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Title: An Extension in Eligibility for Free Primary Care and Avoidable Hospitalisations: A Natural Experiment

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Article title: An Extension in Eligibility for Free Primary Care and Avoidable Hospitalisations: A Natural Experiment

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ABSTRACT

In the Republic of Ireland, approximately 30 per cent of the population ('medical card patients') are entitled to free GP services. Eligibility is determined primarily on the basis of an income means test. The remaining 70 per cent of the population ('private patients') must pay the full cost of GP consultations. In July 2001, eligibility for a medical card was extended to all those over 70 years of age, regardless of income. This extension in eligibility provides a natural experiment whereby we can examine the influence of access to free GP services on avoidable hospitalisations. Avoidable hospitalisations 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. Using hospital discharge data for the period 1999-2004, the purpose of this paper is to test the proposition that enhanced access to GP services for the over 70s after July 2001 led to a decline in avoidable hospitalisations among this group. The results indicate that while avoidable hospitalisations for the over 70s did decline after 2001, they also fell for the under 70s, meaning that a significant difference-in-difference effect could not be identified.

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INTRODUCTION

In the Republic of Ireland, approximately 30 per cent of the population are eligible for free public health services ('medical card patients'). The remaining 70 per cent ('private patients') are entitled to free public hospital services (subject to small co-payments). However, they must pay in full for all primary care services and prescription medicines (although tax relief on medical expenses is available, and a deductible of €120 per month applies for prescription medicines). Eligibility for a medical card is determined primarily on the basis of an income means test, but in July 2001, eligibility for a medical card was extended automatically to all those over 70 years of age. This entitlement has since been revoked, with means testing for medical cards for the over 70s re-introduced from 1 January 2009.

With the exception of accident and emergency (A&E) visits, the general practitioner (GP) is an individual's first point of contact with the health service, with GPs acting as gatekeepers for access to secondary care services. 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 (PHI), 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 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. For the period under review in this paper however, the majority of PHI plans provided cover for in-patient hospital expenses only.

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Ireland has a complex mix between public and private healthcare that is unusual in a European context (Barrington, 1987; Wren, 2003), with the high cost of GP care for those without medical cards a particular concern (Ruane, 2010). The extent to which this system promotes unequal 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; Jiminez-Martin et al., 2001; 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; 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).

A large international literature has documented clear associations between access to primary care services 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.

The purpose of this paper is therefore to analyse whether avoidable hospitalisations among the over 70s declined as a result of the extension in medical card eligibility to all over 70s in July 2001. Using hospital discharge data from the Irish Hospital In-Patient Enquiry (HIPE) over the period 1999-2004, a difference-in-difference approach is employed to test the proposition that the over 70s experienced a significantly greater fall in the probability of experiencing an avoidable hospitalisation after 2001, as would be expected if access to free GP services was extended to all in this group after 2001. Section 2 discusses previous research in the area, while Section 3 introduces the data used in this analysis. Section 4 presents the methodology, Section 5 discusses the empirical results while Section 6 summarises and concludes.

PREVIOUS RESEARCH

One of the earliest introductions to the concept of avoidable hospitalisations is the work by Billings, Zeitel, Lukomnik, Carey, Blank & Newman (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 lower in areas where appropriate outpatient care is more readily available. Much of the earlier research uses regional level data to compare avoidable hospitalisation rates among areas with differing socio-economic profiles, insurance coverage, GP density *etc.* (Basu et al., 2002; Bindman et al., 1995; Epstein, 2001; Gaskin et al., 2000; Nitti et al., 2003; Page et al., 2007; Pappas et al., 1997; Parchman et al., 1999; Roos et al., 2005). A number of studies undertake international comparisons of avoidable hospitalisation rates, principally between the US (with relatively

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poor access to primary care for the majority of the population) and European countries (with universal access to free primary care services) in an attempt to examine the impact of access to primary care services on avoidable hospitalisation rates (Billings et al., 1996; Casanova et al., 1995; Gusmano et al., 2006). However, a major failing of such regional-level analyses is the potential for ecological fallacy (Epstein, 2001; Parchman et al., 1999). Using individual-level data allows researchers to control more comprehensively for individual characteristics, as well as regional and hospital-level characteristics (Blustein et al., 1998; Culler et al., 1998; Gadomski et al., 1998; Gill et al., 1998; Parker et al., 2000; Weissman et al., 1992).

