

Equity and the UK National Health Service: A Review of the Evidence

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Abstract: In recent years, there has been considerable interest in the distribution of health care and finance in the UK. This paper reviews the accumulating evidence. It discusses the empirical measures of equity used in the various studies and the issues involved in the empirical construction of these measures. The main findings on both the delivery and finance side are presented and an extension of these cross-sectional analyses to an investigation of the lifetime equity in delivery and finance based on data from a micro-simulation model is discussed.

I INTRODUCTION

Equity is widely acknowledged to be an important policy objective in the health care field. Concern over equity is a prominent issue in discussions of health care reform in many OECD and non-OECD countries. But despite the high profile given to equity by policy makers, until recently there has been comparatively little research into the equity of particular systems of health care financing and delivery. In recent years, there has been increasing interest in equity and health care and a series of papers have discussed both the appropriate equity concepts and the extent to which equity goals are met in practice.

This paper focuses on recent empirical findings on the distribution of health care resources and payment for these resources in the UK. It makes no attempt to review all the evidence on the distribution of these resources as this would probably not be particularly illuminating. Instead, it concentrates upon a body of research which shares three specific features. First, the studies reviewed here have as their primary focus the specific issue of equity.

Second, they are empirical studies and attempt to test whether equity goals are met in practice. Third, they use large-scale nationally representative data sets in order to carry out these tests. The issues raised with respect to these papers include the appropriate normative goals for equity in the allocation of health care, the policy goals, the construction of empirical tests of equity, and the strengths and weaknesses of available data and the results derived. Section II of the paper examines equity in the distribution of health care resources. Section III examines the rather smaller body of evidence on equity in the distribution of finance for health care. Section IV presents results from an attempt to extend the examination of cross-sectional distributions of health care resources and financing to an analysis of lifetime distributions. The final section raises issues for further research.

II EQUITY IN THE DELIVERY OF HEALTH CARE

The Equity Goal

To investigate whether an equity goal for the delivery of health care is being met, it is necessary first to define the relevant equity goal. There is currently considerable discussion of the normative question of what *ought* to be the appropriate equity goal of a health-care system. Culyer and Wagstaff (1993) have argued that equity in the delivery of health care is an inappropriate goal for public policy. Health care, they argue, is only a means to an end, a way of maintaining health capital. And health care is only useful in this end when the health care provided is effective. Therefore equity in the allocation of health care, without regard to the efficiency of, or the need for, this care, is not a helpful policy aim. But even the pursuit of allocation according to need, by which Culyer and Wagstaff mean equality of health care for equal need and inequality of health care for unequal need, may be an inappropriate goal. First, Culyer and Wagstaff show that "allocation according to need" can give rise to different distributions of health care depending which of several definitions of need is adopted. But second, and more importantly, they argue that the appropriate goals for equity in health care should be the distribution of health care in order to equalise health. If this is accepted as the appropriate goal, then the pursuit of equity in the delivery of health care according to need may actually be counterproductive. Irrespective of how need is defined, equality of health will not be achieved if persons in equal need are treated the same and persons in unequal need are treated in proportion to the relevant inequalities.

While their argument has much force in a normative setting, the current policy goal of the NHS, and of other European health care systems are generally less concerned with equity of health outcomes than with the

allocation of health care (van Doorslaer, *et al.*, 1992). While accepting that NHS policy statements tend to be rather vague, one widely quoted equity goal of the NHS is "allocation of health care according to need" (O'Donnell, *et al.*, 1993). Most empirical studies have sought to establish the extent to which this goal is met. Mooney, *et al.* (1991) have argued that all these empirical studies are misguided because equal treatment for equal need is an inappropriate *policy* notion. The appropriate notion, they argue, is that of "equality of access". "Equal treatment for equal need" overrides individual preferences, while equalising the costs of access allows individuals to exercise these preferences facing the same price. While again in normative terms, equality of access might be (an) appropriate notion, it is far from clear that equality of access is either what is embodied in policy or is a concept that can be easily measured. In terms of policy, Le Grand (1982) has argued that some British policy documents seem to imply a commitment to equality of treatment for those in equal need, others a commitment to equality of access and yet others a commitment to equality of health. The same is true of several other OECD countries (van Doorslaer, *et al.*, 1992). Mooney, *et al.*'s claim that "equality of access" is *the* policy goal does not appear to be supported by the policy statements that do exist. For empirical purposes, measurement of the extent of equality of access would require data to be gathered for this specific purpose. Some of the costs of access, such as travel costs and waiting time, and co-payments for pharmaceuticals are relatively easily measured. Acton (1975), for example, has undertaken a study of travel time costs for the USA. To these costs would have to be added other costs, such as the opportunity cost of time taken off work and also psychic costs of worry etc. While this could be attempted if suitable data were available, no such data has been or presently is in the public domain and no UK large-scale studies of equality of access have been undertaken.

This paper therefore concentrates on attempts to establish whether there is equity in the UK allocation of health care, equity being defined as "allocation according to need". This equity goal is a horizontal equity goal. The achievement of horizontal equity requires that individuals defined as equal should be treated as equal. The characteristics of any individual can be divided into two sets. In the first of these are those characteristics which are established by policy as the basis for resource allocation. In the second are those which are deemed to be irrelevant by policy for the purpose of resource allocation. Horizontal equity requires that allocation should be based only on characteristics from the first set. In the case of the NHS equity goal, need is a characteristic in the first set. Once this characteristic is taken into account, the NHS goal should imply that there are no systematic differences in the allocation of health care across individuals. Systematic differences across

income, socio-economic group or any other measure of ability to pay thus represent departures from this goal. Thus an empirical test of whether the goal is met is whether, after controlling for differences in need, there are systematic differences in the amount of care received by persons of different ability to pay. This requires an empirical definition of (a) need, (b) ability to pay and (c) a measure of the extent of (in)equity.

