

## **The Placement of Elderly Persons: A Logit Estimation and Cost Analysis\***

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*Abstract:* This study focuses on two groups of elderly persons deemed by the relevant health professional to be on the margin of domiciliary care and institutional care, respectively. A logit regression is estimated in order to test for significant factors that may be important in determining the current placement of those elderly persons. The formal and informal costs of care are enumerated and valued, in monetary terms, for the domiciliary based group. Some suggestions are made with regard to current and future placement decision-making for elderly persons. In particular, it seems increasingly inappropriate to treat informal care as a free good given the range of opportunity costs identified by carers.

### I INTRODUCTION

Very little is known about the cost effectiveness of different regimes of care for the elderly in Ireland. There are no comprehensive studies of the disability levels of elderly persons either in residential facilities or living in the community. Neither is there much information about the range of formal services available or the cost of providing these services for elderly persons. There is especially a dearth of quantitative evidence on the extent of informal caring in the community. All of these issues relate crucially to balance of care considerations for elderly persons. The *a priori* expectation in this regard is that elderly persons who are least dependent live at home in the community; those who are most heavily dependent are usually cared for in long stay geriatric institutions. The most interesting elderly group are, therefore, those of intermediate dependency, who are on the margin between domiciliary and institutional care. Of course it is more correct to discuss care of the elderly

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in terms of a continuum of care encompassing respite care, day care, sheltered housing as well as the traditional domiciliary and long stay regimes. Nevertheless, important insights can be gained by concentrating on domiciliary versus long stay care for marginal elderly. This is particularly the case in Ireland where the continuum of care for elderly persons is only beginning to take shape and where decision-making in most health board regions is confined to a choice of either domiciliary or long stay institutions.

The current reality, in this country, is that long stay geriatric beds are being reduced. Institutional care is, as a result, likely to become less available for elderly persons, especially long stay in-patient care. Decision-making with regard to placement must, therefore, ensure that only the most deserving elderly are allocated to institutional beds. Yet, so little is known about the decision to place an elderly person in an institution, either how such decisions are arrived at and/or what are the characteristics of the elderly person that makes institutionalisation a necessity. Any decision not to institutionalise an elderly person raises the related issue of the adequacy of both statutory and informal care in the community. There are at present, according to the National Council for the Aged, an estimated 66,000 elderly persons in the community who require some level of care; 36 per cent of those require a lot of care (National Council for the Aged, 1988). Far too often the case for community care is made without explicit consideration of the adequacy of existing statutory services or the real cost of informal care services provided by the family and friends of the elderly person.

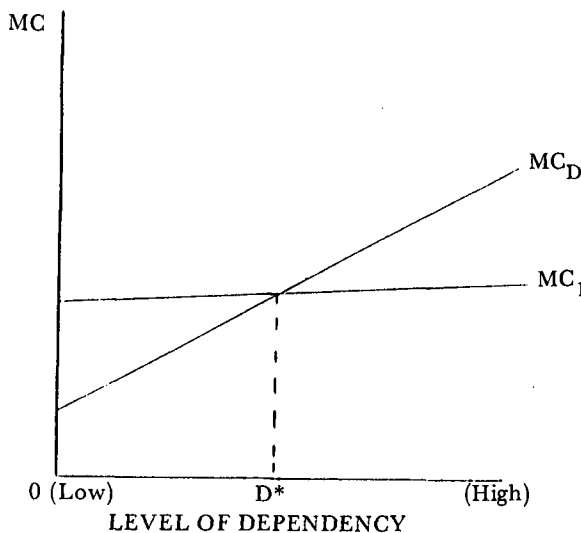
The question of whether domiciliary care or institutional care is the most cost effective, and for whom, is likely to become the dominant care of the elderly issue of the 1990s. The objective of this study is to examine the characteristics of elderly persons who have been identified as being on the margins of domiciliary and institutional care. The nature of care, the cost of statutory services and the extent of informal care are examined for the domiciliary group. A logit model is estimated in order to identify variables that may be significant in determining whether a selected elderly person is likely to be cared for at home or in an institution. Elderly persons included in the study have been chosen by the community physician who has primary responsibility for the allocation of elderly persons within the particular community care area under observation. The quality of care is assumed invariant between regimes of care and the elderly persons are also assumed to be indifferent between care in either regime.

## II SELECTING PATIENTS AND MEASURING DEPENDENCY

Due to the parsimonious nature of resources available to undertake this research project some critical decisions had to be made on how many elderly

persons within the particular community care area, domiciliary and institutional based, could be included in the study.<sup>1</sup> It was decided that the most practical approach was to focus on those elderly who could be classified as either being on the margins of domiciliary or institutional care. The, *a priori*, theoretical rationalisation for such an approach is illustrated in Figure 1. Any elderly person with a dependency level far below  $D^*$  (low disability) has a domiciliary cost of care structure less than that which would be incurred if that elderly person was cared for in an institution. For elderly with dependency levels much above  $D^*$  (high disability) the opposite is presumed to be the case. Those elderly having most policy relevance are characterised by a level of dependency at or around level  $D^*$ . If one assumes that quality of care and health status outcomes are not significantly different between regimes of care decisions about placement of elderly persons can therefore be made on the basis of cost differences between regimes. Of course of equal interest is the estimation of crucial variables that would assist in explaining why some individuals with dependency levels at or around  $D^*$  are currently being cared for in institutions while others with the same level of dependency are being cared for at home.

