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Paediatric emergency care
Seeking, triage and management

Julia Ellbrant

DOCTORAL DISSERTATION
by due permission of the Faculty of Medicine, Lund University,
to be defended at Lilla aulan, MFC, Skåne University Hospital, Malmö, Sweden,
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Title and subtitle: Paediatric emergency care – Seeking, triage and management

Abstract

Overcrowding at paediatric emergency departments (ED), particulary due to increasing patient volumes, is a growing problem all over the world, associated with delayed medical care and higher risk of medical error. Our aims were to evaluate paediatric ED careseeking, triage, and management, associations with parental socio-economic status, and if children were taken care of at appropriate levels of medical care. We also wanted to evaluate if a hospital-integrated primary care unit (HPCU), open outside office-hours (except nighttime), reduces total and less-urgent ED patient load. All parents of children attending a large urban paediatric ED, with no demand for professional referral, during one month of seasonal high-load conditions in 2008 and in 2012, during day- and evening-time, were asked to fill out questionnaires on recent prehospital medical consultations, reasons for coming, and socio-economic status (2012). Corresponding information on ED management was obtained from patient ledgers and medical records. Information on paediatric ED flow during two months before (2012) and after (2015) implementation of an HPCU was retrieved retrospectively from hospital data registers.

One fourth of paediatric ED patients could safely be triaged, by experienced paediatric nurses according to structured and recognised guidelines, for adequate lower levels of medical care or back home with medical advice soon after arrival. Out of two thirds initially triaged to be seen by an ED physician, half of them were assessed as more appropriate for primary care. Almost one fifth arrived after failed attempt at prehospital medical contact, more often outside office-hours, and another fifth came directly with perceived medical urgency as main reason. Non-native origin and limited abilities in the Swedish language were both strongly associated with direct seeking and initial triage away from the ED. After implementation of the HPCU, the proportions of total and less-urgent patient visits decreased, and the proportion of children in need of hospital admission increased, at the paediatric ED.

By initial medical triage at a paediatric ED, with no demand for professional referral, children with less-urgent conditions can safely be directed to adequate and more appropriate lower levels of medical care. The safety margin is high, considering that half of patients triaged for ED care were considered to have been more appropriate for primary care. High knowledge and availability of prehospital medical services are required to limit less-urgent ED use, particularly outside office-hours. Less-urgent paediatric ED visits might be further reduced by identifying and overcoming barriers to prehospital medical services, such as non-native origin or limited abilities in Swedish, and an HPCU available outside office-hours may unburden a paediatric ED, particularly of less-urgent patient visits.

Key words: Emergency department, children, urgency, triage, socio-economic status

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Paediatric emergency care

Seeking, triage and management

Julia Ellbrant
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To the three men in my life

“Happiness can be found even in the darkest of times, if one only remembers to turn on the light.”

Albus Dumbledore
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List of papers

This thesis is based on the following original papers, referred to in text by their Roman figures (I-IV):


IV. Ellbrant J, Sletten H, Åkeson J, Eckner J, Karlsland Åkeson P. Adjacent primary care may reduce less urgent pediatric emergency department visits. Submitted for publication.

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## Abbreviations

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<tr>
<td>ADAPT</td>
<td>Adaptive Process Triage</td>
</tr>
<tr>
<td>ATS</td>
<td>Australian Triage Scale</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency department</td>
</tr>
<tr>
<td>ESI</td>
<td>Emergency Severity Index</td>
</tr>
<tr>
<td>ESS</td>
<td>Emergency Symptoms and Signs</td>
</tr>
<tr>
<td>GP</td>
<td>General practitioner</td>
</tr>
<tr>
<td>HL</td>
<td>Health literacy</td>
</tr>
<tr>
<td>HPCU</td>
<td>Hospital-integrated primary care unit</td>
</tr>
<tr>
<td>METTS</td>
<td>Medical Emergency Triage and Treatment System</td>
</tr>
<tr>
<td>MTS</td>
<td>Manchester Triage Scale</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>p</td>
<td>Level of statistical probability</td>
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<tr>
<td>paedCTAS</td>
<td>paediatric Canadian Triage and Acuity Scale</td>
</tr>
<tr>
<td>PCU</td>
<td>Primary care unit</td>
</tr>
<tr>
<td>RETTS-p</td>
<td>Rapid Emergency Triage and Treatment Scale- paediatric version</td>
</tr>
<tr>
<td>SES</td>
<td>Socio-economic status</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
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<td>WHO</td>
<td>World Health Organization</td>
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## Thesis at a glance

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<td>Prospective cross-sectional data register study of 1057 patient visits at a large urban paediatric ED during seasonal high-load conditions.</td>
<td>One fourth of paediatric ED visits could initially be safely triaged to adequate lower levels of medical care or back home by nurses according to recognized protocols and guidelines.</td>
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<td>To evaluate care-seeking, awareness and availability ofprehospital medical services, and initial patient management, with overall reference to socio-economic status of parents, at a paediatric ED.</td>
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<td>Forty percent attended the paediatric ED directly, with no or failed recent attempts at medical consultation. Failed attempts were more common outside office-hours, and direct seeking more common from the city district with the lowest socio-economic status.</td>
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<td>III. Impact of socio-economic characteristics on use of paediatric emergency care: A questionnarie based study.</td>
<td>To evaluate associations between socio-economic status and paediatric ED seeking, triage and management in a country providing paediatric health-care free of charge.</td>
<td>Prospective cross-sectional questionnarie study of 962 patient visits at a large urban paediatric ED during seasonal high-load conditions.</td>
<td>Having parents of foreign origin or with limited abilities in a new language, or being first-born, were strongly associated with direct and less-urgent seeking of paediatric ED care.</td>
</tr>
<tr>
<td>IV. Adjacent primary care may reduce less-urgent paediatric emergency department visits.</td>
<td>To evaluate if a nearby hospital-integrated primary care unit, available outside office-hours next to a paediatric ED, reduces total and less-urgent ED visits.</td>
<td>Retrospective data register study on 6 290 patient visits at a large urban paediatric ED during seasonal low- and high-load conditions, before and after implementation of a hospital-integrated primary care unit.</td>
<td>A hospital-integrated primary care unit most probably reduces less-urgent paediatric ED visits, and increases the proportions of visits, assessed by ED physicians, and of visits admitted for hospital care.</td>
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“We all got both light and dark inside us. What matters is the part we choose to act on.”

Sirius Black
Introduction

On paediatric health care in Sweden

Public healthcare in Sweden is provided by 20 counties and 290 municipalities [1]. The counties are responsible for healthcare, and the municipalities for care of the elderly and disabled [1]. Most private providers of healthcare are affiliated to the governmental insurance system. All healthcare in the primary, hospital-based inpatient, and dental, care sectors is provided free of charge to children below 18 years of age.

Child healthcare centres, established in 1938 [2] with almost complete national coverage, are in charge of preventable work with regular growth and developmental follow-up, including national vaccination programs in preschool children [3].

National school-based healthcare facilities are responsible for health promotion until 16 years of age. In addition, children may be registered at primary care centres and appointed specific general physicians (GP), but not many paediatricians work within the primary care sector. The most common way to other specialist paediatric care is by referral from a GP, although some hospital facilities allow self-referral.

Sweden has signed the United Nations convention on the Rights of children, where the second article [4] states that all children have the same rights. In Sweden, asylum-seeking children, and children without identification documents, under the age of 18, therefore have the same rights to healthcare and dental care, free of charge, as citizen children [5].

Emergency department care

Over the last century, paediatric healthcare in Sweden has developed a lot, and the mortality rate below five years of age is now among the lowest in the world [6]. In the beginning of the 20th century, there were only two hospitals for children in Sweden [7]. Since then, the clinical specialty of paediatrics has been divided into many subspecialties, and there are paediatric departments in almost all Swedish hospitals. Today, paediatric emergency care is offered at hospitals with no demand for referral from the primary care sector. Normally, emergency department (ED) paediatricians manage problems in children of internal medicine character, whereas most paediatric
ED patients with traumatic injury or surgical problems are managed by paediatric, general or orthopaedic surgeons.

In Malmö, the population has grown rapidly – by approximately 16% over the last decade compared with 9% in total Sweden [8]. In 2017, there were over 23 000 patient visits at the paediatric ED in Malmö, which is 22% more than five years earlier [9], when the use of a computerised patient ledger started. There is no corresponding national information on paediatric ED visits, but the number of total ED visits in Sweden has increased during the same period [10].

Overcrowding

Definitions and causes

Overcrowding (or crowding) by both adults [11] and children [12] at ED settings is acknowledged as a major and growing challenge all over the world. It has been defined as demands for emergency care exceeding provision within a reasonable period of time, causing physicians and nurses to be unable to provide high-quality care [13]. Even though Sweden was not mentioned as one of the countries with the highest overcrowding [11], concerning reports have been released also in Sweden [10, 14], mainly from adult ED settings. A recent report from the National Board of Health and Welfare [10] in Sweden, based on information from 66 of 71 adult EDs, show an almost 3% increase in ED visits and longer ED stay, but no increase in time until physician’s assessment, between 2014 and 2015. Approximately 44–89% of Swedish ED patient visits are being managed within four hours of arrival.

There is increasing demand for ED care in Sweden, the country with the lowest number of in-hospital beds per citizen within the OECD [15] – and bed numbers are still decreasing [16]. The increasing demand together with the low number of available in-hospital beds seem to mainly account for the growing problem of ED overcrowding in Sweden, like in the USA [17-20] and in Australia [21]. The Swedish Health and Social Care Inspectorate has concluded that lack of hospital staff, together with high demands for ED care, increase risks of medical error and inadequate patient safety [14]. Fundamental causes of overcrowding, divided into input, throughput and output process factors, are shown in Figure 1.

Access block due to shortage of in-hospital beds, sometimes resulting from shortage of in-hospital staff, is being recognized as the main reason for adult ED overcrowding [19, 22-24] with longer ED stay [25]. An American study in more than 56 000 paediatric ED patients subjected to almost 10 000 hospital admissions has reported that paediatric ED care is also affected by shortage of in-hospital beds [26]. The length of ED stay was
estimated to have increased by 18 minutes for each discharged, and by 34 minutes for each admitted, paediatric ED patient per five-percent increase in hospital bed occupancy above 80 % [26].

<table>
<thead>
<tr>
<th>INPUT</th>
<th>THROUGHPUT</th>
<th>OUTPUT</th>
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<tbody>
<tr>
<td>High number of total ED visits</td>
<td>Shortage of ED staffing</td>
<td>Shortage of in-hospital beds (access block)</td>
</tr>
<tr>
<td>High proportion of less-urgent ED visits</td>
<td>Shortage of ED beds</td>
<td>Shortage of in-hospital staff</td>
</tr>
<tr>
<td>Large seasonal variation in ED visits</td>
<td>Slow or delayed processes of ED triage and management</td>
<td></td>
</tr>
<tr>
<td>Low knowledge and/or availability of prehospital medical facilities</td>
<td>Slow or delayed laboratory and radiographic services</td>
<td>Delayed patient discharge due to suboptimal in-hospital care</td>
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<tr>
<td></td>
<td>Considerable and frequent ED visits with medical comorbidity</td>
<td>Shortage of facilities for post-hospital nursing care or home care</td>
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Figure 1. Fundamental causes of overcrowding, categorized as input, throughput and output process factors.

