Investigating the hospital dual hierarchy

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Work in Progress

1. Introduction

This paper presents a study addressing the proposition that hospitals are characterised by a dual hierarchy. Harris (1977) drew attention to the possibility of the hospital having such an internal organisation. He concluded that the hospital has two internal firms one made up of medical staff and the other of administrative staff, each with its own objectives and constraints. Although this hypothesis has often been cited in the health economics literature (Evans, 1984, McGuire *et al*, 1987), little work has been undertaken to consider the appropriateness of this characterisation of hospital internal structure.

The first section of the paper gives a brief background to the context of the study. The method used to elicit objectives and the results are then presented. In the discussion the interpretation of the results and the validity of the methodology as a means of eliciting arguments in the objective function are examined.

Background

The data used to analyse the difference in objectives of the managers and doctors were elicited within the context of a specific policy question. The senior management of a NHS acute training Hospital Trust in Scotland wanted a project undertaken to assist in the process of setting priorities between competing clinical service developments.

The Trust was aware that resources for funding clinical service developments were limited and as such choices between the alternative developments were necessary. It was important that the clinical service developments were chosen in such a way as to get the most benefit from the available resources. The Trust wanted the measure of benefit used to reflect the values or preferences of consultants working in the hospital. Given the aim to accrue as much benefit as possible from the choice of clinical service developments, a first step was to identify what constitutes benefits as seen by the hospital consultants and then to assign weights to those dimensions of benefit. That is

the consultants were being asked what objectives they wanted future clinical service developments to achieve[1].

Method

Five possible dimensions of benefit from clinical service developments were identified through meetings with the Trust Medical Advisory Committee. These dimensions were then weighted using the stated preference technique broadly known as conjoint analysis. More specifically discrete choice modelling was used. The levels of the dimensions of benefit were also identified through discussions with the Committee. The dimensions and their levels are shown in Appendix 1.

All the hospital consultants in the acute hospital were asked to complete the questionnaire. Five months later the managers in the hospital were sent the same questionnaire. Both sets of questionnaires contained the same 8 pair-wise choices. An example is shown in the Appendix 2. The consultants were told explicitly that their views would be incorporated into the Trust's priority setting activities. The managers were told that the results of an earlier survey of consultants had been used in the priority setting process and we would like to extend our enquiry to their views.

The data were binary choice responses and contain multiple observations from each respondent. As a result it is necessary to control for the possibility non-randomness in each individual's set of responses. To do this, a random effects probit model was used.

The responses were tested for consistency and for dominance in each attribute (San Miguel *et al*, 1997, Scott, 1998). Respondents that were not consistent in their responses were then eliminated from the data set. Respondents whose choices were dominant in any one of four of the attributes, education, training and research (ETR), strategy (STRAT), health gain (HEG) or professional development (PROD), were dropped from the sample. It was decided not to drop those apparently dominant in clinical effectiveness (CLIN) as this attribute differed in level for only two of the choices compared to six or seven for the other attributes. It was more possible for

[1] For a more detailed account of the priority setting project and the tests undertaken, readers are referred to HERU DP 08/97.

CLIN that a respondent could have answered by chance both choices in such a way as to indicate dominance.

Goodness of fit was measured using an approximation of McFadden's R^2. The restricted log likelihood function (L_0) in McFadden's specification of R^2 is normally calculated by restricting the coefficients on all the variables to zero, leaving only the constant term in the expression. Because the model does not have a constant term, I have taken each of the variables separately and used them as the sole term in the expression restricting the remaining variables to equal zero. This is not strictly the same as McFadden's R^2 but approximates the equation.

In addition, the Mckelvey and Zavoina (1975) pseudo R^2 (R^2_{ZM}) was calculated. Veall and Zimmerman (1996) reviewed the performance of a variety of R^2 measures. They concluded that R^2_{ZM} scored consistently well. The criterion used was the strength of the relationship between the pseudo R^2 for the probit model and the R^2 for the OLS model for the underlying latent variable.

The data were segmented according to which of the two mailings the respondent belonged. i.e. by whether the Trust employed them primarily as a clinician or as a manager. The Wald test was used to test for statistically significant differences between the two sets of coefficients using individual and grouped restrictions.

Two *a priori* hypotheses were made regarding the differences in the coefficients between the doctor model and the manager model. These were:

1. **Doctors would place greater importance on education, training and research than managers.** This is because the professional kudos that managers get from publication of peer reviewed papers, the attraction of research grants and training activities is much less than that of doctors.

