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Eligibility for Free Primary Care and Avoidable Hospitalisations in Ireland

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Abstract: Using hospital discharge data covering the period 1999-2004, the purpose of this paper is to examine the determinants of avoidable hospitalisations in Ireland, with a particular focus on the role of eligibility for free primary health care. Avoidable hospitalisations are those that are potentially avoidable with timely and effective access to primary care services and/or that can be treated more appropriately in a primary care setting, and are often used as an indicator of access to primary care. The issue is particularly relevant for Ireland, where access to free primary care is restricted to those on low incomes (with approximately 30 per cent of the population currently eligible). The results indicate that eligibility for free GP services, as well as GP availability, is significant in explaining the probability of being in hospital with an avoidable condition.

Key Words: Avoidable Hospitalisation; Primary Care; Eligibility; Ireland

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1 Introduction

In Ireland, approximately 30 per cent of the population are eligible for free public health services, including primary care services, prescription medicines and hospital services (‘medical card patients’). The remaining 70 per cent are entitled to free public hospital services (subject to small co-payments), but must pay in full for all primary care services and prescription medicines (‘private patients’). Eligibility for a medical card is determined primarily on the basis of an income means test. With the exception of accident and emergency (A&E) visits, GPs are the individual’s first point of contact with the health service, with GPs acting as gatekeepers for access to secondary care services in Ireland. GPs receive a capitation payment from the state for all medical card patients on their list and a fee-for-service from their private patients, with the majority of GPs in Ireland treating both medical card and private patients. Approximately 50 per cent of the Irish population also purchase private health insurance, which covers the full or partial cost of treatment and care services provided in private hospitals and by medical consultants in private beds in public hospitals but in general does not cover the cost of GP services or prescribed medicines unless a large deductible is reached.

The extent to which this system promotes equal access to GP services has been the subject of an extensive literature (see Section 2), with previous studies all finding that the incentives inherent in medical card eligibility lead to significantly higher levels of GP visiting among those with medical cards, even after controlling for differences in need. Internationally, access to free or heavily subsidised primary care is associated with more frequent GP visits (Chiappori *et al*., 1998, Jimenez-Martin *et al*., 2004 and Van Doorslaer *et al*., 2002), having a more regular source of care (Centers for Disease Control and Prevention, 1998), increased use of preventative services (DeVoe *et al*., 2003 and Gadomski *et al*., 1998) and countries with a well-defined primary health care system generally perform better in terms of health outcomes than those who do not (Macinko *et al*., 2003). The effect of free or subsidised primary care on the use of hospital services is more ambiguous (Dafny and Gruber, 2005); while enhanced access to primary services may reduce hospitalisations by facilitating care in more appropriate out-patient settings (the ‘efficiency’ effect), such insurance may also increase access to hospital overall (the ‘access’ effect).

However, a large international literature has documented clear associations between access to primary care and avoidable hospitalisations, i.e., hospitalisations that are potentially avoidable with timely and effective access to primary care services or that can be treated more appropriately in a primary care setting (Page *et al*., 2007). In other words, access to timely and effective primary care encourages the utilisation of GP services both as a first point of contact and as an ongoing source of care, and thereby reduces the probability of being hospitalised with an avoidable condition. It is important to distinguish between ‘avoidable’ hospitalisations and those that may be deemed ‘unnecessary’. Avoidable hospitalisations include those that could be treated more appropriately in a primary care setting (e.g., hypertension) and could therefore be classified as ‘unnecessary’ hospitalisations, as well as those conditions that could be prevented with timely access to primary care (e.g., rickets) but which are classified as ‘necessary’ hospitalisations once the condition has developed (see Section 3).

Using detailed hospital discharge data from the Hospital In-Patient Enquiry (HIPE) for the period 1999-2003, supplemented with regional data from the Department of Health and Children and Census of Population, the purpose of this paper is to examine the determinants of avoidable hospitalisations in Ireland, with a particular focus on eligibility for free GP care. Here we focus on the ‘efficiency’ effect associated with eligibility for free GP services, by assessing the extent to which such eligibility results in a lower probability of being in hospital with an avoidable condition. Section 2 discusses previous research, while Section 3 introduces the data used in this analysis and presents broad descriptive statistics. Section 4 presents the methodology, Section 5 discusses the empirical results while Section 6 summarises, concludes and provides suggestions for future research.

