CHARACTERISTICS OF EMERGENCY DEPARTMENT ATTENDANCES IN FOUR IRISH TEACHING HOSPITALS

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1. Introduction

This paper focuses on the characteristics of emergency department attendances in four large teaching hospitals in the Dublin area. The objectives are to investigate key factors influencing the decisions that are made at different stages of an episode of emergency care.

Emergency department utilisation is attracting much attention in the Irish health system. In recent years overcrowding at emergency departments throughout the country has sparked widespread media and popular reaction. There is concern in Ireland with the increasing proportion of inpatient admissions originating from the emergency department. This has implications for elective procedures in acute hospitals. There is evidence that elective procedures for surgical patients are being cancelled to make room for emergency medical patients (DOHC, 2002). Inter-linkages between emergency and primary care are also attracting more attention, particularly in the context of the national primary care strategy (DOHC, 2001) and developments in out-of-hours general practitioner (GP) services.

Despite this widespread interest, there is an important lack of baseline information on the characteristics of patients who use emergency department services in the country (Comhairle na nOspidéal, 2002). In response to this problem, a separate paper has provided an up to date profile of emergency department patients in the Dublin area. The paper identifies key factors associated with emergency department (ED) utilisation. These include: males, older age groups; retirement; home duties; unemployment and health care entitlement status.

The profile gives a first indication of what factors might be contributing to some of the observed challenges in emergency care and provides focus for further analysis. This paper takes the next step to look at the role of these factors within the ED. Once the decision has been taken to seek emergency care, the patient can choose whether to self refer or to be referred by a GP. The level of urgency of the presenting complaint can also vary. In the ED, there are a number of ways in which a patient can be treated and discharged. The patient can also choose how many times to visit for health care.

These decisions can be interpreted as a series of steps and ideally they could be modelled as a set of sequential choices, from the initial choice of health care provider (emergency versus primary care) through to discharge destination. To achieve this, the model requires a set of equations where at least one independent covariate is unique to each equation. In the data available for this study the number of covariates is limited and this sort of structural analysis is not feasible.

As the next best alternative, some of these choices can be modelled separately and tentative linkages between the steps can be investigated. Available data permit assessment of the following steps in a patient's episode of emergency care: source of referral; level of urgency; discharge patterns; frequency of attendance. Individual models investigate key characteristics that influence each of these steps, with particular focus on the characteristics that are known to influence higher emergency department utilisation.

Section 2 presents background information on how emergency department care has been modelled in the literature. The previous paper identified interesting variations in ED utilisation by health care entitlement status. To inform further discussion of the role of entitlement status in ED utilisation, Section 3 outlines the financial incentives facing the different entitlement categories. Section 4 introduces the data, and Section 5 outlines the econometric models. Results are presented in Section 6. Discussion and conclusions are given in Sections 7 and 8.

2. Background Literature

This section introduces background literature, where available, to each of the steps in the ED process that will be investigated in the analysis below. Emergency care in Ireland is delivered in public hospital emergency departments. In 2000, there were 40 emergency departments in Ireland[1].

Attendance at an ED can be interpreted as one step in a sequential process of health care utilisation (Cunningham et al., 1995). The first step involves a decision on whether or not to seek medical care (a contact decision). Conditional on this first step, the second involves a decision on where to go to receive the care required (a location decision). A third step could refer to the number of times in a specified period that medical attention will be sought (a frequency decision). Other 'steps' that will be looked at in this paper include the urgency of the presenting complaint which a patient presents with, and the choice of discharge destination made on behalf of (e.g. admission) or by (e.g. self-discharge) the patient.

There are many examples in the literature of analyses using this type of sequential decision making process. Cunningham et al. (1995) estimated the probability of having any non-urgent outpatient visit as a first step, and second estimated the probability of that visit taking place in an ED. In the Irish setting, Nolan and Nolan (2004) have modelled demand for GP care using a two-step process, estimating first the factors influencing the likelihood of seeking primary care, and second the factors influencing the number of GP visits once a first visit has been made. The focus of the paper on emergency department utilisation was at the initial contact stage, identifying key characteristics of those who make contact with emergency services in Ireland, specifically in the Dublin area.

The location decision is a reminder that modelling demand for GP care or for emergency care on its own provides only part of the story. There are many cases where patients choose to present at an ED but could have been adequately treated by a GP. Others may use a GP as the first port of call but find themselves referred on to the ED as the more appropriate location for their care. In Ireland, data are not yet available to investigate demand for emergency and primary care within

[1] More recently, Vhi Healthcare opened the first private minor injury unit in Dublin and others are in the pipeline.

the one sequential framework. However, existing data sources do permit some partial analysis of the factors influencing the different steps in the decision process.

To model the location decision would require descriptive data on choice of care considerations by both GP and ED users. Instead, data are available on observed behaviours and these can be linked to assumptions about underlying choices. The dataset on ED attendances identifies the referral source for each patient. These data include the full sample of those who chose to attend the ED as their first option, but only a sub-sample of those who chose to attend a GP as their first option (i.e. those who were referred on to the ED). The full sample of those choosing their GP first would also need to include those who were not subsequently referred to the ED. Although incomplete, the data do permit investigation of factors influencing whether an individual chose to attend the ED or the GP first. This is the focus of Model 1.

The decision to seek medical attention and the choice of health care provider is linked with the level of urgency of the complaint. Cases where there is little or no scope for choice refer to serious emergencies where immediate care is required (e.g. cardiac arrest). For less immediate needs, there may be more time to choose. Patients attending an ED for minor, non-urgent visits attract considerable attention in the literature. Such visits are considered inappropriate for emergency care leading to unnecessary overcrowding and inefficient use of resources. The urgency of complaint is the focus of Model 2.

Estimates of the proportion of ED attendances that are inappropriate range from 6% to over 85%. This is partly due to differences in study populations, study designs and conflicting views on the definition of an inappropriate ED visit (Lowy et al., 1994). Several studies have defined an inappropriate/non-urgent visit on the basis of clinical diagnosis yet this overlooks other relevant factors (Lowy et al., 1994). A complaint may be diagnosed as treatable in a general practice setting but the facilities needed to reach that diagnosis, however minor the condition, may not be available in general practice (e.g. ankle sprain which may have needed an x-ray for diagnosis). The patient's own perspective on what constitutes an urgent medical problem is a crucial determinant in health-seeking behaviour (Padgett and Brodsky, 1992). Patient perceptions of the

proper role of an ED, and accessibility and quality of GP services (both real and perceived) are other important factors (Lowy et al., 1994).

Given the variations in definition, common characteristics of inappropriate ED patients are difficult to identify from the literature. High risk factors that have been identified in a range of studies (mainly from the US) include poor socioeconomic status (low income, low educational attainment), younger age groups, and minority racial status (Walsh, 1990; Cunningham et al., 1995; Phelps et al., 2000). There is conflicting evidence on the role of medical insurance. Some studies have found that individuals without insurance are more likely to use the ED for non-emergency care, others have found the opposite, and others have found no difference (Weber et al., 2005).

Availability of alternative sources of care is assumed to have important implications for inappropriate use of emergency care but this is not a straightforward relationship (Weber et al., 2005). Studies from the US have shown that the majority of non-urgent patients attend the ED during normal working hours (9am-5pm) when alternative primary care providers are more readily available (Northington et al., 2005). Increased access and availability of alternative sources of care have not been found to automatically trigger reductions in inappropriate use of emergency care (e.g. Krakau and Hassler, 1999). Rather it is regular use of these alternatives that is important. Gill et al. (2000) found that having continuity with a specific alternative provider was significantly associated with decreased likelihood of ED utilisation. This has implications for policy, suggesting that providing patients with a primary care service is not enough in itself and there is need to promote continuity with that service. Rask et al. (1998) also note that the benefits of continuous care with a primary care provider include the diversion of patients away from the ED.

Inappropriate ED users compete for emergency resources with other patients who have greater need for acute hospital care (Lowy et al., 1994). Use of technologically sophisticated and input-demanding emergency services for treatment of an increasing number of less complex and less severely ill patients is technically inefficient (Puig-Junoy et al., 1998). The cost of treatment in an ED has been found to be higher than in general practice for the same presenting complaint.

ED staff tend to use more resources than do GPs for comparable non-acute cases (Lowy et al., 1994; Murphy et al., 1996). From a patient perspective, ED consultation may not be appropriate to their needs. ED doctors are less likely than GPs to discuss social and work-related topics, use a less 'patient-centred' approach, and spend less time listening to patients (Lowy et al., 1994).

Murphy (1998) outlines three strategies used by health services around the world to respond to the perceived problems of inappropriate ED attendances. These include strategies to decrease the number of patients attending EDs (e.g. introducing copayments); measures to refer inappropriate patients to other health care providers; and improvements in triage to provide care more appropriate to the needs of the patients attending. Murphy concludes that the first strategy has not worked as the demand for emergency care has continued to expand, and efforts to refer inappropriate patients have been shown to be unsafe. The third strategy offers more potential for improving the match between patients and services. "Rather than vainly attempting to make the patients more appropriate to the service, future initiatives should concentrate on making the A&E [Accident and Emergency] service more appropriate to the patient" (Murphy, 1998: 36).