2. **Managers would place greater importance on whether the clinical service development was a strategy area.** This is because the managers are more answerable to senior management within the Trust and the rest of the health care

system (i.e. groups that have set those strategy areas) than doctors who are primarily answerable to their professional organisations and patients.

The coefficients (ETR and STRAT) attributes were compared in terms of their absolute sizes. In addition, the relative sizes of the coefficients were compared. To do this, marginal rates of substitution were calculated. The calculation of marginal rates of substitution between ordinal variables is normally avoided. Here they are calculated to make comparisons between the two segments of the model rather than for any direct policy implications. These ratios are use to test the two *a priori* hypotheses above.

The results from the analysis (or at least those from the consultants' responses) were generated for application in an actual decision-making process. Consequently it was possible to test for whether the differences between the results from the two samples had practical implications. The coefficients from consultant model were used to weight the various dimensions of benefit which were associated with the provision of clinical service developments. The weights were used in a simple scoring and weighting exercise. *Actual* proposed clinical service developments (distinct from the hypothetical ones used in the questionnaire) were each given a weighted score, which allowed the developments to be ranked. The coefficients from the model of the managers' preferences were also used in a separate scoring and weighting exercise. The ranking of the service developments by the managers and by the doctors were then compared.

A range of methodological issues were also addressed in the analysis but will not be included in this paper

Results

The response rate for clinicians was 63 per cent (136 completed returns from 216 questionnaires) and 76 per cent for managers (47 out of 62).

Choice 3 (shown in appendix 2) which was included in the questionnaire as a test of internal consistency was answered correctly (i.e. they chose the dominant

development B) by all but one respondent. All their responses were excluded from the subsequent analysis.

Table 1 shows the percentage of respondents with dominant preferences and the attribute in which they were dominant.

The results from the regression model when the respondents dominant in ETR, HEG, PROD and STRAT were taken out of the data set are shown in Table 2[2]. ETR refers to education, training and research; STRAT refers to whether the service constitutes a strategy area; CLIN refers to the level of evidence of clinical effectiveness; HEG refers to the size of the health gain expected from the introduction of the new service; and PROD refers to whether the service would contribute to the professional development within the Trust.

All coefficients have the expected sign and are significant at the 1 per cent level.

Table 1 Dominant Preferences

Attribute	**CLIN**	**ETR**	**HEG**	**PROD**	**STRAT**
% of respondents	12.2	4.4	11.7	2.8	2.8

In Table 2, the pseudo R^2 value is reported using the restricted log likelihood function for the model when the coefficients of the variables STRAT, HEG, CLIN and PRODE are restricted to equal zero. This gives a pseudo R^2 of 0.21. Other combinations produced similar results. This is around what we would expect from McFadden's measure in a model of micro data. The Mckelvey and Zavoina (1975) pseudo R^2 takes a value of 0.67.

Table 3 shows the results of the segmentation of the data. The explanatory variables beginning with M refer to the responses by the managers and the variables beginning with D refer to the responses given by the doctors.

[2] The model with all respondents is shown in Appendix 3

Table 2 Basic model

Explanatory variable	Coefficient	Standard error	P
ETR	0.61	0.49E-01	0.00
STRAT	0.70	0.61E-01	0.00
HEG	0.98	0.76E-01	0.00
CLIN	1.09	0.14	0.00
PROD	0.59	0.63E-01	0.00
Observations			1140
Respondents			180
Log likelihood function, L			-571.07
Restricted log likelihood, L_0 (β_2, β_3, β_4, β_5, =0)			-721.37
McFadden's R^2 (1 –L/L_0) (approximation)			0.21
Likelihood ratio test (df) L_0–L			150.3 (4) ($p<0.001$)
McKelvey and Zaviona R^2 (N-1)*Var(X'b)/(N+(N-1)*Var(X'b)			0.67

Table 3 Segmented model with tests for restrictions

Explanatory variable		Coefficient	Standard error	P	Restrictions	Wald statistic
M*ETR	(β_1)	0.734	0.101	0.00	$\beta_1 - \beta_6 = 0$	0.190
M*STRAT	(β_2)	1.137	0.136	0.00	$\beta_2 - \beta_7 = 0$	0.000
M*HEG	(β_3)	1.362	0.155	0.00	$\beta_3 - \beta_8 = 0$	0.005
M*CLIN	(β_4)	1.516	0.280	0.00	$\beta_4 - \beta_9 = 0$	0.100
M*PROD	(β_5)	0.749	0.120	0.00	$\beta_5 - \beta_{10} = 0$	0.147
D*ETR	(β_6)	0.582	0.575E-01	0.00	$\beta_1 - \beta_6 = 0$,	
D*STRAT	(β_7)	0.561	0.696E-01	0.00	$\beta_2 - \beta_7 = 0$,	
D*HEG	(β_8)	0.856	0.888E-01	0.00	$\beta_3 - \beta_8 = 0$,	
D*CLIN	(β_9)	0.986	0.158	0.00	$\beta_4 - \beta_9 = 0$ and	
D*PROD	(β_{10})	0.544	0.753E-01	0.00	$\beta_5 - \beta_{10} = 0$	0.000