The Definition of Need

There are many possible measures of need. However, all the studies which have examined the distribution of NHS care relative to need and income or socio-economic status across the whole of the UK population have had to rely on a single source of data — the General Household Survey (GHS). The GHS is an annual cross-sectional survey of the UK population and is the only data set which contains measures of ability to pay, measures of health care utilisation and measures of need. The GHS contains four self-assessed measures of ill-health (morbidity). These four measures are argued to represent different facets of need (Blaxter, 1990). They are recorded not as continuous variables but as dummy variables. Individuals give a yes or no reply to four questions about their health. In empirical analysis, such variables can either be treated as representing an underlying variable which is truly dichotomous or as a measure of a continuous latent variable. Two of the first studies of the distribution of health care (Foster, 1976 and Le Grand, 1978) treated these measures as representing underlying dichotomous variables. The methodology they used to assess equality of treatment (discussed below) is equivalent to an assumption that individuals who stated that they had no morbidity have no medical need. Later studies (Evandrou, *et al.*, 1992; O'Donnell and Propper, 1991; Propper and Upward, 1992) treated these variables as dichotomous indicators of a latent variable, in which a zero indicated a lower level rather than no need. However, regardless of whether a negative reply is taken to indicate no need, or simply a lower level of need than a positive response, dichotomous indicators convey relatively little information about the underlying latent variable need. The associated research problem is that results may be sensitive to arbitrary assumptions about the relationship between the dichotomous indicator and the underlying latent variable.

The Definition of Ability to Pay

Early research in this field used socio-economic group (class) as a measure of ability to pay, probably because this measure was widely used in the inequalities in health literature (cf. Townsend and Davidson, 1992). Later research on equity in health care has used current income as a measure of ability to pay. Both measures have their drawbacks. Class or occupation has

been widely used in studies of inequalities in part because the single measure occupational group is highly correlated with a group of other intercorrelated variables, including income, tenure and political attitudes. However, this advantage may turn out to be a disadvantage when comparisons over time are sought. If occupations change over time, so will the numbers in each class. It is therefore difficult to compare trends in class-related events.¹ In addition, the nature of the correlations between variables may change over time, so that it is not clear what the variable class is actually measuring.² Even in a static setting, if inequality is found in the distribution of health care across socio-economic groups, there is no way of knowing which of the variables, class is a proxy for are associated with this inequality. The use of income avoids this drawback. However, all the measures of income used in studies of the distribution of health care have been current income. This will be composed of transitory and permanent components which cannot be disentangled using cross-sectional data. The larger the transitory component, the more misleading current income may be as a measure of ability to pay.

The Empirical Measure of Equity

Any study of equity in the allocation of health care according to need requires a measure of this allocation. It is possible to test for differences in the allocation of health care across income or class by undertaking multivariate analysis controlling for need. This approach was taken by Puffer (1987) and Evandrou, *et al.* (1992) for example. Studies which have focused on investigation of equity *per se* have tended to construct summary measures of departures from proportionality in the allocation of health care by ability to pay group. Forster (1976) and Le Grand (1978) defined this measure as the ratio of health service utilisation to need within an ability to pay group. More formally, if there are only two need groups, one with positive need and the other with no need, and there are j ability to pay groups, the measure is

$$(x_j + x'_j) / n_j \quad (1)$$

where x_j = health care utilisation by those with need in group j
 x'_j = health care utilisation by those with no need in group j
 n_j = number in need in ability to pay group j

Implicit in (1) is an assumption that a value of zero for the dichotomous indicator of medical need implies the individual has zero need.

1. This has been a problem for research on inequalities in health.

2. For example, for investigation of mortality, most deaths occur outside the age ranges to which social class classification may be confidently applied (Le Grand, 1993).

Collins and Klein (1980) examined the variation in utilisation of a single service (use of General Practitioner Services) by individuals of a given need across ability to pay groups. They compared the two ratios

$$x_j / n_j \text{ and } x'_j / n'_j \quad (2)$$

across j ability to pay groups.

O'Donnell and Propper (1991) and Wagstaff, *et al.* (1991) have shown that if need is distributed non-randomly by ability to pay group the empirical results will differ according to whether measure (1) or (2) is used. Propper and Upward (1992) and O'Donnell, *et al.* (1993) used a generalisation of (2) suggested by Wagstaff, *et al.* (1991). A natural extension to (2) is to calculate a weighted sum across need groups, where the weights are the incidence of need of each type in the population. The measure is:

$$\sum_m (x_{mj} / n_{mj}) n_m / N \quad (3)$$

where n_m = number in sample in need group m
 x_{mj} / n_{mj} = average utilisation of health care by those in need group m and ability to pay group j
 N = total sample size.

Each of these three measures embodies a value judgement about the weight to be attached to each form of need. In addition, all three measures are based on the assumption that there is no systematic variation in extent of need within a need category.

Empirical Findings

Data from the early 1970s appeared to indicate that the NHS was not allocating health care according to need. Forster (1976) found that the utilisation of publicly-funded health care was positively associated with class for men, though not for women. Using the same methodological approach and data for 1972, Le Grand concluded that the top two socio-economic groups received 40 per cent more health care per person reporting sick than the bottom two socio-economic groups. But later research using more recent data, a variety of definitions of need and different measures of equity reached different conclusions. Collins and Klein (1980), Puffer (1987), Evandrou, *et al.* (1992) and O'Donnell and Propper (1991) all found considerably smaller and less systematic departures from horizontal equity.

