RISK ADJUSTING HEALTH CARE RESOURCE ALLOCATIONS

Theory and practice in the United Kingdom, The Netherlands and Germany

Adam J Oliver

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1 INTRODUCTION

Most health care systems are characterised by both purchasers (insurers, health authorities), who buy health care for a particular population, and providers (hospitals, primary care physicians), who supply health care services. In circumstances where the purchasers or providers bear any of the financial risk associated with covering a population, incentives to prefer to 'risk select' are present; i.e. purchasers will prefer to provide cover for people who are likely to require relatively little health care. In order to reduce these incentives to risk select, many countries have introduced risk adjustment mechanisms.

Van de Ven and Ellis (1999) have defined risk adjustment as 'the use of information to calculate the expected health expenditures of individual consumers over a fixed interval of time (e.g., a month, quarter, or year) and set subsidies to consumers or health plans to improve efficiency and equity'. However, Van de Ven and Ellis are concerned only with competitive health plan markets. In the current monograph, the discussion of risk adjustment will be extended beyond competitive health plan markets, to include National Health Service (NHS)-type systems.

Within an NHS-type system, the principal purchasers of health care are non-competing health authorities (or their equivalents), fully responsible for a regionally defined population. The health authorities are allocated an annual budget from central government funds, and are required to purchase health care for everybody within their area of jurisdiction. The health authorities are government agencies, and do not bear any financial risk. Therefore, there is no incentive for them to risk select. However, there is likely to be a large degree of diversification concerning the demographic and socio-economic structure of the numerous regionally defined populations within any particular country. Therefore, on grounds of fairness, or equity, it may be appropriate for government to adjust the resource allocations to health authorities on the basis of population characteristics that proxy health care need.

Throughout this monograph, it is assumed that a person is in need of health care if they would experience an improvement in their health status on receiving further health care. As stated above, Van de Ven

and Ellis' definition that risk adjustment is 'the use of information to calculate the expected health expenditures of individual consumers over a fixed interval of time … and set subsidies to consumers or health plans to improve efficiency and equity', is applicable specifically to competitive insurance systems where the aim is to remove the incentives to risk select. In this monograph, the definition is broader, namely: 'the use of information to calculate the expected health expenditures *or health care need* of individual consumers over a fixed interval of time … and set subsidies to consumers or health plans to improve efficiency and equity', in order to accommodate considerations of equity in NHS-type systems.[1]

Thus, there are two principal reasons why a government may want to introduce a risk adjustment mechanism into the health care financing system, with the specific reason being largely a function of the structure of the health care system:

    (i) To promote some form of equity that accounts for the fact that people have differential levels of health care need.

    (ii) To discourage risk selecting activity.

In this monograph, the principle of equity that was the stated motivation for introducing risk adjustment in England is outlined. Also, the reasons why it is considered important to discourage risk selecting, and how risk adjustment may achieve this, are detailed. An in-depth description of the mechanisms of all of the countries that have introduced risk adjustment is beyond the scope of this monograph. Moreover, the practical application of risk adjustment has been developing quite rapidly, and, consequently, published reports are soon dated. The author of this monograph had contact with people intrinsic to the practical application of risk adjustment in England, The Netherlands and Germany, which facilitated an up to date description of these systems at the time of writing. Thus, the health care financing structures and risk adjustment mechanisms currently in

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1 If it is assumed that health care expenditure equates to health care need, the two definitions are identical. However, this assumption is inappropriate in the absence of supporting evidence.

operation in England, The Netherlands and Germany, three European countries with a strong, historical commitment to providing good, universal health care coverage, are discussed.[2]

The discussion is conducted with reference to the principal reasons for introducing risk adjustment in these respective countries. Finally, whether England, The Netherlands and Germany have anything to learn from each other with respect to risk adjustment, and how the various mechanisms might be improved, is considered.

2 The mechanisms in use in Scotland, Wales and Northern Ireland are set out in Appendix C.

2 WHY RISK ADJUST?

2.1 Promoting equity

Risk adjustment can be used in an attempt to promote (some predefined form of) equity.[3] As a plan to promote equity, risk adjustment may be most relevant to systems where health care purchasers are regionally-defined, tax-funded and non-competing. The basic concept of this strategy is that because the overall characteristics of the covered population are likely to differ between each health care purchaser, the resources of each purchaser should be adjusted so as to be consistent with some predefined concept of equity.

There are, however, many things for which a government (or society) might want to be equitable [for reviews of the different types of equity, refer to Culyer 1995a; Culyer and Wagstaff 1992; Mooney 1983]. Since the objective of this monograph is to describe the theory and practice of risk adjustment, a detailed description of all of the types of equity is unnecessary. The discussion here is thus restricted to the principle of equal access for equal need, since this forms the basis of risk-adjustment in the UK, as shall be further discussed in Section 3.1.[4] A brief summary of the principles of equity considered by Mooney is given in Appendix A [Mooney 1983].

Health care need exists when the capacity to benefit from health care treatment is positive. An individual's health care need can be measured by the expenditure required to exhaust their capacity to benefit. This required expenditure may differ between individuals, even when they have the same capacity to benefit from health care at the point of delivery. For example, people who live in remote areas may have high travel costs due to relatively long distances to their local health care facilities. In such circumstances, they may decide to forgo needed

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3 Throughout the remainder of this monograph, it is assumed that a warranted promotion of equity refers to an ethically desired movement towards equality in some stated principle (e.g. the principle of equal access for equal need).

4 Equal access for equal need is by no means universally supported as the appropriate principle to pursue. A discussion of the drawback of this principle will follow; for a more detailed discussion see Culyer and Wagstaff (1992), and the debate between Mooney *et al.* (1991, 1992) and Culyer *et al.* (1992a, 1992b).

health care treatment altogether, potentially harming their health further [Mooney 1983]. There is therefore an argument for adjusting resources to reflect these differential access costs.

Mooney (1983) states that the principle of equal access for equal need should certainly incorporate the time and money costs incurred when using health care. To account for the possibility that the perception of costs will be influenced by the size of a person's income, it has alternatively been proposed that access costs should be couched in terms of (dis)utility [Le Grand 1982]. For example, incurred health care access costs measuring £50 may have a greater detrimental effect on the overall utility of a person earning £5,000 per annum than a person earning £50,000 per annum.

Fundamentally then, the concept of equal access for equal need implies that health care resource allocations should be adjusted across purchasers for characteristics associated with health care need (e.g. the age/gender profile of those covered, the number of unemployed people) and for the differences in costs (or dis-utility) faced by different individuals when requiring health care. This differential allocation is undertaken to enable the purchasers to finance the provision of different levels of health care in accordance with the health care need of each individual in the populations they cover.

This principle is proposing equality in the opportunity to use health care for people with the same level of need, and higher or lower levels of opportunity for people with higher or lower need. If health care is provided and utilised according to the concept of equal access for equal need, there would thus be the equal treatment of equals (horizontal equity) and the unequal treatment of unequals (vertical equity). Whether individuals take full advantage of their opportunities is irrelevant to the concept. In general terms, the basic principle of equality of opportunity seems attractive, but the pursuit of this principle is subject to the following criticism.

Health is an intrinsic good. For example, whereas income is a means to living a better life, and is, therefore, an instrumental good, health is to be valued in itself [Sen 1998]. Essentially, health is nor-

12 mally a prerequisite to enable people to flourish as human beings [Culyer 1995a]. Consequently, to the extent that health care can influence health status, it could be argued that health care resources should be allocated to facilitate the promotion of equal health rather than equal access to health care. This is not necessarily to say that equal health should be pursued at all costs, so that, for example, the health status of the relatively healthy is dramatically reduced for the sake of equality. It is to say that society should decide upon an acceptable level of health status that a person can reasonably expect to enjoy (which could, for example, be defined in terms of quality-adjusted life expectancy), and that resources should be allocated and utilised in a manner that is consistent with promoting equity with respect to the chosen level of health status. The argument is that each individual, irrespective of who they are, should, as far as possible, be given an equitable chance to flourish. However, it is not obvious that equal

Figure 1 **Implications of promoting equal access for equal need**
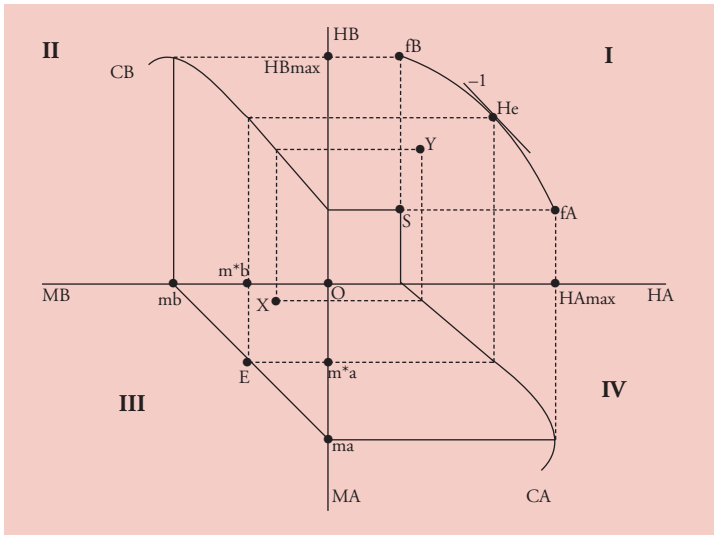
Source: Culyer and Wagstaff (1992)

access for equal need is consistent with promoting movements towards equal health. In order to explain this, the argument of Culyer and Wagstaff is followed [Culyer and Wagstaff 1992].

In Figure 1, quadrant I represents the health status (e.g. quality-adjusted life expectancy) of two individuals: the health of individual A is measured on the horizontal axis and the health of individual B on the vertical axis. Point S depicts the health status endowment for both individuals, or the health status that each individual would enjoy in the absence of health care. For ease of exposition, the endowment for individual A equals that for individual B at point S. The loci CA and CB in quadrants IV and II represent the maximum capacities of individuals A and B to benefit from inputs of health care resources. These resource inputs are measured on the axes MA and MB, respectively.[5] These loci are concave and are also identical for both individuals in Figure 1.[6] Thus, it is assumed that there will be a point at which an increase in health care use by an individual will have a zero and then a negative effect on health. Therefore, HAmax and HBmax in quadrant I represent the maximum achievable health status for individual A and individual B, respectively.

As noted above, the vertical and horizontal axes in quadrant III define the health care expenditures on individuals A and B, respectively. Each individual needs health care resources until the point at which their capacity to benefit from further health care falls to zero. In Figure 1, the points ma and mb respectively represent the amount of resources required to exhaust A and B's capacity to benefit.

