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The Economics of Intermediate Care for Older People: early results from a UK national evaluation

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Abstract

Intermediate Care (IC) broadly refers to services that aim to prevent inappropriate hospital admissions, facilitate supported discharges for patients who no longer need to be in hospital, and avert premature admission to long-term care. Whilst a key component of UK government health policy, evidence on the costs and outcomes associated with IC is scarce. In order to fill this information gap a national evaluation project was commissioned by the UK Department of Health. This paper reports the findings from one part of that project: the econometric modelling

Data on resource use and costs, and outcomes (measured using a generic quality of life instrument, the EQ-5D), were collected from a sample of 3920 episodes of IC in five case study evaluation sites. Unit costs were obtained from service budgets and from national sources. An econometric framework has been used to explore variability. The first model explores the relationship between cost per patient and a vector of explanatory variables including patient characteristics, descriptors of IC services and IC-related services. This analysis uses a Generalised Linear Model (GLM). The second model explores outcome data using an OLS regression model

This paper describes in full the results of the econometric analysis. The paper reports work-in-progress – methodological issues relating to missing data and problems commonly seen in health econometric analyses are raised.

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1 Introduction

The population of frail elderly people in the UK has been increasing over the last five decades. While the total population of England and Wales was expected to increase by 8% in the period 1991 to 2031, the increase is disproportionately higher for older age groups. For instance, it is expected that the numbers of people aged 60 to 74 will rise by 43%, while the increases for the age group 75-84 and 85+ is expected to be 48% and 138%, respectively (DoH, 1999). The majority of hospitalisations are attributable to the elderly. The National Beds Inquiry of 2000 showed that elderly people occupy two-thirds of general and acute hospital beds in the country, and account for over a half of recent growth in emergency admissions. The burden on NHS resources is compounded by the fact that the length of stay in hospital is also significantly greater for older people (DoH, 2000). Steiner and Vaughan (1997) also estimate that 20% of hospital bed days were inappropriate and could have been avoided were suitable alternative facilities in place. It is against this backdrop that the NHS has placed special emphasis on the development of different forms of Intermediate Care (IC) which offer alternatives to early discharge or inappropriate bed occupation and opportunities for rehabilitation and optimum recovery (Wiles et al. 2003). The aim is to improve the health and well being of older people; promoting independent living and raising the quality of services they receive (DoH, 2002).

IC broadly refers to services that seek to prevent inappropriate hospital admissions, facilitate supported discharges for patients who no longer need to be in hospital, and avert premature admission to long-term care. Although older people are regarded as the main recipients of IC, the DoH has stressed that IC is not an age-related service (DoH, 2000). However; evidence on the costs and outcomes associated with IC is relatively scarce. The National Evaluation of Intermediate Care of the elderly in the UK was commissioned by the UK Department of Health, in part, to fill the gap and was undertaken by the Universities of Birmingham, Leicester and Sheffield. The economic component of the project has two parts: (1) process modelling, which considers pathways of care in order to estimate the differences in costs and outcomes between alternative ways of delivering care, and (2) statistical modelling, which explores variability in the costs and health outcomes of IC services. The focus for this paper is the latter.

2. Research Methods

2.1 Data collection

The research reported in this paper sought to explore the magnitude of variation in the costs and outcomes associated with the provision of intermediate care services and to understand that factors associated with such variation.

Five sites participated in the National Evaluation – they were chosen according to the following criteria:

- A range of intermediate care services operational for at least 2-3 years;
- Reasonable throughput into the intermediate care system (at least 1000 cases per annum);
- A mix of urban and rural sites;

- Senior management support for the collection of routine data by services themselves;
- Clinical and managerial support for participation in the national evaluation.

Data on resource use and costs, and outcomes (measured using a generic quality of life instrument, the EQ-5D, and a general measure of functioning, the Barthel Index), were collected from a sample of 3920 consecutive episodes of IC in five case study sites. Data on patient characteristics, descriptors of the IC service, as well as IC-related services' variables were collected. Unit costs were obtained from service budgets and from national sources.