In an attempt to establish a causal link between access to primary care and avoidable hospitalisations, recent research has used difference-in-difference methods to assess the impact of various policy changes. Dafny and Gruber (2005) find that while the 1983-1996 Medicaid expansions in the US were associated with a significant increase in overall hospitalisations among children, an insignificant increase in avoidable hospitalisations and a significant increase in unavoidable hospitalisations. Kaestner et al. (2000) 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 (Madden et al., 2005; Nolan, 2007, 2008a, b; Nolan et al., 2008; Nolan, 1991, 1993; Tussing, 1983, 1985) all finding that the incentives

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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 (Layte, 2007; Layte et al., 2004; Nolan et al., 2000; O'Reilly et al., 2008, 2010). A 2007 report on acute public hospital bed capacity in Ireland found that 13 per cent of patients were admitted to hospital unnecessarily, meaning that the patient could have been treated in a non-acute setting (PA Consulting, 2007).

Previous Irish research has found little evidence for a significant increase in GP visiting among the over 70s after the extension of medical card eligibility in 2001 (Layte et al., 2009). Using difference-in-difference methods, the research showed that while there was some limited evidence that the probability of a GP visit increased significantly for the over 70s after 2001, there was no significant change in the frequency of GP visiting. The current study complements that study by analysing the impact of the same policy change on another common indicator of access to primary care, i.e., avoidable hospitalisations.

DATA

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 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, but due to the change from ICD-9-CM to ICD-10-AM in 2005 (and as many codes are not directly comparable), data for the period 1999-2004 inclusive are employed here.

Unfortunately, a unique patient identifier is not available, meaning that we cannot identify repeat admissions. We concentrate on in-patient discharges for residents of the Republic of Ireland, as those residing 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), 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 (1999-2004), the total number of in-patient discharges increased by 11.9 per cent, but due to population growth, the total number of in-patient discharges per 1,000 persons actually decreased by 3.7 per cent (see Table 1). This is consistent with international trends and with the substantial increase in day-case activity observed in Ireland over the period. As expected, the number of in-patient discharges per 1,000 population increases as age increases, with those aged 85+ having approximately 3.5 times more discharges per 1,000 population than those aged 19-69 years. The decline in in-patient discharges per 1,000 population over the period 1999-2004 was largely driven by the 19-69 year old age group, with the number of in-patient discharges per 1,000 population for the 70-74 and 80-84 year old age groups actually increasing over the period.

[insert Table 1 here]

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Our 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). In common with other studies, we identify avoidable hospitalisations by matching codes for principal diagnoses only. While it is possible that certain cases may be misclassified due to different coding orders, it is unlikely that this would vary systematically across different population sub-groups. Table A1 in the Appendix provides a list of avoidable hospitalisation conditions and their associated ICD-9-CM codes.

Table 2 shows that approximately 12 per cent of all adult in-patient discharges in Ireland over the period 1999-2004 may be classified as avoidable using the codes outlined in Table A1. Table 2 also illustrates that the number of avoidable hospitalisations per 1,000 population declined by 13.5 per cent between 1999 and 2004. Once again, there is considerable variation among the age groups; those aged 85+ have approximately eight times more avoidable hospitalisations per 1,000 population than those aged 19-69 years. Similarly, while approximately 9 per cent of in-patient hospitalisations for those aged 19-69 may be classified as avoidable, the corresponding figure for the over 70s is over 20 per cent. Banham et al. (2010) find that 10.7 per cent of public hospital discharges in South Australia over the period July 2006 to June 2008 could be classified as avoidable. 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.