Figure 1: *The Relationship Between the Costs of Care and Dependency Category for Domiciliary and Institutionally Based Elderly Persons*



$MC_D$  = Marginal cost of domiciliary care.  
 $MC_1$  = Marginal cost of institutional care.

1. A grant from the Irish Society of Medical Officers of Health is gratefully acknowledged.

The multifaceted nature of disability and dependency in elderly persons makes it impossible, however, to identify, in practice, a cross-over ( $D^*$ ) level of dependency as illustrated in Figure 1. Neither is there a common multi-dimensional measure of dependency that is uniformly applied by all physicians charged with the placement of elderly persons among different regimes of care within health boards. The wide differences in rates of institutionalisation for elderly persons among health boards partly reflects this heterogeneity of dependency measurement among physicians (Report of Working Party on Services for the Elderly, 1988). Availability of beds and general resource constraints are also, of course, factors in explaining general variation in rates of institutionalisation.

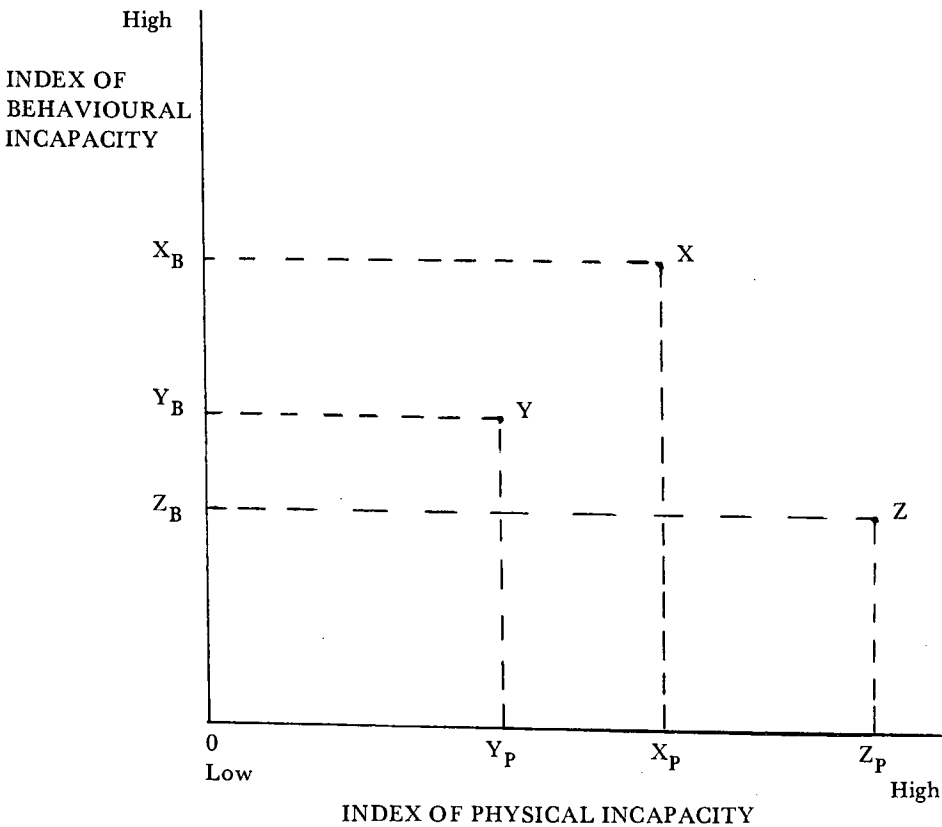
The literature is of limited use to those charged with assigning levels of dependency in elderly persons. Simple, either tested or untested, ordinal scales take a fairly limited approach to measuring dependency. Wright *et al.* (1981), for example, used a Guttman Scaling, based on the cumulative loss of function, mainly on physical activities of daily living, by elderly persons. The scale produced coefficients for reproducibility and scaleability that were satisfactory for both men and women and across forms of care. There were of course elderly who did not correspond to the scale. Wright suggested that these non-scale types might be mainly senile dementia patients. In a subsequent paper, however, Kyle, *et al.* (1987) applied an extended twelve item Guttman Scale to mentally infirm patients and found that it provided a reasonable fit for the patients under observation. Mental state items, such as problems with memory, comprehension, communication and confusion were felt to be adequately reflected in that they would give rise to problems in carrying out the activities of daily living included in the scale.

The main problem with unidimensional scales is, however, this very worry that important non-physical attributes of incapacity are not properly assessed. Health professionals are quick to point out that many factors other than physical dependency are important in balance of care considerations for elderly persons. This is of course correct. Behavioural, social, mental and emotional problems are all elements of a complete index of incapacity. There are, however, complexities in moving from unidimensional to multidimensional indices. The main issues revolve around the combining of ordinal measurements of physical distress with other measurements of incapacity. Assuming, for example, that we could get agreement on an ordinal scaling of both physical and behavioural dimensions of incapacity how would these indices be combined to provide meaningful and consistent measurements? Figure 2 illustrates the problem.

There is no doubt that an elderly person (X) with behavioural incapacity  $X_B$  and physical dependence  $X_P$  is more disabled than an individual (Y) with incapacities  $Y_B$  and  $Y_P$  respectively. Problems arise, however, when one

wants to compare individual (X) with individual (Z). Individual (X) represents greater behavioural incapacity but lower physical incapacity than individual (Z). How, therefore, should one trade off behavioural and physical incapacity? The dynamics of such trade offs are now being investigated within the framework of the "quality adjusted life year" research programme. However, this research is at an early stage and it will be a while before disparate measures of health status can be satisfactorily combined or quantitatively measured. In the meantime as Wright (1986) makes clear, all present scales have some drawbacks; the best way forward is to use the most appropriate measure for the task in hand but to be explicit in outlining all of the measure's limitations.

