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WHAT DETERMINES MEMBERSHIP OF  
LOCAL HEALTH CARE CO-OPERATIVES?  
AN EMPIRICAL ANALYSIS

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## SUMMARY

The Scottish White Paper “*Designed to care: renewing the National Health Service in Scotland*” heralded the introduction of a new type of horizontal integration in primary care. Local health care co-operatives foster co-operation among and between general practices and other providers of primary and community care in Scotland. This study aims, first, to investigate whether general practices that have joined an LHCC differ in any respect from those practices that have not and, second, to test hypotheses founded in economic theories of integration about why general practices sign up to LHCCs. Variations in LHCC membership were analysed using logistic regression analysis.

Initial results seem to indicate that LHCC membership is related to demographic and socio-economic characteristics at general practice level. Larger general practices located in more densely populated areas and covering populations with high levels of morbidity were more likely to join an LHCC. The research also demonstrates that the way general practices respond to national policy initiatives depends on local factors. Further analysis of this data will include information on practice characteristics. Finally, these preliminary results provide an insight into the rationale for participating in an LHCC and may help to design incentives for general practices that haven’t done so already to join an LHCC in the future. However, further research is required not only on the determinants of horizontal integration, but also on the effects of these new organisations on costs and benefits to patients.

**Keywords:** integration in primary care, local health care co-operatives, membership, practice characteristics

## 1. INTRODUCTION

In the last decade, GPs and their associated primary care teams have increasingly reaped the benefits from working together to plan and deliver primary care services for a larger patient population. Various forms of horizontal integration in primary care have developed through GP out-of-hours co-operatives, total purchasing, locality groups, and other models in which general practices are organised into groups. In Scotland, the latest governance structure promoting such collaborative working among general practices are Local Health Care Co-operatives (LHCCs) (Secretary of State for Health, 1997b).

Although LHCCs have been set up to include all general practices in a local area, they are voluntary organisations. This implies that general practices face three successive decisions. First, whether to join or not and, second, which LHCC to join (although this may also be determined by geography). The third decision is that once they have joined, GPs can determine whether - and how much - they want to participate in LHCCs and co-operate with other LHCC members. This paper is concerned with the first decision and aspires to identify the factors that influence a general practice's propensity to join an LHCC.

Previous work has reviewed a number of economic theories of integration in order to draw out the determinants of horizontal and vertical integration in primary care (Simoens and Scott, 1999). This may serve as a framework for empirically deriving the factors that are likely to influence the propensity of general practices to participate in LHCCs. Such an analysis not only needs to relate LHCC membership to the hypothesised determinants, but also needs to account for confounding variables over which general practices have no influence. The current study will contribute to this by using regression analysis to detect the demographic and socio-economic characteristics at practice level that explain LHCC membership. These results may inform any subsequent work that seeks to explain in more detail the decision of general practices to join an LHCC and the extent to which general practices participate in LHCCs.

The aims of the paper are four-fold: first, to assemble a database at general practice level that contains information on LHCC and practice characteristics; second, to describe LHCCs in terms of these characteristics; third, to investigate whether general practices that have joined an LHCC differ in any respect from those general practices that have not; and fourth, to discuss the implications of any observed differences in practice characteristics.

This exercise is undertaken for several reasons. First, given the voluntary nature of LHCCs, the point of the self-selected status of LHCC members needs to be assessed. This means that participating practices do not represent a random sample from the population of Scottish general practices. The potential for selection of general practices into LHCCs has two implications. First, the Government clearly intended LHCCs to cover as many general practices as possible. However, if LHCC members turn out to be the better resourced practices located in affluent areas (as in the case of GP fundholders, see, for instance, Petchey (1995)), then those general practices that the scheme targeted in the first place may well not be included. This may have equity implications if general practices that are not LHCC members are located in deprived areas.

Second, in evaluating a new organisational structure such as LHCCs, the focus usually is on its potential impact on outcome measures, such as efficiency, equity, quality, consumer choice, and responsiveness. However, such an analysis can only be meaningfully carried out to the extent that general practices that have joined an LHCC are comparable with those that have not. If this doesn't hold true, then any observed differences in outcome indicators may be attributable to practice characteristics rather than to the concept of LHCCs per se.

The results may also help to explain variation in LHCC membership and to elicit the factors that influence the decision of a general practice to join an LHCC. This information, in turn, may assist the Health Board in designing incentives for general practices that haven't done so already to join an LHCC in the future and in formulating policies specific to each LHCC.

The analysis is primarily concerned with identifying relationships between LHCC membership and practice characteristics and, to a lesser extent, with explaining any observed relationships. In other words, the focus is on detecting associations rather than on inferring causality. However, the former may inform the latter and the results may be used to generate and test hypotheses about the rationale for joining an LHCC. This work is therefore preliminary. Further work involves more detailed surveys of LHCCs to test hypotheses about the nature and determinants of integration in primary care.

The study is organised as follows. In the next section, the reader is introduced to the concept of Primary Care Groups in England and Local Health Care Co-operatives in Scotland. The paper then goes on to review and appraise any previous studies that have sought to link integration in primary care to practice characteristics. Section 4 outlines the theoretical model and formulates the hypotheses to be tested. The data sources are presented in Section 5. Section 6 summarises the empirical results: descriptive statistics for Scottish LHCCs are shown, LHCC members and non members are compared in terms of practice characteristics, and the factors affecting the propensity to join an LHCC are identified using logistic regression analysis. The implications of these results are discussed in Section 7. Additionally, several caveats of the study are highlighted and avenues of future research for developing a better understanding of the determinants of LHCC membership are proposed. Finally, in section 8, preliminary conclusions are presented.