[insert Table 2 here]

Other individual-specific independent variables include gender and marital status. Medical card eligibility is also included. In common with other studies using hospital discharge data that suffer from the problem of how to measure underlying health status (Deyo et al., 1992), 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). The Charlson comorbidity index has been shown to be a good predictor of inpatient mortality, 30-day mortality, length of stay and complications (Deyo et al., 1992; Kieszak et al., 1999; Quan et al., 2005). 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 relating to spring, summer, autumn and winter are included, as is an indicator for discharges over the weekend (when access to primary care services might be expected to be more difficult). We also included an indicator for residents of border counties, under the assumption that such individuals may be able to access cheaper GP services as private patients under the UK NHS. The variable was always insignificant. In an attempt to include supply-side influences on avoidable hospitalisations, variables relating to the number of GPs, public health nurses, in-patient beds and day beds per 1,000 population at health board level were also constructed. However, the highly aggregated nature of the data (over this period, there were just eight health boards) meant that meaningful results could not be obtained. Table A2 describes the

variables used in this analysis, as well as providing some summary statistics for the treatment and control groups (see also below).

METHODS

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

$$y_{it} = \beta_0 + \beta_1 age_{it} + \beta_2 after + \beta_3 age \cdot after + \beta_4 x_{it} + u_{it} \qquad (1)$$

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 other characteristics (such as eligibility status, gender *etc*.) and u_{it} is the random error term. Standard errors are adjusted for the clustering of observations by hospital.

The coefficient estimate β_1 measures the impact of being in the treatment group (i.e., over 70), β_2 measures the impact of being observed in the treatment period (i.e., after July 2001), while the parameter β_3 is the difference-in-difference estimate and captures the interaction between the policy change and the treatment group as this only takes the value of 1 for the treatment group in the post-treatment period. To estimate the difference-in-difference, let $\bar{y}_0, age_0$ denote the probability of being in hospital with an avoidable condition for the control group in the pre-treatment period, and $\bar{y}_1, age_0$ the probability of being in hospital with an avoidable condition for the control group in the treatment period. Specify the probability of being in hospital with an avoidable condition for the treatment group in the same way. Then the difference-in-difference estimate can be expressed as:

$$(y_1, age_1 - y_0, age_1) - (y_1, age_0 - y_0, age_0) \qquad (2)$$

i.e., the difference in the probability of being in hospital with an avoidable condition for those aged 70 and over before and after the treatment compared to the difference in the probability of being in hospital with an avoidable condition for those aged under 70 before and after the treatment. The last two terms should sum to zero, i.e., there should be no difference in the probability of being in hospital with an avoidable condition for those under 70 years of age before and after the policy change. The first two terms should sum to a negative number (as we expect enhanced access to GP services to lead to a lower probability of having an avoidable hospitalisation among the over 70s after July 2001), meaning that our overall difference-in-difference estimate should be negative.

One important assumption that must be maintained when using the difference-in-difference estimator is that other events which may have occurred during the observation periods should affect both control and treatment groups equally. Section 6 discusses this issue in greater detail. Similarly, it is important to test the assumption that the additional independent variables have identical effects in the two periods, i.e. that the slope coefficients are identical across the two years. Therefore, we also estimate a model of the form:

$$y_{it} = \beta_0 + \beta_1 age_{it} + \beta_2 after + \beta_3 age \cdot after + \beta_4 x_{it} + \beta_5 x_{it} \cdot after + u_{it} \qquad (3)$$

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where $x_{it} \cdot after$ is the vector of other individual- and regional-level characteristics (such as eligibility status, gender *etc*.) interacted with the treatment period (i.e., after 1 July 2001). See Section 5 for further details on model specification tests.