However, assume that there are only enough resources to exhaust the capacity to benefit of *either* individual A *or* individual B, rather than individual A *and* individual B. Thus, there is a budget constraint,

5 It is worth noting that the Culyer/Wagstaff exposition does not incorporate the possibility that an injection of health care resources may induce the beneficiaries of health care to engage in an increase in risk taking behaviour; for example, by inducing the beneficiaries to reduce their efforts in the self-prevention of illness. In defence of Culyer/Wagstaff, the four quadrant diagram is not meant to cover all eventualities; it is essentially a taxonomising device.
6 For an exposition of the four quadrant diagram where the initial endowment points and capacity to benefit loci for the two individuals are not identical, see Culyer (1995b).

mbma. By tracing all possible allocations between individuals A and B on this budget constraint through the capacity to benefit loci in quadrants II and IV, the health frontier fBfA in quadrant I is derived. This gives all the possible distributions of health status for individuals A and B, given the resource and technology constraints embedded in the model.

As stated, individuals A and B have identical capacities to benefit. Further assume that these individuals face identical costs when using health care.[7] Therefore, for individuals A and B, an equal access to health care treatment for equal need will entail each individual being allocated an equivalent amount of health care resources, assuming throughout that the purchasers buy health care commensurate with each individual's need. Thus, if equal access for equal need is being pursued, individuals A and B will be allocated 0m*a and 0m*b level of resources, respectively, which is signified by point E on the budget constraint. If both individuals make maximum use of these resources, point He will be arrived at on the health frontier.[8] The gradient of the health frontier at He is -1, implying that a unit reduction in health status for individual A will lead to an equivalent unit increase in health status for individual B and vice versa. This is the only point on the health frontier where the two individuals have an equivalent health status.

Although it is assumed in this example that an equal amount of the budget has to be allocated to individuals A and B to be consistent with the principle of equal access for equal need, it is not in fact known whether the individuals will take full advantage of their allocation. Therefore, the actual utilisation of health care resources could lie anywhere within the area m*bOm*aE. Actual utilisation of health care resources is likely to be influenced by different preferences, knowledge, information, incomes and opportunity costs across individuals. If

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7 This assumption is imposed; i.e. it is not implied by the four quadrant diagram.
8 When positive identical access costs are assumed for individuals A and B, the health frontier will lie parallel to, and to the south-west of, fBfA. However, since all conclusions are the same, this complication is overlooked in this exposition.

resource allocations are not adjusted for these influences, inequalities in health status between different individuals could be exacerbated. For example, consider point X in Figure 1, where both individuals do not use their entire allocations, but individual B uses relatively more resources than individual A. By following the implications of these utilisations via the capacity to benefit loci, point Y in the health domain is obtained. This final distribution of health represents improved health status for both individuals compared to their initial health endowments. However, inequality in the health status distribution has been exacerbated and, furthermore, point Y lies considerably within the health frontier, indicating inefficiency.

Therefore, if the view that the fundamental principle of health care is to advance, as far as possible, equitable (or efficient) levels of health status throughout the population is accepted, then equal access for equal need is not necessarily the most appropriate principle to adopt when risk adjusting health care resource allocations. If the stated policy aim is the narrowing of inequalities in health status, perhaps a better principle would be to allocate resources towards practices that would encourage people to make full and appropriate use of beneficial health care opportunities (the principle of equal utilisation for equal need). This principle would clearly have to address the notion of differing preferences, knowledge, information, incomes and opportunity costs mentioned above. Alternatively, the more discriminatory policy of directing resources towards individuals or groups that have poor health status could be adopted, even if their capacity to benefit from health care is at a relatively low level (consistent with a movement towards equal health).

To summarise this section, risk adjustment can be used to promote some predefined form of equity. The form of equity that has been adopted as a policy objective in the UK is the principle of equal access for equal need, and it is for this reason that this equity principle is focussed upon in this monograph. The concept of equal access for equal need requires that purchaser resource allocations be adjusted both for characteristics associated with need and for differential access

costs across covered populations. However, due to different prefer-
ences, knowledge, information, incomes and opportunity costs across
individuals, it is important to note that giving individuals or groups
with equal need an equal opportunity to utilise health care may actu-
ally exacerbate health inequalities.

2.2 Removing the incentives to risk select

The previous section described how risk adjustment can be used in an
attempt to promote equity. However, risk adjustment can also be used
as a response to reduce the inappropriate incentives for insurers to risk
select that arise in a competitive environment.

The health care financing system in a number of countries is char-
acterised by competing health care insurers [see, for example, Beck and
Zweifel 1996 (Switzerland); Chinitz 1994 (Israel); Nonneman and
Van Doorslaer 1994 (Belgium); Van de Ven *et al*. 1994 (The
Netherlands); Von der Schulenburg 1994 (Germany)].[9] The insurers
in these countries tend to receive their revenues via an insurance pre-
mium set at a fixed percentage of the income of those they insure. In
many countries it is considered ethically and politically unacceptable
for any particular insurer to set higher premium rates according to the
individual's risk of falling ill. It is therefore typically required that the
premium be set at the same percentage of income for all enrolees with-
in an insurer, though the percentage can vary across insurers.

Generally, over recent years, competition between insurers has
been reinforced through the introduction of market orientated
reforms, with the aim of strengthening the incentives for efficiency
and cost containment [Van Barneveld *et al*. 1998]. A consequence of
this intensified competition, however, is that it has given the insurers
an increased incentive to select their enrolees on the basis of risk fac-
tors that give some indication of the individual's future demand for

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9 The discussion in this section refers to social insurers rather than private insurers.

health care.[10] This consequence is reinforced by the regulation that **17** generally prohibits each insurer to grade premiums to reflect differential individual risk. In these circumstances, risk selecting is a normal market process, common within other insurance sectors. For example, car insurance companies risk select towards relatively careful drivers living in low crime areas.

If insurers can attract mainly low-risk individuals (with relatively low expected health care costs), and hence risk select against high-risk individuals, they may foresee the possibility of three, for them attractive, alternative scenarios:

(i) By maintaining the same premium rate and the same quality of health care insurance coverage, the lower costs can result in increased profits.

(ii) With lower costs and the same premium rate, the insurer can finance an improvement in the quality of its health care insurance coverage in an effort to maintain or increase its membership.

(iii) With lower costs and the same quality of health care insurance coverage, the insurer can lower its premium rate in an effort to maintain or increase its membership.

In a competitive environment, maintaining the premium rate and the quality of health care insurance coverage at a constant level may result in a loss of enrolees. Social insurers are often non-profit making organisations, where the salaries of their managers depend on the size of their enrolled membership. Therefore, the emphasis within the insurers is usually placed on membership maximisation rather than profit maximisation. For these reasons, scenarios (ii) and (iii) above are likely to be more attractive to the social insurer than scenario (i).

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10 There is a wide range of possible health care expenditure-related risk factors cited in the literature. They include factors that can be categorised as demographic (e.g. age/sex), socio-economic (e.g. unemployment), physiologic (e.g. blood pressure), health status-related (e.g. self-rated health state indices) and utilisation-related (e.g. inpatient and outpatient utilisation in the previous year).

18   As stated above, risk selecting signifies a discrimination against those individuals whose future health care costs are expected to be relatively high. These individuals tend to be relatively poor. It has often been the case that certain insurers act as safety nets, covering a disproportionate percentage of those individuals who are at most risk of ill health. Since those at most risk of ill health are usually relatively poor, the high health care demands of these people coupled with their relatively low absolute premium contributions causes intense financial pressure on their insurers. Thus, risk selecting potentially leads to the most vulnerable members of society having to enrol with insurers that are financially stretched, resulting in them being offered inadequate or unaffordable health care coverage. From this, it is clear that the normal market processes of commercial insurance could conflict with the widespread ethical and political imperatives that people have access to reasonable minimum levels of health care irrespective of their level of income.

It is worth noting that when there are incentives to risk select, the insurers may risk select instead of attempting to improve efficiency, which would result in a social welfare loss [Van de Ven and Van Vliet 1992]. Under the assumption that competition between insurers provides worthwhile benefits in the form of increased efficiency and cost containment, the challenge therefore involves finding an effective mechanism to discourage the negative effect of competition; i.e. the increased incentives to risk select.[11]

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11 The theory that competition encourages efficiency relies on the assumption that the insurers will strive to provide an equal or better service at lower costs, by, for example, cutting down on wasteful resource use, negotiating better contracts with providers, etc. The consequent incentives to risk select offer a challenge to ethically-charged notions of fairness (or equity). As will be described later in this monograph, governments may consider the introduction of the measures that can be used to reduce the incentives to risk select as a trade-off between the ethical concept of equity and the economic concept of efficiency. However, if efficiency is alternatively framed in terms of the maximisation of health gain inside the budget constraint, it is not clear that competition (with the consequent risk selecting problem) will improve efficiency, since the sickest members of society (who are possibly those most in need of health care) may face inadequate insurance coverage. The removal of the incentives to risk select in these circumstances may therefore lead to movements towards both equity and efficiency. Under these assumptions, it is not clear that systems of competitive insurance offer any advantage over systems with non-competing purchasers. However, a discussion of the relative merits of competitive and non-competitive health care insurance is not an objective of this monograph.

If an insurer were to receive full compensation for the risk presented by each individual, then aversion to insure high-risk individuals would be removed [Van de Ven and Van Vliet 1992]. One way of achieving this would be to allow differential insurance premium rates within each insurer. However, if those at greatest risk of treatable ill health are charged relatively higher premiums, and ill health generally correlates with low income, then this method would continue to pose problems of inadequate coverage and affordability for those on low incomes.[12] An alternative measure to neutralise the incentives for insurers to risk select would be to introduce some form of risk sharing, or pooling, between the government and the insurers. Risk sharing can take many different forms [Van Barneveld *et al.* 1998], but is essentially the process by which the insurers 'are retrospectively reimbursed by the sponsor for some of the acceptable costs of some of their members' [Van de Ven and Ellis 1999]. Unfortunately, if the insurers know that they will be retrospectively reimbursed for some of their deficits, risk sharing may serve as a disincentive for the insurers to operate efficiently. Due to the imperfections of differential premiums and risk sharing, a government might introduce a risk adjustment mechanism as an alternative means of discouraging risk selecting behaviour.