Figure 2: *Measuring Self-health: Combining Physical Incapacity and Behavioural Incapacity*



One common approach which has sought to circumvent the above problems is to use aggregated cardinally determined point scales to assess severity of conditions. The Modified Crichton Royal behavioural rating scale is often used in this regard (Wilkin and Jolley, 1979). A criticism of this approach is that it assumes that abilities and incapacities are not only cumulative but additive as well. Neither can cardinal scales guarantee homogeneity of dependency across scale points because various combinations of disabilities can yield the same score. There is no doubt that within the objectives of particular studies the aggregation of point scales can provide useful information. However, they are not a solution to the problems of combining scales even if they sometimes prove a convenient way of making quick progress.

Some analysts have taken an even more practical approach to measuring dependency in elderly persons. They seek and accept the assessment of the health professionals charged with the *de facto* responsibility of placement decision-making for elderly persons. Mooney (1978), for example, did not attempt to identify fine or scaleable degrees of differences in dependency among elderly clients in community, residential and hospital care. Instead he used criteria which the nursing staff, caring for the elderly under observation, used daily to characterise risk or dependency among their clients. Judgements on placement and on whether elderly were on/not on the margin of care between domiciliary and residential home; domiciliary and hospital; and residential home and hospital, were made by matrons and public health nurses. The characteristics of the elderly considered important in this approach were as follows: age, living alone, acute illness in the last month, incontinent, instability (frequent falls), night confusion, mental impairment, self neglect, tendency to isolation, inability for self-care; and unable alone to: get out of bed, move around the house, climb stairs or move out of doors.

A similar methodology is used to identify elderly persons for inclusion in this study. The community physician selected suitable elderly persons for alternative regimes of care. Two scenarios were considered. The first involved the community physician selecting domiciliary based elderly who would be suitable for transfer to the institution on the basis of an unlimited number of extra beds becoming available in the institution. The alternative scenario required the physician to select institutional patients who would be capable of living in the community if less beds were available in the institution. There are no ethical issues involved here. Physicians are daily making decisions on the placement of elderly persons within the resource constraints imposed upon them by society. All patients within the institution were assessed by the physician. All domiciliary based elderly, known to the physician, were also assessed. In practice, many of the elderly chosen from the latter group were known to the physician as respite care patients and/or day care patients of the long stay institution.

The above approach yielded 64 domiciliary based elderly on the margin of institutional care and 80 institutional based elderly on the margin of domiciliary care. The rating scheme used by the community physician reflected the medical and psycho-social condition of the elderly person as well as their physical abilities and capacity to complete activities of daily living. Given the subjective nature of the selection procedure, and faced with the reality that selected elderly persons were currently being cared for within particular regimes, those elderly chosen for inclusion in the study were asked to ordinally self-rank their health status across a number of dimensions.

As might be expected, homogeneity of dependency, along a number of dimensions, was evident between the two groups (Table 1). However, significant differences between the two groups occurred on the following dimensions: mobility outside, ability to negotiate stairs and steps, meal preparation, house cleaning, bathing all over, laundry, shopping and refuse disposal. *A priori*, one might expect that if there is to be heterogeneity between groups the domiciliary group would be less incapacitated on all significant dimensions. This is not the case. The domiciliary group is less incapacitated on only two dimensions: the ability to bathe all over and mobility outside the home.

Table 1: Mean Rank Dependency Scores Using Mann Whitney U-Test:  
A Comparison of Domiciliary and Institutionally Based Elderly

Variable	Ins. (n = 80)	Dom. (n = 64)	M-W U Statistic
Continence	69.65	76.06	2332.0
Mental state	73.70	71.00	2464.0
Mobile in building	72.10	73.00	2538.0
Wash hands and face	72.50	72.50	2560.0
Dress	72.90	72.00	2528.0
See	71.50	73.75	2480.0
Hear	71.50	73.75	2480.0
Speak	72.00	73.13	2520.0
Sit/stand steady	73.70	71.00	2464.0
*Mobile outside	90.88	57.80	1384.0
*Stairs and steps	61.60	86.13	1688.0
*Prepare meals	59.10	89.25	1488.0
*House clean	61.60	86.13	1688.0
*Bath all over	91.30	57.60	1368.0
*Laundry	59.90	88.25	1552.0
*Shopping	59.00	89.38	1480.0
*Refuse disposal	59.80	88.38	1544.0

\*Significant at the 1 per cent level.

The lower self-ranking by the institutional group on all of the other significant dimensions deserves explanation. It may reflect Millers' (1984) suggestion that instead of patient dependency causing nursing action, the latter can cause patients to become more or less dependent in a non-systematic manner. Lower self-ranking by the institutional group may also reflect the fact that the latter are not often asked or put in a position to test their abilities along certain dimensions – hence their more positive self-assessment on these dimensions may reflect a time when such tasks could be accomplished. Temporal differences in placement policy for elderly persons may also be a contributory factor in explaining lower rankings by institutional patients. Because of resource constraints domiciliary elderly have nowadays to score more highly on some dependency ratings before they will be admitted to institutions because of this dependency.