Due to the nature of the data available, the analysis suffers from a number of data and methodological limitations. Ideally, information on users and non-users of hospital services would be available but as we can identify individuals only 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 et al., 2000)). However, we control as comprehensively as possible for health need and socio-economic differences between those with differing eligibility for free GP care. Therefore, as data on those who do not enter hospital is not available, the estimates are conditioned on the person being hospitalised. Similarly, the data do not contain any information on contact with a GP or characteristics of the individual's GP or primary care practice, all factors which might be expected to influence the probability of an avoidable hospitalisation.

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 also estimate the model on random 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. While significance levels fall (not surprising given the smaller number of observations), for the significant estimates, we similarly find little difference in the estimated results between those from the full sample and those run on individual days. Finally, in common with others in the literature, we

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identify avoidable hospitalisations by matching codes for principal diagnoses only. While it is possible that certain cases may be misclassified due to different coding orders, it is unlikely that the order would differ systematically between our two groups of interest.

EMPIRICAL RESULTS

Our main independent variable of interest is the difference-in-difference effect of being aged over 70 years of age and observed post-July 2001. Controlling for all other influences on avoidable hospitalisations, we hypothesise that for the over 70s after July 2001, 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. Table 3 presents summary statistics on avoidable hospitalisations across the different age groups before and after the policy change. The data show that avoidable hospitalisations per 1,000 population did decline among the over 70s after 2001, and while avoidable hospitalisations among the under 70s also fell, the aggregate difference-in-difference effect is negative as expected.

[insert Table 3 here]

Tables 4 and 5 present marginal effects from the restricted and unrestricted versions of the models respectively. As our model is a binary probit, neither the sign nor the significance level of the marginal effects for interaction effects can be interpreted as in a linear model (Norton et al., 2004). We therefore estimate correct marginal effects and standard errors for the difference-in-difference effect using the 'inteff' command in Stata Version 10.0. The restricted model contains the difference-in-difference effects only, while the unrestricted model includes additional independent variables (such as age, gender *etc.*) but not the

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interactions between the remaining independent variables and the treatment period, i.e., corresponding to expression (3) above, as the addition of these variables did not improve significantly the fit of the models. We also estimated both restricted and unrestricted versions of the model with a more disaggregated age categorisation for the over 70s (i.e., ages 70-74, 75-79, 80-84 and 85+, and age 70-79 and age 80+) but the models with the aggregated over 70 age category are preferred. The results in Table 4, while rejected in favour of the unrestricted results in Table 5, provide baseline estimates of the effect of the policy change on the probability of being in hospital with an avoidable condition. Consistent with the aggregate patterns presented in Table 3, the probability of experiencing an avoidable hospitalisation is higher for those over 70. The difference-in-difference effect is negative and significant for only one of the random dates. Adding additional controls results in a difference-in-difference effect that is consistently negative, although largely insignificant (Table 5). 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 at weekends.

[insert Tables 4 and 5 here]

The results are robust to a number of differing model specifications. First, it is possible that the results are dependent on the definition of the treatment period. While eligibility for a medical card was automatically extended to all over 70s on 1 July 2001, it is possible that the effects of enhanced access to GP services would take longer to take effect. We therefore estimated the models using two alternative definitions of the treatment period, namely, January 2002 and after, and July 2002 and after, and found consistent results. Second, a key

requirement of difference-in-difference analysis is that the treatment and control groups are as similar as possible (with the exception of exposure to the treatment). We control for all other observable differences between the treatment and control groups in our regressions. However, it is possible that a different definition of the control group may change the results. We investigate the use of alternative age categorisations for the control group, namely, age 60-69 years, age 50-69 years and age 40-69 years. The results are consistent with those from the model defining the control group as those aged 19-69 years. We also investigate the use of a control group aged 65-69 and a treatment group aged 70-74, and a control group aged 60-69 and a treatment group aged 70-79 (to ensure that the treatment and control groups are as similar as possible); the results do not differ from those on the full sample of ages. Finally, in this paper we analyse avoidable hospitalisations in aggregate, not distinguishing between different conditions. We also estimate the models focussing on the three main 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. Results of all specification tests are available from the author.