The tests for equality of the two sets of coefficients showed the weight that the managers and the doctors attached to the variables STRAT and HEG to be statistically significantly different at the 1 per cent level. At the 10 per cent, CLIN was also statistically different. A combined test, which restricted all the coefficients from the management model to equal those of the doctor model showed that overall, the two models were significantly different to one anther.

There were also some differences in ordering of the coefficients. Although both models show CLINEFF and HEG to be the two most important dimensions of benefit, the order of the remaining three differs. Doctors attached the least weight to PROD followed by STRAT. Managers on the other hand attached the least weight to ETR, followed by PROD.

The comparison of the absolute sizes of the ETR coefficients from the two models does not support the *a priori* hypotheses that doctor would place a greater weight on education, training and research than the managers would. However, the same test applied to STRAT supports the hypothesis that managers attach a greater weight to local and national strategy than do doctors.

Table 4 shows the marginal rates of substitution of the two variables raised in the a priori hypotheses relative to clinical effectiveness for the managers and the doctors. Clinical effectiveness was chosen as a convenient base in these calculations because it was the most highly weighted variable for *both* segments of the model.

The first row in the table shows that doctors value ETR relative to HEG more highly compared with managers, i.e. the managers require only 1.7 units of ETR to compensate them for a unit decrease in CLIN. This offers support for the *a priori* hypothesis that doctors value education, training and research more highly than managers do.

The second row indicates that managers value strategy more highly than doctors again offering support for the *a priori* hypothesis.

Table 4 Marginal Rates of Substitution

	MRS	
	Doctor model	**Manager model**
CLIN/ETR	1.7	2.1
CLIN/STRAT	1.8	1.3

Table 5 presents the results of the ranking of the clinical service developments using the doctor and manager segmented models. A total of 45 developments were considered in the priority setting process undertaken by the hospital trust. The top twelve are shown here. Project numbers 1, 7, 10 and 14 received full marks on the scoring element of the exercise and therefore have to be ranked equal first whichever weighting is used. Although there is a little variation in the ordering of the projects it should be noted that the top twelve projects are the same for each of the segmented models.

Table 5 Ranking of Clinical Service Developments

	Clinical Service Development	
Rank	**Doctor model**	**Manager model**
1st	1, 7, 10, 14	1, 7, 10, 14
2nd	29, 30	11, 23
3rd	2	29, 30
4th	11, 23	2
5th	28	28
6th	18	20
7th	20	18

Discussion

This discussion is centred around two main themes

- The validity of stated preference as a means of eliciting objectives of decision-makers and specifically the validity of the technique employed in this study.

- The extent to which we can infer that managers and doctors are driven by different objectives

There have been numerous attempts to elicit the objectives of decision-makers in firms. These have mainly aimed to test the neo-classical theories of the firm relating to marginal analysis and profit maximisation within private industry (Hall and Hitch, 1939, Skinner, 1970, Shipley, 1981). The author is not aware of any studies attempting to elicit the objectives of hospital decision-makers or more specifically distinguish between doctors and managers as decision-makers within a hospital on the basis of their objectives.

The use of stated preference techniques to elicit decision-makers objectives can be criticised on a number of grounds. At a very simple level the respondents may be disinterested in the questionnaire and therefore, give little thought to their answers. Further, the respondents may wish to ingratiate themselves with the researcher, giving the types of answers that they believe the researcher wants. They may choose to answer in a way that they think that presents them in a positive light.

The study reported here is vulnerable to similar types of criticisms. However, the specific context in which this study was set should act as some defence against the worst of those criticisms. The empirical work was opportunistic in that the work to elicit the consultants' views was commissioned by a NHS Trust board. As such it was primarily designed to meet the Trust's priority setting needs and not our own research agenda. Although this restricted the research in some ways it did have a particular advantage: the respondents were aware that their views were being elicited to input into the hospitals decision making process. Given that the consultants were explicitly being asked to contribute to the Trust's priority setting process, the incentive to answer thoughtfully and truthfully was probably higher than it would have been had this been a purely academic exercise.