## **2. THE 1997 NHS WHITE PAPERS**

The 1997 White Papers (Secretary of State for Health, 1997a,b) re-emphasised the promotion of integrated care, with a divergence of policy between England and Scotland (see Table 1).

In England, the primary responsibility for commissioning health care for the local community has been transferred from GP fundholders and Health Authorities to Primary Care Groups (PCGs). These are groups of GP practices serving geographically defined populations of typically around 100,000 patients. Membership of PCGs is compulsory. Four levels of PCGs were outlined: Levels 1

and 2, where the PCG acts as a sub-committee of the Health Authority (from April 1999), and levels 3 and 4 (to which some PCGs have graduated from April 2000), where the PCG becomes a freestanding Primary Care Trust (PCT) accountable to the Health Authority for commissioning care.

In Scotland, horizontal integration among general practices has taken the form of Local Health Care Co-operatives (LHCCs). These are voluntary organisations of GP practices covering natural communities of between 25,000 and 150,000 people. LHCCs form part of Primary Care Trusts, which are responsible for providing community services, all mental health services, services for people with disabilities, continuing care of elderly people as well as primary care services based in general practice. In contrast with PCGs, LHCCs do not commission secondary care services for their local population, although they may wish to hold a budget for prescribing and elements of staffing (e.g. community nurses).

### **3. PREVIOUS LITERATURE**

The literature was reviewed to identify any studies that investigated whether general practices involved in integration in primary care differed systematically from those that had not integrated. Studies that compared different waves of GP fundholding or Total Purchasing Pilots were not considered. The following databases were searched: MEDLINE (1993-2000), HEALTHSTAR (1991-2000), SCI (1990-2000), and HMIC (-2000). The review generated a total of 7 studies that satisfied our inclusion criteria (comparative study, integration in primary care).

A number of studies have documented the response of GPs to the incentives embodied by the 1990 GP contract (Department of Health, 1989). Silcock and Ratcliffe (1994) found that the provision of health promotion clinics and minor surgery sessions was related to practice list size, GP workload, inducement payments, training status and rurality. In a study on childhood immunisation in general practice, GP workload, deprivation, and immunisation payments as a percentage of total fees and allowances were significantly associated with uptake (Lynch, 1994). Two studies were able to attribute differences in the incidence of screening in general practice to the number of partners in the practice and deprivation (Ibbotson et al., 1996) and to

rurality (Li and Logan, 1996). Leese and Bosanquet (1995) concluded that larger practices in more affluent areas of low morbidity were more likely to provide specified disease management programmes for patients with diabetes or asthma and achieve target levels for cervical smear testing and immunisation. Finally, general practices not providing structured diabetes care exhibited a smaller list size and were located in more deprived areas with a high prevalence of diabetes (Goyder et al., 1996).

There is anecdotal evidence that GP fundholding was especially popular among larger general practices located in more affluent areas (see, for instance, Audit Commission, 1995). A study by Baines and Whynes (1996) revealed that GP fundholders were more likely to meet a number of quality criteria laid down by the Government with respect to, for instance, prescribing cost control, minor surgery and cervical screening uptake, and the proportion of emergency to elective admissions.

Overall, relatively few attempts have been made to explain variations in the uptake of integration in primary care in the U.K. Moreover, the majority of studies identified suffered from two drawbacks. First, the focus on a small group of general practices located in the same area limits the generalisability of the results. Second, the rare use of regression techniques is detrimental to the quality of the evidence obtained.

## **4. THEORETICAL FRAMEWORK**

### **4.1. Model**

This study focuses on the decision whether or not to become a member of an LHCC as a mechanism for generating and testing hypotheses about the determinants of integration in primary care. Additionally, this exercise may highlight GP concerns about the organisation and delivery of primary care. The unit of analysis is the general practice as the LHCC membership decision is taken at practice level (as opposed to GP level) and as general practices are in the driving seat of LHCCs. Therefore, the purpose of the model is to help define those factors that play a role in a general practice's decision whether or not to join, i.e. to identify the factors that influence LHCC membership.

The model is based on the premise that the membership decision is guided by the utility that groups of GPs within a general practice derive from joining an LHCC compared to not joining. It is not concerned with explaining the process of how individual GPs belonging to the same general practice interact to decide whether or not the general practice as a whole should become an LHCC member (although this is important, it is beyond the scope of this specific study).

This representation of utility assumes that utility is not derived from the LHCC itself, but from its attributes or features. The additional assumption needs to be made that the utility function is defined over LHCC characteristics, practice characteristics and socio-economic characteristics. It then follows that practice  $i$  will join an LHCC if the utility of becoming a member exceeds the utility associated with the option not to become a member. In other words, LHCC membership is determined by the following equations:

$$(1) \quad \text{Join if } U_{iM} - U_{iNM} > 0$$

$$(2) \quad \text{Not join if } U_{iM} - U_{iNM} < 0$$

Where  $U_{iM}$  = is the utility that practice  $i$  derives from becoming a *Member* of an LHCC and  $U_{iNM}$  = is the utility that practice  $i$  derives from *Not* becoming a *Member* of an LHCC.