While the consistency of findings across different definitions of need, utilisation and measures of equity suggest that the finding of less systematic departures from equity for data from the 1980s is relatively robust, the differences in methodology between the early and later studies meant that it

was not possible to disentangle changes over time in the distribution of health care standardised for need from differences in methodological approach. In an attempt to control for differences in methodological approach, Propper and Upward (1992) used all three measures (1), (2) and (3) to examine the distribution of health care standardised for need across income group for four years between 1974 and 1987. In common with earlier work they used the GHS as the data source. Their results indicated that regardless of the measure of equity used, the hypothesis of differential allocation across income groups was not supported by the data. Table 1 presents their results using Equation (3) to derive percentage shares of NHS health care expenditure standardised for need.³

Table 1: *Percentage Shares of Standardised NHS Expenditure 1974-1987*

| <i>Income Quintile</i> | <i>1974</i> | <i>1982</i> | <i>1985</i> | <i>1987</i> |
|------------------------|-------------|-------------|-------------|-------------|
| Bottom | 24.6 | 22.5 | 22.7 | 22.7 |
| 2nd | 21.6 | 20.3 | 22.7 | 21.2 |
| 3rd | 19.3 | 21.1 | 19.7 | 19.9 |
| 4th | 17.9 | 21.7 | 18.9 | 19.8 |
| 5th | 16.6 | 14.5 | 16.1 | 16.3 |
| Concentration index | -0.083 | -0.092 | -0.070 | -0.062 |

Source: Propper and Upward (1992).

The table shows the percentage share of NHS expenditure adjusted for the need received by each income quintile.⁴ The concentration index presented at the bottom of each column is a summary measure of the extent of departure from proportionality in the allocation of medical care standardised for need (Wagstaff, *et al.*, 1991). The index is bounded between -1 and 1. A positive value indicates a regressive distribution, a negative value a progressive distribution. The magnitude of this index is very similar in all the columns of Table 1 and indicates little departure from horizontal equity. The signs of these indices indicates that if there is any departure from horizontal equity it is not "pro-rich" but "pro-poor".⁵ The authors also repeated the Le Grand (1978) analysis using socio-economic groups as a measure of ability to pay and found no systematic variation in the allocation of care across groups.

Van Doorslaer, *et al.* (1992) compared the equity of health care delivery in eight OECD countries using the methodology of Equation (3). This study

3. The methodology used also controlled for differences in the demographic composition of different income groups.

4. All the analysis is undertaken using micro-data.

5. Note there are no standard errors given for the concentration indices. They could all be insignificantly different from zero.

found that the UK distribution is less progressive than that of several other countries and is similar to Spain and the USA.⁶ However, there appears to be no obvious relationship between cross-country differences and health-care delivery systems.

III EQUITY IN THE FINANCE OF HEALTH CARE

There have been fewer studies of the distribution of payments for health care than of health care utilisation, but in the last 10 years increasing attention has been devoted to finding out who pays for health care. In part, the distribution of payments for health care is of concern because it affects the utilisation of health care. For example, in health-care systems in which co-payments are used there is concern that the use of such payments will limit the use of the poorest, who are precisely those individuals who are most in need of health care. But the widespread search for financing measures to limit the growth in health care costs (Hurst, 1992) has also prompted a concern for the distributional impact of different forms of health care financing. Regardless of the impact of finance on utilisation, a health-care-financing system which required the greatest contributions from the poorest members of society may not be regarded as desirable.

Studies of the distribution of finance, for Britain and elsewhere, have taken as their starting point the premise that health care ought to be financed according to ability to pay (for example, Gottshalk, *et al.*, 1989; Hurst, 1985). But as Wagstaff and van Doorslaer (1993) point out, there are two distinct equity concepts within this premise. The first is the concept of vertical equity (the requirement that individuals or families of unequal ability to pay make appropriately dissimilar payments for health care) and the second is the concept of horizontal equity (that individuals or families who are defined as of equal ability to pay make the same contributions). In systems in which health care is financed through a combination of public and private insurance, pay-roll taxation, general taxation and out-of-pocket payments, an individual's payments for health care can depend upon, *inter alia*, their employment status, their marital status, their age and their income. In these systems, the issue of horizontal equity is likely to be particularly important. While both concepts of equity are applicable to the distribution of health care financing, the empirical research undertaken to date has examined vertical and not horizontal equity. This section therefore examines only the issues in the analysis of vertical equity and the UK results.

6. The countries were Denmark, France, Ireland, Italy, The Netherlands, Portugal, Spain, Switzerland, UK, USA.

Definition of Equity

Measurement of vertical (and horizontal) equity requires a definition of ability to pay. As noted above, empirical analyses of the distribution of health care have used class as well as income as a measure of ability to pay, but empirical studies of the financing side have only used income. Income is the measure most generally used in analyses of the equity of tax systems. Income has the advantage over occupation that summary measures of departures from equity such as those used in the analysis of equity in the distribution of taxation can be computed. These allow different distributions to be compared, both across time and across country. However, which definition of income should be used? Should it be pre-tax or post-tax income? Pre-tax income may be measured as original income or a gross income. The first includes all sources of income which are not provided by the state. The second includes transfers to individuals from the state (such as pension payments) but excludes transfers by individuals to the state, i.e. taxes. Post-tax (disposable) income includes these transfers as well. Should income be adjusted for family or household composition to derive an estimate of per capita ability to pay?