DISCUSSION AND CONCLUSIONS

Equity of access to health care is a key component of national and international health statements of health policy. As the first point of contact with the health service for most individuals, ensuring equity of access to primary care services is a key component of an equitable and efficient health care service. There is a consistent set of evidence of the benefits of health systems with a strong primary care focus, in terms of health outcomes, quality of care, health inequalities and health care costs. 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. Internationally, statistically significant links between eligibility for free primary care and avoidable hospitalisations have been demonstrated. In this paper, the impact of an extension in eligibility for free primary care on avoidable hospitalisations was examined. In July 2001, medical card eligibility (i.e., eligibility for free primary care services) was automatically extended to all those over 70 years of age in Ireland. The analysis shows that avoidable hospitalisations among the over 70s declined after July 2001 (as we would expect as a result of enhanced access to free GP services), but that this decline was not, in general, significantly different to that experienced by the under 70s.

The research findings are subject to a number of caveats. First, information on potentially important variables such as availability of GP services, individual income and more detailed measures of health status are not available. Second, 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. However, it is unlikely that provider practices for the control and treatment groups would have changed in different ways over the period we analyse. Third, while the method of payment for over 70s GP services changed from a fee-for-service (private pre-2001) and capitation (public pre-2001) to capitation (all post-2001), previous evidence for Ireland has found little evidence for financially motivated behaviour on the part of Irish GPs (Madden et al., 2005). In any case, GPs were well compensated for the move to capitation for the over 70s, receiving a capitation payment for 'new' over 70s that was between 2.7 and 4.8 times that received for 'old' over 70s.

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 (i.e., factors such as wealth, genetic inheritance, attitudes towards health care *etc*.). However, undertaking the analysis on individual days (under the assumption that individuals are unlikely to be admitted, discharged and re-admitted on the same day), reveals similar, albeit less significant results than those using the full sample of discharges.

Notwithstanding these caveats, what would explain the relatively small fall in avoidable hospitalisations among the over 70s after July 2001? First, it is interesting that related research on the effect of the extension of eligibility for free GP services in 2001 on the utilisation of GP services also found an insignificant difference-in-difference effect. Layte et al. (2009) found that the extension of medical card eligibility to all over 70s did not result in a significant increase in the number of GP visits among this group over the period 2000-2004. This would imply that access to GP services (at least in the form of extra visits) did not improve for the over 70s after the extension of medical card eligibility; such a picture is consistent with the results in this paper. The re-introduction of means testing for medical cards for the over 70s from January 2009 offers an opportunity for future research into this issue.

Second, It is possible that non-financial barriers in accessing GP services such as personal mobility, transport and information may be relatively more important for the older population. Information on GP and area-level characteristics such as transport links, practice size and composition *etc*. are not available but may be just as, if not more, important in

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influencing GP utilisation, and by extension, the probability of experiencing an avoidable hospitalisation among the older population. Finally, it is possible that enhanced access to GPs among the over 70s led to a change in more subtle aspects of avoidable hospitalisations such as severity of illness at presentation or length of stay, rather than the actual number of such episodes (see also (Kaestner et al., 2000)).

Third, it is possible that the treatment was just not 'large' enough to identify significant effects. Medical card eligibility for all age groups prior to 2001 was assessed on the basis of an income means test. In 2000, approximately 75 per cent of the over 70s held a medical card (derived from the HeSSOP I survey; see Layte et al. (2009)). It is therefore possible that the 25 per cent of the over 70s who became newly eligible for a medical card after July 2001 is just too small to identify a significant difference-in-difference effect. In addition, their particular characteristics (in general the newly eligible over 70s were richer and in better health) may mean that their sensitivity to a change in the price of GP care was less than that of the general over 70s population; a change to free GP care may not have had such a large effect on their GP visiting behaviour, and by extension, their probability of an avoidable hospitalisation.

