





# Differences Between Urgent and Non Urgent Patients in the Paediatric Emergency Department: A 240,000 Visits' Analysis

João Viana<sup>1,2</sup>(✉) , Almeida Santos<sup>3</sup>, and Alberto Freitas<sup>1,2</sup> 

<sup>1</sup> MEDCIDS – Department of Community Medicine,  
Information and Health Decision Sciences,

Faculty of Medicine of the University of Porto, Porto, Portugal  
joaoviana@med.up.pt

<sup>2</sup> CINTESIS – Centre for Health Technology and Services Research,  
Porto, Portugal

<sup>3</sup> São João Hospital Centre, Porto, Portugal

**Abstract.** The volume of non urgent attenders in the emergency department has been a problem in the Emergency Department for several decades leading to overcrowding, unnecessary exposure to the hospital environment and unnecessary costs to the National Health System. This study aims to search for differences between urgent and non urgent patients. Considering information available at the time of admission, this study identifies referrals and previous visits within 24 h as a deterrent for non urgent visits. The further away the patient lives from the paediatric emergency department the less likely is for him to be admitted as a non urgent visit. This study also identifies Ophthalmology and Stomatology as the discharge physician's specialities that are more likely to receive a non urgent visit. The cost of non urgent visits ascends to 2,500,000€ per year in this paediatric emergency department alone. This burden would be greatly reduced by profiling these patients and implementing measures for them to find alternative and more appropriate means of health care.

**Keywords:** Performance · Indicators · Paediatrics · Emergency department  
Children · Non urgent

## 1 Introduction

### 1.1 Background

Non urgent (NU) attenders has been a problem in the Emergency Department (ED) for several decades leading to overcrowding, unnecessary exposure to the hospital environment and unnecessary costs to the National Health System (NHS).

Crowding in ED is known to be a significant problem, leading to poor outcomes and generally worse quality of care [1–4].

Despite the impact on crowding of NU visits, patients subject themselves to the hazardous hospital environment [5–7]. Being most of them self-referral patients, they lack the knowledge to weigh the risks of exposing themselves or their children to this environment [8]. This is a structural NHS and knowledge asymmetry problem that clashes with patients' perspective, as the type of care division exists only on the caregiver side, and the patient is most of the time unaware of the primary, secondary or even tertiary nature of his health problem.

Non Urgent attenders are also an unnecessary burden to the NHS since the cost is significantly greater when compared to a visit to a primary care provider (PCP) [9].

Other attempts to describe this group tend to focus on chronic illnesses or on the socio-economic aspects to characterize NU visits to the ED. However, in the Paediatric Emergency Department (PED), and due to the Portuguese Health Service (HS) paradigm, factors involved might be different.

Under these circumstances, it is important to characterize these patients in order to mitigate this problem.

## 1.2 Objectives

This study aims to search for differences between urgent patients and non urgent patients, i.e. considered better suited for primary care. This is done in two perspectives; considering variables known at the time of admission, enabling to profile the patients, and analysing variables known after the patient is admitted to the PED, to measure how these visits impact the ED.

## 2 Methods

This paper is structured according to the RECORD statement i.e. The REporting of studies Conducted using Observational Routinely-collected health Data [10].

### 2.1 Study Design

Case control study on patients who visited the PED, comparing NU visits (cases) with urgent or semi-urgent (USU) visits (controls).

### 2.2 Setting

Urgent and emergency care in Portugal is provided by hospitals with ED and healthcare centres.

Healthcare centres provide primary care, each serving the population of a geographically defined catchment area, mostly during office hours. There are appointment slots called “Open medical appointment” used to treat acute illness and injury, scheduled for the same day, attributed to walk-in patients.

Hospitals serve a much larger geographically defined catchment area, located on top of the NHS referral network. However, Hospitals in Portugal cannot redirect walk-in patients regardless of their medical condition.

There is also a helpline created by the Ministry of Health, “Linha Saúde 24”, that provides triage, therapeutic counselling, referral, assistance in public health matters, and general health information, available to all citizens. This service is provided by nurses [11].