Measurement of vertical equity requires a definition of differential treatment of unequals. Should the relationship between ability to pay and payments for health care be progressive, so that individuals with greater ability to pay, pay more in proportional terms? If progressive, how progressive should the yardstick be? Or should the definition be one of proportionality? Or is a regressive system in which all individuals pay the same for their health care, regardless of their ability to pay, the appropriate yardstick? As Wagstaff and van Doorslaer (1993) point out, typically policy statements do not address such issues.

In practice, empirical studies are limited by data availability. In defining income, UK studies have used disposable income,⁷ gross income,⁸ and gross income adjusted for family composition, using weights that are derived from estimation of equivalence scales.⁹ And in the absence of a clear yardstick defined by policy, researchers have generally, either explicitly or implicitly, examined departures from proportionality. In other words, they have sought to answer the question, do individuals across the income distribution all pay the same proportion of their income to finance health care, or do richer individuals pay more or less?

7. For example, Gottshalk, *et al.* (1989).

8. For example, O'Donnell, *et al.* (1993).

9. Adjustment of household income using weights from equivalence scales is one way of estimating individual utility. But since policy pronouncements of equity statements focus on ability to pay, there is no need to accept this interpretation of income adjusted for family composition. Adjustment for family composition using these weights can simply be seen as a way of deriving a needs-adjusted measure of per capita income.

Empirical Measure of Equity in Financing

One method of examining departures from proportionality is to tabulate shares of income received and health care payments made by income decile and compare these. While illustrative, this approach does not allow comparison of the progressivity of sources of finance between health care systems or in the same health care system over time. To do this requires calculation of a summary measure of progressivity. Wagstaff, *et al.* (1989) suggested the use of the same summary indices as are used in the literature on tax progressivity to assess the distribution of taxes relative to income (Lambert, 1989), to assess the distribution of health-care payments. They suggest two indices. Both are based on the difference between the distribution of income and the distribution of health care finance. Both are measures of the extent of departure from proportionality in the distribution of health care finance relative to income. The Kakwani index weights all departures from proportionality equally while the Suits index gives greater weight to departures from proportionality that occur among higher income groups than to departures occurring amongst lower income groups. A negative value for both indices indicates a regressive distribution, a positive value a progressive distribution.¹⁰ A useful property of both indices is that the overall index for two or more taxes (types of health-care financing) is the weighted average of the indices for the individual components, where the weights are the proportions of the taxes (types of health care financing) in total tax (health care financing) revenue.¹¹

Empirical Findings

In the UK the majority of health care is financed through taxation and provided by the NHS. In 1985 for example, publicly financed NHS expenditure accounted for 76.5 per cent of total expenditure on health (OHE, 1987). All of this expenditure is raised through general taxation. (User charges for NHS services are treated as private payments and account for only 3 per cent of total NHS financing.) The share of public finance in health care in the UK is one of the highest in the OECD (OECD, 1989). Gottshalk, *et al.* (1989) examined the distribution of health care finance in relation to the distribution of post-tax income in the UK, American and Dutch health care systems. The results (reproduced in Table 2) show the UK system to be more progressive than that of the other two countries. Individuals in the poorest

10. The Kakwani index ranges from -2.0 (when all the pre-tax income is concentrated in the hands of the richest person and the entire health care financing burden falls on someone else) to 1.0 (when the pre-tax income is distributed equally and the entire financing burden falls on one person). The Suits index ranges from -1.0 (when the entire health care financing burden falls on the poorest person) to 1.0 (when the entire financing burden falls on the richest person).

11. For details of the construction of these measures see Wagstaff and van Doorslaer (1993).

decile of after-tax income received 2.7 per cent of total disposable income and contributed 1.7 per cent of health service finance (paid 1.7 per cent of allocated taxes). The highest decile had 23.7 per cent of disposable income and contributed 25.6 per cent of health service finance. The implicit definition of equity in this analysis is allocation of finance proportional to (post-tax) income. Given this null, the UK system for 1981 is progressive. A similar study by Hurst (1985) also concluded the UK system was progressive.

Table 2: *Comparison of Distribution of Health Care Financing: USA, UK, The Netherlands, 1981*

| Decile | Distribution of Post-tax Income | | | Distribution of Health Care Financing | | |
|--------|---------------------------------|------|-----------------|---------------------------------------|------|-----------------|
| | USA | UK | The Netherlands | USA | UK | The Netherlands |
| 1 | 1.4 | 2.7 | 0.4 | 3.9 | 1.7 | 1.9 |
| 2 | 2.9 | 4.0 | 5.2 | 4.9 | 2.5 | 4.3 |
| 3 | 4.4 | 5.3 | 6.6 | 5.5 | 4.0 | 6.1 |
| 4 | 5.7 | 6.8 | 7.9 | 7.0 | 6.2 | 8.3 |
| 5 | 7.1 | 8.2 | 8.9 | 8.6 | 7.9 | 8.3 |
| 6 | 8.5 | 9.6 | 10.1 | 9.7 | 9.8 | 11.5 |
| 7 | 10.1 | 11.1 | 11.5 | 10.9 | 11.5 | 12.3 |
| 8 | 11.9 | 13.0 | 13.1 | 12.8 | 13.5 | 13.9 |
| 9 | 14.9 | 15.6 | 15.5 | 15.0 | 17.1 | 15.4 |
| 10 | 33.1 | 23.7 | 20.8 | 21.8 | 25.6 | 16.7 |

Source: Gottshalk, *et al.* (1989).

O'Donnell, *et al.* (1993) used the summary measures suggested by Wagstaff, *et al.* (1989) to estimate the proportionality of the UK health care financing system. In carrying out this analysis, O'Donnell, *et al.*, attempted to allocate more forms of health care payments than previous research. For each form of health care payment they calculated Kakwani and Suits' indices and then used the "adding up" property of these indices to estimate the progressivity of the total distribution of health care finance.