IC broadly refers to services that aim to prevent inappropriate admission to, or unnecessarily extended stays in, hospitals. While there are services that provide long-term care and rehabilitation, the most prominent types of IC are Supported discharge and Admission avoidance. The source of referral is a good indicator of the type of service that an IC patient requires. Another classification that is useful is whether these services are either residential or non-residential in nature. Residential IC units are those where patients are institutionalised for the whole duration of IC provision. Non-residential units provide an 'outpatient' type of service and usually involve IC teams servicing clients in settings other than where these teams are normally based.

The two outcome measures selected were chosen as the EQ-5D has been used as to model health related quality of life for the elderly people in the IC settings (King 1996, Griffiths et al 2001) while the Barthel Index has also been widely used in measuring health outcomes (van den Bos et al, 2002; Davies, 1996). This paper reports the results for the EQ-5D and not the Barthel.

2.2 Statistical Analyses

In order to understand the relationships between the variables used in the study, descriptive summary statistics were generated. Frequency tables, histograms and box plots were utilised. Simple parametric and non-parametric statistical tests were also used to further understand the associations between the continuous and categorical variables. The parametric tests assumed normality of the dependent variables while the non-parametric tests only assumed that the variables were ordinal. The Two independent samples t-test and the Wilcoxon-Mann-Whitney test were used to test whether there were any statistically significant differences between the mean of normal and non-normal interval dependent variables, respectively, for two independent groups. The Chi-square test was also used to test for significant relationships between categorical variables. Also employed were the Kruskal Wallis and the simple one-way ANOVA.

Regression modelling addresses the question of variability in costs and health outcomes. Specifically, it seeks to answer why we see variation in costs and outcomes and why costs and outcomes differ among model variables. As such, an econometric framework was a plausible choice to answer this question. Two sets of models (explained in fuller detail below) were used to answer these questions.

The first dependent variable is 'cost per patient', which is used in the cost model. This variable was calculated through combining the patient-specific resource use data with the service-specific top-down unit cost estimates.

The outcome model has EQ5DChange as the dependent variable. This is a dummy variable which is an indicator of the change in the quality of life between admission and discharge and defined as follows:

$$\text{EQ5DChange} \begin{cases} 1 = \text{Improvement (i.e. EQ5Diff} > 0\text{), and} \\ 0 = \text{No improvement (i.e. EQ5Diff} \leq 0\text{)} \end{cases}$$

where EQ5Diff = EQ5D2 - EQ5D1
EQ5D1 = EQ5D score at admission, and
EQ5D2 = EQ5D score at discharge

The Independent variables can be divided into 3 groups:

(i) Episode Characteristics,

(ii) Descriptors of IC services and

(iii) Descriptors of IC-related Services.

A full list of these independent variables is presented in Table 1.

2.3 Choice of Statistical Model

First, we discuss the model choice issues for the cost model, and then for the outcome models.

Most health data are skewed to the right (Rascati et al, 2001; Evers et al, 2002; Zhou et al, 1997), have heavy tails (Manning & Mullahy, 2001) and also have heteroscedastic error terms (Chunrong & Norton, 2000; Manning 1998). Therefore, any model chosen has to incorporate ways of removing interpretation biases that would result if these problems were ignored. Our analysis does not address issues relating to truncation, censoring or zero costs, which are potential problems in any analysis. According to Lipscomb et al (1998); Polsky and Glick (2002); Basu et al (2004); Andersen et al (2000), three main forms of regression models are amenable to modelling health care costs: Generalised Linear Model, Cox-proportional Hazards Model and the Two-Part regression Model. Since we do not have the problems of censoring as well as that of zero costs in our data, the second and third models are not very appropriate. Therefore, a GLM has been used to model costs.[1]

Given below is the relationship between dependent variable (cost per patient) and the explanatory variables

[1] Use of the GLM explicitly takes into account non-constant variance while at the same retaining the original scale of the data.

$$C_i = \sum_j \beta \, x_{ij} + \varepsilon \qquad (1)$$

Where c denotes health care cost and x is a vector of explanatory variables. β is a vector of regression coefficients and ε is the residual error.

The GLM can be broken down into 3 parts (Blough et al, 1999): the linear component, a differentiable link function and a variance function**.**

The linear component

$$\alpha_{i} = x_i \beta \qquad (2)$$

where x is a set of covariates for the i^{th} client and β is the vector unknown coefficients.