### III DISCRIMINANT FUNCTION

The absence of homogeneity on all dimensions of dependency and the *de facto* observed placement of elderly persons makes it worthwhile investigating further differences between the domiciliary and institutional groups. One possibility in this regard is to estimate a discriminant function that would allow the identification of a simultaneous set of variables useful in analysing the difference between groups of elderly persons. Mooney (1978), for example, estimated a discriminant function for elderly, within a balance of care model, and found that a function with four variables: living alone, age, stairs within dwellings and mobility had a high ability to predict those elderly on the margins of alternative regimes of care.

For a linear discriminant model to be optimal, that is to provide a rule for classification that minimises the probability of misclassification, certain assumptions about the data must hold. Each group must be a sample from a multivariate normal population and the population covariance matrices must be equal. In the application of a discriminant function to the data collected for this study both of these assumptions fail to hold. In particular, the model fails Box's M test of the equality of the group covariance matrices. It has been argued that where equality does not hold the quadratic classification rule is deemed appropriate. However, given that the statistical literature is unclear (Sudarsanam and Taffler, 1985) on whether using a quadratic rule actually leads to better results, the linear formulation is retained. Much more serious, however, is the observation that the normality assumption is undermined by the dichotomous nature of many of the variables included in the discriminant function (Eisenbeis, 1977). Given these caveats the coefficients of the estimated discriminant function shown in Table 2 must be interpreted with caution. All results are approximations, useful as pointers to crucial variables,



but subject to significant bias in many cases. In the light of the dichotomous nature of many of Mooney's (1978) variables the reader is encouraged to treat his discriminant results in the same manner.

In order to estimate the discriminant function a stepwise option was used to select the prime discriminating variables from among the appropriate number of variables available for inclusion in the stepwise procedure. At each step the variable that results in the smallest Wilks Lambda (the proportion of the total variance in the discriminant scores not attributable to difference between groups) for the discriminant function is selected for entry (Norusis, 1985). The number of steps was limited to eight in the interest of maintaining a fair case variable ratio. The discriminant score evaluated at group means is 1.05 for the community group and -0.840 for the institutional group. The coefficient on each variable shows that variable's relative contribution to the overall discriminant function and the value of the coefficient for a particular variable depends on the other variables included in the function. The actual signs of the coefficients are arbitrary. The positive coefficients for the variables ability to bathe, mobility outside, living with others and living conditions could just as well be negative if the signs of the other coefficients were reversed.

Table 2: *Standardised Discriminant Function Coefficients*

<i>Variables</i>	<i>Coefficients</i>	<i>Correlations between discriminating variables and canonical discriminating functions</i>
Ability to bathe (all over)	0.513	0.604
Mobility outside the home	0.543	0.574
Home help	-0.444	-0.477
General practitioner	-0.273	-0.253
Living with others	0.220	0.026
Public health nurse	-0.219	-0.292
Sex of elderly person	-0.228	-0.030
Living conditions	0.177	0.117

The coefficients indicate that as ability to bathe and mobility outside increase the probability of being in the domiciliary group increases. Similarly, as living conditions improve and the elderly live with others (Living alone: Yes = 0, No = 1) the probability of being in the domiciliary group increases. The absence of the services: general practitioner (Yes = 0, No = 1), public health nurses (Yes = 0, No = 1), and home help (Yes = 0, No = 1) increases the probability of being in the institutional group; being female (Sex: Male = 0, Female = 1) also increases the probability of being in the institutional group.

In terms of the accuracy of prediction of domiciliary and institutional elderly, using these eight factors, the overall prediction rate is 84.0 per cent; 78.1 per cent of domiciliary elderly are correctly classified; 88.8 per cent of institutionalised elderly are correctly classified. Any satisfaction regarding the good classificatory performance must however be tempered by the caveats raised above. Furthermore, the use of a stepwise selection procedure invalidates tests of significance (Draper and Smith, 1966) which consequently are not always reliable (Kennedy, 1985).

#### IV LOGIT MODEL

One way to overcome the problems posed by the dichotomous nature of many of the variables used in the analysis is to use an ordinary binomial logit procedure. A multivariate model has, therefore, been estimated for the data and the results of the logit regression are presented in Table 3. Many variables were considered but only those variables that were significant and/or formed part of the discriminant function estimated in Table 2 are shown.

For the logit model a linear function of the independent variables is equal to the logarithm of the ratio of the probability of an elderly person being cared for at home in the community and being cared for within the long stay geriatric institution.

The probability of being in the community is equal to:

$$\text{Prob (Comm)} = \frac{e^{X\beta}}{1 + e^{X\beta}}$$

where  $X\beta$  is a linear function of the characteristics of elderly persons. This in turn implies that the probability of being in the institution is equal to

$$\text{Prob (Inst)} = 1 - \text{Prob (Comm)} = \frac{1}{1 + e^{X\beta}}$$

This implies that

$$\frac{\text{Prob (Comm)}}{\text{Prob (Inst)}} = e^{X\beta}$$

So that:

$$\ln \frac{\text{Prob (Comm)}}{\text{Prob (Inst)}} = X\beta$$

The dependent variable is constructed as a dichotomous binary choice variable which assumes the value 1 if the elderly person is being cared for at home in

the community and 0 if the elderly person is in the long stay geriatric institution. Only the final version of the explanatory variables are presented here. Therefore the variables discussed below either achieve desired significance levels or form part of the discriminant function estimated above.