On the other hand, the opportunity to influence this senior management process may have encouraged the consultants to behave in a strategic way. For instance, if a consultant knew that the clinical service developments being proposed from their own directorate would score well in education, training and research, they would have an

incentive to favour hypothetical developments in the questionnaire with larger gains in this dimension in order to skew the weighting towards education, training and research.

Generally though, the complexity of the questionnaire design may work in its favour, as it is not immediately obvious how a respondent should respond in order to have a strategic influence over the results.

A possible complicating factor is that when the managers were surveyed it was not possible to state directly that their responses would be influential in the priority setting process. However, the covering letter to the questionnaire was ambiguous and could easily be interpreted as meaning that their responses would be used. This has implications for the comparability of the two sets of responses.

Shipley (1981) attempted to repeat previous surveys of pricing objectives of managers in firms. One of the problems that he encountered was the existence of multiple and conflicting objectives. In this study, we endeavoured to overcome this by using an economic instrument of discrete choice modelling. This has been praised in other settings as incorporating opportunity cost and allowing the respondents to make trade-offs between competing attributes (Shackley and Ryan, 1995). As such it may have help overcome some of the problems encountered by Shipley in his use of ranking style questions.

The lack of input by the non-medical staff to the process of identifying the dimensions to be included in the priority setting process is of concern. The study used attributes identified by the medical staff to set priorities. It then elicited weightings for these attributes from those medical staff and non-medical staff. The differences between the two groups may be better identified if the non-medical managers were also allowed to identify the dimensions of benefit prior to the weighting exercise.

However, the model of the managers' responses had more explanatory power than the doctor, which runs counter to the above argument. A possible explanation of this is that the members of the TMAC advisory groups who identified the dimensions of benefits although of medical training and employed as clinicians may be used to

thinking at a strategic level rather than at an individual patient level. This may marry them more closely with the managers than other doctors.

Turning to the empirical results of the study, the evidence regarding the difference in the objectives of the two groups is mixed. Three out of the five variables in the two segmented models have been shown to be statistically different and when taken together the coefficients are significantly different to one another. This does offer some support to the hypothesis that the managers and doctors within a hospital can be distinguished form one another on the basis of their objectives at least within this particular decision-making context. A stronger test of this would be to test whether the model can predict whether a respondent is a manager or a doctor.

On the testing of the two hypotheses regarding the doctors' and managers' weighting of 'education, training and research' and 'local and national priorities', there is a question of how the results for the relative sizes of the coefficients on these two variables should be interpreted. All of the variables in the managers' model exceed the corresponding variable in the doctors' model. Therefore, the strength of a test for the hypothesis that the coefficient of STRAT is greater for managers than for doctors is questionable.

The practical application of the two sets of coefficients although showed some differences between the two groups, managers and doctors, was far from overwhelming in its distinction in the ranking of the clinical service developments.

The above discussion addresses the issue of what we can infer from the specific statistical and practical results from the empirical work. We now turn to a broader issue of whether the results of this study are useful as providing an insight into the extent to which the managers and doctors within a hospital have divergent objectives.

A fundamental question to be addressed here is what is it that has been elicited and can it be interpreted as the objectives of the managers or doctors completing the questionnaire? The respondents were asked to choose between pairs of clinical service developments in a priority setting context. This is a very specific context in terms of the activity that is taking place. Firstly, it is about priority setting and secondly,

decision-making is at the margin of activity within the trust, i.e. we are addressing small changes in the overall service. The specific priority setting process and the technique used required the possible objectives to be defined by the Trust Medical Advisory Committee. This may have limited what were included as criteria for choosing between projects. For instance, growth of the hospital as an objective may be so ingrained in the decision-making process that it did not enter the criteria as it is seen as an essential. Within other contexts other objectives may be introduced.

With respect to the extent to which the study was examining decision making at the margin, it would be interesting to consider the extent to which existing services meet the criteria identified as important by the respondents to the questionnaire.

Furthermore, if we interpret the dimensions of benefit as objectives are they (i) the objectives of the respondents, (ii) what the respondents believe the Trust has as its objectives or (iii) what the respondents believe the Trust should have as its objectives? To answer this, would require follow-up of the respondents.

Not only is the context specific but the setting may also restrict the wider applicability of these results. The hospital under scrutiny in this project is a teaching hospital. The objectives of the staff within a teaching hospital may be quite different to a district general hospital. We might expect more emphasis to be placed on education, training and research obviously. But we might also find that the level of clinical effectiveness of interventions is more keenly sought in a setting where research and innovation are more the norm.