The link function

$$g\{(E(y_i)\} = x_i \beta \qquad (3)$$

This shows the relationship between the expected value of y_i (cost for the i^{th} patient) and the linear predictor

The variance function depicting the relationship between the variance and the mean

$$Var(y_i) = \delta_i^2 = \alpha \, f\{E((y_i)\} \qquad (4)$$

α is the dispersion factor

In order to choose an Estimator, Manning and Mullahy (2001) suggested an algorithm to select from among the GLMs or exponential conditional mean models. Another test is to use the raw scale residuals from a GLM with a log link. To do this a squared raw scale residual in a modified Park test is used to determine the appropriate family (distribution) to employ from among the GLM alternatives (ibid).

Characterizing the class of variance functions by

$$Var\ (y/x) = \delta_i^2 = \alpha\, [E(y/x)]^{\lambda} = \alpha\, [\mu(x\beta)]^{\lambda}$$

provided that λ is finite and non-negative, then our choice of GLM distribution will be guided by:

$\lambda = 0 \Rightarrow$ usual non-linear least squares estimator

$\lambda = 1 \Rightarrow$ Poisson like class

$\lambda = 2 \Rightarrow$ Gamma, Homoscedastic Log-normal, Weibull distribution

$\lambda = 3 \Rightarrow$ Inverse Gaussian (Wald) distribution

Blough et al (1999) propose use of a measure of goodness-of-fit in terms of the scaled deviance to decide on the best GLM to use.

In terms of the health outcome variable, the EQ-5D measured quality of life. Whereas the EQ5D, as dependent variable, could be expressed in an unpacked form, where each of the parts that make it up are considered in categorical form and tested against independent variables (Cowdery & Pesa, 2002), the model used here took the composite or summary scores for the measure. Though using a composite measure inevitably leads to some loss of information, there is the advantage of having a simple index that can be easily compared across cases (Goldacar, 1996).

Since the change in the measure has been dichotomised, Logistic regression has been used. To ensure that misleading results due to the ceiling effect are not obtained, the dichotomous dependant variable is transformed into logit form (Hosmer and Lemeshow, 1989).

Algebraically, we have

$$\text{Logit}\ (Q_{ij}) = \sum_{j} \eta\ z_{ij}$$

where Q is the measure of health outcome and *z* is a vector of explanatory variables, η is a vector of regression coefficients

2.4 Other analysis issues

First we consider the missing data issue. By far the most common approach to dealing with missing data is simply to omit those cases with missing data and to run our analyses on what remains. This approach is referred to as "complete-case analysis". This approach should be avoided so that inferences about the entire population can be made. Methods that ensure that missing data are part of the analysis are generally more appropriate than complete-case analysis.

There are several ways of dealing with missing data according to whether it is missing completely at random (MCAR), missing at random (MAR) or non-ignorable (Little and Rubin, 1987). Some other procedures for dealing with missing data include substituting the mean of a variable in place of missing values, and then adjusting the degrees of freedom accordingly, using regression analyses to estimate what the observations would have been, based on other variables that are available, and collecting more data to replace what is missing. The problem with all of these approaches, however, is that they don't take into account that the missing data, if it were available, might not resemble the data we do have. None of these procedures explicitly takes into account the fact that a missing piece of data is special precisely because it is missing.

Multiple Imputation (MI) has been suggested as a superior technique of handling missing data (Schafer, 1997 and Briggs et al, 2003). Another attraction of MI is that implementing it readily makes data usable for such analyses as regression (Patrician, 2002).

Five datasets were generated and the regression coefficients obtained from each of these datasets were combined using rules for MI inference as set out in Schafer and Olsen (1998).

In addition, the models were checked for Specification Error, Goodness-of-fit, Multicolinearity and outliers to prevent erroneous or biased results.

STATA version 8.2 was used for all regressions and S-Plus 6.2 and Norm 3.0 were used for MI.

3. Results

3.1 Descriptive Analyses

Descriptors of IC Services

Table 2 reports results for the descriptors if IC services.