As stated earlier, this study aims to investigate if the probability of becoming a member of an LHCC is related to demographic and socio-economic characteristics at practice level ( $z_i$ ). In other words,

$$(3) \quad P(U_{iM} - U_{iNM} > 0) = f(z_i)$$

## **4.2. Factors affecting membership of LHCCs**

### *4.2.1. Hypotheses*

A review of the literature has indicated that the following arguments may enter in the GP's utility function: income, leisure, workload, inducement, patients' interests, societal interests, reputation, intellectual satisfaction, autonomy (Scott, 1997). Given that LHCCs are likely to affect some or all of the above arguments, their introduction will have an impact on the utility of GPs. Previous work generated a number of hypotheses about the determinants of integration in primary care derived from economic theories of integration (see Table 2 or Simoens and Scott, 1999, for a more detailed explanation). Some of these hypotheses are presented here.

Transaction cost economics suggests that the decision to join an LHCC is determined by the objective to minimise transaction costs (Williamson, 1989). Hence, general practices will only sign up to an LHCC to the extent that the marginal transaction costs of internal co-ordination within the LHCC are inferior to those of managing relationships with other general practices and community hospitals in the absence of an LHCC. General practices located in rural areas are expected to incur higher costs in attending LHCC meetings and in co-ordinating policies across LHCC members. Therefore, rurality is predicted to have a negative impact on LHCC membership. Two indicators of rurality were used: population sparsity and population density.

Supply assurance implies the existence of a market imperfection that affects the degree to which general practices can obtain access to other NHS facilities. Various factors may lie at the origin of this imperfection. General practices, for instance, may face inflexible prices charged by Acute Hospital Trusts. Additionally, hospital capacity may not always match demand for certain services. By joining an organisation that covers community hospitals, other health care professionals, including community pharmacists, dentists, and ophthalmic opticians, general practices may expect to secure supply for the services of these other health care providers. As a result, access to other NHS facilities is predicted to have a negative impact on LHCC membership. The following access measures were considered:

access to NHS acute hospital beds, access to NHS mental illness beds, and access to NHS community hospital and GP-controlled beds.

Managerial economics suggests that GPs may favour LHCC membership for purposes related to their personal interests. One of the factors that is of concern to GPs is workload. Given that LHCCs are likely to impose additional demands on GPs in terms of management, administration, and time spent away from patients, joining an LHCC may add to practice and GP workload. This may deter practices with an already high workload from participation in the scheme. Consequently, list size per GP as a proxy for workload is predicted to have a negative impact on LHCC membership. There are also other population characteristics related to workload (e.g. deprivation) that may have similar signs.

Institutional theory of the firm emphasises that social interactions and conformance with environmental pressures to integrate may motivate LHCC membership (DiMaggio and Powell, 1983). This may work in different ways. First, through coercion. GPs may support the proposal of joining an LHCC as a result of pressure exerted by colleagues working for the same general practice or other practices. Second, through imitation. GPs that have participated in previous forms of integration such as GP fundholding, or GPs that have experienced the benefits (and costs!) of co-operating with other GPs in a group practice may be more likely to consider joining an LHCC. Accordingly, the number of GPs in the general practice is predicted to have a positive impact on LHCC membership.

#### *4.2.2. Confounding variables*

In addition to the independent variables as suggested by economic theories of integration, the analysis needs to control for a number of demographic and socio-economic characteristics that may influence LHCC membership. This also enables us to examine potential equity effects of integration.

Following the review of the literature, the following characteristics were expected to influence the extent to which general practices respond to the incentives embodied by the 1997 Scottish White Paper (Secretary of State for Health, 1997b) and, in this

instance, the introduction of LHCCs: the size of the patient population covered by the general practice, deprivation and population morbidity.

Finally, the unit of observation is the general practice and the analysis aims to link LHCC membership with characteristics at practice level. However, general practices belong to one of 15 Health Boards. This implies that the decision to integrate or not may be affected by the Health Board to which the general practice belongs and, hence, that the Health Board acts as an additional source of variability. This effect can be separated by including dummy variables for each Health Board.

#### *4.2.3. Data*

The demographic and socio-economic characteristics ( $z_i$ ) that enter as independent variables in the model are summarised in Table 3. This table presents the variables that potentially affect a general practice's choice to participate in an LHCC, the actual measures used and their definition. A distinction is made between those variables that are hypothesised by economic theories of integration to influence LHCC membership and confounding variables. Data are currently being sought on additional variables that may influence LHCC membership, such as previous fundholding status and other practice and GP characteristics.

## **5. METHODS**

### **5.1. Dependent variable**

Information on whether or not a practice had joined an LHCC was obtained for each general practice in Scotland from the Information and Statistics Division (ISD) of the Scottish NHS. For those general practices that have joined an LHCC, further data were provided on the LHCC, Primary Care Trust and Health Board of which they are a part.

Although LHCCs officially went live from 1<sup>st</sup> April 1999, general practices can still make a decision about LHCC membership. Hence, ISD continuously updates its database as general practices become a member or decide to opt out. To illustrate the

dynamic nature of LHCC membership, the situation as of 1<sup>st</sup> November 1999 was compared with that of 1<sup>st</sup> May 2000. On 1<sup>st</sup> November 1999, 187 general practices had not joined an LHCC, whereas this number had fallen down to 105 general practices by 1<sup>st</sup> May 2000. During that period, 8 general practices that had previously participated in an LHCC chose to renounce membership. However, more than one year after the official launch date, it is unlikely that the database used in this analysis which reflects the situation on 1<sup>st</sup> May 2000 will substantially change in the future and, hence, LHCC membership is assumed to be stable for our purposes.

