertake daily reviews of the charts and radiographs of all patients treated by ENPs, as they would for junior doctors or senior house officers. The charts and radiographs are reviewed for accuracy of diagnosis and treatment.

In using the MTS, nurses allocate to patients one of the five MTS clinical categories: 1, or 'red', 2, or 'orange', 3, or 'yellow', 4, or 'green', and 5, or 'blue'. This allocation depends on the extent to which patients' conditions conform to MTS 'discriminators', or characteristics. There are more than 180 of these discriminators, which are presented on 52 different flowcharts [1].

Category 2 patients are treated only by ENPs who are competent to diagnose and treat the relevant conditions, which means that most ENPs treat only category 3, 4 or 5 patients. So, for example, ENPs are competent to treat patients with dislocated shoulder, who are allocated to category 2 because the condition is painful, but are not competent to treat children with asthma, who are allocated to the less urgent category 4, because ENPs are not trained in paediatric care. Thus, ENPs' diagnoses are not linked directly to clinical priority.

To clarify role boundaries and manage patient streaming, it was decided that a standardised system for identifying which patients are suitable for treatment by ENPs at triage was needed.

A literature search was undertaken to clarify the roles and responsibilities of ENPs in emergency departments and to identify existing systems for prioritising patients. Most studies in the international literature on ENP practice in emergency setting focus on how they manage patients with non-urgent conditions and most of these conclude that ENPs reduce waiting times and length of stay in emergency departments [4,5], or improve patient satisfaction [6,7] or care outcomes [7,8].

The literature also shows that the scope of the ENP role varies. For example, some ENPs work in fast-track areas, others provide care to acute and critically ill patients, and some practise in both areas [9].

At the Medical Centre Haaglanden, it was decided that ENPs should treat patients with non-life-threatening injuries and illnesses and some problems, such as shoulder dislocation or renal colic, which are more urgent. A second literature search was undertaken, therefore, for a clear method of patient allocation to ENP consultation.

Many organisations have written clinical-practice guidelines on which the allocation of patients to ENPs is based [10,11]. Meanwhile, in some emergency departments, triage nurses draw up lists of relevant conditions that can be assessed and treated by ENPs [12] or limit the scope of practice of ENPs to specific triage categories [13].

## TRIAGE EXTENSION

The authors searched for an allocation system that does not depend on which triage nurses are on duty or on ENP task lists. No such system was found, however, so it was decided that the MTS should be adapted. This was done by adding three subcategories to the MTS discriminators to identify by whom patients should be treated.

The subcategories are:

- Suitability for treatment by the trauma team, coronary care or stroke team.
- Suitability for treatment by a physician.
- Suitability for treatment by an ENP or physician.

The third of these subcategories is defined by local treatment protocols and clinical guidelines and depends on agreement with a group of health care professionals comprising an ENP, the ED manager and a general physician.

The hospital's information technology (IT) system was updated too so that, when patients are allocated to MTS levels, they are also allocated to the appropriate subcategories. Thus patients allocated the third subcategory are directed to the ENP unit (NPU), with the only visible change to triage practice being an automatically added mark on a computer screen.

The ENPs started work in the emergency department in November 2007 so that, on each shift, one ED nurse was an ENP. The new categories were added to the MTS in January 2008. No extra nursing or medical staff were provided for the change in triage practice or implementation of the ENP roles, but the registration and triage process remained the same so the MTS extension was accepted easily.

The change in work processes after triage was substantial, however, because one group of patients was now treated by the new ENPs and it soon became apparent that the ENPs could not treat all their patients without compromising target times. As a result, the coordinating nurses began to refer patients to physicians, which occasionally left the ENPs with no patients until communication between coordinating nurses and ENPs was improved.

One of the most successful aspects of the new system is its flexibility. For example, when the emergency department but not the NPU is busy, ENPs can help their colleagues treat patients, and this has enhanced their acceptance by the other ED nurses. Meanwhile, ENPs have developed their clinical experience by treating patients with non-life-threatening complaints.

As the ENPs' knowledge and skills increase, moreover, the MTS can be extended further to encompass more discriminators. There have been no complaints from ED staff about the MTS extension, which is strongly supported by nursing and medical staff, and has become a permanent part of ED practice.

## CONCLUSION

There is a clear need for the development of standardised protocols for ENPs without reducing their role to the fulfilment of a series of tasks [10,14]. One way of doing this is to extend the MTS so that patients are assigned to a specific clinical area to be treated by ENPs. This system helps to clarify the ENP role while ensuring that the objective of triage, to organise patients according to clinical urgency, remains the same.

It should be noted, however, that such changes in nurses' roles should be preceded by clarification of role boundaries [15] to ensure that they are accepted by ED staff. Although ED staff at the Medical Centre Haaglanden have expressed satisfaction with the extension of the MTS, there has been no formal evaluation and a study of the accuracy of the triage extension is under way.

As well as clarifying the role of ENPs in the emergency department, the MTS extension has improved patient flow and decreased the mean length of stay for patients with non-life-threatening injuries and illnesses [16].

The need to adapt to the public's changing health demands adds to the pressure on emergency departments, therefore ENP roles are likely to become increasingly widespread throughout the Netherlands, which will further highlight the need for role clarification. The authors think that this can be simplified by adapting triage systems to local needs or health-service changes.

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# Chapter 7

## **Managing patient flow with triage streaming to identify patients for Dutch emergency nurse practitioners**

M. Christien van der Linden  
Robert Lindeboom  
Naomi van der Linden  
Cees Lucas

*International Emergency Nursing, 2012, 20 (2): 52-57*



## ABSTRACT

### Introduction

We developed a stream system to the current triage system in order to manage patient flow at the emergency department and to clarify emergency nurse practitioner role boundaries.

### Methods

Data on admission and death rates - indicating injury severity - and data on length of stay -indicating resource utilisation - were collected from 48,397 patients triaged in the Netherlands in 2009.

### Results

A total of 24,294 (50.2%) patients were triaged as 'suitable for treatment by an emergency nurse practitioner' (ENP-stream). Remaining patients were triaged 'medium care' or 'high care'. In the medium and high care groups, significantly more admissions took place (6100, 25.3%) and significantly more patients died at the emergency department (31, 0.1%) compared to the patient group in the ENP-stream (admissions: 840, 3.5%,  $P < 0.001$  and deaths 0, 0.0%,  $P < 0.001$ ). The ENP-streaming is an accurate predictor of not needing to be admitted (PPV=97%) and of emergency department survival (PPV=100%). Mean length of stay was significantly shorter for patients in the ENP-stream compared to the other patients (back transformed values: 74 vs. 147 minutes,  $P < 0.001$ ).

### Conclusion

This study showed excellent correlation between the ENP-streaming and patients' injury severity and resource utilisation, suggesting high internal validity of our triage streaming system. It clarifies the emergency nurse practitioner role, minimising the subjectivity of patient allocation.

## INTRODUCTION

Because more and more people seek help at emergency departments (EDs), it is important to treat patients according to need, instead of according to order of arrival [1,2]. Triage has been defined as a dynamic decision-making process that prioritises a person's need for medical care on arrival at an emergency department [3]. The goals of triage include: to rapidly identify patients with urgent, life-threatening conditions, to decrease congestion in emergency treatment areas, and to determine the most appropriate treatment area for patients presenting to the emergency department [4].

In many European hospitals, the Manchester Triage System (MTS), an algorithmic aid to the process of triage, is used [5]. The MTS utilises a series of flowcharts (based on main complaint) that lead the triage nurse to a logical choice of triage category. It is inevitable that this will direct resources away from less urgent cases [6], leading to longer waiting times for those patients who can wait safely. To prevent long waits for this category of patients, the Medical Centre Haaglanden (MCH) retrained seven emergency nurses into Emergency Nurse Practitioners (ENPs). These ENPs are now managing the less urgent patients, namely patients with minor injuries and minor illnesses. A separate three room Nurse Practitioner Unit (NPU) was built. The NPU operates between 7.30 a.m. and 11 p.m. In every day- and evening shift one ENP works at the NPU, treating 15-20 patients per shift. An experienced emergency physician is available for consultation.

In the Netherlands, ENPs are registered emergency nurses with a masters' degree in advanced nursing practice. They are autonomous practitioners skilled in diagnosing and managing patients in a defined scope of practice. The ENPs used to select patients, waiting to be seen and of which they presumed to fall within their scope of practice, from the waiting room. However, often the triage level (combined with patients' complaint as documented by the registration), was not specific enough to recognise suitability for ENP treatment, causing delays because of lengthy treatments by doctors, or waiting for an inpatient bed, while occupying a NPU room.

To identify patients suitable for treatment by an ENP, the triage categories are of little use. Our local protocols allow ENPs to diagnose and treat patients with a wide range of defined minor injuries and illnesses (e.g. simple fractures, wounds requiring suturing, burns, foreign objects in skin or body cavity, blunt limb trauma, infections of eye, ear or throat and many more) in triage categories 2-5.

It was not sufficient to simply assign all blue (triage category 5) and green (triage category 4) patients to the ENP. ENPs are able to treat certain categories of patients in triage category 2 (orange) and 3 (yellow) as well, while some patients in categories 4 and 5 should be treated by a physician. E.g., our ENPs can treat patients with a dislocation of the shoulder that were triaged in category 2 because of the pain. However, they are not sufficiently trained to treat asthmatic children in category 4.

In various countries, ENPs play an important role in emergency care. However, each nurse and department has designed the ENP's interference slightly different. There is a lack of consensus about role boundaries, titles, clinical accountability and educational requirements [7-9]. In an attempt to clarify ENP role boundaries and, at the same time, manage patient streaming, the MCH developed a stream system to the MTS, to identify patients suitable for treatment by ENPs [10]. We defined suitability for ENP treatment based on our local treatment protocols. The MTS flowcharts consist of several 'discriminators' that allows the triage nurse to allocate patients to one of the five clinical categories of the MTS (blue-red). Newly developed was a streaming element attached to each discriminator, indicating one out of three ED streams: 1. patients suitable for treatment by the trauma team, coronary care team, or stroke team (high care), 2. patients suitable for treatment by one of the physicians (medium care) and 3. patients suitable for treatment by a ENP (ENP-stream). The triage nurse selects one of the computerised MTS-flowcharts from a standardised complaint list. Then all relevant discriminators are displayed and the triage nurse chooses the discriminator that fits the patients' condition best. Once the triage nurse assigns the MTS level based on the discriminator, the electronic system adds a mark indicating one of the three streams. E.g. for a patient with a swelling of her ankle, the triage nurse chooses the MTS flowchart 'Limb problems' and selects the discriminator 'Swelling'. After selecting the discriminator, the electronic system adds 'Nurse Practitioner Unit' to the name of the patient in the computer screen (Figure 1). No changes were made in the registration and triage processes, therefore there was no need for additional training.

The purpose of this study is to validate the ENP-stream against ED patients' injury severity and resource utilisation.

### **Validation of triage tools**

The aim of triage is to sort patients according to clinical urgency. The aim of the ENP-stream is to identify patients suitable for treatment by an ENP at triage. In order to validate this ENP-stream, we would have to measure the stratification accuracy of patients it induces. However, there is no single outcome measure that captures this concept. Lack of consensus about outcome measures is a fundamental problem in the validation of triage tools [11].

To evaluate the validity of triage systems, researchers have used different proxy reference standards for prognosis. Amongst others, these include: length of stay (LOS), admission rate, intensive care admission rate, hospital charges, mortality, resource use, and a combination of vital signs at presentation, potentially life-threatening conditions, diagnostic resources, therapeutic interventions and follow-up [12-17].

Since resource use and admission rates are associated with the complexity and severity of a patient's status, these parameters have been used as validity criteria in many studies [17-20]. In concordance with these studies, we used admission- and death rates (both markers for injury severity) and LOS (a marker for resource utilisation) as primary outcome measures to evaluate the validity of the ENP-stream. The assumption was that patients suitable for treatment by an ENP would have a smaller number of admissions and deaths and a shorter LOS than medium- or high care marked patients. Patients triaged as 'suitable for treatment by an ENP' that died or needed to be admitted were considered 'under triaged'.

## METHODS

### Study design and setting

We conducted a retrospective, cross-sectional study in the emergency department of an urban, community teaching hospital in the Netherlands, with  $\pm 50,000$  patients annually and an overall ED hospital admission rate of 20%. All patients were included, except for those who had left before physician or ENP assessment. The regional medical research ethics committee and the institutional review board approved the study.

### Measures

Data were retrieved from the hospitals' electronic patient database (ChipSoft, Amsterdam, the Netherlands).

Our primary outcome measures were admission rates, death at the emergency department and LOS. Length of stay was defined as the interval between patient arrival time and the moment the patient left the emergency department.

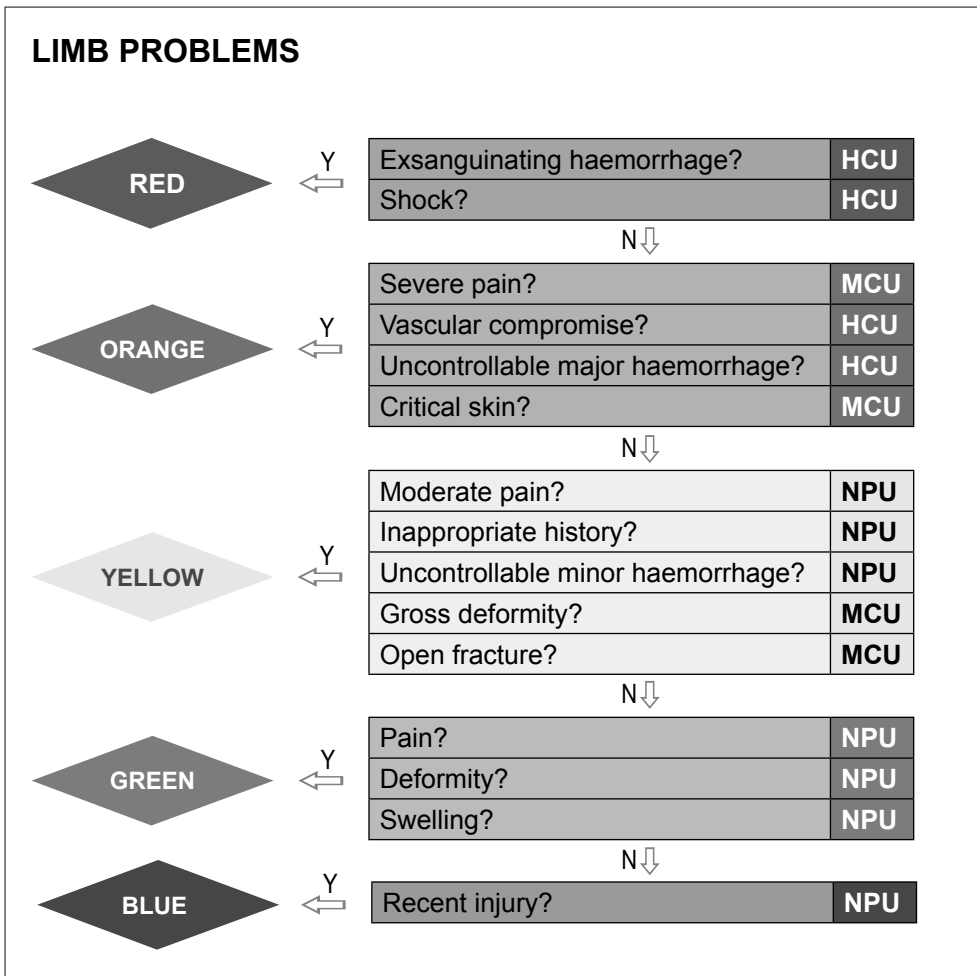
### Data analysis

Patients who left before medical assessment, were removed from the original data file. The file was checked against medical records in case of missing data, outliers in LOS, and patients triaged with more than one discriminator. For patients triaged with more than one discriminator (for example, in the flowchart 'limb problems', the discriminators 'gross deformity' and 'uncontrollable minor haemorrhage', Figure 1.), the code that was actually used in practice (leading to the stream), was also used for analysis.

Pearson’s  $\chi^2$  was used to examine the relationship between the ENP-stream and admission rates, and between the ENP-stream and death rates. To assess the ENP-stream as a predictor of not needing to be admitted or death, positive predictive values were calculated.

After normalising the LOS data with a logarithmic function, the relation between the ENP-stream and LOS was tested using an unpaired *t* test.

Data analysis was performed using PASW (Predictive Analytics Software, version 17, Chicago, Illinois, USA).



**Figure 1.** Allocation of patients with limb problems to one of the three ED streams, based on MTS discriminators.

## RESULTS

In 2009, 49,474 patients visited the emergency department, of which 1,077 (2.2%) left before medical assessment. The remaining 48,397 patients were analysed. Of these, 24,294 (50.2%) were triaged with the ENP-stream: patients suitable for treatment by an ENP.

In the medium and high care-marked patient groups, significantly more admissions took place (6,100, 25.3%) in comparison to the patient group with the ENP-stream (840, 3.5%) ( $P < 0.001$ ). The positive predictive value shows that the ENP-stream is an accurate predictor of not needing to be admitted (PPV=97%). The patient group with an ENP-stream needing to be admitted (considered to be under triaged) included significantly more patients with back pain ( $P = 0.007$ ), head injuries ( $P < 0.001$ ), limb problems ( $P < 0.001$ ), local infections and abscesses ( $P < 0.001$ ), a sore throat ( $P = 0.037$ ) or urinary problems ( $P < 0.001$ ).

In the medium and high care-marked patient groups, significantly more patients died at the emergency department (31, 0.1%) compared to the patient group with an ENP-stream (0, 0.0%) ( $P < 0.001$ ). Thus, the positive predictive value of the ENP-extension on ED survival was 100%.

In the medium and high care-marked patient groups, mean LOS was significantly longer (back transformed value: 147 minutes) in comparison to the patient group with an ENP-stream (back transformed value: 74 minutes) ( $P < 0.001$ ).

## DISCUSSION

Research has demonstrated that ENPs are able to care for low acuity patients within the emergency department [9,21-23]. However, there has never been a standardised, validated approach in the assignment of presumed low acuity patients to ENPs. Wide acceptance of an objective streaming system could minimise the subjectivity of the patient's allocation, clarify ENP role boundaries, provide greater uniformity between the ENPs and improve research possibilities.

A small amount of the patients with the ENP-stream (3.5%), were under triaged (admitted). Although the literature demonstrates this to be lower than the amount of under triage associated with 'regular' triage systems [24], the MTS streaming system could even be further improved by reducing this number.

The group of under triaged patients included many subjects presenting with back pain, head injuries, limb problems, local infections and abscesses, a sore throat or urinary problems. Although these patients needed to be admitted, analyses of their patient files showed that four out of these six diagnostic groups (head injuries, limb problems, local infections and abscesses and urinary problems) could be handled perfectly well by ENPs. However, final diagnoses of the patients triaged with back pain or a sore throat indicated that it might be better to remove the ENP-streaming from these two groups.

ENP-marked, admitted patients with head injuries, limb problems, local infections and abscesses and urinary problems were considered under triaged, but the reasons for their admission were often straightforward and captured in protocols. Since ENPs are able to identify those patients in need of admission and/or more specialised care, ENP treatment of these patients is not hazardous. Amongst others, reasons for admission were: fractured limbs needing reposition in the operating room, monitoring consciousness level of intoxicated patients (alcohol/drugs), incision and drainage of an abscess under sedation, or the need for intravenous antibiotics and fluid resuscitation. Since ENPs can identify these patients while independently treating all other patients with the same triage streaming, marking these patients as suitable for treatment by an ENP is safe and efficient.

However, in patients triaged within the flowchart 'sore throat' or 'back pain', the safety of ENP treatment and thus ENP-marking appeared to be questionable. While most patients with a sore throat can be treated by an ENP, final diagnoses demonstrate that some of these patients can better be treated by a physician to recognise serious problems. Final diagnoses included pneumonia, lung carcinoma, leukaemia, pericarditis and even one patient with an aphasia based on ischemic brain injury. The same is applicable for the flowchart 'back pain', since this included patients with, amongst others, spondylodiscitis, neoplastic metastases, pneumothorax, long embolism and pyelonephritis. Although part of these patients were triaged in the wrong way (they would not have been marked as a patient suitable for treatment by an ENP if the MTS had been used properly), we recommend partial removal of these triage categories from the ENP streaming, to improve patient safety. If the streaming codes 'hot adult' and 'moderate pain' in the flow chart 'sore throat' and the extension codes 'moderate pain' and 'unable to walk' in the flow chart 'back pain' would be regarded as medium care instead of ENP care, the ENP-streaming of the MTS would be further improved. Although this adaptation reduces efficiency and most of these patients can be treated by ENPs perfectly well, a 'sore throat' or 'back pain' might be the only sign of having a serious underlying disease. To prevent ENPs from misdiagnosing these patients, a physician should treat patients with previously mentioned streaming codes.



Furthermore, in order to improve the results of the MTS streaming system, the MTS should be used correctly and patients should be triaged with the most specific discriminator possible. Only if no specific discriminators suggest a higher categorisation, general discriminators such as 'severe pain', 'moderate pain', or 'pain' should be chosen. In many of the under triaged patients in the research population, the discriminators 'pain' or 'moderate pain' -both leading to the ENP-streaming- were used while an other discriminator -leading to a medium or high care streaming- would be more appropriate. More accurate use of the MTS would reduce the amount of under triage (3.5%) even further.

Reducing the number of admissions among patients triaged with the ENP-streaming to 0% is impossible and unnecessary. Admission of ENP-marked patients can not be completely avoided without very large groups of patients with the same diagnoses being excluded from the ENP-streaming. In spite of their admission, most of these ENP-marked patients can be managed by ENPs since they are trained to identify the patients that require handover to medical staff. Besides, our ENPs can consult emergency physicians any time while the patient remains at the NPU.

One of the objectives of ENPs handling patients with minor injuries and minor illnesses was to reduce waiting times for patients with less urgent symptoms. These patients experience the longest waits, especially when they present to an emergency department with more than 30,000 visits annually or a teaching hospital [25]. However, while waiting times are expected to be relatively long for patients triaged with the ENP-streaming, total LOS should be relatively short. Waiting time is just a minor part of LOS. We presumed total LOS to be a marker for resource utilisation [26]. Although we did not account for waiting time in our study, LOS indeed turned out to be significantly shorter for ENP-marked patients (74 minutes), than for the medium and high care-marked patients (147 minutes,  $P < 0.001$ ). This upholds the presumption that ENP-marked patients need a less extensive kind of care.

The MTS streaming system in our hospital has evolved to be an effective aid to improve the flow of patients and is well accepted by patients and staff. Emergency department personnel expressed no resistance to the implementation of ENPs. We believe this was partly due to the clear role boundaries on the one hand, and flexibility on the other. Although staff and management verbalised their satisfaction with the streaming system of the MTS, no formal evaluation was conducted.