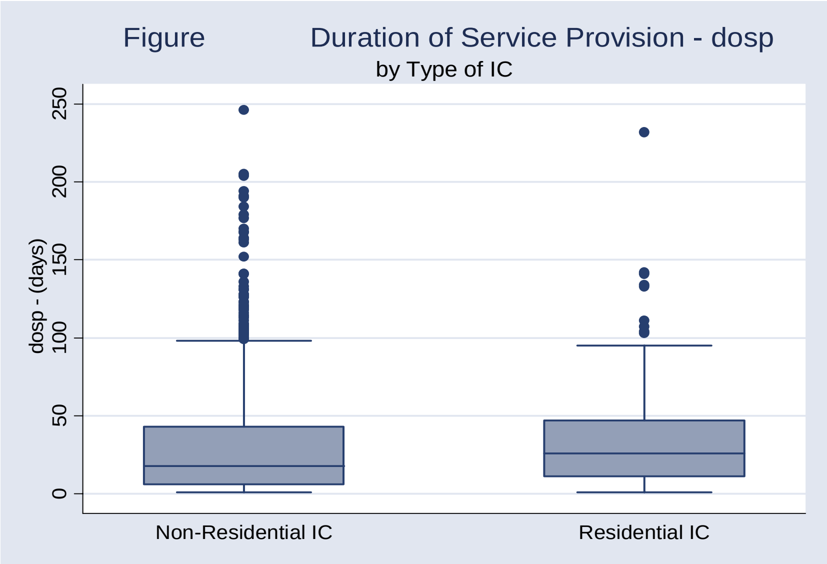
In terms of the type of IC, units were either Residential (17.84%) or Non-Residential (82.16%). Residential IC units are those where patients are institutionalised for the whole duration of IC provision. Non-residential units provide an 'outpatient' type of service and usually involve IC teams providing care in settings other than where these teams are normally based. A further description/classification could be according to the type of services provided. At least 53% of them were offering Acute Admission Avoidance services, and about 40% were Supported Discharge services (see Table 3 above).

The majority of individuals in our sample (about 65%) completed their IC episode while about 14% were transferred before the end of the IC episode. Almost all of these transfers (92%) were to acute hospitals. A small proportion (2.44%) died. IC providers' view of a successful outcome may differ from that of clients. We can, however, assume that an individual completing an IC episode and then being discharged to their home would have had a successful period of care. Considering the fact that over 89% of those that completed an episode of IC were discharged to their home, we may conclude that IC was successful for most patients. A few patients (8.15%) were taken to a nursing home upon being discharged.

It may be important, however, to note that on average, the sample that had a successful competition of their IC episode had higher Barthel and EQ-5D scores at admission than the others. This implies that careful judgements need to be made before using the criteria described above to label an episode as having been successful or not.

What seems surprising is the negligible difference in the duration of service for residential and non-residential IC services (Figure 1). Though duration of service is longer in residential IC, the two, on average differ only by 11%, a difference that is not statistically significant.

Figure 1: Duration of service provision by type of IC



Further investigation of the duration of service provision by the type of service provided revealed that Supported discharge services, on average, had longer contact with patients (38 days) than Admission Avoidance schemes (32 days). As expected, the group of ‘other’ IC services had a much longer duration of service provision (74 days) as included in this group was long-term care. This period is above the 6 weeks set out in the DoH policy guidelines. It seems therefore that the majority of services, on average adhere to the 6 week IC service limit.

Episode characteristics

The mean age was 79.44 years. The majority of the IC subjects in this sample were above 65 years of age. This serves to underscore the fact that older people are regarded as the main recipients of IC. But as a reflection of the reality that IC is not entirely an age related service (NHS, 2000, Audit Commission, 2000), just under 14% of the sample are below the age 65 with the youngest being 18 years old. The majority of patients in the sample were female (69.24%). On average, females had a lower EQ-5D score at admission. On average too, female patients in the sample were older than their male counterparts and therefore had a higher possibility of having a lower quality of health due to their advanced age. On the other hand, females had a larger improvement in EQ-5D at discharge. A possible reason may be that the lower the EQ-5D at admission, the larger the capacity for improvement. A similar pattern was seen for the Barthel scores

An individual’s living arrangements could be seen as a fair proxy of independence. A person living alone is likely to be able to carry out a fair amount of their activities of daily living without much help and is, therefore, likely to be more independent than another person living with relatives or friends. 54 % of females as opposed to 35% of males were living alone in their own homes. Looking at these statistics, we may wrongly conclude that females, on average, were more independent than men. An examination of these individuals who were living alone reveals that about 56% of them were receiving some support services. The majority of these were women.