Discharge destination provides additional information on the nature of health problems with which people present to the ED. Inpatient admission from the ED has been used as an indicator of acuity in studies investigating appropriate and inappropriate ED utilisation (e.g. Cunningham et al., 1995). In Ireland, there is growing concern with increased pressures to admit patients from emergency departments (DOHC, 2002). This has implications for elective procedures in acute hospitals. There is evidence that elective procedures for surgical patients are being cancelled to make room for emergency medical patients (DOHC, 2002). While there is no official standard for the rate of admissions from an emergency department, displacement of predictable and planned procedures with an increasing proportion of unpredictable and unplanned admissions is a source of inefficiency in a hospital.

Factors influencing the rate of admissions from emergency departments are not fully understood in the Irish context. National reports propose a range of factors that are likely to be involved but more detailed analysis is not available. Walsh et al. (2004) highlight the high proportion of elderly in inpatient admissions from Dublin based emergency departments. There is anecdotal

evidence that the ED is seen as the main route through which a patient can secure an inpatient bed. Thus, GPs and other health professionals may choose to refer their patient to the ED who should otherwise have been admitted electively (DOHC, 2002). Dunne (1997) suggested that some GPs refer patients to the ED in an effort to by-pass long outpatient waiting lists. These are complex issues and are difficult to uncover from available data. However, a useful first step is to provide a baseline profile of factors influencing the likelihood of being admitted from an ED. This is the focus of Model 3.

Less attention has been given in the literature to the practice of self-discharging from emergency departments. This may be another indicator of less urgent cases, or a sign of overcrowding and inefficiency in the emergency department. The degree to which patients are self-discharging, and factors associated with this practice, are the focus of Model 4.

Finally, the frequency with which patients are visiting EDs provides additional information on how people are using emergency services and for what reasons. Several studies have shown that a relatively small number of emergency department patients are responsible for a disproportionate number of ED visits (Blank et al., 2005). In a Swedish setting, Hansagi et al. (2001) estimated that 4% of ED patients accounted for 18% of the total number of ED visits.

Studies from a range of countries (including France, Ireland, UK, Sweden, US, Canada) have identified consistently similar profiles for frequent users of emergency services (Byrne et al., 2003). These patients tend to be males, from poor socioeconomic backgrounds, with psychosocial problems, and who experience significantly increased morbidity and mortality (e.g. Byrne et al., 2003; Lang et al., 1997; Blank et al., 2005; Griswold et al., 2005). Alcohol and drug problems are also common factors for these patients (Lynch and Greaves, 2000). Byrne et al. (2003) found that these ED patients are also likely to be relatively intensive users of other alternative sources of health care. The authors concluded that it is not the case that these frequent attenders are using the ED because of lack of access to alternative primary care services.

Frequent attenders are believed to place a disproportionate burden on ED services. Lynch and Greaves (2000) observed a small group of regular attenders representing less than 2% of total

attendances to an ED accounting for much greater amounts of doctors' and nurses' time relative to other ED patients. The profile of frequent attenders in Ireland and their relative burden on ED services is based on data from the 1990s and from single site hospitals. The focus of Model 5 is to provide a more robust profile of regular ED attenders.

3. Entitlement incentives

In the literature on ED utilisation, evidence on the influence of insurance has been mixed. In Ireland, private health insurance does not provide the full picture of medical coverage for the population and it is more appropriate to focus on entitlement.

There are two broad categories of eligibility for public health services. Category One are eligible for free access to public health services, including primary care, public hospital inpatient and outpatient care, and other community health services. Category Two are eligible to receive public hospital services at nominal charges and are provided with assistance towards the cost of medicines[2] but are required to pay privately for primary care. Eligibility for the two categories is determined primarily on the basis of income. Category One eligibility is granted to persons earning an income below a specified threshold level. A medical card is issued to these persons, covering the individuals and their dependents. Since 2001, all people aged 70 years and over are also entitled to a medical card, regardless of income (Government of Ireland, 2001).

Many people in Category Two purchase supplementary private health insurance and a small proportion in Category One also hold private health insurance as well as a medical card. Private health insurance secures consultant provided care and other hotel benefits (e.g. private or semi-private room) in the acute hospital system. An increasing range of insurance schemes also provide assistance towards primary care.

Thus the population can be categorised into four entitlement groups: medical card holders; privately insured; individuals with both medical card and private health insurance ('duplicate cover'); individuals with neither medical card nor private health insurance ('no additional cover')[3]. In 2004, over 28% of the population held a medical card, 50% had private health insurance and just over 24% had no additional cover. A small proportion (3%) held duplicate cover from private health insurance and a medical card (NESF, 2002; Amárach Consulting, 2003; Insight Statistical Consulting, 2005; PCRS, 2005; Central Statistics Office, 2007).

[2] The Drug Refund scheme reimburses payments above €85 per month. The Long Term Illness Scheme fully reimburses drug payments for specified long term illnesses.

[3] For ease of presentation the four groups are referred to in the text as follows: medical card holders, privately insured, duplicate cover (or med card/privately insured), no additional cover (or non-covered).

There are a priori reasons why entitlement might influence the ways in which individuals make use of emergency services in Ireland. Table 1 outlines the financial incentive structures facing each of the four entitlement categories for accessing health services in the Irish system.

Table 1 Financial costs of key health services by entitlement category

Entitlement	Emergency dept.	Alternatives		Inpatient care
		GP	Private[1] Specialists	
Medical card	FREE unconditional	FREE	CHARGE	FREE unconditional
Privately insured	CHARGE conditional, fixed[2]	CHARGE[3] variable	CHARGE partially covered	FREE unconditional
Duplicate cover	FREE unconditional	FREE	CHARGE partially covered	FREE unconditional
No additional cover	CHARGE conditional, fixed	CHARGE variable	CHARGE	CHARGE variable (public or private)

[1]Access to public specialists is based on a referral process.
[2]The terms fixed and variable in the table refer to fixed/variable across providers.
[3]Assumes that private health insurance does not cover primary care. This applies to the majority of private insurance policies although would need to be revised in future years.

In the initial choice to seek care, medical card holders (with and without private health insurance) face no charges except in the case of private specialist care, where referral is usually required. Controlling for all other factors (i.e. health status, socio-economic status etc.), the financial incentives are in favour of higher health care utilisation by medical card holders relative to non medical card holders.[4]

Individuals with private health insurance face fewer charges for secondary health care (specialist and inpatient care) relative to those with no additional cover. As these sources of care usually require referral, *cetaris paribus*, the financial incentives suggest very little difference between the privately insured and those with no additional cover in the initial choice to seek care.

[4] Individuals who hold duplicate cover from private health insurance and a medical card tend to be from the group aged 70 and older who became eligible for a medical card in 2001 without means testing. Thus these individuals have seen an effective reduction in the cost of health services. Dynamic analysis might show an increase in health care utilisation by this group since 2001.

If the decision is made to seek care, financial incentives may influence the next choice on where to go. The focus of this discussion is on the choice between emergency and primary care[5]. This first assumes that there is time for choice (i.e. not an immediate emergency), and that there are alternative sources of care in the area.

Medical card holders (with and without private health insurance) are financially indifferent between emergency and GP care as both are free. For the non medical card holders (privately insured and non covered), attendance at an ED is charged at a fixed rate (currently €60) for anyone presenting without a medical card. This fee is waived if the patient has a referral letter from a GP, or if the patient is subsequently admitted (whereupon they become liable for inpatient fees where applicable). GP fees are charged for all non medical card holders at a market rate.

If the GP charge is equal to or close to that of the ED, in financial terms, the non medical card holders will be indifferent between the two. Where the GP charge is lower than €60, the financial incentives favour attending the GP first and vice versa. Published estimates of GP charges range from €35 to €36 (Indecon, 2003). However, anecdotal estimates are much higher than these. GP out-of-hours co-operatives in the Dublin area charge €50 per visit suggesting this is closer to the average GP charge for Dublin. This indicates that the gap between GP charges and the ED charge is not large. Controlling for all other factors, individuals with private health insurance or with no additional cover are likely to be financially indifferent between emergency and primary care.

[5] Individuals may refer themselves directly to private consultant specialists. The financial incentives for choosing between primary care and private consultant care, or between emergency care and private consultant care, vary by entitlement group. However, direct referral to consultant care is not understood to be common practice in Ireland and is not the focus of this paper.

4. Data

Data on ED attendances have been collected from four hospitals located in Dublin. These are large teaching hospitals whose inpatient bed capacity range from 471 to 753 (Health Service Executive, 2007). The four hospitals were purposively chosen to ensure representation of the different demographic and socio-economic profiles of local areas within Dublin.

The adult emergency departments in these hospitals each receive more than 30,000 new attendances per year and mainly cater for patients aged 15 and over[6].

Following registration at reception, patients (including those who are referred by a GP) are assessed by a triage nurse and treated thereafter in accordance with the level of urgency of the complaint. The four hospitals operate the Manchester Triage Scale which rates the urgency of a case on a five-point likert scale from 1 (immediate) to five (non urgent) (Manchester Triage Group, 1997).

The ED dataset includes all attendances to the emergency departments during the calendar year 2004. Table 2 outlines the demographic, administrative and clinical variables available for each observation. There are some variations in availability of specific variables. Entitlement was routinely collected in 2004 in two out of the four hospitals. Marital status was collected in three out of the four hospitals.