2 Previous Research

One of the earliest introductions to the concept of avoidable hospitalisations is the work by Billings *et al*. (1993), which identifies a list of 28 conditions as part of a project assessing access to primary care in New York. They find that for certain conditions defined as avoidable, hospitalisation rates are higher in low income areas than in high-income areas where appropriate outpatient care is more readily available. Much of the earlier research uses regional level data (at various levels of aggregation) to compare avoidable hospitalisation rates among areas with differing socio-economic profiles, insurance coverage, GP density *etc*. (see Basu *et al*., 2002, Bindman *et al*., 1995, Epstein, 2001, Gaskin and Hoffman, 2000, Nitti and Ng, 2003, Page *et al*., 2007, Pappas *et al*., 1997, Parchman and Culler, 1999 and Roos *et al*., 2005). A number of studies undertake international comparisons of avoidable hospitalisation rates, principally between the US (with relatively poor access to primary care for the majority of the population) and European countries (with universal access to free primary care services) (see for example, Billings *et al*., 1996, Casanova and Starfield, 1995 and Gusmano *et al*., 2000). A major failing of such regional-level analyses is the potential for ecological fallacy (see Parchman and Culler, 1998 and Epstein, 2001), whereby inferences about individuals are made on the basis of the assumption that individual characteristics correspond to group characteristics. Using individual-level data allows researchers to control more comprehensively for individual characteristics, as well as regional and hospital-level characteristics (see for example, Blustein *et al*., 1998, Culler *et al*., 1998, Gill *et al*., 1998, Gadomski *et al*., 1998, Parker and Shoendorf, 2000 and Weissman *et al*., 1992).

In an attempt to establish a causal link between access to primary health care and avoidable hospitalisations, more recent research has used difference-in-difference methods to assess the impact of various policy changes on avoidable hospitalisations. Dafny and Gruber (2005) find that the 1983-1996 Medicaid expansions in the US are associated with a significant decline in avoidable hospitalisations among children (and a significant increase in overall hospitalisations). Kaestner *et al*. (2000) use difference-in-difference techniques to examine the differential change in the rates of hospitalisations and lengths of stay for infants from low-income, compared with high-income, zip codes. They find that, contrary to expectations, expansions in the Medicaid programme did not result in a decrease in the avoidable hospitalisation rate or average length of stay (a proxy for severity of illness at admission) for infants from low income areas. However, examining the probability of experiencing an avoidable hospitalisation on a cross-sectional basis, they find a clear socio-economic gradient in avoidable hospitalisations by income.

In Ireland, an extensive literature has examined the role of differential access to free GP services on the utilisation of GP services, with Tussing (1983, 1985), Nolan (1991, 1993), Madden *et al*. (2005), Nolan (2007), Nolan (2008a, 2008b) and Nolan and Nolan (2008) all finding that the incentives inherent in medical card eligibility lead to significantly higher levels of GP visiting among those with medical cards, even after controlling for differences in need. Analyses of the utilisation of hospital services are fewer, with previous research focussing on the implications of the public-private mix in Irish public hospitals for equity of access (see for example, Layte and Nolan, 2004, Layte, 2007, Nolan and Wiley, 2000 and O'Reilly and Wiley, 2007, 2008). In terms of avoidable hospitalisations, a 2007 report on acute public hospital bed capacity in Ireland found that 13 per cent of patients were admitted to hospital 'unnecessarily' (PA Consulting, 2007), although there was no analysis of the factors influencing this rate. Smith (2007) examines A&E attendances at four large teaching hospitals in Dublin and finds that patients with no cover (i.e., without a medical card or private insurance) are significantly more likely to visit A&E with non-urgent complaints and less likely to be admitted to hospital than medical card patients. This suggests that even though the health needs of those with no medical cover are lower than medical card patients, poorer access to primary care leads to a relatively higher utilisation of A&E services for non-urgent reasons. The purpose of this paper is therefore to apply techniques from the international literature on avoidable hospitalisations to the Irish situation, where differing eligibility for free GP care may be expected to impact on the probability of experiencing an avoidable hospitalisation.

3. Data

In this paper, the unit of analysis is a hospital discharge. Data on hospital discharges are available from the Hospital In-Patient Enquiry (HIPE), a computer-based health information system which is designed to collect demographic, clinical and administrative data on all day case and in-patient discharges (including deaths) from acute hospitals in Ireland. Each HIPE discharge record represents an episode of care. As of 2006 there were 58 hospitals participating in HIPE (including two private hospitals), with a coverage rate of approximately 95 per cent. Currently, data from 1999-2006 on the public hospitals participating in HIPE are available for research purposes.