## **5.2. Independent variables**

Data on explanatory variables were collected from two sources: ISD and the supply and needs database compiled for the National Review of Resource Allocation for the NHS in Scotland (Scottish Executive Health Department, 1999). All indicators were calculated at practice level. Variables obtained from ISD referred to 2000 and variables contained in the supply and needs database referred to 1991 (census data attributed to general practices) or 1997. With respect to the latter, the current analysis retained indicators covering four different types of information (see Fair Shares For All Technical Report for more details about the source and method of calculation of the these variables) (Scottish Executive Health Department, 1999). The variables in Table 3 are described below:

### *1. Population variables*

General Register Office for Scotland mid-year estimates of population were combined with data from the Community Health Index database to estimate the postcode sector breakdown of the population by age and sex. Mid-year estimates, which are issued annually, were based on the 1991 Census of Population.

### *2. Measures of supply of other NHS facilities*

The utilisation of NHS facilities does not solely depend on patient need and demand, but also on the availability of NHS facilities and the availability of substitute or complementary social care facilities. This variation in capacity and expected demand

between areas needs to be controlled for when calculating accessibility scores. To this effect, an accessibility score was derived for a given supply variable for each postcode sector based on a distance weighted “beds per head of population” ratio. This score has two main components: a measure of bed availability at each facility and a measure of the distance from each postcode sector to each facility. Moreover, the formula for calculating accessibility scores takes account of potential competing demands on each facility from surrounding populations.

### *3. Measures of population sparsity and density*

Measures of population sparsity and density were included as indicators of rurality. Settlement pattern indicators as devised by the Scottish Executive Central Research Unit and the General Register Office for Scotland provided information on population sparsity. Data on population density were taken from the 1991 Census of Population.

### *4. Measures of morbidity and social deprivation*

Information derived from the 1991 Census of Population was used to calculate age/sex standardised permanent sickness ratios. Standardised mortality ratios acted as proxies of self-reported morbidity and mortality. Two measures of multiple deprivation in households as defined by the Scottish Executive Central Research Unit were also included in the analysis. These reflected the proportion of households having either 2 or more (“multiply deprived”) or 3 or more (“severely deprived”) deprivation indicators using 6-indicator classification. The following indicators were used for each household: (a) unemployed or permanently sick head of household; (b) low socio-economic group of head of household; (c) overcrowding; (d) large household (> 3 dependent children); (e) lone parent family; (f) all-elderly household. The main data sources for the Census indicators of morbidity and social deprivation were the Local Base Statistics and the Small Area Statistics.

### 5.3. Statistical analysis

The one-sample Kolmogorov-Smirnov test was used to check whether continuous variables representing practice characteristics were normally distributed. In order to analyse the heterogeneity of general practices that have joined an LHCC and those that have not in terms of demographic and socio-economic characteristics, means of the two groups were compared using the two independent samples t-test for normally distributed continuous variables and medians of the two groups were compared using the two independent samples Mann-Whitney test for not normally distributed continuous variables. The two independent samples chi-squared test was used for binary variables.

A logistic regression analysis was then performed to investigate the relationship between LHCC membership and practice characteristics. The model was run in SPSS. Given that the original model specification comprised 22 independent variables, some means of reducing the model had to be chosen. A “general to specific” methodology was followed. This implies starting with a model that comprises all explanatory variables and then excluding variables on the basis of their t-ratio (Wald test) in order to obtain a more parsimonious version.

The validity of each successive model was ascertained by calculating the log likelihood function at the maximum, the restricted log likelihood function assuming all slopes are 0, Cox and Snell  $R^2$ , Nagelkerke  $R^2$ , pseudo  $R^2$  (Cragg and Uhler, 1970), McFadden’s  $R^2$  (McFadden, 1974), and count  $R^2$ . Additionally, the chi-squared test for investigating the assumption that all slopes are 0, the Hosmer and Lemeshow goodness-of-fit test, and the likelihood ratio test comparing the full model with the reduced model were performed.

## **6. RESULTS**

### **6.1. Descriptive statistics of Scottish LHCCs**

Scotland is divided into 15 Health Boards that cover 1,076 general practices employing 4,266 GPs (figures for 2000). 14 Primary Care Trusts and 81 LHCCs were introduced as of 1<sup>st</sup> April 1999. In general, one Primary Care Trust was set up in each Health Board. However, Argyll and Clyde Health Board and Lothian Health Board have two Primary Care Trusts each, whereas no Primary Care Trusts were created in Orkney Health Board, Shetland Health Board, and Western Isles Health Board. The number of LHCCs per Primary Care Trust varies with, at one end of the spectrum, West Lothian Healthcare NHS Trust comprising 1 LHCC and, at the other end, Greater Glasgow Primary Care Trust comprising 16 LHCCs.

The characteristics of Scottish LHCCs are presented in Table 4. This table shows that LHCCs conformed to the population size envisaged by the Scottish White Paper (25,000-150,000 patients), although the lower boundary was not always adhered to. The other striking aspect to note is the wide variation in size of both providers and population, underlining the need to adapt policies and practices pertaining to LHCCs to local circumstances.

A geographic distribution of LHCCs by Health Board is shown in Table 5. This table indicates that all general practices of Fife Health Board and Forth Valley Health Board have joined an LHCC, whereas no LHCCs were set up in Orkney Health Board, Shetland Health Board, and Western Isles Health Board.