Increased numbers of adult and paediatric total and less urgent ED visits have been associated with overcrowding [11, 27]. Reasons for parents to use ED care for less-urgent medical problems have been explored in Europe and North America, and found to be associated with overestimation of medical urgency [28, 29], dissatisfaction with primary care, need for medical reassurance, and high availability and expected quality of ED care [29, 30-32]. In recent years, the impact of less-urgent patient load and its contribution to ED overcrowding has been under debate. Whereas boarding seems to be a larger problem in adult ED care [33-35], a large American study [36], reporting low-acuity visits to account for almost 10 % of total paediatric ED visits, has concluded that although low-acuity patients may require marginal resources for their individual care, they use limited resources when systems reach capacity constraints [36]. A large Canadian collaboration [37] to identify markers of paediatric ED overcrowding based on 140 000 patient visits has concluded patient load and volumes as more relevant for paediatric ED overcrowding than delayed provision of in-hospital beds. Research on ED overcrowding in both adult and paediatric ED care is therefore important before proposing solutions and implementing changes in either kind of setting.
Outcomes and implications

Various scoring systems have been proposed to assess ED overcrowding with high statistical sensitivity and specificity [38-41]. Those validated scales can be used both in adult and paediatric ED care, but so far various paediatric ED patient volumes have been proposed to more accurately reflect paediatric ED overcrowding than use of any such scale based on other specific factors. Examples of patient volumes reported to reflect paediatric ED overloading are numbers of patients arriving and being registered [37, 42], and awaiting assessment [42] at a paediatric ED.

Figure 2. Examples of outcome measures of ED overcrowding.

Overcrowding has been associated not only with delayed management but also with adverse outcomes in both adults and children (Fig. 2). Significant associations between ED overcrowding and patient mortality have also been found, mainly in adults [43-48] but also in children [49].

Delayed administration of antibiotic in adults with pneumonia [50] or sepsis [51] have been proposed to result from ED overcrowding. Delayed administration of antibiotic in febrile neonates has been reported to be [52], or not to be [53], associated with paediatric ED overcrowding. Prolonged time until administration of glucocorticoid in children with acute asthma [54, 55] and of analgesic in those with long-bone fracture [56], has also been associated with overcrowding. A recent report from the USA has
shown that the rate of re-assessment of critically abnormal vital signs in children decreased by 3.1 % per patient awaiting hospital admission, by 1.0 % per patient in the waiting area, and by 0.6 % per patient at the paediatric ED [57]. Accordingly, the time to triage on ED arrival, total length of ED stay, and time to medical assessment have all been reported to correlate with patient load at a large urban paediatric ED [58]. Prolonged paediatric ED stay during periods of overcrowding has also been claimed to be associated with lower admission rate despite unchanged number of return visits within 48 hours [59], possibly resulting, at least in part, from longer observation periods in the ED.

Medical errors associated with medication, e.g. incorrect dose, administration interval, or choice of drug, have been reported to significantly correlate with overcrowding in American adult ED care [60], and to be two-fold higher during periods of maximal, compared with minimal, overcrowding scores in patients with acute myocardial infarction or bronchial asthma [61]. Accordingly, risks of medical error in paediatric ED patients should be evaluated during periods of overcrowding.

Overcrowding has also been found to be associated with lower patient satisfaction [62], more patients leaving without having been managed [22, 58, 63, 64], and with longer time from ED arrival until triage, and from triage until medical assessment [65].

In conclusion, extensive research in this area – particularly in adult, but also in paediatric, ED care – has confirmed serious effects of ED overcrowding on patient flow and medical quality, and safety of healthcare addressing profound interventions and changes to be undertaken.

**Interventions and solutions**

Studies to reduce patient volumes have been carried out in both adult and paediatric ED care. Van den Heede et al. [66] have recently evaluated the effectiveness of interventions to reduce ED patient load, including cost-sharing, and better supply of, and access to, primary care and telephone healthline services. They conclude co-location of primary and ED care together with telephone triage systems to be the preferred and most effective interventions available for reduction of total and less-urgent ED visits [66].

Paediatric ED studies [67-69] have reported inverse correlations between access to primary care and less-urgent and self-referred use of paediatric ED care. To strengthen primary care, increased near-by supply and staffing may be needed, but also higher availability outside office-hours. GP led walk-in centres or GP led ED cooperatives, have become more common in the UK [70], Switzerland [71] and the Netherlands [72]. The cooperatives have been found to significantly reduce less-urgent, self-referred ED patient visits by adults [71-73]. Prehospital telephone healthline services have been
reported in the USA to enable referral of up to 80% of potential paediatric ED patients for adequate lower levels of healthcare or back home [74, 75] with low risks of under-triage – with potential exceptions of infants < 6 weeks and night time visits [74].

Cost-sharing, meaning that patients themselves pay parts of actual costs for ED care, has mainly been explored in the USA [66] and reported to reduce total and less-urgent ED use by up to 50% [76, 77]. However, since 1986 a federal law, the Emergency Medical Treatment and Labor Act, gives everyone in the USA the right to be treated at an ED regardless of insurance status or ability to pay [78]. In Sweden, all ED care for children is free of charge (whereas adults pay approximately 30 Euros per ED visit.

The American College of Emergency Physicians acknowledges that many ED settings in the USA are critically overcrowded and released a statement paper in 2008 [35] proposing high-impact solutions to overcrowding and boarding - the primary cause of adult ED overcrowding according to the authors. Their proposed high-impact solutions were moving admitted patients out of the ED to in-hospital areas (e.g. hallways), coordinating discharge of in-hospital patients before noon, and coordinating scheduling of elective and non-elective surgery [35]. Those solutions mainly refer to adult ED care, and their potential impact on paediatric ED care is unknown.

Interventions directed at ED and in-hospital staffing [79] and team triage [80, 81], in addition to boarding and patient load, have been shown to be valuable in adult, but not yet in paediatric, ED care.

In conclusion, ED overcrowding should not be considered as something just for ED settings to fix but rather as a sign of systemic dysfunction of the healthcare organization. This includes all of the medical network – individual medical knowledge and responsibility, availability of primary care and prehospital services, ED organization, processes, staffing and competence, in-hospital efficacy, staffing and organization, and responsibility of the society for healthcare resources – putting into attention that only when all stakeholders agree that the problem is systemic and hospital-wide can solutions be implemented …. that will protect everyone’s access to emergency care [35].
Health literacy

Definitions and categorization

Health literacy (HL), a concept first mentioned in the seventies [82], is now used by health professionals all over the world. In its most simple and early form it originally referred to the ability to read, write, talk and understand health-related information. In 1998 this term was also included in the World Health Organization (WHO) Health Promotion Glossary [83] (Fig. 3).

![Health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.](image)

Figure 3. Definition of the term health literacy according to the World Health Organization [83].

This definition has been modified by global promoters of healthcare over the past twenty years. In 2012 Sørensen et al. [84] defined HL as ability to access, understand, appraise and apply information on healthcare, disease prevention and health promotion [84]. Accordingly, a high level of HL would enable not only informed medical decision-making but also promote understanding of interactions between health and disease (Fig. 4).

Categorization of HL (Fig. 5) is now considered mandatory to evaluate and measure HL in various populations [85]. Skills within all categories of HL promote both individual and population-based action at any level of healthcare.
Figure 4. A matrix including four dimensions of health literacy applied in three health domains according to Sørensen et al. [84].

Figure 5. Categorization of health literacy according to Nutbeam et al. [85].
Importance and implications

An individual, i.e. a parent, with high skills in all HL categories could probably overcome obstacles in healthcare seeking and would be considered well equipped to obtain and improve health and avoid, if wanted, risk factors for disease. In contrast, low HL skills may lead to common negative health care patterns e.g. as suggested by Wångdahl [86]. Some of those are presented in Figure 6.

![Diagram showing common negative healthcare patterns associated with low health literacy as suggested by Wångdahl [86].](image_url)

Figure 6. Common negative healthcare patterns associated with low health literacy as suggested by Wångdahl [86].
Morrison et al, found that low HL was associated with higher use of paediatric ED care for non-urgent conditions [87, 88]. Serious long-term adverse effects of low HL are poor health status in children [89] and adults [90], and even higher mortality rates in adults [91, 92]. In addition, low HL may also contribute to both under- and over-use of medical facilities. Low HL should therefore be taken most seriously – for individual as well as organizational and financial reasons.

Global considerations

In 2009-2012 an international HL survey [93] based on approximately 8000 respondents in eight European countries, led to the conclusion that approximately 47 % of the general population had limited HL. Studies from Denmark [94], the USA [95], and Australia [96, 97] have reported inadequate levels of HL among 7-60 % of citizens, and HL among American parents has been found to vary between 10 and 48 % [98]. Despite different proportions, HL is limited among many citizens in Western countries.

Socio-economic considerations

Socio-economic status and HL are associated [93-95, 99]. Lower HL has mainly been associated with age over 65 years, ethnic minority groups, lower level of education and living below poverty level [93, 95, 100]. Significant predictors of low HL among parents in the USA have been reported to be less than high-school education, limited understanding of English language, being black or Hispanic, having low income or being born outside the USA [99]. Low HL was also significantly associated with having a child without insurance [99].

High HL implies ability to seek information on healthcare issues, make appropriate decisions to promote health, understand social and medical contexts, and be aware of relevant medical systems, structures and laws. This requires not only reading and writing skills but also linguistic abilities and acculturation. Refugees in Sweden have recently been reported to have low functional, communicative and critical HL [101, 102].

Interventions and obligations

Low HL may lead to poor health and high costs [90]. Since 44 % of the population in the study city of Malmö has foreign background [103], HL should be taken into account to enable parents to more appropriately use the healthcare system. Accordingly, major future challenges – preferably by continuous systematic efforts targeting social
Triage

Adult triage systems

Dominique Jean Larrey, a French baron and military chief surgeon of emperor Napoleon’s Imperial Guard, changed the past tradition that military rank was decisive of which wounded soldier would receive medical attention first [113]. Instead he insisted that soldiers with the highest probability of survival should be treated first, regardless of military rank [114]. He also introduced immediate evacuation and treatment, also during ongoing battle [115].

Those who are dangerously wounded should receive the first attention, without regard to rank or distinction. They who are injured in a less degree may wait until their brethren in arms, who are badly mutilated, have been operated on and dressed, otherwise the latter would not survive many hours, rarely until the succeeding day.

Figure 7. Statement in 1812 by military chief surgeon D J Larrey [113].

During the early 19th century, military principles of medicinal triage were developed further by the French baron, whereas corresponding civilian triage was not being used until by the mid-20th century [114]. Current principles of medical triage can be applied in various settings under different circumstances – from routine use in ED or
in-hospital emergency care to large-scale use in multi-casualty accidents, associated with civilian or war disaster management.

Medical triage can be defined as staging of patients for treatment, based on the medical condition, according to predefined criteria for scoring under conditions of at least modest resource scarcity [113]. Today, the Swedish law (SFL 2017:30, chapter 3, 2 §) [116] states that the individual in most need of healthcare should receive it first, which in modern ED settings is accomplished by medical triage, where medical staff – nurses or physicians – use applicable individual triage scoring to determine the order of further assessment between different patients. In this process, patients can be triaged in a correct manner, or be under- or over-triaged. Dangers with under-triage (low-sensitivity scoring) are obvious – underestimation of medical conditions may harm individual patients by delaying appropriate diagnosis and treatment – whereas overestimation of the severity of medical conditions by over-triage (high-sensitivity scoring) rather harms the healthcare system and may accordingly be harder to detect and evaluate [117].