The NHS in Portugal is funded mainly by taxes, nevertheless there is a patient’s co-payment that was set at 20€ per visit to the ED in 2011 [12]. However there are situations where patients get free medical care e.g. during pregnancy, patients under 12 years old and patients with low income [13]. From January of 2015, the age limit to be entitled to free medical care was raised to include all minors i.e. less than 19 years old [14].

The São João Hospital Centre (SJHC) in Porto, Portugal is an inner-city university-affiliated hospital with a catchment area of approximately 800 thousand habitants, its PED receives more than 81,000 visits per year from an estimated population of 137,016 children or adolescents [0..17] (data supplied on request) [15]. It is the only hospital with a PED in the area.

At any moment, in the PED, there are always 2 senior physicians, trained in paediatric emergency medicine, aided by 2 to 3 residents (depending on the workload). There is also a permanent team of 8 nurses and 3 auxiliary staff per shift. All these teams work in shifts providing 24 h per day coverage.

The PED triages visitors from Level I through V according to the Canadian Triage and Acuity Scale Paediatric (PaedCTAS) [16].

All visits are registered using a proprietary information system called JOne, where events are logged, e.g. attending medical staff, diagnoses and cause of admission. All triage procedures are also registered using this information system.

### 2.3 Participants

This study included all patients who attended the SJHC’s PED in a 3-year period (between 01/Jan/2014, and 31/Dec/2016).

### 2.4 Variables

Visits to the PED were separated into 2 groups, USU visits and NU visits, this division was made mainly according to the PaedCTAS, considering patients with triage Level I, II and III as USU and Levels IV and V as NU. However, and despite the triage category assigned, were also considered as USU the following patients: medicated in the PED; investigations performed in the ED; treatment performed in the ED; observation and reassessment in the ED; hospital admission or transfer to other healthcare facility.

This latter selection was made in order to maintain a conservative approach, reinforced by the fact that PaedCTAS encourages triage personnel to use their instincts and experience, to “up triage” patients’ priority when deemed necessary.

The R code used to make this selection is presented below:

```
dataset$urg <-
ifelse((dataset$physician.discharge.destination == "Ad-
mitted to Hospital" | data-
set$physician.discharge.destination == "Other NHS Hospi-
tal" | dataset$physician.discharge.destination == "Non
NHS Hospital") | dataset$medicated == "Yes" | data-
set$medical.analysis == "Yes" | dataset$radiologic.exams
== "Yes" | dataset$observation == "Yes" | data-
set$triage.level == "1" | dataset$triage.level == "2" |
dataset$triage.level == "3", c("USU"), c("NU"))
```

## 2.5 Data Sources

The dataset provided for this analysis was exported in comma separated values (CSV) from the JOne information system.

## 2.6 Bias

The data gathered had the original purpose of providing healthcare to the patients in the PED, therefore subjected to the bias of any observational study based on routinely collected data, e.g. Information system downtime and the inability to control the manner the variables are collected.

## 2.7 Study Size

The study was made on clinical health records from the PED for a 3-year period (between 01/Jan/2014, and 31/Dec/2016), all the visits to the PED were included in this study.

## 2.8 Quantitative Variables

The variables that measure process durations were reported and analysed in minutes. The variable that refers to age was reported in years.

## 2.9 Statistical Methods

All the data analysis was performed in R version 3.4.1 (2017-06-30). The integrated development environment (IDE) used was RStudio Version 1.1.383.

Logit regressions were performed to measure different perspectives, i.e. factors know at admission and non urgent visits' impact on the PED.

## 2.10 Data Access and Cleaning Methods

There was no direct access, only a selected set of variables were exported by Hospital personnel.

## 2.11 Linkage

The record linkage done for this study consisted in the connection of patients' parish of residence with the information from Google Maps to measure the distance in Km and minutes (driving) from the parish of residence to the hospital.

## 3 Results

### 3.1 Participants

The dataset used to perform this study has 240,396 records which reflects the number of visits to the PED for a 3-year period (between 01/Jan/2014 and 31/Dec/2016). There were 92,203 visits made by distinct patients during that time.