A perfect risk adjustment mechanism would incorporate all of the risk factors that are associated with the likelihood of a person falling ill. However, even in theory, a perfect risk adjustment mechanism is not necessarily required in order to remove the incentives to risk select. In fact, the basic ethos of the mechanism is that it should incorporate sufficient risk factors to be able to estimate each potential enrolee's future health care expenditure as accurately as the insurers can themselves. On the basis of enrolee health care expenditure data, calculations can be undertaken by the sponsor (e.g. the government) to determine the expected influence on future health care expenditures of

12 It may be possible to introduce a system where the insurer is allowed to vary its premium rates, but poor and/or sick individuals are subsidised to enable them to pay the premium of whichever insurer they choose to join. Such a system was introduced in Switzerland in 1996, but because market forces were not entirely trusted, a risk adjustment mechanism was also introduced [Zweifel *et al.* 1998].

each of the chosen risk factors employed within the mechanism. The extent to which the risk factors are present within each insurer's enrolled population can then be measured, and insurer revenues can be adjusted by the estimates of the mechanism. If the risk adjustment mechanism is able to produce estimates of individual health care expenditures that the insurers themselves cannot improve upon, then the incentive for risk selecting has been removed.

In practical terms, risk adjustment mechanisms are often formulaic, and an adequate sample size for each risk factor is required to facilitate a useful estimate of the influence that each factor will have on future medical expenditures. Unfortunately, there is unlikely to be a sufficient number of people with some potential risk factors to facilitate a useful formulaic estimation for these particular factors. For example, it may be suspected that a previous diagnosis of a rare disease has an effect on future health care utilisation. However, the small number of people with this particular diagnosis would render it impossible formulaically to predict future associated health care costs with any degree of accuracy.

However, on the basis of experience with previous enrolees, insurers may risk select by drawing on specific personal characteristics of potential enrolees, even if the number of people presenting with these risk factors is small. For example, an insurer may have enrolled numerous people with a previous diagnosis of a particular rare disease over a time span of many years, and the insurers may feel that they are in a position to make a reasonable ad hoc estimate of the influence that this will have on an individual's future demand for health care resources. Thus, the insurers may draw on their experience to risk select on the basis of risk factors that occur so infrequently that they cannot usefully be incorporated in a formulaic framework. In these circumstances, therefore, a risk adjustment mechanism can only include sufficient risk factors to make it as difficult and costly as possible for the insurers to out-predict the mechanism and risk select.

In some of the countries that have adopted risk adjustment mechanisms to discourage risk selecting, there have been complaints by the

insurers that these mechanisms have served as a disincentive for them to operate efficiently.[13] Their concern can be interpreted in two ways. Firstly, low-cost insurers that have some of their revenue reallocated away from them due to risk adjustment may perceive that they are being punished for operating efficiently (e.g. through low wastage, skilful contract negotiation). This perception may be reinforced if they believe that high-cost insurers are inefficient and, as a result of their inefficiency, are having their revenues adjusted upwards. However, well-designed risk adjustment mechanisms will not adjust for the level of insurer efficiency. For example, an insurer that has low costs due to efficient operation but has the national average level of all relevant risk factors among its insured population should, *ceteris paribus*, face no upward or downward adjustment to its revenues. Nevertheless, if insurers continue to believe that risk adjustment rewards the inefficient at the expense of the efficient, they may perceive that the effort required to improve levels of efficiency reaps insufficient rewards.

Secondly, insurers may have the perception that risk adjustment effectively results in the health care expenditure of each specific enrolee being predicted with a large degree of accuracy. If the health care providers have ready access to this predictive data, it is possible that the insurers will see little opportunity to negotiate more efficient contracts with the providers. Essentially, the perception that the mechanism has a high degree of predictive power could instil the notion that

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13 Indeed, on a theoretical level, there may be a degree of trade-off between risk adjustment and efficiency [Schokkaert *et al.* 1998], though this theoretical trade-off is unlikely to have been a cause of concern for the insurers. As a hypothetical example of the theoretical trade-off, assume that a risk adjustment mechanism is introduced that incorporates age as a risk factor. Insurers with a large percentage of elderly enrolees will now be compensated for the relatively higher health care resource use by these individuals. Moreover, assume that health care providers are relatively adept at inducing demand with respect to elderly patients. Assume further that this supplier-induced demand is inefficient in the sense that it generates costs without health gain. Prior to the introduction of risk adjustment, it was in the interest of insurers with a large proportion of elderly enrolees to negotiate contracts with the providers that kept the influence of supplier-induced demand on elderly patients to a minimum. However, since these insurers are now compensated for the higher expenditure on their elderly enrolees (where part of this higher expenditure will be caused by the supplier-induced demand), their incentive to attempt to reduce the influence of supplier-induced demand may have diminished to some extent [Schokkaert *et al.* 1998]. Thus, under a particular set of assumptions, risk adjustment could involve a trade-off with efficiency.

there is little room to manoeuvre in contract negotiations with the providers, and may consequently dampen purchaser enthusiasm to strive for greater efficiency.

However, the view that risk adjustment mechanisms can predict individual health care expenditures with a high degree of accuracy is mistaken. By using modelling techniques, it is possible to predict a theoretical maximum of only 30-35% of the variance in individual health care expenditures [Ellis and Van de Ven 1999]. This theoretical maximum depends on the data set and the particular set of assumptions employed in the model, and many previously published estimates have in fact been considerably lower than 30-35%. For example, Van Vliet and Van de Ven (1992) estimated that a maximum of 13.8% is predictable, while Newhouse *et al.* (1989) have estimated the maximum to be 14.5%.[14] However, the important point to note is that most of the variation in individual health care expenditures is not predictable.

As well as estimating the maximum predictable variance in individual health care expenditures, Van Vliet and Van de Ven also developed several models of risk adjustment in their 1992 article. Through their most comprehensive model, which included demographic, socioeconomic and health status risk factors, they were able to explain empirically 11.4% of the variance in individual health care expenditures, or four-fifths of their theoretical maximum of 13.8% [Van Vliet and Van de Ven 1992]. A risk adjustment mechanism of this sort may considerably reduce the incentives to risk select.

Since current thinking is that only 30-35% of the variance in individual health care expenditures can be predicted, then 65-70% of the variance in individual health care expenditures cannot be predicted. It

14 Newhouse *et al.* (1989) used regression analysis to estimate the proportion of total variance in individual health care expenditures attributable to the person-specific, time-invariant component of variance (the person-specific, time-invariant component of variance refers to stable or nearly stable characteristics such as age, sex, cholesterol level etc). Newhouse *et al.* imply that this proportion represents something close to the maximum predictable proportion of variance in individual health care expenditures.

is quite conceivable that the influence of insurer efficiency on health care expenditures (through waste limitation measures, degree of skill in contract negotiation, etc.) lies within this large range of unpredictability. If so, there appears to remain ample opportunity for the insurers to improve their levels of efficiency, even when the most sophisticated risk adjustment mechanisms are adopted. Also, as mentioned above, even if it is assumed that the influence of efficiency on individual health care expenditures can be predicted, a government will not deliberately adjust for this factor, since doing so would result in inefficient insurers being protected from competition by efficient insurers elsewhere.

To summarise this section, risk adjustment mechanisms can be introduced to reduce the incentives for risk selecting, a problem that is particularly relevant in health care systems that are characterised by competing insurers. Even the most comprehensive mechanisms are likely to be able to predict only relatively small percentages of the total variance in individual health care expenditures. However, the extent to which risk adjustment discourages risk selecting depends on how costly it is for the insurers to out-predict the risk adjustment mechanism rather than on the mechanism's absolute degree of explanatory power. If risk adjustment successfully eradicates risk selecting, the insurers will not discriminate with respect to whom they insure and, *ceteris paribus*, any existing disparities between insurance premiums and the quality of health care coverage across insurers will diminish.

Having described the theoretical reasons for risk adjusting health care resource allocations, a description of the practical application of risk adjustment in England, The Netherlands and Germany will be given in the following sections. An attempt will also be made to identify the extent to which these mechanisms have been successful.

3 RISK ADJUSTMENT IN PRACTICE

3.1 England

The principal purchasers of health care in England are regionally-defined, non-competing, tax-funded health authorities, each of which effectively insures a population that resides within their area of geographical jurisdiction. The revenue to fund the health authorities is mainly generated from national taxes, though a small proportion comes from a hypothecated tax, called National Health Contributions, which is collected together with National Insurance Contributions. In total, there are 100 health authorities, and their main function is to plan and allocate funds to local health care providers. Hospital and Community Health Services (HCHS) absorbed approximately 70% of NHS funds in the 1995/96 financial year [Department of Health 1998]. Most of the remainder was spent on primary health care (Family Health Services, FHS), including general practitioners and the medicines they prescribe.

Funds are allocated to each health authority by the Department of Health. Since 1976, originally following the guidance of the Resource Allocation Working Party (RAWP), these allocations have been risk adjusted. A simplified illustration of the point at which risk adjustment enters the English system of health care financing is given in Figure 2.

The objective of the risk adjustment mechanism in England is a fundamental attempt to promote geographical equity in the access to health care services. Indeed, the avowed aim of RAWP was to promote equal access for equal need [Department of Health and Social Security 1976; McGuire *et al*. 1988].[15]

The risk adjustment mechanism in England is commonly referred to as 'weighted capitation'. Essentially, the risk adjusted allocation to each of the health authorities is based upon the size of the population covered by the health authority, adjusted by the local age structure, the local input costs of delivering health services, and local health care

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15 It has been argued, however, that policy makers may not fully understand the intricacies of the principles of equity that they propose [Culyer *et al*. 1992a].

Figure 2 **Risk adjusting health care finances in England: flow of funds**
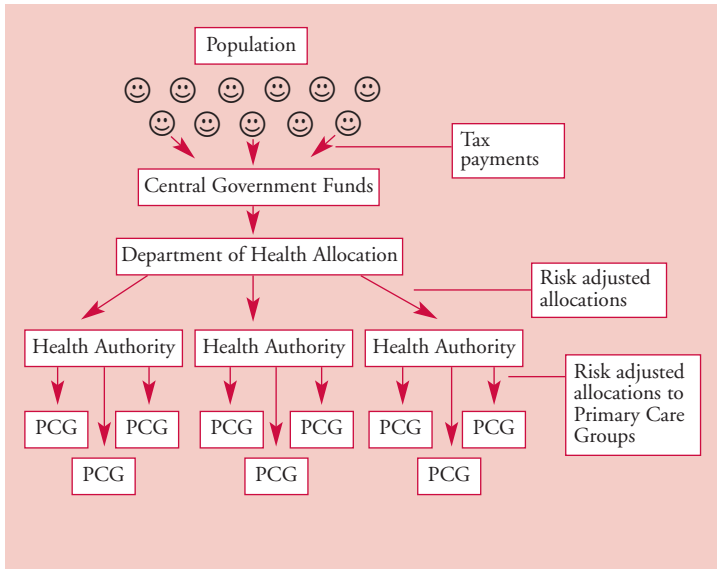
needs, relative to the national average. The risk adjustment formula applied to health authority budget allocations is given in Appendix B.