According to a recent Swedish report in 2010 on triage [118], 73 % of adult Swedish ED settings used some sort of system for medical triage, the most common ones being the Rapid Emergency Triage and Treatment System (RETTS), the Manchester Triage System (MTS) and the Adaptive Process Triage system (ADAPT) [118]. It was concluded that the risk of dying if triaged at the lowest level of urgency is extremely low, although five percent were hospitalized, and that medical triage, interprofessional team-triage, and fast-track programs reduce waiting time and ED stay. Team-triage also reduces the number of patients leaving before medical assessment. In Sweden, the RETTS [119], implemented in 2005, validated as the Medical Emergency Triage and Treatment System (METTS) [120, 121] and renamed in 2011, was implemented to identify patients that could safely wait for medical assessment [119].

**Paediatric triage systems**

Specific paediatric triage scoring systems have evolved from adult scales and many regionally developed manuals have been replaced by nationally or internationally evaluated ones. Whereas the Manchester Triage System (MTS), the Emergency Severity Index (ESI), the paediatric Canadian Triage and Acuity Score (paedCTAS), and the Australian Triage Scale (ATS) [122] are being used internationally [122], a paediatric version of the RETTS (RETTS-p) evolved in Sweden and was adopted in Malmö in 2012. The main purpose of this system is to detect deterioration and illness with high sensitivity, i.e. assuring paediatric patient safety by overestimating the medical conditions (over-triage) [123]. The RETTS-p evaluates paediatric conditions based on bedside assessments of vital parameters (oxygen saturation, respiratory rate, heart rate, blood pressure, awareness, and body temperature) and the Emergency
Symptoms and Signs (ESS) system [124], according to a five-level priority colour scale [125] (Fig 8) - from life-threatening (red) and possibly life-threatening (orange), via not life-threatening but in need of emergency care within reasonable time (yellow or green) to not life-threatening and not in need of emergency care if treatment at lower levels of care is available (blue) [125].

Each triaged child is assigned the highest priority level from the vital parameter or ESS algorithms, but interpreted individual bedside signs or patient history findings is allowed to influence the final priority level. Patients triaged as red, orange, yellow or green have previously been considered to require medical assessment within four hours, but the most recent versions of the RETTS-p recommends no other time limit than immediate management of patients triaged as red or orange. In Sweden and Norway, the RETTS-p has been found to have good to very good interindividual reproducibility [126, 127] with 3.3 % under-triage and three times higher rate of over-triage. There is still need for validation of all paediatric triage systems to further assure medically safe clinical applications. Evaluations of the RETTS-p are promising, but more research is required to validate the tool for triage in paediatric emergency care [126, 127].
Summary of introduction

Patient flows in paediatric ED care increased already in the zeroes, also in Malmö, with longer waiting times. Not all patients seemed acutely sick and some of them could probably also have been safely managed at adequate lower levels of medical care. European and American studies on ED overcrowding reported delayed patient management. However, there were no studies in Sweden on associations between seeking of paediatric ED care and patient characteristics, medical triage, and ED management. Questions on how parents made their ways to the paediatric ED, and if their children were being assessed and treated at appropriate medical levels of care, needed to be answered. At this time, the concept of HL was already being acknowledged as important for less-urgent use of ED care.

It was in this context that the clinical and scientific fundamentals of this thesis were being designed. We wanted to evaluate parental care-seeking at a paediatric ED with no demand for professional referral, and corresponding paediatric ED triage and management, with particular reference to SES.

Such information would improve our understanding of how limited resources of the healthcare system can be used to provide more appropriate medical information and safely direct parents of sick children to adequate and more appropriate levels of paediatric emergency care.
Aims

The overall aim of this thesis was to evaluate care-seeking, triage and management at an urban paediatric ED, with no demand for professional referral, in a country with national insurance and healthcare free of charge for children. More specific aims were to evaluate

- if paediatric patients can be safely triaged to adequate lower levels of medical care soon after ED arrival.

- awareness of prehospital medical alternatives before seeking paediatric ED care.

- availability of prehospital medical services before seeking paediatric ED care during and outside office-hours, and potential associations with care-seeking.

- reasons reported for directly attending a paediatric ED with no recent attempt at prehospital medical contact.

- the most appropriate level of medical care for patients initially triaged to be assessed by an ED paediatrician

- potential associations between socio-economic status and paediatric ED care-seeking, triage and management.

- if a hospital-integrated primary care unit, available outside office-hours close to a paediatric ED, reduces the number of total and less-urgent paediatric ED visits.

- if a nearby hospital-integrated primary care unit, available outside office-hours, shortens paediatric ED stay.
“It takes a great deal of bravery to stand up to our enemies, but just as much to stand up to our friends.”

*Albus Dumbledore*
Methods

Study setting (I-IV)

The studies for this thesis were carried out at a large urban university hospital in Malmö— a city in southern Sweden with about 300,000 inhabitants [128] and a catchment area of another 100,000, 20% being children up to 17 years of age. From 2008 until 2015, the proportion of first- and second-generation immigrants (from at least 177 countries [128]), increased from 38 to 43 % [129]. Malmö is a segregated city with ten city districts [128], differing considerably in SES characteristics (i.e. education, employment, income, social assistance, native origin).

The paediatric ED at the university hospital provided care of infants and children for medical emergencies with no demand for professional referral. Children with surgical, orthopaedic, or more serious otorhinolaryngological conditions were referred by nurses to the adult ED for further evaluation. In 2008 the paediatric ED was situated in the outskirts of the hospital area but moved in early 2012 next to the adult ED. In 2014 a primary care unit, open outside office-hours during evenings and weekends, and previously situated about 1.5 km from the hospital, moved into the ED facility.

Study patients (I-IV)

Patients aged 0-17 years with non-scheduled visits at the paediatric ED were eligible for inclusion. Written information about the studies (I-III) (in Swedish, English or Arabic), and corresponding oral information (in Swedish or English), was provided to parents and to children above seven years of age. Interpreters considered needed for the medical visit also assisted in filling out the forms and questionnaires if applicable. Signed informed consents were obtained from participating parents, and from children above 15 years of age.

An experienced paediatric nurse assessed each study patient on ED arrival in 2008 and in 2012 (I-III), to determine the most appropriate level of medical care based on patient history, presenting symptoms, and individual assessments of clinical signs according to the guidelines in a locally developed and recognized clinical manual for triage.
management in the county region. The patients were then triaged to be assessed by a paediatric ED physician, be referred to another healthcare provider, or return home with medical advice. Patients triaged for medical ED assessment were also evaluated by the nurse for medical urgency (I-III), according to a four-level scale, to be managed immediately (level 1), not immediately but within one hour (level 2), within one to three hours (level 3), or within three to twelve hours (level 4). From March 2012 (IV) triage was based on RETTS-p [126, 127] and ESS [124] protocols, and each child was accordingly triaged into one of five different colours with corresponding urgency levels (Fig. 8) from life-threatening (red) or potentially life-threatening (orange), via not life-threatening but in need of ED care within reasonable time (yellow or green), to not life-threatening and possible to manage at lower level of healthcare if available (blue) [125].

Statistics (I-IV)

Data were recorded in Microsoft Excel spreadsheets (Microsoft Corporation, San Francisco, CA) (I). The Statistical Package for the Social Sciences (SPSS) for Windows and MAC, software version 20-24 (IBM Corp, Armonk California, USA) was used to record, structure and analyse study data (I-IV).

Ethics (I-IV)

All studies were approved by the regional Human Research Ethical Review Board, Lund Sweden - Dnr 2007/620 (I, II), 2012/18 (III), 2016/710 (IV).
Paper I

Study design (I)

In this prospective, cross-sectional register study, children up to 17 years of age, arriving at the paediatric ED between 08:00 and 20:59, during 25 days of seasonal high-load conditions were included. Scheduled ED revisits were not included. Basic nighttime data (from 21:00 until 07:59) was included for comparison. Data on patient characteristics, ED management and visit outcome was compiled from patient ledgers and analysed de-identified.
Statistics (I)

Categorical variables are reported as numbers, with 95% confidence intervals (CI). Continuous variables were presented as mean with standard deviation (SD). Proportions were compared with the two-sided Fisher’s exact test. Probability (p) levels of < 0.05 were considered statistically significant.

Paper II

Study design (II)

In this prospective cross-sectional questionnaire study, children up to 17 years of age, arriving at the paediatric ED between 08:00 and 20:59, during 25 days of seasonal high-load conditions were included. For practical reasons, no nighttime visits were included.

Parents of eligible study patients were asked to answerer a questionnaire on recent – successful or failed – attempts at contact with medical caregivers before their present ED visit, and main reasons for seeking ED care. The questionnaire was evaluated during a two-day testing period at the paediatric ED before the start of the study to identify and minimize risks of misunderstanding. Individual data on age, gender, presenting problem, medical priority, waiting time, day of week, time of day and city district was retrieved from an ED ledger. Overall SES data on all city districts in Malmö was compiled from city statistical records [128].

Statistics (II)

Categorical data is expressed as numbers (%). Proportions were compared with the two-sided Fisher’s exact test or the Chi2 test with Yates’ correction when needed. Univariate binary logistic regression analysis was used to evaluate associations between categorical data, and results are reported as odds ratios (OR) with 95% CI. Levels of p < 0.05 were considered statistically significant.
Paper III

Study design (III)

In this prospective cross-sectional questionnaire study, children up to 17 years of age, arriving at the paediatric ED between 08.00 and 20.59 were included. Scheduled ED revisits were not included. For practical reasons, no night-time visits were included. Parents of the study patients were asked to fill out a questionnaire on their recent medical contacts, reasons for care-seeking, country of birth, self-rated abilities in the Swedish, educational level, current employment, civil status, total number of children, and diseased child’s order among siblings.

Patients assessed by ED physicians were also evaluated, according to a structured protocol, to determine if ED, primary or no medical care would have been the most appropriate level of individual care, and how medically urgent their ED visit was considered to have been. Paediatric ED patients with or without completed physician’s protocol were included. The questionnaire and protocol were both pre-evaluated during a two-day test period at the ED before start of the study to detect and minimize risks of misunderstanding.

Statistics (III)

Statistical analyses were based on the child’s parent with the individually highest rated levels of education, employment and abilities in the Swedish language. Missing internal values in each form was registered. No imputation method was used. Categorical variables were expressed as numbers (percent). Proportions between groups were compared with two-sided Fisher’s exact test. To evaluate SES characteristics and association to care seeking variables, binary logistic regression analysis, both univariate and multivariate, were used and results were reported as odds ratios (OR) with 95% CI, and p-values < 0.05 were considered statistically significant.

Paper IV

Study design (IV)

This retrospective register study was carried out before (2012) and after (2015) the implementation of a hospital-integrated primary care unit (HPCU). In 2014 the city
PCU previously located about 1.5 km away from the paediatric ED moved in next-door to the paediatric and adult hospital ED facilities. All patients, 0-17 years of age, visiting the paediatric ED during one month at high (March) and one month at low (September) seasonal load, before (2012) and after (2015) the implementation of the HPCU, were included in the study. Data was compiled from hospital data registers. Scheduled revisits were not included. Patients from the HPCU were included in the study for comparison.