While HIPE provide comprehensive clinical and administrative data on the majority of discharges from acute public hospitals in Ireland, a unique patient identifier is not available, meaning that we cannot identify repeat admissions. Undertaking the analysis at a more aggregated regional level would overcome this problem (see O'Reilly and Wiley, 2008) but apart from the problems associated with making inferences about individual behaviour using aggregated data, any analysis is hindered by the lack of detailed demographic and socio-economic data at a regional level in Ireland. In particular, information on medical card eligibility is available only at a highly aggregated county level, and information on population health status is not even available at this level. For this reason, we persist with a discharge-level analysis, controlling for possible dependence between observations (see Section 4).

We concentrate on in-patient discharges for residents of the Republic of Ireland, as those resident outside the Republic are exposed to different healthcare systems with differing eligibility for free or subsidised primary care services. We also exclude children (i.e., those aged 18 years or younger), those aged 70 years or older[1], long-stay patients (i.e., those with a length of stay greater than 30 days) and discharges from paediatric and long-stay hospitals. Finally, in an attempt to mitigate the problem of repeated observations on the same individual, we exclude discharges that were re-admissions or transfers from HIPE hospitals. For our sample over the period we analyse (1999-2003), the total number of in-patient discharges increased by 10.4 per cent, but due to population growth, the total number of in-patient discharges per 1,000 persons decreased by 3.3 per cent (from 121.2 in 1999 to 117.2 in 2003) (see Table 1). This is consistent with international trends, and with the substantial increase in day-case activity observed in Ireland over the period.

The dependent variable is a binary variable indicating an avoidable hospitalisation. A key challenge of this type of research is the identification of hospitalisations that may be deemed avoidable. An extensive literature has compiled sets of conditions for which hospitalisations could be reduced or eliminated if adequate primary care were provided; in this paper, we follow the classification employed by Page *et al*. (2007). It is important to define such conditions in a way that excludes conditions that are preventable with other measures such as population-based health promotion and injury prevention strategies, such as smoking-related illnesses or road traffic accidents. In common with all other studies of avoidable hospitalisations (see for example, Weissman *et al*., 1993), we identify avoidable hospitalisations by matching codes for principal diagnoses only. While it is possible that certain admissions may be misclassified due to different coding orders, it is unlikely that this would vary systematically across different population sub-groups. Table A1 provides a list of avoidable hospitalisation conditions and their associated ICD-9-CM codes.

[1] Over 70s were granted automatic entitlement to a medical card from 1 July 2001 (although this has since been revoked). The effect of the extension of eligibility for a medical card to all over 70s in July 2001 is the subject of current research by the author.

Table 1 shows that approximately 10 per cent of all in-patient discharges among 19-69 year-olds in Ireland over the period 1999-2003 may be classified as avoidable using the criteria defined in Table A1. Table 1 also illustrates that the number of avoidable hospitalisations per 1,000 population declined from 11.7 in 1999 to 10.7 in 2003. In a comparison of avoidable hospitalisation rates for the under 65s in a selection of US and Canadian cities in 1990, Billings *et al*. (1996) reports rates of avoidable hospitalisations per 1,000 that range from 6.9 in Portland to 15.2 in New York city. Basu *et al*. (2002) reports an avoidable hospitalisation rate of 15.4 per 1,000 population among New York adults aged 20-64 in 1995. In 1999, the top five avoidable conditions were angina, chronic obstructive pulmonary disease (COPD), convulsions, asthma and influenza (in that order), while in 2003, the top five were largely the same (cellulitis, convulsions, influenza, COPD and angina). The top five avoidable hospitalisations accounted for 52 (53) per cent of all avoidable discharges, and 5 (5) per cent of all in-patient discharges in 1999 (2003).

The major focus of this paper is the impact of access to free GP care on avoidable hospitalisations. Our main independent variable of interest is a dummy variable indicating eligibility for free GP care. Ideally, we would like detailed information on socio-economic status in an attempt to distinguish further between private patients of differing income. Unfortunately, HIPE does not record the private insurance status or income of the individual, but by using information on medical card eligibility combined with information on whether the individual was treated by a public or private consultant while in hospital[2], we can construct a three-category indicator of access to health care as follows:

- Medical card[3]
- No medical card and private care (i.e., no medical card and treated by a private consultant)
- No medical card and public care (i.e., no medical card and treated by a public consultant)

While we do not know what proportion of private patients who are treated by a private consultant have private health insurance or pay out-of-pocket, we assume that such patients are likely to be of higher socio-economic status than those private patients treated by a public

[2] The majority of hospital consultants are contracted to provide 30 hours a week service to public patients. The remainder of their time may be spent in private practice, much of which is carried out in public hospitals (see Nolan and Wiley, 2000).