The UK Central Statistics Office (CSO) publishes annual tables showing the distribution of the tax burden by gross household income decile (not adjusted for household composition).¹² Table 3 presents the summary indices for all taxes allocated by the CSO. The final column of the table shows these taxes are close to progressive. These taxes account for about 74 per cent of all UK taxes paid by UK residents, so O'Donnell, *et al.*, use the findings of

12. The incidence assumptions used to generate the data in Table 3 are: income tax and employees' national insurance contributions incident upon the tax payer, employers' national insurance contributions and indirect taxes incident upon consumers.

O'Higgins and Ruggles (1981) on the incidence of the remaining 26 per cent of taxes, and data on the distribution of prescriptions, payments for over-the-counter medicines premia for private health insurance to derive a "guestimate" for the overall distribution of health-care financing. This is given in Table 4 and shows the impact of adding sources of finance other than the taxes allocated by the CSO is to reduce the value of progressivity indices by around 50 per cent. The overall conclusion is that the distribution of total UK health care is slightly progressive.¹³

Table 3: *Distribution of Tax Payments (1985)*

| <i>Income decile (households ranked by gross household income)</i> | <i>Gross Income (1)</i> | <i>Income Tax (2)</i> | <i>National Insurance (3)</i> | <i>Indirect Tax (4)</i> | <i>Total Tax (5)</i> |
|--|-------------------------|-----------------------|-------------------------------|-------------------------|----------------------|
| Gini coefficient | .38 | .575 | .449 | .311 | .448 |
| Kakwani index | | .195 | .069 | -.069 | .068 |
| Suits index | | .213 | .051 | -.079 | .068 |
| % of tax revenue | | 41.9 | 18.6 | 39.5 | |

Note: Column (5) is derived from the weighted sum of indices for columns (2)-(4) where the weights are the proportion of allocated taxes raised.

Source: O'Donnell, *et al.* (1993).

Table 4: *Estimated Progressivity of UK Health Care Finances (1985)*

| | <i>Income Tax</i> | <i>National Insurance</i> | <i>Indirect Tax</i> | <i>CSO Unallocated</i> | <i>Prescriptions + OTC Payments</i> | <i>Private Health Insurance</i> | <i>Total</i> |
|---------|-------------------|---------------------------|---------------------|------------------------|-------------------------------------|---------------------------------|--------------|
| Kakwani | .195 | .0069 | -.069 | -.019 | -.19 | .20 | .032 |
| Suits | .213 | .051 | -.079 | -.025 | -.21 | .25 | .031 |
| Weight | .268 | .119 | .253 | .224 | .087 | .048 | |

Note: Weights from national income accounts.

Source: O'Donnell, *et al.* (1993).

This UK distribution of health-care financing appears to be relatively equitable when compared to that of several other OECD countries. Using the same methodology Wagstaff, *et al.* (1992) found that tax financed health care systems (the UK, Denmark, Ireland and Portugal) tend to be mildly progressive, while social insurance systems (France, The Netherlands, Spain) and predominantly private insurance systems (USA, Switzerland) tend to be regressive, the latter systems being particularly so.

13. The authors stress this is a tentative conclusion as most of the change in the values of the index is due to the effect of the non-CSO allocated taxes, the incidence of which the authors have least confidence in.

IV ANALYSES OF THE LIFETIME DISTRIBUTION OF HEALTH CARE RECEIPTS AND FINANCE

The results discussed above are all derived from analyses of cross-sectional micro-data. But cross-sectional snapshots of relative gains and losses from the health care system by income groups (even when standardised for age) may be rather misleading. For example, if those persons who get most health care at young ages are the same people who get most in later life, and these persons are also the poor, then the lifetime distribution of health care receipts is considerably more concentrated than if those who get health care in later life are a richer group. Cross-sectional data cannot be used to distinguish between those cases where relative gains are concentrated among the same persons for their whole life and where they are dispersed across different persons. Ideally, what is required is panel data, and this panel must be of considerable length, as health care usage is highest in the early years and later years of a person's life. At present, such panel data is not available for the UK. Nor, given the length of panel required, will it be available for many years.

Micro-simulation models offer an alternative source of such data. These are models which generate data on individuals (micro-data) from simulations based on observed behaviour from cross-sectional and short panel data. Cross-sectional micro-simulation models are widely used in policy analysis (examples are tax-benefits models used to simulate the effects of tax and social security regimes).¹⁴ But these models are not suitable for analysis of lifetime or lifecycle effects. Such analysis requires a model which simulates the behaviour of a cohort over a lifetime or of several cohorts over their lifetime. One such model exists for the UK (Falkingham and Hills, forthcoming). This model, called LIFEMOD, simulates the behaviour of a cohort of persons born in 1985 over their lifetimes. As this model contains, amongst other variables, data on health care receipts, income and taxes paid, it can be used to study the lifetime distribution of health care payments and receipts. Comparisons can therefore be made between simulated lifetime distributions and those discussed above derived from cross-sectional data.

The Simulation Model

The LIFEMOD model generates simulated data for individuals. The details of the construction of the model are given in Falkingham and Lessof (1992). What follows here is a brief outline relevant to use of this model to examine lifetime distributions of health care and payments for this care. The model

14. UK examples include TAXMOD and the Institute for Fiscal Studies Tax-benefits model (Atkinson and Sutherland, 1989).

simulates events for each year of life from birth to death for 4,000 observations, 2,000 male and 2,000 female. These events include death, social class of parents, education, labour market participation, fertility and family formation and dissolution, earned and unearned income, direct taxes paid and benefits received from the state, health status and health care utilisation. The probability of each event occurring for any observation in the model is based on econometric analysis of the factors determining the event. Given the value of this probability a Monte Carlo procedure is used to determine whether or not the event occurs.