[6] Public information on the websites of adult and paediatric hospitals indicates a cut-off age of under 15 for paediatric cases. This is further confirmed in the emergency department patient level data where less than 3% of patients are aged under 15 in all four hospitals.

Table 2 Data collected from four Dublin teaching hospitals (all attendances Jan-Dec 2004)

	Variable	Hospital 1	Hospital 2	Hospital 3	Hospital 4
Demographic	Age	✓	✓	✓	✓
	Gender	✓	✓	✓	✓
	Marital Status	Not available	✓	✓	✓
	Occupation	✓	✓	✓	✓
	Area of Residence.	✓	✓	✓	✓
Administrative	Date and Time of Attendance	✓	✓	✓	✓
	Entitlement status	Not available	Not available	✓	✓
	Source of Referral	✓	✓	✓	✓
	Discharge Destination	✓	✓	✓	✓
	New/Return	✓	✓	✓	✓
	Distance from hospital (minutes)[1]	✓	✓	✓	✓
Clinical	Presenting Complaint	✓	✓	✓	✓
	Triage Category	✓	✓	✓	✓

[1] Estimated time taken to reach the ED from patients' area of residence, based on data provided by the Small Area Health Research Unit (SAHRU).

Two levels of ED data are identified. Patient level data identify the demographic and socio-economic characteristics of the patients attending the EDs during the year by removing duplicate cases where a patient has attended more than once. Attendance level data allows identification of the clinical and administrative details of each ED visit. The analysis in this paper is based on attendance level data.

5. Econometric Models

Estimation sample

The ED attendance level data from the four hospitals are combined into one dataset. To identify important variations across hospitals, hospital identifiers are included as dummy variables in the analyses. Five separate models are estimated using these data. To ensure consistency with the analysis on utilisation in the previous paper, the estimation sample is restricted to patients who report an area of residence within the respective catchment areas of the receiving hospitals, and to new attendances. The small proportion of patients under the age of 15 is also excluded from the analysis[7]. Observations with missing details on any of the covariates in the regression equation are automatically omitted from the analysis. Thus there are small variations in the sample size from one model to another depending on which independent covariates are included. The full estimation sample size based on data from all four hospitals ranges from 81,667 to 88,198.

In each hospital, a small proportion of patients attended more than once during the year. To control for clustering on individuals with more than one visit, the data are analysed as a panel, with random effects. The time variable in the panel refers to the day of attendance[8], numbered from 1 (January 1st) to 366 (December 31st)[9]. The panel is unbalanced given that the majority of patients attended only once in that time period.

Theoretical framework

The models estimated using the above data are all investigating a particular aspect of health care utilisation (e.g. urgency of complaint; mode of referral; frequency of attendance). In the health services literature there is frequent reference to the works by Andersen et al. (Andersen and Newman, 1973; Aday and Andersen, 1974) which provide a framework for investigating access to and utilisation of health care services. This framework is used to guide the selection of the independent covariates in each of the following models. Individual determinants of health care

[7] These are adult emergency departments and patients younger than 15 attending these departments would not be representative of their age groups.
[8] A small proportion of patients had more than one attendance within the same day. These are omitted to allow construction of the panel data set.
[9] 2004 was a leap year.

utilisation include predisposing, enabling and need factors (Andersen and Newman, 1973). Predisposing factors describe the innate propensity of individuals to use services, prior to the onset of illness (e.g. age, gender, religion etc.). Enabling factors refer to the resources that individuals have available to them to use health care services (e.g. income, insurance coverage, distance from health services). The need factor refers to the degree of ill health suffered by the individual and is the most immediate cause of health service use. Access to health care is influenced by characteristics of the health care system, including availability of health care facilities and appropriate human resources (Aday and Andersen, 1974).

Model 1 Mode of referral

The first model investigates factors influencing patients' choice on mode of referral. Where circumstances allow, patients can choose to self refer to the ED or to be referred by their GP. A small proportion of cases are referred to the ED within the hospital system (e.g. by another hospital, or within the host hospital). The focus in this paper is on factors motivating patient actions, and thus referrals instigated by the hospital are not included in the analysis. Self referrals include patients transported by ambulance to the department.

Discrete choice modelling is required for the binomial dependent variable, which takes on a value of one for GP referral and zero for self referral. The logit is chosen as the link function.

The independent covariates include predisposing demographic characteristics, enabling factors and need factors. Demographic covariates include gender (with males as the reference category), age and marital status. To capture signs of non-linearity in the relationship with the dependent variable, age is modelled as a categorical variable (with age 15-24 as the base category). Enabling factors are proxied by employment status (employed as base category) and entitlement status (medical card holders as base category). To capture health need, triage level is included. Triage 2 (very urgent) is selected as the reference category[10]. To investigate the influence of frequent attendance on choice of referral mode, dummy variables for the visit number are included (first/only visit as the base category).

[10] Triage 1 refers to immediate cases and patients with all other levels of triage are more likely to be referred by a GP relative to this category. It is thus more informative to use Triage 2 as a reference category.

To capture information on the characteristics of the health care system, hospital dummies are included to control for context (Hospital 1 as base category). A dummy variable indicating the average distance (measured in terms of minutes) of the patient is also included. GP services are more readily available during normal working hours and to control for this, a dummy variable is included, indicating if the patient attended after 6pm Monday to Friday, or during the weekends/bank holidays.

The data are analysed in a panel logit model, the definition of the panel is outlined above. Two sets of results are presented. The first set is based on the full estimation sample which includes all four hospitals. The second set is based on the estimation sample including hospitals 3 and 4. The latter model includes the independent covariates on entitlement and marital status, these are not available in the full estimation sample.

Model 2 Triage level

Patients attending for minor, non-urgent visits attract considerable attention in the literature. While there is no standard definition for an inappropriate visit, triage level is frequently used as a key indicator of appropriate/inappropriate utilisation (along with information on patient perceptions, contact with other primary care providers etc.). There is consistency in the approach adopted in modelling factors related to triage. Triage scales (with four or five levels) are typically aggregated into two categories, urgent and non-urgent (e.g. Grumbach et al., 1993; Shah et al., 1996; Phelps et al., 2000). Levels 2 to 3 in a five point scale (very urgent, urgent) are labelled urgent and levels 4 and 5 (standard, not urgent) are labelled non-urgent.

Model 2 investigates the factors influencing the level of urgency of patients' presenting complaints at the emergency departments. The standard dichotomy of urgent/non-urgent is applied to the five point triage scale[11]. Thus the dependent variable is a binomial variable which takes a value of zero for an urgent visit and a value of one for a non-urgent visit. The independent covariates are selected in line with the theoretical framework and are the same as in

[11] The alternative is to model triage as an ordered variable (e.g. using an ordered logit model). Using this approach, the results are not very different to the binomial approach. For ease of presentation and for consistency with the literature, the results from the binomial model are outlined.

Model 1. As for Model 1, the data are analysed in a panel logit and two sets of results are presented (full sample of four hospitals and restricted sample of hospitals 3 and 4 only).

Model 3 Admission

Once a patient is registered in the emergency department it is reasonable to assume that from this point forward their progression through the emergency system will be largely determined by medical need and by the medical profession. However, given the growing concerns with the high rate of inpatient admissions from emergency departments in Ireland, the characteristics associated with admitted attendees require attention. The purpose of Model 3 is to identify factors influencing the likelihood of inpatient admission for emergency department attendees.

The dependent variable is dichotomous which takes a value of one if the patient is admitted and zero otherwise. The independent covariates are the same as for Model 1 with an additional dummy to indicate how the patient was referred (self referred as the base category). The data are analysed in a panel logit and two sets of results are presented (full sample and restricted sample).

Model 4 Self-discharge

Descriptive data indicate that even after registration, some patients take matters into their own hands and decide to leave the department before the episode of care is concluded. In Hospital 3, over 22% of attendances result in patients discharging themselves prematurely. Self-discharging is inefficient, wasting hospital administrative and medical resources, and patients' resources (e.g. time foregone, travel costs etc.). It is important to identify the factors associated with this behaviour to improve the efficiency with which emergency department services are used. Model 4 investigates the characteristics associated with patients who self-discharge.

The dependent variable is binomial which takes a value of one if the patient self discharges and zero otherwise. The independent covariates and model estimation methods are the same as in Model 3. Two sets of results are presented. Self-discharges are not separately identified in Hospital 2 and thus the full estimation sample includes Hospitals 1, 3 and 4. The restricted sample includes Hospitals 3 and 4 as before.

Model 5 Frequent attendance

Within the literature on inappropriate ED utilisation, there is some specific focus on the small proportion of patients who attend EDs on a regular basis. There is no agreed standard definition of a regular ED attender and definitions range from two or more visits per year to more than 10 visits per year (Lynch and Greaves, 2000). There is some consensus to define attendees with 4 to 11 visits per year as regular attenders and those with more than 12 visits per year as heavy users of emergency services (Byrne et al., 2003). Model 5 investigates the factors influencing regular attendance of emergency services. Patients are grouped according the number of visits, separating those with four or more visits from those with 1 to 3 visits in the year.