**Limitations**

The most important limitation of our research is that we evaluated the validity of the triage streaming system based on its accuracy in predicting hospital admission, mortality and LOS. The premise was that in patients in the ENP-stream, LOS should be shorter and admission and death rates should be lower in comparison to patients in a medium or high care-stream. This seems reasonable, since patients triaged as suitable for treatment by an ENP should be those with relatively uncomplicated problems. In absence of a clear reference standard, the MTS streaming system can not be validated without using these kinds or proxy measures.

A second limitation of our study is that it is not possible to compare our findings to other study results, because of the different methods used to allocate patients to ENPs and the lack of other research on this subject. Therefore, our study is limited to the experience of one hospital. More studies on the same subject and in other settings are necessary to evaluate external validity of the triage streaming system. We acknowledge that consensus view, on which this streaming system is based, is the weakest form of evidence. However, being in function now for over three years, combined with the fact that the MTS is a well accepted triage system, we believe the streaming system is only a minor adjustment with great potential.

Thirdly, working with retrospective data, data inaccuracies or flaws in the computer system could have biased the results. Nevertheless, it is unlikely that patients were not entered into the emergency departments' computer system, as well as it is unlikely that inaccuracies were unequally divided over the different patient categories that were investigated.

**CONCLUSIONS**

Our study showed excellent correlation between the ENP-streaming and patient severity (admission and death rates) and resource utilisation (LOS), suggesting high internal validity of the triage streaming system.

We believe the ENP model of care to be an important strategy in the management of increased service demands and therefore, in preventing or handling ED overcrowding. A streaming system based on discriminators of an accepted triage system to objectively identify patients suitable for treatment by ENPs, is one of the possibilities to clarify the ENP role, minimise the subjectivity of patient allocation and increase research possibilities. In the emergency department of the MCH, triage nurses are perfectly able to decide which patients to assign to an ENP.

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# Chapter 8

## **Diagnostic accuracy of emergency nurse practitioners versus physicians related to minor illnesses and injuries**

M. Christien van der Linden  
T.M.A.J.(Resi) Reijnen  
Rien de Vos

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## ABSTRACT

### Introduction

Our objectives were to determine the incidence of missed injuries and inappropriately managed cases in patients with minor injuries and illnesses and to evaluate diagnostic accuracy of the emergency nurse practitioners compared with junior doctors/senior house officers.

### Methods

In a descriptive cohort study, 741 patients treated by emergency nurse practitioners were compared with a random sample of 741 patients treated by junior doctors/senior house officers. Groups were compared regarding incidence and severity of missed injuries and inappropriately managed cases, waiting times, and length of stay.

### Results

Within the total group, 29 of the 1,482 patients (1.9%) had a missed injury or were inappropriately managed. No statistically significant difference was found between the emergency nurse practitioner and physician groups in terms of missed injuries or inappropriate management, with 9 errors (1.2%) by junior doctors/senior house officers and 20 errors (2.7%) by emergency nurse practitioners. The most common reason for missed injuries was misinterpretation of radiographs (13 of 17 missed injuries). There was no significant difference in waiting time for treatment by junior doctors/senior house officers versus emergency nurse practitioners (20 minutes vs. 19 minutes). The mean length of stay was significantly longer for junior doctors/senior house officers (65 minutes for emergency nurse practitioners and 85 minutes for junior doctors/senior house officers,  $P < 0.001$ ).

### Discussion

Emergency nurse practitioners showed high diagnostic accuracy, with 97.3% of the patients being correctly diagnosed and managed. No significant differences between emergency nurse practitioners and physicians related to missed injuries and inappropriately management were detected.

## INTRODUCTION

In busy emergency departments (EDs) it is probable that diagnostic and management errors will occur [1,2]. Contributing to error occurrence is a recent increase in patient self-referrals to the emergency department, leading to overcrowding, long waiting times, and increased length of stay for patients [3]. Some hospitals have recruited emergency nurse practitioners (ENPs) to supplement emergency physicians in an attempt to reduce overcrowding, waiting times, and length of stay. ENPs are advanced-practice emergency nurses skilled in diagnosing and managing patients in a defined scope of practice. As such, it is imperative that ENPs treat patients with a diagnostic and management accuracy equivalent to that of a physician.

Previous research on ENP care focused mainly on patient satisfaction, waiting time, and length of stay [4-8]. Only a few studies have focused on diagnostic and management accuracy. In a randomised controlled trial of adults (n =199) presenting to the emergency department with minor injuries, Cooper et al. [9] reported higher levels of patient satisfaction with ENP-led care. However, they reported that no differences in missed injury rates were detected because of inadequate statistical power. In another randomised controlled trial of 1,453 adults presenting to the emergency department with minor injuries, Sakr et al. [10] reported no significant differences between ENPs and junior doctors in the accuracy of examination, adequacy of treatment, planned follow-up, and radiographs requests. Emergency nurse practitioners and junior doctors made clinically important errors in 65 (9.2%) of 704 patients and in 80 (10.7%) of 749 patients, respectively, but this difference was also not significant. Our study extended the work of previous investigators by comparing care provided by ENPs and junior doctors/senior house officers (SHOs) to patients with minor injuries and illnesses; in addition, we evaluated waiting time and length of ED stay.

## METHODS

### Study design and setting

This retrospective cohort study was conducted in the emergency department of an urban community teaching hospital in the Netherlands. The annual ED patient volume is 48,000 visits. The regional medical research ethics committee and the institutional review board approved the study.

### Selection of participants

Previous research by Cooper et al. [9] found a 2% difference in misdiagnoses between ENPs and SHOs. To detect a 2% difference in missed injuries and inappropriate management between ENPs and junior doctors/SHOs, with a power of 80% and a 95% level of significance,

we calculated that a sample of 1,400 patients would be needed for this study. This study included patients visiting the emergency department between January 1 and June 8, 2008. After registration and triage, all 'low-care' patients were treated by either an ENP or junior doctor/SHO, according to availability. All patients considered to be low-care patients and treated by an ENP were included in this study. After the sample of ENP patients was identified, a random sample of low-care patients treated by junior doctors/SHOs was matched by date. In cases of missing triage information, charts were checked for initial injury/complaint and included in the study when triaged as low care. Excluded were all patients treated by an ENP but only in need of nursing care (e.g., removal of stitches and immunization against tetanus).

### **Procedures and data collection**

Our hospital uses the Manchester Triage System, [11] an algorithmic aid to the process of triage. It uses a series of flowcharts (based on chief complaint) that lead the triage nurse to a logical choice of triage category using a 5-point scale. An extension in the Manchester Triage System was made to identify low-care patients, suitable for treatment by ENPs. After triage, patients were treated by a physician (junior doctor/SHO) or an ENP. An ENP was defined as a registered emergency nurse with a masters' degree in advanced nursing practice. ENPs are autonomous practitioners who can diagnose and treat patients without necessarily consulting a physician. The local protocol allows ENPs to diagnose and treat patients with a wide range of defined minor injuries and minor illnesses (e.g., simple fractures, wounds requiring simple suturing, burns, foreign objects in skin or body cavity, blunt limb trauma, epistaxis, and infections of the eye, ear, or throat. Patients with injuries and illnesses suitable for treatment by ENPs were classified as low-care patients. Junior doctors are physicians who have not yet chosen a specialization, whereas an SHO is a resident physician.

All data were collected from the hospitals' electronic patient database (ChipSoft, Amsterdam, the Netherlands). Data collected included generic data, missed injuries, inappropriately managed cases, and secondary outcomes. Generic data included demographic details (sex, age), type of complaint, additional diagnostics, diagnosis, and treatment. In addition, registration time, time of entrance into the consulting room and time of discharge were obtained.

Furthermore, patients' records were reviewed for unplanned return visits to the emergency department (related to the first visit) for 1 month after initial treatment. Missed injuries were defined as diagnoses that could have been made in the emergency department but were not made until after the patient had left. These included injuries not seen or those misinterpreted on radiographs, as well as those discovered at planned/unplanned return visits. The day after the initial visit to the emergency department, all charts and radiographs



were reviewed for accuracy of diagnosis and treatment by a team (radiologist, surgeon, emergency physician, junior doctor/SHO, ENP). Inappropriately managed cases were defined as cases in which treatment was not administered in accordance with ED protocols (containing all problems in the scope of practice of the ENP) and there was no justification for deviation from these protocols. These were identified by radiology report, chart review, and monitoring return visits. False-positive diagnoses were excluded because this study concerned under treatment of patients, not over treatment. Missed diagnoses were further objectified by the misdiagnosis severity score (MSS) [12]. This nonlinear scale separates the more significant errors from the less significant errors, on a scale from 1 to 7, where 1 is a relatively minor problem and 7 relates to a situation where surgery should have been performed immediately. No error scores 0, because all errors have implications for patient care [12]. The validity of the MSS has been tested by Guly [13] against senior doctors' perceptions of error severity. The concordance between doctors' assessments of severity was tested by use of the Kendall coefficient of concordance, which was highly significant ( $W = 1.23$ ,  $\chi^2 = 125.5$ ,  $P < 0.001$ ). The significant concordance between doctors' assessments of severity allowed comparison of the median of their scores with the 7-point MSS, and the correlation was highly significant (Spearman rank coefficient [ $r_s$ ] = 0.902,  $P < 0.001$ ). The MSS compares well with experienced doctors' assessments of severity and can reasonably be used as a measure of the severity of diagnostic errors [13].

Secondary outcomes were also derived from the electronic patient database. Waiting time was defined as the time between registration and entrance into the consulting room. Length of stay was defined as the time between entrance into the consulting room and discharge from the emergency department.

### Data analysis

Predictive Analytics Software (PASW, version 14, Chicago, Illinois, USA) was used to analyse the data. Descriptive statistics were used to analyse clinical and demographic characteristics of the study group, incidence of missed injuries, inappropriately managed cases, and unplanned return visits. To compare missed injuries of health care providers (ENP or junior doctor/SHO), the  $\chi^2$  test was used, and the Fisher exact test was used when appropriate. Differences between health care providers in waiting time and length of stay were analysed by use of 2-tailed independent-samples  $t$  tests.  $\chi^2$  Analysis was used to compare age categories, time of admission, and triage categories. To compare MSS, the Mann-Whitney  $U$  test was used. Multivariate analysis was used to analyse missed injuries, inappropriately managed cases, and unplanned return visits corrected for differences in patient characteristics.

## RESULTS

From January 1 to June 8, 2008, 21,365 patients visited the emergency department. Of these, 10,555 were triaged as low-care patients, of whom 748 were treated by an ENP. We excluded 7 patients: 6 had only received nursing care by an ENP and 1 was treated at another location in the hospital. This led to a study group of 741 ENP-treated patients who were compared with 741 patients treated by a junior doctor/SHO.

Emergency nurse practitioners/ENPCs had a median emergency nursing experience of 7.6 years (range, 2-13 years) and a median time working as emergency nurse practitioner candidates (ENPC) (including 2 years of training) of 2.1 years (range, 0.6-3.3 years). Junior doctors and SHOs had a median time working as a doctor of 3.5 years (range, 0.08-8.3 years).

Table 1 shows the demographic characteristics and chief complaint on which triage was based for both groups. There were statistically significant differences in terms of age, time of admission, and chief complaint. Emergency nurse practitioners treated significantly more children aged 0 to 15 years, more patients during the day shift, and more patients with eye problems. Junior doctors/SHOs treated significantly more patients aged over 75 years, more patients during the night shift, and more patients with local infections and limb problems.

Incorrect treatment is shown in Table 2. Of the total sample of 1,482 patients, 29 (1.9%) had a missed injury (17 [1.1%]) or were managed inappropriately (12 [0.8%]). In the group treated by ENPs, there were 20 patients who had a missed injury (12 [1.6%]) or received unsatisfactory clinical management (8 [1.1%]). In the group treated by junior doctors/SHOs, there were 9 patients who had a missed injury (5 [0.7%]) or inappropriate management (4 [0.5%]).

**Table 1.** Patient characteristics

	All (N =1482)	SHO (n =741)	ENP (n =741)	P
<b>Age</b> [mean (SD)] (y)	30,93 (18,55)	32,97 (19,49)	28,89 (17,32)	<i>P</i> <0.001
<b>Age categories</b> [n (%)]				<i>P</i> =0.001
- 0 to 15 y	315 (21,3)	137 (18,5)	178 (24,0)	
- 16-35 y	633 (42,7)	305 (41,2)	328 (44,3)	
- 36-55 y	364 (24,6)	197 (26,6)	167 (22,5)	
- 56-75 y	138 (9,3)	79 (10,7)	59 (8,0)	
- >75 y	32 (2,2)	23 (3,1)	9 (1,2)	
<b>Sex</b> [n (%)]				<i>P</i> =0.08
- Male	911 (61,5)	439 (59,2)	472 (63,7)	
- Female	571 (38,5)	302 (40,8)	269 (36,3)	
<b>Time of admission</b> [n (%)]				<i>P</i> =0.01
- Day	731 (49,3)	340 (45,9)	391 (52,8)	
- Evening	660 (44,5)	346 (46,7)	314 (42,4)	
- Night	91 (6,1)	55 (7,4)	36 (4,9)	
<b>Chief complaint</b> [n (%)]				<i>P</i> <0.001
- Limb problems	763 (51,5)	421 (56,8)	342 (46,2)	
- Wounds	248 (16,7)	124 (16,7)	124 (16,7)	
- Local infections and abscesses	47 (3,2)	31 (4,2)	16 (2,2)	
- Eye problems	41 (2,8)	11 (1,5)	30 (4,0)	
- Ear problems	33 (2,2)	13 (1,8)	20 (2,7)	
- Back pain	28 (1,9)	19 (2,6)	9 (1,2)	
- Head injury	25 (1,7)	13 (1,8)	12 (1,6)	
- Nasal problems	21 (1,4)	11 (1,5)	10 (1,3)	
- Rashes	21 (1,4)	10 (1,3)	11 (1,5)	
- Sore throat	21 (1,4)	10 (1,3)	11 (1,5)	
- Burns and scalds	20 (1,3)	11 (1,5)	9 (1,2)	
- Dental problems	17 (1,1)	5 (0,7)	12 (1,6)	
- Urinary problems	12 (0,8)	6 (0,8)	6 (0,8)	
- Physical abuse	12 (0,8)	8 (1,1)	4 (0,5)	
- Other	173 (11,5)	48 (6,4)	125 (16,5)	

**Table 2.** Comparison of incorrect treatment between ENPs and physicians

	All [N (%)]	SHO [n (%)]	ENP [n (%)]
Missed injury	17 (1.1)	5 (0.7)	12 (1.6)
Avulsion fracture of talus	1		1
Fracture of distal tibia	1		1
Fracture of distal radius	4		4
Fracture of lateral malleolus	3	2	1
Fracture of proximal fibula	1	1	
Fracture of proximal ulna	1		1
Fracture of radial head	1		1
Fracture of scaphoid	1	1	
Fracture of supracondylar humerus	2	1	1
Hyperplasia of thymus	1		1
Small apical pneumothorax	1		1
Inappropriate management	12 (0.8)	4 (0.5)	8 (1.1)
Forgotten injection	3		3
Inappropriate follow-up	1		1
Inappropriate physical examination	3	1	2
Incomplete intervention	2		2
Prescription for wrong medication	1	1	
Protocol not followed	1	1	
Reposition fracture necessary	1	1	
No missed injury and no inappropriate management	1,453 (98.0)	732 (98.8)	721 (97.3)

No significant difference was found between ENP and physician groups in terms of missed injuries or inappropriate management (9 errors by junior doctors/SHOs [1.2%] and 20 errors by ENPs [2.7%]; relative risk, 0.4; 95% confidence interval (CI), 0.03-1.59). After correction for differences in patient characteristics via multivariate analysis, no significant difference was demonstrable. The main reason for missed injuries was misinterpretation of radiographs (13 of 17 missed injuries). No radiograph was obtained during the initial visit in 3 cases. In 1 patient who had already left the emergency department, the radiologist discovered a coincidental finding on computed tomography scan of the thorax.

Unplanned return visits accounted for detection of 5 missed injuries (29.4%) and 5 inappropriately managed cases (41.7%). The remaining missed injuries were discovered through the daily radiology report (9 [52.9%]), through chart review (2 [11.8%]), and by the treating health care provider (1 [5.9%]). The remaining inappropriately managed cases were discovered through chart review (3 [25%]), by the treating health care provider (2 [16.7%]), and by data analysis for this study (2 [16.7%]).

The median missed injury severity score (by use of the MSS) was 2 in both groups. There were 7 patients with an MSS of 1, 10 patients with an MSS of 2, 5 patients with an MSS of 3, and 7 patients with an MSS of 4. No diagnostic errors with an MSS of 5 or greater were made by ENPs or junior doctors/SHOs.

Of the patients, 76 (5.1%) made an unplanned return visit to the emergency department within 1 month after the initial visit. Most patients returned because they were worried about their injury (29 [38.2%]) or had a problem with the bandage/cast (18 [23.7%]). There were 6 complications from treatment (side effects of medication, deep venous thrombosis due to immobilization, wound infection/dehiscence). Progression of skin infections despite antibiotic use accounted for 4 unplanned return visits.

The efficiency of work by ENPs and junior doctors/SHOs is shown in Table 3. There was no significant difference in waiting time (19 minutes for ENP and 20 minutes for junior doctor/SHO). However, the mean length of stay was significantly longer for junior doctors/SHOs (SHO: 85 minutes, 95% CI 81 to 89 minutes, ENP: 65 minutes, 95% CI 62 to 68 minutes,  $P < 0.001$ ).

## DISCUSSION

The purpose of this study was to compare ENPs with junior doctors/SHOs in terms of missed injury and inappropriately managed cases in patients with minor injuries and minor illnesses. The sample size of this study was calculated based on results from a study by Cooper et al. [9] that suggested that 3% of ENP patients and 1% of SHO patients might be misdiagnosed or initially incorrectly managed. Our study showed comparable results: a total of 1.9% patients had a missed injury or inappropriately managed case. Emergency nurse practitioners made more errors than junior doctors/SHOs (2.7% vs. 1.2%), although this was not statistically significant. Furthermore, our results are similar to those of Sakr et al., [10] who also found no significant difference in the error rate between ENPs and junior doctors.

The most common reason for missing injuries in our study was misreading radiographs (76.5%). This finding is supported by a study of Guly [14] concerning the causes of diagnostic errors in the emergency department. In that study 953 missed injuries were found in 934 patients; 79.7% were missed fractures. Misreading radiographs (77.8%) and failure to perform radiographs (13.4%) were the most common reasons for error. Misreading radiographs can result in inappropriate treatment. Because of our daily radiology report, these errors were recognised within 24 hours and appropriate treatment was initiated without further delay.

Several studies have shown that the greater the level of experience, the greater the accuracy of interpreting a radiograph [15-17]. Moreover, attention should be paid to the occurrence of multiple fractures. Leong et al. [18] reported that health care providers more experienced in interpreting radiographs focus for a shorter period on a single fracture and are more likely to diagnose additional fractures. In our study ENP-led care was not yet well established; therefore there was not a large degree of experience in interpreting radiographs.

### **Limitations**

The most important limitations of this study are related to differences in patient characteristics. This study was conducted during a period when the ENPs were not working full time as ENPs but were also working as emergency staff nurses. Therefore they were primarily available for patients with minor injuries and illnesses during the daytime. Because we used within-day randomization, junior doctors/SHOs treated significantly more patients during night shifts. This could have influenced patient characteristics as well as the efficiency and accuracy of the practitioner.

Regarding the triage category, we believe that ENPs are reluctant to treat patients who are likely to need surgery (e.g., collar fracture and complicated fracture). In addition, patients brought to the hospital by paramedics or referred by their general practitioner are not treated by ENPs because of their location within the emergency department. This could also explain why junior doctors/SHOs treated more patients aged over 75 years and more patients with infections and abscesses. On the other hand, it is reasonable to assume that junior doctors/SHOs tend to leave patients with non-surgical problems (e.g., eye problems) to ENPs, choosing patients that they find more interesting to treat (perhaps because of an appeal to their surgical skills).

Another limitation of the study is the fact that junior doctors/SHOs also treat patients in higher triage categories. During busy periods, ENPs tend to help the other nurses with patients in higher triage categories to reduce work-related pressure. Both circumstances could have caused longer waiting times and lengths of stay for patients with minor injuries and minor illnesses and possibly affected the incidence of diagnostic errors.

Finally, it is possible that patients visited another physician/hospital because of their persistent problem. For that reason, some errors may not have been discovered.

### **CONCLUSIONS**

Emergency nurse practitioners showed high diagnostic accuracy, with 97.3% of the patients being correctly diagnosed and managed. No significant differences were detected between ENPs and physicians regarding missed injuries and inappropriate management. Similar to other studies, the overall incidence of missed injuries and inappropriate management in this study was very low. Still, further reduction of missed injuries and inappropriately managed cases may be achievable by giving ENPs the chance to develop their skills and arrange specific training in interpretation of radiographs.

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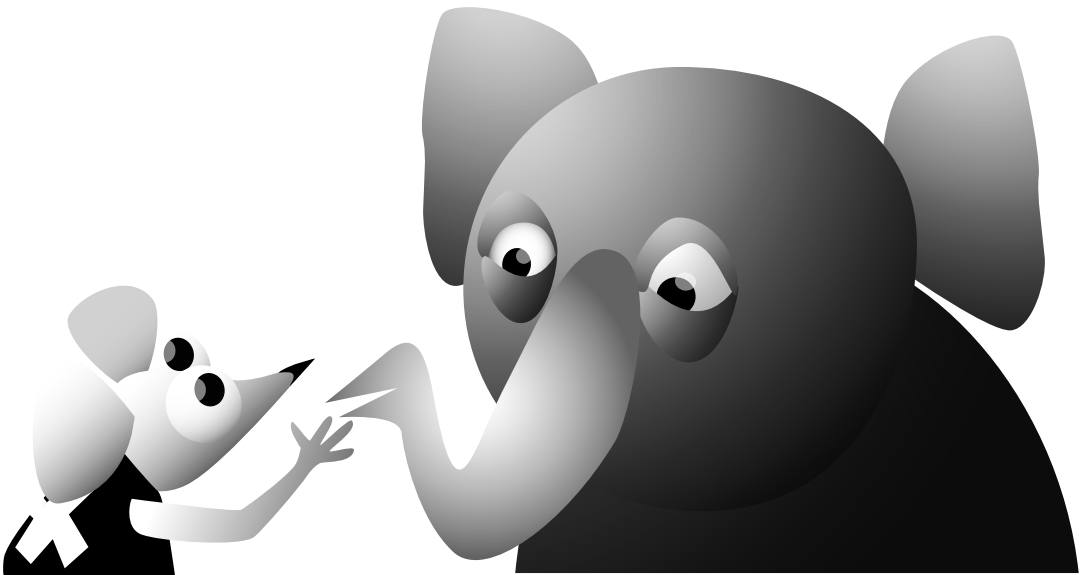
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# Part IV

## OUTPUT OF THE EMERGENCY DEPARTMENT





# Chapter 9

## **Walkouts from the emergency department: characteristics, reasons and medical care needs**

M. Christien van der Linden  
Robert Lindeboom  
Naomi van der Linden  
Crispijn L. van den Brand  
Rianne C. Lam  
Cees Lucas  
Steven J. Rhemrev  
Rob J. de Haan  
J. Carel Goslings

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## ABSTRACT

### Objectives

The aim of this study was to assess the walkout rate and to identify influencing patient- and visit characteristics on walkout. Furthermore, we assessed the reasons for leaving and medical care needs after leaving.