Finally, in the literature on objectives, a distinction is drawn between motives and objectives. Hay and Morris (1991) define people's motives as "what they aim to achieve independent of the particular environment in which they find themselves: for example the desire for prestige." (p. 298) The variables described as motives generally have two distinct characteristics. First, the individual can only affect the level of the motive through affecting something in the firm in which he or she works, i.e. s/he can not affect these variables directly. Second, these variables do not have well-defined units of measurement.

Clearly, in the study described in this paper we have not elicited anything so fundamental as the motivating factors for the decision-makers. We may however, have gone some way to identifying those variables which affect to increase the motivating factors. These are what are what are generally referred to as objectives. So for instance, if the decision-maker is motivated by a desire to increase his/her own prestige this may be met through achieving some of the dimensions of benefit identified in the study.

Conclusion

The aim of this study was modest: to explore the area of the dual hierarchy of the hospital with respect to differing objectives of managers and doctors. A number of shortcomings relating to the methodology employed have been identified in the discussion. Furthermore, there is ambiguity in the statistical results from the study. Where hypotheses have been tested, the results partially support the differences expected between the groups. However, the results are far from unequivocal. Nevertheless, some differences in what factors influenced the prioritisation of clinical service developments by managers and doctors were identified. If these factors can be interpreted as indications of objectives then this offers some support for the proposition that a dual hierarchy exists within the hospital.

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Appendix 1 The dimensions of benefit and their levels

Dimension of benefit	*Levels*	*Description*	*Value for regression analysis*
Level of evidence of clinical effectiveness[1]	**A**	Requires at least one randomised controlled trial as part of the body of literature of overall good quality and consistency addressing specific recommendations	3
	B	Requires availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation	2
	C	Requires evidence from expert committee opinions and/or clinical experience of respected authorities. Indicates absence of directly applicable clinical studies of good quality.	1
Size of health gain	**Large**	Big gain per patient + large numbers	3
	Medium	Big gain + small numbers or small gain + large numbers	2
	Small	Small gain + small numbers	1
Contribution to professional development	**Improvement**	Takes account of job characteristics such as job satisfaction, job security and recruitment and retention.	2
	No change		1
Contribution to education training and research	**0**	Contributes to 0 of these	0
	1	Contributes to 1 of these	1
	2	Contributes to 2 of these	2
	3	Contributes to all 3	3
Strategy area	**No priority**	The proposed development represents a local or national priority.	1
	Local or national priority		2
	Local and national priority		3

Note: 1. The levels assigned to 'evidence of clinical effectiveness' were taken from SIGN (Scottish Inter-Collegiate Guidelines Network) and are widely recognised by consultants, General Practitioners and managers in the Scottish Health Service.

Appendix 2 An extract from the questionnaire

• **Choice 1**	**Development A**	**Development B**
Evidence of clinical effectiveness	C	C
Contribution to education, training and research	1 out of 3	2 out of 3
Professional development	Improvement	Improvement
Health gain	Large	Medium
Strategy area	No priority	Local **and** national
	Prefer development A	Prefer development B
Which development would you prefer (*tick one box only*)?	☐	☐

• **Choice 2**	**Development A**	**Development B**
Evidence of clinical effectiveness	A	B
Contribution to education, training and research	1 out of 3	2 out of 3
Professional development	Improvement	No change
Health gain	Small	Large
Strategy area	No priority	No priority
	Prefer development A	Prefer development B
Which development would you prefer (*tick one box only*)?	☐	☐

• **Choice 3**	**Development A**	**Development B**
Evidence of clinical effectiveness	C	C
Contribution to education, training and research	None	3 out of 3
Professional development	No change	Improvement
Health gain	Small	Large
Strategy area	Local **or** national	Local **or** national
	Prefer development A	Prefer development B
Which development would you prefer (*tick one box only*)?	☐	☐

Appendix 3

Table A1 Full model

Explanatory variable	Coefficient	Standard error	P
ETR	0.49	0.39E-01	0.00
STRAT	0.52	0.49E-01	0.00
HEG	0.84	0.63E-01	0.00
CLIN	0.81	0.11	0.00
PROD	0.51	0.53E-01	0.00
Rho	0		
N			1445
Log likelihood function, L			-753.22
Restricted log likelihood, L_0 (β_2, β_3, β_4, β_5, =0)			-922.39
McFadden's R^2 ($1 - L/L_0$)			0.18
McKelvey and Zaviona R^2			0.60