**Statistics (IV)**

Categorical data were expressed as numbers (percent) and continuous non-parametric variables as median (IQR). Proportions between groups were compared with two-sided Fisher’s exact test. Continuous non-parametric variables were compared between groups using Mann-Whitney U test. Levels of p < 0.05 were considered statistically significant.
Results

Paper I

On arrival of the 1057 study patients, ED nurses triaged two thirds (n=713) to be assessed by paediatric physicians. Of the remaining 344 patients, one sixth (n=54) was referred for other ED care, one third (n=114) for primary care, and half of them (n=176) were sent home with medical advice (Fig 10).

Patients arriving outside office-hours were more often referred from the ED after initial triage than those arriving during office-hours (p < 0.001). Sixty-two percent of the study patients were younger than two years, and those below six months of age were more frequently triaged for paediatric ED physician assessment (p < 0.001).

Most children with respiratory (p < 0.001) or neurological (p < 0.001) problems on arrival were triaged to be assessed by a paediatric ED physician. Patients presenting with fever, or with symptoms of gastrointestinal or upper airway infection – the most
common clinical signs on arrival — were either triaged away from the ED or for physician’s assessment, depending on the medical condition.

Of 344 patient visits triaged away from the paediatric ED, 26 patients (7.6%) returned within 72 hours for similar clinical reasons (gastrointestinal infection, respiratory problem or cough), and three of them were admitted. The remaining 23 patients were sent back home after triage or physician’s assessment.

**Paper II**

A total number of 657 patients assessed by paediatric ED physicians (92% of eligible patients) were included. More than one third of their parents had recently failed (18%), or not tried (21%), to contact prehospital medical services before attending. Failed attempts at prehospital medical consultation were more common outside office-hours ($p = 0.014$). Reasons for failed contact were inability to get in touch by telephone with the ED (68%), with primary care providers (19%) or with the formal telephone healthline (13%).

Approximately half of paediatric ED patients attending after prehospital medical contact were referred by telephone, and the other ones by medical assessment (Fig. 11).

Several parents of children with successful prehospital consultation had more than one contact with ED, primary care, telephone health line or other prehospital services. Patients attending the ED with no attempt at prehospital medical contact were not triaged as less-urgent than those with failed or successful contact. Almost all of the most urgent ED patients (corresponding to 1.2%) arrived directly, and parents coming to the paediatric ED with no recent attempt at prehospital contact most often stated perceived urgency as the main reason. Children of parents with failed attempt at contact were triaged as less-urgent than those with successful contact ($p = 0.014$). There was no difference in age, gender or admission rate between ED patients with no, failed or successful prehospital contact.

Among patients coming from within the city (79%), there was a higher relative proportion of paediatric ED visits from the district with the lowest, compared with the highest, SES — 19 vs. 5.5 per 1000 children and 30 days ($p < 0.0001$), respectively. Arriving directly was more (OR 2.02; $p = 0.008$), and being admitted to hospital less (OR 2.59; $p = 0.016$), common among ED patients from the district with the lowest SES.
Paper III

In the third study, 809 of 962 study patients were triaged to, and the remaining 153 triaged from the ED, corresponding to 76 % and 45 %, respectively, of eligible patients. The physician’s protocol, reflecting assessed medical appropriateness of the ED visit, was completed in 729 patients (90 %).

Both parents of 368 children were born outside a Nordic country – 34 % in other parts of Europe, 43 % in the Middle East, and 14 % in Africa. Primary care was considered to have been more suitable than ED care in 45 % of study patients triaged for ED care. It was more common to attend the ED with no prehospita contact (OR 2.23; p < 0.001) if both parents were born outside Nordic countries. Children of non-native parents (OR 1.66; p = 0.018) or parents with limited abilities in the Swedish (OR 2.66;
p = 0.003) were more often triaged away from the ED soon after arrival, and so were first-born children (OR 1.96; p= 0.001) (Fig 12). Accordingly, if triaged for physician’s assessment, those patients were more often considered less appropriate for paediatric ED care (Fig 13).

Some socio-economic characteristics such as having unemployed parents (OR 1.51; p= 0.042) or parents with less than 12 years of education (OR= 1.37; p= 0.030) were associated with direct seeking. Having unemployed parents was also associated with less often being considered appropriate for paediatric ED care (OR= 0.60; p = 0.013). However, these associations did not remain significant after adjustment for other SES characteristics, such as foreign origin or low understanding of the Swedish language. There was no correlation between assessments of medical urgency by ED physicians or by parents regardless of SES.

![Odds ratios with 95 % CI for being triaged back home or for other level of care](image)

Figure 12. Odds ratios with 95 % confidence intervals (CI, diamond edges), calculated by multivariate multiple regression analysis, of being triaged away from a paediatric emergency department (ED) under various socio-economic preconditions.
Paper IV

In this retrospective data register study, we included 3,216 paediatric ED visits in 2012 and 3,074 in 2015, together with 2,302 paediatric HPCU visits in 2015. Outside office-hours (except nighttime), when the HPCU was available, the proportions of total and less-urgent paediatric ED visits were 28% and 36% lower, respectively, than in 2012 (p < 0.001). During office-hours, when the HPCU was closed, the proportion of less-urgent paediatric ED visits was higher in 2015 than in 2012 (p < 0.001). The median length of stay at the HPCU was below one fourth of that at the paediatric ED (p < 0.001). The length of stay at the paediatric ED was not shorter in 2015, after implementation of the HPCU, compared with in 2012.

When the HPCU was open, the proportion of infants below three months of age was higher (p < 0.001), and the proportions of children with fever (p = 0.001) or ear pain (p < 0.001) were lower, at the paediatric ED. Higher proportions of patients were also
triaged for physician’s assessment (p < 0.001) or admitted to hospital (p = 0.033). Figure 14 shows characteristics of ED visits during outside office-hours before and after implementation of the HPCU in 2015.

Figure 14. Characteristics of patient visits at a large urban paediatric ED before (2012) and after (2015) the implementation of a near-by hospital-integrated primary care unit available outside office-hours (except nighttime).
Discussion

Our main finding that more than one fourth of the patients can rapidly, appropriately and safely be triaged from a paediatric ED, with no demand for professional referral, by experienced nurses according to recognized principles and guidelines (I), has to our knowledge not been reported elsewhere. Considering that less than one tenth of them returned to the ED for the same condition within 72 hours (I), and that few had to be admitted for hospital care (I), initial triage away from the ED seems to have been safe and clinically acceptable, particularly considering that many parents seek medical advice early in the course of an infection, and that some children later deteriorate despite appropriate initial management. The need for professional triage from ED settings allowing direct seeking is emphasized by high proportions (39-64 %) of adult ED patients assessed more suitable for primary care in Sweden [130]. Experienced nurses have been reported to appropriately identify and triage adult ED patients with less-urgent medical conditions [131], and also to prevent paediatric return visits by giving medical advice to parents spontaneously leaving the ED [132]. Arrangements of primary care appointments for patients triaged for primary care may have contributed to our low rate of return visits (I), in agreement with findings in American paediatric [133] and Swedish adult [134] ED studies, where such measures were associated with fewer less-urgent patient visits.

Our finding that patients were more often triaged away from the ED outside office-hours, despite similar return visit rate within 72 hours compared with during daytime (I), indicates higher proportions of less-urgent ED visits during evenings and weekends, most probably reflecting corresponding relative shortness of urban primary care facilities. We also found that our triage system has large safety margins, considering that out of those two thirds of patients initially triaged to be seen by an ED physician, half of them would have been more appropriate for primary care according to the ED physicians. Improved accessibility of primary care centres during and outside office-hours might prevent less-urgent ED visits [68, 135-137], considering that shortage of daytime appointments at primary care centres is considered as an important reason for seeking paediatric ED care for less-urgent conditions [29, 32, 138]. However, a single PCU open outside office-hours but located away from the ED, does not seem to be enough to meet the needs of the parents (I), some of whom may also have been bound to seek medical care for their children after work. Many parents do attend a paediatric ED for less-urgent problems anyway [139, 140], due to worries about the medical
condition or perception of emergency (II), whereas others just need re-assurance [II, 139]. By meeting the child and its parent(s) face to face on arrival, ED nurses are able to make a safe and reasonably appropriate initial assessment of the medical condition and, if considered not to require paediatric ED care, rapidly triage the child for primary care or back home with medical advice (I-III). Overcrowding at paediatric ED settings, found to be associated with longer waiting periods [58], might thus be reduced by individual clinical assessments on arrival and rapid triage away from the ED (I), preferably together with systematic use of fast-track systems [141-143], or by a HPCU (IV).

As could be expected [144, 145], a vast majority of children seeking ED care during late winter presented with infections or breathing problems (I-III). Whereas emergency signs of respiratory distress or neurological dysfunction called for assessment by a paediatric ED physician (I-III), some children with slight to modest signs of fever, gastrointestinal, or upper airway infection, or fever could be appropriately managed also by a primary care physician, or even be sent home with medical advice, depending on the individual condition, where recognized strategies for rehydration or temperature reduction could be enough. Initial appropriate assessment at a paediatric ED remains mandatory for safe patient management, particularly considering that the most common presenting problems in paediatric patients admitted for hospital care are respiratory distress, fever, vomiting or diarrhoea [144-146].

Even though almost all parents knew where to seek prehospital medical advice, approximately two fifths of ED arrivals were direct visits with failed or no previous medical consultation (II). These findings conform to similar or even higher self-referral rates in diverging paediatric ED populations in Europe [147-149] and North America [150, 151]. Perceived urgency was a main reason for direct paediatric ED seeking (II), as also found elsewhere [151, 152], where short duration of illness, and rapid perceived deterioration, in these children (II) might explain part of this care-seeking behaviour. Considering that almost all patients requiring immediate ED management were self-referred (II), as also reported by others [148], parental concerns should be taken seriously despite differences between professional and non-professional judgements of individual medical severity [152]. The similar levels of assessed urgency in ED patients with successful versus no attempt at prehospital medical contact (II) might indicate that many parents are able to appropriately estimate the level of medical severity of their sick children [151].

Failed recent medical contact before a paediatric ED visit, particularly outside office-hours (II), may in part be explained by failure to get in touch by telephone. This highlights the importance of 24-hour telephone availability to reduce less-urgent paediatric ED visits, and accordingly the occasionally open ED telephone healthline was closed soon after the study (II) had been completed. Telephone healthlines have been reported to reduce paediatric ED arrivals by up to four fifths [74, 75], and
resulting ED visits to be appropriate in two thirds to ninety percent [153, 154]. In addition, low availability of primary care outside office-hours, when many parents first notice deterioration of their children [155], might explain why many parents failed to reach this alternative before their ED visit. Accordingly, high supply of primary care, particularly outside office-hours, has been reported to counteract paediatric ED overloading [68, 156]. Although self-referred paediatric ED patients have been reported to be more urgent than those referred by general practitioners [151], opposite results have been reported in patients with failed attempt at prehospital medical contact [148, 149], in agreement with our findings (II).

Most Swedish parents tried to get prehospital medical advice before attending the ED (II), despite free access to both primary and ED care, and although governmental provision of healthcare free of charge has been reported to promote ED care-seeking regardless of medical urgency [157]. This indicates that if appropriate medical alternatives are available, free healthcare does not seem to promote direct paediatric ED care-seeking. It also suggests that increased availability of prehospital medical services might further reduce less-urgent use of paediatric ED care and promote seeking at more appropriate levels of medical care.