### Methods

In a 4-month population-based cohort study, the characteristics and influencing factors of walkout from two emergency departments in the Netherlands were studied. Afterwards, a follow-up telephone interview was conducted to assess the reasons for leaving and medical care needed.

### Results

A total of 169 out of 23,780 (0.7%) registered patients left without treatment, of whom 62% left after triage. Of the triaged walkouts, 26% had urgent or highly urgent medical complaints and target times to treatment had elapsed for 54% of the triaged walkouts. Independent predictors of leaving without treatment included being self-referred, arriving during the evening or night or during crowded conditions, and relatively lower urgency triage allocation. Ninety (53%) walkouts were contacted afterwards by phone. Long waiting time (61%) was the most-cited prime reason for leaving. Medical problems had resolved spontaneously in 19 of the 90 (21%) walkouts and 47 (52%) walkouts reported having sought medical care elsewhere. For 24 of the 90 (27%) walkouts with persisting complaints, medical care was advised during the follow-up telephone phone call.

### Conclusions

The average observed daily walkout rate was 1.4 patients over the 4-months period. In general, walkouts are self referrals with lower urgent complaints, arriving during the evening or night shift or during crowded conditions. Most walkouts leave because of perceived long waiting times.

## INTRODUCTION

Emergency department (ED) crowding is associated with long waiting times for patients before evaluation. This can lead to patients leaving the emergency department without being seen by a physician [1,2]. Patients who fail to wait for medical assessment are referred to as 'walkouts', 'did not wait', or patients 'leaving without being seen (LWBS)'. Reported percentages of LWBS vary from 0.06% to 20% [3-6]. Previous international studies on the outcomes of walkouts showed that the rates of reported adverse events are low [7,8]. Still, as often a large proportion of patients are unaccounted for because of poor response rates, walkouts are of concern to emergency departments.

In the Netherlands, the percentage, profile and outcomes of ED walkouts are unknown. There are about 2 million ED visits per year, with an average growth rate of 2% to 4% [9]. General practitioner (GP) services are available 24/7 and there is basic health insurance available to all. The state of ED crowding is unknown, although it is assumed that crowding is not a major issue [10]. Little is known about ED walkouts in countries with well-established primary care systems. Therefore, the aims of this study were to describe 1) the number of walkouts and their triage status, 2) predictors of walkout, 3) reasons for leaving, including the influence of crowding on walkout rate and 4) walkouts' medical care needs.

## METHODS

### Study sample, setting and data collection

This prospective cohort study was carried out in a Dutch hospital with two locations: a level 1 trauma centre with  $\pm 52,000$  ED patient visits per year and a level 3 emergency department with  $\pm 22,000$  ED patient visits per year. Both emergency departments treat adults as well as children. We included all walkouts who left the emergency department before or immediately after triage during November 1, 2010 and February 28, 2011 as identified by daily review of the patient records. Patients who left against medical advice after being treated were excluded as they have a different pathology [11], higher emergent hospitalization rates and higher triage levels compared with patients who leave without treatment [12].

Variables, collected from the hospitals' database and retrieved manually from the patients' medical records for all patients included in this study, were based on previous walkout research. Variables collected from the hospitals' database included arrival time (day, evening, or night shift) [7,13-15], age [3,7,15], sex [15], arrival transport mode (ambulance or not)[7,14], referral source (self-referred or non-self-referred) [14] and waiting time [7,14].

Variables retrieved manually from the patients' medical records and the hospitals' database were 'having a GP', 'having a health insurance' [3,14,16], the number of ED visits [3] and admissions in the previous 12 months, crowding index, triage level [13] and target time to treatment [7].

Waiting time was defined as leaving time minus arrival time for walkouts and treatment time minus arrival time for patients who stayed for treatment. Crowding index was defined as the number of patients presenting within the same hour and in the hour before the ED visit of a patient [17]. Triage levels were assigned to patients according to the Manchester Triage System: immediate (level 1), very urgent (level 2), urgent (level 3), standard (level 4) and non-urgent (level 5) [18]. For the analysis, level 1 was combined with level 2 and level 4 was combined with level 5 because of small numbers of patients with level 1 and 5.

In the second phase of the study, a telephonic interview was conducted 3-8 days after the ED visit to assess a walkouts' reason for leaving prematurely and to enquire whether they had obtained medical care elsewhere after leaving the emergency department. Verbal consent was obtained at the beginning of the semi-structured interview. A maximum of five attempts at different times were made to contact each walkout. All telephone calls were made by the ED social worker, using a sheet with standardised set of open-ended questions, on the basis of previous research [19]. Walkouts were asked their reason for LWBS, perceived waiting time, what could have prevented them from leaving and whether they had sought any medical care after leaving the emergency department. If participants indicated that they had not obtained medical care but still needed medical care, the social worker advised the appropriate service to them according to protocol (e.g., return to the emergency department, go to their GP or pharmacy). The social worker wrote down the exact answers of the participants on the sheet. Categorisation of the themes was performed by two researchers (RCL and MCL) working independent of each other. If no agreement between the two researchers was noted in categorisation, the case was reviewed by a third researcher (NL) and assigned to the category on which two of three researchers agreed.

The dataset analysed did not contain individual identifiers to ensure anonymity of subjects. The regional medical research ethics committee and the institutional review board approved the study; no participant informed consent was necessary.

### Statistical analysis

All variables were compared between walkouts ( $n = 169$ ) and a random sample of patients who stayed for treatment ( $n = 338$ ), to detect a weak to moderate association (odds ratio (OR)  $\approx 1.5$ ) between the variable and walkout, with 80% power (see the Results section).

The independent impact of patient and visit characteristics on the presence of walkout was analysed using logistic regression, adjusting for the other variables. Adjusted ORs are provided with their 95% confidence intervals (CIs) to indicate the likelihood of walkout for each explanatory variable adjusted for the other variables. A final model was constructed using a backward elimination procedure. The calibration and overall discriminative capacity of the final model were assessed using the Hosmer-Lemeshow test and the area under the receiver operating characteristic curve [20].

Responses to the questions used in the telephonic interview were summarised using simple descriptive statistics. Differences between the patients who were interviewed and the patients who were not interviewed were analysed using  $t$  tests (age, crowding index) and  $\chi^2$  tests (sex, triage levels, self-referral).

Data were analysed using PASW (Predictive Analytics Software, version 18, Chicago, Illinois, USA).

## RESULTS

### Number and triage status of walkouts

During the study period, 16,590 patients registered for care in the level 1 emergency department and 7,190 patients in the level 3 emergency department, totalling 23,780 patients. There were 169 patients (0.7%) who left without treatment (walkouts): 0.89% of the level 1 ED patients and 0.29% of the level 3 ED patients. The average observed daily walkout rate was 1.4 walkouts over the 4-month observation period. The 169 walkout patients were compared with a random sample of 338 patients who stayed for treatment. With this number of patients, we could statistically detect an OR for walkout of 1.40.

Sixty-four (38%) walkouts left before triage. Target times to treatment had elapsed for 57 walkouts at the moment of leaving (54% of the triaged walkouts ( $n = 105$ )). For patients who stayed for treatment, target times to treatment had elapsed for 61 patients (19% of the triaged patients who stayed for treatment,  $n = 322$ ) at the start of their treatment. Walkouts were more often standard/non-urgent patients: 74.3% of the walkouts compared with 48.1% of the patients who stayed were triaged standard/non-urgent.

### Risk factors for walkout

Table 1 shows the adjusted OR and 95% CI of each predictor of walkout. Arriving during the evening and night (OR 2.14, 95% CI 1.23 to 3.70 and OR 4.40, 95% CI 2.00 to 9.67, respectively) or during crowded conditions (OR 1.06, 95% CI 1.01 to 1.10) was significantly associated with walkout. Age, sex, ambulance arrival, having a GP, being uninsured, number of ED visits and number of hospital admissions of the patient in the previous year were not significant in our model. The odds of walkout increased significantly when the patient was self-referred (OR 2.81, 95% CI 1.46 to 5.41) and when allocated triage a standard/non-urgent triage level (OR 5.53, 95% CI 1.82 to 16.79). The Hosmer-Lemeshow goodness-of-fit test *P* value was 0.09. Accuracy of the model as obtained by the receiver operating characteristic area under the curve was 0.74 (95% CI 0.69 to 0.79).

**Table 1.** Predictors of walkout\*

	Walkouts <sup>a</sup> ( <i>n</i> =169)	Patients who stayed for treatment <sup>a</sup> ( <i>n</i> =338)	Adjusted odds ratio <sup>b</sup> (95% CI)	Adjusted odds ratio (95% CI), final model
<b>Arrival time</b>				
Day shift	50 (29.6)	153 (45.3)	Reference	Reference
Evening shift	88 (52.1)	133 (39.3)	1.97 (1.12, 3.46)	2.14 (1.23, 3.70)
Night shift	31 (18.3)	52 (15.4)	4.00 (1.76, 9.08)	4.40 (2.00, 9.67)
<b>Age (mean, SD)</b>	30.70 (18.5)	40.1 (22.8)	0.99 (0.98, 1.00)	-
<b>Sex, male</b>	93 (55.0)	165 (48.8)	1.10 (0.67, 1.80)	-
<b>Arrival with ambulance</b>	8 (4.7)	63 (18.6)	1.05 (0.31, 3.58)	-
<b>Self-referred</b>	151 (89.3)	200 (59.2)	2.58 (1.12, 5.95)	2.81 (1.46, 5.41)
<b>Registered with a GP</b>	139 (82.2)	301 (89.1)	1.67 (0.83, 3.38)	-
<b>Uninsured</b>	14 (8.3)	17 (5.0)	1.05 (0.38, 2.94)	-
<b>ED visits in the previous year</b> (mean, SD)	1.06 (2.0)	1.09 (2.2)	1.06 (0.93, 1.21)	-
<b>Hospital admissions previous year</b> (mean, SD)	0.24 (0.9)	0.59 (2.1)	0.92 (0.68, 1.24)	-
<b>Crowding index<sup>c</sup> (mean, SD)</b>	16 (7)	14 (7)	1.06 (1.01, 1.10)	1.06 (1.01, 1.10)
<b>Triage level</b>				
Immediate and high urgent	4 (3.8)	57 (17.7)	Reference	Reference
Urgent	23 (21.9)	110 (34.2)	2.26 (0.70, 7.28)	2.34 (0.74, 7.37)
Standard and non-urgent	78 (74.3)	155 (48.1)	5.17 (1.65, 16.21)	5.53 (1.82, 16.79)

\* Model based on 427 observations due to missing values on triage level

<sup>a</sup> Number of subjects (%) except otherwise indicated

<sup>b</sup> Adjusted for other variables by logistic regression, OR > 1 indicate an increased risk of walkout.

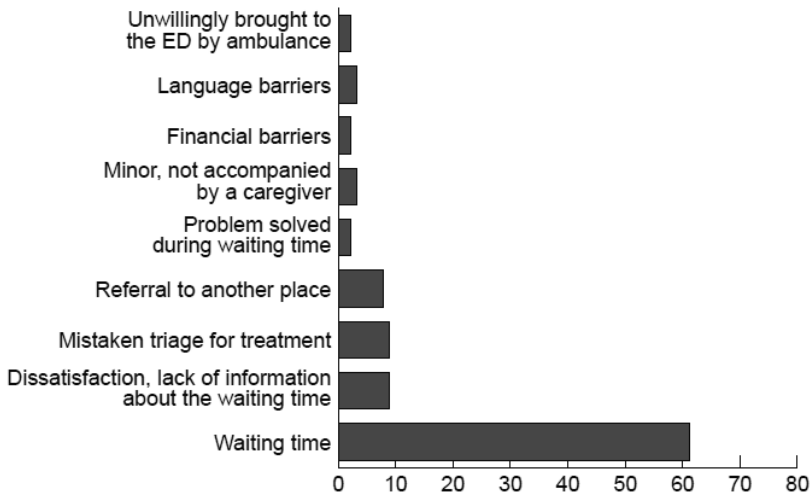
<sup>c</sup> The number of patients presenting within the same hour and in the hour before the ED visit of a subject



### Reasons for leaving without treatment

Of the walkouts, 90 (53.3%) were contacted by telephone, consented to be interviewed and completed the survey. Seventy-nine (46.7%) patients were not contacted: 46 patients had an incorrect or no telephone number listed, 14 patients were not reached, four patients could not be interviewed because of language barriers, one patient was admitted to the hospital and 12 patients had already revisited the emergency department before they were reached by phone. Another two patients refused to participate. No notable differences in arrival time, age, sex, self-referral, crowding index and triage level were found between the patients who were interviewed and the patients who were not interviewed (data not presented).

Figure 1 shows the reported reasons for leaving without treatment. The most-cited reason for leaving (61.1%) was waiting time, followed by dissatisfaction because of lack of information about the waiting time (8.9%) and mistaking triage for treatment (8.9%). Two patients left because they were brought to the emergency department by ambulance against their will, both after an epileptic seizure.



**Figure 1.** Reasons for leaving without treatment

Of the 90 walkouts interviewed, 73 answered the question about their waiting times before leaving; the remaining 17 were unsure. The median actual waiting time for walkouts was 88 minutes (range 1-332 minutes). The median perceived waiting time was 60 minutes (range 1-420 minutes).

Table 2 shows that most patients simply wanted to be helped sooner (46.6%) to prevent them from leaving. Sixteen patients mentioned more than one intervention: quicker help, more information about the reason of waiting and whether it was actually necessary to wait for a doctor. Although it is ED policy to keep patients fasted until their diagnosis is certain in case they need surgery, four patients claimed that having food and drinks available would have increased the amount of time they would have been willing to wait.

**Table 2.** Factors patients reported that might have prevented them from leaving without treatment ( $n=90$ )

	<i>n</i> (%)
Getting help quicker by ‘adding more doctors’	42 (46.7)
More than one intervention needed (such as quicker help, or more information about the waiting time and about the reason for waiting)	16 (17.8)
Information about the waiting time	11 (12.2)
Comfort measures (analgesics, a better chair, a separate room)	10 (11.1)
Catering service in the waiting room	4 (4.4)
Improved communication during triage for patients with language barriers	4 (4.4)
Arranging parental consent for minors by telephone	2 (2.2)
Prescription of medication during triage	1 (1.1)

### Walkouts’ medical care needs

Twelve (7.1%) walkouts returned to the emergency department on their own initiative within 3 days for the same complaint or its direct consequences; one patient was subsequently hospitalised for deep vein thrombosis of the left leg and a pulmonary embolus.

Table 3 summarises the medical care needs, if any, after leaving. Forty-seven (52.2%) out of the 90 walkouts who had a follow-up interview sought medical care within 3 days after leaving the emergency department. Eighteen patients went to their GP, 14 patients went to another hospital and nine patients sought specialist care within the hospital. The six patients in the ‘Other’ category were patients seeking help from a dentist, pharmacy, or a midwife.

**Table 3.** Medical care needs of walkouts ( $n=90$ )

	<i>n</i> (%)
<b>Walkouts that did seek medical care</b>	<b>47 (52.2)</b>
GP	18 (20.0)
Emergency department of another hospital	14 (15.6)
Outpatient clinic within the same hospital	9 (10.0)
Other (dentist, pharmacy, midwife)	6 (6.7)
<b>Walkouts that did not seek medical care</b>	<b>43 (47.8)</b>
Medical problems had spontaneously resolved	19 (21.1)
Advised by ED social worker to go to the GP	16 (17.8)
Invited back to the emergency department by ED social worker	4 (4.4)
Advised by ED social worker to go to the pharmacy	4 (4.4)

Of the remaining 43 patients who did not seek medical care within 3 days, 19 had medical problems that resolved spontaneously and the remaining 24 patients indicated having persisting medical problems needing care. The ED social worker advised 16 of them to go to their GP, four patients were invited to return to the emergency department and four patients were advised to go to a pharmacy for prescription-free drugs (Table 3).

## DISCUSSION

We observed a walkout rate of about 1-2 patients every day over 4 months. Target times to treatment had elapsed for more than half of the triaged walkouts at the moment of leaving. Independent predictors of leaving without treatment included arriving during the evening or night or during crowded conditions, being self-referred and lower urgency triage allocation. Waiting time was the main reason for leaving. Strategies addressing long waiting times are required, especially targeting the high risk groups such as the urgent or high urgent walkouts (over one-quarter of the triaged walkouts). A substantial part of the interviewed walkouts who perceived a need for medical care, were helped by our social worker in finding appropriate care, indicating that it is useful to follow-up on walkouts.

Published percentages of walkouts vary from 0.06% to 20% [3-5,15] depending on the definition for example, with or without including patients leaving the examination room [4,21]. Our walkout rate (0.7%) was relatively low compared with international data, probably because ED crowding is milder in the Netherlands compared with many other countries [10]. However, target times to treatment elapsed for 54% of the walkouts and 38% of the walkouts left before triage, suggesting that crowding issues did occur during our study. Our triage system, which includes blood draw requests, radiographs and nurse-driven pain medication prescription, may prevent some patients from leaving prematurely [4,19]. The opposite may also occur: eight patients did not wait for treatment because they thought that the triage was the treatment. The latter implies the necessity of better communication during triage.

In line with other studies, our walkouts on average had lower urgency triage levels [4,8]. In some studies, walkouts were younger [3,22] and more likely to be male [13,15,22,23], but we found no effect of age and sex.

Walkout patients may be at risk for poor health outcomes. About 7% of the walkouts revisited the emergency department within 3 days for the same complaint. Although others report hospitalization rates of walkouts of  $\pm$ 4-11% [17,23], in our study only one (0.6%) walkout patient needed hospital admission. Whether this admission could have been prevented if the patient would have stayed during the first ED presentation is unclear.

**Follow-up interview with the walkouts**

In line with other reports, the main reason for patients to walkout in our study was waiting time [15,19]. Displaying the approximate waiting time for various triage categories in the waiting area may be helpful to prevent patients from leaving [13], although the opposite might also occur: patients leaving when they see the displayed long waiting time. Eleven patients mentioned that information about waiting time would have prevented them from leaving and another 16 mentioned waiting time among other interventions. Initiatives to address elapsed target times to treatment, such as expanding nursing staff and double triage covering, are the key in preventing patients from leaving before treatment.

**Limitations**

First, we were unable to contact about half of the walkouts, despite five attempts. A sizable number did not have any details or incorrect details and thus could not be contacted, which calls for improvements in the registration process. No notable differences were found in patient characteristics between participants and nonparticipants, making it less likely that the findings were subject to no response bias. However, it is possible that patients with psychosocial distress were over-represented in the group of non-responders.

We may also have missed admissions or ED revisits to one of the other hospitals in the non-responders. Many responders had ongoing symptoms and either sought care or were helped with finding the appropriate care. However, the absence of a control group from patients who did wait to be seen and experience ongoing symptoms limits the value of this finding.

Second, there is no criterion measure for crowding [24]. The method used, counting the number of patients registered during the hour of registration and the hour before, represents only one aspect of ED crowding. It does not account for the intensity of care needed for the patients at the emergency department, for example, patients waiting to be admitted. Future studies should determine to what extent crowding affects the frequency of patients leaving without treatment using validated crowding measurements [25].

Third, leaving time of the walkouts was set at the time that the patient was called by the triage nurse and not being present in the waiting room. This measure results in an overestimation of the actual waiting times of the walkouts.

The fourth limitation is related to data that were not captured in this study, such as ethnicity and socioeconomic status, both known to have an impact on LWBS [5,26]. Unfortunately, this information is not routinely entered in the hospital information system.

Finally, data were collected at only two emergency departments; thus, findings may not be generalizable to other emergency departments because of social and cultural differences. However, for the two emergency departments in our study, the inclusion of emergency department (level 1 vs. level 3) in the modelling was not associated independently with the walkout rate and did not alter the associations presented (results not shown).

## CONCLUSION

Independent predictors of leaving without treatment included arriving during the evening or night or during crowded conditions, being self-referred and lower urgency triage allocation. Most walkouts leave because of the perceived waiting time. A small but significant proportion of ED patients lack required timely medical treatment. As a matter of risk management, it might be useful to follow-up on the walkouts to be able to refer them to appropriate care.