The health care needs-adjuster has been the most debated aspect of the mechanism [Carr-Hill *et al*. 1994a]. Prior to 1995, the needs-adjuster consisted entirely of the application of the square root of the under-75 standardised mortality ratio (SMR) [Royston *et al*. 1992]. This method was subject to much criticism. For example, the mechanism implicitly assumed that death rates among the under-75 population were the only proxy for health care need, and therefore populations with a relatively high level of non-fatal disease may have been discriminated against in terms of resource allocation.

In 1995, a new needs index developed at the University of York was introduced [Carr-Hill *et al*. 1994a; Carr-Hill *et al*. 1994b]. This

index initially comprised two sets of variables, one of which accounts for acute sector services and the other for psychiatric services. However, the index now also includes variables for community mental health services and non-psychiatric community services [NHS Executive 1997]. The variables that comprise this index are listed in Table 1.

Table 1 **Risk factors in the English risk adjustment mechanism**

Acute needs variables:	Coefficient[a]
Standardised mortality ratio (under 75)	0.1619
Proportion of pensionable age living alone	0.0765
Proportion of dependants in single carer households	0.0436
Proportion of economically active who are unemployed	0.0287
Standardised limiting long-standing illness ratio (under 75)	0.2528
Psychiatric needs variables:	
Standardised mortality ratio (under 75)	0.2426
Proportion of pensionable age living alone	0.3609
Proportion of dependants with no carer	0.1431
Proportion of adult population permanently sick	0.2616
Proportion of persons in lone parent families	0.1846
Proportion born in New Commonwealth[b]	0.1073
Community mental illness needs variables[c]:	
Standardised mortality ratio (under 75)	0.519
Residents with no car	0.128
Single, widowed or divorced	0.800
Single parent households	0.130
Non-psychiatric community needs variables[c]:	
District nursing	
Standardised mortality ratio (under 75)	0.424
Residents with no car	0.263
Households with 3 or more children	0.142

Health visiting	
Residents with no central heating	0.088
Elderly living alone	0.172
Single parent households	0.069
Dependants in no carer households	0.169
Community maternity	
Single carer households	0.265
Chiropody	
Standardised mortality ratio (under 75)	0.725
Residents with no car	0.108
Born in New Commonwealth	0.139
Educational qualifications	−0.115
Other community health	
Residents with no car	0.108
Single, widowed or divorced	0.532

a The coefficients indicate the relative weight attached to each variable. See Appendix B for an explanation of how these weights are used to produce the overall adjustment factor.

b The New Commonwealth primarily comprises Britain's former colonies in the Indian Subcontinent, East Africa and The West Indies.

c The community health services coefficients are based on data that are of an inferior quality to those used to calculate the original acute and psychiatric coefficients. It is intended that the quality of the data used will be improved over time. The community health service coefficients were estimated by researchers from the Universities of Kent and Plymouth.

Sources: Carr-Hill *et al.* (1994a); NHS Executive (1997)

The other countries that constitute the United Kingdom have also adopted systems of weighted capitation for the purpose of allocating resources to health authorities (or their equivalents) from government tax revenues. The mechanisms employed in Wales, Scotland and Northern Ireland are currently being, or have recently been, reviewed. They have adopted, or are likely to adopt, approaches similar to that used in England. Brief descriptions of the needs index components of

the mechanisms currently employed in Wales, Scotland and Northern Ireland are given in Appendix C.

The Department of Health applies the acute needs factors, the non-psychiatric community needs factors, the psychiatric needs factors and the community mental illness needs factors to approximately 64%, 11%, 10% and 1% of the English HCHS budget, respectively [NHS Executive 1997]. Approximately 14% of the HCHS budget is not adjusted for need. The implication of the introduction of the York index was a substantial redistribution of resources from rural to urban areas, with the main thrust of this effect driven by the psychiatric variables [Peacock and Smith 1995].

One of the functions of the health authorities is to allocate resources to primary care. Between 1991 and 1997, primary care general medical practitioners (GPs) could apply to manage their own budget, covering staff salaries, prescription costs and selected non-emergency hospital and community services. GPs who managed their own practice budgets were called fundholders. Finances for hospital services falling outside the fundholder's remit were based on contract negotiations with the health authorities. More than half of all GPs became fundholders during this period. In April 1999, the NHS was reorganised. The system of practice-based fundholding was abolished and Primary Care Groups (PCGs) were established. PCGs essentially comprise all former fundholders, non-fundholders and community nurses who are located within a particular geographical area. Typically, there are around 50 GPs within a PCG. The physicians and nurses within each PCG are required to co-operate with each other, and receive a collective budget for the purpose of providing and commissioning health care for the individuals within their geographical catchment area.

When formerly allocating budgets to the fundholders, and presently to the PCGs, most health authorities, though not required to, use a risk adjustment mechanism. Typically, allocations from the health authorities to the PCGs are adjusted for age, gender, and health care-related price differentials. At the time of writing, there is no

sophisticated mandatory risk adjustment mechanism in operation for allocating resources to PCGs, though it is well known that researchers are in the process of developing formulae intended for use at this level. However, employing a more extensive set of risk factors may be problematic at this level, as there may not be an obvious role for many of the potential risk factors in the epidemiology of the health conditions presenting in primary care [Sheldon *et al.* 1994].

It is also important to consider the size of the population for which future health care expenditures are being predicted. A patient list size of just 5,000 was required for a group of general medical practitioners to attain fundholding status. Therefore, there may have been considerable scope for error when using risk adjustment to predict fundholder budgets. To illustrate, by using the York acute sector variables, it has been estimated that the probability of a plus or minus 10% deviation of predicted health care expenditure from actual health care expenditure in any one year is 1/3 for populations of 10,000 people; however, the probability is only 1/400 for populations of 100,000 people [Martin *et al.* 1998]. The improvement in predictive power as the population size increases is explained by the law of large numbers. That is, as the population size increases, the low consumers and high consumers of health care increasingly cancel each other out. Since PCGs typically serve a population of 100,000 people, the problem relating to insufficient population size evident under the fundholding system may have been largely removed.

Physicians are possibly the best qualified persons to predict the future health care expenditures of individuals. Since primary care physicians in a PCG are jointly responsible for a budget, they do bear some financial risk. Therefore, in this sense, PCGs have more in common with the Dutch and German health care insurers (described later) than do the health authorities. Consequently, the possibility that they will attempt to risk select cannot be completely ruled out. This point is particularly pertinent when it is noted that physicians are allowed to remove patients from their lists without explanation. However, there is no evidence to suggest that risk selecting currently presents a partic-

ular problem in the UK countries. For example, under the fundholding system, it was empirically observed using data from Northern Ireland that a fundholding practice with a patient list size of 5,000 people would on average decide to remove only one more person from their list every five years than would a non-fundholder with the same list size [O'Reilly *et al.* 1998]. Having said this, there is some anecdotal evidence that homeless people often find it difficult to register with a general practitioner [Ainsworth 1999]. Risk selecting may occur if GPs expect to be inconvenienced, rather than for any fundamental financial reasons.

There are several possible reasons why risk selecting has not been particularly evident in England [Matsaganis and Glennerster 1994]. For example, fundholders who experienced deficits were retrospectively reimbursed by their local health authority. Also, fundholders were not, in any case, responsible for procedures on an individual patient whose cost exceeded £6,000 in any one year, a type of mechanism that is often referred to as 'outlier risk sharing'.

At the beginning of this section it was stated that the avowed aim of RAWP was to promote equal access for equal need. Though the RAWP formula has long since been replaced, this same aim may be presumed to be behind the current risk adjustment formulae. The extent to which the current risk adjustment mechanism has achieved this objective shall now be briefly discussed.

First, a technical point. According to Mooney's definitions outlined in Appendix A, equal access for equal need involves some adjustment for the differential costs faced by individuals when they want to access health care. For example, if it is deemed to be more costly for individuals who live in rural regions than those who live in inner cities to gain access to health care services, then allocations should be adjusted towards purchasers that disproportionately cover rural populations, *ceteris paribus*. However, in the current English mechanism, unlike the Welsh and Scottish mechanisms where there is at least some consideration of sparsity, there is no adjustment for proximity to health care services. Therefore, in a strict sense, the English mechanism appears to

be based on a principle of equal inputs for equal need [Mooney 1983]. In defence of the English mechanism, the York group did consider a sparsity factor in their initial analysis, but concluded this to be an insignificant predictor of hospital utilisation [Carr-Hill *et al.* 1994a].

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A second point to remember is that, as explained in Section 2.1, it is not clear that equal access for equal need is an appropriate policy goal. Striving for equal access for equal need may exacerbate inequalities in health. Therefore, if the fundamental principle in a society is to generate the conditions whereby there is more equality in health status across groups, then the equity principle should perhaps focus more directly on equalising health status. This policy goal would require the incorporation of different risk factors into the risk adjustment mechanism. For example, assume that it was found that the lower social classes suffer worse lifetime health due to a high incidence of cardiovascular disease in males, and that there are effective health care interventions for treating and preventing this disease. Relatively more resources could then be directed towards populations with a high proportion of these individuals, *ceteris paribus*. However, for the remainder of this discussion, the stated policy goal of equal access for equal need shall be accepted and focussed upon.

The third point to question is the extent to which the risk factors employed in the mechanism adequately reflect health care need. Many of the York risk factor coefficients are estimated from hospital inpatient utilisation data. Adjustments are made to account for differences in the supply of inpatient facilities across areas, on the premise that greater supply will equate to greater utilisation, with need constant. Nevertheless, relative utilisation may not be a good indication of relative need. For example, certain groups within society may be more adept at gaining access to health care resources than others, or may have higher or lower thresholds that determine the point at which they seek health care treatment [Sheldon *et al.* 1994]. Moreover, utilisation may be negatively correlated with the opportunity cost of using health care. For instance, unemployed people may utilise more health care

than employed people because they do not have to consider the consequences of taking time off work. Therefore, accepting the York index as an indicator of need necessitates the assumption that the utilisation of health care is highly correlated with health care need. Similarly, the continued incorporation of the under-75 SMR is based on the assumption that mortality is a good proxy for need.