Socio-economic status (SES) does influence the use of paediatric ED care, considering the higher use by children from the city district with the lowest SES and highest proportion of immigrants (II), and the strong associations of direct paediatric ED seeking with non-native origin and low abilities in Swedish (III). Accordingly, immigrants in Scandinavian and other European countries have been reported to use adult ED care more than native citizens [158, 159], also for less-urgent problems [160]. Higher paediatric ED seeking for less-urgent conditions by parents of non-native status and with low abilities in a new language (III) is in agreement with Italian findings [161]. In contrast, American investigators have reported fewer ED and primary care visits by children of adult immigrants, however claimed to depend mainly on lack of national public insurance and low availability of healthcare [162-168]. The American College of Physicians has addressed need for major change in American healthcare policy to provide adequate medical healthcare to those apparently vulnerable groups [169].

That non-native parents, regardless of abilities in Swedish, had less prehospital medical contact, and that their children were more often triaged away from the ED (III), shows that cultural differences, in addition to linguistic barriers, affect seeking of paediatric ED care, also in a healthcare system based on national public insurance. These results (III) might reflect barriers to prehospital healthcare services for particularly vulnerable patient groups and problems of the healthcare system to inform, communicate with, and advise them.

International differences in organization of healthcare services might, at least in part, also explain different healthcare seeking patterns between native and non-native parents.
of sick children [170], e.g. whether they initially turn to primary or paediatric ED care for respiratory illness, diarrhoea or fever [170]. However, a recent Norwegian study reported that children of first-generation immigrant parents used primary healthcare less, but those of second-generation immigrant parents more, than did children of native parents, suggesting that paediatric ED use by immigrants might be expected to decrease over time [171]. Accordingly, Latino-families with lower acculturation have been found to use paediatric ED facilities as a more regular source of healthcare than those who have lived for a longer time in the USA [172].

In agreement with our findings (III), linguistic barriers to communication among Danish [173] and American [174, 175] immigrants have been found to be associated with less use of prehospital services for medical advice or assistance, particularly by telephone. Linguistic barriers to communication are considered as a major problem at Swedish healthcare centres [176], and since the use of telephone healthlines by Swedish immigrants may complicate medical decision-making [177], multilingual telephone operator services have been proposed to meet this challenge [174].

Our findings that shorter education and unemployment among parents were associated, although non-significantly when adjusted for ethnic origin and knowledge of Swedish, with direct ED seeking (III), and also with initial triage away from the ED (III), conform to higher non-urgent paediatric ED use by American parents with lower SES [178].

Non-native populations, and those with lower SES, have been found to have lower health literacy [95, 179], i.e. lower individual ability to obtain, process and understand basic health information and services required for appropriate health decisions [180]. Low health literacy has also been reported to be an independent predictor of more frequent and less-urgent paediatric ED use [87, 88]. Accordingly, adult immigrant ED patients in Norway were recently reported to rate their medical level of urgency higher than native ED patients, regardless of physicians’ assessments [181]. Inadequate knowledge of the local healthcare system might be prevented by earlier interventions bridging over barriers to navigating the system. Accordingly, interventions to improve health literacy and care-seeking behaviour have in some American studies been found to reduce paediatric ED visits by non-native [108] and low-SES parents [110]. However, low SES and low health literacy may also imply risks of delayed healthcare and worse health status [163-165] – challenges even more important to meet.

We also found that a HPCU adjacent to an ED and available outside office-hours, reduces total and less-urgent paediatric ED visits (IV), probably by primarily preventing some of them while enabling more rapid referral of others from the ED soon after arrival. That less-urgent patient visits decreased by more than one third outside office-hours after implementation of this HPCU (IV), conforms to previous findings in adults, where self-referral and less-urgent ED use also decreased [71, 73, 182-184]. The reduction by more than one fourth of total paediatric ED visits when the HPCU was
available (IV), most probably also released resources for medically more compromised patients. That paediatric ED patients were more often triaged to be assessed by ED physicians during opening hours of the HPCU (IV), indicates that they were more appropriately selected for ED care. Their higher demand for medical assessment and treatment most probably accounted for their longer ED stay during opening-hours of the HPCU compared with in 2012 (IV), also considering that shorter paediatric ED stay among patients triaged for lower levels of care was recently found in another European study [185]. Implementation of HPCU facilities have also been associated with shorter time from arrival until medical assessment of more urgent ED patients [186], but we lack corresponding information (IV).

The higher admission rate from the paediatric ED outside office-hours in 2015 compared with in 2012 (IV), in agreement with findings in adults [73], and the higher proportion of young infants (IV), both further indicate that implementation of the HPCU contributed to more appropriate initial selection of paediatric ED patients.

The significantly shorter length of stay at the HPCU than at the paediatric ED (IV) – in close agreement with recent Swiss findings [187] – indicates that a HPCU contributes to rapid management of children with less-urgent medical conditions. Accordingly, HPCU facilities have been reported to reduce self-referred adult ED patient visits [71] and also costs of healthcare [188].

The total number of patients seeking ED care during office-hours increased between 2012 and 2015, which might reflect a corresponding nine-percent increase in the number of children in the city of Malmö [189]. Since there was also an increase in the proportion of less-urgent ED visits, we cannot exclude that some parents preferred the ED walk-in service to daytime primary care, as also proposed by others [190]. However, better access to HPCU facilities have been reported to result in fewer total and self-referred adult ED visits during day- and evening-time [71]. Accordingly, the lower number of paediatric ED visits when the HPCU was available (IV) emphasizes its importance for unburdening an ED and for improving the appropriateness of emergency care regardless of medical urgency.

Our questionnaire-based studies (II, III) might be limited by potential language difficulties, although interpreters required for individual ED management also assisted in filling them out. In addition, we cannot exclude some selection bias, since some parents did probably not participate due to linguistic barriers. However, if so, our main results on SES (III) would rather have been more statistically significant if they had chosen to participate.

Since parents of children often wished to leave the ED soon after completion of the triage without spending additional time to fill out the questionnaires (III), we have limited information on their SES characteristics, seeking patterns, and initial management of their children (III). However, lack of differences in age and gender
between study participants and non-participants indicates that study information obtained does reflect patients triaged away from the ED in this respect (III).

Another limitation is the retrospective design of the last study (IV), and also that information recorded outside office-hours at the city PCU in 2012 was irretrievable (IV). Such information would have been helpful to better understand the total impact of the HPCU on flow patterns of paediatric patients to, between and from ED and primary care.

By evaluating during and outside office-hours different aspects – mainly SES (IV), recent medical contact (II, III), and availability of alternative healthcare facilities (I-IV) – on seeking, triage, management and outcome of patient visits at an urban paediatric ED, with no demand for professional referral, we have gained new and relevant knowledge for more optimal paediatric emergency care of more or less-urgent medical conditions.

In conclusion, high knowledge and availability of prehospital services are required to limit less-urgent ED use (I-IV), and efforts to improve health literacy, particularly among parents of non-native origin, would probably attenuate both direct and less-urgent paediatric ED use. We have shown that a paediatric ED with no demand for professional referral can be unburdened by primarily limiting less-urgent ED visits outside office-hours (IV), and by promoting (I-III) and facilitating (IV) rapid and safe redirection of less-urgent paediatric ED visits to adequate and more appropriate, preferably adjacent (IV), lower levels of medical care.
Conclusions

- Early appropriate redirection of less-urgent ED visits by experienced nurses according to predefined protocols seems to be a safe and useful way of reducing patient load at a paediatric ED with no demand for professional referral, since more than one fourth of the patients could be triaged to adequate lower levels of care, and few of them returned (I).

- Most parents are aware of prehospital medical alternatives before attending a paediatric ED, since approximately 60% of them arrived after successful, and another 20% after failed, attempt at prehospital medical consultation (II).

- Low availability of prehospital medical facilities, particularly outside office-hours, promotes direct seeking of paediatric ED care, since approximately 20% of parents arrived after failed attempt at prehospital medical consultation (II).

- Overestimation of the severity of a medical condition often contributes to direct seeking of paediatric ED care, since the main reason reported for attending with no recent attempt at prehospital medical consultation was perceived urgency (II).

- The medical system of ED triage has wide margins of patient safety, considering that two thirds of the ED visits were triaged for paediatric ED assessment, but only half of them were assessed to have been appropriate for ED care (III).
- Providing appropriate prehospital medical services to all parents, including those of non-native origin or with limited abilities in Swedish, is a major challenge to the healthcare system, since lower socio-economic status was significantly associated with more direct and less-urgent seeking of paediatric ED care (II, III).

- A hospital-based primary care unit open outside office-hours most probably contributes to more efficient management of less-urgent paediatric patients at more adequate levels of medical care, since the proportion of less-urgent patient visits was lower, that of patients in need of hospital admission higher, at the paediatric ED after implementation of this facility (IV).

- Factors other than fewer less-urgent patient visits, probably associated with higher demand for medical survey of more complex or compromised patients, influence the paediatric ED patient flow, considering that implementation of a hospital-integrated primary care unit outside office-hours did not reduce paediatric ED length of stay (IV).
Future perspectives

The numbers of patients seeking ED care are increasing all over the world, and methods to improve patient flow and direct patients to adequate and more appropriate lower levels of medical care are required to reduce overcrowding, and particularly so in paediatric ED care.

Evaluating the medical condition of a sick child is difficult for a parent. However, we have shown that most parents are aware of prehospital medical alternatives before attending a paediatric ED, and that low availability of prehospital medical alternatives contributes to less-urgent ED seeking. Higher availability of primary care and telephone health line services, particularly outside office-hours, are therefore required to reduce paediatric ED seeking for less-urgent problems, while also enabling more urgent patients to be managed sooner. Considering that our studies (I-IV) indicate that a large proportion of paediatric visits to an ED with no demand for professional referral, could have been managed at lower levels of medical care, initial appropriate medical triage remains a mainstay for diverting less-urgent children to adequate and safe lower levels of medical care. Since low SES was associated with less prehospital use of medical services, and with more less-urgent seeking in the present (II, III) and previous studies, it is important to identify and reach these families to enable appropriate medical care for their children. A major challenge to the healthcare system is to reach parents of non-native origin or with limited abilities in the Swedish language, since those characteristics were significantly associated with direct and less urgent seeking of paediatric ED care (II, III). Providing more accessible, multi-linguistic healthcare information, as well as telephone health services, might attenuate less-urgent ED seeking by promoting use of prehospital services and lower levels of healthcare. However, such interventions need to be evaluated further to develop optimal medical prehospital services for parents and children.

Another way of safely directing paediatric patients to adequate lower levels of medical care, evaluated in the present thesis, is by an adjacent HPCU, found to most probably have unburdened the paediatric ED by one fourth of the patient load. For parents seeking paediatric ED care for less-urgent medical problems, this unit contributed to safe and rapid management at adequate lower levels of medical care by promoting primary use of the HPCU while enabling rapid referral from the ED. More research is required to confirm these findings. Future paediatric ED studies should preferably address ways of providing appropriate, accessible and feasible medical information, and
prehospital medical services, to parents regardless of HL, and also of safely directing less-urgent patients to adequate and more appropriate lower levels of healthcare and release resources for those in higher need of paediatric ED care.

Vårt mål med denna avhandling var att utvärdera hur och varför föräldrar söker på en barnakutmottagning, hur barnen sorteras efter hur akut sjuka de är (triageras), och hur de sedan behandlas, också med hänsyn till socio-ekonomiska förhållanden. Vi ville dessutom undersöka vad en ny sjukhusintegrerad primärvårdsförebyggande mottagning, öppen under kväll och helger, skulle betyda för söktrycket på barnakutmottagningen.