The dependent variable is dichotomous taking a value of one if the patient has four or more visits during the year and zero otherwise[12]. The independent covariates and model estimation methods are the same as in Models 3 and 4, with an additional dummy to mark the discharge destination of the patients (inpatient admission as the base category). Two sets of results are presented (full sample of four hospitals and restricted sample of hospitals 3 and 4 only).

Each of the models performs well in terms of classifying positive outcomes, and has been checked for signs of heteroscedasticity. A general to specific modelling approach has been used, and the results presented here are for the final most parsimonious models. Variable labels and definitions are presented in Table 8. Descriptive data on the five dependent variables are presented in Table 9.

[12] The alternative would be to model the frequency of visits as a continuous dependent variable. However the skewed nature of the variable causes difficulties for ordinary least squares and the discrete modeling approach is favourable in this case.

6. Results

Results are presented for each model in Tables 3 to 7. The majority of the patterns in the odds ratios are consistent across the models based on the full and restricted samples unless otherwise referred to in the text.

Model 1 Mode of Referral

Model 1 investigates factors influencing the likelihood of being referred by a GP rather than self-referring to the ED. Overall, the majority of cases in an ED are self referrals. For the full sample including all four hospitals, almost 79% of attendances are self-referrals. Table 3 presents the two sets of results for Model 1. Odds ratios indicate the odds on the patient being referred by their GP rather than being self-referred.

The demographic predisposing factors have significant impacts on the referral choice. The odds of being referred by a GP are higher for females relative to males. The odds of GP referral increase with age. Patients aged 55 and older are significantly more likely to be GP referrals relative to younger age groups. There are also some significant differences in marital status. Relative to single people, individuals who are married and who are widowed are more likely to be GP referrals.

The socio-economic enabling factors have less significance in their impact on referral choice after controlling for the other covariates in the model. The most significant result is in entitlement status, indicated in the results for the restricted sample of hospitals 3 and 4. Individuals with no additional cover are significantly less likely to be referred by a GP relative to the base category of medical card holders. Changing the base category further shows that the group with no additional cover are significantly less likely to be GP referrals relative to all of the other entitlement groups (i.e. privately insured, duplicate cover). In employment status, there is some significant variation. The odds of GP referral are significantly higher for retired individuals relative to employed individuals.

The urgency of the presenting complaint, used to proxy health need, shows significant variation in the mode of referral. Relative to the base category of very urgent cases, the odds of GP referral

are significantly lower both for cases with immediate needs for medical attention (Triage 1) and for cases of standard and non urgent needs for attention (Triage 4 and 5). There is no significant difference between the urgent and the very urgent cases in the mode of referral.

Health system characteristics also have significant impacts on the referral choice. The odds of GP referral vary across the four hospital sites. Relative to Hospital 1, attendances at Hospitals 2 and 3 are significantly less likely to be GP referrals while attendances at Hospital 4 are not significantly different. Distance from the hospital is important. Relative to individuals living within 4 minutes of the nearest ED, those living further away are more likely to be referred by a GP. Time of day is very significant. Attendances after 6pm on weekdays, or at any time on weekends (and bank holidays), are much less likely to be referred by a GP.

Finally, the odds of GP referral progressively decline with the number of visits made by an individual to the ED. The odds of GP referral for attendances with four or more visits are much lower relative to the base category of those with one visit/first visit during the year.

Table 3 Results from Model 1 (Dependent variable = probability of GP referral)

	All hospitals			Hospitals 3 and 4		
	Odds Ratio	**95% CI**		**Odds Ratio**	**95% CI**	
Female	1.411 ***	(1.349	1.475)	1.381 ***	(1.286	1.483)
Age 25-34	1.215 ***	(1.125	1.312)	1.037	(0.905	1.187)
Age 35-44	1.462 ***	(1.346	1.587)	1.154	(0.990	1.344)
Age 45-54	1.676 ***	(1.541	1.824)	1.221 **	(1.041	1.433)
Age 55+	1.944 ***	(1.789	2.112)	1.437 ***	(1.226	1.686)
Married				1.295 ***	(1.181	1.421)
Separated/Divorced				0.963	(0.824	1.127)
Widowed				1.181 ***	(1.046	1.333)
Unemployed	0.949	(0.883	1.019)	0.884	(0.777	1.007)
Home duties	1.057	(0.986	1.132)	1.130	(0.996	1.281)
Retired	1.106 ***	(1.030	1.189)	1.180 ***	(1.044	1.332)
Student	1.061	(0.970	1.160)	0.959	(0.826	1.113)
Private health insurance				1.066	(0.964	1.177)
Med card/Private ins.				1.140 **	(1.018	1.277)
No additional cover				0.822 ***	(0.743	0.911)
Immediate triage	0.259 ***	(0.188	0.355)	0.320 ***	(0.214	0.478)
Urgent triage	1.168 ***	(1.100	1.239)	1.077	(0.994	1.166)
Standard/non urgent triage	0.545 ***	(0.510	0.583)	0.540 ***	(0.491	0.593)
Visit 2	0.771 ***	(0.728	0.816)	0.757 ***	(0.694	0.826)
Visit 3	0.666 ***	(0.605	0.733)	0.635 ***	(0.548	0.735)
Visit 4				0.566 ***	(0.454	0.706)
Visit 5				0.412 ***	(0.296	0.571)
Visit 6				0.357 ***	(0.225	0.566)
Visit 7-13				0.362 ***	(0.255	0.514)
Visit 14-31				0.097 ***	(0.034	0.282)
Visit 32+				0.169 **	(0.033	0.856)
Visit 4+	0.450 ***	(0.402	0.503)			
Hospital 2	0.733 ***	(0.691	0.777)			
Hospital 3	0.754 ***	(0.707	0.805)			
Hospital 4	1.030	(0.970	1.093)	1.427 ***	(1.326	1.536)
Distance: 5-9 mins	1.335 ***	(1.274	1.398)	1.300 ***	(1.205	1.402)
Distance: 10-14 mins	1.700 ***	(1.592	1.814)	1.156 ***	(1.038	1.288)
Out of hours	0.219 ***	(0.210	0.228)	0.215 ***	(0.202	0.230)
	Number of observations		83260	Number of observations		33819
	Log likelihood		-37783.71	Log likelihood		-16185.37
	Wald chi2 (21)		7719.54	Wald chi2 (30)		2911.31
	Prob > chi2		0.0000	Prob > chi2		0.0000

**significant at 5% level
***significant at 1% level

Model 2 Triage level

Table 4 presents the results from Model 2 which investigates factors influencing the level of urgency of patients' presenting complaints. Analysis focuses on the probability of being a non-urgent case (Triage 4 and 5) relative to being an urgent case (Triage 2 and 3). In the full sample with all four hospitals, over 60% of attendances are urgent cases.

The odds of being a non-urgent case are significantly lower for females relative to males, and are progressively lower as age increases. In the model based on the full sample, the odds of being a non-urgent case for individuals aged 85 and older are 0.2 times the odds for individuals age 15-24 ($p>0.000$). Married, separated or widowed individuals are significantly less likely to be non-urgent cases relative to single people.

Enabling factors show important variations in triage level. The odds of non-urgent triage are significantly lower for individuals who are unemployed, engaged in home duties, or retired relative to those who are employed. Odds ratios for entitlement status are presented relative to the base category of privately insured individuals. Medical card holders are significantly less likely to be non-urgent cases relative to the privately insured. Changing the base category shows that the odds of non-urgent triage are lower for medical card holders relative to each of the other entitlement categories.

Health system characteristics have significant impacts on triage level. There are variations in triage across the four hospitals. The odds of non-urgent cases are smallest for Hospital 3 relative to the other three sites. For individuals living further away from the ED, the odds of being a non-urgent case are smaller. The odds of non-urgent triage are also lower for attendances occurring outside normal working hours.

Relative to individuals on their first/only visit during the year, the odds of non-urgent triage are smaller for individuals with more than one visit. However, this is not a linear relationship and at 14 or more visits the odds of being a non-urgent case are higher relative to individuals with fewer visits.