Finally, even if it is assumed that resources are being allocated to the health authorities and PCGs according to the principle of equal access for equal need, the extent to which health care facilities and services are actually being provided according to this principle is unclear. For example, on a national level it may be estimated that the unemployed need relatively more health care. However, it is difficult to ascertain the extent to which a particular health authority or PCG with a high unemployed population addresses this need with the resources that have been directed towards them for this purpose. Holding the health authorities and PCGs highly accountable for their activities is one way of addressing this lack of clarity.

Following the definitions given by Le Grand and Mooney outlined in Section 2.1, equal access requires all individuals to face the same time and money costs, or (dis)utility, when using health care [Le Grand 1982; Mooney 1983]. Equal access for equal need implies that all those with an equal capacity to benefit from, for example, chemotherapy, should face identical costs or (dis)utility when travelling to and accessing a chemotherapy unit. In England, and every other country, this principle is not realised and, indeed, is practicably impossible. It is always likely to be more costly for individuals who live in remote rural areas to gain access to acute sector hospitals than for those who live in the inner cities, and the extent to which inequalities in access can be countered is difficult to measure with any degree of accuracy. However, if it is assumed that the risk factors employed in the English mechanism are a good proxy of need, and that the health authorities and PCGs are financing and providing health care in a manner that is consistent with promoting equal access for equal need, then it can be concluded that the risk adjustment mechanism in

England is taking health care provision closer to this principle of equity than would be realised in its absence.

To summarise this section, risk adjustment has been employed in England in the allocation of resources to regionally-defined health authorities for more than 20 years. This risk adjustment has taken the form of weighted capitation, and was implemented with the stated objective of promoting equal access for equal need. It is important to stress that risk adjustment was implemented as a plan to promote equity, rather than as an attempt to remove inappropriate incentives to risk select. Risk adjustment is also voluntarily applied by most health authorities when allocating resources to PCGs. Although the PCGs bear some financial risk, there is little evidence of risk selecting presenting a problem at the primary care level in the UK. Therefore, as with the allocations to the health authorities, the purpose of risk adjusting PCG resource allocations is to promote geographical equity. Overall, it is difficult to measure the extent to which risk adjustment has realised equal access for equal need, though with a fairly strict set of assumptions it is possible to conclude that the mechanism has moved health care provision in the direction of this policy goal.

3.2 The Netherlands

The health care financing system in The Netherlands is characterised by 25 competing insurers, which are generally termed 'sickness funds'. Over recent years, competition between the insurers has been intensified as a stated aim of government policy. To encourage competition, the insurers are now allowed to operate on a national, as opposed to a purely regional, basis, and enrolees have been given an annual opportunity to change their insurance plan [Van Barneveld *et al.* 1998]. Although blatant risk selecting, in the sense of the insurers openly refusing to insure certain individuals, is forbidden, in the absence of adequate risk adjustment there are incentives for the insurers to practise the more subtle forms of risk selecting. Subtle risk selecting can occur when people attempt to enrol, or when the insurers encourage

them to disenrol. For example, risk selecting at the point of enrolment can consist of the insurers [Van de Ven and Van Vliet 1992]:

(i) contracting with providers that are unsuitable for high-risk individuals,

(ii) advising high-risk individuals to purchase insurance from another insurer where coverage is said to be more appropriate,

(iii) combining health insurance coverage with other insurance packages, such as skiing insurance, that are geared towards the affluent and healthy, or

(iv) selectively advertising for enrolees.

Risk selecting at the point of disenrolment can consist of insurers:

(i) deliberately providing a poor quality service,

(ii) failing to provide coverage for follow-up care for a main treatment episode, or

(iii) discreetly paying high-risk patients to insure themselves elsewhere.

As background, to permit a better understanding of risk adjustment as practised in The Netherlands, the Dutch system of financing health care will now be outlined. The measures that have been introduced over recent years to reduce the incentives for risk selecting are then detailed. A simplified illustration of the point at which risk adjustment enters the Dutch system of health care financing is given in Figure 3.

The system is financed by insurance premiums that are based on a percentage of individual income. All premiums are directed to the Central Sickness Fund Council (CSFC), which prospectively and retrospectively allocates resources to each insurer on an annual basis. Provision within the system is divided into services provided under the Health Insurance Act (ZFW) and those provided under the Exceptional Medical Expenses Act (AWBZ). The ZFW covers general medical practitioner services, dental care and short-term hospital care. In 1998, this Act provided mandatory insurance for those with annual earnings less than Dfl 62,200 (£19,456), or, for those aged over 65 years, Dfl 38,300 (£11,980) [OECD 1998]. Including the enrolees'

Figure 3 **Risk adjusting health care finances in The Netherlands:** **35**
flow of funds
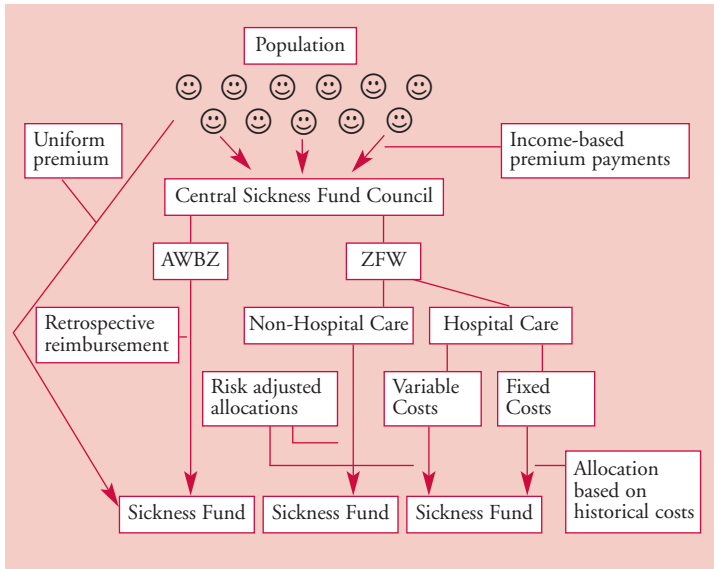
dependants, the ZFW covers 63% of the population, with most of the
remainder purchasing private insurance for these services [Luursema
1998]. However, everyone who has some form of income is required
to contribute 6.8% of their income or benefits towards the services
provided under the ZFW, including those who do not directly benefit
from the Act.

The AWBZ provides a basic insurance package for serious illness
health care provision and long term disability expenditures for all
Dutch residents. It is financed by a premium set at 9.6% of individu-
al income or benefits, up to a maximum income of Dfl 47,000
(£14,701) per annum [OECD 1998]. There is no opportunity to buy
private insurance for the services provided under the AWBZ.

All expenditures incurred on services provided under the AWBZ are retrospectively reimbursed. Thus, prospective budget allocations to insurers only apply to the services provided under the ZFW. Moreover, under the ZFW, non-hospital and hospital budget allocations are estimated in different ways (hospital expenditures account for between 1/2 and 2/3 of ZFW expenditures).

(i) Non-hospital health care allocations

The non-hospital service component of the ZFW-related budget allocation is subject to risk adjustment. Each insurer submits information to the CSFC on previous non-hospital health care expenditures on their enrolees. The CSFC is then able to estimate the average per capita non-hospital health care expenditures for a number of age/gender risk groups. These average per capita expenditure estimates are normalised to accord with the Ministry of Health's forecast for total non-hospital health care costs, and the prospective allocations for non-hospital services are adjusted according to the age/gender mix of the populations enrolled with each insurer.

The age/gender-adjusted normalised non-hospital allocations are multiplied by factors that account for area of residence and disability. The factor that accounts for an enrolee's area of residence is defined as the 'regional uplift factor', and is based on five levels of urbanisation. *Ceteris paribus*, individuals who reside in urban areas receive a higher per-capita resource allocation than those who live in less urbanised areas. An insurer's budget is thus adjusted according to the percentage of its total enrolees living in each of the levels of urbanisation. This factor is not adjusting for the degree of risk presented by the (potential) enrolee *per se*. It is adjusting for the fact that the costs of health care services are relatively high in urban areas and is allowing for differential input costs. Therefore, this adjustment is not based on the degree to which an individual will benefit from health care. Nor is it based on a hypothesis that certain socio-economic groups utilise more health care. However, without this adjustment, the competing insurers in the Dutch system will have an incentive to risk select against

those who live in the relatively high-cost urban areas.[16]

An adjustment for disability is undertaken by multiplying the percentage of each insurer's enrolled population who are registered as disabled by a factor that is approximately double that which is applied to those who are not registered as disabled. The incentive to risk select against those who are registered as disabled is consequently reduced. However, it seems reasonable to assume that many potential enrolees who are not registered as disabled will nevertheless possess easily identifiable characteristics that suggest a future utilisation of health care resources. Moreover, it has been empirically estimated that the current risk adjustment mechanism is only able to predict approximately 5% of the variance in individual health care expenditures [Van Barneveld *et al.* 1998]. Therefore, significant incentives for the insurers to risk select in subtle ways appear to remain.

After the normalised non-hospital health care expenditure budget has been adjusted for residence and disability, the CSFC reduces the budget allocation to each insurer by approximately 10%. Each insurer is required to cover this shortfall by demanding a direct payment from their enrolees. The payment is fixed within each insurer but can vary across insurers, and is defined as a 'uniform premium'. It is in the interest of the insurers to keep this premium as low as possible so as to attract new enrolees. In this sense, the premium forms a crucial part of the government's cost-containment strategy. However, since the uniform premium is fixed within each insurer, it is also likely to exacerbate the incentive to risk select.

(ii) Hospital health care allocations

The budget allocations to insurers for hospital care provided under the ZFW consist of a fixed and a variable part. The fixed part accounts for

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16 In the absence of risk adjustment, an insurer could technically sign a contract with hospitals that are located in relatively low cost areas to treat their enrolees, including those who reside in the higher cost urban areas. This may prompt the urban enrolees to find an alternative insurer that will not inconvenience them in this manner. If this were to happen, it can be concluded that the former insurer has employed a subtle form of risk selecting.

70-75% of the hospital budget under the ZFW. The CSFC calculates the fixed part by subtracting the budget for the variable part from total expected hospital costs. The variable part is subject to a risk adjustment mechanism, and is calculated in almost the same way as that for non-hospital health care expenditures. The only difference is that the budget for variable hospital expenditure is based on an average per capita cost function that is dependent upon the numbers of hospital days, hospitalisations, outpatient visits and day cases for each age/gender risk group, rather than the direct measurement of average per capita costs. The budget formulas applied to non-hospital health care services and variable hospital services are given in Appendix D.

The imperfections in the general system of budget allocation are not entirely ignored. Four retrospective corrections are made to the budget in an attempt to account for these imperfections.