Uppgifter om antal sökande, kön, ålder, besöksorsak, initial bedömnings, tid på akutmottagningen och eventuell inläggning inhämtades från sjukhusets dataregister. Vi fann att en fjärdedel av barnakutmottagningens patienter utifrån strukturerade manualer på ett medicinskt säkert sätt kunde triageras från akutmottagningen till primärvård, annan specialistvård, eller hem med medicinsk rådgivning utan att först ha bedömts av barnläkare. Systemet med triagering visade även på goda
säkerhetsmarginaler, då hälften av de två tredjedelar som initialt triagerades för akut barnläkarbedömning, bedömdes ha kunnat ses av en primärvårdsläkare istället.

Nästan fyra femtedel av alla föräldrar hade först sökt råd och hjälp via primärvård eller telefonrådgivning innan de kom till akuten, men nästan en femtedel hade inte lyckats få kontakt, framför allt inte under jourtid. En femtedel hade valt att söka direkt på akuten, i första hand för att de upplevde att barnet snabbt behövde bedömas och behandlas.

Utländsk härkomst och lägre förståelse av svenska var vanligare bland dem som sökt direkt, liksom bland dem som inte bedömdes vara i akut behov av barnläkarbedömning.

Den sjukhusintegrerade primärvårdsenheten avlastade barnakuten med en fjärdedel under kvällar och helger, framför allt av lite äldre barn och av dem som inte bedömdes vara i behov av barnläkarbedömning.

I våra studier har vi visat, att det på en stor barnakutmottagning utan remisstvång genom tidig bedömning av barns sjukdomsgrad och behov av barnläkarbedömning är möjligt att säkert hänvisa många barn med lättare sjukdomstillstånd till en lägre nivå av medicinsk vård eller tillbaka hem med medicinsk rådgivning. Vi har också visat att kunskap om och tillgänglighet till primärvård eller telefonrådgivning, också under kvällar och helger, är nödvändigt för att kunna erbjuda alternativ till föräldrar med sjuka barn och därmed kunna minska andelen sökande med lättare sjukdomstillstånd till en barnakutmottagning. Det är en utmaning för primärvården och samhället att näta ut med information om hur och var man i första hand bör söka med sitt sjuka barn, i synnerhet till föräldrar av utländsk härkomst och med lägre förståelse av svenska. En primärvårdsenhet vid sidan om akutmottagningen, öppen under kvällar och helger, är också ett effektivt sätt att avlasta en barnakutmottagning, såväl genom att förhindra mindre brädskande akutbesök som genom att enkelt möjliggöra snabb och säker hänvisning dit från barnakuten.
Acknowledgements

First of all, I want to express gratitude to all the parents and children that participated in the studies. A sincere thanks to,

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“It does not well to dwell on dreams and forget to live.”

Albus Dumbledore
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After all this time?
Always….  

Severus Snape
Paper I
Results, first paragraph, from the fourth row, text should be “Among the remaining 1057 patients included in the study, 62% were younger than 2 years. After having been triaged on arrival by the pediatric nurse, two thirds (n=713) of all study patients were assessed by pediatric physicians (Table 1) of which 58% were boys (P < 0.001).” Figure 2, upper square, bottom row, numbers should be 15, 10 and 1.
Pediatric Emergency Department Management Benefits From Appropriate Early Redirection of Nonurgent Visits

Julia Ellbrant, MD,* Jonas Åkeson, MD, PHD,* and Pia Karlsland Åkeson, MD, PHD†

Aims: Overcrowding at pediatric emergency departments (EDs) may result in delayed clinical management and higher risks of medical error. This study was designed to prospectively evaluate what parents of sick children seek emergency care for and how these patients are being assessed and managed.

Methods: Patients aged 0 to 17 years seeking ED care at an urban Swedish university hospital, from 8 AM to 9 PM on 25 consecutive days, were included. Clinical urgency and further level of medical care were determined by experienced nurses based on individual clinical signs and vital parameters. Information on presenting problem, medical priority, gender, age, wait time, day of week, time of day, and further management was recorded.

Results: Among 1057 included children, two thirds were assessed by physicians, whereas one third were referred directly by nurses for other ED (n = 54) or primary care (n = 114), or sent home with medical advice (n = 176), more often during evenings and weekends. Of primarily referred patients, 7.6% returned within 72 hours, and three of them were admitted. Young infants, patients with respiratory or neurologic problems, and sicker patients with fever or infections were mainly assessed by physicians, within desired priority time.

Discussion: More than one fourth of pediatric ED patients might rapidly, appropriately, and safely be referred for primary care or sent home by experienced pediatric nurses soon after arrival, thereby facilitating management of urgent and more appropriate patients. Evaluations by physicians were primarily required in young infants and for urgent medical conditions demanding qualified pediatric skills.

Key Words: crowding, nonurgent, triage

The main purpose of a pediatric emergency department (ED) is to provide rapid and highly specialized care for urgent, sometimes life-threatening, conditions in infants and children. Patient visits to EDs have been shown to increase, and reports from many countries describe overcrowding at EDs, including pediatric ones.1–3 It is essential that parents seek ED care in time for children with urgent diseases. However, some parents of sick children also seek care for nonurgent conditions that could have been managed at lower levels of medical care. High patient loads may delay management of children with less acute needs and may even put more urgent medical care at risk.4

Rationales for parents seeking pediatric emergency care for nonurgent problems of their children have been explored in more urgent medical care at risk.

Management of children with less acute needs and may even put aged at lower levels of medical care. High patient loads may delay management of infants and children. Parent visits to EDs have been shown to increase, and reports from many countries describe overcrowding at EDs, including pediatric ones.1–3 It is essential that parents seek ED care in time for children with urgent diseases. However, some parents of sick children also seek care for nonurgent conditions that could have been managed at lower levels of medical care. High patient loads may delay management of children with less acute needs and may even put more urgent medical care at risk.4

Rationales for parents seeking pediatric emergency care for nonurgent problems of their children have been explored in more urgent medical care at risk.

However, no such pediatric studies have been made in northern Europe, where the health care system is primarily based on universal health insurance (instead of a mixture of Medicaid and private insurance) and where pediatric hospital and primary care visits, at least in Sweden, are free of charge up to the age of 18 years. Continuously aiming at providing optimal medical care for each ED patient at an appropriate individual level of urgency and pediatric competence is crucial. This study was designed to evaluate whether parents of sick children seek ED care for and how these children are being assessed and managed to provide clinical information for more efficient emergency care of both urgent and nonurgent pediatric conditions.

METHODS

Study Design

This prospective clinical study of daytime (8:00 AM to 4:59 PM) and evening-time (5:00 to 8:59 PM) pediatric ED (PED) visits, also comprising basic nighttime (9:00 PM to 7:59 AM) data, was carried out on 25 consecutive days in February and March at Skåne University Hospital in Malmö, the third biggest city in Sweden, serving approximately 400,000 urban inhabitants (approximately one fifth below 18 years of age), comprising more than 40% first- or second-generation immigrants.13

Telephone health care service was available for medical advice 24 hours a day. In addition, a primary care office was available for all age groups (children and adults) between 5 PM and 12 PM on weekdays, and between 8 AM and 12 AM during weekends. Because ED physicians of otorhinolaryngology and general surgery are working in other parts of the hospital, children with ear problem or head injury at arrival are rapidly referred from the PED.

The study design was approved by the regional ethical review board at Lund University, Lund, Sweden.

Patients

On arrival at the PED, each child was rapidly assessed by a pediatric nurse to determine further urgency and level of individual medical care based on presenting symptoms, patient history, and vital parameters according to guidelines in a locally developed and recognized clinical manual for triage management. Based on bedside assessment including information on vital parameters (eg, values of heart rate, respiratory rate, saturation of oxygen, and body temperature) and the current patient history, the nurse determined whether the child was to be assessed by a PED physician, be referred to another health care provider, or be returned home with medical advice. Whenever appropriate and possible, the nurse tried to arrange for a primary care appointment for the patient on the same or the next day.

Children considered to require assessment by a PED physician were scored for medical urgency by the nurse, according to
a four-grade urgency scale, to be managed at once (1), within 1 hour (2), within 1 to 3 hours (3), or within 3 to 12 hours (4). Individual information on presenting problem, medical priority, gender, age, waiting time, day of week, and time of day was recorded in an ED ledger regardless of primary assessment or further management. Information on further management was obtained from individual patient records.

All information obtained was compiled and analyzed deidentified.

Statistics

Proportions are reported with 95% confidence intervals (CIs) in tables. Deidentified individual results obtained were recorded in Microsoft Excel spreadsheets (Microsoft Corporation, San Francisco, CA) and analyzed with the Statistical Packages for the Social Sciences software, version 20.0 (IBM Corporation, Armonk, NY). Proportions were compared with two-tailed Fisher exact test.

Statistical $P$ levels less than 0.05 were considered to indicate statistical significance.

RESULTS

A total number of 1539 patients arrived during daytime, evening time, and nighttime during the study period, and 1157 of them (75%) came outside nighttime (Fig. 1). One hundred patients with scheduled secondary control visits were not included. Among the remaining 1057 patients included in the study, 62% were younger than 2 years, and 58% were boys ($P < 0.001$). After having been triaged on arrival by the pediatric nurse, two thirds (n = 713) of all study patients were assessed by pediatric physicians; although children with respiratory ($P < 0.001$) or neurological ($P < 0.001$) problems were almost exclusively assessed by PED physicians, patients with signs of fever, vomiting, diarrhea, or upper airway infection were or were not triaged to see a pediatric physician depending on their medical conditions (Table 1).

In total, 9.9% of the study patients (arriving during daytime or evening time) were admitted, compared with 10.2% of those arriving during nighttime ($P ≤ 0.300$). Of patients assessed by PED physicians, 14.7% (52% boys) were admitted during daytime and eveningtime compared with 17.7% during nighttime ($P = 0.287$). Nine of 10 patients requiring immediate treatment at arrival (two for respiratory distress, four for seizures, three for allergic reaction, and one for diabetic complication) were admitted.

Of all patients primarily assessed by PED physicians, 1.4% had been triaged to be seen at once, 39% within 1 hour, and 59% within 1 to 3 hours. In fact, 43% and 46% were assessed within 1 and 3 hours, respectively, whereas less than 1% had to wait more than 6 hours for a doctor.

Individual dates and times of arrival, and the corresponding presenting problems, were further analyzed in patients not triaged to be assessed by a pediatric physician (Fig. 2). Of 344 patients primarily assessed by pediatric nurses (and referred for other ED care, for primary care, or sent home according to Fig. 1), 26 patients (7.6%) were found to have returned within 72 hours to the ED for similar clinical reasons (12 with vomiting or diarrhea, 7 with respiratory problems, and 7 with cough).

Three of them had been admitted (one with vomiting or diarrhea, one with respiratory problem, and one with cough), whereas 19 were sent home by pediatric physicians, and 4 were once again sent home by pediatric nurses (Fig. 2).