Table 4 Results from Model 2 (Dependent variable = probability of non-urgent triage)

	All hospitals			Hospitals 3 and 4		
	Odds Ratio		**95% CI**	**Odds Ratio**		**95% CI**
Female	0.855	***	(0.819 0.892)	0.876	***	(0.816 0.940)
Age 25-34	0.805	***	(0.755 0.857)	0.943		(0.839 1.060)
Age 35-44	0.602	***	(0.561 0.646)	0.843	**	(0.735 0.967)
Age 45-54	0.513	***	(0.476 0.552)	0.826	**	(0.713 0.957)
Age 55-64	0.398	***	(0.367 0.431)	0.707	***	(0.604 0.828)
Age 65-69	0.310	***	(0.277 0.348)	0.601	***	(0.489 0.738)
Age 70-74	0.277	***	(0.244 0.313)	0.490	***	(0.391 0.613)
Age 75-79	0.242	***	(0.212 0.276)	0.519	***	(0.414 0.650)
Age 80-84	0.218	***	(0.189 0.252)	0.485	***	(0.381 0.618)
Age 85+	0.202	***	(0.173 0.235)	0.512	***	(0.398 0.658)
Married				0.720	***	(0.656 0.790)
Separated/Divorced				0.653	***	(0.557 0.767)
Widowed				0.741	***	(0.643 0.854)
Unemployed	0.645	***	(0.604 0.688)	0.671	***	(0.593 0.760)
Home duties	0.750	***	(0.699 0.804)	0.803	***	(0.701 0.920)
Retired	0.599	***	(0.546 0.658)	0.727	***	(0.627 0.843)
Student	0.929		(0.863 1.001)	1.055		(0.927 1.200)
Medical card holder				0.736	***	(0.664 0.817)
Med card/Private ins.				0.882		(0.757 1.027)
No additional cover				1.090	**	(1.000 1.187)
Visit 2	0.856	***	(0.813 0.900)			
Visit 3	0.791	***	(0.726 0.862)			
Visit 4	0.705	***	(0.618 0.804)			
Visit 5	0.719	***	(0.597 0.865)			
Visit 6	0.688	***	(0.538 0.880)			
Visit 7-13	0.911		(0.753 1.101)			
Visit 14-31	1.619	***	(1.153 2.273)			
Visit 32+	2.320	**	(1.227 4.386)			
Visit 2-13				0.984		(0.916 1.058)
Visit 14+				2.889	***	(1.916 4.355)
Hospital 2	0.602	***	(0.571 0.634)			
Hospital 3	0.279	***	(0.262 0.298)			
Hospital 4	0.453	***	(0.428 0.480)	1.497	***	(1.390 1.611)
Distance: 5-9 mins	0.821	***	(0.787 0.857)	0.756	***	(0.702 0.815)
Distance: 10-14 mins	0.678	***	(0.637 0.722)	0.804	***	(0.722 0.894)
Out of hours	0.776	***	(0.748 0.805)	0.819	***	(0.771 0.870)
	Number of observations		88198	Number of observations		34715
	Log likelihood		-53887.36	Log likelihood		-19895.84
	Wald chi2 (28)		5703.87	Wald chi2 (26)		1393.61
	Prob > chi2		0.0000	Prob > chi2		0.0000

**significant at 5% level
***significant at 1% level

Model 3 Admission

The results for Model 3 on the factors influencing inpatient admission from the ED are presented in Table 5. In the full sample of all four hospitals almost 24% of ED attendances are admitted.

Controlling for all other covariates in the model, females are less likely to be admitted relative to males. Older people are more likely to be admitted and the odds on admission progressively increase with each age group. In the full sample, the odds on admission for individuals aged 85 and older are almost 7 times higher than the base category of 15-24 year olds. Single people are not significantly more or less likely to be admitted relative to other marital status groups.

Enabling factors also have significant impacts on the likelihood of admission. Relative to the reference category of employed individuals, the odds of admission are higher for unemployed, retired and individuals engaged in home duties. Privately insured patients and individuals with no additional cover are significantly less likely to be admitted relative to medical card holders (with and without private health insurance).

Relative to patients with immediate need for attention (Triage 1), very urgent cases are more likely to be admitted. The odds on admission are much smaller for non-urgent cases. The odds on admission for cases in the least urgent category (Triage 5) are 0.04 ($p>0.000$) times the odds for immediate cases.

The odds for admission are different across the four hospitals. Controlling for all other covariates in the model, the odds of admission are smaller for Hospitals 2, 3 and 4 relative to Hospital 1. Changing the reference category, the odds of admission are smallest for Hospital 2 relative to each of the other hospitals. The likelihood of admission is significantly greater for individuals who live further away from the ED but the absolute difference in the odds is not large. Time of day does not have a significant impact on the likelihood of admission.

The likelihood of admission increases as the number of visits increases but only up to the fifth visit. The odds on admission for individuals with more than 5 visits are not significantly different to individuals attending for their first/only visit in the year.

Referral source has an important impact on the likelihood of admission. GP referrals are more likely to be admitted relative to self-referred patients.

Table 5 Results from Model 3 (Dependent variable = probability of inpatient admission)

	All hospitals				Hospitals 3 and 4			
	Odds Ratio		95% CI		Odds Ratio		95% CI	
Female	0.910	***	(0.865	0.958)	0.888	***	(0.823	0.957)
Age 25-34	1.117	**	(1.018	1.225)	1.077		(0.927	1.252)
Age 35-44	1.491	***	(1.353	1.643)	1.627	***	(1.382	1.915)
Age 45-54	1.909	***	(1.731	2.106)	1.885	***	(1.591	2.233)
Age 55-64	2.808	***	(2.539	3.105)	2.678	***	(2.249	3.189)
Age 65-69	3.732	***	(3.292	4.232)	3.444	***	(2.797	4.241)
Age 70-74	4.471	***	(3.924	5.095)	3.994	***	(3.214	4.964)
Age 75-79	5.312	***	(4.645	6.074)	4.573	***	(3.673	5.693)
Age 80-84	6.622	***	(5.743	7.635)	5.910	***	(4.688	7.450)
Age 85+	6.947	***	(5.988	8.059)	6.379	***	(5.013	8.117)
Married					0.953		(0.866	1.048)
Separated/Divorced					0.963		(0.828	1.119)
Widowed					1.069		(0.943	1.212)
Unemployed	1.246	***	(1.155	1.344)	1.169	**	(1.034	1.321)
Home duties	1.115	***	(1.030	1.207)	1.139		(0.999	1.300)
Retired	1.375	***	(1.257	1.504)	1.372	***	(1.200	1.569)
Student	1.068		(0.957	1.192)	1.008		(0.851	1.193)
Private health insurance					0.839	***	(0.754	0.934)
Med card/Private ins.					1.031		(0.917	1.158)
No additional cover					0.768	***	(0.692	0.853)
Visit 2	1.169	***	(1.102	1.239)	1.118	**	(1.027	1.217)
Visit 3	1.297	***	(1.183	1.422)	1.219	***	(1.066	1.394)
Visit 4	1.342	***	(1.174	1.535)	1.366	***	(1.131	1.651)
Visit 5	1.438	***	(1.192	1.734)	1.350	**	(1.045	1.743)
Visit 6	1.100		(0.855	1.415)	1.093		(0.786	1.520)
Visit 7-13	1.122		(0.921	1.367)	1.088		(0.851	1.390)
Visit 14-31	0.787		(0.513	1.207)	0.836		(0.517	1.353)
Visit 32+	0.955		(0.437	2.088)	1.039		(0.466	2.318)
Immediate triage					0.390	***	(0.296	0.514)
Very urgent triage	2.569	***	(2.108	3.130)				
Urgent triage	0.610	***	(0.503	0.740)	0.268	***	(0.248	0.289)
Standard triage	0.085	***	(0.069	0.104)	0.040	***	(0.035	0.045)
Non urgent triage	0.038	***	(0.026	0.055)	0.034	***	(0.021	0.056)
Hospital 2	0.446	***	(0.416	0.477)				
Hospital 3	0.870	***	(0.812	0.933)				
Hospital 4	0.595	***	(0.555	0.638)	0.759	***	(0.704	0.819)
Distance: 5-9 mins	1.093	***	(1.039	1.150)	1.140	***	(1.055	1.231)
Distance: 10-14 mins	1.186	***	(1.101	1.277)	0.998		(0.888	1.122)
Out of hours	1.040		(0.994	1.088)	1.005		(0.941	1.074)
GP referral	1.684	***	(1.599	1.773)	1.717	***	(1.593	1.850)
	Number of observations			81667	Number of observations			32965
	Log likelihood			-33844.50	Log likelihood			-15656.21
	Wald chi2 (33)			10488.22	Wald chi2 (37)			4530.3
	Prob > chi2			0.0000	Prob > chi2			0.0000

**significant at 5% level
***significant at 1% level

Model 4 Self-discharge

The factors influencing the likelihood of self-discharge are investigated in Model 4 and results are presented in Table 6. The full sample includes Hospitals 1, 3 and 4. Just under 10% of attendances in the full sample discharged themselves from the ED.

The odds on self-discharging are lower for females relative to males, and for older age groups relative to younger age groups. In particular, those aged 65 and above are much less likely to self-discharge relative to younger patients.

Unemployed individuals are consistently and significantly more likely to self-discharge relative to all other employment categories. Relative to the reference category of medical card holders, individuals with private health insurance or with no additional cover are significantly less likely to self-discharge.

Triage category is very significant. The odds of self-discharging are much larger for individuals with less urgent complaints relative to the base category of very urgent complaints. In the full sample, the odds on self-discharging for the least urgent cases (Triage 5) are 20.7 times the odds for very urgent cases ($p>0.000$).

There are also important variations across hospital sites. The odds on self-discharging are significantly higher in Hospital 3 relative to Hospitals 1 and 4. Individuals who live more than 4 minutes away from the ED are less likely to self-discharge. Individuals who attend outside of normal working hours are more likely to self-discharge.

The likelihood of self-discharging increases as the number of visits increases. There is a significant jump in the odds of self-discharging for individuals with 14 or more visits relative to those with fewer visits during the year.

Individuals who are referred by a GP are significantly less likely to self-discharge relative to those who have self referred.