Firstly, at the end of the financial year, full retrospective recalculations of the budgets are undertaken by the CSFC to account for any fluctuations in the size of each insurer's membership since prospective budgets were allocated. Budgets are then adjusted accordingly.

Secondly, the insurers are retrospectively compensated for 90% of all expenditures incurred by those enrolees whose health care costs have exceeded a certain threshold. In 1999 this threshold was set at Dfl 7,500 (£2,346) [OECD 1998]. This retrospective reimbursement is a form of outlier risk sharing.

Thirdly, 30% of any financial surpluses or shortfalls experienced by the insurers are subject to redistribution at the end of the financial year. Essentially, the per capita surplus/shortfall for each insurer is compared to the national average, and funds are partially reallocated accordingly. This will remove some of the incentives to risk select, since the insurers know that they will have to return 30% of any above average surpluses due to this retrospective mechanism.

Finally, the CSFC retrospectively reimburses 95% of any remaining fixed hospital cost shortfalls, under the rationale that deficits in this area of care are largely beyond the influence of the insurers. Moreover, 25% of any deficits in both variable hospital expenditure

and non-hospital health care expenditure are retrospectively reimbursed, though this percentage has been falling over recent years, and is likely to be subject to continued reductions. The government's objective in giving the insurers an increasing responsibility for their variable hospital and non-hospital health care deficits is that this will translate into improvements in efficiency. However, with such a loose risk adjustment mechanism in operation, giving the insurers more responsibility for their deficits may well exacerbate the incentives to risk select.

In summary, the intensification of competition between health care insurers in The Netherlands has introduced incentives for subtle forms of risk selecting. The government has attempted to offset this by subjecting part of the insurers' revenue to a risk adjustment mechanism. However, this mechanism appears to be too simple to eradicate all of the incentives to risk select. Moreover, the insurers are being made increasingly responsible for any deficits they incur, which may well exacerbate the incentives to risk select.

3.3 Germany

The German health care financing system is also characterised by a system of competing health care insurers, which, as in The Netherlands, are known as 'sickness funds'. The historical development of the German health insurance system produced four principal types of insurer. Three of these types can be categorised as 'primary funds'. These consist of insurers open to local residents (residence-based insurers), company-based insurers and guild-based insurers.[17] The primary funds were established by the Bismarck legislation of 1883, which assigned blue-collar workers, including retirees, to these insurers. The fourth principal type of insurer are the 'substitute funds' which, until very recently, were primarily open to salaried employees. The substitute funds predate the primary funds, and their name

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17 A 'guild' in this context refers to a particular trade or profession.

derives from the fact that some employees were allowed to substitute their existing insurer for a primary insurer at the time of the 1883 Act [Files and Murray 1995]. Self-employed people are not mandatorily insured in the statutory health insurance system, and so usually buy private health care insurance [Jacobs 1999]. Following the enactment of the Act, the opportunity for individuals to choose their insurer was restricted.

However, since 1997, people have been allowed a greater degree of freedom concerning the insurer with which they choose to enrol. Therefore, the relevance of the distinction between the primary and substitute funds has largely disappeared. Instead, insurers are now distinguished by those that are open to everybody, and those that continue to employ some membership restrictions [Jacobs 1998].

Unlike The Netherlands, where insurers receive most of their funds from revenues collected by the CSFC, the German insurers are entirely self-funded. Therefore, each insurer is responsible for collecting sufficient insurance premium payments to cover their costs. Insurance premiums are set as a fixed percentage of income or benefits for all enrolees within each insurer. A higher income thus corresponds to a higher absolute premium contribution. However, the premium percentage can vary across insurers. For example, depending on insurer, the premium rate varied from 8.5% to 16.8% in 1993, with an average of 13.4% [Files and Murray 1995]. This variance reflects the fact that different insurers are faced with different health care prices and administration costs, and cover populations that have different levels of average income and aggregate health care utilisation.

Prior to 1994, the residence-based insurers essentially acted as safety nets for people who could not find insurance elsewhere; for example, the unemployed and welfare recipients [Jacobs 1998]. These people tended to be those who utilise a relatively large amount of health care resources. Since income levels in these groups are relatively low, insurance premium rates were necessarily high in order to accommodate the high health care utilisation. Therefore, the situation arose whereby the poorer members of society were faced with the high-

est health care insurance premiums, which offered a direct challenge to
the German commitment to social solidarity.

In 1993, the government introduced the Health Care Reform Act.
This Act proposed a series of measures to be gradually introduced over
a number of years. The main purpose of these measures was to give
individuals more opportunity to choose their health care insurer. This
was expected to stimulate competition among the insurers, and, con-
sequently, aided by new regulations in the Act facilitating mergers, a
period of dramatic insurer concentration occurred. For example,
between 1993 and 1998, the number of residence-based, company-
based and guild-based insurers fell from 269 to 18, from 803 to 497
and from 176 to 48, respectively [Jacobs 1998].

The 1993 Act laid the foundations for the insurers to open up
beyond their traditional membership. As mentioned above, from
1997, individuals were offered more choice with respect to the insur-
er they join. An estimated 80% of enrolees are free to choose their
insurer under the new system, compared to only 50% in 1993 [Files
and Murray 1995; Zipperer 1993].[18] However, some insurers remain
restricted to offering coverage to individuals who live in specific areas
(e.g. individual federal states). Since national insurers are able to
spread their costs over high and low cost areas, the localised insurers
that are restricted to high cost areas may be placed at a competitive dis-
advantage [Files and Murray 1995; Jacobs 1998]. Nevertheless, under
the system of more open choice, high-risk individuals may have more
opportunity to gain access to insurers that have previously been denied
them, and this may contribute towards reducing the differences in pre-
mium rates across insurers.

However, with the increased choice and intensification of compe-
tition between the insurers, incentives to risk select have emerged. As

18 The people who had some freedom over which insurer they chose in 1993 comprised mainly
those who were not mandatorily insured in the statutory health insurance system; i.e. civil
servants, high paid workers and the self-employed. Under the new system, some people are still
restricted in their choice of insurer. This is because it is not possible to enrol with an insurer that
does not operate in the region in which one lives, and because some company-based and guild-
based insurers continue to enforce membership restrictions.

in The Netherlands, blatant risk selecting is illegal in Germany, and thus the more subtle forms come to the fore. The main incentive for the German insurers to risk select is that this would facilitate lower premium rates, which would help them towards their key objective: that of membership maximisation. As alluded to in Section 2.2, the reason that membership maximisation takes precedence over profit maximisation is because the German sickness funds are non-profit making bodies, and membership levels usually determine the salaries of their senior managers [Jacobs 1998]. If risk selecting becomes widespread, the effective freedom of many individuals to choose their insurer might be restricted, which could exacerbate the differences in premium rates; high-risk individuals could become increasingly concentrated in the insurers with the highest premium rates.

In an attempt to discourage thoughts of risk selecting that seemed inevitable with the introduction of greater choice, the implementation of a risk adjustment mechanism was proposed in the 1993 Act. This mechanism was applied in 1994. A simplified illustration of the point at which risk adjustment enters the German system of health care financing is given in Figure 4.

Figure 4 **Risk adjusting health care finances in Germany: flow of funds**
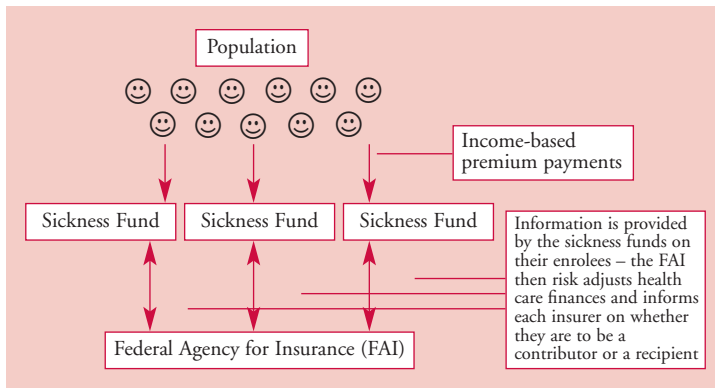
The risk adjustment calculations are undertaken by the Federal Agency for Insurance (FAI). The fact that premiums are set as a fixed proportion of income gives the incentive, in the absence of risk adjustment, for the insurers to risk select against low earners. Therefore, income is incorporated as a risk factor within the mechanism. As with the regional uplift factor included in the Dutch mechanism, income does not directly reflect the degree of health risk presented by potential enrolees. However, those with low incomes may also be the least healthy members of society, and therefore income may indirectly serve as a health-related risk factor. The other risk factors used in the mechanism are age, gender, number of dependants and number of disabled pensioners. Essentially, health care expenditure profiles by age and gender that also account for the numbers of enrolled dependants and disabled pensioners are used to adjust for the different membership profiles across insurers. A simple explanation of the mechanics of the German risk adjustment mechanism is given in Appendix E [McCarthy *et al.* 1995].

The risk adjustment mechanism offers a slightly different profile for the former East and West German federal states. The estimated costs for these regions are based on a random sample of the population drawn from each. From January 1999, the adjustment for income levels is undertaken for Germany as a whole, though adjustment on the basis of the other risk factors remains specific to East and West. Full integration of the risk adjustment mechanism will occur when the average income level in the East reaches 90% of that in the West [Jacobs 1998].

On an intuitive level, it might be expected that the risk adjustment mechanism will remove the incentives for selecting on the basis of income and number of dependants. However, restricting the health-related risk adjusters to age, gender and the number of disabled pensioners would appear to leave considerable opportunity to risk select. There is, to the author's knowledge, no published estimate of the percentage of the variance in individual health care expenditures that can be predicted by the German risk adjustment mechanism. However, a

model that incorporated a similar though slightly more extensive set of risk adjusters comprising age, gender, family size, chronic conditions and physical impairments was estimated on Dutch data [Van Vliet and Van de Ven 1992]. This model was able to explain 7.7% of the variance in individual health care expenditures, considerably less than the maximum explainable percentage obtainable with the same data set of 13.8%, as discussed in Section 2.2.

Therefore, if the objective remains to reduce the incentives to risk select, there is a strong case for incorporating more risk factors into the German mechanism. This is opposed by many people in Germany for fear that the introduction of too many risk factors would undermine competition between the insurers [Files and Murray 1995; McCarthy *et al.* 1995]. However, as explained in Section 2.2, even the most comprehensive risk adjustment mechanisms are able to explain only a relatively small percentage of the variance in individual health care expenditures. Thus, the part of the variance in individual health care expenditures that is dependent upon differences in efficiency is likely to fall outside the realm of even the most comprehensive mechanisms. Therefore, considerable scope for the insurers to compete with one another on the basis of efficiency is likely to remain.