(a) *Sex*

If an elderly person is classified as female, she is given a score of 1; males are classified as 0. Given that females live longer than males and that ageing and hospitalisation are highly correlated it is expected that the sign on this coefficient will be negative.

(b) *Living Alone*

This variable assumes the value of 1 if an elderly person lives alone. The ability of an elderly person to live in the community is enhanced if the elderly person lives with others or has a network of family and friends who provide care and communication: Mooney (1978), Wright, *et al.* (1981). Consequently, the expected sign on this coefficient will be negative.

(c) *Living Conditions*

We are interested here in estimating the extent to which good living conditions influences the probability of being cared for at home in the community. The domiciliary group have significantly better household amenities than the institutional group had prior to institutionalisation. Furthermore, 48 per cent of the domiciliary group described their living conditions as good while only 30 per cent of the institutional group described their former living conditions as good. It is expected that good living conditions will be reflected by an increase in the likelihood of an elderly person being cared for at home.

(d) *General Practitioner, Public Health Nurse, Home Help*

These variables measure the availability and take up of the statutory services. Some evidence exists which suggests that some applicants for residential care could be maintained at home with a guaranteed delivery of formal intensive domiciliary care (Avon County Council Social Services Department, 1981); other evidence suggests that institutional based elderly could be discharged to domiciliary care if appropriate services were available (Hakansson, 1986). The Kent community care project has focused on an integrated approach to formal and informal service provision in order to maintain elderly persons in the community. Within an agreed budget, social workers are empowered to demand and allocate formal and informal community care resources on behalf of domiciliary elderly, provided that such resource use does not exceed an agreed proportion of the alternative cost of institutional care (Challis and

Davies, 1980). In the light of this evidence and experiment the coefficients on each of the above variables are expected to be positive.

(e) *Inability to Bathe All Over; Immobility Outside the House*

Given the results of the Mann Whitney U Test and the discriminant approximations the coefficients on both these variables are expected to be negative. The immobility variable finds particular support in the literature as being important in decisions to transfer elderly from domiciliary to institutional care (Wright, *et al.*, 1981; Mooney, 1978). Both variables are nearly always included in indices used for the assessment of whether elderly persons are more suitable for domiciliary care or institutional care (Kyle, *et al.*, 1987; Gibbins, *et al.*, 1982).

(f) *Other Variables*

Other variables were estimated. All significant dimensions of dependency that had been identified using the Mann Whitney comparison of mean rank scores were considered (recoded to read 1 for unable and 0 for able) in various estimations of the logit function. Only bathing and mobility were significant. Age was also included in the model, dichotomised into those greater than 65 and less than 75 equal to 1, otherwise equal to 0. Most surprisingly, given its importance in other boundary of care models (Mooney, 1978), age turned out to be correctly signed but insignificant. Perhaps a more sensitive disaggregation of age would have produced a more significant effect. All non-significant variables did have the correct sign. For example, the variable inability to climb stairs and steps had a positive sign, reflecting the earlier discussion on why domiciliary elderly may have more disability on this variable than institutional patients.

Information on informal care was not available for the institutionalised group and so could not be included in the logit expression. Neither was it possible to use information on the purely medical condition of the elderly, either domiciliary or institutionally-based. The inclusion of variables reflecting both informal care and medical criteria would, undoubtedly, have enhanced the model.

## V THE RESULTS

The results presented here suggest that the logit model fits the data well with an observed significance level for the goodness of fit statistic of approximately 0.8. The chi-square values indicate that an independence model fits the data well. Based on the analysis of dispersion, it is possible to infer that 45 to 51 per cent of the total dispersion in the dependent variable is attributable to the model. Haberman (1982) does warn, however, of the dangers of

interpreting measures of association as quasi  $R^2$ , especially since the variables may be strongly related even though the coefficients are small.

Both immobility and inability to bathe are significant (1% level) and correctly signed. An increase in dependency on both these dimensions increases the likelihood that an individual is in an institution. Similarly, living alone decreases the likelihood of living at home. However, this variable did not reach conventional levels of significance even though it is signed correctly. Being female also enters negatively but insignificant on the likelihood of an elderly person living at home in the community. The higher probability of females being in institutional care more than likely reflects their longevity than any other factor. Good living conditions are, however, significant (5% level) and correctly signed. The likelihood of an elderly person living at home in the community increases as their living conditions improve. Given that social factors influence most placement decisions, it is hardly surprising that good housing stock has a role to play in prolonging the community life of an elderly person.

All of the statutory services included in the model are correctly signed. However, only the variables general practitioner (5% level) and home help (1% level) are significant for these data. The absence of significance on the public health nurse variable more than likely reflects the comprehensive nature of this service for at risk elderly persons. Almost all elderly persons received visits from the public health nurse, currently in the case of the domiciliary group and formerly in the case of the institutional group. The availability of home help services significantly increases the likelihood of domiciliary care. Home helps provide many basic services that would, otherwise, be denied the elderly person due to their incapacity to carry out such activities. Home help is particularly beneficial if the elderly person does not have a network of family and friends to provide help with these activities.

The significance of general practitioner visits is more difficult to interpret. One argument that focuses on the incentives for general practitioners to generate demand for their own services would, no doubt, contend that it is in the financial interest of general practitioners to maintain elderly in their own homes, facilitating easier access and on-going care, thereby enhancing income (see Evans, 1974). Tussing's (1985) results on the prevalence of physician-induced demand in Ireland are not, however, encouraging as a support for the above argument. Consequently, the significance of general practitioner care may have more to do with how the spatial availability of such care induces in domiciliary elderly the confidence to believe that living at home is a viable option to institutional care, even should minor forms of illness occur in an uncertain future. Furthermore, the general practitioner may encourage preventative activities that slow down the depreciation of elderly persons' health status.