Table 6 Results from Model 4 (Dependent variable = probability of self-discharge)

	All hospitals (excl. Hospital 2)				Hospitals 3 and 4			
	Odds Ratio		95% CI		Odds Ratio		95% CI	
Female	0.916	**	(0.850	0.986)	0.902	**	(0.820	0.993)
Age 25-34	0.963		(0.866	1.071)				
Age 35-44	0.946		(0.840	1.065)				
Age 45-54	0.839	***	(0.740	0.951)				
Age 55-64	0.699	***	(0.606	0.805)				
Age 65-69	0.483	***	(0.387	0.603)				
Age 70-74	0.419	***	(0.328	0.534)				
Age 75-79	0.291	***	(0.223	0.379)				
Age 80-84	0.262	***	(0.194	0.354)				
Age 85+	0.197	***	(0.139	0.280)				
Age 65+					0.489	***	(0.405	0.590)
Married					0.857	***	(0.765	0.960)
Separated/Divorced					1.232	**	(1.043	1.455)
Widowed					0.791	**	(0.648	0.967)
Unemployed	1.979	***	(1.805	2.171)	1.717	***	(1.504	1.960)
Home duties	1.193	***	(1.051	1.354)	0.951		(0.795	1.138)
Retired	1.175		(0.982	1.408)	0.821		(0.669	1.008)
Student	0.928		(0.816	1.056)	1.003		(0.862	1.167)
Private health insurance					0.741	***	(0.645	0.851)
Med card/Private ins.					0.862		(0.689	1.077)
No additional cover					0.783	***	(0.696	0.882)
Immediate triage	0.392	**	(0.157	0.980)	0.294	**	(0.091	0.955)
Urgent triage	4.302	***	(3.688	5.019)	4.554	***	(3.847	5.393)
Standard triage	7.127	***	(6.083	8.350)	8.877	***	(7.443	10.59)
Non urgent triage	20.69	***	(16.68	25.68)	32.681	***	(23.62	45.22)
Visit 2	1.100	**	(1.003	1.206)				
Visit 3	1.253	***	(1.088	1.444)				
Visit 4	1.350	***	(1.100	1.655)				
Visit 5	1.666	***	(1.282	2.165)				
Visit 6	1.930	***	(1.417	2.627)				
Visit 7-13	2.273	***	(1.826	2.830)				
Visit 14-31	3.510	***	(2.430	5.070)				
Visit 32+	7.180	***	(3.535	14.58)				
Visit 2-13					1.098		(0.999	1.206)
Visit 14+					2.617	***	(1.770	3.868)
Hospital 3	5.245	***	(4.820	5.708)				
Hospital 4	1.191	***	(1.076	1.318)	0.214	***	(0.192	0.238)
Distance: 5-9 mins	0.851	***	(0.793	0.914)	0.861	***	(0.783	0.946)
Distance: 10-14 mins	0.901		(0.771	1.053)	0.972		(0.819	1.153)
Out of hours	1.628	***	(1.517	1.746)	1.797	***	(1.643	1.965)
GP referral	0.728	***	(0.661	0.802)	0.666	***	(0.589	0.753)
Number of observations				54356	Number of observations			32977
Log likelihood				-14819.60	Log likelihood			-9569.22
Wald chi2 (32)				3587.2	Wald chi2 (23)			2568.99
Prob > chi2				0.0000	Prob > chi2			0.0000

**significant at 5% level
***significant at 1% level

Model 5 Frequent attendance

Model 5 investigates the factors influencing the likelihood of attending the ED more than three times in the year. In the full sample with all four hospitals, over 12% of attendances are by patients attending more than 3 times during the year. There are differences in the burden of frequent attendances across the hospitals. In Hospitals 1 and 4, less than 3% of patients account for 8.4% of attendances. In Hospital 2, 3.5% of patients account for 11% of attendances, and in Hospital 3 over 5% of patients account for more than 18% of total attendances. For ease of presentation, the term 'frequent attenders' refers to patients with more than 3 visits during the year.

Females are less likely than males to be frequent attenders. Controlling for all other covariates in the model, there is no clear trend in the influence of age on the frequency of attendance. The odds for frequent attendance are generally higher for individuals aged 25 and older relative to the 15-24 age group but they are largely insignificant. The model based on the restricted sample shows that marital status has an important impact on frequency. The odds on frequent attendance are smaller for married and widowed individuals relative to single and separated individuals.

Enabling factors have important impacts on frequency of attendance. Unemployed patients are significantly more likely to have more than 3 visits relative to employed patients. Retired patients and individuals engaged in home duties are also more likely than employed patients to have more than 3 visits. The odds on frequent attendance are greater for medical card holders (with and without private health insurance) relative to the privately insured or those with no additional cover.

Health need factors, proxied by triage, are largely insignificant in the models on frequency of attendance. In the full sample, attendances with standard triage (Triage 4) are significantly less likely to be frequent attenders relative to the other triage categories.

Health service characteristics have important impacts on the frequency of attendance. Frequent attenders are more likely in Hospitals 2 and 3 relative to Hospitals 1 and 4. Individuals who live

more than 4 minutes away from the ED are less likely to be frequent attenders. Time of attendance is not significantly related to frequency of attendance.

Patients who are referred by their GP are less likely to be frequent attenders. Discharge status also has some important linkages with frequency of attendance. The odds on frequent attendance are larger for individuals who self-discharge relative to the reference category of those who are admitted.

Table 7 Results from Model 5 (Dependent variable = probability of 4/more visits)

	All hospitals			Hospitals 3 and 4		
	Odds Ratio	95% CI		Odds Ratio	95% CI	
Female	0.836 ***	(0.757	0.923)	0.540 ***	(0.462	0.631)
Age 25-34	0.847 **	(0.722	0.995)	1.204	(0.910	1.593)
Age 35-44	1.209 **	(1.023	1.430)	1.666 ***	(1.229	2.257)
Age 45-54	1.105	(0.926	1.318)	1.560 ***	(1.125	2.163)
Age 55-64	1.301 ***	(1.084	1.561)	1.687 ***	(1.201	2.368)
Age 65-69	1.002	(0.786	1.276)	1.260	(0.828	1.917)
Age 70-74	1.375 **	(1.076	1.759)	1.192	(0.775	1.834)
Age 75-79	1.353 **	(1.051	1.740)	1.376	(0.895	2.115)
Age 80-84	1.351 **	(1.031	1.769)	1.372	(0.871	2.162)
Age 85+	1.187	(0.892	1.580)	1.242	(0.768	2.007)
Married				0.548 ***	(0.450	0.667)
Separated/Divorced				1.350 **	(1.021	1.786)
Widowed				0.899	(0.698	1.157)
Unemployed	4.747 ***	(4.188	5.381)	3.146 ***	(2.525	3.920)
Home duties	2.629 ***	(2.257	3.061)	2.965 ***	(2.243	3.918)
Retired	2.956 ***	(2.467	3.543)	2.446 ***	(1.837	3.255)
Student	0.658 ***	(0.530	0.817)	0.715	(0.507	1.008)
Private health insurance				0.355 ***	(0.282	0.448)
Med card/Private ins.				1.009	(0.799	1.274)
No additional cover				0.488 ***	(0.399	0.595)
Immediate triage	0.951	(0.613	1.476)	1.197	(0.634	2.262)
Urgent triage	0.982	(0.879	1.096)	0.907	(0.781	1.053)
Standard triage	0.732 ***	(0.643	0.833)	0.872	(0.725	1.050)
Non urgent triage	0.881	(0.666	1.165)	1.437	(0.847	2.439)
Hospital 2	1.253 ***	(1.092	1.437)			
Hospital 3	1.976 ***	(1.731	2.255)			
Hospital 4	0.849 **	(0.738	0.976)	0.490 ***	(0.419	0.573)
Distance: 5-9 mins	0.659 ***	(0.600	0.724)	0.574 ***	(0.497	0.665)
Distance: 10-14 mins	0.605 ***	(0.525	0.698)	0.642 ***	(0.503	0.819)
Out of hours	1.029	(0.953	1.110)	1.071	(0.952	1.204)
GP referral	0.700 ***	(0.635	0.771)	0.715 ***	(0.617	0.828)
Discharged to GP	0.896	(0.783	1.026)	0.979	(0.816	1.175)
Discharged to OPD	1.065	(0.928	1.223)	1.047	(0.857	1.279)
Discharged to self care	1.044	(0.937	1.162)	1.183	(0.998	1.403)
Self-discharge	1.544 ***	(1.319	1.808)	1.397 ***	(1.144	1.706)
Died	0.342 **	(0.138	0.847)	0.274 **	(0.089	0.845)
Discharged to ED clinic	0.971	(0.792	1.191)	1.465 **	(1.095	1.960)
	Number of observations		81667	Number of observations		32965
	Log likelihood		-16687.51	Log likelihood		-6979.84
	Wald chi2 (31)		1664.33	Wald chi2 (35)		1021.73
	Prob > chi2		0.0000	Prob > chi2		0.0000

**significant at 5% level
***significant at 1% level

7. Discussion

Mode of referral

Although the majority of patients in the sample were self-referred, results from Model 1 identified specific factors linked to GP referral. The demographic and socio-economic characteristics of GP referrals are consistent with the findings from the primary care literature on the profiles of individuals who are more likely to use GP services (i.e. females, older age groups, retired individuals, medical card holders, privately insured). This suggests that there is a tendency for those who are more regular users of primary care to use this source of care as their first port of call in the location choice on where to seek care.