Table 5 also illustrates that the proportion of participating GPs exceeds the proportion of participating general practices for each Health Board (except Lanarkshire Health Board) and that the proportion of participating population surpasses the proportion of participating general practices for each Health Board (apart from Borders Health Board). This implies that general practices employing fewer GPs and covering smaller populations are less likely to become a member of an LHCC.

Overall, 971 general practices have joined an LHCC as opposed to 105 general practices that preferred to opt out. This means that 90.2% of Scottish general practices employing 93.6% of Scottish GPs and covering 94.5% of the Scottish population participate in LHCCs.

## **6.2. Characteristics of LHCC members and non members**

Characteristics of participating and non participating general practices are summarised in Table 6. Both groups were compared in terms of the demographic and socio-economic indicators that act as independent variables in the regression analysis. This preliminary analysis provides information on the nature of the differences between general practices that have joined an LHCC and those that have not.

LHCC members appeared to be located in urban areas and had better access to NHS acute hospital beds, NHS mental illness beds, and NHS community hospital and GP-controlled beds. General practices that joined an LHCC had a higher workload (i.e. higher list size per GP) than those that opted out, although the difference did not reach statistical significance. Participating practices also tended to be larger: they employed more GPs and catered for a larger population. Finally, levels of both deprivation and population morbidity of LHCC members were significantly higher than those of non members. The one exception was the standardised mortality ratio, which was equal across groups.

## **6.3. Factors affecting LHCC membership**

Observations had to be excluded from the original sample of 1,076 general practices for one of the following reasons. First, data on demographic and socio-economic characteristics were not available for some of the general practices. Second, general practices that covered a population of less than 100 patients were not incorporated in the analysis. Third, the particular circumstances faced by the three Island Health Boards led the Government to conclude not to set up LHCCs in these regions. Instead, these Health Boards will continue to exercise responsibility for general practices through their directly-managed units. This implies that general practices belonging to Orkney Health Board, Shetland Health Board or Western Isles Health

Board did not face a genuine choice to join or not to join an LHCC and, as a consequence, were removed from the sample. This leaves us with 910 participating practices and 51 non participating practices to run the logistic regression model.

Table 7 presents descriptive statistics for the potential independent variables. Some of the variables were rescaled. This ensured that all variables took on values of a similar order of magnitude. The results of the logistic regression of LHCC membership on practice characteristics are summarised in Table 8. Diagnostics of the regression model are shown in Table 9.

The first two columns of Table 7 indicate the coefficients and t-ratios associated with the model including all potential independent variables. The various  $R^2$  measures reported ranged from 0.025 to 0.165. Thus, it appears that the variables controlling for demographic and socio-economic characteristics of general practices do not contribute a great deal to the explanation of variation in LHCC membership. Additional tests were carried out to gauge the influence of the set of independent variables. The Chi-squared test showed that, despite their small contribution, the inclusion of the independent variables improved the explanatory power of the model. The Hosmer and Lemeshow goodness-of-fit test which is based on the comparison of observed with predicted values provided further evidence in support of the full model. Overall, the full model had good predictive power: 94,59 % of observations were correctly classified. The model was subsequently reduced using backward stepwise regression, but the likelihood ratio test comparing the full with the reduced model was not significant.

In the full model, variables related to population sparsity and morbidity, and three Health Boards reached statistical significance. Results from the reduced model were similar to those of the full model. However, the number of GPs and three additional Health Boards were now also statistically significant at the 5% level.

The results are consistent with some of the hypotheses derived earlier. First, general practices with a higher proportion of people living in urban locations having population > 500 people were more likely to be LHCC members. This is in accordance with the hypothesis that general practices located in more sparsely

populated areas are less likely to join an LHCC due to potentially high transaction costs. Second, the results suggest that general practices with sicker populations had a higher probability of joining an LHCC, although SMR and deprivation were not statistically significant.

Larger practices as measured by the number of GPs employed was not systematically related to LHCC membership (although this variable was significant in the reduced model). One possible explanation is peer pressure and previous experience of integration that predisposes larger general practices to become LHCC members. However, this may also be because such general practices are better organised, and are used to co-operating with other practices. For example, larger general practices are more likely to have been fundholders. The inclusion of other practice characteristics may shed light on this.

The coefficient of list size per GP turned out to be negative as hypothesised, although it was not statistically significant. Managerial economics predicted that general practices with a high workload may be deterred from joining an LHCC. The three variables measuring access to other NHS facilities did not add to the explanatory power of the model. Due to the existence of market imperfections, general practices that found it difficult to gain access to facilities had been hypothesised to be more likely to join an LHCC. Moreover, the size of the patient population covered and population deprivation both had a negative impact on LHCC membership, contrary to the prior hypotheses.

Three Health Boards turned out to be statistically significantly related to LHCC membership: Ayrshire and Arran Health Board, Lanarkshire Health Board, and Lothian Health Board. Greater Glasgow Health Board, Highland Health Board and Tayside Health Board also reached statistical significance in the reduced model. The signs of all Health Board coefficients were negative, indicating that general practices belonging to one of these five Health Boards had a smaller probability of joining an LHCC than general practices belonging to Argyll and Clyde Health Board, the comparator.

In Table 4, it can be seen that the statistically significant dummy variables represent those Health Boards for which the proportion of non participating general practices is greater than that of Argyll and Clyde Health Board. This points to the existence of a Health Board effect as separate from the effect of demographic and socio-economic characteristics on the propensity to become a member of an LHCC. Health Board dummy variables may pick up the product of the pressure that Health Boards - and through them, the Government - exercise on general practices to join LHCCs.