Table 3: *Logit Analysis of Placement of Elderly Persons*

<i>Variable</i>	<i>Coefficient</i>	<i>SE</i>	<i>t</i>
Sex of elderly person	-0.147	0.133	-1.103
Living alone	-0.157	0.141	-1.117
Public health nurse	0.216	0.212	1.016
General practitioner	0.806	0.313	+2.580*
Home help	0.707	0.223	+3.171**
Immobility outside the home	-0.517	0.143	-3.610**
Unable to bathe (all over)	-0.544	0.150	-3.620**
Living conditions	0.324	0.138	2.353*

*Analysis of Dispersion*

	<i>Entropy</i>	<i>Dispersion Concentration</i>	<i>DF</i>
Source of variation	44.729	36.778	
Due to residual	54.243	34.382	
Total	98.972	71.160	143

*Measures of Association*

Entropy = .451935  
Concentration = .516833

*Goodness of Fit Statistics*

Likelihood Ratio Chi Square = 43.43960  
DF = 53  
P = .823

Pearson Chi Square = 43.16500  
DF = 53  
P = .830

\*Significant at the level of 5 per cent.

\*\*Significant at the level of 1 per cent.

The results presented in Table 3 show the model to have performed reasonably well, with a number of the variables, tentatively identified by the discriminant function, proving significant. All variables are correctly signed and produce the *a priori* expected effects on the likelihood of an elderly person living at home in the community. The literature has identified relationships between each of the variables and the placement of elderly persons. The logit estimation technique has confirmed and quantified these effects. Given the problems associated with the estimated discriminant function, especially the absence of normality, the estimation of a logit regression function allows for a much more meaningful discussion of the issues. The absence of important variables from the logit expression should, however, be noted (especially

informal care and pure medical care). The size of the elderly groups under observation and the geographical restrictiveness of the site chosen for study should also cause some concern. However, the logit model is a promising methodology for further work in this area.

## VI THE COST OF CARE

### *Formal Care*

Information was only collected on the actual, *de facto*, use of formal care by the domiciliary group deemed to be on the margin of institutional care. Almost all members of this group receive visits from the general practitioner and the public health nurse. About one-third receive visits from the home help services while only 14 per cent receive the service of meals on wheels. Although visits from the occupational therapist and the chiropodist do not, in general, occur, facilities are available in cases where an acute need has been identified; 18.8 per cent of the group travel to the chiropodist. The data used to cost these services are based on prevailing 1987 payment rates for visits and salary levels, whichever is appropriate to use for the particular service. Travel costs are calculated at current public sector rates, adjusted to give an average cost per mile.

Respite care in the district geriatric institution is availed of by 37.5 per cent of the domiciliary group; a total of 70 weeks during the last year was spent in respite care. The current and capital costs of this care must be included in the domiciliary care costings. An estimate of the costs of attendance at the hospital day centre<sup>2</sup> must also be included; a total of 48 visits per week is made by the 34.1 per cent of the domiciliary group who attend. There is no readily available information on the cost of this type of hospital day care. For the purposes of this study a rather crude and unsatisfactory estimate of cost is made, based on what is currently known about the cost per attendance at day hospital care in the National Health Service (Hildick-Smith, 1984) and the cost of attending day care centres in the Eastern Health Board (National Council for the Aged, 1987).

The total cost of domiciliary group modifications to housing stock, specifically to improve caring facilities within the household, amounted to £24,000. Assuming a life-span of 10 years and discounting at 5 per cent (both can be subjected to sensitivity analysis), the household alteration cost attributable to each domiciliary elderly person can be estimated. Only 20 per cent of the

2. Care in the local hospital day centre seems to embrace activities that are more comprehensive than non-hospital based day centres but yet not so complete that one could define such care as being of the type carried on in a conventional day hospital. Such ambiguity is subsequently reflected in the crudeness of the cost estimate assigned to the variable in this study.

elderly households, however, made alterations to their dwellings, spending between £500 and £4,000 on modifications.

Information was also collected on the availability and rate of religious and voluntary visiting to the domiciliary elderly group; 65.0 per cent of the group received religious visits; 23.0 per cent of the group received visits from voluntary organisations. Both types of visits are tentatively valued at the hourly home help rate of £2.00 per hour. The use of this valuation for religious visits is not inconsistent with available information on the *de facto* fee per item of service being offered to religious for services rendered.

The cost of pharmaceutical consumption by the domiciliary group is not included in this study. The collection of this information proved beyond the scope of the study. Neither is the cost of in-patient acute care, required by the domiciliary group during the past year, included in the analysis. Although a total of 60 weeks was spent in acute care the marginal cost information necessary to compute the monetary valuation of this care is not available.