Descriptors of IC-Related Services

Table 4 can be used as a pointer of how many hospital places may possibly have been saved by having IC. For many patients, the alternative would have been either to stay on in, or be referred to, hospital (41.06%). This seems to suggest that for a large number in our sample, IC served as an alternative to the use of hospital places and resources. As expected, this is more pronounced among those referred by hospitals. Since most patients actually end up in non-residential IC, these results seem to suggest that IC serves to free up hospital beds. In the absence of IC, most of the patients would have either continued in, or been referred to, a hospital for attention.

The majority of patients (about 55.21%) were referred from a hospital setting (either an A&E unit or a hospital ward). 60.91% of these would have stayed on or been sent to another hospital setting in the absence of IC. IC services, therefore, serve as a 'hospital decongesting' service.

In addition to other measures, the level of need could be proxied by whether or not individuals had some form of support services at the time of admission. Receiving support services could be seen as a pointer of the pre-IC episode levels of independence. Slightly over 50% of our sample did not have any kind of support before IC. For those that received support, 36.88 % required only homecare while the majority 52.48 % had a combination of services.

3.2 Regression Results (with Multiple Imputation)

As indicated above, multiple imputations were performed using S-plus 6.2 to generate observations that would replace the missing values.

Cost model

Table 5 shows the results of the main cost model. The model shows both negative and positive associations between cost per patient and the independent variables in the model.

In terms of episode characteristics, none of the patient characteristics were significant in explaining variation of cost per patient. These results, therefore, seem to suggest that an individual's age, gender or living arrangements do not have an impact on the cost that will be incurred during an IC episode.

In contrast, all of the descriptor of IC service variables were significant. Settings that provided acute admission avoidance services had lower costs per patient. This may reflect the fact that this type of patient did not require expensive clinical attention, just rehabilitative services in most instances. Unsurprisingly, residential IC services incurred a higher cost per patient than the non-residential ones. Patients who completed their episodes of care had a higher cost than those who had other outcomes to their episodes of IC. This is understandable considering that the former category of patient had longer duration of service, which is positively related to costs per patient. As expected, the longer the duration of IC service provision, the higher the cost.

The source of a referral also had a bearing on the cost. Patients referred from hospitals were associated with a lower cost than those referred from any other setting. This may be a reflection of the fact that the majority of them (up to 63%) ended up in the stroke discharge unit which has the third lowest cost. Using a low cost as a proxy for low level of need, this result may be a pointer to the possibility of reducing unnecessary hospital stays by referring patients to IC.

Patients who would have ended up in hospital, if they had not been sent to an IC service, were more likely to have a higher cost than any other group of patients. This group of patients are most likely to have had the greatest (clinical) need and, therefore, require more resources to be dedicated to them at a greater cost.

Outcome model

The main outcome model, with the EQ-5D result being the focus, is shown in Table 6.

Females were more likely to have an improvement in EQ-5D than males. A possible explanation may be the fact that, on average, female patients had lower EQ-5D scores at admission, thereby allowing more capacity for improvement than their male counterparts. This is further highlighted by the negative relationship between EQChange and the EQ5D score at admission. On the other hand, a higher Barthel score at admission leads to a bigger improvement in EQ-5D. Also, a positive difference between the Barthel score at admission and at discharge was associated with an improvement in EQ-5D.

Settings that provided acute admission avoidance services were not as likely to have an improvement in EQ5D as others. A reflection of the amount of care, residential IC units were more likely to lead to improvements in EQ-5D than non-residential ones. Patients who completed their IC episodes or those who had a long duration of service were associated with a larger improvement in their quality of life. Note here that EQChange was not available for patients who were transferred or died as EQ5D2 was only collected at discharge.

Patients who would have ended up in hospital if not sent to an IC service were more likely to have an improvement in EQ-5D than those for whom the alternative would have been a home. This group of patients are most likely to have had the greatest (clinical) need and, therefore, require more resources to be dedicated to them at a greater cost (as measured by EQ-5D and Barthel at admission).

4. Discussion

Further work that has been undertaken but is not reported here due to space limitations includes analyses using interaction terms, a comparison of MI model results and complete case results, and similar models for the Barthel Index as the dependent variable. The results from the comparison of the MI and complete case analyses highlight the dangers of not accounting for missing data in an analysis.