### 3.2 Descriptive Data

Table 1 presents summary statistics for the analysed variables by year and the overall summary statistics for the study period. Discharge physician's speciality is used as a proxy for the nature of the PED visit.

**Table 1.** Summary statistics of the study population

	Year			Overall
	2014	2015	2016	
Number of Visits	83587	76490	80319	240396
Sex = Female (%)	39283 (47.0)	35972 (47.0)	37712 (47.0)	112967 (47.0)
Age in years (median [IQR])	5 [2, 11]	6 [2, 12]	6 [2, 12]	6 [2, 12]
Referral = Yes (%)	8443 (10.1)	9228 (12.1)	10893 (13.6)	28564 (11.9)
Number of visit per year (median [IQR])	2 [1, 4]	2 [1, 4]	2 [1, 4]	2 [1, 4]
Is a return visit within 24 h = Yes (%)	1755 (2.1)	1451 (1.9)	1568 (2.0)	4774 (2.0)
Hour of day (median [IQR])	16 [12, 20]	16 [12, 20]	16 [12, 21]	16 [12, 20]
Minutes from parish of residence (median [IQR])	16 [14, 19]	16 [14, 19]	16 [14, 19]	16 [14, 19]
Weekend = Yes (%)	22492 (26.9)	20113 (26.3)	21004 (26.2)	63609 (26.5)
School Holiday = Yes (%)	63523 (76.0)	55930 (73.1)	60084 (74.8)	179537 (74.7)
Discharge physician's speciality (%)				
Paediatrics	54677 (66.2)	48766 (64.3)	51697 (64.9)	155140 (65.2)

(continued)

**Table 1.** (continued)

	Year			Overall
	2014	2015	2016	
Orthopedics	11328 (13.7)	11301 (14.9)	11611 (14.6)	34240 (14.4)
Paediatric surgery	10154 (12.3)	9431 (12.4)	9585 (12.0)	29170 (12.3)
Ophthalmology	2226 (2.7)	2212 (2.9)	2402 (3.0)	6840 (2.9)
Otolaryngology	1983 (2.4)	1869 (2.5)	2092 (2.6)	5944 (2.5)
Stomatology	577 (0.7)	624 (0.8)	622 (0.8)	1823 (0.8)
Immunoallergology	241 (0.3)	161 (0.2)	548 (0.7)	950 (0.4)
Obstetrics	188 (0.2)	180 (0.2)	190 (0.2)	558 (0.2)
Reconstructive surgery	110 (0.1)	301 (0.4)	118 (0.1)	529 (0.2)
Other	1163 (1.4)	965 (1.3)	734 (0.9)	2862 (1.2)
Will return within 24 h = Yes (%)	1754 (2.1)	1451 (1.9)	1566 (1.9)	4771 (2.0)
Duration (minutes)				
From admission to triage (median [IQR])	7 [4, 11]	6 [3, 9]	6 [4, 11]	6 [4, 10]
Triage (median [IQR])	1 [0, 2]	1 [0, 2]	1 [0, 2]	1 [0, 2]
Triage end to doctor (median [IQR])	21 [7, 51]	16 [5, 41]	19 [6, 46]	19 [6, 46]
From doctor to discharge (median [IQR])	48 [19, 117]	54 [20, 125]	51 [19, 120]	51 [19, 121]

### 3.3 Outcome Data

After the creation of the groups there were 167,634 (70.1%) visits considered USU and 71,335 (29.9%) considered NU.

### 3.4 Main Results

#### Factors know at admission

In Table 2 the results for the two logit regressions are presented. It shows that a NU visit is less likely to be a referral (OR 0.610) and to be a return visit (24 h) (OR 0.769). On the other hand, a NU visits are less likely to happen during school days (OR 843) and weekends (OR 1.112). Furthermore, the more time it takes from the patient's residence to the PED, the less likely it is to be a NU visit (OR 0.994 for each minute).

