

Statutory packages of health care alongside voluntary insurance: what treatments should be covered?

Peter C. Smith
Centre for Health Economics
University of York
York YO10 5DD
United Kingdom

February 2005

E-mail: pcs1@york.ac.uk

Phone: + 44 1904 321443

Fax: + 44 1904 321454

Acknowledgements

A previous version of this paper was presented at the University of Aberdeen, and I should like to thank the seminar participants for comments. I am supported by Economic and Social Research Council research fellowship R000271253.

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Abstract

This paper examines the economic link between statutory and voluntary health insurance from an economic perspective. The statutory package is available to all free at the point of access, and is funded by taxation. Citizens differ in wealth and health, and may choose to augment the statutory package with voluntary insurance, charged at an actuarially fair premium. The government's problem is to determine the optimal size and composition of the statutory package in the light of efficiency and equity concerns. The paper shows that when health care is insured solely under a statutory package, equity concerns may be important in selecting the interventions to insure. However, when voluntary insurance is also available, interventions for the statutory package can be selected solely according to their cost-effectiveness. Equity concerns are instead addressed through the size of the implicit tax transfer from rich to poor. Possible extensions to the model, including a public choice perspective, are outlined. The results have important implications for policy on health technology assessment and national priority setting.

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Introduction

The principal means of financing most mature health systems is a statutory health care insurance scheme, covering all citizens whatever their circumstances. This is often supplemented by a non-statutory insurance system, used only by those willing and able to pay (Mossialos *et al.* 2002). The statutory system is usually funded by some sort of taxation or social insurance, with contributions unrelated to health status. The non-statutory system is funded either by user fees or by voluntary insurance, with financial contributions therefore usually reflecting actual or expected use of services (Mossialos and Thomson 2004).

Most wealthy countries seek to make the statutory package reasonably comprehensive, ensuring that all citizens are insured for reimbursement of most mainstream health care (albeit sometimes with a modest user copayment). However, health care is offering rapidly increasing opportunities to address sickness and disability, and citizens are placing increasing demands on their health care systems. At the same time, many commentators claim that there are limits to the extent to which the traditional sources of finance for statutory insurance can be exploited. The principle of comprehensiveness is therefore coming under strain. The policy questions therefore arise: should some interventions be removed from the statutory package; and if so, which ones?

In low income countries, there are often limited financial resources available for statutory insurance, based on a slender tax base and (sometimes) donor funds. There is therefore usually no attempt to offer comprehensive coverage, and a much heavier reliance is placed on personal finance of health care, usually in the form of user charges (Gertler and Van der Gaag 1990). A key policy question in these circumstances is the extent to which the limited statutory system is being deployed to best effect. In many countries there has been a persistent concern that the statutory funds available are being deployed on interventions that are not cost-effective, or are not supporting those most in need (the sick and the poor) (Hauck, Smith and Goddard 2002).

Such concerns have led to an increasingly concerted effort in all types of health system to specify explicitly an 'essential' package of health care that is covered by the statutory insurance fund (Jost 2005). The intention is to create a set of interventions to which all qualifying citizens have a right when clinical indications are satisfied.¹ The usual assumption is that receipt will be free or subject to a small copayment. Of course, the scope of the essential package is constrained by the financial resources available to the statutory scheme.

Economists have championed the use of the cost-effectiveness ratio as the main criterion for selecting interventions for inclusion in the essential package of care (Drummond *et al.* 1997). This policy prescription flows from the notion of maximizing health benefits subject to a budget constraint. Cost-effectiveness analysis may therefore be relevant at the margin for choosing interventions to exclude from a

near-comprehensive statutory package of health care. However, the cost-effectiveness criterion may on its own be inappropriate for determining the essential package when private payments play a significant role in funding health care. The purpose of this paper is to identify optimality conditions for selecting interventions to include in the essential package when citizens can pay for voluntary insurance to supplement or replace the statutory coverage.

The paper is structured as follows. The next section briefly discusses the role of voluntary health insurance in health systems, and the relevant academic literature. A stylized model of health care is then introduced, in which governments must choose a statutory package of insured health care, and citizens choose the nature of any additional voluntary insurance. The optimal government package of care is described. Extensions to the model are suggested in which the possible resistance of the rich to financing public insurance is modelled. The paper ends with policy conclusions.