[3] A very small proportion of total discharges are medical card patients who were treated by a private consultant (1.9 per cent); we therefore aggregate medical card patients to one category in our econometric analyses.

consultant (who most likely will not have private health insurance and/or the resources to pay for private hospital care).

Other independent variables include the age, gender and marital status of the individual. In common with other studies using hospital discharge data that suffer from the problem of how to measure underlying health status, we construct an indicator of comorbidity (the Charlson comorbidity index, which identifies discharges with one or more of seventeen comorbidities associated with poor health outcomes). It has been shown to be a good predictor of in-patient mortality, 30-day mortality, length of stay and complications (see Kieszak *et al.*, 1999). While the index ranges from zero to 37, we construct a three-category indicator to identify those scoring zero, one and two or greater. We also include an indicator for discharges where the first secondary diagnosis refers to a condition in a different medical diagnosis group (MDG) to the principal diagnosis. Unfortunately, more general indicators of physical or psychological health status are not available. Seasonal variables and an indicator for admissions over the weekend (when access to GP services might be expected to be more difficult) are also included. Finally, we include an indicator for residents of border counties, as such individuals may be able to access cheaper GP services as private patients under the UK NHS.

In order to include information on supply-side influences on avoidable hospitalisation rates, data from HIPE are supplemented with data from additional sources, albeit at an aggregated regional level. Data on primary care providers and hospital bed capacity from the Department of Health and Children are combined with population data from the Central Statistics Office to provide information on the number of GPs, public health nurses, in-patient beds and day beds per 1,000 population (at health board level). In-patient beds and day-patient beds per 1,000 population are included to proxy hospital capacity constraints; in areas with bed shortages, GPs may be less willing to refer patients to hospital and more willing to treat avoidable conditions in a primary care setting (see also Basu *et al.*, 2002). Table 2 presents variable definitions and sources.

4 Methods

As our dependent variable is a binary indicator variable, we estimate a pooled binary probit model, as follows:

$$y_{it} = \alpha_i + \beta_1 x_{it} + u_{it} \tag{1}$$

where y_{it} is the binary dependent variable, with observations taking the value one if the hospitalisation is classed as avoidable, x_{it} is the vector of individual- and regional-level characteristics (such as eligibility status, age, gender, GP density *etc*.) and u_{it} is the random error term. Year and hospital dummies are included in each of the models.

Due to the nature of the data available, the analysis suffers from a number of methodological limitations. Ideally, information on users and non-users of hospital services would be available, allowing us to model the determinants of firstly, the probability of being hospitalised, and conditional on that event, the probability of that hospitalisation being for an avoidable condition. We can only identify individuals once they are hospitalised; problems could arise if individuals with different eligibility for free GP care have different probabilities of hospitalisation, given all other influences (see also Gaskin and Hoffman, 2000). Therefore, as data on those who do not enter hospital is not available, the estimates are conditioned on the person being hospitalised. The coefficients (converted to odds ratios) measure the marginal impact of, for example, having a medical card, on the probability that the reason for the hospitalisation was for an avoidable condition, given that the patient was hospitalised.

The fact that the unit of analysis is a hospital discharge rather than an individual could cause a repeated measurement problem for persons with multiple admissions in a year. We exclude planned re-admissions and transfers but multiple admissions for the same person cannot be identified. In an attempt to overcome this problem, we also run the model on specific dates, under the assumption that is very unlikely that an individual would be admitted, discharged, and admitted again in the same 24-hour period. Blustein *et al*. (1998) estimated the discharge-level and individual-level models for a sample of Medicare patients and did not find significant differences.[4]

Finally, variables such as GP and public nurse density and the number of in-patient and day-patient beds are measured at an aggregated health board level, while information on other potential influential variables such as patients' GP visiting behaviour is unavailable. Nonetheless, the research provides first estimates of the effect of eligibility for free GP care on avoidable hospitalisations in Ireland.

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[4] We similarly find little difference in the estimated results between those from the full sample and those run on individual days (results available on request from the author).