## **7. DISCUSSION**

This paper has presented a preliminary analysis of those factors influencing horizontal integration in primary care in Scotland, with specific reference to LHCCs. The evidence from the logistic regression analysis seems to suggest that three types of factors play a role in a general practice's propensity to participate in an LHCC: Health Board pressure, population morbidity and rurality. The extent to which Health Boards actively encourage general practices to join an LHCC is likely to vary across different parts of Scotland. LHCC membership was also related to population morbidity in that general practices with sicker populations were more likely to integrate. The study has provided some limited support for the hypothesised effects of transaction costs on integration through rurality.

To the best of the authors' knowledge, this is the first study that attempted to relate LHCC membership to local area characteristics of general practices. The analysis employed regression techniques and covered all general practices in Scotland. However, the results must be interpreted with the following caveats. First, the extent to which LHCC membership is voluntary and the role that the Health Board plays in this process may vary across regions. Second, the data sources on the independent variables referred to different time periods for which no adjustment was made. Third, further work is needed to develop the theoretical model and to test its econometric specification.

There remains much unexplained variation in the data. Various factors may lie at the origin of the low explanatory power of the logistic regression model. First, the independent variables included in the model did not cover the complete set of

characteristics that affect LHCC membership. Insufficient data were available to test all hypotheses presented in Table 1 and the number of variables reflecting GP characteristics was limited. Further information is currently being sought on previous fundholding status and other practice and GP characteristics. Second, to date, very little is known about the decision process that ultimately leads to LHCC membership or not. The empirical literature on the factors that influence integration in primary care is scarce. Third, other studies using regression analysis to investigate the relationship between integration in primary care and practice characteristics have reported similar low coefficients of determination (see, for instance, Silcock and Ratcliffe, 1994; Ibbotson et al., 1996).

This study has enabled us to test certain hypotheses derived from economic theories of integration. The results have drawn attention to the role of transaction cost economics in integration in primary care. Another potential route to take is to relate the choice of governance structure to the dimensions of the transaction. For instance, the extent to which general practices co-operate within an LHCC may well depend on the characteristics of the services on which they collaborate.

Two results stand out that have particular relevance to policy makers: the variation between participating and non participating practices and the variation among LHCC members. First, general practices located in more sparsely populated areas and covering populations with low levels of morbidity exhibited a lower propensity to join an LHCC. These results have different implications for equity. On the one hand, the policy of LHCCs seems to be happening only in relatively urban areas. This has consequences for rural general practice, which may be missing out on some of the benefits that integration provides. Hence, equal needs do not get equal treatment (horizontal inequity). On the other hand, population morbidity is positively related to LHCC membership, indicating that general practices with the highest need are able to enjoy some of the benefits that integration provides (vertical equity). This also suggests that the introduction of LHCCs does not follow the inverse care law and may not (unlike GP fundholding) create a “two tier” service, although further work needs to be conducted on this issue. At the moment, the only safe conclusion to draw is that the provision of care may well become dependent on whether or not a general practice is a member of an LHCC. Second, the diversity among LHCCs in terms of the

number of participating general practices and GPs, and the size of the population covered has been noted. This underlines the importance of formulating LHCC policy at local level.

Three avenues of future research for developing a better understanding of LHCCs and LHCC membership can be suggested. First, some of the hypotheses derived above need to be investigated in more detail. Second, in addition to analysing the factors that may affect LHCC membership, future research should explore reasons for joining an LHCC, factors facilitating and barriers to co-operation within LHCCs, and quantify the actual extent of co-operation within LHCCs (this research is currently being conducted). Third, the opportunity should not be missed to carry out an analysis comparing factors affecting membership of LHCCs with the features that influence the propensity to move from one level of Primary Care Group to another.

## **8. CONCLUSIONS**

In the last decade, a plethora of schemes have been set up that relied on a mixture of incentives and pressure to change general practice and GP behaviour. However, the response to these policy changes has not been uniform. The evidence reported here seems to support the existence of selection bias in LHCC membership. Certain key variables such as rurality and population morbidity are likely to determine how general practices respond to incentives in a systematic way. It should be noted that the features that make it possible to discriminate between participating and non participating practices predate LHCC membership and, hence, are not attributable to LHCCs. Moreover, this research has illustrated how local factors might modify or affect the influence of national policy initiatives. Finally, the results have implications for the analysis of the factors affecting LHCC membership. Any future regression model should include local area characteristics of general practices and other practice characteristics in addition to hypothesised determinants.

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**APPENDIX: Tables**

**Table 1 Comparison of features of Primary Care Groups in England and Local Health Care Co-operatives in Scotland.**

<b>Feature</b>	<b>Primary Care Groups</b>	<b>Local Health Care Co-operatives</b>
1. Size	100,000 patients	25,000-150,000 patients
2. Membership	Compulsory	Voluntary
3. Forms	Four levels	One level
4. Governance	Multi-professional board	No blueprint
5. Budget	Hospital and community health services, GP prescribing, and general practice infrastructure	Prescribing and staffing
6. Cash	Administered by Health Authority or Primary Care Trust	Administered by Primary Care Trust
7. Accountability	Health Authority	Primary Care Trust
8. Acute hospital services	Commissioning	Planning