The cost of formal statutory service provision for the domiciliary group is shown in Table 4. The estimated average weekly domiciliary cost of care per elderly person is £30.70. This cost is sensitive to all variables shown in the table but is particularly so to the estimated monetary valuation of hospital day care. It is unfortunate that comprehensive and accurate cost information is not available for this variable given the heterogenous nature of care possible within this form of care. More generally the conventional wisdom that day hospital care represents the future direction of care of the elderly in this country, makes the continued absence of cost information on this service particularly alarming. The absence of information on drugs and acute care costs is also regretted. The most recent available estimate of the weekly average cost of keeping a patient in the nearest acute care hospital to the domiciliary group is £655.43 (Department of Health, 1985). There may, however, be a significant difference between the marginal and average cost of acute care by client and diagnostic group. Hence average cost is not suitable as a basis for acute care costing in this model. If the utilisation of acute care facilities and the consumption of drugs could be assumed not to differ significantly between marginal domiciliary and marginal institutional elderly the absence of cost information may not be so damaging, especially in models that seek only to examine relative cost effectiveness between regimes. Nevertheless, their absence from this study serves to underestimate the real cost of domiciliary care.

It must be borne in mind that the level of formal care services examined is *de facto* care for the group under observation. There is no implication in the study that such care is optimal in terms of quality and effectiveness. The optimisation of community care services is affected by the extent and form of the prevailing budget constraint. Within such a framework, for example,



Table 4: *Cost of Statutory Services*

<i>Service</i>	<i>Uptake %</i>	<i>Cost per patient per week £</i>
Visits by GP	98.4	1.05
Visits to the GP	43.8	0.19
Travel costs	43.8	0.04
Visits by the PHN	96.9	0.54
Travel costs	96.9	0.04
Visits by home help	32.8	7.09
Meals on wheels	14.1	1.16
Religious visits	65.6	0.07
Voluntary visits	23.4	0.03
Visits to chiropodist	18.8	0.04
Alterations to dwelling	20.3	0.93
Respite care (current)	37.5	4.01
Respite care (capital)		1.03
Travel to day care		0.02
Hospital day care (current and capital) (est.)	34.1	<u>14.46</u>
		30.70

the expansion of specific community care services, may, perhaps, only be feasible if resources are redeployed from the institutional sector. Closing institutions is not a simple task and takes a long time to complete. In the meantime physicians may be unwilling to dispatch elderly into the community because the necessary and sufficient services are not available to provide optimal care.

## VII INFORMAL CARE

An economic service has been defined by Hawrylshyn (1977) as one which may be done by someone other than the person benefiting therefrom. If one accepts such a definition then informal care of the elderly can be valued at the relevant opportunity cost of using a paid carer to carry out the required tasks. Informal caring, however, conveys benefits not only to the caree but also the carer. The latter may receive a direct psychological benefit from caring. Furthermore, any negative utility from the ongoing rigors of caring may be offset retrospectively by a feeling of pride and honour that even though the caring was difficult, the carer did not give up and performed to the limits of her abilities. The valuation of informal care is further complicated if one attempts to weight each activity upon which time is expended according to individual perceptions as to the nature, productivity and pleasantness associated with that activity.

The practicalities of valuing informal care have led many to the view that, in the absence of unpaid resident carers, society would have to pay the market rate for care of the elderly person (Wright, 1987). This approach is implicitly accepted in this paper. However, the relevant opportunity costs for carers may not only be market work-time forgone. Therefore this analysis includes details of unpaid non-market work forgone and leisure time forgone by carers of the elderly persons. Carers give up paid work (7.8%), unpaid work (76.6%) and leisure time (84.4%) to look after the elderly group. Hours of paid work forgone is valued at the average industrial earnings hourly rate for 1987 (£4.68 per hour); non-market unpaid work is valued at the hourly home help rate (£2.00 per hour); leisure time forgone is valued, following the literature on transport appraisal (Leitch, 1978), at 25 per cent of working time (£1.17 per hour). Sensitivity analysis can and should be applied to these assumptions especially where base line valuations are crucial and significant in determining final outcomes.

The amount of informal care expended on the domiciliary group is disaggregated by caring activity and shown in Table 5. Not all elderly in the domiciliary group receive informal care services and some services are provided more than others. Almost 78 per cent of the domiciliary elderly group receive some supervision; 77 per cent receive mobility assistance; 69 per cent receive laundry services; while 75 per cent had carers who provided help with shopping. At the other extreme only 1 elderly person requires help with feeding; 19 per cent require help with general administration; while 36 per cent require help with bathing. The aggregate number of informal care hours per day received by the domiciliary group is 515 hours; supervision constitutes 48 per cent of all caring hours; mobility assistance (21%) and cooking (15%) are next in order of time allocation. No attempt is made to disaggregate care by dependency category or to weight activities by the unpleasantness of the tasks to be done. The average amount of caring hours given to those elderly receiving care is 10.30 hours per day; for all elderly (whether receiving care or not) the average caring hours per day is 8.05 hours. The information on standard deviation contained in Table 5 shows that there is considerable variation in hours of care per item of service, especially with regard to shopping, laundry and general administration.

The application of monetary values to informal care, based on the estimates discussed earlier, yields an average cost per elderly person per week (whether receiving care or not) of £103.45. If this figure is disaggregated to reveal constituent differences in opportunity costs, £16.10 can be allocated to paid work forgone, £61.39 to unpaid non-market work forgone and £25.96 to leisure time forgone. Any evaluation of community care options for elderly persons which does not include the monetary valuation of informal care is, given the above results, seriously underestimated.