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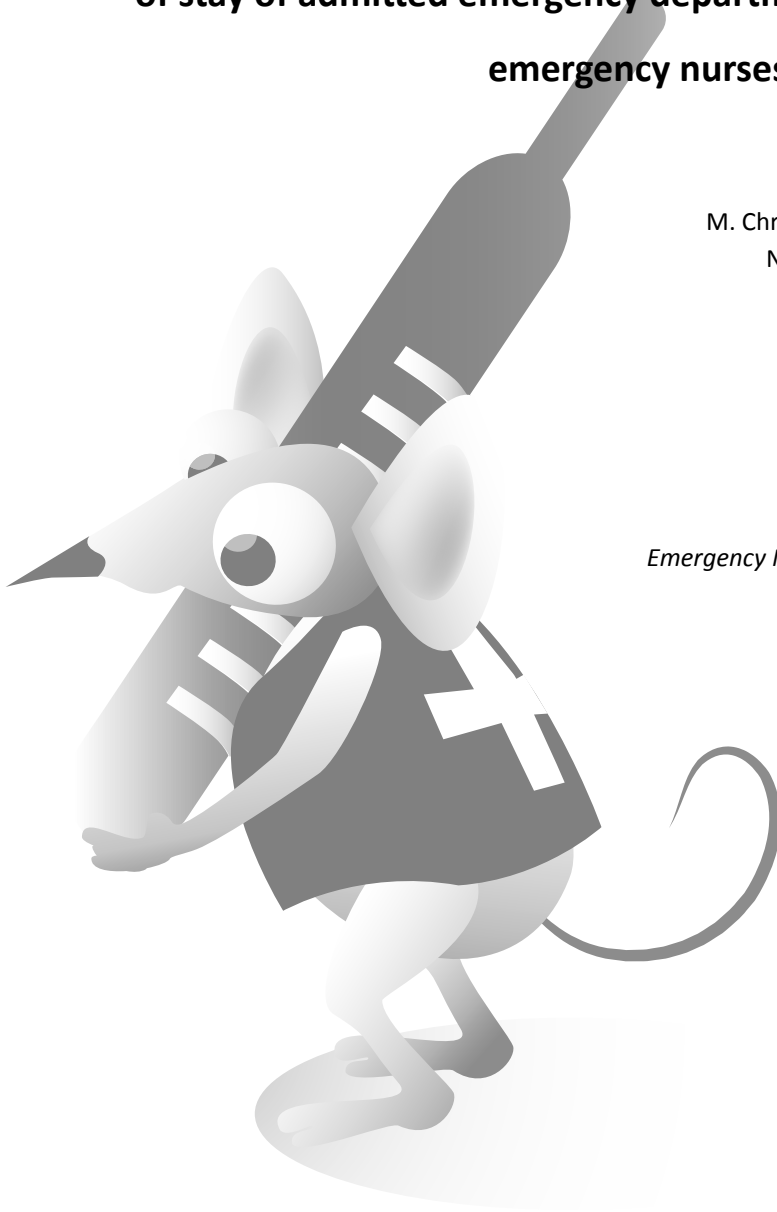


# Chapter 10

## **A flexible acute admission unit to decrease length of stay of admitted emergency department patients: emergency nurses' perceptions**

M. Christien van der Linden  
Naomi van der Linden  
Robert Lindeboom

*Emergency Nurse*, 2010, 18: 12-7



**SUMMARY**

The Medical Centre Haaglanden, the Hague, the Netherlands, has opened a flexible acute admission unit to increase throughput of acute patients. The flexible acute 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. A qualitative evaluation of the flexible acute admission unit has revealed that it has reduced emergency nurses' workload and allowed them more time to see and treat patients. This suggests that the introduction of flexible acute admission units may address similar problems of emergency department throughput in the United Kingdom.

## INTRODUCTION

One of the major causes of overcrowding in emergency departments (EDs) is the need for patients to wait until beds become available [1]. These waits are largely determined by the acute and critical care bed capacity of the hospitals concerned [2].

Long waits in emergency departments are a patient safety risk [3], causes patients to leave without being seen [4] and increases inpatient mortality [5]. Ensuring that inpatient beds are available when they are required is essential, therefore, if emergency departments are to operate efficiently while meeting acceptable levels of risk [6].

Research has demonstrated that overcrowding in emergency departments can be reduced most effectively by moving admitted patients to inpatient settings as rapidly as possible [7].

Measures to decrease the number of admitted patients waiting for beds include the allocation of space in or near emergency departments for use as waiting areas, known as short-stay or acute-admission units [8-11], or the adoption of a full-capacity protocol, by which admitted patients are sent to wait in corridors in other wards until inpatient beds are available [3, 12, 13].

Where the full-capacity protocol is adopted, inpatient wards cease to be shielded from hospital overflow. Finding beds for patients becomes a hospital-wide, rather than an ED-only, problem [14], and doctors and other staff are more motivated to make beds available [15].

The Medical Centre Haaglanden (MCH) emergency department has had overcrowding problems for several years and, as a result, its staff have been under growing pressure to improve patient flow.

Although there has been spare capacity in the MCH, ED staff have experienced difficulties in obtaining inpatient beds because specialists and staff have been reluctant to admit patients from other specialties to 'their' beds. Instead, patients have been transferred to other hospitals, and have had to occupy valuable space in the emergency department while they wait for their transfers to other hospitals.

At the MCH, the full-capacity protocol was adapted to create a 'flexible' acute admission unit (FAAU), in which at least 15 inpatient beds are allocated daily and out-of-hours on several wards throughout the hospital. Children, pregnant women and patients waiting for admission to coronary care or intensive care units are excluded from the FAAU.

The FAAU is not an ED admissions unit, in which diagnoses have yet to be determined. Instead, FAAU beds are intended for patients whom decisions to admit have already been made, but no standard inpatient beds are available in the appropriate specialties.

The unit is expected to increase bed flexibility; that is, to ensure that beds that are temporarily empty but for which there are sufficient staff and equipment, are allocated for acute admissions. Such flexibility supports the transfer of admitted patients from the emergency department to other floors.

Implementation of the FAAU requires the energetic management of existing hospital resources. An admissions coordinator scouts for empty beds on every floor during the daily bed-management rounds at 3 p.m. Empty beds are changed to FAAU beds from 4 p.m. until 8 a.m. the next day. If possible, patients are transferred during office hours from the FAAU beds to the specialty wards.

Because the influx of patients into emergency departments is reasonable predictable (Greene 2007), the number of inpatient beds needed may be assessed in advance. In the MCH, an average of ten patients a day are admitted out-of-hours to the wards, which means that no more than 15 dedicated FAAU beds are needed during the evenings and nights.

## QUALITATIVE STUDY

The authors, who are awaiting the results of quantitative research into the FAAU, undertook a qualitative evaluation of staff experiences of the initiative to identify their opinions, perceived problems and how these can be overcome.

Data were collected by asking all nurses in the emergency department three open questions by email and by including them in a focus group. The three questions were:

- What do you think about the FAAU?
- What are the advantages?
- What are the disadvantages?

These questions were sent to the nurses by email to allow them to comment on anything they thought was important, at any length. The nurses were also given written and verbal explanations of the purpose of the study and how the data would be used.

Of the 42 nurses in the emergency department, 33 (79 per cent), comprising seven males and 26 females, responded to the emails. The lengths of response ranged from 44 to 491 words.

Invitations to participate in the focus group were sent in the weekly emailed newsletter to all 42 emergency nurses. Seven (17 per cent) comprising two males and five females, agreed to take part and the focus group was held on December 21 2009.

The focus group began with an introduction of the informed consent process, including consent to the discussion being recorded for analysis. Confidentiality was maintained and all data were stored securely so that only the researchers had access to it. During the meeting, the researchers asked semi-structured questions to clarify responses to the emailed questionnaire.

Recordings of the discussion were then transcribed, and the transcriptions and the emailed responses were analysed using a fundamental qualitative description approach [16].

Two of the researchers extracted, coded and categorised all statements that related to the perceived effects of the FAAU. The data were then organised into seven themes: ED throughput, time, ease, feelings, cultural differences, effects on others, and suggestions. Where there was ambiguity, the final coding was determined by mutual agreement between the researchers.

### **Emergency department throughput**

Six of the seven nurses in the focus group said that the implementation of the FAAU had improved ED throughput even though the number of patients had increased and injuries had become more severe over time.

Moreover, because implementation allowed more patients to be admitted to the hospital, waiting times for ambulances to transfer patients to other hospitals had become negligible.

These experiences support Howell et al.'s (2008) [17] findings, that management of available inpatient beds can decrease ED throughput times and ambulance-throughput problems.

However, while finding and allocating beds at MCH has become easier, transfer to the relevant wards can still take a long time, especially to those that have been allocated several patients over short periods of time. In such cases, patients must wait in ED beds and ED throughput decreases.

One nurse claimed that, occasionally, doctors wait until 4 p.m., when FAAU beds are available, before admitting some patients, even though the FAAU was implanted to make the process of admitting patients out-of-hours easier. When doctors wait in this way, ED throughput is unchanged although daytime transfers to other hospitals are reduced.

### Time

Hlipala et al. (2005) [18] describe hospital admission processes as ‘fragmented, time consuming and a source of patient and staff dissatisfaction’, and the biggest advantage of the FAAU, according to respondents, is that it decreases their workload and saves them time.

Before implementation of the FAAU, ED nurses were responsible for finding beds, which often meant they had to contact staff in other hospitals and wait for ambulances to transport patients to them. After implementation, however, staff can admit most patients at the serving hospital, if necessary to non-specialty beds.

Only intensive care admissions still take as long as they did, but this is because such patients cannot be allocated to FAAU beds and must be monitored carefully until their transfer.

Comments on how FAAU implementation has changed the time taken to transfer patients included:

*‘You do not lose hours and hours on the phone,’* Nurse 2.

*‘Usually, you can get a patient out of here within half an hour,’* Nurse 7.

*‘When you ask the night head nurse for a bed, you immediately know where your patient can go,’* Nurse 4.

*‘You can be certain that there are free beds after four o’clock,’* Nurse 1.

### Ease

According to Shih et al. (1999) [19], clear rules are needed to ensure flexible bed assignment and to decide which wards should accommodate ED admissions.

All participants in the study said that, after implementation of the FAAU, patients, especially those from the ‘wrong’ specialties, could be admitted more easily.

This is important because, according to one participant, Nurse 5: *‘Sometimes you get neuro patients all night and sometimes you get patients with pulmonary complaints all night.’*

Respondents claimed that, before implementation of the FAAU, ward staff could refuse to admit patients even though they had beds available and their reasons for doing so were sometimes unclear. They would say, for example, that they could not ‘handle’ a specific patient or that their manager had decided that ‘no more patients will get in’.

After implementation, however, these situations should not arise. As Nurse 1 said: *‘Now, everybody knows the rules of the game. There is less discussion and, disregarding time-pressed situations, there should be at least 15 beds available on the wards after four o’clock.’*

Implementation of the FAAU was a relief to nurses who had experienced high workloads and irritation from discussing patient admissions. Nurse 1, for example, said that co-operation and communication between the emergency department and other hospital wards *'is better since the rules are clear'*.

However, where the rules about patient admission remain unclear, for example when patients must be admitted to specific parts of MCH, nurses still experience problems doing so. Problems can also arise at weekends, when the FAAU does not operate and when hospital ward staff, especially those who are busy or inexperienced, can be reluctant to admit patients.

On this subject, Nurse 3 noted: *'Good communication is crucial to get as many people as possible admitted without hassle.'*

Meanwhile, Nurse 1 said: *'It is better than it used to be, when we were told that there are no beds and that is that.'*

### Feelings

Stress among care providers can lead to burnout and loss of skilled staff [20]. In discussing how FAAU bed management affected how they felt about the admission process, respondents' comments included:

*'Before, sometimes, everything was just full up, and there you were with all your admissions,'* Nurse 2.

*'You know those 15 beds are there,'* Nurse 2.

*'You feel like you always have some room,'* Nurse 5.

*'It is a relief,'* Nurse 3.

Respondents also said that they like to have an overview of the available beds. Even when long periods of time pass until patients leave the emergency department after beds have been reserved, the fact that beds have been made available gives staff a feeling of certainty.

Nurse 3 said of having an overview of available beds: *'You can attend to other patients.'*

Nurse 2 said: *'You can get it out of your mind. You do not feel the pressure.'*

### Cultural differences

Distrust arising from perceived cultural differences between groups of staff can hinder the patient-admission process. These perceived differences are between staff 'downstairs', in the emergency department, and those 'upstairs', in other hospital wards. For example, while ED staff must take their lunch breaks if and when they have the time, ward staff take them at the same time and for the same duration every day.

This leads to irritation among ED staff when the ED waiting room is full and patients must be admitted while ward staff are at lunch.

As Nurse 3 said: *'If the personnel upstairs are eating, it is impossible for them to admit any patients. Like we have time for lunch.'*

Emergency nurses sometimes think that ward staff are reluctant to admit patients and hold back available beds. Their excuses for doing so include:

*'The severity of the injuries is too high,'* Nurse 6.

*'Because of sickness of personnel,'* Nurse 7.

*'Because there are agreements with the manager,'* Nurse 3.

These kinds of complaints can be found in the literature. Sorelle (2001) [20], for example, cites an emergency physician's comment on the overcrowding problem: *'There are often beds available but emergency nurses cannot get patients into them because someone is hiding them or using them for more financially attractive cases. You can only meet so much and have so many memos written before you get exhausted by it.'*

Nurse 1 said of the situation: *'I keep finding this strange.'* Nurse 4 was more blunt, saying: *'Upstairs, they cheat.'*

Nurse 3, meanwhile, described the wards as *'a grey area'* and Nurse 2 called them *'the twilight zone'*.

Since the implementation of the FAAU, these problems still arise and vary by day and ward, but, according to Nurse 1, are *'nothing compared to how it was before'*.

The new way of working, Nurse 6 said, *'keeps everybody involved with the acute admissions'*.

### **Effects on others**

For patients, there are advantages and disadvantages in the FAAU. It has reduced the number of transfers to other hospitals and ensures that patients are admitted earlier.

However, since patients are admitted to the 'wrong' specialty wards, they must often be transferred again, which is inconvenient for them and for staff.

Respondents acknowledged that there are advantages and disadvantages in the FAAU for other ward staff too. In wards with many unoccupied beds, for example, acute admission can be burdensome, especially if several take place during a single evening shift.



Emergency nurses cannot therefore expect ward staff to come to the emergency department to organise patient admissions within five minutes of being called.

When it is clear which beds are unoccupied, ED staff try to spread admissions over different wards.

Ward staff may be unfamiliar with some patients' symptoms and illnesses, or think that they cannot provide patients with optimal care.

Respondents were uncertain about the importance of this. Nurse 6 said: *'On the one hand, nurses should be able to turn their hands to anything and be able to ask questions or call out when a patient's condition changes. On the other, some cases are really complex.'*

## DISCUSSION

### Improvements

Although all respondents said that they were satisfied with the FAAU, they added that there is room for improvement. The minimum of 15 FAAU beds is not always reached.

Several respondents wanted the number of FAAU beds to be increased, to be 'on the safe side'; although Nurse 1 said the number *'usually seems to be enough'*. Some respondents said they would like the FAAU to operate at weekends.

For the system to work, everyone involved in it in the emergency department and on the wards must know how it works. Yet, emergency nurses believe strongly that there should be no discussion between them and ward staff about admitting patients to FAAU beds, particularly in time-pressed circumstances.

At the emergency nurses' request, therefore, signs were put on all FAAU beds to identify them as free for acute admission without any need for discussion. Ward staff, however, thought these were childish and unnecessary, so they were taken down.

Other methods of encouraging ward staff to admit acute patients without discussion were suggested, therefore.

One of these was to ask each ward nurse to spend an evening in the emergency department to see the pressure on ED beds for themselves, and to promote a greater understanding between them and ED staff. This was not followed up because, over time, the FAAU has become well-enough understood by ward staff that far less discussion is needed during admissions.

Another suggestion, that ward nurses should receive extra training in the care of acute patients to overcome their reluctance to admit such patients from other specialties, has been accepted and relevant clinical lessons are being organised.

### **Limitations**

The purpose of this study was to record and describe emergency nurses' views of the FAAU, and to identify perceived consequences, difficulties and suggestions for improvements.

Although the results are specific to MCH, ED overcrowding occurs and can be addressed in many hospitals in a similar way.

In the study, the sample of emergency nurses was not collected randomly. Most of the participants work as head nurses during night shifts and must cope with admission problems regularly. They probably had a special interest in the FAAU, therefore, and may have been more motivated to participate in the study than some of their colleagues.

Although the research sample was small, data saturation was achieved and is indicated by the high level of agreement between the answers. Actual data on throughput were not included in the study. Quantitative data have recently been collected and will be discussed in a separate article.

Emergency nurses identified improvements in the admission process after implementation of the FAAU, but these will not necessarily be replicated in the quantitative results.

### **CONCLUSION**

The study's findings indicate that emergency nurses are satisfied with the FAAU intervention. Their workloads have decreased and, in knowing that beds are always available for acute admissions, they are under less stress. However, mutual understanding among, and communication between, ED and other hospital staff can still be improved.

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# Chapter 11

## **Evaluation of a flexible acute admission unit: effects on transfers to other hospitals and patient throughput times**

M. Christien van der Linden  
Cees Lucas  
Naomi van der Linden  
Robert Lindeboom

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## ABSTRACT

### Introduction

To prevent overcrowding of the emergency department, a flexible acute admission unit was created, consisting of 15 inpatient regular beds located in different departments. We expected the flexible acute admission unit to result in fewer transfers to other hospitals and in a lower length of stay of patients needing hospital admission.

### Methods

A before-and-after interventional study was performed in a level 1 trauma centre in the Netherlands. Number of transfers and length of stay of admitted emergency department patients in a 4-month period in 2008 (control period) and a 4-month period in 2009 (intervention period) were analysed.

### Results

Of 1,619 regular admission patients, 768 were admitted in the control period and 851 in the intervention period. The number of transfers decreased from 80 (10.4%) to 54 (6.4%) ( $P=0.004$ ). The emergency department mean length of stay of both the non-admitted patients and the admitted patients needing special care significantly increased (105 vs. 117 minutes,  $P=0.02$ ; and 176 vs. 191 minutes,  $P<0.001$  respectively). However, the mean length of stay of flexible acute admission unit-admissible patients was unaltered (226 vs. 225 minutes,  $P=0.87$ ).

### Conclusions

The flexible acute admission unit reduced the number of transfers of admitted patients to other hospitals. The increase in length of stay for special care patients and non-admitted patients was not observed for regular, flexible acute admission unit-admissible patients. Flexible bed management might be useful in preventing overcrowding.

## INTRODUCTION

Emergency department (ED) crowding because of constraints in capacity, is associated with decreased patient safety, increased 10-day inpatient mortality rates, long patient waits, and ambulance diversion [1-3]. Ambulance diversion may result in increased mortality rates [4]. Empirical evidence confirms that a lack of ready and available admitting beds contributes to the problem of ED crowding [4-6]. Although there are multiple causes of ED crowding, inadequate inpatient capacity seems to be the main cause [7-9]. The inability to move admitted patients from the emergency department to an inpatient bed forces the emergency department to board these patients until inpatient beds are available. Boarding leads to delays in the care of new patients [10,11].

Schneider et al. [12] concluded that rapidly transferring admitted patients from the emergency department to a hospital bed had the single greatest impact in alleviating ED crowding. Computer simulation modelling by Khare et al. [13] subscribed to this conclusion.

Our hospital has a 'no diversion' policy, accepting all incoming patients. Since 2006, we have had difficulty in obtaining inpatient beds for ED patients. Crowding of the ED patient treatment area and transfers to other hospitals for patients needing admission were common. This occurred despite submaximal hospital occupancy, mainly because specialists were reluctant to admit patients from other specialties on 'their beds'. For example: a patient with rectal carcinoma had to wait in the emergency department until transfer to another hospital, despite enough available beds on other, non-oncology wards.

Dutch emergency departments do not experience overcrowding yet, but crowded conditions and ED throughput times are steadily increasing, including in our centre. To prevent this trend from continuing, we started using flexible bed management and created a flexible acute admission unit (FAAU). At least 15 potential FAAU beds divided over several departments were identified on a daily basis. The empty beds on every floor were changed into 'FAAU' beds from 4 p.m. until 8 a.m. the next day. During office hours, if necessary, emergency admissions were transferred from the FAAU beds to the departments where they belonged.

With this study, we tested the hypothesis that flexible bed management would lead to fewer transfers to other hospitals and to a lower length of stay (LOS) for ED patients needing hospital admission.

## METHODS

### Study design

We performed a before-and-after interventional study in an inner-city, level 1 trauma centre in the Netherlands with approximately 50,000 patient visits per year. We analysed all patients registered during off hours at our emergency department during a 4-month period in 2008 (control period) and a 4-month period in 2009 (intervention period). Patients who presented during weekends were excluded. The regional medical research ethics committee and the institutional review board approved the study.

### Intervention

A FAAU was implemented, consisting of 15 inpatient regular beds during off hours. Eight months after implementation of the FAAU, an extra intervention was introduced to sustain its effect. An 'admissions coordinator' was appointed to pay regular visits to the admission floors to scout for empty beds.

### Measurements

#### *Transfers*

In both periods, we counted the number of regular admission patients transferred to other hospitals.

#### *Throughput*

We measured throughput of ED patients by determining patient LOS, defined as the interval between patient registration and the moment the patient leaves the emergency department. Our group of interest was the 'regular admission patients' (n =1,619). These patients were not in need of special care (coronary care unit, cardiology, intensive care unit (ICU), stroke, obstetric, or paediatric care) and thus – in the intervention period - qualified for admission to a FAAU bed. We also report LOS for the non-admitted patients and for the admitted special care patients.

All data were collected from the hospital's electronic database (ChipSoft, Amsterdam, the Netherlands).

### Analysis

Data were transferred to PASW (Predictive Analytics Software, version 17, Chicago, Illinois, USA). Data validation comprised checking the data against medical records, complementing missing data, and inspecting the outliers in LOS for their correctness.



We used the  $\chi^2$  statistic to test the difference in the relative frequencies in number of transfers to other hospitals between the control period and the intervention period. The difference in mean LOS between both periods was tested by use of a 2-tailed, unpaired *t* test. Length of stay data were corrected for patient age, triage code and patient census by use of multivariable linear regression. Residuals were inspected for their approximate normality to check the assumptions of the regression model.

## RESULTS

In total, 17,308 patients visited our emergency department, of whom 8,377 were seen in the control period and 8,931 in the intervention period. Of those patients, 1,130 patients needed hospital admission in the control period and 1,271 needed admission in the intervention period. There were 792 special care patients, leaving 1,619 FAAU-eligible patients (*n* = 768 in the control period and *n* = 851 in the intervention period) ('regular admission patients') (Figure 1). The inpatient mortality rate in regular admission patients was similar for the control period (6.8 in 1,000) and the intervention period (6.4 in 1,000).

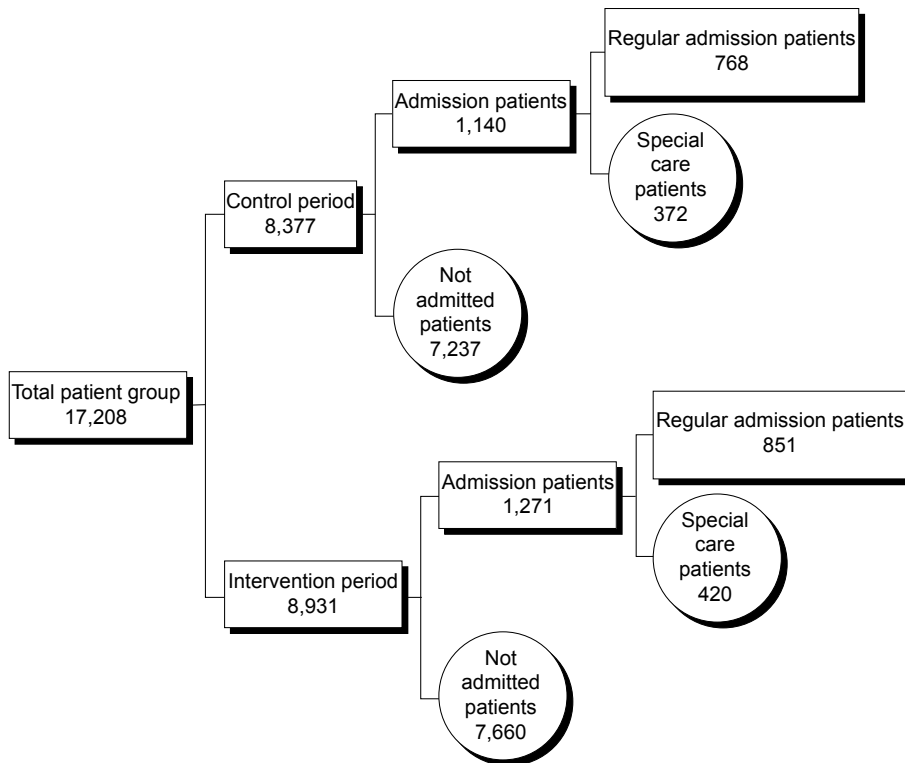


Figure 1. Patient flow scheme

Table 1 summarises the characteristics of all patients visiting the emergency department in the control and intervention periods. There were negligible differences in distribution of age, medical specialty, triage code and type of admission (regular admissions and special care admissions) between the control and intervention periods, although some differences were statistically significant because of the large sample size.