The tendency for individuals without cover to be less likely to be referred by a GP, even after controlling for the level of urgency of the complaint, is consistent with the factors influencing GP utilisation. However, this finding is interesting in light of the financial incentives for choosing between primary and emergency care. Privately insured individuals and those with no additional cover face the same set of financial incentives yet they each respond differently to the location choice. Although employment status has been controlled for, it is likely that entitlement status is also capturing differences in socio-economic status and this may be driving the observed behaviours. The results suggest that the more wealthy privately insured individuals are better able to afford GP fees.

Yet this is still puzzling given the €60 charge that applies to an ED visit for all those without a medical card or a letter of referral. However, two factors are important here. First, there is a risk that one GP visit might lead to further visits, where additional charges would apply. By going directly to a higher level of care in the ED (with more equipment, staff resources etc.), this risk is reduced and minimises the visit charges. Individuals with no cover, who are relatively more economically vulnerable, may be more conscious of this risk. Second, it is possible that rather than responding to actual price structures, the public responds to their own perceptions/knowledge of what the price structure is. The costs associated with a GP visit might be more prominent in the public mind than the charge attached to an ED attendance. There is some evidence for this. An unpublished survey of attitudes on ED utilisation found that 27% of

those who had visited an emergency department in the past six months chose to use the ED rather than visiting a GP because the former was cheaper (Red C, 2004). Although the charges are levied on all people who are liable, in practice, the collection rate may be low. In Hospital 3, an audit of ED fee payment found that 51% of fees payable were collected at the time of attendance. Of the remaining 49% who were invoiced by post, just 2% of these had actually been paid six months later.

GP referrals are also more likely to attend the ED for urgent or very urgent complaints relative to self-referred patients. This finding provides some evidence of the gatekeeping role that GPs play in the health system. However the fact that over 25% of the total sample of patients are referred by their GP with non-urgent complaints (Triage 4 and 5) indicates that other factors may be at play in GP referral decisions.

Not surprisingly, the odds of being a GP referral are much lower outside of normal working hours (i.e. after 6pm Monday to Friday, and at weekends). This is the case even in the restricted sample for Hospitals 3 and 4 which in the year 2004 were better served by out-of-hours GP co-operatives relative to Hospitals 1 and 2. The out-of-hours GP services operating in Dublin provide more limited hours of services than in the rest of the country. Further research is needed to investigate more closely the impact of the different models of co-ops on emergency departments throughout the country.

Proximity is also important in the location choice. Individuals living within 4 minutes of the ED are more likely to refer themselves directly to the department. GP referrals are more likely to come from areas more than 4 minutes away from the ED. The results suggest that people in need of care have a tendency to go to the nearest available health service provider.

Triage level

Results from Model 2 show that the majority of ED cases are in need of urgent medical attention and less than 40% are in the less urgent categories. Many of the studies on non-urgent ED utilisation in the literature have been able to control for health status and other factors known to influence the utilisation choice (e.g. preferences for emergency versus primary care; availability

of regular source of alternative care etc.). These data are not available in this study and thus strong conclusions about inappropriate utilisation of these four EDs are not made.

However, there are specific factors that are associated with the less urgent cases and these can be compared with the literature. Males are more likely than females to present for non-urgent complaints. Younger age groups are more likely to be non-urgent cases and this is consistent with other studies (e.g. Cunningham et al., 1995). Unemployed, those engaged in home duties, and retired individuals are less likely to be non-urgent attenders relative to employed individuals. The result for unemployment is interesting as poor socio-economic status has been identified as a trigger of non-urgent ED utilisation in other studies. Medical card holders (with and without private health insurance) are less likely to be non-urgent relative to privately insured individuals and those with no cover[13]. Socio-economic status is closely linked with deprivation and health status. Thus the relationships between the socio-economic indicators and urgency in this study could in fact be capturing health status effects that have not otherwise been controlled for.

Non-urgent utilisation of emergency services has also been linked in the literature to lack of continuity of care with a primary provider. As indicated by Nolan & Nolan (2004) medical card holders are likely to visit their GP more often relative to non medical card holders, suggesting that this group has greater continuity of care with primary providers relative to the other groups. This could further explain the observed differences in non-urgent utilisation of emergency services across the entitlement groups. Relative to individuals with no cover, privately insured individuals have more frequent contact with primary care providers, and the odds on non-urgent visits for the privately insured are in fact lower (although only marginally) than for individuals with no cover.

Inpatient admission

Consistent with national estimates of inpatient admissions from emergency departments, almost a quarter of all ED attendances in the sample were admitted. It is assumed that decisions on whether or not to admit a patient are driven more by medical professionals and health need rather

[13] Although the difference between individuals with duplicate cover and privately insured individuals is not statistically significant.

than by patient level characteristics or choices. It is therefore interesting that a range of patient level factors are found to be significantly associated with the likelihood of admission.

Very urgent cases are more likely to be admitted relative to less urgent cases[14]. Thus triage acts as a valid indicator of severity and health status.

The influence of age on admission rates that has been already highlighted in the Irish literature is apparent from this analysis. Even after controlling for triage level, older age groups are much more likely to be admitted. This suggests that even for less acute complaints, older people present with more complex health problems that require more extensive medical attention than is needed for younger patients.

It is likely that socio-economic factors are also picking up on health status variations. Unemployed individuals and medical card holders are both more likely to be admitted, in line with assumptions of higher deprivation and poorer health status amongst these groups.

GP referrals are more likely to be urgent cases and are thus more likely to require admission. This is certainly evidence that GPs are referring cases that are relatively serious and require advanced medical attention in the form of inpatient care. Yet this does not automatically imply that all GP referrals are appropriate for emergency department care. Even after controlling for triage, GP referrals are more likely to be admitted relative to self-referred cases. As indicated above, this suggests that GPs may be referring patients to the ED as a route to an inpatient bed in the system.

Self-discharge

In contrast to those who are admitted, patients who discharge themselves are more likely to be from the younger age groups and to have lower levels of triage.

[14] Patients with immediate need for medical attention represent a small proportion of patients and their discharge outcome tends be divided between deaths and inpatient admissions.

However, controlling for age and triage, individuals who are unemployed and those who hold a medical card are more likely to self-discharge. Yet these factors are also important indicators of inpatient admission. Patients who self-discharge may return at a later stage for the same complaint if care from an alternative provider is not sought in the meantime. Dynamic analysis could investigate factors involved in the patterns of attendance and re-attendance by self-dischargers to further understand this process. It is possible that following self-discharge on the first visit, the untreated patient then re-attends with a more acute presenting complaint and is admitted on the subsequent visit.

The influence of entitlement on self-discharging is also interesting in relation to availability of alternative sources of care. In the choice between waiting for care within the emergency department and seeking care elsewhere, medical card holders have easier financial access (i.e. free) to alternative primary care relative to the privately insured and those without cover. Medical card holders thus have less incentive to wait for long periods of time at the ED relative to the other entitlement groups and the results support this hypothesis.

There is further support for the gatekeeping role of GPs as patients who are GP referred are less likely to discharge themselves.

Frequent attendance

The profile of frequent attenders in the four hospitals is consistent with available Irish and international literature. Factors associated with frequent attendance (defined as 4 or more visits in a year) include males, unemployment and medical card entitlement. The latter two are indicators of poorer socio-economic background and also of lower health status. The relatively intensive use of primary care by medical card holders is also consistent with the findings from Byrne et al. (2003) that frequent ED users are also likely to be regular users of other alternative sources of care. Ease of access is clearly linked to frequency as patients living within 4 minutes of the EDs are more likely to attend more than 3 times in the year.

Triage is not a strong predictor of frequency when all other covariates are included in the model. This is possibly due to the non linear relationship between triage and number of visits that is

indicated in Model 2. For individuals who are medium users of the ED, the likelihood of the complaint being urgent is greater relative to individuals on their first or only visit. However for heavy users of the ED, the urgency of the complaint declines as the number of visits extends beyond 14. Frequent attenders are also more likely to self-discharge than to be admitted. These factors further point to the need for some dynamic analysis of these data to better understand the way in which frequent attenders are using the emergency departments.

Model linkages

As noted earlier, the ideal way to analyse emergency department utilisation would be as a set of sequential steps from the decision to seek care through to decisions on discharge. This would give a dynamic picture of key characteristics influencing the different pathways through the emergency system that different groups may be taking. Instead these different steps have been analysed as separate stages in line with available data.

It is important not to over-interpret the findings but it is possible to identify some interesting trends in the data that can serve to inform current concerns in emergency care in Ireland.

Older age, unemployment, medical card entitlement, and individuals with no additional entitlement are factors associated with relatively high use of emergency services in the Dublin area (Smith, 2007). These are also linked to particular patterns of emergency department use.

Controlling for all other factors, older aged individuals are more likely to be referred by their GP, to present with relatively urgent complaints, and to be admitted. Concerns with the burden of older age groups on emergency services have already been noted in the Irish literature. These concerns are supported by this analysis and emphasises the need to expand facilities appropriate to the needs of the elderly and to examine further the referral patterns by GPs.