Data limitations and the specific form of the simulation model shape the events that are simulated in the model. Most of the estimated probabilities are derived using data from 1985. LIFEMOD is therefore a model of a 1985 steady-state world. In addition, the probability of any event occurring for an observation in LIFEMOD can only be a function of events which have already been estimated within the model. The specific health status and health care variables modelled in LIFEMOD are the same variables as used in many of the analyses presented in Sections II and III of this paper. Two measures of health status — chronic and acute morbidity — and one measure of health care expenditure — total NHS expenditure — are simulated. Formally, the simulation process first calculates

$$\text{pr}(m_{ijt} = 1) = f(\underline{x}_{it}), j = 1, 2, i = 1, 400, t = 1, 100 \quad (4)$$

where $m_{ijt} = 1$ if morbidity j occurs for individual i , year t
 0 otherwise

\underline{x}_{it} = variables including age, work status, socio-economic status, and an autocorrelated error to reflect correlation in health status over time

j = chronic or acute morbidity

A Monte Carlo process is used to assign a value of 1 or 0 to the two health status indicator variables. Conditional on the realisations of these two events, the level of NHS expenditure for observation i in year t is determined by

$$E(\text{exp}_{it}) = \text{pr}(\text{exp}_{it} > 0 | z_{it}) * E(\text{exp}_{it} | \text{exp}_{it} > 0) \quad (5)$$

where exp_{it} = total NHS expenditure person i year t

z_{it} = variables including age, work status, socio-economic status and predicted morbidity.

The first term in (5) is the estimated probability that observation i will use the NHS in year t . This probability depends on a set of variables which include predicted health status from Equation (4), demographics and ind-

vidual socio-economic characteristics. A Monte Carlo process is used to determine the realisation of this event. If this event is realised, the level of NHS expenditure is determined by the second term in Equation (5). This realisation of this second term is deterministic and depends only on age and gender (further details in Propper and Upward, 1993).

The functional forms of Equations (4) and (5) are based on econometric estimates of the incidence of acute and chronic morbidity and of the probability of incurring NHS expenditure in a given year, derived from the 1985 GHS. Thus the incidence of an event is modelled as the 1985 incidence. As there is no health care supply side in the GHS,¹⁵ and so none in LIFEMOD, the vector z_{it} contains no measures of health care supply. However, as only the first term of Equation (5) — the probability of use of the NHS — is modelled as a function of individual behaviour in LIFEMOD, and as initial contact with the medical care providers is generally argued to be the result of demand side factors, the omission of supply side variables does not seem inappropriate. A limited relationship between health status, income and employment is modelled in LIFEMOD. Because of lack of adequate cross-section data and the consequent form of the model in which income is estimated prior to health status and care, while health status in year t is modelled as a function of employment status and income in year t , income and employment status are not modelled as a function of health. Finally, behavioural response to policy change is assumed to be zero.¹⁶

Lifetime Equity in the Delivery of UK Health Care

LIFEMOD data was used to replicate the cross-sectional analysis of equity presented in Table 1 above using lifetime data. Expenditure was standardised for need using the methodology in Equation (3) of Section II. The income definition used was gross household income, adjusted for household composition, using the same equivalence scale as Propper and Upward (1992). Taxes were levied according to the tax and social security regime in operation in 1985. For each observation, a lifetime total of health care standardised for need was derived by summing annual expenditure standardised for need over the length of life of that observation. A lifetime average was formed by dividing the lifetime total by the number of years of life of that observation. These annualised values were then averaged across annualised lifetime income

15. Nor is there any other data set that can be used to link supply side characteristics to individuals (i.e. to the demand side).

16. Incorporation of behavioural response to policy or tax change is problematic, both because econometric studies designed to estimate such responses give widely differing results and because these estimates are typically derived from cross-section data or short panel data. If individual behaviour in the long run differs from short run behaviour, this will not be captured in the model.

groups (annualised income being obtained in the same way as annualised health care) to obtain the lifetime distribution of health care standardised for need by income group (Propper, forthcoming).¹⁷ Table 5 presents the percentage shares of annualised lifetime health care standardised for need by annualised lifetime income deciles.¹⁸ The results indicate no clear pattern of association with income. They suggest that if equity is defined as "allocation according to need" over the lifetime, the distribution of NHS expenditure appears to be fairly equitable. Similar results are obtained from an analysis of lifetime totals of health care expenditure standardised for need (Propper, forthcoming). The lifetime distribution is not dissimilar to the cross-sectional distribution between the mid 1970s and the late 1980s presented in Table 1. These results are subject to the caveat that they are generated by a micro-

Table 5: *Percentage Shares of Annualised Lifetime Health Care Expenditure Standardised for Need using LIFEMOD Data*
Individuals Ranked by Annualised Equivalent Cross Income

| <i>Annualised Lifetime Income Decile</i> | <i>Standardised by both Acute and Chronic Morbidity</i> | <i>Standardised by Chronic Morbidity Only</i> |
|--|---|---|
| Bottom | 9.62 | 9.68 |
| 2nd | 9.89 | 9.93 |
| 3rd | 10.03 | 10.04 |
| 4th | 9.97 | 9.80 |
| 5th | 9.93 | 9.92 |
| 6th | 10.23 | 10.12 |
| 7th | 10.08 | 10.07 |
| 8th | 9.99 | 9.99 |
| 9th | 10.48 | 10.45 |
| Top | 9.98 | 10.00 |