5 Empirical Results

Table 3 presents summary statistics on the extent of avoidable hospitalisations across the different eligibility categories. Controlling for all other influences on avoidable hospitalisations (such as health need, GP availability *etc*.), we hypothesise that medical card eligibility lowers the price of primary care, encourages the utilisation of GP services both as a first point of contact and as an ongoing source of care, and thereby reduces the probability of being in hospital with an avoidable condition. For private patients treated by a public consultant, we hypothesise that these patients will have the highest probability of being hospitalised for an avoidable condition due to the relatively high cost of a GP consultation and reliance on public hospital care (which may be subject to long waiting lists). For private patients treated by a private consultant, we hypothesise an effect somewhere in the middle; while GP visits must be paid for out-of-pocket, higher incomes mean that the cost of a GP visit is not as prohibitive as for those on lower incomes and in addition, access to private hospital care (in public as well as private hospitals) may lead to faster access to secondary care.

The data in Table 3 suggest a more complicated picture. Private patients treated by a private consultant (i.e., higher income private patients) have the lowest rates of avoidable hospitalisations across the period 1999-2003 (as expected), but medical card patients have higher rates of avoidable hospitalisations than private patients treated by a public consultant (i.e., lower income private patients). However, those with medical cards are on average, sicker, older and poorer than those without (see Nolan and Nolan, 2007), necessitating the use of multivariate analysis to untangle the independent effect of eligibility status. In addition, it must be noted that GPs are paid on a capitation basis for their medical card patients, while receiving fee-for-service payments from their private patients. This obviously creates an incentive for GPs to lessen the amount of time spent with medical card patients, to refer to secondary care as early as possible and to discourage repeat consultations (see Nolan and Nolan, 2007). However, given the absence of evidence in favour of demand inducement on the part of Irish GPs (see Madden *et al*., 2005), it is more likely that these aggregated patterns are driven by the substantially poorer health and socio-economic profile of medical card patients.

Columns (1) and (2) in Table 4 present empirical results from the restricted (i.e., eligibility variables only) and unrestricted (i.e., including other independent variables such as age, gender *etc*.) versions of the models respectively. The results in column (1), while rejected in favour of the unrestricted results on the basis of log-likelihood tests, provide baseline estimates of the effect of eligibility for free GP care on the probability of experiencing an avoidable hospitalisation. Consistent with the aggregate patterns presented in Table 3, private patients treated by a private consultant (i.e., high income private patients) are significantly less likely to be in hospital for an avoidable condition, in comparison with private patients treated by a public consultant. Once again, consistent with the aggregate patterns in Table 3, medical card patients are significantly more likely to be in hospital for an avoidable condition than private patients treated by a public consultant.

The results in column (2) add controls for health need and other socio-economic characteristics as well as regional, supply-side factors. The effects for private patients treated by a private consultant remain largely unchanged in magnitude, while the effects for medical card patients fall in size, although all remain highly significant. Medical card patients are approximately 1.3 times more likely to be in hospital for an avoidable condition than private patients treated by a public consultant, while private patients treated by a private consultant are approximately 5 per cent less likely to be in hospital for an avoidable condition. We know from previous research that medical card patients are significantly more likely to experience chronic ill-health and to be more intensive users of health services (see Layte *et al*., 2007), so it is likely that this is driving some of the estimated effect. While realising that our controls for health and socio-economic status may not be fully picking up differences in need and socio-economic status between those with differing eligibility for free GP care, the results do nonetheless suggest that eligibility for free GP care has an independent effect on the probability of experiencing an avoidable hospitalisation.

Given the direction of the effects (i.e., medical card patients have the highest probability of experiencing an avoidable hospitalisation, followed by private patients treated by a public consultant, while private patients treated by a private consultant have the lowest probability), it is possible that GP reimbursement may be influencing these results. GPs receive a capitation payment from the state for their medical card patients and receive a fee-for-service for each visit from their private patients. The nature of the current system of reimbursement for GPs creates incentives for GPs to minimise consultation times, reduce the frequency of follow-up appointments and refer medical card patients to secondary care as early as possible. The current system may therefore incentivise GPs to treat private patients with an avoidable condition in their surgery, while encouraging them to refer similar medical card patients to secondary care. However, previous research finds no evidence in favour of such behaviour by Irish GPs (Madden *et al*., 2005). Of course, it is also possible that differences in the probability of being treated in a public or private hospital for those with an avoidable condition could be driving this result; if private patients with private insurance with an avoidable condition are more likely to seek treatment in a private hospital, while those with medical cards or with no cover seek treatment in a public hospital, this could also account for the direction of the effects observed. Without any information on activity in private hospitals in Ireland, it is impossible to test this proposition. However, the three types of patient have very similar avoidable hospitalisation conditions, reducing the possibility that the three groups differ significantly in the probability of being treated for such conditions in public versus private facilities. Another possible explanation may be that doctors are more likely to admit medical card patients with avoidable conditions if they have concerns over compliance with follow-up instructions and after-care (Weissman *et al*., 1992).