Overall, the results seem to suggest that a patient's characteristics at baseline are not an important factor in determining what IC cost they are going to incur. What really appear to drive the IC cost up or down are variables that are specific to the type of IC or to an IC-related service.

Important weaknesses to consider in this work relate to the cost per patient variable and the change in EQ-5D variable. On the former, a top-down cost estimate was used - if bottom up costs had been available then more between-patient variability would have been introduced into the model. On the EQ-5D variable, whereas a cost per patient could be attached to individuals who had outcomes other than completing an IC episode of care (e.g. transferred or died), the same could not be done for change in EQ-5D. This is because EQ5D2 were only collected at the end of an IC episode.

This paper reports work-in-progress and so we would welcome comments on the data analysis conducted to date and thoughts on how the analysis might be strengthened.

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Table 1 Independent variables used and their descriptions

Variable	Description	Missing (%)
Episode Characteristics		
age 2003	Age on 01/01/03	3
Gender	Sex (1 = female , 0 = Male)	0
Livealone	0 Otherwise, 1 = Individual lives alone	5
Barthel 1	Barthel Score at admission	35
Barthel 2	Barthel Score at discharge	46
EQ5D1	EQ 5D at admission	44
EQ5D2	EQ 5D at discharge	54
EDdiff	Difference between EQ5D score at discharge and at admission	45
Bartdiff	Difference between Barthel score at discharge and at admission	52
Descriptors of IC Services		
Serv AcuServ Other Services	Type of service required 0 = Otherwise,1 = Acute Admission Avoidance 0 = Otherwise, 1 = Other IC Services	0.9
ICtype	0 = Non-Residential IC, 1 = Residential IC	0
Outcome Transfer Complete PatDied OthOutcome	Outcome of IC episode 0 = Other outcome, 1 = Transferred before end of IC episode 0 = Otherwise, 1 = Completed IC episode 0 = Otherwise, 1 = Patient Died 0 = Other outcome, 1 Alternative Outcome	5
dosp	Duration of service provision	11
Descriptors of IC related services		
RefSource PriReferral HosReferral OtherReferral SocReferral	Source of referral 0 = Otherwise, 1 = Primary Care 0 = Otherwise, 1 = Hospital 0 = Otherwise, 1 = Other Sources 0 = Otherwise, 1 = Social Services	0.9
NRef NRefHome NRefOther NRefHos	Alternatives to IC services 0 = Else, 1 = Home 0 = Else 1 = Other alternatives 0 = Else, 1 = Hospital	7

Table 2 Descriptors of IC Services

Type of IC	Variable	Obs	%	Mean	S.D.	Min	Mdn	Max
Residential		402	17.84					
	AcuServ	135	33.58					
	SupServ	259	64.43					
	OtherServ	7	1.74					
	Complete	221	54.98					
	Transfer	106	26.37					
	PatDied	6	1.49					
	OthOutcome	10	2.49					
	dosp	333		32.26	29.55	1		232
Non Residential		1,851	82.16					
	AcuServ	1,065	57.54					
	SupServ	650	35.12					
	OtherServ	69	3.73					
	Complete	1,249	67.48					
	Transfer	210	11.35					
	PatDied	49	2.65					
	OthOutcome	106	5.73					
	dosp	1,547		28.92	31.47	1		246
Total								
	AcuServ	1,200	53.26					
	SupServ	909	40.35					
	OtherServ	76	3.37					
	Complete	1,470	65.25					
	Transfer	316	14.03					
	PatDied	55	2.44					
	OthOutcome	116	5.15					
	dosp	1,880		29.51	31.15	1		246