#### Non urgent visits' impact on the PED

Table 3 shows that NU visits are less likely to return to the PED within 24 h (OR 0.892) adjusted to sex and age and discharge physician's speciality. The discharge physician's specialities (with the reference the medical specialty Paediatrics) that are

less likely to receive a NU visit are Reconstructive surgery (OR 0.593), Obstetrics (OR 0.454) and Orthopaedics (OR 0.174). On the other hand, the discharge physician’s specialities which are more likely to receive a NU visit are Ophthalmology (OR 9.856) and Stomatology (OR 2.548). Regarding waiting times the differences between USU and NU visits, despite their statistical significance, are very small.

**Table 2.** Results for the two logit regressions considering information known at the time of PED admission. (1) including minutes from parish of residence to the PED (2) not including minutes from parish of residence to the PED due to the lack of distance information outside the catchment area.

	Dependent variable:	
	Reference: Urgent or Semi Urgent	
	(1)	(2)
Sex (Female)	1.021*** (1.002, 1.040)	1.034*** (1.017, 1.052)
Age in years	1.007*** (1.006, 1.009)	1.009*** (1.007, 1.011)
Referral (Yes)	0.610*** (0.574, 0.646)	0.591*** (0.561, 0.621)
Number of visit per year	0.966*** (0.963, 0.970)	0.966*** (0.963, 0.970)
Is a return visit within 24 h (Yes)	0.769*** (0.695, 0.844)	0.780*** (0.712, 0.849)
Hour of day [0..24]	1.007*** (1.006, 1.009)	1.007*** (1.005, 1.008)
Minutes from parish of residence	0.994*** (0.992, 0.996)	
Weekend (Yes)	1.112*** (1.091, 1.134)	1.097*** (1.077, 1.117)
School Holiday (Yes)	0.843*** (0.821, 0.865)	0.847*** (0.827, 0.867)
Constant	0.511*** (0.459, 0.562)	0.460*** (0.425, 0.495)
Observations	198,819	238,725

Note: Odds Ratio (95%CI)

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01

**Table 3.** Results for the three logit regressions considering information known at the time of PED admission. (1) Discharge physician’s speciality (DPS) with the reference Paediatrics, adjusted to sex and age, (2) odds of the patient return within 24 h, adjusted to sex and age and Discharge physician’s speciality and (3) odds of the patient return within 24 h, adjusted to sex and age.

	Dependent variable:		
	Reference: Urgent or Semi Urgent		
	(1)	(2)	(3)
Sex (Female)	1.037*** (1.019, 1.056)	1.037*** (1.019, 1.056)	1.084*** (1.063, 1.104)
Age in years	1.036*** (1.034, 1.038)	1.036*** (1.034, 1.038)	1.017*** (1.015, 1.019)
DPS - Paediatric surgery	1.198*** (1.172, 1.225)	1.198*** (1.171, 1.225)	
DPS - Reconstructive surgery	0.593*** (0.389, 0.796)	0.592*** (0.389, 0.796)	
DPS - Stomatology	2.548*** (2.455, 2.642)	2.545*** (2.452, 2.639)	

(continued)

**Table 3.** (continued)

	Dependent variable:		
	Reference: Urgent or Semi Urgent		
	(1)	(2)	(3)
DPS - Immuno-allergology	1.060*** (0.922, 1.198)	1.060*** (0.922, 1.198)	
DPS - Obstetrics	0.454*** (0.252, 0.656)	0.455*** (0.252, 0.657)	
DPS - Ophthalmology	9.856*** (9.793, 9.919)	9.840*** (9.777, 9.903)	
DPS - Orthopaedics	0.174*** (0.133, 0.215)	0.173*** (0.133, 0.214)	
DPS - Other	1.004*** (0.925, 1.084)	1.003*** (0.924, 1.083)	
DPS - Otolaryngology	1.786*** (1.733, 1.838)	1.784*** (1.731, 1.836)	
Will return within 24 h (Yes)		0.892*** (0.827, 0.958)	
Duration (minutes)			
From admission to triage			0.980*** (0.978, 0.981)
Triage			0.941*** (0.932, 0.949)
Triage end to doctor			1.007*** (1.007, 1.007)
From doctor to discharge			0.976*** (0.976, 0.976)
Constant	0.349*** (0.332, 0.366)	0.350*** (0.333, 0.367)	1.336*** (1.308, 1.364)
Observations	237,933	237,933	234,028

Note: Odds Ratio (95%CI)

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01

### 3.5 Other Analyses

According to the document [9] that sets the prices for the ED admissions in the Portuguese NHS, each visit is charged 107,59€. Assuming this value as an average for the 3 years, the total burden of NU visits ascends to 7,674,932.65€.