**Table 2 Hypotheses derived from economic theories of integration**

Theories of integration	Determinants of integration	Integration in primary care	
		Relevant	Not relevant
<b>1. Transaction cost economics</b>	Asset specificity, uncertainty, complexity, frequency	Site specificity, human asset specificity and know-how, reputational assets, opportunism, uncertainty, small-numbers bargaining, complexity, frequency	Physical asset specificity, dedicated assets
<b>2. Technological economies</b>	Economies of scale, economies of scope	Economies of scale and scope	
<b>3. Market imperfections</b>	Market power, price and quantity discrimination, barriers to entry, foreclosure of competition, supply assurance, information asymmetry	Supply assurance, information asymmetry	Market power, price and quantity discrimination, barriers to entry, foreclosure of competition
<b>4. Managerial economics</b>	Income, status, power, security, expense preference, social organisation	Income, workload, patients' interests, reputation amongst peers, intellectual satisfaction, power, autonomy	-
<b>5. Resource-based theories of the firm</b>	Resource needs, resource dependence, resource opportunities	Resource needs, resource dependence, resource opportunities	-
<b>6. Institutional theory of the firm</b>	Organisational legitimacy	Organisational legitimacy, technological advances, socio-demographic trends, government policy, medical profession, normative environment	-

**Table 3 Independent variables**

<b>Variable</b>	<b>Actual measure used</b>	<b>Definition</b>
Rurality	SPAR5	Proportion of people living in urban locations having population > 500 people, 1991
	DENS97	Number of residents per hectare, 1997
Access	ACUTE	Average access to NHS acute hospital beds, 1997
	MI	Average access to NHS mental illness beds, 1997
	COMMUN	Average access to NHS community hospital and GP-controlled beds, 1997
Workload	LIST	List size per GP, 2000
Institutional pressure	GP	Number of GPs in general practice, 2000
Deprivation	SEVDEPH	Proportion of households having 3 or more deprivation indicators using 6-indicator classification, 1991
Morbidity	SPR	Standardised permanent sickness ratio: proportion of population over 16 economically inactive because permanently sick, age-sex standardised, 1991
	SMR	Standardised mortality ratio (deaths for 5 years, 1992-1996), all-age
Population	POP	Practice patient population, 1997 (in thousands)
Health Board	HB1, ..., HB12	Health Board to which practice belongs, 2000, with HB1 = Argyll and Clyde; HB2 = Ayrshire and Arran; HB3 = Borders; HB4 = Dumfries and Galloway; HB5 = Fife; HB6 = Forth Valley; HB7 = Grampian; HB8 = Greater Glasgow; HB9 = Highland; HB10 = Lanarkshire; HB11 = Lothian; HB12 = Tayside

**Table 4 LHCC characteristics (as of 1<sup>st</sup> May 2000)**

<b>Variable</b>	<b>Mean</b>	<b>Minimum</b>	<b>Maximum</b>
Number of practices	12	2	28
Number of GPs	50	3	121
Size of patient population covered*	57,706	1,059	149,811

\* Data on the size of patient population covered were missing for some practices. Hence, the figures reported here under-estimate true population coverage

**Table 5 Descriptive statistics of LHCCs by Health Board (as of 1<sup>st</sup> May 2000)**

<b>Health Board</b>	<b>Practice IN</b>	<b>Practice OUT</b>	<b>GPs IN</b>	<b>GPs OUT</b>	<b>Populat IN*</b>	<b>Populat OUT*</b>
Argyll and Clyde	98 (94.2%)	6 (5.8%)	351 (98%)	7 (2%)	397,870 (98.9%)	4,262 (1.1%)
Ayrshire and Arran	53 (86.9%)	8 (13.1%)	256 (90.5%)	27 (9.5%)	315,452 (90.5%)	33,101 (9.5%)
Borders	21 (95.5%)	1 (4.5%)	96 (96%)	4 (4%)	82,057 (93.4%)	5,762 (6.6%)
Dumfries and Galloway	35 (94.6%)	2 (5.4%)	155 (96.3%)	6 (3.7%)	141,899 (99%)	1,451 (1%)
Fife	62 (100%)	0 (0%)	272 (100%)	0 (0%)	346,630 (100%)	0 (0%)
Forth Valley	56 (100%)	0 (0%)	223 (100%)	0 (0%)	276,621 (100%)	0 (0%)
Grampian	86 (98.9%)	1 (1.1%)	420 (99.8%)	1 (0.2%)	473,836 (99.9%)	659 (0.1%)
Greater Glasgow	211 (94.2%)	13 (5.8%)	726 (97.7%)	17 (2.3%)	865,609 (97.4%)	22,870 (2.6%)
Highland	65 (87.8%)	9 (12.2%)	217 (89.3%)	26 (10.7%)	187,784 (92.7%)	14,722 (7.3%)
Lanarkshire	97 (91.5%)	9 (8.5%)	338 (89.7%)	39 (10.3%)	476,604 (92.3%)	39,531 (7.7%)
Lothian	118 (91.5%)	11 (8.5%)	620 (92.5%)	50 (7.5%)	687,271 (92.2%)	58,283 (7.8%)
Orkney	0 (0%)	15 (100%)	0 (0%)	25 (100%)	0 (0%)	19,838 (100%)
Shetland	0 (0%)	10 (100%)	0 (0%)	24 (100%)	0 (0%)	23,018 (100%)
Tayside	69 (92%)	6 (8%)	319 (96.1%)	13 (3.9%)	364,872 (95.3%)	17,841 (4.7%)
Western Isles	0 (0%)	14 (100%)	0 (0%)	34 (100%)	0 (0%)	28,239 (100%)
<b>TOTAL</b>	<b>971 (90.2%)</b>	<b>105 (9.8%)</b>	<b>3,993 (93.6%)</b>	<b>273 (6.4%)</b>	<b>4,616,505 (94.5%)</b>	<b>269,577 (5.5%)</b>