INTRODUCTION

Countries rely to greatly varying extents on voluntary health insurance (Colombo and Tapay 2004). The World Health Report 2002 indicates that 90 out of the 149 countries with populations over 1 million have recorded expenditure of less than 1% of all health financed from prepaid private insurance (World Health Organization 2002). They account for 67% of the world's population. However, Table 1 shows that a small number of countries make very heavy reliance on private insurance. Although in certain countries, such as the Netherlands, private coverage is mandatory for some citizens, private coverage is in most countries voluntary.

South Africa	44.3
Uruguay	36.8
USA	34.8
Namibia	32.1
Zimbabwe	26.7
Netherlands	24.9
Chile	23.1
Brazil	20.8
Canada	19.8
Switzerland	18.8

Table 1: Countries with heaviest reliance on private insurance as a percentage of all health care financing (source: World Health Report 2002).

The universal pressure on all sources of health finance has led many countries to re-examine the potential for increasing the use of voluntary insurance to finance health care, especially where there has been a traditionally high reliance on user charges. The first requirement for a viable insurance function is to establish appropriate and reliable systems of governance, to assure the collection and stewardship of insurance premiums, and to ensure that providers are reimbursed according to the use made by

insurees. These basic requirements imply the need for a minimum degree of long-term trust in the institutions of health care, a rudimentary flow of adequate information, and the reliable enforcement of contracts. They are essential for any system of insurance, and are regrettably absent in many low income countries. However, in this paper we must assume that they are satisfied.

Private health insurance (alongside a publicly funded compulsory package) can take three broad forms: substitutive, supplementary or complementary (Mossialos and Thomson 2004). Substitutive insurance is purchased as an alternative to the statutory insurance, with the implication that those who elect to take out such coverage are at least partially exempt from the premiums or taxes associated with the statutory package. Substitutive insurance may lead to the creation of a voluntary risk pool with a relatively low expenditure requirement, as it will tend to be attractive to the rich and healthy.

Supplementary private insurance covers services in the statutory package, but insurees receive no exemption from payments towards the statutory package, and therefore enjoy double coverage. A market in supplementary insurance implies that it must offer a perceived quality advantage over the care secured by the statutory package, perhaps in the form of reduced waiting times or access to superior facilities. In contrast, complementary insurance offers full or partial cover for services that are excluded or not fully covered by the statutory health care system. In particular, as in France, it may cover liability for copayments levied on services within the statutory package.

There has been a small economic literature on the role of voluntary health insurance alongside a statutory publicly-funded 'essential' package of health care. Besley (1989) examines the extent to which the problem of moral hazard can be abated by augmenting a competitive insurance market with publicly funded catastrophic health insurance. The paper stimulated a lively academic exchange that is not strictly relevant to the problem addressed in this paper, but which does highlight the complexity of formulating mathematical models in this domain, and the need for clarity about the assumptions underlying any modelling (Selden 1993; Blomqvist and Johansson 1997).

Petretto (1999) examines the functioning of a publicly insured essential package of care alongside a market in private complementary insurance. The citizen is free to choose the insured copayment rate for the complementary services. Citizens make three contributions to health care financing: a tax contribution; a private insurance premium; and the residual copayment. A form of optimal income taxation model is used to analyse the government's problem, which is to select the optimal statutory copayment rate, in the light of response in the private insurance market.

These models require specification of a social welfare function in order to infer optimal policy. In contrast, Epple and Romano (1996b) model the mix of public and private health insurance from a public choice perspective. They demonstrate that a mix of public and private provision will in many circumstances be socially preferred to systems relying solely on government or private provision.

There is also a broader public economics literature on the public/private mix. Blackorby and Donaldson (1988) note that the sort of ‘in kind’ transfers implied by social insurance may be preferred to cash transfers when (as in the case of health care) they are non-tradeable. In contrast to cash transfers, in-kind transfers can ensure that only the intended beneficiaries receive the relevant service. Munro (1991) examines the implications for optimal taxation policy of such transfers. Ireland (1990) models the integration of in-kind transfers and cash transfers, in the form of unconditional payments to the poor, and conditional subsidies of private consumption, for example in the form of vouchers.