Explaining the proportionately greater fall in the probability of experiencing an avoidable hospitalisation among the under 70s is difficult as there was no obvious policy or institutional change affecting this group over the period. However, PHI companies have started to offer plans with limited cover for GP and other primary care expenses in recent years. If, over the period 1999-2004, an increasing proportion of those aged 19-69 years with PHI were covered by such plans, and this encouraged more frequent contact with primary care, then it is possible that the probability of avoidable hospitalisation among the

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control group would fall by a proportionately greater amount. However, the plans with limited cover for primary care expenses were introduced in the latter part of the last decade, and even now there are no published statistics on estimates of the numbers with such plans (Brick et al., 2010). In addition, the Switfcare clinics operated by VHI Healthcare (the largest PHI company in Ireland), which act as a part substitute for GP and A&E services for VHI members, were first opened in late 2005. While there were a number of high-profile public health developments over the period that might be expected to reduce the extent of avoidable hospitalisations among younger cohorts (the introduction of the MenC vaccine in 2000 and the general workplace smoking ban in 2003), it is difficult to see how the effects of such interventions could feed through so quickly in the data available here. The re-introduction of means testing for medical cards for the over 70s from January 2009 offers an opportunity for future research into this complex issue.

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TABLES

Table 1 Total in-patient discharges, 1999-2004[a]

	1999	2000	2001	2002	2003	2004	*% change*
In-patient discharges							
Age 19-69	272,853	281,672	293,671	295,344	301,206	308,274	*13.0*
Age 70+	93,687	95,204	97,207	97,737	100,576	102,036	*8.9*
of which							
Age 70-74	28,253	28,971	28,642	28,116	28,745	29,183	*3.3*
Age 75-79	29,288	29,171	30,162	29,708	29,707	29,537	*0.9*
Age 80-84	20,705	21,346	22,044	22,722	24,086	24,853	*20.0*
Age 85+	15,441	15,716	16,359	17,191	18,038	18,463	*19.6*
All 19+	366,540	376,876	390,878	393,081	401,782	410,310	*11.9*
In-patient discharges per 1,000 population							
Age 19-69	119.4	118.7	119.2	116.3	115.4	115.0	*-3.7*
Age 70+	322.0	322.9	325.3	323.1	326.5	325.3	*1.0*
of which							
Age 70-74	251.3	257.9	255.2	250.7	252.4	252.3	*0.4*
Age 75-79	342.4	335.4	341.0	330.8	328.3	324.1	*-5.4*
Age 80-84	366.2	372.4	379.3	386.1	399.0	401.4	*9.6*
Age 85+	423.9	410.5	406.6	412.0	416.6	410.9	*-3.1*
All 19+	142.2	141.2	141.5	138.4	137.7	137.0	*-3.7*

[a] Excluding those resident outside the Republic of Ireland, those aged 0-18 years, day cases, discharges with a length of stay greater than 30 days and re-admissions and transfers.

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Table 2 Avoidable in-patient discharges, 1999-2003[a]

	1999	2000	2001	2002	2003	2004	*% change*
Avoidable in-patient discharges							
Age 19-69	26,745	26,613	27,144	27,153	27,732	26,792	*0.2*
Age 70+	19,871	19,029	19,187	19,676	20,027	20,071	*1.0*
of which							
Age 70-74	5,761	5,440	5,338	5,401	5,260	5,155	*-10.5*
Age 75-79	6,287	5,864	5,989	6,043	5,843	5,968	*-5.1*
Age 80-84	4,523	4,348	4,463	4,719	5,002	5,023	*11.1*
Age 85+	3,300	3,377	3,397	3,513	3,922	3,925	*18.9*
All 19+	46,616	45,642	46,331	46,829	47,759	46,863	*0.5*
Avoidable in-patient discharges per 1,000 population							
Age 19-69	11.7	11.2	11.0	10.7	10.6	10.0	*-14.6*
Age 70+	68.3	64.5	64.2	65.0	65.0	64.0	*-6.3*
of which							
Age 70-74	51.2	48.4	47.6	48.2	46.2	44.6	*-13.0*
Age 75-79	73.5	67.4	67.7	67.3	64.6	65.5	*-10.9*
Age 80-84	80.0	75.8	76.8	80.2	82.9	81.1	*1.4*
Age 85+	90.6	88.2	84.4	84.2	90.6	87.3	*-3.6*
All 19+	18.1	17.1	16.8	16.5	16.4	15.6	*-13.5*
Avoidable in-patient discharges as % of total in-patient discharges							
Age 19-69	9.8	9.4	9.2	9.2	9.2	8.7	
Age 70+	21.2	20.0	19.7	20.1	19.9	19.7	
of which							
Age 70-74	20.4	18.8	18.6	19.2	18.3	17.7	
Age 75-79	21.5	20.1	19.9	20.3	19.7	20.2	
Age 80-84	21.8	20.4	20.2	20.8	20.8	20.2	
Age 85+	21.4	21.5	20.8	20.4	21.7	21.3	
All 19+	12.7	12.1	11.9	11.9	11.9	11.4	