In summary, the German government has introduced measures in recent years with the ultimate objective of giving individuals more freedom to choose their insurer. This has stimulated competition between the insurers, which, if left to itself, would increase the incentives for them to risk select. Therefore, a risk adjustment mechanism has been introduced. This mechanism has very possibly been successful at reducing the incentives for the insurers to select on the basis of an individual's income and number of dependants. However, the number of health state risk factors included in the model is too limited, and considerable scope and incentives for the insurers to employ some of the more subtle forms of risk selecting remain.

4 LEARNING FROM EACH OTHER

The objectives and constructions of the Dutch and German risk adjustment mechanisms are similar. Specifically, greater competition in their systems of numerous health care insurers was deemed desirable by their governments, and risk adjustment was implemented to counter the incentives for insurers to risk select that arose from increased competition. Risk adjustment in England was a plan rather than a response, and is associated with a more fundamental principle of equity. Therefore, risk adjustment serves a different purpose in England than in The Netherlands and Germany, and this limits the extent to which the English mechanism is applicable to the structure of the Dutch or German health care systems and vice versa. However, a few comments can be made.

First, what might The Netherlands and Germany learn from England? The first point to note is that the Dutch and German mechanisms do not adjust for supply side factors. The York needs index is based on a two-step regression model that adjusts for the influence of the supply of health care services on utilisation rates. Therefore, assuming that the risk factors employed in the English mechanism adequately reflect need, the York index adjusts resources on the basis of how much health care is needed by particular groups, and not on the basis of discrepancies in supply. In The Netherlands and Germany, where this adjustment is not undertaken, health care resource allocations according to need are possibly being confounded by utilisation according to supply. Adjustment for supply side factors in The Netherlands and Germany is therefore recommended.

Secondly, England employs a far more extensive set of risk factors than either The Netherlands or Germany. Currently, the set of risk factors incorporated in the Dutch and German mechanisms is simply too small to remove all of the incentives for the more subtle forms of risk selecting outlined in Section 3.2.

In a practical sense, however, introducing more risk factors into the Dutch and German mechanisms is not as easy as it sounds.[19] The sick-

19 The introduction of more risk factors, for example a risk factor based on previously prescribed drugs, is, however, currently being considered by the Dutch government.

46   ness fund managers are resistant to the introduction of risk adjustment mechanisms, and improving the mechanisms intensifies this resistance. As mentioned in Section 2.2, possibly the main reason for this is that low-cost insurers who have their revenue adjusted downwards may perceive that efficient practice will be punished, and this perception may be reinforced if they believe that high-cost gainers from risk adjustment are inefficient. In fact, apart from some relatively small (theoretical) trade-offs between risk adjustment and efficiency, risk adjustment does not adjust for the degree of insurer efficiency in itself, though the insurance managers may not be easily convinced of this. If the insurers believe that risk adjustment rewards the inefficient at the expense of the efficient, their willingness to operate efficiently may diminish. It is for this reason that there is a political balancing act in The Netherlands and Germany between promoting efficient practice and reducing the incentives to risk select.[20]

In England, the health authorities are government agencies and do not compete for enrolees. Moreover, a fundamental equity objective is perceived by most people who work within the health care sector as desirable, even if the majority are unclear of the specific form that equity should or does take. Therefore, risk adjustment, in the form of weighted capitation, with its objective of promoting geographical equity, is rarely opposed in principle, even if the specifics are often criticised. The active opposition to risk adjustment by insurance managers evident in The Netherlands and Germany is thus absent in England. This is possibly the main reason why risk adjustment in England is relatively sophisticated. In terms of practical application, England, primarily due to a very different system of health care insurance, probably has little to learn from the Dutch or German risk adjustment mechanisms.

Having said this, the new PCGs do bear some financial risk. Therefore, the possibility that GPs will attempt to risk select in the

20 The further development and refinement of the risk adjustment mechanisms in The Netherlands and Germany is also a function of the level of political will to redistribute health care resources towards those who are more likely to use health care.

future cannot be entirely ruled out. It is for this reason that it is possible to argue that the sophisticated models of risk adjustment that have been developed by researchers in other countries, and based on factors such as the diagnostic record of each enrolee [Ellis *et al.* 1996; Lamers and Van Vliet 1996], may be applicable to the English system. However, the evidence suggests that risk selecting was not in great evidence in the recently abolished system of GP fundholding, where participating physicians also bore some financial risk. Therefore, until such time that risk selecting becomes evident, risk adjustment in England can go beyond the objective of reducing the incentives to risk select and can be used instead to address differential health care need. Existing models based on diagnostic records may give some indication of future health care utilisation, but it is not clear that this utilisation appropriately reflects need. Whether the existing models with risk factors relating to diagnoses are appropriate for use within the English system is therefore debatable.

This is not to say the English mechanism cannot be improved, even if it is accepted that equal access for equal need is an appropriate policy goal. For example, as mentioned above, there appears to be an inadequate adjustment for the patient cost of accessing health care in the English mechanism, a problem that could perhaps be rectified to some extent by the inclusion of a population sparsity weight similar to those included in the Welsh and Scottish mechanisms (outlined in Appendix C).

There is also the issue of the York needs index being based on the assumption that health care utilisation is a good proxy for health care need. Utilisation data is second best. Attempts should be made to incorporate risk factors that may more closely reflect individuals' capacity to benefit from health care interventions. One possible way of measuring the capacity to benefit from medical treatments would be to measure the health status of individuals in various disease categories, both pre- and post-treatment. The capacity to benefit from preventive programmes, where such programmes are known to be effective, could perhaps be measured by comparing the health status of

persons with a particular illness (to which the preventive programme is targeted) against the health status of a comparable sub-group who are free from this illness.

Proponents of the current mechanism might argue that health status data would be difficult to obtain, and that utilisation reflects need closely enough for the marginal cost of collecting health status data to exceed the marginal benefit. But these arguments do not negate a thorough investigation into how far health status improvements correlate with the level of health care utilisation in subgroups of the population. Following thorough investigation, it may indeed be concluded that health care utilisation data form an adequate and appropriate basis for the purpose of allocating resources. But conclusions should follow, rather than precede, investigation.

5 CONCLUSION

The theoretical reasons for risk adjusting health care resource allocations are twofold:

(i) To promote some predefined concept of equity. Such attempts are perhaps more relevant to health care systems where the purchasers are regionally-defined, tax-funded and non-competing, than to systems of competing insurers. The predefined concept of equity can take many forms. A commonly referred to ideal is that of equal access for equal need. However, it can be demonstrated that the pursuit of this concept could exacerbate inequalities in health.

(ii) To reduce the incentives for risk selecting, of particular relevance to health care systems that are characterised by competing insurers. This point is especially pertinent if the competition between the insurers is intense. In order to discourage risk selecting, the risk adjustment mechanism needs to be powerful enough to generate circumstances in which the marginal costs of risk selecting to the insurer exceed the marginal benefits.

The health care system in the UK is characterised by non-competing, geographically-defined, tax-financed purchasers (i.e. health authorities and their equivalents). The health authorities are responsible for all of the population that resides within their geographical areas of jurisdiction, and therefore, at this level, risk selecting is not an issue. The risk adjustment of health care resource allocations to the different health authorities is an attempt at promoting greater geographical equity. Specifically, the stated objective of this strategy is to promote equal access for equal need. The current mechanism uses health care utilisation data as a proxy for health care need. If it is accepted that utilisation and need are highly correlated, and it is assumed that the health authorities, and the health care providers that they fund, are utilising their resources in accordance with the principle of equal access for equal need, it can be concluded that the risk adjustment mechanism has facilitated a movement towards this principle of equity.

Whilst risk selecting is not an issue at the health authority level, PCGs in England also receive budgets and their GP members are

allowed to exclude patients from their lists. Therefore, the incentive to risk select may exist in PCGs. However, there has thus far been little evidence to suggest that risk selecting is a major problem at the primary care level.

The health care systems in The Netherlands and Germany are characterised by competing health care insurers that are financed from insurance premiums. The intensification of competition in the health care systems of these countries over recent years, stimulated by their governments in an attempt to improve efficiency, has magnified the incentives for risk selecting. In an attempt to offset these incentives, the Dutch and German governments have introduced risk adjustment mechanisms. However, the risk factors incorporated in these mechanisms appear to be too few to eradicate all of the incentives to risk select. The managers of the sickness funds are highly resistant to the incorporation of more risk factors, principally because they (incorrectly) feel that risk adjustment implies a punishment for operating efficiently. This feeling creates an environment where the further development of these risk adjustment mechanisms may cause the insurers to abandon any efforts towards greater efficiency. Therefore, the Dutch and German governments are forced to balance their objectives of stimulating greater efficiency and reducing risk selecting.

The relative simplicity of the Dutch and German risk adjustment mechanisms, and the political tensions that would arise if an attempt were made to significantly extend the number of risk factors employed, implies that The Netherlands and Germany are unlikely to borrow anything from England with respect to the practical application of risk adjustment at this point in time, as well as vice versa. However, the investigation into how the mechanisms could be developed to better conform with the underlying policy objectives should be on ongoing process. For example, the Dutch and German governments should persist in demonstrating to the insurance managers that risk adjustment does not punish efficient insurers. As for England, the risk adjustment mechanism incorporates a wide range of risk factors, and most health authority managers may well feel that the mechanism

generates a reasonably fair distribution of the total health care budget. However, many of these factors are calculated on the basis of utilisation rather than need. Therefore, the existing mechanism may be perpetuating current utilisation patterns, rather than helping to address disparities in health care need across groups. Following a full investigation of these issues, it may be concluded that utilisation reflects need closely enough to be accepted as an adequate proxy, but it would be better if this conclusion was based on evidence rather than on assumption.

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APPENDIX A

Concepts of equity in health care

For a more complete discussion of the principles of equity outlined in this section, refer to Mooney (1983).

Equal expenditure per capita
Given the budget constraint, health care resource allocations are allocated entirely according to the size of the population covered by each purchaser.

Equal inputs (resources) per capita
Allowance should be made for the differential prices of inputs (resources), such as labour, land and capital, faced by different purchasers. This should facilitate the same amount of per capita purchase of inputs, irrespective of purchaser.

Equal inputs for equal need
Indicators of need, beyond population size, are incorporated. These may include the age/gender structure of a purchaser's covered population, socio-economic risk factors, for example, the number of unemployed people, etc.