DISCUSSION

Our main finding that more than one fourth of PED patients might rapidly, appropriately, and safely be referred for primary care or sent home by experienced pediatric nurses soon after arrival has to our knowledge not been reported elsewhere. Considering that less than 8% of these patients returned to the ED during the same period of illness and that less than 1% of

![FIGURE 1. Initial clinical triage and final management of patients arriving during daytime or evening time over a 4-week winter period at a PED of an urban university hospital in southern Sweden.](image-url)
This management is supported by other pediatric one important reason why patients did not return more often. present study tried to arrange primary care appointments for navigation into primary care facilities from the ED was re-

referred patients had to be admitted, the decisions made by our referring nurses seem to have been appropriate bearing in mind that because many parents seek medical advice early in the course of an infection, some children may deteriorate despite appropriate initial management. Fewer nonurgent visits to ED physicians mean better use of ED and hospital resources with more optimal condition and hence less delay of urgent patient management. Accordingly, we were able to confirm higher conformity between scheduled and actual individual waiting hours to pediatric physicians in our ED, thus reducing risks pointed out by Australian reports where excessive adult and pediatric patient loads were associated with delayed ED management, higher risk of medical error, and increased patient mortality. The need for professional triaging of ED patients is further emphasized by the high proportions (39%-64%) of patients in Swedish adult EDs reported to be more suitable for primary than emergency care facilities, and medical advice from nurses has also been reported to reduce return frequency in children whose parents had already chosen to leave the ED. The fact that pediatric nurses in the present study tried to arrange primary care appointments for patients in need of primary care assessments was probably one important reason why patients did not return more often. This management is supported by other pediatric and adult studies from the United States and Sweden, respectively, where navigation into primary care facilities from the ED was reported to reduce the number of nonurgent visits to EDs.

Although patients were referred more often from the ED by triaging nurses outside office hours in the present study, they did not return more often within 72 hours than did those triaged during office hours, indicating more nonurgent patient visits during evenings and weekends. This finding, most likely reflecting short-

TABLE 1. Age Intervals and Final Clinical Management of Patients Arriving During Daytime or Evening Time Over a 25-Day Winter Period at a PED of an Urban University Hospital in Southern Sweden

![Table 1](image)

<table>
<thead>
<tr>
<th>Age Interval (Mo)</th>
<th>Sent Home (% of Total)</th>
<th>Referred for Primary Care (% of Total)</th>
<th>Referred for Other Specialist Care (% of Total)</th>
<th>Total (% of Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–3 mo</td>
<td>27 (9.7–20)</td>
<td>2 (0.2–4.1)</td>
<td>2 (0.2–4.1)</td>
<td>31 (0.9–23)</td>
</tr>
<tr>
<td>4–6 mo</td>
<td>10 (4.9–17)</td>
<td>4 (1.2–11)</td>
<td>5 (1.8–12)</td>
<td>19 (0.6–11)</td>
</tr>
<tr>
<td>7–12 mo</td>
<td>33 (15–29)</td>
<td>26 (11–24)</td>
<td>5 (1.2–7.8)</td>
<td>64 (2.3–39)</td>
</tr>
<tr>
<td>13–23 mo</td>
<td>38 (13–24)</td>
<td>35 (11–23)</td>
<td>11 (2.7–9.3)</td>
<td>84 (3.1–52)</td>
</tr>
<tr>
<td>2–3 y</td>
<td>49 (18–31)</td>
<td>23 (7.4–17)</td>
<td>18 (5.5–14)</td>
<td>80 (2.8–51)</td>
</tr>
<tr>
<td>4–6 y</td>
<td>10 (6.2–22)</td>
<td>15 (10–29)</td>
<td>5 (2.2–15)</td>
<td>30 (1.1–19)</td>
</tr>
<tr>
<td>7–12 y</td>
<td>8 (5.4–24)</td>
<td>7 (4.8–22)</td>
<td>5 (2.9–18)</td>
<td>20 (0.7–13)</td>
</tr>
<tr>
<td>13–18 y</td>
<td>1 (0.1–15)</td>
<td>2 (0.9–18)</td>
<td>3 (1.9–22)</td>
<td>6 (0.2–4)</td>
</tr>
<tr>
<td>Total</td>
<td>176 (14–19)</td>
<td>114 (9.0–13)</td>
<td>54 (3.9–6.7)</td>
<td>344 (2.5–21)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. Patients (95% CI), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage to Be Assessed by a PED Nurse and Physician</td>
</tr>
<tr>
<td>Sent Home</td>
</tr>
<tr>
<td>0–3 mo</td>
</tr>
<tr>
<td>4–6 mo</td>
</tr>
<tr>
<td>7–12 mo</td>
</tr>
<tr>
<td>13–23 mo</td>
</tr>
<tr>
<td>2–3 y</td>
</tr>
<tr>
<td>4–6 y</td>
</tr>
<tr>
<td>7–12 y</td>
</tr>
<tr>
<td>13–18 y</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

TABLE 2. Patients Triage on Arrival, During Office or Out-of-Office Hours, to Be Assessed or Not Assessed, by Pediatric Physicians During a 25-Day Study Period at a PED of an Urban University Hospital in Southern Sweden

![Table 2](image)

<table>
<thead>
<tr>
<th>Patient Arrival During</th>
<th>Not Assessed by Physicians</th>
<th>Assessed by Physicians</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office hours</td>
<td>0.90 (154)</td>
<td>2.37 (405)</td>
<td>3.27 (559)</td>
</tr>
<tr>
<td>Out-of-office hours</td>
<td>1.23 (190)</td>
<td>2.00 (308)*</td>
<td>3.23 (498)</td>
</tr>
<tr>
<td></td>
<td>0.69 (162)</td>
<td>0.80 (220)*</td>
<td>1.39 (382)</td>
</tr>
</tbody>
</table>

Hourly proportions of patients were compared by 2-tailed Fisher exact test between office and out-of-office hours. *P < 0.001.
TABLE 3. Presenting Problems in, and Further Clinical Management of, Patients During a 25-Day Winter Period at a PED of an Urban University Hospital in Southern Sweden

<table>
<thead>
<tr>
<th>No. Patients</th>
<th>Triaged to Be Assessed by a PED Nurse and</th>
<th>Triaged to Be Assessed by a PED Physician and</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sent Home</td>
<td>Referred for Primary Care</td>
</tr>
<tr>
<td></td>
<td>After Initially Having Shown or Reported Clinical Signs of</td>
<td></td>
</tr>
<tr>
<td>Vomiting or diarrhea</td>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td>Cough</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Fever</td>
<td>25</td>
<td>36</td>
</tr>
<tr>
<td>Breathing problem</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Cold</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Seizure, other neurological problem</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Rash</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Ear pain</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Head injury</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Abdominal pain, constipation</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Neonatal problem*</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Other problem</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total number (95% CI), %</td>
<td>176 (14–19)</td>
<td>114 (9.0–13)</td>
</tr>
</tbody>
</table>

*Neonatal problems include, for example, icterus or feeding difficulty.

FIGURE 2. Clinical management of patients returning within 72 hours of initial assessment by PED nurses for similar presenting symptoms during daytime or evening time over a 4-week winter period at a PED of an urban university hospital in southern Sweden. In total, 344 patient visits were primarily managed by PED nurses according to Figure 1. Four of them were revisits within 72 hours, and 340 were primary visits.
clinical assessments at arrival made by experienced PED nurses, as found by us, and further enhanced when combined with systematic use of a fast-track system as reported by others.\textsuperscript{29–31} This study, carried out in a European country with a universal health insurance system, does not have to consider various economical rations behind seeking patterns, as extensively discussed in American studies.\textsuperscript{32,33}

In the present study, we also considered differences in presenting problems reported on arrival between patients assessed by PED physicians in the present study and those assessed by triaging nurses depending on the individual clinical condition, where recognized strategies for rehydration or temperature reduction could be enough. However, initial appropriate assessment in the PED remains mandatory for successful and safe patient management, particularly considering that the most common presenting problems in patients admitted for pediatric inpatient care were respiratory distress, fever, vomiting, or diarrhea.\textsuperscript{3,34–36} It is well known that most PED patients are below two years of age and mainly present with infections.\textsuperscript{36,37} and parents of infants and young children have also been reported as more likely to seek nonurgent ED care.\textsuperscript{38} Our finding that most young infants were assessed by PED physicians is not surprising because medical urgency of their clinical problems is hard to appropriately assess by nurses or nonpediatric physicians compared with that in older children.

Male overrepresentation among infants and young children assessed by PED physicians, as found in the present study, has also been reported elsewhere.\textsuperscript{1,2,3,5} Morbidity and mortality rates have previously been found to be higher in young boys\textsuperscript{39,40} with higher incidence and severity of respiratory infection,\textsuperscript{41,42} whereas older PED patients have been reported to have a more even gender distribution.\textsuperscript{40} Despite gender differences between ED patients assessed by pediatric physicians in the present study, there were no significant differences in gender among admitted patients, in contrast to findings by Hull et al\textsuperscript{43} where more boys were admitted.\textsuperscript{43} Because this study was carried out during the high-season peak of pediatric infections, when more parents seek ED care for their children, it represents PED management under high-pressure conditions, although comprising only one month. Most referrals to other EDs comprised patients with ear problem or head injury, where specific medical competence was only available in other parts of the hospital. No information was obtained on previous hospitalization or perception of severity of illness—circumstances previously reported to make adults more inclined to seek ED care.\textsuperscript{44} In summary, our study shows that at least one fourth of PED patients at a large urban university hospital might be safely redirected to lower levels of medical care or be sent home with medical advice by skilled pediatric nurses. Evaluations by PED physicians are primarily required for urgent medical conditions, assessment of young infants, and clinical problems demanding qualified pediatric skills. We conclude early appropriate redirection of nonurgent ED visits to be a useful way of reducing waiting hours and improving clinical management of both urgent and nonurgent PED patients. However, because this study was carried out in a limited number of PED patients, further studies are needed to confirm our findings and whether they are applicable to different medical systems in other countries.

REFERENCES


Influence of awareness and availability of medical alternatives on parents seeking paediatric emergency care

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Abstract

Aims: Direct seeking of care at paediatric emergency departments may result from an inadequate awareness or a short supply of medical alternatives. We therefore evaluated the care-seeking patterns, availability of medical options and initial medical assessments – with overall reference to socioeconomic status – of parents at an urban paediatric emergency department in a Scandinavian country providing free paediatric healthcare. Methods: The parents of children assessed by paediatric emergency department physicians at a Swedish university hospital over a 25-day winter period completed a questionnaire on recent medical contacts and their reasons for attendance. Additional information was obtained from ledgers, patient records and population demographics. Results: In total, 657 of 713 eligible patients (92%) were included. Seventy-nine per cent of their parents either failed to or managed to establish medical contact before the emergency department visit, whereas 21% sought care with no attempt at recent medical contact. Visits with a failed telephone or primary care contact (18%) were more common outside office hours (p=0.014) and were scored as less urgent (p=0.014). A perceived emergency was the main reason for no attempt at medical contact before the visit. Direct emergency department care-seeking was more common from the city district with the lowest socioeconomic status (p=0.027). Conclusions: Although most parents in this Swedish study tried to seek medical advice before attending a paediatric emergency department, perceived emergency, a short supply of telephone health line or primary care facilities and lower socioeconomic status contributed to direct care-seeking by almost 40% of parents. Pre-hospital awareness and the availability of medical alternatives with an emphasis on major differences in socioeconomic status should therefore be considered to further optimize care-seeking in paediatric emergency departments.

Key Words: Children, emergency department, paediatrics, primary care, seeking behaviour, socioeconomic status, telephone health line, urgency

Introduction

Overcrowding at emergency departments due to rapidly increasing numbers of patient visits remains a major global medical, ethical and organizational health care problem [1,2], which might delay the more urgent management of patients and reduce the quality of care and patient safety [3]. The resulting longer waiting times in emergency departments have increased during recent years in Sweden [4] and many adult patients seek direct care with non-urgent problems [5,6]. High rates of paediatric emergency department self-referral have also been reported to contribute to overcrowding in other European countries [7,8] and socioeconomic status has been reported to influence the direct seeking of emergency department care [9].