Epple and Romano (Epple and Romano 1996a) examine the public private mix within a majority voting model, and finds that society’s choice may depend on the balance of electoral power between middle income voters (who prefer higher public provision) and a coalition of high and low earners (who prefer lower public provision). Finally, Besley and Coate (1991) note the crucial redistributive function of social provision of private goods. Providing the quality of the social good is not ‘too high’, some richer households will - without the need for financial compensation - opt out of the social good in order to consume its private counterpart, yielding an implicit financial transfer to the poor. In a similar vein, Blomqvist and Horn (1984) examine the transfer from the healthy to the sick implicit in a system of statutory insurance in a health care setting.

None of this literature explicitly models the great heterogeneity of services that make up health care, or the variations in epidemiology across social groups. They focus principally on the choice of taxation and copayment rates, and do not address a fundamental concern of policy-makers – which types of service to include in the essential package. This paper therefore examines that choice when there is a market in voluntary private insurance. It does not consider variable copayment rates, which are treated elsewhere (Smith forthcoming). Instead, I assume that procedures are either fully subsidised by public funds (therefore in the essential package) or must be insured at market rates through private insurance.

THE MODEL

Assume there is a set of n health care problems, and for each problem there is a technology available at a known constant price x_i , with known constant health benefit b_i that does not differ between individuals. Also assume that the technologies are efficient, in the sense that for each the benefits exceed the costs, and no technology is dominated by any other for the specified condition (i.e. these are the best technologies for each condition). The decision-makers are a national government and individuals. The government must decide what package of health care to subsidize from public funds. The package comprises a subset of the health technologies that is offered at zero price to the patient. This statutory package is financed by a tax on all citizens.

Any technology i not in the government package is available at market price x_i to patients, and private insurance exists with which the individual can purchase coverage for all procedures not in the government package. In the first instance I assume that there are no differences between public and private sector in the costs or benefits of procedures. This assumption is later relaxed. The voluntary insurance market is presumed to be complete and efficient.

Moral hazard and adverse selection are not a central concern of this model. Citizens are presumed to receive an intervention if and only if they will secure the expected benefit b_i . Moral hazard may arise, but is not a central concern of the model. Treatments can only be secured through insurance (either public or private), and the parameter b_i should therefore reflect the average expected net benefits of treatment, including any opportunity cost associated with unnecessary treatment. Private premiums are risk-related, and the assumption of no adverse selection in the voluntary insurance market presumes that insurers have adequate information with which to set actuarially fair premiums.

Individuals optimize their voluntary coverage knowing the statutory package chosen by the government. The government chooses the statutory package in the light of the known responses of individuals in the voluntary insurance sector. The model is solved using backwards induction. The next section therefore considers the individual's response to a statutory package, and the government's optimization problem is then considered.

The individual

The individual (or household) is the starting point of the analysis. Individuals differ in wealth and health. In the first instance I consider a dichotomy of just 'rich' and 'poor' people. The incidence of disease differs according to wealth (though it may not always be the poor who have higher incidence for all diseases). The implications of a continuous distribution of wealth are considered later in the paper.

Individual utility $U(h, y)$ depends on health and wealth, with the usual properties (diminishing marginal utility in health and wealth). Health state with no health care for rich and poor is $h_0^R > h_0^P$. Wealth with no health care expenditure is $y_0^R > y_0^P$. The proportion of rich people in the population is ρ . The annual incidence of the health problem requiring intervention i is distributed as π_i^R and π_i^P in rich and poor populations respectively, with the aggregate incidence equal to $\Pi_i = \rho\pi_i^R + (1 - \rho)\pi_i^P$. Although I make no explicit assumption about risk aversion, there is an implication that the benefits b_i include any utility gains from risk reduction associated with the insured intervention.

With no statutory health care package, the private insurance problem for an individual in wealth group Z is to choose the set of interventions that:

$$\text{Maximize } U(h_0^Z + \sum_i \pi_i^Z \theta_i b_i, y_0^Z - \sum_i \pi_i^Z \theta_i x_i)$$

where the decision variables $\{\theta_i\}_{i=1}^n$ are binary variables indicating whether or not the intervention is insured. This yields the familiar rule that intervention i is covered if and only if:

$$\frac{b_i}{x_i} \geq \frac{\partial U^Z}{\partial y} \bigg/ \frac{\partial U^Z}{\partial h}$$

where the marginal conditions apply at wealth after the relevant premium has been paid. Under most reasonable assumptions, this ratio decreases with wealth, yielding the obvious result that the rich will purchase a more extensive insurance coverage

than the poor. Note this solution requires the existence of a complete insurance market that is able to offer bespoke policies to all citizens.