Equal access for equal need
Adjustments are made for the costs associated with gaining access to health care faced by the people covered by each purchaser. The emphasis is on the costs to the patients rather than the prices of inputs (land, labour and capital). Therefore, for example, people living in remote rural areas may face greater costs when visiting a physician or hospital than those living in urban areas, and allocations should be adjusted to account for this.

Equal utilisation for equal need
Equal access for equal need gives everyone an equal opportunity to use health care. However, information, tastes and preferences for health and health care differ across individuals. Therefore, equal opportunity does not necessarily equate to equal utilisation. Under the principle of equal utilisation for equal need, allocations are adjusted so as to

58 facilitate positive discrimination in favour of those who are less willing to use health care.

Equal marginal met need
This principle assumes that purchasers will rank needs according to priority, and that the ranking will be the same across all purchasers. Allocations should then be adjusted so that, with their available budgets, the last, or marginal, met need will be identical for all purchasers.

Equal health
All previous definitions are concerned with equity in terms of health care resources. To achieve (more) equality in health across different groups (e.g. purchasers or social classes), however, is likely to require a much greater positive discrimination of health care resources.

APPENDIX B

Risk adjustment mechanism in England

The risk adjusted allocation to each health authority is based upon [Peacock and Smith 1995]:

$$WP^j = POP^j (1 + a^j)(1 + c^j)(1 + n^j)$$

where
WP^j is the weighted population covered by health authority j
POP^j is the size of the population living within the jurisdiction of health authority j
a^j is an age-adjustment relevant to the population covered by health authority j
c^j reflects the local costs of delivering health care services faced by health authority j
n^j is a needs-adjustment relevant to the population covered by health authority j (see Table 1 in the main text)

To calculate the needs index within each service sector, each variable is raised to the power of its associated coefficient, and then the product of the variables is derived. For example, with reference to Table 1, the community mental illness needs index for each health authority is given by (Residents with no car)$^{0.128}$ * (Single, widowed or divorced)$^{0.800}$ * (Single parent households)$^{0.130}$ * (Under-75 standardised mortality ratio)$^{0.519}$.

The national averages of a, c and n are set at zero. Therefore, for example, if health authority j covers a population 8% older than the national average, with needs that are 4% above the national average, but faces costs that are 6% below the national average, $(1 + a^j)$, $(1 + c^j)$ and $(1 + n^j)$ are 1.08, 0.94 and 1.04, respectively.

APPENDIX C

Risk adjustment mechanisms in Wales, Scotland and Northern Ireland

Wales

The current Welsh mechanism is under review, principally because it does not consider socio-economic factors, but also because the data that feed the model are somewhat dated [Welsh Office/NHS Resource Allocation Working Group 1998].

The existing mechanism was introduced in 1991 with the aim of adjusting for the differential geographical need for Hospital and Community Health Services (HCHS) across the country. Approximately 5% of health authority expenditure is excluded from this risk adjusted allocation. Different service expenditure blocks are subject to different risk factors. These are outlined in Table A1.

In general, the risk factors are age, gender, the under-75 SMR, and a sparsity weight. The sparsity weight is either derived from survey

Table A1 **Risk factors in the Welsh risk adjustment mechanism**

Expenditure block	Percentage of HCHS expenditure	Risk factors
Non-psychiatric inpatient services	62.0	Age, gender, under-75 SMR[a] applied to those aged under 75
Psychiatric inpatient services	7.0	Age, gender
Outpatient services	12.5	Age, gender, under-75 SMR applied to those aged under 75
Community health services (CHS)	15.0	Age, gender, under-75 SMR applied to those aged under 75, sparsity weight
Ambulance services	3.5	Age, gender, sparsity weight
a Standardised mortality ratio		

Source: Welsh Office/NHS Resource Allocation Working Group (1998)

information on the travelling distances for those people working in the Community Health Services, or from road length per head of population for the ambulance service expenditure block. The sparsity weight is included to reflect the greater costs of providing health care services to dispersed populations.

Scotland

The current Scottish mechanism was introduced two decades ago, and is currently under review for similar reasons to those noted for Wales. At the time of writing, a new mechanism detailed in the Arbuthnott Review of Resource Allocation had entered a period of public consultation. The proposed new mechanism is similar to that used in England in that it is based on a range of epidemiologic, socio-economic and demographic risk factors. However, the mechanism differs from that used in England in that it employs a single formula,

Table A2 **Risk factors in the Scottish risk adjustment mechanism**

Expenditure block	Percentage of HCHS expenditure	Risk factors
Acute and long stay	52.0	Age, gender, under-65 SMR[a] applied to those aged under 65
Maternity	5.0	Mother's age, birth rates
Psychiatric	15.5	Age, gender, marital status
Learning difficulties	4.0	Age, gender
Day and outpatients	12.5	Age, gender, under-65 SMR applied to those aged under 65
Community services	11.0	Age, gender, under-65 SMR applied to those aged under 65, sparsity weight

a Standardised mortality ratio

Source: Welsh Office/NHS Resource Allocation Working Group (1998)

and that population sparsity forms an integral part of the new mechanism [Millar 1999; Sutton *et al.* 1999].

The current Scottish mechanism is based on six service expenditure blocks, as outlined in Table A2.

The risk factors variously employed within the expenditure blocks include age, gender, the under-65 SMR, birth rates, marital status and a geographical sparsity weight. The sparsity weight is based on the population distance from general medical practitioners. However, the bulk of budget allocation is driven by age, gender and the under-65 SMR.

Northern Ireland
The current mechanism in Northern Ireland was introduced, following review, in 1995. The mechanism used in Northern Ireland adjusts for personal social services as well as health care services. This necessitates a model that incorporates a wide range of services, including acute health services, maternity and child health, family and child care, elderly care, mental health, care for those with learning disabilities, care for those with physical and sensory disabilities, health promotion and disease prevention, and primary health and adult and community care.

For acute services, the mechanism adjusts for age and need, using modified English age-cost weightings and the York acute needs variables, respectively. Non-acute services are adjusted by various indices and age-cost relationships derived from local data [Northern Ireland Department of Health and Social Services 1995].

APPENDIX D

Risk adjustment mechanism in The Netherlands

The regional uplift factor is based on five areas of urbanisation, classified as Groups 1 to 5 with declining level of urbanisation (i.e. Group 1 represents the most urbanised areas). The index numbers for Groups 1 to 5 are set at 1.16, 1.04, 1.02, 0.91 and 0.87, respectively. Therefore, for example, an insurer with 30%, 20%, 20%, 15% and 15% of its enrolees living in Groups 1 to 5, respectively, will be assigned a regional uplift factor of 1.16*0.3 + 1.04*0.2 + 1.02*0.2 + 0.91*0.15 + 0.87*0.15, or 1.027.

The disability uplift factor is based on index numbers of 2.025 and 0.933 for disabled and non-disabled persons, respectively. Thus, for example, an insurer with 10% of its enrolees registered as disabled will be assigned a disability uplift factor of 2.025*0.1 + 0.933*0.9, or 1.042.

For any particular insurer, the same regional uplift factor and disability uplift factor will apply to both non-hospital health care services and variable hospital services.

The budget allocation for non-hospital health care services is given by:

$$B_{n-h}^j = R^j H^j \left(\sum_{i=1}^{38} n_i^j C_i \right) - pA^j$$

where

B_{n-h}^j is the non-hospital health care budget for insurer j

R^j is the regional uplift factor for insurer j

H^j is the disability uplift factor for insurer j

38 is the number of age/gender risk groups, i, with the groups defined by five-year age bands (for each sex); i.e. 0-4 years, 5-9 years,…, 85-89 years, ≥ 90 years

n_i^j is the number of enrolees in risk group i within insurer j

C_i is the normalised non-hospital average per-capita cost in risk group i

p is the uniform premium estimated by the Ministry of Health and applied to all insurers

A^j is the number of people who are liable to pay an insurance premium in insurer j

64   The budget allocation for the variable part of hospital services is calculated in almost the same way as that for non-hospital health care services:

$$B_v^j = R^j H^j (\sum_{i=1}^{38} n_i^j D_i) - pA^j$$

where
B_v^j is the variable hospital health care budget for insurer j
D_i is an average per capita cost function based on the number of hospital days, hospitalisations, outpatient visits and day cases in risk group i.
All other notation as above.

APPENDIX E

Risk adjustment mechanism in Germany

The risk factors of age, gender, number of dependants and number of disabled pensioners define the risk groups. For example, paying men aged 30-34 years, non-paying women aged 50-54 years and paying disabled men aged 75-79 years all define risk groups.

The total income levels for which enrolee's are liable to pay premiums within each insurer are defined as an insurer's relevant income. The total relevant income is calculated by the Federal Agency for Insurance for each insurer.

The per capita reference costs within each risk group are based on the estimated national per capita health care expenditures for individuals within that risk group. For each insurer, the per capita reference costs are multiplied by the number of people within each risk group. This gives the standardised health care expenditure for each insurer. For example, if the per capita reference costs for paying men aged 30-34 years are Deutschmark (DM) 3,000, and an insurer covers 5,000 paying men aged 30-34 years, then the standardised health care expenditure for paying men aged 30-34 years within that insurer is DM 15,000,000.

The sum of the standardised health care expenditures for all risk groups within each insurer gives the insurer's contribution requirement. An average premium percentage, α, is derived by dividing the sum of contribution requirements over all insurers by the sum of relevant income levels:

$$\alpha = (\Sigma \text{ insurers' contribution requirements})/(\Sigma \text{ insurers' relevant incomes})$$

The relevant income level of each insurer is then multiplied by α to determine the insurer's financial strength. The financial strength is compared to the insurer's contribution requirement in order to determine whether the risk adjustment process has required the insurer to be a net contributor to or a net recipient of reallocated funds.

For example, consider a hypothetical market with two insurers, A and B, where the relevant income levels and contribution requirements of A and B are DM 500 billion, DM 300 billion, and DM 40 billion, DM 20 billion, respectively. Thus:

α = (40 billion + 20 billion)/(500 billion + 300 billion) = 0.075

The financial strength of insurer A = 0.075(DM 500 billion) = DM 37.5 billion
The financial strength of insurer B = 0.075(DM 300 billion) = DM 22.5 billion

Therefore, the contribution requirement of A exceeds its financial strength by DM 2.5 billion. Accordingly, A is a net recipient of this difference. For B the situation is exactly the reverse, necessitating this insurer to contribute DM 2.5 billion for reallocation. Since the contribution requirement of A is double that of B whilst the relevant income of A is less than double that of B, this redistribution in the direction of A makes intuitive sense.

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