We also investigate the impact of institutional or supply-side factors and find significant effects. For example, patients admitted to hospital at the weekend are significantly more likely to have an avoidable condition, a result consistent with the relatively poor availability of GP services outside of the traditional Monday-Friday schedule. Similarly, those in border counties (who may be able to avail of cheaper GP services across the border in Northern Ireland) are significantly less likely to be in hospital for an avoidable condition. Our regional supply-side variables are necessarily highly aggregated, and therefore the results for these variables are less robust than for the other explanatory variables. Nonetheless, these results do suggest that residents of areas with a higher number of GPs per capita are significantly less likely to be in hospital for an avoidable condition. The number of public health nurses per capita has a similar effect. Those resident in areas with a higher supply of in-patient and day-patient beds are significantly more likely to be in hospital for an avoidable condition, perhaps due to the increased willingness of GPs to refer patients with an avoidable condition to secondary care in areas with fewer bed shortages.

In summary, the results provide tentative evidence that eligibility for free GP care has an impact on whether those in hospital are being treated for an avoidable condition. While the research has a number of methodological limitations, it is the first attempt to establish a link between eligibility for free GP care and subsequent use of appropriate hospital services. The results suggest that medical card patients are significantly more likely to be in hospital with an avoidable condition, even after controlling for differences in need or other characteristics. This has obvious implications for resource use in the acute hospital sector, as well as patients' own experiences and health outcomes.

In terms of sensitivity testing, we also ran the model on individual years, and find no substantive difference in the effects. We also estimate the models focussing on the three broad groups of avoidable conditions, namely, vaccine-preventable, chronic and acute. Once again, the results are largely consistent with those from the overall model, with the exception of the results for acute conditions which are always insignificant. Finally, the 2002 Census of Population also provides detailed information on socio-economic status at ED (electoral division[5]) level. We therefore estimated the same set of models on 2002 data with an additional control for county-level deprivation score.[6] The results are largely consistent with those from Table 5, and suggest that much of the medical card effect remains when an additional control for socio-economic status (albeit at a regional level) is included.[7]

6 Summary and Conclusions

Avoidable hospitalisation conditions are those that are potentially avoidable with timely and effective access to primary care services or that can be treated more appropriately in a primary care setting, and are often used as an indicator of access to primary care. This research suggests that approximately 10 per cent of in-patient discharges in Ireland over the period 1999-2003 were for an avoidable condition. Despite limitations in data and methods, this study nonetheless provides evidence on the determinants of avoidable hospitalisations in Ireland over the period 1999-2003. The analysis shows that eligibility for a medical card is significantly associated with the probability of experiencing an avoidable hospitalisation, as is the supply of GP services.

[5] The ED is the smallest administrative area for which population statistics are published. There are 3,440 EDs in the state.
[6] Data on unemployment, social class, type of housing tenure, housing quality and car ownership are combined to form the deprivation score (see Kelly and Teljeur, 2007 for further details).
[7] Results from the models with these various alternative specifications are available on request from the author.

The results indicate that private patients treated by a private consultant are significantly less likely than private patients treated by a public consultant to experience an avoidable hospitalisation, despite the fact that both groups must pay in full for GP services. However, private patients treated by a private consultant are likely to be of higher socio-economic status than those treated by a public consultant. In addition, some private health insurance plans now offer partial refunds for GP expenses, with those treated by a private consultant more likely to have private health insurance.[8] Medical card patients are significantly more likely to experience an avoidable hospitalisation than private patients treated by a public consultant, a result contrary to our initial expectations. However, medical card patients are a particularly disadvantaged segment of the population and while we have attempted to control as comprehensively as possible for differences in health and socio-economic status, it is possible that some of this effect is accounted for by the fact that medical card patients are poorer and more likely to experience chronic ill-health than private patients. A further possibility is due to the fact that GPs are reimbursed differently for medical card and private patients, although previous research in Ireland has not found evidence in favour of demand inducement on the part of Irish GPs. However, it is possible that hospital doctors may be more likely to admit a patient with an avoidable hospitalisation with a medical card or no cover if they have concerns over the quality of follow-up care in an out-patient setting that may be available to such patients (see also Weissman *et al*., 1992). The findings for institutional and supply-side factors support the contention that availability of GP care is an important determinant of experiencing an avoidable hospitalisation. Those that are admitted at weekends are significantly more likely to be in hospital for an avoidable condition, as are those resident in areas with a lower number of GPs and public health nurses per capita.