Table 5: *Informal Domiciliary Care Hours Per Day*

<i>Service</i>	<i>No. of community elderly receiving (n = 64)</i>	<i>Hours of paid work given up by carers</i>	<i>Hours of unpaid (non-market) work given up by carers</i>	<i>Hours of leisure time forgone by carers</i>	<i>Total hours of care to those receiving</i>	<i>Mean hours of care to those receiving</i>	<i>Standard deviation hours of care to receiving</i>
Supervision	50	19.00	130.50	99.00	248.50	4.97	2.70
Bathing	23	0.26	1.20	3.64	5.10	0.22	0.21
Toileting	0	0.00	0.00	0.00	0.00	0.00	0.00
Dressing	29	2.00	8.79	20.10	30.89	1.07	0.90
Shopping	48	0.14	9.97	8.34	18.45	0.38	0.39
Cooking	45	2.50	58.30	14.90	75.70	1.68	0.80
Feeding	1	0.00	2.00	0.00	2.00	2.00	—
Laundry	44	0.80	11.17	6.15	18.12	0.41	0.57
Mobility assistance	49	6.50	56.65	47.15	110.30	2.25	1.24
General administration	12	0.14	2.00	2.66	4.80	0.40	0.82
Other	4	0.14	0.00	0.94	1.08	0.27	0.15
All	50	31.50	280.58	202.88	514.94	10.30	4.38

Sensitivity analysis can and should be applied to variables whose valuation is far from settled and which are likely to affect the outcome of the analysis. Informal care is the most problematic and crucial variable. It is, therefore, worthwhile to briefly consider if alternative valuations affect the outcome. If informal care is not valued, the cost of community care for the domiciliary group is entirely focused on formal care (estimated to be £30.70 per elderly person per week) and represents a comparatively cheap option for care of the elderly. Alternatively, if the opportunity cost of non-market work time forgone is valued, not at the hourly home help rate (£2.00 per hour), but at the average industrial wage rate (£4.64 per hour), the informal care cost per elderly person per week increases to £185.62. The latest available estimate of the weekly cost to a health board of maintaining an elderly person in a long stay geriatric hospital is £159.00 (National Council for the Aged, 1988). Thus, in this case, domiciliary care, only taking into account informal care, is more expensive than institutional care. When formal statutory community care services are valued and included the cost of domiciliary care increases to £216.32. Clearly, the decision to value informal care and the methodology used for such valuation does make a difference, especially if the cost effectiveness of domiciliary care is being compared to that of institutional care.

#### VIII DISCUSSION

The role of the community physician is, in practice, crucial in determining marginal elderly on the boundary of care between domiciliary and institutional care. In this study when dependency was further refined, using the elderly's own health status rankings, significant differences on some important dimensions emerged between the two groups chosen by the physician. It is clear that balance of care models which depend solely on medical judgement or, alternatively, rely on a limited set of non-medical socio-economic measures to select patients, provide an unsatisfactory framework for valid cost comparisons to take place. For that reason the model outlined in this paper must be interpreted with caution and any temptation to over-generalise the results of the model should be resisted. A more refined measure of dependency is obviously required. One possibility is the *ex post* identification of marginal elderly by associating marginal changes in dependency with incremental changes in community care provision and usage (Wright, 1987). The Kent community care project is an implicit application of this approach, not for evaluation purposes, but as a practical model for caring in the community (see Challis and Davies, 1980). Social workers are used as case managers to ensure that each elderly client receives the full range of formal and informal care services that their particular dependency warrants with that dependency, in turn, classified by the range and type of services received.

The discriminant function estimated for the data in this study is unreliable due to the multivariate normality assumption being breached on a number of variables. An application of the logit procedure provides a much more useful framework for the analysis of crucial placement variables. In particular, the following variables prove significant when estimated using the logit regression: immobility outside the home, inability to bathe, use of general practitioner services, use of home help services and condition of housing. All variables included in the logit expression have the, *a priori*, expected sign.

The major factor in determining the real cost of domiciliary care is the extent to which informal care is valued in monetary terms. Informal care when valued along the base lines discussed is over three times above the estimated *de facto* cost of formal community care services. There are good reasons why informal care should be valued – there are real opportunity costs associated with care. There is less agreement on how informal care should be valued. The most practical approach has been to use the valuation of services that would have to be paid for in the event of informal carers not being available. Such an approach may over-estimate the true opportunity cost of caring – many carers enjoy the caring role, often perceiving the role as a leisure time activity. Furthermore not all caring involves market work-time forgone – non-market work time and leisure time may, instead, be forgone. There are strong arguments, however, that, no matter what the social and/or moral responsibility felt by carers, there is a diminishing marginal valuation of time spent caring. Real opportunity costs do exist and are perceived by carers.

There is no implication in the study that the current placement of elderly persons should be disturbed willy nilly or that existing community care services are optimal or even adequate for current numbers of domiciliary elderly. Furthermore some of the elderly may actually like where they are now living, whether this is in domiciliary or institutional care. The relevance of the analysis may be to raise critical issues about the future placement of elderly persons especially with regard to the identification of the crucial variables that serve either to increase the likelihood of domiciliary care or its alternative. The extent to which care in the community is dependent on the availability of informal carers is also acknowledged.

The model discussed in this paper is, however, more suggestive than definitive; its main function is to make explicit many of the issues that up to now have remained either implicit or completely hidden. Much more information is required on the full range of costs and benefits of both domiciliary and institutional care before a more complex model can be developed (Wright, *et al.*, 1981, 1986). The assumption of homogeneity across regimes with regard to quality of care may, in particular, need revision. In the meantime, however, it no longer seems appropriate to treat informal care as a free good, especially in an environment where, more and more, policy-makers are seeking to shift the burden of care from the exchequer to the family.

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