Now consider the individual's insurance decision when there is a statutory package, funded from taxation. The individual must decide whether or not to purchase some form of insurance; and if so whether to purchase complementary insurance (covering non-statutory health care) or substitutive insurance (comprehensive voluntary insurance replacing the statutory insurance). I subsume supplementary insurance as a special case of substitutive insurance in which the insure gains no financial relief from statutory coverage.

The individual's choice can be modelled by comparing expected utility under the following three insurance arrangements:

- a) public insurance only;
- b) complementary plus statutory insurance;
- c) substitutive insurance.

Expected benefits of the chosen statutory package will in general vary according to wealth and the epidemiology of disease. The chosen public package reduces the wealth of all according to the required tax rate. Utility will be as follows:

- a) under public insurance only, utility will be a function of the expected benefits of the public package and its personal tax cost;
- b) under complementary plus public insurance, utility will be a function of the expected benefits of the combined voluntary and statutory packages, and the personal tax cost plus the voluntary insurance premium;
- c) under substitute insurance, utility will be a function of the expected benefits of the replacement private package, and the tax cost of the unused public package plus the private insurance premium.

The status of intervention i in the statutory package is indicated by a binary choice variable λ_i , where $\lambda_i = 1$ if intervention i is in the statutory package, $\lambda_i = 0$ otherwise. Tax payments for the rich and poor are indicated by t^R and t^P . First assume that the mode of coverage (statutory or voluntary) makes no difference to the quality or price of an intervention. Citizens therefore have no incentive to purchase substitute or supplementary insurance. However, individuals may purchase complementary insurance, covering interventions not included in the statutory package λ . The extent of the complementary package is indicated by the binary choice variables θ_i , where $\theta_i = 1$ if intervention i is in the complementary package, $\theta_i = 0$ otherwise. The voluntary insurance premium is actuarially fair, equal to the expected cost of utilization. An individual in wealth group z will then choose a complementary coverage package $\{\theta_i\}_{i=1}^n$ so as to:

$$\text{Maximize } U(h_0^z + \sum_i (\theta_i + \lambda_i) b_i \pi_i^z, y_0^z - t^z - \sum_i \theta_i x_i \pi_i^z)$$

$$\text{subject to } \theta_i + \lambda_i \leq 1 \quad \forall i$$

If complementary insurance is selected (some $\theta_i = 1$) then the marginal conditions for the selected interventions (after the relevant tax and voluntary premium have been paid) are:

$$\frac{b_i}{x_i} \geq \frac{\partial U^Z}{\partial y} \Big/ \frac{\partial U^Z}{\partial h}$$

with equality for the marginal intervention. In general, a bigger statutory package will reduce the wealth of all citizens (through the necessary tax contributions), therefore increasing the threshold for inclusion in the voluntary package.

Within the framework used so far there is no cause for individuals to take out substitutive insurance (which duplicates and may augment the statutory package). In order for such insurance to be attractive, there must be either a financial or a quality advantage to replacing the benefits already insured through the statutory package. Any financial incentive to take out substitute insurance is simply a transfer payment, and is not analytically interesting, as it merely involves adjustments to the tax payments t^R and t^P .

However, substitute insurance may become attractive if the private package enjoys a quality advantage over the statutory package. Quality differences of this sort are readily observed in health systems with significant private insurance markets, for example in the form of reduced waiting times (in the UK) or superior choice and ‘hotel’ arrangements (in Germany). For a full treatment of the welfare implications of quality differences see Besley and Coate (1991) and Ireland (1990). Here I merely note the criterion for the rich replicating coverage of a lower quality public intervention in their voluntary package.