Of course, the research findings are subject to a number of caveats. Firstly, the research suffers from measurement error and omitted variable bias, with information on potentially important variables not available at a sufficiently disaggregated level (e.g., GP density) or just not available at all (e.g., patient income, health status and previous contact with their GP). In particular, information on potentially important variables relating to health and socio-economic status is not available. We know that medical card patients are more intensive users of health services, in part due to their poorer health and socio-economic status; it is therefore

[8] The three main health insurers now offer partial coverage for GP expenses, either as a fixed refund per consultation or as a percentage of the cost. Despite the extension of private medical insurance to partial coverage of GP expenses, data from EU-SILC for 2004 show that the proportion of those with private health insurance availing of these schemes is very low.

possible that part of the estimated effect could be reduced with better controls for such factors (although the estimated odds ratios remain largely the same when the model is run on 2002 data with an additional control for area-level deprivation). In addition, it is possible that differences in the probability of experiencing an avoidable hospitalisation could be due to differences in provider practices or diagnosis, but without more detailed information on individual patients and their GPs, it is difficult to control for this. Ideally, we would like information on non-users of hospital services as well, so that we could model the various factors determining firstly, hospital admission, and conditional on that, the probability of experiencing an avoidable hospitalisation. For our analysis, it is also possible that differences in the probability of experiencing an avoidable hospitalisation could be due to differences in the probability of seeking treatment for such conditions in public and private hospitals. However, the distribution of avoidable conditions is similar across the three eligibility groups, which suggests that there is little systematic difference in the type of hospital chosen for treatment for patients with an avoidable condition.[9] Finally, the absence of a unique patient identifier means that the analysis is necessarily at the discharge-level, rather than individual-level. A unique patient identifier would allow us to track individuals as they re-enter hospital and thereby control for unobserved individual heterogeneity.

[9] In addition, the majority of patients with an avoidable condition enter hospital as emergencies, rather than as planned in-patients.

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TABLES

Table 1 Total In-Patient and Avoidable Discharges, 1999-2003

	1999	2000	2001	2002	2003	*% change*
In-patient discharges	277,027	285,850	298,099	300,251	305,767	*10.4*
In-patient discharges per 1,000 population	121.2	120.4	121.0	118.3	117.2	*-3.3*
Avoidable in-patient discharges	26,803	26,704	27,229	27,227	27,813	*3.8*
Avoidable in-patient discharges per 1,000 population	11.7	11.2	11.0	10.7	10.7	*-9.1*

Excluding non-Republic of Ireland residents, those aged 0-18 years and 70+ years, day cases, re-admissions, transfers and discharges from paediatric and long-stay hospitals.
See Table A1 in the Appendix for a fuller description of conditions that are deemed avoidable.

Table 2 Variable descriptions and sources

	Description	Source
Individual level		
Medical card	=1 if individual has a medical card	HIPE
Private – private consultant	=1 if individual does not have a medical card and is treated by a private consultant (Reference category = private patient and treated by a public consultant)	HIPE
Age 30-39	=1 if aged 30-39 years	HIPE
Age 40-49	=1 if aged 40-49 years	HIPE
Age 50-59	=1 if aged 50-59 years	HIPE
Age 60-69	=1 if aged 60-69 years (Reference group = aged 19-29 years)	HIPE
Female	=1 if female (Reference category = male)	HIPE
Married	=1 if married (Reference category = never married, separated or divorced, widowed)	HIPE
Comorbidity index	Charlson comorbidity index*	HIPE
Weekend	=1 if discharged at the weekend (Saturday or Sunday) (Reference category = discharged on a weekday)	HIPE
Spring	=1 if discharged during Spring	HIPE
Summer	=1 if discharged during Summer	HIPE
Autumn	=1 if discharged during Autumn (Reference category = discharged during Winter)	HIPE
Border	=1 if living in a border county (Louth, Cavan, Monaghan, Leitrim, Donegal) (Reference category = not living in a border county)	HIPE
Health board level		
GP	GPs per 1,000 population	DOHC
Public health nurse	Public health nurses per 1,000 population	DOHC
In-patient beds	In-patient beds per 1,000 population	DOHC
Day beds	Day beds per 1,000 population	DOHC

* constructed from information on secondary diagnoses reported in HIPE using STATA code (http://fmwww.bc.edu/RePEc/bocode/c).