**Table 1.** Patient characteristics

	Observation period	
	Control period ( <i>n</i> =8,377)	Intervention period ( <i>n</i> =8,931)
<b>Mean age (SD) (y)</b>	35.65 (21.04)	35.41 (21.25)
<b>Medical specialty [<i>n</i> (%)]</b>		
Cardiology	631 (8)	687 (8)
Neurology/neurosurgery	612 (7)	687 (8)
Internal medicine <sup>1</sup>	1,522 (18)	1,777 (20)*
Surgery	4,309 (51)	4,374 (49)*
Paediatrics	198 (2)	302 (3)
Gynaecology	438 (5)	417 (5)
Other <sup>2</sup>	650 (8)	686 (8)
No specialism assigned	17 (0)	1 (0)
<b>Triage code [<i>n</i> (%)]</b>		
Red, immediate	40 (1)	62 (1)
Orange, very urgent	1,147 (14)	1,322 (15)
Yellow, urgent	2,806 (34)	2,770 (31)*
Green, standard	3,829 (46)	4,227 (47)*
Blue, non-urgent	92 (1)	112 (1)
No triage category assigned	463 (6)	438 (5)
<b>Admissions [<i>n</i> (%)]</b>		
Not admitted	7,237 (86)	7,660 (86)
Regular admission	768 (9)	851 (10)
Special care admission	372 (4)	420 (5)

\*  $P < 0.05$

1) Including gastroenterology and pulmonary medicine.

2) Including dermatology, ophthalmology, oral and maxillofacial surgery, otolaryngology, plastic surgery, psychiatry, radiology, rehabilitation medicine, rheumatology, and urology.

### Transfers

The number of patients who were transferred to other hospitals because there was no available bed decreased from 80 of 768 (10.4%) in the control period to 54 of 851 (6.4%) in the intervention period ( $P=0.004$ ). If we exclude transfers to the other location of our hospital, the number of transfers decreased from 10 of 768 (1.30%) in the control period to 1 of 851 (0.12%) in the intervention period ( $P=0.004$ ). The results of both methods of calculation were significant.

### Throughput

For the 14,897 patients who did not need to be admitted (of the total 17,308), the mean LOS in the intervention period was significantly higher than the mean LOS in the control period (117 minutes vs. 105 minutes,  $P < 0.001$ ) (Table 2). In addition, for the 792 special care patients (patients that could not be admitted to an FAAU bed), the mean LOS was significantly higher in the intervention period (191 minutes vs. 176 minutes,  $P=0.02$ ). For patients admissible to an FAAU-bed, this increase in LOS did not occur. The mean LOS of the 1,619 regular admission patients – eligible for an FAAU bed - did not significantly differ between the intervention period (2009) and the control period (2008) (226 minutes vs. 225 minutes,  $P=0.87$ ).

Correction for patient age, triage code, and patient census by use of multivariable linear regression did not alter these results in a noteworthy manner.

**Table 2.** Length of stay of non-admitted patients, regular admission patients (FAAU), and special care patients during the control period and the intervention period

	Control period ( <i>n</i> =8,377) LOS in minutes	Intervention period ( <i>n</i> =8,931) LOS in minutes
Non-admitted patients	105	117*
Regular admission patients (FAAU) ( <i>n</i> =1,619)	225	226
Special care admission	176	191*

\*  $P < 0.05$

## DISCUSSION

The instalment of the FAAU reduced the amount of transfers of admitted patients to other hospitals. The increase in LOS for special care patients and non-admitted patients was not observed for regular, FAAU-admissible patients, suggesting that the FAAU prevented ED crowding from increasing.

According to the American College of Emergency Physicians, moving admitted ED patients out of the emergency department to inpatient areas is a high-impact solution to reduce boarding and improve ED patient flow [14]. When inpatient beds are not available, patient flow barriers continue for those admitted [15], so it is imperative to match inpatient capacities to the number of ED admissions. Because the influx of patients into emergency departments is reasonably predictable [16], the number of inpatient beds needed can be assessed in advance. In our centre, on average, ten patients per day are admitted on regular floors during off hours. The assignment of 15 FAAU beds per day during off hours resulted in a substantial decrease in patient transfers to other hospitals.

Various measures exist to alleviate boarding. One is to create special waiting units (e.g., clinical decision units, short-stay units, or acute admission units) for these patients [17-19]. Another strategy is to send admitted patients up to the units' hallways until a bed is available, instead of boarding these patients in the halls of the emergency department. This is called the 'adopt-a-boarder' or 'full-capacity' approach to ED crowding [16,20-22]. The boarding of ED patients becomes a hospital problem as opposed to an ED problem [23] and motivates physicians and staff to make beds available because their awareness of crowded conditions grows [24]. The FAAU is a combination of both strategies.

It is difficult to compare our results with those of other studies on the effect of 'real' (centralised) acute admission units on LOS. In a US hospital, Buckley et al. [17] determined the impact of an express-admit ED unit on median LOS and found a 10% improvement (from 8 hours 21 minutes to 7 hours 41 minutes for all admitted patients). Hong et al. [22] found a significant decrease in ED LOS of 62 minutes between patients admitted to an express-admit unit and non-express-admit unit patients (9 hours 47 minutes vs. 8 hours 45 minutes). Bazarian et al. [25] showed that implementing a short-stay unit shortens LOS not only for admitted patients but also for certain groups of patients who were discharged home. Buckley et al. found a small improvement (4%) in LOS for discharged patients as well (from a median of 3 hours 41 minutes to 3 hours 35 minutes) [17]. Our LOS for discharged ED patients did not decrease but increased and so did the LOS for special care patients. We believe this is the effect of crowding and expect the overall mean LOS to increase further. For a few years, we have struggled with a shortage of beds in the emergency department and a sharp increase in the number of patients registering for treatment. The FAAU would only affect the regular admitted patients and not the special care patients and discharged patients.

Contrary to some other European countries and in the United States, ED crowding is a relatively recent problem in the Netherlands. Although the ED of our centre is one of the busiest emergency departments in the Netherlands, its mean LOS (<2 hours) is shorter than that in many other countries. Valuable lessons can be learned from these countries in the prevention of ED crowding, because various approaches, such as observation units and hospital bed access, have been evaluated extensively [26].

A direction for further research would be to assess the cost-effectiveness and long-term effects of the FAAU and to compare these with the effects of regular acute admission units or other holding units.

### **Limitations**

Because of our quasi-experimental design, this study has various limitations. First, although a causal relationship between instalment of the FAAU and the number of transfers or LOS is likely, it is difficult to prove such a relationship. Although we corrected for age of patients, triage code, and patient census, we could not correct for physician and nursing staffing and clinical experience level of staff between the control and intervention periods because we did not have these data. However, to our knowledge, no substantial changes in staffing, protocols, or processes occurred. Other sources of unmeasured variability may be related to laboratory and radiology turnaround times, number of intensive care patients in the emergency department, number of resuscitations, response times of consulted physicians, diagnosis, comorbid diseases, consultation rate, and other factors that may have complicated the evaluation process, making it more time-consuming. These variables may all affect LOS and probably have contributed to the small observed decrease in LOS between the control and intervention periods. This finding is in line with other reports on the increase in complexity and acuity of patients presenting to emergency departments [1,9].

Second, weekends and office hours were excluded, because the FAAU was in function only during off hours on weekdays.

A final limitation regards external validity, because our study was performed at a single centre.

**Implications for emergency nurses**

With the start of the FAAU, maximal bed flexibility was expected. Beds that otherwise were 'empty for admission the next day', or 'from another specialty' but were equipped and staffed, were assigned for acute admissions. Thus, admitted patients from most specialties could be directly transferred from the emergency department to other floors. The new procedure was implemented hospital wide, with high commitment of inpatient nursing wards. Hospital admission processes are often time-consuming and a source of patient and staff dissatisfaction [27]. For the ED nurses, 'finding a bed' is demanding, especially during off hours [28]. Despite the fact that the ED LOS stayed the same for the regular patients, ED nurses are very pleased with the flexible bed arrangements, knowing that there is always a bed available for their patient and often no transfer to another hospital is needed. Emergency department crowding is not just an ED problem and requires a systematic facility-wide multidisciplinary response [29]. Recognition of that insight by our hospital management led to the flexible bed arrangement. The ED nurses feel supported in their battle against ED crowding, because the entire hospital contributes to the ED flow.

**CONCLUSION**

In our hospital the implementation of the FAAU helped alleviate ED crowding by reducing boarding of regular admission patients waiting for transfer and by preventing an increase of ED LOS of these patients.

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# Chapter 12

## General discussion

INTRODUCTION

DISCUSSION OF THE MAIN FINDINGS

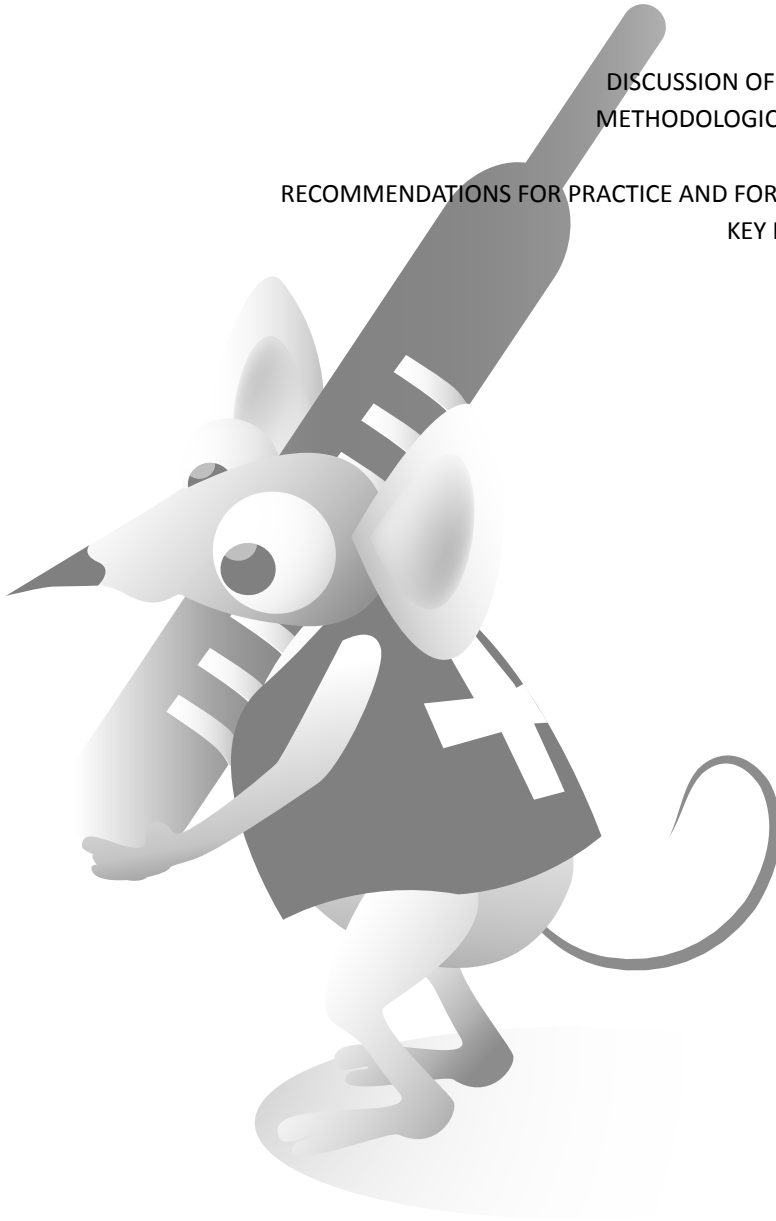
METHODOLOGICAL CONSIDERATIONS

CONCLUSIONS

RECOMMENDATIONS FOR PRACTICE AND FOR FURTHER RESEARCH

KEY RECOMMENDATIONS

REFERENCES





## INTRODUCTION

This thesis focused on different aspects of emergency department (ED) crowding and patient flow at the emergency department, using the largest inner-city emergency department in the Netherlands as study setting for most of our research. 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 and in improving patient flow at emergency departments in the Netherlands.

## DISCUSSION OF THE MAIN FINDINGS

### *PART I CROWDING IN DUTCH EMERGENCY DEPARTMENTS*

Sixty-eight percent of the responding Dutch ED nurse managers reported crowding occurring several times a week or even daily (**chapter 2**). Delays in consultations and laboratory and radiology services contributed to the problem. Admitted patients had a longer length of stay because of delays in obtaining inpatient beds. The reported crowding is well below that of studies performed in the USA in which 91% of the ED directors reported crowding to be a problem [1-3].

### *PART II INPUT OF THE EMERGENCY DEPARTMENT*

In our inner-city emergency department, 60% of our patients were self-referred, bypassing their general practitioner because of the EDs' easy access and because they believed that hospital emergency care was necessary for their complaint (**chapter 3**). Compared to previously published data from Dutch emergency departments, our self-referral rate was high [4,5]. Our self-referrals had urgent medical problems more often than those in another Dutch study [6]. An urgent medical problem increases the risk of a prolonged length of stay and associated ED crowding.

Emergency department crowding causes long waiting times and delays in treatment [7-12]. Maintaining a non-crowded emergency department requires hospital and ED staff to optimise patient flow and decrease patients' length of stay. Focusing on a timely discharge of patients that do not require admission is an important strategy for mitigating ED crowding [13]. Although the timely and swift treatment of patients is an important goal for emergency departments, it might lead to premature discharges [14] which, in turn may trigger unwanted ED return visits [15]. Patients returning to the emergency department within a few days of their visit or their stay at the hospital may contribute to ED crowding [15,16] and it is a vicious circle. In our study regarding ED return visits (**chapter 4**), unscheduled return

accounted for 5% of the ED visits. Our return visit rate compares well with other published return rates [15-21]. Most associated factors (an immediate/high urgent or urgent triage level, arriving during the night, having a longer length of stay at the first visit, suffering from a wound or local infection, or a urinary problem) differ from previous studies, except for 'abdominal complaints', which was found to be a risk factor in many studies [15,17,19]. The reasons for ED return were comparable with studies from other countries [15,21-23]: most often illness-related, then patient-related and least often physician-related reasons, prompted the patient back to the emergency department.

It has been documented that patients with frequent ED visits account for a disproportionate amount of the total ED workload and contribute to ED crowding [24]. Frequent visitors and highly frequent visitors are sometimes portrayed as unnecessarily clogging emergency departments by presenting with primary care problems better treated elsewhere [25]. A recent systematic review however, showed that many frequent visitors present with true medical needs [26]. The majority of the presentations of frequent visitors are not suitable for general practice [27]. Our findings in the study regarding high ED utilization (**Chapter 5**) were consistent with the latest evidence regarding high ED utilization: both frequent visitors and highly frequent visitors visited the emergency department for significant medical problems: shortness of breath, abdominal pain, urinary tract problems and psychiatric disorders. Frequent visitors had higher admission rates than patients with single visits. High ED utilization seems to be less a problem than outlined in international literature: frequent visitors and highly frequent visitors comprised only 0.5% of total ED patients, who presented to the two emergency departments on 2,338 occasions (3.3% of total ED consultations in one year). It is possible that the strong primary care network in the Netherlands prevents part of the ED visits.

## *PART II THROUGHPUT OF THE EMERGENCY DEPARTMENT*

One of the strategies proposed to improve patient flow and reduce crowding in Medical Centre Haaglanden was to allow trained emergency nurse practitioners to assess and treat patients with non-urgent complaints (minor injuries or illnesses) autonomously. Non-urgent presentation rates to emergency departments vary between 4.8 and 90% [28]. Non-urgent ED patients may contribute to ED crowding [28,29].

Studies from Canada, Australia, the Middle Eastern and the United Kingdom have demonstrated that emergency nurse practitioners are able to care for non-urgent ED patients, reduce ED crowding and improve patient satisfaction [30-34]. However, no allocation system or standardised approach in the assignment of presumed non-urgent ED patients to emergency nurse practitioners was found in the literature. Therefore, we

adapted the current triage system and validated the triage streaming. This stream system has helped to clarify emergency nurse practitioners role and prevent long waiting times for patients with minor injuries and minor illnesses (**chapter 6 and 7**).

The problem posed by redirecting a part of the patients to emergency nurse practitioners is safety of care. Are Dutch emergency nurse practitioners capable of treating patients with a diagnostic and management accuracy equivalent to that of a physician? We answered this question in **chapter 8**, accompanied with a description of the differences in patients' waiting times and patients' length of stay between emergency nurse practitioners and physicians. Our study confirmed that emergency nurse practitioners are able to care for non-urgent patients; there were no differences in diagnostic accuracy between physicians and emergency nurse practitioners. Furthermore, patients treated by emergency nurse practitioners as compared with patients treated by physicians had a shorter length of stay. Our results corroborate previous studies comparing emergency nurse practitioners with physicians in other countries [33,35].

### *PART III OUTPUT OF THE EMERGENCY DEPARTMENT*

Since ED crowding is associated with long waiting times for patients before evaluation, it can lead to patients leaving the emergency department without being seen or treated by a physician or emergency nurse practitioner [36,37]. Our walkout rate (0.7%) (**chapter 9**) was relatively low compared to international data, perhaps because ED crowding is milder in the Netherlands compared to other countries. However, target times to treatment elapsed for 54% of the walkouts and 38% of the walkouts left before triage, suggesting that crowding issues did occur during the study.

Output issues, especially the inability to transfer emergency patients to inpatient beds and the resultant 'boarding' of admitted patients in the emergency department for long periods, are most commonly associated with ED crowding [38-43]. Ensuring that inpatient beds are available when they are required is essential if EDs are to operate efficiently [44] and ED crowding can be reduced most effectively by moving admitted patients to inpatient settings as rapidly as possible [45]. To increase throughput of acute patients Medical Centre Haaglanden Westeinde opened a flexible acute admission unit. Our qualitative evaluation revealed that the flexible acute admission unit reduced ED nurses' workload (**chapter 10**). A before-and-after interventional study (**chapter 11**) showed a relevant reduction of the number of transfers of admitted patients to other hospitals. The expected increase in length of stay for special care patients and non-admitted patients was not observed for flexible acute admission unit-admissible patients. This finding suggests that flexible bed management might be useful in preventing ED crowding.

## METHODOLOGICAL CONSIDERATIONS

### LIMITATIONS

The limitations of each of the individual studies included in this thesis have been discussed in accompanying chapters. Here, we summarise some general methodological considerations.

Our studies, presenting different aspects of ED flow, were observational and explorative. Each study was conducted in response to questions posed by the Netherlands Society of Emergency Nurses (NVSHV) (chapter 2), the management of the emergency department of Medical Centre Haaglanden (chapters 4, 5, 6, 7 and 9) and hospital management (chapters 3, 8, 10 and 11). Although we were unable to test causal mechanisms as a result of the observational designs, our study results supply health care professionals and hospital management with valuable information regarding different aspects of patient flow and the state of ED crowding in the Netherlands.

We studied aspects of ED flow and factors related to ED crowding while lacking a standard definition of crowding and lacking a validated, objective measure of ED crowding. We used ED length of stay as a proxy for crowding to assess the effect of crowding on the studied subject (chapter 4, Unscheduled returns and chapter 5, High ED utilization) or the effect of the studied subject on crowding (chapter 10 and 11, Flexible acute admission unit). There is an accepted association between increased ED length of stay for admitted patients and crowding. This is based on the fact that boarding patients at the ED results in increased ED length of stay. However, increased ED length of stay will also contribute to crowding. The complicated relationship between ED length of stay, ED efficiency, ED capacity and ED crowding has not been fully explored [46]. The other measure we used (in chapter 9, Walkouts) was the crowding index, which was defined as the number of patients registered during the hour of registration of the index patient and the number of patients registered during the hour before the index patient [47]. The crowding index, as with length of stay, represents only one aspect of ED crowding and does not account for the intensity of care needed for the patients at the emergency department.

Measurements of crowding are not well developed internationally [46]. However, our purpose was to focus on different aspects of patient flow at the emergency department and to compare our findings regarding patient flow with international evidence. Both were possible since many retrospective, observational studies from North America and Australia have been carried out which used similar flow aspects and proxy measures.

Our studies took place in a single hospital, except for the study described in chapter 2 (which contained information regarding 63 emergency departments in the Netherlands) and the studies in chapters 5 and 9 (which were performed in two emergency departments). Our results presumably do not exactly represent other emergency departments in the Netherlands. Since the Medical Centre Haaglanden Westeinde was the largest emergency department in the Netherlands at the time of our studies, we assumed that crowding issues would be most prevalent in this study setting. However, our survey of ED crowding in chapter 2 showed that smaller emergency departments also suffer from crowding and some of these smaller emergency departments suffer from crowding even more often than some larger emergency departments in the Netherlands. Although the results in this thesis may not be literally transferred to other regions of the Netherlands, they provide an understanding of patient flow at Dutch emergency departments and factors related to ED crowding.

## CONCLUSIONS

We conclude that problems with patient flow exist in the Netherlands. Although crowding has not been the focus of research, clearly many Dutch emergency departments struggle with it. Most departments are implementing interventions to improve patient flow in order to prevent ED crowding.

Our study results suggest that it is possible to reduce the input of patients at our emergency department: a number of the self-referrals are suitable for primary care and some of the unscheduled returns may be prevented. The rate of frequent visits is very low and the majority of these visits are made for significant medical problems. Efforts focusing on this small group of patients will have minimal impact on ED use and on ED crowding.

A stream triage system may be used to objectively identify patients suitable for treatment by emergency nurse practitioners. Since the emergency nurse practitioners showed high diagnostic accuracy, the emergency nurse practitioner model of care is an important strategy in reducing length of stay of ED patients and may prevent ED crowding.