[a] Excluding those resident outside the Republic of Ireland, those aged 0-18 years, day cases, discharges with a length of stay greater than 30 days and re-admissions and transfers.

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Table 3 Total in-patient and avoidable discharges, pre- and post-2001[a,b]

	Pre-2001	Post-2001	*Difference*
In-patient discharges per 1,000 population			
Age 19-69	119.0	115.6	-3.4
Age 70+	322.5	325.0	2.5
All	141.7	137.7	*-4.0*
Avoidable in-patient discharges per 1,000 population			
Age 19-69	11.5	10.4	-1.1
Age 70+	66.4	64.7	-1.7
All	17.6	16.2	*-1.4*
Difference-in-difference			*-0.6*

[a] Excluding those resident outside the Republic of Ireland, those aged 0-18 years, day cases, discharges with a length of stay greater than 30 days and re-admissions and transfers.
[b] Pre-2001 refers to the average of 1999 and 2000, while post-2001 refers to the average of 2002, 2003 and 2004.

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Table 4 Estimation results (marginal effects[a]) – with no additional covariates

	(1)[c]	(2)	(3)	(4)	(5)
Age 70+	0.113 ***	0.101 ***	0.110 ***	0.108 ***	0.110 ***
After July 2001	-0.010 ***	-0.008 **	-0.007	-0.009 **	-0.001
Age 70+ * After July 2001	-0.004	0.003	-0.013 **	0.004	0.002
N	73,576	75,573	72,010	71,781	72,458
Pseudo-R^2	0.0283	0.0253	0.0256	0.0278	0.0267

[a] Standard errors (which are not presented here but available on request from the author) are adjusted for clustering of observations by hospital. * significant at 10 per cent level; ** significant at 5 per cent level; *** significant at one per cent level.

[b] Model (1) – all discharges on the 4th day of the month; Model (2) – all discharges on the 8th day of the month; Model (3) – all discharges on the 16th day of the month; Model (4) – all discharges on the 23rd day of the month; Model (5) – all discharges on the 28th day of the month. A variety of random days were examined for analysis, and as the results are largely consistent across different days, we take the days falling on 10th, 25th, 50th, 75th and 90th percentiles of the month as our random days.

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Table 5 Estimation results (marginal effects[a]) – with additional covariates