Table 3 Episode Characteristics

Gender	Variable	Obs	%	Mean	S.D.	Min	Mdn	Max
Male		681	30.76					
	Age	655		76.44	11.34	22.93	78.80	100.63
	<65	94	13.80					
	65-74	147	21.59					
	75-84	283	41.56					
	85+	157	23.05					
	EQ5D1	359		0.45	0.37	-0.59	0.59	1.00
	EQdiff	263		0.13	0.32	-1.00	0.03	1.28
	Barthel1	381		15.16	4.20	0.00	16.00	20.00
	Bartdiff	261		1.62	2.77	-6.00	1.00	13.00
	Livealone	244	35.83					
Female		1,533	69.24					
	Age	1,492		80.71	9.63	18.87	81.87	105.82
	<65	98	6.39					
	65-74	211	13.76					
	75-84	682	44.49					
	85+	542	35.36					
	EQ5D1	826		0.41	0.36	-0.59	0.52	1.00
	EQdiff	586		0.18	0.32	-1.11	0.10	1.59
	Barthel1	830		14.64	3.74	10.00	13.00	18.00
	Bartdiff	608		1.71	2.94	-12.00	1.00	16.00
	Livealone	834	54.40					
Total		2,253	100					
	Age	2,180		79.44	10.34	18.87	86.59	105.82
	<65	193	8.57					
	65-74	364	16.16					
	75-84	978	43.41					
	85+	718	31.87					
	EQ5D1	1,189		0.42	0.36	-0.59	0.69	1
	EQdiff	852		0.16	0.32	-1.11	0.10	1.59
	Barthel1	1,215		14.80	4.22	0.00	16.00	20.00
	Bartdiff	871		1.68	2.89	-12.00	1.00	16.00
	Livealone	1,096	48.65					

Table 4 Descriptors IC-Related services

Variable	Alternative to IC – Hospital Obs	Alternative to IC – Hospital %	Alternative to IC – Home Obs	Alternative to IC – Home %	Alternative to IC - Other Obs	Alternative to IC - Other %
PriReferral	127	21.74	166	28.42	76	13.02
HosReferral	593	53.76	250	22.67	92	10.65
SocReferral	47	33.57	34	24.29	28	20.00
OtherReferral	11	16.18	27	39.70	22	22.06
Total Referrals	*778*	*41.06*	*477*	*25.17*	*695*	*36.68*
spserv	195	46.65	81	19.38	41	9.81

Table 5 Cost Model

	Variables	Coeff.	Std Err	Z	.05 % sig.
Episode Characteristics	age2003	-0.001	0.002	-0.420	
	Gender	0.051	0.036	1.430	
	Livealone	0.044	0.033	1.315	
Descriptors of IC Service	AcuServ	-0.655	0.043	-15.080	√
	ICtype	0.724	0.045	16.250	√
	Transfer	-0.173	0.073	-2.379	√
	Complete	0.300	0.067	4.450	√
	OthOutcome	-0.272	0.078	-3.477	√
	PatDied (Ref. Group)				
	dosp	0.027	0.001	35.067	√
Descriptors of IC-related Services	PriReferral	0.159	0.059	2.683	√
	HosReferral	-0.439	0.060	-7.255	√
	OtherRefer~l	0.256	0.109	2.355	√
	SocReferral (Ref Group)				
	NRefOther	-0.202	0.043	-4.697	√
	NRefHome	-0.257	0.037	-6.928	√
	NRefHos (Ref. Group)				
	_cons	6.238	0.154	40.512	√

Dependent variable = costpat (cost per patient); n =3920 √ = Sig. at 0.05%

Table 6 Outcome Model – EQChange as dependent variable

	Variables	Coeff.	Std Err	Z-score	.05 % sig.
Episode Characteristics	age2003	-0.001	0.004	-0.174	
	Gender	0.303	0.080	3.794	√
	Livealone	0.021	0.074	0.281	
	EQ5D1	-1.682	0.128	-13.163	√
	Barthel1	0.079	0.011	7.042	√
	Bartdiff	0.121	0.010	11.992	√
Descriptors of IC Service	AcuServ	-0.537	0.093	-5.805	√
	ICtype	0.190	0.097	1.962	√
	Complete	0.467	0.099	4.720	√
	dosp	0.004	0.001	3.692	√
Descriptors of IC-related Services	PriReferral	-0.204	0.137	-1.487	
	HosReferral	-0.474	0.138	-3.442	√
	OtherRefer~l	-0.002	0.239	-0.009	
	SocReferral (Ref Group)				
	NRefOther	-0.048	0.096	-0.494	
	NRefHome	-0.304	0.082	-3.695	√
	NRefHos (Ref. Group)				
	_cons	-0.550	0.374	-1.469	

Dependent variable = EQChange (change in EQ5D); n =3173 √ = Sig. at 0.05%