N=3983.¹⁹

17. The mean incidence of ill-health in LIFEMOD is slightly higher than in the cross-sectional data; the average incidence of chronic morbidity in LIFEMOD among adult men being 35 per cent and among adult women being 40 per cent whereas the proportions in the 1985 GHS are 35 and 38 per cent respectively. The average incidence for adult men and women of acute sickness in LIFEMOD is 11 per cent for men and 15 per cent for women: the GHS figures are 10 and 14 per cent respectively. This is because observations in LIFEMOD have longer duration of life than those in current cross-sectional data and ill-health is positively associated with age. The average lifetime incidence of morbidity and health care receipt (all variables adjusted for length of life) across individuals ranked by lifetime income are weakly pro-poor; that is, over a lifetime the poor are both sicker and receive a higher share of NHS health-care expenditure.

18. Annualisation (dividing by years of life) could mask significant differences in incidence of ill-health and lifetime receipt of health care, but does not appear to do so here. The distribution across income groups of total lifetime incidence of morbidity and health care received is similar to the distribution of annualised morbidity and health care.

19. There are 4,000 observations in LIFEMOD. But observations which die before age 17 are omitted as they have no income (as they die before entering the labour force).

simulation model that can only be as good as the data on which it is based. As the data are based on the GHS, both the need and the utilisation measures are subject to the same caveats as the cross-sectional analyses using this data (discussed in Section V below).

The Lifetime Distribution of Finance

LIFEMOD data can be used to replicate part of the O'Donnell, *et al.* (1993) analysis of the cross-sectional distribution of finance for health care. As only direct taxes (income tax and national insurance contributions) are modelled in LIFEMOD, the LIFEMOD results can only be compared to columns (2) and (3) of Table 3. The same incidence assumptions are made as in the cross-sectional analyses (employers' contributions to National Insurance are passed on to consumers and that direct taxes are borne by the payer). Table 6 presents the distribution from LIFEMOD of annualised lifetime income, income tax, and national insurance contributions by annualised lifetime income decile. Both the Kakwani and the Suits indices indicate that lifetime distribution of finance from income tax is progressive while that from national insurance is neutral.²⁰ Comparison with the cross-sectional results in Table 3 indicates the following. First, the lifetime distribution of taxes over the lifetime has the same pattern as the cross-sectional distribution. Second, the lifetime distribution of gross income, income tax and national insurance is more

Table 6: *The Distribution of Annualised Lifetime Income and Payments*
Individuals Ranked by Annualised Equivalent Gross Income

| <i>Annualised Lifetime Income Decile</i> | <i>Percentage of Income</i> | <i>Percentage of Income Tax</i> | <i>Percentage of National Insurance</i> |
|--|---------------------------------|-------------------------------------|---|
| Bottom | 4.91 | 2.23 | 3.55 |
| 2nd | 6.51 | 4.20 | 5.99 |
| 3rd | 7.28 | 5.21 | 6.96 |
| 4th | 8.33 | 6.84 | 8.46 |
| 5th | 8.86 | 7.78 | 9.18 |
| 6th | 9.42 | 8.66 | 10.01 |
| 7th | 10.60 | 10.63 | 11.37 |
| 8th | 11.71 | 12.52 | 12.61 |
| 9th | 13.53 | 15.70 | 14.33 |
| Top | 18.85 | 26.21 | 17.54 |
| Gini | 0.20 | 0.35 | 0.23 |
| Kakwani | | 0.11 | 0.03 |
| Suits Index | | 0.14 | 0.01 |

N=3983.

20. Annualisation appears to make little difference to the results — the distribution of the lifetime totals of tax payments is very similar to that of Table 6 (Propper, forthcoming).

equal than the cross-sectional distribution (the Gini coefficients are smaller in the lifetime data). Third, the lifetime distribution of finance for health care relative to income is less progressive than the cross-sectional distribution, as both the Suits and the Kakwani indices are smaller in Table 6.²¹

Net Incidence

Tables 5 and 6 replicate cross-sectional analyses and so provide comparison of the simulated lifetime distributions with cross-sectional distributions. LIFEMOD data can also be used to examine net incidence of health care receipts and payments — the difference between what individuals pay to the state for health care in terms of taxes and what they receive from the state for health care (Propper, forthcoming). This analysis allows comparison of health-care receipts and payments with the net distribution of other state transfers, such as education, pensions or social security payments (Falkingham and Hills, forthcoming). Table 7 presents the net lifetime distribution of payments for, and receipts of, health care under the assumption that all health care is financed proportional to direct taxation. The average net gain across all observations was set to zero, so the amount of direct tax paid by each observation was scaled down so that average lifetime payment for health care equalled the value of health care received. Under these assumptions, Table 7 indicates that individuals in the bottom six deciles of lifetime income would be net gainers, whilst those in the top 4 deciles would be net losers. The main determinant of this lifetime redistribution from poor to rich is the income tax system.²²

There has been no comparable analysis using actual cross-sectional data, but the third column of Table 7 presents the results using LIFEMOD data as a single cross section. The comparison shows that the cross-sectional distribution is considerably more extreme. The distribution of lifetime net benefits by lifetime income is more equal than the cross-sectional distribution. This provides confirmation of the more general picture: that taking a lifetime perspective reduces the extent of redistribution in the health-care-financing system.