	(1)[b]	(2)	(3)	(4)	(5)
Age 70+	0.059 ***	0.048 ***	0.054 ***	0.054 ***	0.053 ***
After July 2001	-0.007 **	-0.007 **	-0.005	-0.008 **	-0.000
Age 70+ * After July 2001	-0.011 *	-0.005	-0.016 **	-0.002	-0.005
Male	ref.	ref.	ref.	ref.	ref.
Female	-0.055 ***	-0.054 ***	-0.056 ***	-0.059 ***	-0.058 ***
Medical card	0.041 ***	0.042 ***	0.038 ***	0.039 ***	0.039 ***
No medical card	ref.	ref.	ref.	ref.	ref.
Married	-0.013 ***	-0.012 ***	-0.017 ***	-0.014 ***	-0.016 ***
Separated/divorced	0.013	-0.003	0.011	0.016 **	0.010
Widowed	0.031 ***	0.021 ***	0.028 ***	0.021 ***	0.027 ***
Comorbidity index	0.023 ***	0.025 ***	0.025 ***	0.026 ***	0.027 ***
Unrelated co-morbidities	0.030 ***	0.037 ***	0.037 ***	0.037 ***	0.032 ***
Spring	-0.002	-0.001	0.002	-0.012 **	-0.014 ***
Summer	-0.010 ***	-0.002	-0.007 **	-0.023 ***	-0.016 ***
Autumn	-0.015 ***	-0.003	-0.010 ***	-0.020 ***	-0.019 ***
Winter	ref.	ref.	ref.	ref.	ref.
Weekday	ref.	ref.	ref.	ref.	ref.
Weekend	0.008 ***	0.012 ***	0.010 ***	0.006	0.004

Table 5 continued

	(1)[b]	(2)	(3)	(4)	(5)
N	73,576	75,573	72,010	71,781	72,458
Pseudo-R^2	0.0541	0.0541	0.0555	0.0579	0.0551

[a] Standard errors (which are not presented here but available on request from the author) are adjusted for clustering of observations by hospital. * significant at 10 per cent level; ** significant at 5 per cent level; *** significant at one per cent level.

[b] Model (1) – all discharges on the 4th day of the month; Model (2) – all discharges on the 8th day of the month; Model (3) – all discharges on the 16th day of the month; Model (4) – all discharges on the 23rd day of the month; Model (5) – all discharges on the 28th day of the month. A variety of random days were examined for analysis, and as the results are largely consistent across different days, we take the days falling on 10th, 25th, 50th, 75th and 90th percentiles of the month as our random days.

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APPENDIX

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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Table A2 Variable descriptions and sample means

	Description	19-69 years	70+ years
Individual level			
Age 70+	=1 if aged 70+ years (Reference = aged 19-69 years)	0.00	1.00
After	=1 if discharged after July 2001 (Reference = discharged before July 2001)	0.61	0.60
Age 70+ * After	=1 if aged 70+ years and discharged after July 2001 (Reference = aged 19-69 years and discharged before July 2001)	0.00	0.60
Medical card	=1 if individual has a medical card (Reference category = no medical card)	0.37	0.83
Male	=1 if male (Reference category = female)	0.63	0.53
Married	=1 if married	0.57	0.40
Separated/divorced	=1 if separated or divorced	0.04	0.01
Widow	=1 if widowed (Reference category = never married)	0.03	0.40
Comorbidity index	Charlson comorbidity index[a]	0.18	0.56
Comorbidity	=1 if reports one or more secondary diagnoses, and first secondary diagnosis is for a condition in a different medical diagnosis group (MDG) to the principal diagnosis (Reference category = no secondary diagnoses, or secondary diagnoses in the same MDG)	0.44	0.58
Weekend	=1 if discharged at the weekend (Saturday or Sunday) (Reference category = discharged on a weekday)	0.20	0.20
Spring	=1 if discharged during spring	0.25	0.25
Summer	=1 if discharged during summer	0.25	0.25
Autumn	=1 if discharged during autumn (Reference category = discharged during winter)	0.25	0.24

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

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AN EXTENSION IN ELIGIBILITY FOR FREE PRIMARY CARE AND AVOIDABLE HOSPITALISATIONS: A NATURAL EXPERIMENT

RESEARCH HIGHLIGHTS

In this paper, we examine the impact of an extension in eligibility for free primary care on avoidable hospitalisations in Ireland.

Avoidable hospitalisations are often used as an indicator of access to primary care services.

As the policy change affected those aged over 70 years of age only, a difference-in-difference approach was used.

Using hospital discharge data, we found that while avoidable hospitalisations fell for the treated group, they also fell for the control group.

A significant difference-in-difference effect could not be detected.

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