Suppose enhanced quality under private cover for intervention i enter the utility function through the ‘health’ argument. Denote the associated benefits by $b_i^P > b_i$ and the costs $x_i^P \geq x_i$. Then an intervention already in the statutory package will also be included in the private supplementary package if and only if the additional benefits $b_i^P - b_i$ are sufficiently valued in relation to the additional costs x_i^P – that is:

$$\frac{b_i^P - b_i}{x_i^P} \geq \frac{\partial U^Z}{\partial y} \Big/ \frac{\partial U^Z}{\partial h}.$$

A system of publicly funded health care vouchers may be used, under which patients are offered a cash payment equivalent to some proportion ϕ_i of the cost of the intervention in the public sector if they secure treatment through a private insurer. In these circumstances, it will be necessary to secure supplementary insurance coverage only for the incremental private cost not covered by the value of the voucher.

Procedures included in the supplementary package will then satisfy:

$$\frac{b_i^P - b_i}{x_i^P - \phi_i x_i} \geq \frac{\partial U^Z}{\partial y} \Big/ \frac{\partial U^Z}{\partial h}.$$

Note therefore that the quality of the public sector (relative to its private counterpart) $\{b_i^P / b_i\}_{i=1}^n$ and the set of voucher payments $\{\phi_i\}_{i=1}^n$ potentially offer the government further policy instruments, in addition to the tax payments and the statutory package specification $\{\lambda_i\}_{i=1}^n$ that are the focus of this paper.

The government

The government must decide which interventions to include in a statutory package of health care, available to all at no direct charge. There is a social welfare function $W(\rho U^R, (1-\rho)U^P)$ that the government wishes to maximize, subject to the constraint that the costs of the chosen statutory package must be funded by tax payments by all citizens.² First assume that there is no voluntary insurance. Then the government's problem is to choose interventions $\{\lambda_i\}_{i=1}^n$ and taxes t^R and t^P for the rich and poor so as to:

$$\begin{aligned} & \text{Maximize } W\left(\rho U(h_0^R + \sum_i \lambda_i \pi_i^R b_i, y_0^R - t^R), (1-\rho)U(h_0^P + \sum_i \lambda_i \pi_i^P b_i, y_0^P - t^P)\right) \\ & \text{Subject to } \sum_i \lambda_i \{\rho \pi_i^R + (1-\rho)\pi_i^P\} x_i = \rho t^R + (1-\rho)t^P \\ & \lambda_i \in \{0,1\} \end{aligned}$$

First order conditions yield the result that intervention i is selected if and only if:

$$\frac{b_i}{x_i} \geq \frac{\mu [\rho \pi_i^R + (1-\rho)\pi_i^P]}{\left[\rho \pi_i^R \frac{\partial W}{\partial U^R} \frac{\partial U^R}{\partial h} + (1-\rho)\pi_i^P \frac{\partial W}{\partial U^P} \frac{\partial U^P}{\partial h} \right]} = \frac{\mu \Pi_i}{\left[\rho \beta_R \pi_i^R + (1-\rho)\beta_P \pi_i^P \right]}$$

where μ is the opportunity cost of tax funds and $\beta_Z = \frac{\partial W}{\partial U^Z} \frac{\partial U^Z}{\partial h}$ is the marginal social value of an improvement in health for group Z . This equation effectively adjusts μ for variations in the social importance of the two population groups, reducing the hurdle rate for interventions with a high incidence in the poorer group if there is a pro-poor equity concern. It is consistent with the policy recommendation of adjusting the cost-effectiveness ratios of clinical interventions according to their equity implications (Williams, Tsuchiya and Dolan 2005).

The tax contributions satisfy the marginal conditions:

$$\frac{\partial W}{\partial U^R} \frac{\partial U^R}{\partial y} = \frac{\partial W}{\partial U^P} \frac{\partial U^P}{\partial y} = \mu$$

A crucial role of the tax payments is therefore to equalize social marginal utility of wealth across social groups. The special case of a linear wealth tax constrains the government's options for effecting transfers³, and the marginality condition becomes:

$$\mu = \left(\rho \frac{\partial W}{\partial U^R} \frac{\partial U^R}{\partial y} y_0^R + (1-\rho) \frac{\partial W}{\partial U^P} \frac{\partial U^P}{\partial y} y_0^P \right) / (\rho y_0^R + (1-\rho)y_0^P).$$

Suppose now that private complementary insurance is available. If neither group chooses to insure, the situation remains as just examined (no voluntary insurance). If both groups choose to insure, the marginal conditions are those discussed earlier (with no statutory insurance), although note there will have been an effective cash transfer between groups brought about by the tax contributions. However, the analytically interesting case is when the rich group chooses to insure while the poor group does not.