## 4 Discussion

### 4.1 Key Results

Considering information available at the time of admission, this study identifies referral and previous visit within 24 h as a deterrent for NU visits, and that the further away the patient lives from the PED the less likely it is for him to be admitted in the PED as a NU visit. On the other hand, it identifies an increased likelihood of occurring NU visits in the periods of school holidays and weekends.

When studying the NU visit's impact on the PED management, this study identifies Reconstructive surgery, Obstetrics, and Orthopaedics as the discharge physician's specialities that are less likely to receive a NU visit and Ophthalmology and Stomatology as the discharge physician's specialities that are more likely to receive a NU visit. Patients in a NU visit are also less likely to return to the PED within 24 h.



## 4.2 Limitations

The analysis was made on the total visits to the PED, i.e. the total number of episodes and therefore visits made by the same patients, e.g. frequent attenders or patients with chronic diseases, might be a source of bias.

In this study, the discharge physician's speciality is used as a proxy for the nature of the PED visit, despite being a possible source of bias, considering the PED's organization it is not likely to influence the results.

The distances reported in this study are in minutes (driving) and from the parish of residence, this assumes that the patients were driven from home to the PED. This might be a source of bias.

Variables related to time, despite being analysed, must be carefully interpreted due to their interdependency with the triage category.

The age might also be a source of bias, due to the manner the USU and NU groups were separated and the nature of the triage protocol, i.e. age up to 7 days is triaged as level 2, up to 24 months with vomits or diarrheal is triaged as level 3, and up to 36 months with fever is triaged as level 3.

## 4.3 Generalisability

The evidence suggests that prior assessment of severity by a health care professional i.e. referral and convenience of the ED are important factors, driving non urgent ED use. Moreover, and considering the ED management, it is possible to identify medical specialities that are being burdened by NU ED use.

The cost of NU patients to the NHS ascended to more than 7,500,000€ in the study period, i.e. approximately 2,500,000€ per year in Hospital de São João's PED alone; PED visits were approximately a third of the total visits to the Hospital de São João's ED in 2014. Yearly, in Portugal, the visits to this hospital represent 6% of the paediatric ED visits and 1% of all ED visits [9, 17, 18]. This burden would be greatly reduced by profiling these patients and implementing measures for them to find alternative means of health care, e.g. seek a PCP.

To the best of our knowledge there are no similar studies done in Portugal. However, and given the Portuguese health care system paradigm, there is no reason to believe that the panorama in other EDs is very different from what is reported in this study.

**Funding.** Project NORTE-01-0145-FEDER-000016 (NanoSTIMA) is financed by the North Portugal Regional Operational Programme (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, and through the European Regional Development Fund (ERDF).