Unemployed individuals are more likely to refer to the emergency department with urgent complaints relative to employed individuals. These individuals are also more likely than employed individuals to be admitted. Relative to all other occupation categories, the unemployed are more likely to discharge themselves from the department and to attend frequently during the

year. These patterns hold when all other covariates are controlled in the models. This group of individuals clearly have high health needs and are attending the ED with conditions that are urgent and require admission. However, the strong associations of this group with frequency of attendance and self-discharging suggests that their needs are not being met in the most effective and efficient way. Dynamic analysis could help to understand in more depth the ways in which this group is using the ED and to identify how their needs could be more appropriately met.

Medical card holders are more likely to be referred by their GP, to present with more urgent complaints, and to be admitted. However they are also more likely than the other entitlement groups to self-discharge and to attend frequently[15]. The relative intensity with which medical card holders make use of primary care in Ireland has been well documented. This analysis shows that this intensive use extends to the emergency department also, although health status has not been controlled for as comprehensively as in the primary care literature.

Individuals with no additional cover also have high ED utilisation rates but the analysis in this paper indicates that these individuals are using the emergency department in different ways to the medical card holders. The non-covered attend for less urgent complaints, are less likely to be admitted and attend less frequently relative to medical card holders. They are also less likely to self-discharge relative to medical card holders. These patterns suggest that while the health needs of this group are clearly lower relative to medical card holders, their access to primary care is restricted leading to relatively high utilisation of emergency services for non urgent reasons. The patterns of utilisation are similar for non-covered to those of the privately insured. However the latter are more likely to be referred by their GP and have lower utilisation rates relative to the non-covered (Smith, 2007). This suggests that while the health needs of these two groups may be similar, the privately insured are making more use of primary care services while the non-covered are making more use of emergency care services. This is despite the fact that both groups face the same financial incentives for primary and emergency care. The results support the suggestion that the charges attached to emergency care are not perceived to be as much of an access barrier as they can be for primary care.

[15] The similarities in the results for the unemployed and the medical card categories are likely to reflect common socio-economic and health status indicating a degree of multicollinearity in the models.

Finally, there are important differences across the hospital sites in the burden and source of cases received. Hospital 3 is distinctive in terms of a significantly higher proportion of urgent cases relative to the other hospitals. This triage burden is consistent with the high level of deprivation in the surrounding catchment population. The odds of self-discharging are also significantly greater in this hospital. It is possible that these two observations are linked. The burden of urgent cases on available resources (staff, equipment etc.) could be triggering long delays which may be contributing to higher rates of self-discharge by patients unable or unwilling to wait. However, in data published by the Health Services Executive on waiting times, there are no consistent trends for higher waiting times in Hospital 1 relative to the others in the sample. The variations across the hospitals are thus difficult to entangle but nevertheless indicate the importance of using more than one site to get a more robust picture of the ways in which emergency department services are being used.

8. Conclusions

Analysis in this paper has focused on different stages within an emergency department visit. While this analysis does not provide direct answers to the key questions and challenges about emergency care in Ireland, it provides some evidence to inform the debates. First, characteristics that are linked to relatively high use of emergency services in the Dublin area are also linked to particular patterns of use within the emergency department system. Second, gatekeeping by GPs is evident, but there are also signs that some patients may be referred to the ED as a route to an inpatient bed (e.g. older patients). Third, important distinctions between regular primary care and emergency care users are suggested by the analysis on referral source.

Further analysis is warranted to exploit the dynamic information in the data, to identify patterns of use for frequent attenders from one visit to the next. The analysis of discharge in this paper has focused on admissions and self-discharges. Patients can also be referred onwards to a GP, to an outpatient appointment or to other care providers. Future work could explore these other discharge patterns.

Overall, the advantage of using four hospitals has been to allow a more robust picture of what happens in an emergency department in Dublin from referral through to discharge and frequency of attendance.

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Table 8 Labels and definitions for independent covariates

Variable	Definition	
Female	=1 if female (Base category = male)	=0 otherwise
Age 25-34	=1 if aged 25-34 years	=0 otherwise
Age 35-44	=1 if aged 25-34 years	=0 otherwise
Age 45-54	=1 if aged 25-34 years	=0 otherwise
Age 55-64	=1 if aged 25-34 years	=0 otherwise
Age 65-69	=1 if aged 25-34 years	=0 otherwise
Age 70-74	=1 if aged 25-34 years	=0 otherwise
Age 75-79	=1 if aged 25-34 years	=0 otherwise
Age 80-84	=1 if aged 25-34 years	=0 otherwise
Age 85+	=1 if aged 25-34 years (Base category = 15-24 years)	=0 otherwise
Age 55+	=1 if aged 55+ years (Base category = 15-54 years)	=0 otherwise
Age 65+	=1 if aged 65+ years (Base category = 15-64 years)	=0 otherwise
Married	=1 if married	=0 otherwise
Separated/Divorced	=1 if separated/divorced	=0 otherwise
Widowed	=1 if widowed (Base category = single)	=0 otherwise
Unemployed	=1 if unemployed	=0 otherwise
Home duties	=1 if engaged in home duties	=0 otherwise
Retired	=1 if retired	=0 otherwise
Student	=1 if student (Base category = employed)	=0 otherwise
Medical card holder	=1 if patient holds a medical card only	=0 otherwise
Private health insurance	=1 if patient holds private health insurance only	=0 otherwise
Med card/Private ins.	=1 if patient holds both medical card and private health insurance	=0 otherwise
No additional cover	=1 if patient has no additional cover from medical card or insurance (Base category varies)	=0 otherwise
Immediate triage	=1 if Triage level 1 (immediate)	=0 otherwise
Very urgent triage	=1 if Triage level 2 (very urgent)	=0 otherwise
Urgent triage	=1 if Triage level 3 (urgent)	=0 otherwise
Standard triage	=1 if Triage level 4 (standard)	=0 otherwise
Non urgent triage	=1 if Triage level 5 (non urgent)	=0 otherwise
Standard/non urgent triage	=1 if Triage level 4 or 5 (standard/non urgent) (Base category varies)	=0 otherwise
Visit 2	=1 if patient attending for 2nd visit	=0 otherwise
Visit 3	=1 if patient attending for 3rd visit	=0 otherwise
Visit 4	=1 if patient attending for 4th visit	=0 otherwise
Visit 5	=1 if patient attending for 5th visit	=0 otherwise
Visit 6	=1 if patient attending for 6th visit	=0 otherwise
Visit 7-13	=1 if patient attending for 7th-13th visit	=0 otherwise
Visit 14-31	=1 if patient attending for 14th-31st visit	=0 otherwise
Visit 32+	=1 if patient attending for 32nd+ visit	=0 otherwise
Visit 2-13	=1 if patient attending for 2nd-13th visit	=0 otherwise
Visit 14+	=1 if patient attending for 14th+ visit	=0 otherwise
Visit 4+	=1 if patient attending for 4th+ visit (Base category = patient attending for 1st/only visit)	=0 otherwise
Hospital 2	=1 if attending Hospital 2	=0 otherwise
Hospital 3	=1 if attending Hospital 3	=0 otherwise
Hospital 4	=1 if attending Hospital 4 (Base category = Hospital 1)	=0 otherwise
Distance: 5-9 mins	=1 if live within 5-9 minutes of the ED	=0 otherwise
Distance: 10-14 mins	=1 if live within 10-14 minutes of the ED (Base category = live within 0-4 mins of the ED)	=0 otherwise
Out of hours	=1 if out of hours (after 6pm Mon-Fri; weekends/bank holidays) (Base category = In hours (9am-6pm Mon-Fri)	=0 otherwise
GP referral	=1 if referred by GP (Base category = self referred)	=0 otherwise
Discharged to GP	=1 if discharged to GP care	=0 otherwise
Discharged to OPD	=1 if discharged to outpatient care	=0 otherwise
Discharged to self care	=1 if discharged home to self care	=0 otherwise
Self-discharge	=1 if patient self discharges	=0 otherwise
Died	=1 if patient dies	=0 otherwise
Discharged to ED clinic	=1 if discharged to ED return clinic (e.g. for dressing) (Base category = admitted)	=0 otherwise

Table 9 Descriptive statistics for the five dependent variables in the logit models, by hospital (2004)

	Hospital 1 (2004)	Hospital 2 (2004)	Hospital 3 (2004)	Hospital 4 (2004)
	%	%	%	%
Referral source				
GP referral	19.44	19.19	16.95	23.89
Self referral	78.39	77.88	80.75	72.07
Hospital referral	2.17	2.92	2.31	4.04
Total	100.00	100.00	100.00	100.00
Discharge destination				
Admitted	21.54	19.58	31.98	30.93
GP	28.72	-	13.21	19.74
OPD	19.95	3.55	12.38	9.77
Self-care	19.78	76.87	18.89	32.58
Self-discharge	9.55	-	22.88	6.46
Died	0.45	-	0.67	0.51
Total	100.00	100.00	100.00	100.00
Triage category				
1 Immediate	0.88	0.65	1.24	1.17
2 Very urgent	3.91	11.10	17.72	19.03
3 Urgent	41.38	49.06	53.71	46.48
4 Standard	49.33	37.54	25.40	32.70
5 Non urgent	4.51	1.65	1.93	0.61
Total	100.00	100.00	100.00	100.00
No. of visits				
1-3 visits	91.49	88.70	80.94	91.44
4-11 visits	7.94	10.17	14.24	7.72
12+ visits	0.57	1.13	4.82	0.84
Total	100.00	100.00	100.00	100.00