Table 3 Total in-patient and avoidable hospitalisations by eligibility category (per 1,000 population), 1999-2003

	1999	2000	2001	2002	2003	*% change*
Total in-patient discharges						
Medical card	142.7	139.6	143.2	136.1	137.8	*-3.5*
Private – private consultant	65.8	61.7	59.6	59.1	61.2	*-7.0*
Private – public consultant	150.0	167.6	213.6	217.9	201.5	*34.3*
All	121.2	120.4	121.0	118.3	117.2	*-3.3*
Avoidable discharges						
Medical card	18.6	17.6	17.3	17.2	17.8	*-4.5*
Private – private consultant	4.7	4.1	3.9	3.9	4.0	*-14.8*
Private – public consultant	11.9	13.4	16.7	16.3	14.8	*24.6*
All	11.7	11.2	11.0	10.7	10.7	*-9.1*

Excluding non-Republic of Ireland residents, those aged 0-18 years and 70+ years, day cases, re-admissions, transfers and discharges from paediatric and long-stay hospitals.

Table 4 Estimation results (odds ratios)

	(1)	(2)
Medical card	1.55 ***	1.27 ***
Private – private consultant	0.96 ***	0.94 ***
Private – public consultant	ref.	ref.
Age 19-29		ref.
Age 30-39		0.96 ***
Age 40-49		1.36 ***
Age 50-59		1.66 ***
Age 60-69		1.99 ***
Female		0.70 ***
Male		ref.
Never married		ref.
Married		0.72 ***
Charlson index		1.12 ***
Comorbidity – different MDG		1.46 ***
Comorbidity – same MDG		ref.
Spring		0.96 ***
Summer		0.92 ***
Autumn		0.92 ***
Winter		ref.
Weekday		ref.
Weekend		1.07 ***
Border area		0.80 ***
Not living in a border area		ref.
GP		0.58 ***
Public health nurse		0.31 ***
In-patient beds		1.11 ***
Day patient beds		2.41 ***
Time dummies	Y	Y
Hospital dummies	Y	Y
N	1,369,148	1,369,148
Pseudo-R^2	0.0732	0.0997

* significant at 10 per cent level; ** significant at 5 per cent level; *** significant at one per cent level

Models (1) and (2) are the restricted and unrestricted versions of the model run on the full sample of all discharges

Results for the analyses run on individual days are available on request from the author.

APPENDIX A

Table A1 Avoidable Hospitalisation Conditions (ICD-9-CM Codes)

	ICD-9-CM codes
Vaccine-preventable	
Influenza and pneumonia	486, 487, 481, 482.2, 482.3, 482.9, 483.0, 483.8
Other vaccine preventable	032, 033, 037, 045, 055, 056, 070.3, 072, 056.71, 320.0
Chronic	
Diabetes complications	250
Nutritional difficulties	260, 261, 262, 268.0, 268.1
Iron deficiency anaemia	280.8, 280.9
Hypertension	401, 402.00, 402.10, 402.90
Congestive heart failure	402.01, 402.11, 402.91, 428, 518.4
Angina	411.1, 413, 411.8
Chronic obstructive pulmonary disease	491.0, 491.1, 491.8, 491.21,491.9, 492, 494, 496
Asthma	493
Acute	
Dehydration and gastroenteritis	276.5, 558.9
Convulsions and epilepsy	345, 780.3, 642.6
Ear, nose and throat infections	382, 462, 463, 465, 472.1
Dental conditions	101, 521, 522, 523, 525, 526, 528.0, 528.2, 528.3, 528.4, 528.5, 528.6, 528.7, 528.8, 528.9
Perforated/bleeding ulcer	531.0, 531.1, 531.2, 531.4, 531.5, 531.6, 532.0, 532.1, 532.2, 532.4, 532.5, 532.6, 533.0, 533.1, 533.2, 533.4, 533.5, 533.6, 534.0, 534.1, 534.2, 534.4, 534.5, 534.6
Ruptured appendix	540.0
Pyelonephritis	590.0, 590.1, 590.8, 590.9, 593.73
Pelvic inflammatory disease	614, 016.70
Cellulitis	681, 682, 683, 686
Gangrene	785.4

Source: Page *et al.*, 2007

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