Assuming the rich choose a complementary package $\{\theta_i\}_{i=1}^n$, the government's optimization problem becomes:

$$\text{Maximize } W \left(\begin{array}{l} \rho U(h_0^R + \sum_i (\theta_i + \lambda_i) \pi_i^R b_i, y_0^R - t^R - \sum_i \theta_i \pi_i^R x_i), \\ (1 - \rho) U(h_0^P + \sum_i \lambda_i \pi_i^P b_i, y_0^P - t^P) \end{array} \right)$$

$$\text{Subject to } \sum_i \lambda_i \{ \rho \pi_i^R + (1 - \rho) \pi_i^P \} x_i = \rho t^R + (1 - \rho) t^P$$

$$\lambda_i \in \{0, 1\}$$

This yields the solution that for an intervention to be in the statutory package:

$$\frac{b_i}{x_i} \geq \frac{\mu(\Pi_i - \rho \pi_i^R)}{\left[(1 - \rho) \pi_i^P \frac{\partial W}{\partial U^P} \frac{\partial U^P}{\partial h} \right]} = \frac{\mu}{\left[\frac{\partial W}{\partial U^P} \frac{\partial U^P}{\partial h} \right]} = \frac{\partial U^P}{\partial y} \bigg/ \frac{\partial U^P}{\partial h}$$

and for an intervention to be included in the complementary package purchased by the rich:

$$\frac{\partial U^P}{\partial y} \bigg/ \frac{\partial U^P}{\partial h} \geq \frac{b_i}{x_i} \geq \frac{\partial U^R}{\partial y} \bigg/ \frac{\partial U^R}{\partial h}$$

The policy maker's decision rule is straightforward. The essential package is chosen by a simple ranking of interventions in line with their cost-effectiveness ratios, with the cut-off rate being the post-tax preferences of the poor. It differs from the 'no statutory insurance' case only in the sense that the poor receive a tax transfer from the rich, in line with social preferences (and therefore the implicit threshold for accepting technologies into the insured package for the poor has been relaxed compared to the purely private case with no transfers). The rich use the statutory package and secure additional complementary insurance, up to the point where for the marginal intervention:

$$\frac{b_i}{x_i} = \frac{\partial U^R}{\partial y} \bigg/ \frac{\partial U^R}{\partial h}$$

Thus the main role of the statutory package under these circumstances is to effect a financial transfer from rich to poor, allowing the poor access to a broader package of care than would otherwise have been the case. The magnitude of this transfer will depend on the nature of the social welfare function, which will be determined by considerations such as equity or the government's re-election concerns. The rich may still wish to purchase complementary insurance. However, the extent of the package for the rich is less than under no statutory insurance because the transfer to the poor reduces their wealth, and therefore their willingness to pay for coverage. The benefit/cost ratio remains the criterion for selecting both statutory and voluntary package. Thus the system of combined statutory and voluntary insurance replicates a first best solution to health insurance after a socially optimal cash transfer between wealth groups has been effected.

It might at first glance be surprising to see no reference to the epidemiology of diseases in the choice of statutory package, as it is commonly argued that a government concerned with redistribution should concentrate on insuring diseases with high prevalence amongst the poor. However, with complementary private

insurance this is not necessary. If treatments with relatively high use amongst the rich are included in the statutory package (because they are highly cost-effective), then the associated insurance costs can be recouped in the taxes levied on the rich. Health care payments of the rich comprise (a) an element of tax required to fund their own part of the statutory package, (b) an element of tax required to subsidize the poor's part of the statutory package, and (c) the voluntary insurance premium. Elements (a) and (c) merely reflect in aggregate the costs of their preferred insurance package. The real policy choice is the size of (b), the transfer to the poor.

It is worth noting here the implications of excluding procedure i from the statutory package:

- a) for a poor person, the procedure is no longer available, so there is an expected health loss $\pi_i^P b_i$;
- b) for the rich, the procedure must now be covered through voluntary insurance, at a cost of $\pi_i^R x_i$;
- c) for both groups, there is a reduction in the tax payment, in sum equal to $\Pi_i x_i$.