One of the predictors of leaving without treatment was arrival during crowded conditions. Waiting time was the main reason for leaving. When ED crowding evolves, strategies addressing long waiting times are required.

The implementation of the flexible acute admission unit alleviated output issues at our emergency department. Improving processes at the emergency department will reduce patients' length of stay. The effect of reduced ED length of stay on mitigating the problem of ED crowding needs further research.

## RECOMMENDATIONS FOR PRACTICE AND FOR FURTHER RESEARCH

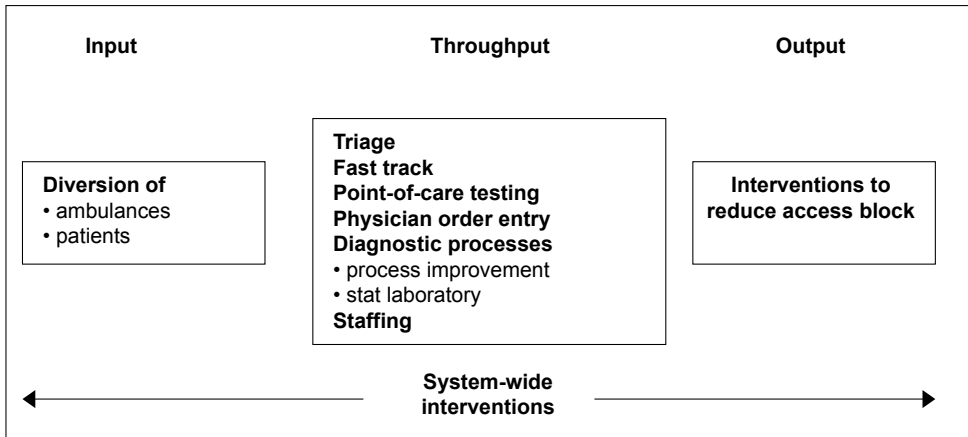
Internationally, research at emergency departments has been focusing on trying to define and measure ED crowding. Measures used in the literature to quantify crowding are categorised into five types [48]: clinician opinion, input factors, throughput factors, output factors and multidimensional scales. Input measures of crowding include waiting time [49,50], time to physician [51], waiting room filled > 6 hours/day [1,3], number of patients registered [52,53], ambulance diversion episodes [54] and number of patients awaiting triage [53]. Throughput measures of crowding include ED beds at capacity > 6 hours [1,3], number of full rooms [53], total number of patients in emergency department [41,51,53,55-57], ED occupancy rate [49-51,54,58,59], number of ED diagnostic orders [60], number of patients per nurse or physician [41,54] and ED length of stay [49-52,54]. Output measures of crowding include the number or percentage of admissions [56,61,62], the number or percentage of boarders [49-54,58,61-64], boarding time [49-51,53,54,57,58,63], ED admission transfer rate [54], the number of inpatients ready for discharge [54], patients leaving without being seen [58, 60] and inpatient occupancy level [54,56,60-62]. Finally, several multidimensional scales are used to quantify crowding [65-70]. In the Netherlands, only one study using a crowding scale has been published [71]. Many emergency departments in the Netherlands do not use electronic patient tracking systems that routinely collect the data elements needed to compute crowding scale scores.

Instead of calling for action to start collecting data elements to compute crowding scale scores in all Dutch emergency departments, we would recommend to measuring patient flow items. As Brent Asplin wrote: *Instead of defining and measuring what we don't want to happen, we should start defining and measuring what we want to happen* [72]. Measuring patient flow items consistently across sites and throughout time would enable researchers to study the effects of interventions aimed to prevent ED crowding or to reduce ED crowding. The input-throughput-output conceptual model of interventions (Figure 1) clarifies the ED processes that may improve patient flow and consequently, alleviate crowding if they are changed [73].

Many interventions of varying complexity, intensity and duration have been applied to improve ED patient flow and address the issue of ED crowding at the same time [73]. Additional personnel may reduce the patient length of stay and the rate of patients leaving the emergency department without being seen by a physician or emergency nurse practitioner [74,75]. Implementing point-of-care laboratory testing may decrease the length of stay [76]. Training nursing staff to order X-rays at triage is helpful and cuts the patients' stay by around 20 minutes [77]. Observation units may reduce the length of stay for outpatients, decrease ambulance diversion, reduce the number of boarding patients and reduce the



rate of patients leaving without being seen [44,78,79]. Increasing the number of critical care beds may reduce ambulance diversion [86]. Most interventions generate a moderate to large effect on ED crowding [73], however, similar interventions were implemented at different hospitals with varied success [80]. Before interventions are instituted, it is critical to identify what the main causes of crowding are in an emergency department [81] and how to make the flow through that specific emergency department more efficient.



**Figure 1.** Input-throughput-output conceptual model of interventions to alleviate ED crowding [73]. Model adapted from Asplin et al. [90] and Fatovich [91].

In conclusion, potential interventions to improve patient flow through the emergency department depend on the causes of ED crowding. In the Netherlands, input factors (such as the number of self-referrals presenting at the emergency department and the frequent users of the emergency department), were considered to be an important cause of ED crowding. A solution to this problem would be the implementation of general practitioner cooperatives at emergency departments and the referral of patients with minor complaints to a general practitioner. Internationally, research investigating the causes of crowding initially focused on input factors such as the use of the emergency department for non-urgent complaints [24,82-85]. More recent research suggests that input factors are probably not the root cause of the problem of ED crowding [81]. Discouraging the use of the emergency department for non-urgent issues will not have a meaningful impact on reducing waiting times for other patients or lessen crowding [86,87]. Strategies aimed at diverting patients with minor conditions may not work [88]: *while patients with minor conditions wait for care, they do so in the waiting room, thus not preventing access by seriously ill or injured patients to the emergency department.*

Rather, output issues especially the inability to transfer emergency patients to inpatient beds and the resultant boarding of admitted patients in the emergency department for long periods, are most commonly associated with ED crowding [38]. Nowadays, ED crowding is seen as *a local manifestation of a systemic disease* [29]. It is not a problem that results solely from problems in the ED or one that can be addressed using only ED-based solutions [72]. For example, there is a reasonable body of evidence correlating hospital occupancy with ED crowding [46].

In order to understand the complexity of the problem and the state of ED crowding in the Netherlands, we need robust, long-term data collection and analysis at national level. *Who* or *what* is causing crowding at the emergency departments in the Netherlands?

The lack of consistent collection of standardised ED data at institutional and national levels impairs the ability to quantify ED use and ED flow issues. No national registration database regarding setting characteristics and input- throughput- and output factors of the emergency departments in the Netherlands exists. LET'S START REGISTERING NOW!

## KEY RECOMMENDATIONS

- The Netherlands Society of Emergency Physicians (NVSHA), the Netherlands Society of Emergency Nurses (NVSHV) and government agencies should partner to bring together leadership dedicated to solve ED crowding. Since patients are harmed in crowded emergency departments [89], crowding should be considered as unacceptable.
- A consistent collection of standardised ED data (ED setting characteristics and input-throughput- and output factors) at institutional and national levels is needed to accurately measure and monitor ED use and ED flow nationwide and to measure and evaluate the effect of interventions to improve patient flow.

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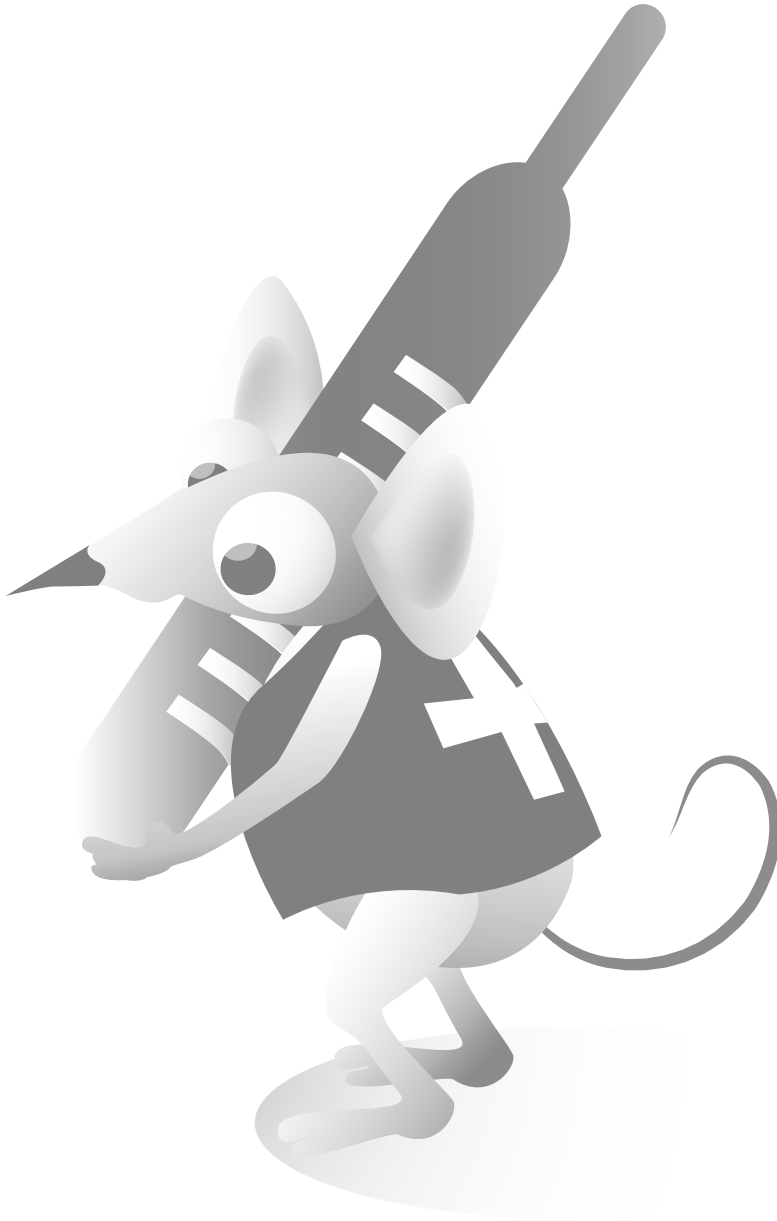
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# Chapter 13

## Summary in English





**Chapter 1** describes the background of this thesis. Crowding at emergency departments (EDs) is a widespread and complex problem. Consequences of ED crowding are listed. Furthermore, the conceptual model of Asplin which breaks down the problem of ED crowding into input, throughput and output factors is discussed. The aim of the studies in this thesis was to focus 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 and improve patient flow at Dutch emergency departments. A summary of each chapter of this thesis follows below.

### *PART I CROWDING IN DUTCH EMERGENCY DEPARTMENTS*

In the Netherlands, the state of ED crowding is unknown. Anecdotal evidence suggests that ED patients experience a longer length of stay compared to some years ago, which is indicative of crowding. However, no multi centre studies have been performed to quantify length of stay and assess crowding at Dutch emergency departments. In **chapter 2**, we present a study which describes the current state of emergency departments in the Netherlands regarding patients' length of stay and ED managers' experiences of crowding.

A survey was sent to all 94 ED managers in the Netherlands, with questions regarding type of facility, annual ED census, and patients' length of stay. Additional questions 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.

Surveys were collected from 63 emergency departments (67%). Mean annual ED visits were 24,936 (SD±9,840); mean length of stay for discharged patients was 119 (SD± 40) minutes and mean length of stay for admitted patients was 146 (SD± 49) minutes. Consultation delays, laboratory and radiology delays, and hospital bed shortage for patients needing admission were the most cited reasons for crowding. Admitted patients had a longer length of stay because of delays in obtaining inpatient beds. Thirty-nine of 57 respondents (68%) reported that crowding occurred several times a week or even daily, mostly between 12:00 and 20:00. Measures taken by hospitals to manage crowding included placing patients in hallways and using fast-track with treatment of patients by trained emergency nurse practitioners.

Despite a relatively short length of stay, frequent crowding appears to be a nationwide problem according to Dutch ED managers, with 68% of them reporting that crowding occurred several times a week or even daily.

## *PART II INPUT OF THE EMERGENCY DEPARTMENT*

**Chapter 3** presents a description of the caseload at the emergency department of MCH Westeinde, focusing on ED use by self-referrals and their eligibility for primary care treatment. Main outcome measures in this study were 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.

Of the 5,003 consecutive ED patients registering within the 5-week observation period, 3,028 (60.5%) were self-referrals. Younger age; non-urgent triage level; chest pain, ear-nose- or throat problems; and injuries were independent predictors for self-referral. Thirty-nine percent of the self-referrals had urgent triage levels, as opposed to 65% of the non-self-referrals. Self-referrals presented during out-of-hours as well as during office hours as a heterogenic group. Most cited motives for self-referring were 'accessibility and convenience' and perceived 'medical necessity'.

We concluded that about half of all self-referrals were eligible for primary care, during office hours as well as during out-of-hours. Therefore, other models of health care delivery than an out-of-hours ED - GP cooperative combination should be considered. For inner-city hospitals with many self-referrals presenting during office hours, an integrated emergency department and GP cooperative which functions 24 hours a day, 7 days a week, might work. Other options are GPs working in the emergency department, or the combination of emergency nurse practitioners with emergency physicians. Self-referrals with minor injuries and minor illnesses can be handled by emergency nurse practitioners via a separate fast-track stream. For more complex problems an emergency physician or a GP is available and for self-referrals with major trauma or needing specialist care, emergency physicians and other medical specialists are available. We recommend further research into different models of care, their clinical outcomes and cost-effectiveness and in ways to discriminate between patients needing hospital emergency care and patients who can be managed by primary care.

**Chapter 4** characterises ED return visits with respect to incidence, risk factors, reasons and post-ED destination. We hypothesised that risk factors for unscheduled return and reasons for returning would differ from previous international studies, due to differences in health care systems. All unscheduled return visits occurring within one week and related to the initial ED visit were selected. Multivariable logistic regression was conducted to determine independent factors associated with unscheduled return, using patient-information available at the initial visit. Reasons for returning unscheduled were categorised into illness-, patient-, or physician-related. Post-ED destination was compared between patients with unscheduled return visits and patients who did not return.

Unscheduled within-week return accounted for 5% (2,492/49,341) of our ED visits, implying an unscheduled return rate of over 200 visits a month. Patients presenting during the night shift, with a wound or local infection, abdominal pain or urinary problems, and with an urgent triage level were more likely to return unscheduled. Short-term follow-up at the outpatient clinic or GP for these patients might prevent unscheduled return.

Reasons to revisit unscheduled were comparable with studies from other countries: mostly illness-related (49%) or patient-related (41%). Admission rates for returning patients were the same as for the patients who did not return. Apart from abdominal complaints, risk factors for unscheduled return differ from previous studies.

**Chapter 5** presents a study on high ED utilisation. We assessed the proportions of frequent visitors (7 to 17 visits per year) and highly frequent visitors (greater than or equal to 18 visits per year); compared age, sex, and visit outcomes between patients with high ED utilisation and patients with single ED visits; and explored the factors associated with high ED utilisation. Two separate logistic regression models were developed, comparing frequent ED use with single ED use, and highly frequent ED use with single ED use. The variables included in the models were arrival time, arrival with ambulance, self-referral, chief complaint and triage level.

Frequent visitors and highly frequent visitors (together accounting for 0.5% of total ED patients) attended the emergency department 2,338 times (3.3% of the total number of ED visits). Frequent visitors and highly frequent visitors were equally likely to be male or female, were less likely to be self-referred, and they suffered from urgent complaints more often compared to patients with single visits. Frequent visitors were significantly older than patients with single visits and more often admitted than patients with single visits. Several chief complaints were indicative for frequent and highly frequent ED use, such as shortness of breath and a psychiatric disorder. Frequent visitors were more likely to be admitted than patients with single visits. Most patients with high ED utilisation visit the emergency department for significant medical problems.

Chapters 3, 4 and 5 assessed the caseload of the emergency department at MCH Westeinde. The results described in chapter 3 and 4 suggest that it is possible to reduce the input of patients at the emergency department: a part of the self-referrals are suitable for primary care and a part of the unscheduled returns may be prevented. Chapter 5 shows that the rate of frequent visits at our emergency departments is low compared to international standards. Moreover, the majority of these frequent visitors and highly frequent visitors visit the emergency department for significant medical problems. Efforts to improve ED flow that focus on this small group of patients will have minimal impact on ED crowding.

### *PART III THROUGHPUT OF THE EMERGENCY DEPARTMENT*

The Medical Centre Haaglanden Westeinde introduced the Manchester Triage System in 2002. The objective of the Manchester Triage System is to prioritise patients according to the severity of their conditions, consisting of five triage levels: immediate (level 1), very urgent (level 2), urgent (level 3), standard (level 4) and non-urgent (level 5).

To improve patient flow for patients with non-life-threatening conditions, a fast-tracking system for patients with minor injuries and/or minor illnesses was introduced in 2007. Emergency nurses were retrained as emergency nurse practitioner to assess, treat, and discharge patients with minor injuries and/or minor illnesses autonomously.

**Chapter 6** reports on the implementation of an adapted version of the Manchester Triage System in the Medical Centre Haaglanden Westeinde. The adaptation of the Manchester Triage System was needed to clarify emergency nurse practitioners' role boundaries and manage patient streaming. Emergency nurse practitioners' diagnoses are not linked directly to clinical priority (triage level). Therefore, it was not sufficient to simply assign all level 5 and level 4 patients to the emergency nurse practitioner. Emergency nurse practitioners are able to treat certain categories of patients with triage level 2 and 3 as well, while some patients with levels 4 and 5 should be treated by a physician. For example, our emergency nurse practitioners can treat patients with a dislocation of the shoulder that were triaged with level 2 because of the pain. However, they are not sufficiently trained to treat asthmatic children with level 4. The stream system helps to clarify the emergency nurse practitioners' role while ensuring that the objective of triage, to organise patients according to clinical priority, remains the same. Working with the stream system has improved patient flow and decreased the mean length of stay for patients with minor illnesses and minor injuries.

In **chapter 7**, we validated the stream system of the Manchester Triage System against ED patients' injury severity and resource utilisation. Electronic data on admission and death rates – indicating injury severity – and data on length of stay – indicating resource utilisation – were collected from 48,397 patients triaged in the Medical Centre Haaglanden Westeinde in 2009. A total of 24,294 (50.2%) patients were triaged as 'suitable for treatment by an emergency nurse practitioner' (ENP-stream). Remaining patients were triaged 'medium care' or 'high care'. In the medium and high care groups, significantly more admissions took place (6100, 25.3%) and significantly more patients had died at the emergency department (31, 0.1%) compared to the patient group in the ENP-stream (admissions: 840, 3.5%,  $P < 0.001$  and deaths 0, 0.0%,  $P < 0.001$ ).

We concluded that the ENP-streaming is an accurate predictor of not needing to be admitted (PPV=97%) and of ED survival (PPV=100%). Mean length of stay was significantly shorter for patients in the ENP-stream compared to the other patients (back transformed values:

74 vs. 147 minutes,  $P < 0.001$ ). Our study showed excellent correlation between the ENP-streaming and patients' injury severity and resource utilisation, suggesting high validity of our triage streaming system. The stream system clarifies the emergency nurse practitioner role, minimising the subjectivity of patient allocation.

**Chapter 8** presents a study on the incidence of missed injuries and inappropriately managed cases in patients with minor injuries and illnesses. We evaluated diagnostic accuracy of the ENPs compared with junior doctors/senior house officers. In addition, we evaluated waiting time and length of stay of the patients. In a descriptive cohort study, 741 patients treated by ENPs were compared with a random sample of 741 patients treated by junior doctors/senior house officers.

Within the total group, 29 of the 1,482 patients (1.9%) had a missed injury or were inappropriately managed. No statistically significant difference was found between the emergency nurse practitioner and physician groups in terms of missed injuries or inappropriate management, with 9 errors (1.2%) by junior doctors/senior house officers and 20 errors (2.7%) by emergency nurse practitioners. The most common reason for missed injuries was misinterpretation of radiographs (13 of 17 missed injuries). There was no significant difference in waiting time for treatment by junior doctors/senior house officers versus emergency nurse practitioners (20 minutes vs. 19 minutes). The length of stay of patients who were treated by junior doctors/senior house officers was significantly longer than for patients who were treated by emergency nurse practitioners (senior house officer mean length of stay: 85 minutes, 95% CI 81 to 89 minutes, versus emergency nurse practitioner mean length of stay: 65 minutes, 95% CI 62 to 68 minutes,  $P < 0.001$ ).

The three studies in the throughput section of this thesis show that a stream system based on discriminators of an accepted triage system may be used to objectively identify patients suitable for treatment by emergency nurse practitioners (chapters 4 and 5). Since the emergency nurse practitioners showed high diagnostic accuracy, the emergency nurse practitioner model of care is an important strategy in the improvement of the throughput of ED patients and therefore, in preventing or handling ED crowding (chapter 6).

#### *PART IV OUTPUT OF THE EMERGENCY DEPARTMENT*

Emergency department crowding is associated with long waiting times for patients before evaluation. This can lead to patients leaving the emergency department without being seen by a physician or emergency nurse practitioner. Patients who fail to wait for medical evaluation are referred to as 'walkouts'. The percentage of walkouts is used as a measure for the severity of ED crowding. Little is known about ED walkouts in countries with well-established primary care systems such as the Netherlands.

In **chapter 9** we present a study on walkout from two emergency departments: the Medical Centre Haaglanden Westeinde and the Medical Centre Haaglanden Antoniushove. The purpose of our population-based cohort study was to assess the walkout rate and to identify influencing patient- and visit characteristics, including crowding, on walkout. Furthermore, we assessed reasons for leaving and medical care needs after leaving, using a follow-up telephone interview.

A total of 169 (0.7%) of 23,780 registered patients left without treatment, of whom 62% left after triage. Of the triaged walkouts 26% had urgent or highly urgent medical complaints and target times to treatment had elapsed for more than half of the triaged walkouts. Independent predictors of leaving without treatment included being self-referred, arriving during the evening or night or during crowded conditions and relatively lower urgency triage allocation. Ninety walkouts (53%) were contacted afterwards by phone. Long waiting time (61%) was the most cited prime reason for leaving. Medical problems had resolved spontaneously in 19 of the 90 walkouts (21%) and 47 walkouts (52%) reported having sought medical care elsewhere. For 24 of the 90 walkouts (27%) with persisting complaints, medical care was advised during the follow-up phone call. We concluded that a small but significant proportion of ED patients lack required timely medical treatment. As a matter of risk management, it might be useful to follow-up on the walkouts to be able to refer them to appropriate care.