In Sweden, parents of sick children are expected to primarily seek medical advice from a telephone health line or primary care facilities, unless urgent emergency department assessment is required. We have shown that 25% of patients at a paediatric emergency department in Sweden could be safely and
routinely referred for primary care or sent home by experienced nurses, indicating many non-urgent visits [10]. To further optimize paediatric emergency department care-seeking, it is crucial to understand why parents seek care the way they do and how this may be influenced by socioeconomic factors. Pre-hospital alternatives are important and US studies indicate that low availability increases paediatric emergency department care-seeking [11–13]. To our knowledge, it has not previously been studied how paediatric emergency department care-seeking patterns of parents are associated with the availability of medical alternatives and with socioeconomic status in a Scandinavian country providing public health-care based on national insurance.

This Swedish study, carried out at a large urban paediatric emergency department serving a socioeconomically heterogeneous population, was designed to evaluate to what extent parents contact medical alternatives before seeking care in a paediatric emergency department – with overall reference to available medical alternatives and to socioeconomic status – in a country where paediatric care is free of charge.

Methods

Study setting

This cross-sectional questionnaire study was carried out at a large university hospital in the city of Malmö in southern Sweden, serving a population of almost 400,000, with about 40% first- or second-generation immigrants [14]. The overall socioeconomic status data of all 10 city districts was obtained from Malmö city statistical records [14]. In the two districts with the lowest and highest socioeconomic status, the proportions of first- and second-generation immigrants were 86 and 18%, lower educational status (<12 years) 50 and 20% and unemployment rates 6.8 and 1.6%, respectively. The average income level in the city district with the lowest socioeconomic status was 58% of that in the district with the highest socioeconomic status.

A primary care office in the city was available from 1700 to 2400 h on weekdays and from 0800 to 2400 h on weekends. A telephone health line for medical advice was available on a 24-hour basis at the time of the study, together with a paediatric emergency department telephone health line, where paediatric nurses gave advice when possible. Occasionally, a native foreign language service other than English was offered for advice by telephone. The study was approved by the regional Human Research Ethical Review Board, Lund, Sweden.

Procedures

On arrival, all patients were assessed by experienced paediatric emergency department nurses to determine appropriate individual levels of medical care and urgency based on presenting clinical signs, patient history and vital parameters. The patients were then triaged to be assessed by a paediatric emergency department physician, be referred to another healthcare provider or return home with medical advice. Each child was also scored by the triage nurses according to the level of urgency to be managed by a paediatric emergency department physician immediately (1), within one hour (2), within one to three hours (3) or within three to twelve hours (4).

Participants and questionnaire

Children aged 0–17 years and arriving unscheduled at the paediatric emergency department during the day (0800 to 1659 h) and evening (1700 to 2059 h) and assessed by a paediatric emergency department physician were considered for inclusion in the questionnaire study during 25 consecutive winter days in February and March, when the total number of paediatric emergency department patients usually peaks. For practical reasons, no night-time (2100 to 0759 h) arrivals were included. Patients with ear problems (older than 1 year age), head injury or other trauma on arrival were rapidly referred to specialists in otorhinolaryngology, general surgery or orthopaedics. The parents of the potential study patients were asked to fill out a questionnaire on recent – successful or failed – attempts to contact medical care-givers before their present visit and the main reasons for seeking emergency care. The questionnaire was evaluated over a two-day testing period at the emergency department before start of the study to identify and minimize risks of misunderstanding.

Oral (in Swedish or English) and written (in Swedish, English or Arabic) study information was given to participating parents and children older than 7 years by the main investigator (JE). Signed informed consents were obtained from the participating parents of all study patients and also from study patients aged at least 15 years. Individual information on age, gender, presenting problem, medical priority, waiting time, day of week, time of day and city district was obtained from an emergency department ledger.

Statistical analysis

The study was conducted during high-load conditions, corresponding to more than 1000 expected day- and evening-time emergency department visits per
month to include sufficient study patients [7,8]. Information obtained was de-identified, recorded in Microsoft Excel (Microsoft Corporation, San Francisco, CA, USA) spreadsheets and analysed with the Statistical Packages for the Social Sciences (SPSS) software, version 20.0 (IBM Corporation, Armonk, CA, USA).

The proportions reported with 95% confidence intervals (CI) were compared statistically using the two-tailed Fisher’s exact test. The χ² test with Yates’ correction or a two-tailed Fisher’s exact test was used to compare levels of categorical data by CI on patients from the two city districts with the highest and lowest overall socioeconomic status (income, education, employment and proportion of immigrants). Parametric data are reported as mean ± SD values. Binary logistic regression analysis was used to calculate the odds ratios (OR) for direct seeking and hospital admission for those two city districts compared with the others; p < 0.05 was considered statistically significant.

Results
In total, 1057 non-scheduled day- and evening-time (together with 382 night-time) emergency department visits were recorded during the study period and 713 were triaged on arrival to require assessment by paediatric emergency department physicians. The parents of 56 eligible study patients declined to participate and information was obtained from parents of the remaining 657 study patients (92%). The mean ± SD time spent in the emergency department was 3.0 ± 1.6 h.

Pre-hospital care-seeking patterns of the parents of emergency department patients are shown in Figure 1. The parents of more than one-third of the study patients had not tried (21%) or had failed (18%) to establish medical contact before the emergency department visit. The reasons for failed contact were inability to get in touch by telephone with the emergency department (68%), with primary care providers (19%) or with the formal telephone health line (13%). Among those 402 patients with successful medical contact before the emergency department visit, almost 50% were referred after telephone contact with emergency department care, primary care or telephone health line facilities, and another 24% after primary care assessment. The remaining visits were preceded by perceived deterioration or inadequate improvement in their child’s condition after a recent assessment by a physician. Many parents reported more than one recent contact – with emergency department, primary care, telephone health line or (occasionally) other healthcare facilities – before the visit (Figure 2).

Information obtained in the study patients with no, failed or successful attempts at medical contact before the emergency department visit is reported in Table I. Almost all the patients in need of immediate emergency department treatment (1.2%) arrived directly with no recent attempt at medical contact (p < 0.001). Patients seeking direct emergency care had a shorter duration of illness than those with failed (p = 0.024) or successful (p < 0.001) recent contact and also showed a more rapid medical deterioration (p = 0.015) than those with successful contact (Table I). Except for the most urgent visits, patients seeking care directly were not considered medically worse than those with failed or successful contact, whereas patients with failed contact were triaged as less urgent than those with successful contact (p = 0.014).

There was no significant difference in age, sex or admission rate between patients with no, failed or successful recent medical contact (Table I). Failed recent attempts at medical contact were more common during out-of-office hours (p = 0.014). The corresponding presenting problems have recently been reported in detail elsewhere [10]. The main reason for direct care-seeking was a perceived medical emergency (58%). Other common reasons were expected more rapid assessment (6.5%) or chronic disease (6.5%).

Seventy-nine per cent of the study patients arrived from within the city. There was an almost four-fold higher proportion of paediatric emergency department visits – corresponding to 19 vs. 5.5 per 1000 children and 30 days (p < 0.0001) – from the city district with the lowest than from that with the highest socioeconomic status. Accordingly, direct care-seeking was more (33 vs. 13%; p = 0.027) and hospital admission less (11 vs. 26%; p = 0.058) common among emergency department visits from the two city districts with the lowest and highest socioeconomic status, respectively. When compared with the other city districts, direct care-seeking was also more common from the district with the lowest socioeconomic status (p = 0.008, OR = 2.016) and hospital admission more common from that with the highest status (p=0.016, OR 2.593) socioeconomic status (Table II).

Discussion
We have shown, for the first time in a Scandinavian country, that although most parents seek medical advice before attending a paediatric emergency department, perceived urgency together with short supply of telephone and primary care services are associated with, and might contribute to, direct seeking of paediatric emergency department care – a pattern probably further reinforced by lower levels of socioeconomic status.
Our finding of the direct arrival of about two-fifths of paediatric emergency department visits conforms to similar or considerably higher self-referral rates reported in diverging paediatric emergency populations in Europe [7,15,16] and North America [17,18]. Perceived urgency as the main reason for direct paediatric emergency department seeking also conforms to findings by other workers [18,19]. The shorter duration of illness and deterioration in those children might explain part of this care-seeking behaviour and the need for professional re-assurance of their parents. Despite disparities between non-professional and professional judgements of individual medical severity [19], parental concern has to be taken seriously considering that

Figure 1. Recent pre-hospital medical contacts of parents of 657 sick children visiting a large urban paediatric emergency department in southern Sweden during a four-week study period. The numbers of patient visits are shown at the arrowheads.
Factors influencing paediatric emergency visits

Our findings that children from the city district with the lowest socioeconomic status used emergency department care more frequently, and also more often arrived directly, compared with those from the district with the highest socioeconomic status are in accordance with an adult emergency department report from Denmark and paediatric emergency department studies from England and the USA [9,25–27]. We also found that children from the district with the highest socioeconomic status more often required hospital admission – presumably, at least in part, resulting from preceding recent primary care assessment and referral.

The proportion of immigrants differed considerably between the city districts with the lowest and highest socioeconomic status and seeking of emergency department care has been reported to be influenced by factors reflecting socioeconomic status, including income [28], ethnicity [9], educational level [9] and knowledge of native language [29]. Neither the paediatric emergency department nor formal telephone health line service regularly offered foreign native linguistic support, except in English, which might explain why more immigrants (with a lower knowledge of Swedish language) arrived directly at the emergency department. Our finding that socioeconomic status seems to influence paediatric emergency department care-seeking needs to be further investigated and taken into consideration when planning pre-hospital medical services to offer medical care below paediatric emergency department care level. It seems important to offer foreign native linguistic support on telephone health lines.

The fact that most study patients were below 2 years of age [10], regardless of recent medical contact, indicates that low patient age does not per se affect the propensity of parents to obtain professional advice before seeking paediatric emergency department care.

National health insurance systems have been reported to influence paediatric emergency department care-seeking [12] and government provision of health care free of charge to promote emergency department care-seeking regardless of medical urgency [30]. Nevertheless, most parents in this Swedish study – despite free access to both primary and emergency department care – still tried to contact other caregivers before attending the emergency department, indicating that free healthcare does not promote direct paediatric emergency department care-seeking as long as appropriate medical alternatives are available.

Our findings may be nationally applicable for larger urban regions with respect to a common national telephone health line and similar primary health care systems. Like Malmö, most larger Swedish cities host high proportions of immigrants. Nevertheless, to provide individual paediatric management at appropriate...
A strength of this clinical study is its high inclusion rate, despite the high turnover rate of emergency department patients. Nevertheless, information on patterns of care-seeking by patients not assessed by paediatric emergency department physicians might have provided additional information. Socioeconomic status data was obtained from city statistics [14] and not from individual parents. However, by comparing emergency department patients from the two city districts differing the most in socioeconomic status, we still consider our results to reflect the relevant socioeconomic determinants of paediatric emergency department care-seeking in Sweden.

Our study indicates that even though most parents seek pre-hospital medical advice before their paediatric emergency department visit, many patients arrive directly. An awareness of, and the availability of, pre-hospital facilities as well as socioeconomic status seem to influence their seeking patterns. These findings should be taken into consideration to reduce non-urgent future use of paediatric emergency department care and to promote paediatric emergency management at more appropriate levels of medical care.
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