21. Note there are no standard errors for the indices.

22. There is a marked lifecycle distribution to the annual net gains which underlie the lifetime totals. All income groups (income defined as lifetime income) are gainers before the age of 15. Once income is earned and taxes are paid, net gains tend towards zero. Richer individuals remain net payers until retirement, a function of their higher than average taxes and marginally lower than average health care expenditure. Net gains for the lowest quintile remain close to zero for the duration of working life. On retirement, net gains for all groups become positive, as health care expenditure rises and direct taxes fall to close to zero. The cumulative incidence of average net gains over the lifecycle for survivors indicates all income groups begin as gainers. The top three quintiles then become losers until age 64. Over the whole of their lifetime, individuals falling into the top quintile of the (lifetime) income distribution remain net losers.

Table 7: *Net Incidence of Average Annual Health Care Transfers by Lifetime Annualised Income Derived from LIFEMOD*
Individuals Ranked by Annualised Equivalent Gross Income

| <i>Annualised Lifetime Income Decile</i> | <i>Average Net Incidence (£pa rounded)</i> | <i>Average Incidence of Annual Transfers (£pa rounded)¹</i> |
|--|--|--|
| (1) | (2) | (3) |
| Bottom | 214 | 171 |
| 2nd | 147 | 278 |
| 3rd | 109 | 347 |
| 4th | 95 | 358 |
| 5th | 55 | 210 |
| 6th | 21 | 75 |
| 7th | -23 | -78 |
| 8th | -68 | -228 |
| 9th | -166 | -386 |
| 10th | -383 | -751 |

¹Observations ranked by annual gross equivalised income.

N=3987 for cols (1) and (2). N=234071 for col (3).

V DISCUSSION

The body of evidence reviewed in this paper provides three “stylised facts”. First, if equity in the distribution of health care is defined as “equal treatment for equal need” then the UK health care system broadly meets this goal and has met this goal since (at least) the mid 1970s. Second, if equity in the distribution of payments is defined as “contribution according to ability to pay”, then the UK system broadly meets this goal, in that the health-care-financing system in total is quite close to proportional. If the goal is a system that is more progressive, then the use of indirect taxation and user charges to finance health care reduces the extent of progressivity. Third, the system of financing health care used in the UK is one of the most progressive of a number of OECD countries.

Analyses using simulated lifetime data for a single cohort indicates that the extent of redistribution from richer to poorer over the lifetime would be less than suggested by cross-sectional snapshots. So taking a lifetime perspective would reduce the extent of redistribution, on both the delivery and the finance side. If only cash transfers are considered (i.e. not adjusting utilisation for need) then over the lifetime the NHS acts to transfer cash resources from lifetime rich to lifetime poor. Once again, the transfer when analysed for whole lifetimes is less than suggested by a cross-sectional analysis.

The finding on the delivery side that the NHS distributes health care more or less according to need emerges from a growing number of UK studies using large scale data, and the consistency of results is some indication of robustness. It is also echoed in results from other OECD countries (van Doorslaer, *et al.*, 1992). Yet the finding of small differences across income groups fits slightly uneasily with evidence from some smaller-scale studies that poorer individuals receive less or different health care than better off individuals (cf. *BMJ*, 30 April 1994).²³ One explanation could be that the smaller-scale studies capture only part of the picture. But the answer is likely to be more complicated and to be linked to the extent to which differences in the extent of need and amount of medical care can be measured using annual cross-sectional large scale data sets.

First, the methodology used in all the studies of equity discussed above embody the assumption that within a particular morbidity group, any variation in the extent of morbidity is random — in other words that there is no systematic variation in severity across individuals in a particular need category.²⁴ This assumption is made because there is no evidence in most years of the General Household Data to the contrary. Analysis of another large-scale data set, the Health and Lifestyles Survey (Cox, *et al.*, 1987) showed that poorer individuals are more likely to suffer more severe morbidity for chronic conditions, although for several types of morbidity, differences between poorer and richer were not statistically significant once differences across income group in demographic composition were taken into account (O'Donnell and Propper, 1991). Analysis of the 1974 GHS also showed that poorer individuals had more chronic conditions (Propper and Upward, 1992). If, within each need group, the poor are sicker, then the large-scale measures reported here will overestimate the extent of redistribution from higher to lower income groups.

Second, the results may be quite sensitive to the way in which morbidity groups are defined from the data. As was noted above, the Le Grand (1978) approach assumed that those recorded as having no morbidity were not in need. This assumption will affect the results. While the methodology used in later studies does not make this assumption, binary variables are used to represent an underlying latent variable, ill-health. Were more detailed measures of this latent variable to become available, the results could change. The results could also be sensitive to how these more detailed measures were used to defined need groups (for example, if a n-point scale

23. The finding of a negative relationship between income and *health* is common to both studies of the distribution of health care and those of the distribution of health.

24. The assumption that there is no within morbidity category variation in severity is not required.

were used to define fewer than n need categories).

Third, the measures of utilisation used in the large-scale studies assume that each individual recorded as receiving a type of medical care (primary care, inpatient or outpatient hospital care) receives on average the same amount. If there are systematic differences across income groups such that the rich get more, then the studies reported here will once again overestimate the distribution from higher to lower income group. On the other hand, if the poor get more, then the studies will underestimate the extent of redistribution. Fourth, the General Household Survey does not cover those in institutional care. This is a group who are both in greater need and receive greater health care than those not in institutional care. In younger age groups, they will have lower income than those not in institutional care. Given this, it cannot be established *a priori* how the addition of this population would change the aggregate picture, but given that this group are recipients of a considerable amount of care, a fuller picture should include those in institutions. All these caveats to the relatively consistent picture that emerges from aggregate data are issues for further research if and when suitable data become available. But finally, the studies reviewed here have provided a relatively consistent description of the distributions of health care resources and finance. More research is needed, particularly on the delivery side, to understand the factors that determine these distributions.

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