One of the major causes of ED crowding is the need for patients to wait at the emergency department until an inpatient bed is available. According to many researchers, ED crowding can be reduced most effectively by moving admitted patients to inpatient settings as rapidly as possible. To increase the throughput of acute patients, the Medical Centre Haaglanden Westeinde introduced a flexible acute admission unit in 2009. The flexible acute admission unit consists of 15 inpatient beds located in different wards that are set aside for patients from the emergency department when all of the beds in specialty wards are being used. In **chapter 10** we present a qualitative evaluation of the flexible acute admission unit. This evaluation has revealed that the flexible acute admission unit has reduced emergency nurses' workload and, in knowing that beds are always available for acute admissions, they are under less stress.

**Chapter 11** is a quantitative evaluation of flexible acute admission unit. With the flexible acute admission unit, maximal bed flexibility was expected in the Medical Centre Haaglanden Westeinde. Beds that otherwise were 'empty for admission the next day' or 'from another specialty' but were equipped and staffed were assigned for acute admissions. On average, 10 ED patients a day need to be admitted at a regular floor (and thus were potential flexible



acute admission unit patients) during off-hours. A study was performed during four months in 2008 (control period) and four months in 2009 (intervention period), evaluating whether the flexible acute admission unit would result in fewer transfers to other hospitals and in a lower ED length of stay of patients needing hospital admission.

Of 1,619 regular admission patients, 768 were admitted in the control period and 851 in the intervention period. The flexible acute admission unit reduced the number of transfers of admitted patients to other hospitals from 80 (10.4%) to 54 (6.4%) ( $P=0.004$ ). The increase in length of stay for special care patients and non-admitted patients was not observed for regular, flexible acute admission unit-admissible patients. We concluded that flexible bed management might be useful in preventing or reducing ED crowding.

Chapters 10 and 11 in the output section of this thesis assessed the effects of flexible bed management. Access to hospital beds is deemed essential in reducing ED crowding. When emergency patients who have been admitted at the hospital are moved out of the emergency department to inpatient areas, the burden of boarding is more evenly spread across the hospital, thus freeing the emergency department to function effectively (chapters 9 and 10).

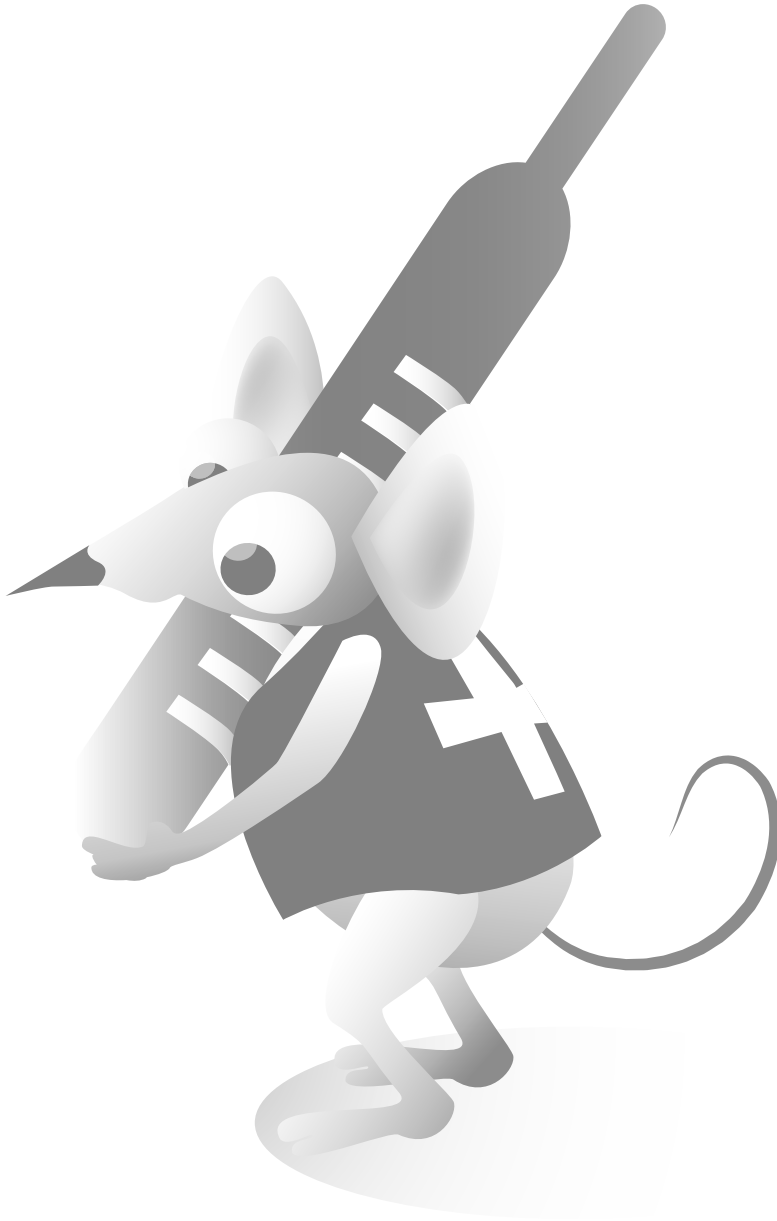
In **chapter 12** we present the general discussion of this thesis, summarising the main findings and interpretations, discussing some methodological considerations, and reflecting on the implications for practice and future research.



# Chapter 14

**Summary in Dutch**

**Samenvatting**





**Hoofdstuk 1** beschrijft de achtergrond van dit proefschrift: het wijdverspreide en complexe probleem van *crowding* op de Spoedeisende Hulp-afdeling (SEH). De gevolgen van *crowding* worden opgesomd. Het conceptuele model van Asplin wordt beschreven. In dit model worden de oorzaken van *crowding* onderverdeeld in factoren die te maken hebben met de instroom, doorstroom en uitstroom van patiënten op de SEH.

Het doel van het onderzoek in dit proefschrift was inzicht te krijgen in de verschillende aspecten van *crowding* op de SEH en doorloop van patiënten op de SEH. Kennis over SEH-processen die gerelateerd zijn aan *crowding* en het vergelijken van onze bevindingen over de voortgang van patiënten op de SEH (instroom, doorstroom en uitstroom van patiënten) met wetenschappelijk bewijs uit het buitenland zou professionals die werkzaam zijn op een SEH en management van ziekenhuizen kunnen ondersteunen in het proces van herkennen en bestrijden van *crowding* in Nederland en het verbeteren van de doorloop van patiënten op SEH-afdelingen in Nederland.

Hieronder volgt een samenvatting van ieder hoofdstuk uit dit proefschrift.

#### DEEL I DRUKTE OP DE SPOEDEISENDE HULPAFDELING IN NEDERLAND

In Nederland is de mate van *crowding* niet bekend. Men zegt dat SEH-patiënten een langere doorlooptijd hebben in vergelijking met een aantal jaar geleden, wat zou kunnen wijzen op *crowding*. Maar er zijn nog geen onderzoeken gedaan waarbij op meerdere SEH-afdelingen de doorlooptijd en *crowding* geanalyseerd zijn. In **hoofdstuk 2** presenteren we een studie die de huidige staat van de Nederlandse SEH-afdelingen beschrijft inzake de doorlooptijd en de ervaringen van de SEH-managers met *crowding*.

We stuurden een vragenlijst naar alle 94 SEH-managers in Nederland, met vragen over het type ziekenhuis, het aantal SEH-bezoeken per jaar, en de gemiddelde doorlooptijd van patiënten. Verder werd gevraagd of *crowding* werd ervaren op de betreffende SEH-afdeling, hoe vaak dit voorkwam, tijdens welke tijdstippen de afdeling het vaakst *crowded* was, en welke maatregelen de betreffende SEH-afdeling had getroffen om de doorloop van patiënten te verbeteren.

Vragenlijsten werden verzameld van 63 SEH-afdelingen (67%). Het gemiddelde aantal SEH-bezoeken per jaar was 24.936 (SD±9.480); de gemiddelde doorlooptijd voor patiënten die met ontslag gingen was 119 (SD± 40) minuten, en de gemiddelde doorlooptijd voor opnamepatiënten was 146 (SD± 49) minuten.

Wachten op medische consulten, op bloedafname en op röntgenonderzoek, alsmede tekorten aan opnamecapaciteit werden het vaakst genoemd als reden voor *crowding*.

Opnamepatiënten hadden een langere doorlooptijd vanwege gebrek aan opnamecapaciteit. Negenendertig van de 57 respondenten (68%) rapporteerden dat *crowding* meerdere keren per week of zelfs dagelijks plaatsvond, en meestal tussen 12 en 20 uur.

Maatregelen die SEH-afdelingen hadden getroffen om de doorloop van patiënten te verbeteren bestonden uit het plaatsen van patiënten in gangen van de SEH, en het gebruiken van *fast-track* met behandeling van patiënten door verpleegkundig specialisten.

Ondanks relatief korte doorlooptijden is *crowding* toch een landelijk probleem volgens de SEH-managers. Volgens 68% van de respondenten speelt *crowding* een aantal keer per week - soms zelfs dagelijks.

## DEEL II INSTROOM OP DE SPOEDEISENDE HULPAFDELING

In **hoofdstuk 3** beschrijven we de SEH-bezoekers van Medisch Centrum Haaglanden Westeinde, waarbij gefocust wordt op de zelfverwijzer en de geschiktheid van die zelfverwijzer voor behandeling door een huisarts. De belangrijkste uitkomstmaten in deze studie waren de karakteristieken van zelfverwijzers en niet-zelfverwijzers, de noodzaak voor spoedeisende zorg en de redenen van zelfverwijzers om zich te melden op een SEH in plaats van bij een huisarts.

Van de 5.003 SEH-bezoekers die zich tijdens de onderzoeksperiode van 5 weken meldden op de SEH, was 60.5% ( $n = 3.028$ ) zelfverwijzer. Jonge leeftijd, niet-urgente triagecategorie, het hebben van pijn op de borst, keel, neus en oorklachten, en traumatisch letsel waren voorspellers voor het zich op de SEH presenteren als zelfverwijzer. Negenendertig procent van de zelfverwijzers had een urgent probleem. Zelfverwijzers kwamen zowel tijdens als buiten kantoortijden en vormden een heterogene groep. De meest genoemde redenen om naar de SEH te komen in plaats van zich te melden bij een huisarts waren toegankelijkheid en gemak, en medische noodzaak (volgens de patiënt).

Ongeveer de helft van alle zelfverwijzers was geschikt voor behandeling door een huisarts, zowel tijdens als buiten kantoortijden. Daarom zouden, naast een geïntegreerde huisartsenpost met SEH buiten kantoortijden, ook andere organisatiemodellen overwogen moeten worden. Voor binnenstadsziekenhuizen met zowel zelfverwijzers tijdens als buiten kantoortijden zou een geïntegreerde huisartsenpost met SEH die 24 uur per dag, 7 dagen per week geopend is een goede oplossing kunnen zijn. Andere opties zijn het in dienst nemen van huisartsen op de SEH, of de combinatie van verpleegkundig specialisten met SEH-artsen. Zelfverwijzers met laag-complexe letsels en ziekten kunnen dan worden behandeld door verpleegkundig specialisten via een *fast-track* systeem. Voor meer complexe problematiek is een SEH-arts of huisarts in dienst van de SEH beschikbaar, en voor zelfverwijzers met ernstig traumatisch letsel of zelfverwijzers die specialistische zorg nodig hebben zijn er SEH-artsen en andere medisch specialisten. Meer onderzoek is nodig naar verschillende organisatiemodellen en hun klinische uitkomsten en kosteneffectiviteit, en naar manieren om onderscheid te kunnen maken tussen patiënten geschikt voor huisartsenzorg en patiënten voor wie spoedeisende zorg nodig is.

In **hoofdstuk 4** beschrijven we een onderzoek naar retourbezoeken op de SEH, waarbij gekeken is naar de incidentie, risicofactoren, redenen en bestemming. De veronderstelling was dat de risicofactoren en de redenen voor ongepland retourbezoek zouden verschillen van voorgaande internationale onderzoeken, vanwege andere gezondheidszorgsystemen. Alle gerelateerde retourbezoeken binnen een week na het initiële SEH-bezoek werden geselecteerd. Onafhankelijke factoren die geassocieerd waren met ongepland retourbezoek werden bepaald met behulp van multivariabele logistische regressie, waarbij patiënteninformatie werd gebruikt die beschikbaar was tijdens het initiële SEH-bezoek. Redenen voor het retourbezoek werden gecategoriseerd in ziektegerelateerde, patiëntgerelateerde en artsgerelateerde redenen. De bestemming van patiënten na het SEH-bezoek werd vergeleken tussen patiënten met ongepland retourbezoek en patiënten zonder ongepland retourbezoek.

Vijf procent van de SEH-bezoeken (2.492/49.341) waren ongeplande retourbezoeken: ongeveer 200 SEH-bezoeken per maand. Patiënten die zich tijdens de nachtdienst meldden, patiënten met buikklachten, een wond of lokale infectie of urinewegproblemen, en patiënten die getrieerd waren met een van de drie hoogste triagecategorieën (levensbedreigend, hoogurgent of urgent) hadden meer kans op een ongepland retourbezoek.

Redenen voor retourbezoek waren vergelijkbaar met redenen die gevonden zijn in andere studies: meestal ziekte gerelateerd (49%) of patiënt gerelateerd (41%). Opnamepercentages voor patiënten met een retourbezoek waren hetzelfde als voor patiënten zonder retourbezoek. De risicofactoren voor ongepland retourbezoek verschilden van de risicofactoren die gevonden zijn in andere studies. Alleen de bevinding dat het hebben van buikklachten een risicofactor was voor ongepland retourbezoek is ook gevonden in buitenlandse onderzoeken. Een controleafspraak op korte termijn op de polikliniek of bij de huisarts voor patiënten met een wond of lokale infectie, een urinewegprobleem of buikklachten zou ongepland retourbezoek op de SEH kunnen voorkomen.

In **hoofdstuk 5** presenteren we een onderzoek naar veelvuldig SEH-bezoek. We onderzochten de proporties van frequente bezoekers (met 7 tot 17 SEH-bezoeken per jaar) en hoogfrequente bezoekers (met 18 of meer bezoeken per jaar). We vergeleken leeftijd, geslacht en bestemming tussen patiënten met veelvuldig SEH-bezoek en patiënten met een enkel SEH-bezoek in de studieperiode; en we onderzochten de risicofactoren voor veelvuldig SEH-bezoek.

Onafhankelijke factoren die geassocieerd waren met frequent en met hoogfrequent SEH-bezoek werden bepaald met behulp van multivariabele logistische regressie. Aankomsttijd, ambulancevervoer, zelfverwijzer, medische klacht en urgentieniveau werden geïncorporeerd in het model.

Frequente en hoogfrequente bezoekers (0,5% van de SEH patiënten) meldden zich 2.338 keer op de SEH (3,3% van het totaal aantal SEH-bezoeken). Frequente en hoogfrequente bezoekers waren net zo vaak man als vrouw, waren minder vaak zelfverwijzer, en zij presenteerden zich met urgentere medische klachten dan patiënten met een enkel SEH-bezoek in het studiejaar.

Patiënten met kortademigheidklachten of een psychiatrisch ziektebeeld hadden meer kans op veelvuldig SEH-bezoek. Veelbezoekers werden vaker opgenomen op een verpleegafdeling. Veelbezoekers van de SEH komen met een goede reden naar de SEH.

De hoofdstukken 3, 4 en 5 van het gedeelte over de instroom beschrijven de patiëntenpopulatie van de SEH van Medisch Centrum Haaglanden Westeinde. De bevindingen in hoofdstuk 3 en 4 tonen dat het mogelijk is om de instroom van patiënten op de SEH te beïnvloeden: een deel van de zelfverwijzers is geschikt voor behandeling door een huisarts en een deel van de ongeplande retourbezoeken kan voorkomen worden door voor de patiënten met een hoog risico op retourbezoek een afspraak te regelen op een polikliniek of bij de huisarts. Uit hoofdstuk 5 blijkt dat het aantal veelbezoekers op de SEH laag is vergeleken met internationaal onderzoek. Bovendien komt de meerderheid van deze veelbezoekers naar de SEH omdat zij significante medische klachten heeft. Interventies die focussen op deze kleine patiëntengroep hebben een minimale impact op SEH *crowding*.

### *DEEL III DOORSTROOM OP DE SPOEDEISENDE HULPAFDELING*

Het Medisch Centrum Haaglanden Westeinde introduceerde het Manchester Triage Systeem in 2002. Het doel van het Manchester Triage Systeem is het bepalen van de behandelprioriteit op basis van de urgentie van de klacht van de patiënt. Het Manchester Triage Systeem bestaat uit vijf categorieën: levensbedreigend (triagecategorie 1), hoogurgent (triagecategorie 2), urgent (triagecategorie 3), standaard (triagecategorie 4), en niet-urgent (triagecategorie 5). Om de doorstroom van patiënten met niet-urgente of standaard triagecategorie te verbeteren, werd een *fast-track* systeem geïntroduceerd in Medisch Centrum Haaglanden Westeinde in 2007. SEH-verpleegkundigen werden opgeleid tot verpleegkundig specialisten om patiënten met laagcomplexere letsels en ziekten zelfstandig te kunnen onderzoeken en behandelen.

In **hoofdstuk 6** rapporteren wij over de implementatie van een aangepaste versie van het Manchester Triage Systeem op de SEH van Medisch Centrum Haaglanden Westeinde, waarbij verwijscodes werden toegevoegd. Deze aangepaste versie van het Manchester Triage Systeem met verwijscodes was nodig om de rol van de verpleegkundig specialisten te verduidelijken en tegelijkertijd de doorstroom van patiënten op de SEH te verbeteren. Diagnoses die door de verpleegkundig specialisten gesteld mogen worden en patiënten



die behandeld kunnen worden door verpleegkundig specialisten, komen niet per definitie overeen met de klinische prioriteit of triagecategorie. Het gebied van klachten die verpleegkundig specialisten mogen behandelen beperkt zich niet tot de urgenties standaard en niet-urgent (triagecategorie 4 en 5). Verpleegkundig specialisten kunnen ook patiënten behandelen die binnen triagecategorie 2 of 3 (hoogurgent of urgent) vallen, terwijl sommige patiënten die in triagecategorie 4 of 5 zijn getrieerd juist behandeld moeten worden door een arts.

Onze verpleegkundig specialisten kunnen bijvoorbeeld een patiënt met een schouderluxatie behandelen die een hoge urgentie (triagecategorie 2, hoog-urgent) heeft op basis van de pijn. Daarentegen kunnen de verpleegkundig specialisten geen kinderen met astma, getrieerd met triagecategorie 4, behandelen, omdat zij daarvoor niet zijn opgeleid zijn. Het toevoegen van de verwijscodes aan het Manchester Triage Systeem heeft de rol van de verpleegkundig specialist op de SEH verhelderd terwijl het primaire doel van triage, het bepalen van de behandelprioriteit op basis van de urgentie van de klacht van de patiënt, onveranderd is. Het werken met de verwijscodes heeft de doorstroom van patiënten verbeterd en de doorlooptijd van patiënten met laagcomplexere letsels en ziekten verlaagd.

In **hoofdstuk 7** is de validiteit van het verwijscodesysteem van het Manchester Triage Systeem onderzocht. Dit is gedaan door de associatie te meten tussen de verwijscode enerzijds en de ernst van het letsel van de patiënt en het gebruik van de SEH anderzijds. Aantallen klinische opnames en sterfte op de SEH – als maten voor ernst van het letsel – en doorlooptijd – als maat voor gebruik van de SEH – werden verzameld van 48.397 patiënten die in 2009 in Medisch Centrum Haaglanden Westeinde getrieerd waren.

In totaal werden 24.294 (50.2%) patiënten getrieerd met de verwijscode laagcomplexere zorg (geschikt voor behandeling door een verpleegkundig specialist). De overige patiënten kregen de verwijscodes middencomplexere zorg of hoogcomplexere zorg. In de middencomplexere en hoogcomplexere zorgstromen vonden significant meer opnames plaats (6.100, 25,3%), en was de mortaliteit significant hoger (31, 0.1%) vergeleken met de laagcomplexere stroom die behandeld werd door de verpleegkundig specialist (klinische opnames: 840, 3,5%,  $P < 0.001$  en mortaliteit (0, 0%,  $P < 0.001$ ). We concludeerden dat de verwijscode naar de verpleegkundig specialist een accurate voorspeller is van 'geen klinische opname nodig' (PPV=97%) en van overleven (PPV=100%).

In de middencomplexere en hoogcomplexere zorgstromen was de gemiddelde doorlooptijd significant hoger (teuggetransformeerde waarde: 147 minuten) vergeleken met de doorlooptijd van de patiëntengroep van de verpleegkundig specialist (teruggetransformeerde waarde: 74 minuten) ( $P < 0.001$ ).

Uit dit onderzoek blijkt een uitstekende correlatie tussen enerzijds de verwijzing naar de verpleegkundig specialist en anderzijds de ernst van het letsel van de patiënt en het

gebruik van de SEH, wat een hoge validiteit van de uitbreiding van het triagesysteem met verwijscodes suggereert.

De verwijscodes van het Manchester Triage Systeem verhelderen de rol van de verpleegkundig specialist en verminderen de subjectiviteit van patiëntentoewijzing.

In **hoofdstuk 8** presenteren we een onderzoek naar de incidentie van gemiste diagnoses en foutief ingezette behandelingen bij patiënten met laagcomplexere letsels en ziekten. Naast de diagnostische accuratesse werd de wachttijd en de doorlooptijd van patiënten met laagcomplexere letsels en ziekten geëvalueerd. In een beschrijvende cohortstudie werden 741 patiënten die behandeld waren door verpleegkundig specialisten van de SEH vergeleken met 741 random gekozen patiënten die behandeld waren door arts-assistenten van de SEH. In totaal hadden 29 van de 1.482 patiënten (1.9%) een gemiste diagnose of foutief ingezette behandeling. Er was geen statistisch significant verschil tussen de verpleegkundig specialisten en de arts-assistenten van de SEH, met 9 fouten (1.2%) bij de arts-assistenten en 20 fouten (2.4%) bij de verpleegkundig specialisten. De meest voorkomende reden voor gemiste diagnoses was het fout interpreteren van röntgenonderzoek (13 van de 17 gemiste diagnoses). Er was geen significant verschil in wachttijd voor behandeling door de verpleegkundig specialist versus de wachttijd voor behandeling door de arts-assistent (19 minuten versus 20 minuten). De gemiddelde doorlooptijd voor patiënten die waren behandeld door arts-assistenten (85 minuten, 95% betrouwbaarheidsinterval 81 tot 89 minuten) was significant langer dan de gemiddelde doorlooptijd van patiënten die behandeld waren door de verpleegkundig specialisten (65 minuten, 95% betrouwbaarheidsinterval 62 tot 68 minuten,  $P < 0.001$ ).