## References

1. Hoot, N.R., Aronsky, D.: Systematic review of emergency department crowding: causes, effects, and solutions. *Ann. Emerg. Med.* **52**(2), 126–136 (2008). <http://www.ncbi.nlm.nih.gov/pubmed/18433933>. Accessed 12 Dec 2013
2. Miró, O., Antonio, M.T., Jiménez, S., De Dios, A., Sánchez, M., Borrás, A., et al.: Decreased health care quality associated with emergency department overcrowding. *Eur. J. Emerg. Med.* **6**(2), 105–107 (1999). <http://www.ncbi.nlm.nih.gov/pubmed/10461551>. Accessed 12 Dec 2013
3. Schull, M.J., Guttman, A., Leaver, C.A., Vermeulen, M., Hatcher, C.M., Rowe, B.H., et al.: Prioritizing performance measurement for emergency department care: consensus on evidence-based quality of care indicators. *Can. J. Emerg. Med.* **13**(5), 300–309 (2011). <http://www.ncbi.nlm.nih.gov/pubmed/21955411>. Accessed 25 Sep 2014
4. Guttman, A., Schull, M.J., Vermeulen, M.J., Stukel, T.A.: Association between waiting times and short term mortality and hospital admission after departure from emergency department: population based cohort study from Ontario, Canada. *BMJ* **342**, d2983 (2011). <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3106148&tool=pmcentrez&rendertype=abstract>. Accessed 13 Dec 2013
5. Coulter, A.: Shifting the balance from secondary to primary care. *BMJ* **311**(7018), 1447–1448 (1995). <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2543753/pdf/bmj00621-0005.pdf>
6. Quach, C., McArthur, M., McGeer, A., Li, L., Simor, A., Dionne, M., et al.: Risk of infection following a visit to the emergency department: a cohort study. *Can. Med. Assoc. J.* **184**, E232–E239 (2012). <http://eurpub.oxfordjournals.org.proxy.lib.ul.ie/content/early/2013/11/27/eurpub.ckt179%5Cnhttp://www.cmaj.ca/content/184/4/E232.short>
7. Simmering, J.E., Polgreen, L.A., Cavanaugh, J.E., Polgreen, P.M.: Are well-child visits a risk factor for subsequent influenza-like illness visits? *Infect. Control Hosp. Epidemiol.* **35**(3), 251–256 (2014). <http://www.jstor.org/stable/info/10.1086/675281>
8. Jo, S., Kim, K., Lee, J.H., Rhee, J.E., Kim, Y.J., Suh, G.J., et al.: Emergency department crowding is associated with 28-day mortality in community-acquired pneumonia patients. *J. Infect.* **64**(3), 268–275 (2012). <http://www.ncbi.nlm.nih.gov/pubmed/22227383>. Accessed 7 Dec 2013
9. Administrações Regionais de Saúde. Metodologia para definição de preços e fixação de objetivos – Contrato-Programa 2015 (2014)
10. Benchimol, E.I., Smeeth, L., Guttman, A., Harron, K., Moher, D., Petersen, I., et al.: The REporting of studies conducted using observational routinely-collected health data (RECORD) statement. *PLoS Med.* **12**(10), e1001885 (2015). <http://dx.plos.org/10.1371/journal.pmed.1001885>
11. Ministério da Saúde. Saude 24 (2007). <http://www.saude24.pt/>. Accessed 15 Feb 2015
12. Diário da Republica: 1ª série - nº 242. Portaria nº 306-A/2011 de 20 de Dezembro dos Ministérios das Finanças e da Saúde [Internet]. Diário da Republica, 1ª série-nº 242 Portugal, pp. 5348(2)-5348(4) (2011). [www.dre.pt](http://www.dre.pt)
13. Diário da Republica: 1ª série - nº 229. Decreto-Lei nº 113/2011 de 29 de Novembro do Ministério da Saúde [Internet]. Diário da Republica, 1ª série-nº 229 Portugal, pp. 5108–5110 (2011). [www.dre.pt](http://www.dre.pt)
14. Diário da Republica: 1ª série - nº 78. Decreto-Lei nº 61/2015 de 22 de Abril do Ministério da Saúde [Internet]. Diário da Republica; 1ª série-nº 78, p. 2034 (2015). <http://www.dre.pt>
15. Statistics Portugal: Instituto Nacional de Estatística - Portugal (2015). <http://www.ine.pt>. Accessed 23 Dec 2014

16. Warren, D.W., Jarvis, A., LeBlanc, L., Gravel, J., CTAS National Working Group, Canadian Association of Emergency Physicians, et al.: Revisions to the Canadian triage and acuity scale paediatric guidelines (PaedCTAS). *CJEM* **10**(3), 224–243 (2008). <http://www.cjem-online.ca/v3/n4/PaedCTAS/>
17. Centro Hospitalar de São João: Relatório e Contas. Porto (2014)
18. Ministério da Saúde: Transparência SNS (2016). <https://transparencia.sns.gov.pt>. Accessed 10 Mar 2016