\* Data on the size of patient population covered were missing for some practices. Hence, the figures reported here under-estimate true population coverage

**Table 6 Comparison of LHCC members and non members**

<b>Variable</b>	<b>Participating practices</b>	<b>Non participating practices</b>	<b>P-value</b>
<b>SPAR5</b>	0.9720 (0-1)	0.8812 (0.005-0.999)	0.036
<b>DENS97</b>	0.0144 (1.260 E-5 - 0.076)	0.0026 (1.49 E-5 – 0.074)	0.027
<b>ACUTE</b>	0.3283 (3.1 E-4 – 0.818)	0.2940 (0.005-0.585)	0.086
<b>MI</b>	0.17 (1 E-4 – 1.523)	0.1402 (9.2 E-5 – 0.394)	0.019
<b>COMMUN</b>	0.0105 (1.28 E-4 – 0.839)	0.0111 (1.76 E-4 – 0.589)	0.107
<b>LIST</b>	1.2205 (0.107-4.052)	1.1383 (0.223-3.125)	0.610
<b>GP</b>	4 (1-14)	3 (1-11)	0.003
<b>SEVDEPH</b>	0.3865 (0-2.913)	0.2331 (0.025-2.020)	0.055
<b>SPR</b>	0.9133 (0.258-3.359)	0.7340 (0.297-2.338)	0.009
<b>SMR</b>	0.9911 (0.569-1.796)	0.9974 (0.512-1.356)	0.497
<b>POP</b>	4.520 (0.107-19.700)	1.916 (0.076-13.028)	0.003

Figures are expressed as medians (minimum-maximum)

**Table 7 Descriptive statistics of independent variables**

<b>Variable</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Standard deviation</b>
<b>SPAR5</b>	0	1	0.8764	0.1940
<b>DENS97</b>	1.256 E-5	0.0761	0.0188	0.0182
<b>ACUTE</b>	0.0003	0.8184	0.3332	0.1815
<b>MI</b>	9.193 E-5	1.5229	0.1601	0.0926
<b>COMMUN</b>	0.0001	0.8392	0.0377	0.0845
<b>LIST</b>	0.1070	4.0520	1.2490	0.4498
<b>GP</b>	1	14	4	2.4500
<b>SEVDEPH</b>	0	2.9126	0.5261	0.4513
<b>SPR</b>	0.2586	3.3595	1.0112	0.4915
<b>SMR</b>	0.5122	1.7964	1.0124	0.1563
<b>POP</b>	0.1070	19.7000	4.9876	3.1501

**Table 8 Logistic regression of LHCC membership on practice characteristics**

Independent variables	Full model		Reduced model	
	Coefficient	t-ratio	Coefficient	t-ratio
<b>CONSTANT</b>	1.5822	0.7488	0.9696	2.2536
<b>SPAR5</b>	2.0415	3.3680*	2.2493	7.0836**
<b>DENS97</b>	-2.3059	0.0265		
<b>ACUTE</b>	0.3190	0.0414		
<b>MI</b>	0.8171	0.0925		
<b>COMMUN</b>	-1.4990	0.9918		
<b>LIST</b>	-0.2528	0.2456		
<b>GP</b>	0.2482	1.3453	0.1837	6.0776**
<b>SEVDEPH</b>	-0.4155	0.2304		
<b>SPR</b>	1.15258	2.7531*	0.8752	3.4281*
<b>SMR</b>	-1.1421	0.3333		
<b>POP</b>	-0.0825	0.2564		
<b>HB2</b>	-1.8600	5.4079**	-2.5217	17.0188**
<b>HB3</b>	-0.1753	0.0213		
<b>HB4</b>	0.2681	0.0495		
<b>HB5</b>	6.2567	0.0930		
<b>HB6</b>	6.3332	0.0856		
<b>HB7</b>	1.4980	1.6272		
<b>HB8</b>	-1.0483	1.4329	-1.7461	7.0099**
<b>HB9</b>	-0.8597	1.1812	-1.2227	5.0622**
<b>HB10</b>	-1.6921	3.4280*	-2.2424	9.5831**
<b>HB11</b>	-1.5209	3.4268*	-2.2248	14.0533**
<b>HB12</b>	-0.9456	1.3775	-1.6063	6.4424**

\* statistically significant at 10% level

\*\* statistically significant at 5% level

**Table 9 Diagnostics of the logistic regression model**

<b>N = 961</b>		
<b>-2 log likelihood</b>	343.364	352.202
<b>-2 restricted log likelihood</b>	398.731	398.731
<b>Cox and Snell R<sup>2</sup></b>	0.056	0.047
<b>Nagelkerke R<sup>2</sup></b>	0.165	0.139
<b>Pseudo R<sup>2</sup></b>	0.025	0.021
<b>McFadden R<sup>2</sup></b>	0.025	0.021
<b>Count R<sup>2</sup></b>	94.59%	94.59%
<b>Chi-squared test</b>	55.367**	46.530**
<b>Hosmer and Lemeshow goodness-of-fit test</b>	3.5576 (P=0.8947)	5.1564 (P=0.7407)
<b>Likelihood ratio test (full model – reduced model)</b>	8.838	

\* statistically significant at 10% level

\*\* statistically significant at 5% level