Uit de drie onderzoeken in het gedeelte over de doorstroom op de SEH blijkt dat het verwijscodesysteem gebaseerd op het Manchester Triage Systeem gebruikt kan worden om patiënten te identificeren die geschikt zijn voor behandeling door een verpleegkundig specialist (hoofdstukken 6 en 7). Gezien het feit dat de verpleegkundig specialisten een hoge diagnostische accuratesse behaalden (hoofdstuk 8), kan het werken met verpleegkundig specialisten een belangrijke strategie zijn in de verbetering van de doorstroom en daarmee, in het voorkomen of verminderen van *crowding*.

#### DEEL IV UITSTROOM VAN DE SPOEDEISENDE HULPAFDELING

*Crowding* op de SEH kan gepaard gaan met lange wachttijden voor patiënten voordat zij behandeld worden. Hierdoor kunnen sommige patiënten de SEH al verlaten hebben voordat zij gezien zijn door een arts of verpleegkundig specialist. Patiënten die niet wachten op het medisch onderzoek worden weglopers genoemd. Het percentage weglopers van de SEH wordt gebruikt als maat voor de ernst van *crowding*. Er is nog maar weinig bekend over weglopers in landen met een adequaat eerstelijnszorgsysteem zoals Nederland.

In **hoofdstuk 9** presenteren we een onderzoek naar weglopen van twee SEH-afdelingen: het Medisch Centrum Haaglanden Westeinde en het Medisch Centrum Haaglanden Antoniushove. Het doel van deze studie was om het percentage weglopers vast te stellen, en beïnvloedende factoren, waaronder *crowding*, te bepalen.

Verder onderzochten we de redenen voor weglopen en de medische zorg die nodig was nadat de patiënt de SEH had verlaten. Hiervoor namen we een interview af per telefoon.

In totaal liepen 169 (0,7%) van de 23.780 patiënten weg voordat zij door een dokter of verpleegkundig specialist gezien waren. Tweeënzestig procent van deze patiënten vertrok nadat zij getrieerd waren. Van deze getrieerde weglopers had 26% urgente of hoog-urgente medische klachten. De targettijden tot behandeling waren voor meer dan de helft van de getrieerde weglopers verstreken voordat zij de SEH verlieten.

Onafhankelijke voorspellers van het weglopen zonder behandeling waren het zelfverwijzer zijn, het arriveren tijdens de avond- of nachtdienst of tijdens *crowding*, en relatief lage urgentiecategorieën. Bij 90 weglopers (53%) werd een telefonisch interview gedaan. Lange wachttijd (61%) werd het meest genoemd als reden om weg te lopen. Bij 19 van de 90 weglopers (21%) waren de medische klachten spontaan verdwenen, en 47 weglopers (52%) gaven aan dat zij elders medische hulp hadden gezocht. Tijdens de telefoongesprekken werd aan 24 van de 90 weglopers (27%) met aanhoudende klachten medisch advies gegeven.

Een klein deel van de SEH-patiënten krijgt niet op tijd de noodzakelijke medische zorg. In het kader van risicovermijding is het mogelijk nuttig om nazorg voor weglopers te organiseren, zodat weglopers naar de juiste hulpverlening kunnen worden verwezen in geval van aanhoudende klachten.

Een van de hoofdoorzaken van *crowding* op de SEH is het wachten op een bed op een verpleegafdeling. Volgens veel onderzoekers kan *crowding* het meest effectief verminderd worden door het zo snel mogelijk verplaatsen van opgenomen patiënten van de SEH naar verpleegafdelingen. Om de doorloop van acute patiënten te verbeteren introduceerde Medisch Centrum Haaglanden Westeinde een flexibele acute opname afdeling in 2009. De flexibele acute opname afdeling bestaat uit 15 opnamebedden op verschillende verpleegafdelingen die gereserveerd zijn voor acute opnamepatiënten als alle bedden op de betreffende afdelingen vol zijn. **Hoofdstuk 10** is een kwalitatieve evaluatie van de flexibele acute opname afdeling. Uit deze evaluatie kwam naar voren dat de flexibele acute opname afdeling de werkdruk van de SEH-verpleegkundigen heeft verminderd en dat SEH-verpleegkundigen minder stress ervaren omdat er altijd bedden beschikbaar zijn voor acute opnamepatiënten.

**Hoofdstuk 11** is een kwantitatieve evaluatie van de flexibele acute opname afdeling. Met de start van de flexibele acute opname afdeling in Medisch Centrum Haaglanden Westeinde werd maximale flexibiliteit verwacht ten aanzien van de beschikbaarheid

van bedden. Bedden die leegstonden vanwege een verwachte opname van de volgende dag of een bed van een ander specialisme werden buiten kantoortijden aangewezen als acuut opnamebed. Gemiddeld werden per dag buiten kantoortijden 10 SEH-patiënten opgenomen op een reguliere verpleegafdeling – zij waren dus geschikt voor opname op een flexibele acute opname afdeling bed. Een onderzoek werd uitgevoerd tijdens 4 maanden in 2008 (controleperiode) en vier maanden in 2009 (interventieperiode), om te evalueren of de flexibele acute opname afdeling zou resulteren in minder overplaatsingen naar andere ziekenhuizen en in een kortere doorlooptijd op de SEH voor reguliere acute opnamepatiënten.

Van de 1.619 patiënten die opgenomen werden op een regulier bed, kwamen 768 patiënten in de controleperiode en 851 patiënten in de interventieperiode binnen op de SEH. De flexibele acute opname afdeling verminderde het aantal overplaatsingen naar andere ziekenhuizen van 80 (10,4%) naar 54 (6,4%) ( $P=0.004$ ). De toename van de doorlooptijd van patiënten die op een intensive care bed opgenomen moesten worden en van patiënten die niet opgenomen hoefden te worden, werd niet gezien bij patiënten die op een regulier bed opgenomen moesten worden (en dus geschikt waren voor opname op de flexibele acute opname afdeling). We concludeerden dat flexibel bedmanagement nuttig zou kunnen zijn in het voorkomen of verminderen van *crowding*.

Twee van de drie studies in het uitstroomdeel van dit proefschrift beschrijven de effecten van flexibel bedmanagement. De beschikbaarheid van opnamecapaciteit is essentieel bij het verminderen van *crowding*. Als SEH-patiënten die in het ziekenhuis opgenomen worden tijdig verplaatst worden naar de verpleegafdelingen wordt de last van spoedopnames gelijk verdeeld en de SEH vrijgehouden voor nieuwe patiënten (hoofdstukken 10 en 11).

Tot slot beschrijven we in **hoofdstuk 12** de algemene discussie van dit proefschrift, bestaande uit een samenvatting van de belangrijkste resultaten en interpretatie van de studies, en een overzicht van enkele methodologische overwegingen. Daarnaast worden de praktische en wetenschappelijke implicaties van de bevindingen bediscussieerd.

# Appendices

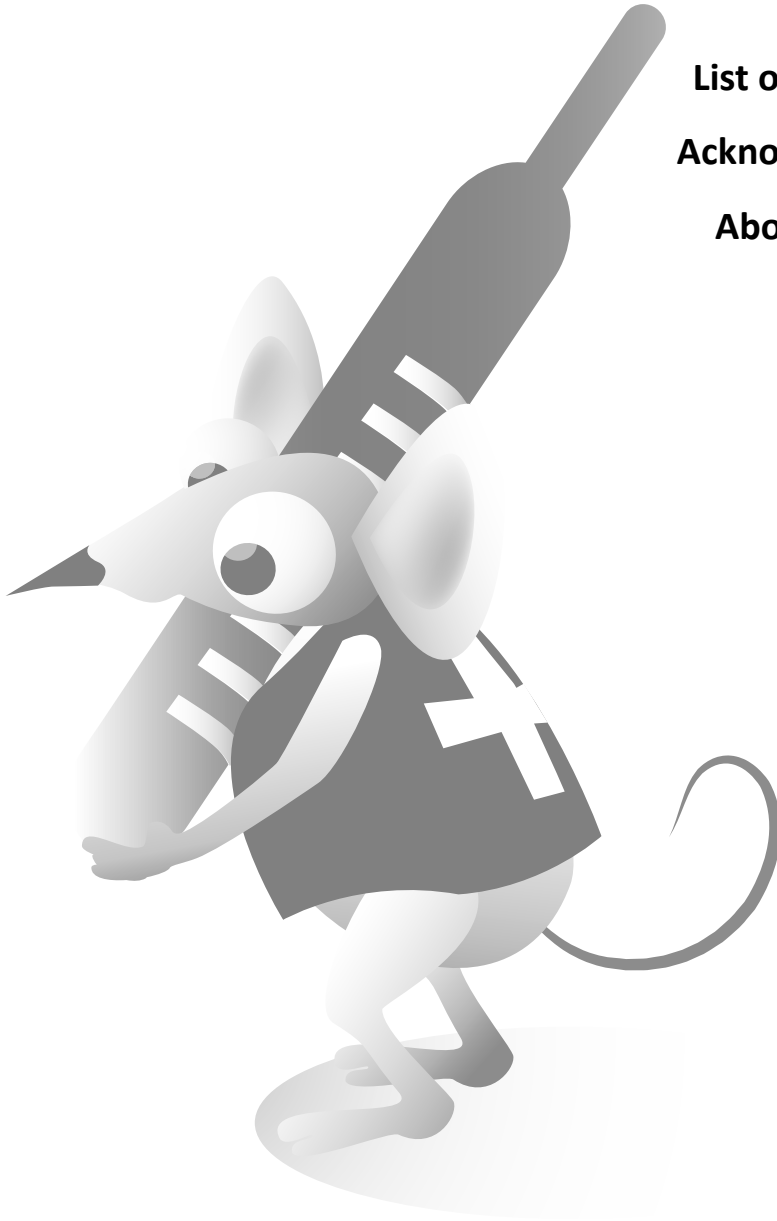
**List of definitions and abbreviations**

**PhD portfolio**

**List of publications**

**Acknowledgements**

**About the author**





## LIST OF DEFINITIONS AND ABBREVIATIONS

### GENERAL

**Crowding / overcrowding** Crowding occurs when the identified need for emergency services exceeds available resources for patient care in the emergency department, hospital, or both [1]

### DEFINITIONS

**Access block** A situation in which patients in the emergency department requiring inpatient care cannot gain access to appropriate hospital beds within a reasonable time frame. The term 'exit block' is synonymous [2].

**Ambulance diversion** An ambulance is diverted when hospitals request that ambulances bypass their emergency department and transport patients to other medical facilities [3].

**Assessment unit** Typically medical, surgical, paediatric case mix. Usually run by inpatient teams as short-stay assessment and treatment areas for their admitted patients [4].

**Boarding** A patient remains in the emergency department after the decision to admit or transfer the patient has been made (e.g., because an inpatient bed elsewhere in the hospital is not yet available [3]).

**Census** Head count of either number of patients presenting to an emergency department over a given time period (e.g., annual census), or number of patients in the emergency department itself at a given point in time [4].

**Diversion time** The total number of minutes the hospitals are on ambulance diversion [5].

**ED capacity** The number of ED treatment areas, excluding observation wards and corridor spaces [5].

ED gridlock	Simultaneous ambulance diversion at multiple emergency departments [2].
Input measures	Measures related to the number of patients seeking ED care [2].
Left without being seen	Left without being seen (LWBS)/left without treatment (LWT)/did not wait (DNW): when patients choose to leave the emergency department before their care has been completed [4].
Occupancy	Generally taken to mean the number of occupied beds divided by the total number of beds and expressed as a percentage. For example, hospital occupancy of 95% implies the beds have a patient in them 95% of the time [4].
Output measures	Measures of factors related to those processes that move patients out of the emergency department to other areas or to discharge. [2].
Throughput measures	Measures of the efficiency and capacity of the ED system to admit and treat patients requiring emergency care [2].



## ABBREVIATIONS

ACEM	Australasian College of Emergency Medicine
ACEP	American College of Emergency Physicians
AUC ROC	Area Under the Receiver Operating Curve
CAEP	Canadian Association of Emergency Physicians
CI	Confidence Interval
CT	Computerised Tomography
EBP	Evidence Based Practice
ECTS	European Credit Transfer System
ED	Emergency Department
EDWIN	Emergency Department Work Index Score
EKG	Electrocardiogram
ENP	Emergency Nurse Practitioner
ENPC	Emergency Nurse Practitioner Candidate
EP	Emergency Physician
FAAU	Flexible Acute Admission Unit
FV	Frequent Visitor
GP	General Practitioner
GPC	General Practitioner Cooperative
HCU	High Care Unit
HFV	Highly Frequent Visitor
ICU	Intensive Care Unit
IT	Information Technology
LCU	Low Care Unit
LWBS	Left or leaving Without Being Seen
LAMA	Left or leaving Against Medical Advice
LOS	Length Of Stay
MCH	Medical Centre Haaglanden
MCU	Medium Care Unit
METC	Medical Research Ethics Committee
MRI	Magnetic Resonance Imaging
MRSA	Methicilline Resistente Staphylococcus Aureus
MSS	Misdiagnosis Severity Score
MTS	Manchester Triage System
NEDOCS	National Emergency Department Overcrowding Scale
NPU	Nurse Practitioner Unit
NVSHA	Netherlands Society of Emergency Physicians

NVSHV	Netherlands Society of Emergency Nurses
OR	Odds Ratio
PASW	Predictive Analytics Soft Ware
SD	Standard Deviation
SE	Standard Error
SEH	Spoed Eisende Hulp
SES	Socio-Economic Status
SHO	Senior House Officer
SPSS	Statistical Package for the Social Sciences
UK	United Kingdom
USA	United States of America
$\chi^2$	Chi Square test

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## PhD PORTFOLIO

Summary of PhD training, teaching and parameters of esteem

Name PhD student: Christien van der Linden  
 PhD period: 2009-2014  
 Name PhD supervisors: Prof. dr. J.C. Goslings  
 Prof. dr. R.J. de Haan  
 Name PhD co-supervisors: Dr. R. Lindeboom  
 Prof. dr. C. Lucas

### 1. PhD training

	Year	Hours	Workload (ECTS)
<b>Master of Arts in Advanced Nursing Practice</b>	2002-2004		
Research I, II, project proposal, thesis		840	30
<b>Evidence Based Practice</b>	2006-2008		
Basic epidemiology and EBP – concepts and designs		560	20
Elementary biostatistics		252	9
Advanced EBP systematic reviews and clinical guidelines		168	6
Advanced biostatistics and epidemiology		252	9
Clinimetrics		196	7
Health economics		168	6
Health care policy evaluation		196	7
Capita selecta		168	6
<b>Generic Academic Skills</b>			
Handling the media	2007	5	0.2
Good clinical practice	2013	8	0.3
<b>Additional Courses Research Skills</b>			
Building and validating prediction models using logistic regression	2010	5	0.2
Sample size calculation and power analysis for intervention and diagnostic research	2010	5	0.2
Counterfactuals	2014	5	0.2
Missing data and data imputation methods	2014	2	0.1

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**International presentations**
*Emergency Nurses Association*

Evaluation of a flexible acute admission unit. Poster.  
San Antonio, Texas. 2010 14 1.5

A flexible acute admission unit: nurses' perceived effects. Poster.  
San Antonio, Texas. 2010 14 1.5

Walk-out patients in the emergency department. Poster.  
Tampa, Florida. 2011 14 1.5

Return visits to the emergency department: avoidable? Poster.  
San Diego, California. 2012 14 1.5

*European Society of Emergency Nursing*

Nurse practitioners' roles at the emergency department. Oral.  
Interlaken, Swiss. 2013 14 1.5

The crowded emergency department. Oral. Brussels, Belgium. 2014 14 1.5

*Other*

Frequent visitors at the emergency department: rate, characteristics  
and associated factors. Poster.

First global conference on emergency nursing and trauma care.  
Dublin, Ireland. 2014 14 1.5

**National presentations**

Nurse practitioners at the emergency department: guidelines regarding  
role and responsibilities. Oral.  
5 per year; 30 in total. 2006-2011 14 1.5

Factors influencing the decision to use nurse practitioners at the  
emergency department. Oral.  
5 per year; 30 in total. 2006-2011 420 1.5

Detection of child abuse at the emergency department using a new  
protocol based on parental characteristics. Oral.  
1 per year; 3 in total. 2009-2010 42 1.5

Prevalence of suicidal behaviour among the youth in the Hague and  
importance of secondary prevention at the emergency department.  
Oral. 1 per 4 months, several symposia in the Netherlands, 15 in total. 2009-2014 210 7.5

The latest research shows that we really should do something with all  
this research. Oral, keynote speaker (Medical Science Day, the Hague). 2011 14 1.5

Emergency department in the Netherlands: is the system sick? Oral,  
duo presentation with prof. dr. J.C. Goslings (symposium Evidence  
Based Practice). 2012 14 1.5

Rate, characteristics and factors associated with high emergency  
department utilization. Oral. (Professional in the Lead Symposium,  
Amsterdam). 2014 14 1.5

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<b>Other</b>			
Hospital research meeting (3 per year, 13 in total).	2009-2013	26	0.9
Emergency department research meeting (2 per year, 6 in total).	2012-2014	12	0.4
Journal club emergency department (8 per year, 11 in total)	2013-2014	12	0.4

## 2. Teaching

Prevalence of suicidal behaviour among the youth in the Hague and importance of secondary prevention at the emergency department (1 per two months; 50 in total; hospitals and family health services, Region of the Hague).	2006-2014	100	3.6
Evidence-based practice for senior nurses (1 per year, 4 participating hospitals).	2009-2013	10	0.4
The effect of pharmacy-based medication reconciliation on unintentional medication discrepancies in acute hospital admissions of elderly patients (1 per year; 4 in total).	2010-2013	4	0.2
Client expectations and satisfaction surveys (National Academy, Ministry of Finance, the Hague).	2011	5	0.2
Epidemiology at an emergency department: medication reconciliation at the emergency department (Academic Medical Centre, Amsterdam).	2011	2	0.1
Epidemiology at an emergency department: Diagnostic accuracy of nurse practitioners versus physicians (Academic Medical Centre, Amsterdam, 1 per year).	2011-2014	4	0.2
Epidemiology at an emergency department: Walk-out patients at the emergency department, patient characteristics and follow-up (Academic Medical Centre, Amsterdam, 1 per year)	2012-2014	4	0.2
Walk-out patients at the emergency department: how to handle and findings of after care program (clinical lessons, 8 in total)	2011	8	0.3
Evidence-based practice for nurse practitioners (once per year, School of Health Professions, Rotterdam).	2011-2012	4	0.2
Evidence-based practice for nurse practitioners (once per year, the Hague).	2013-2014	4	0.2

## 3. Parameters of esteem

<b>Prizes and awards</b>	
2009	Anna Reynvaan Practice Award, the best nursing project in the Netherlands and Belgium of 2009, for research and implementation of a unit for patients with minor injuries and minor illnesses, run by emergency nurse practitioners.
2011	Anna Reynvaan Practice Award, the best nursing project in the Netherlands and Belgium of 2011, for research and implementation of aftercare for patients who left the emergency department without being seen by a doctor of emergency nurse practitioner.

NB. 1 ECTS = 28 hours, based on the European Credit Transfer System



## LIST OF PUBLICATIONS

### INTERNATIONAL PUBLICATIONS

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Het gaat patiënten en familie niet alleen maar om technisch bekwaame, ervaren, volgens de richtlijn van *evidence based practice* werkende verpleegkundigen, het gaat bovenal om oprecht geïnteresseerde en lieve verpleegkundigen. Mensen die eerst naar jou kijken en dan pas naar de monitor. Of, als de monitor piept, misschien wel eerst even naar de monitor maar dan toch ook heel snel naar jou. De ziekenhuiswereld heeft nog veel te leren, dat heb ik ook door jou geleerd. Maantje, wat zou je trots zijn geweest als je mijn promotie mee had kunnen maken. Dank je wel dat je bijna 50 jaar lang mijn speciale zusje was.

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#### Promoveren of niet?

Dat was een terugkerend thema gedurende de afgelopen jaren. En eerlijk gezegd, het begrip carrière zegt me nog steeds niet zoveel. Ik wil gewoon leuk werk. En bezig zijn met onderzoek, onderzoek direct bruikbaar door beleid en praktijk, het verbeteren van de kwaliteit van de verpleegkundige en medische zorg, dáár kun je me voor wakker maken. Het kostte me moeite me aan te passen aan het tempo van de wetenschap. Voor een SEH-verpleegkundige met altijd haast is het lastig om te wachten op medeauteurs en tijdschriften. Toen ik erachter was dat 'haast hebben' helemaal niet opschoot, voelde het hele promoveren veel minder frustrerend. En opeens was het zover. Mijn proefschrift is af.

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## ABOUT THE AUTHOR

Christien van der Linden werd in 1962 geboren in Den Haag. Na het behalen van haar havo-diploma aan het Edith Stein College in Den Haag in 1979, volgde ze de *inservice*-opleiding voor A-verpleegkundigen aan het opleidingsinstituut Florence Nightingale van het Westeinde ziekenhuis (later: Medisch Centrum Haaglanden (MCH) locatie Westeinde) in Den Haag. Vervolgens werkte zij op de afdeling Orthopedie in dezelfde instelling, maar ook als verpleegkundige in de wijk, en bij de opvang voor verslaafde prostituees bij de gemeente Den Haag.

Vanaf 1991 werkte zij als verpleegkundige op de Spoedeisende Hulpafdeling (SEH) van het MCH Westeinde en volgde de specialisatie tot SEH-verpleegkundige. Zij ronde daarnaast de tropenopleiding af. Van 1998 tot 2007 gaf zij, naast haar werk op de SEH en als nachthoofd, regelmatig les aan gespecialiseerd verpleegkundigen op het gebied van basis acute zorg, traumaopvang en de opvang van patiënten met niet-aangeboren hersenletsel.

In 2004 ronde zij de opleiding *Advanced Nursing Practice* cum laude af aan de Hogeschool in Diemen, waarna zij van 2006-2008 de Masteropleiding *Evidence Based Practice* aan de Universiteit van Amsterdam volgde. Tijdens beide opleidingen werkte zij fulltime als SEH-verpleegkundige op de SEH van MCH Westeinde.

Sinds 2009 bekleedt zij de functie van klinisch epidemioloog, waarin zij zich vooral bezighoudt met de wetenschappelijke onderbouwing van ontwikkelingen binnen de acute zorg en het introduceren van verbeteringen van de kwaliteit van de acute zorg.

Christien is sinds 1983 getrouwd met Harry Rotteveel en heeft twee kinderen, Naomi (1985) en Shanna (1987) en een kleindochter, Isa (2013).