For the marginal procedure, the welfare losses associated with (a) and (b) will be balanced against the gains (c). An equivalent way of formulating the conditions for the marginal intervention k is therefore as follows.

$$(1 - \rho) \frac{\partial W}{\partial U^P} \cdot \frac{\partial U^P}{\partial h} \pi_k^P b_k + \rho \frac{\partial W}{\partial U^R} \cdot \frac{\partial U^R}{\partial y} \pi_k^R x_k = \mu \Pi_k x_k$$

On left hand side, the first expression gives the health benefits to the poor of including intervention k in the statutory package. The second expression gives the financial benefits to the rich of removing intervention k from the voluntary package. The right hand side gives the incremental tax cost to both rich and poor of including intervention k in the statutory package.

The solution can be illustrated diagrammatically. Figure 1 shows the health production function for a poor person. This is constructed by computing the cumulative impact on health of all potential interventions, ranked in decreasing order of cost-effectiveness. With no subsidy, expenditure X_0^P is chosen. The implicit subsidy from the rich introduced by a statutory insurance package effectively shifts the production function to the left by the amount of the subsidy. This leads to a revised choice of expenditure by the poor (which is effectively their tax contribution t_p). Total expenditure on statutory insurance for the poor is then X_1^P , with the tax subsidy from the rich being $X_1^P - t_p$. Both utility and health outcome are higher than under no statutory insurance.

<Figure 1 about here>

Figure 2 shows the health production function for a rich person. With no subsidy, expenditure X_0^R is chosen. The implicit subsidy to the poor introduced by a statutory insurance package shifts the production function to the right by the amount of the subsidy. This leads to a revised choice of expenditure by the rich T_R , comprising the tax contribution t_R and any voluntary insurance expenditure. Total expenditure on insurance for the rich is then X_1^R , with the tax subsidy to the poor being $T_R - X_1^R$. In general, the insurance cover of the rich will comprise a mix of the statutory package

and some complementary voluntary coverage. Utility and health outcome are lower than under no statutory insurance.

<Figure 2 about here>

For a given statutory package (with voluntary supplement) a rich person can be induced to withdraw entirely from the public coverage if paid a suitable transfer \hat{y} . The minimum value of the transfer is such that utility with statutory plus supplementary insurance is equal to utility with purely private insurance plus the transfer, after all taxes and insurance premiums have been paid. In the context of Figure 2, the minimum transfer – a form of compensating variation – is calculated by constructing the indifference curve through the outcome (X_1^R, H_1^R) . The personal production function is then shifted to the right until tangency is secured, the magnitude of the shift indicating the required transfer.

Note that the payment of such transfers dilutes the redistributive role of statutory health insurance. If the rich ‘opt out’ of the statutory package, the tax base available for the statutory package is reduced. In general, it will usually be the case that the net tax revenue lost by the exit of the richest citizen in the statutory scheme will exceed the reduction in costs associated with their statutory health care expenditure liability. Under these circumstances, there will usually be no equilibrium social provision, and the statutory package is unviable (Ireland 1990).

If the costs and benefits of health care secured under private insurance differ from those under statutory care, then the rich face a different health production function depending on which insurance arrangement they choose. The government can affect the relative shape of these functions by adjusting the benefits of selected statutory treatments (such as allowing waiting times to increase under public provision) or altering the costs of private treatment (through specific taxes or subsidies in the form of vouchers). For example, under a given statutory package, the rich can be induced to insure intervention i privately through receipt of a voucher $\hat{\phi}_i$ such that the additional benefits of private coverage balance the additional costs $x_i^P - \hat{\phi}_i x_i$. Clearly, vouchers have policy relevance only if private coverage offers a quality advantage over statutory coverage, and the required size of $\hat{\phi}_i$ is inversely related to the magnitude of that advantage $b_i^P - b_i$.

Hitherto, we have assumed that a government can effect a redistribution from rich to poor by levying the required tax rate in accordance with its chosen social welfare function. In practice, particularly in low income countries, there might be a limit to the extent to which a tax base can be exploited, as those paying taxes greatly in excess of the benefits they receive may resist the implied redistribution. Such resistance might take a number of forms, most obviously the increased difficulty and costs of collecting the tax amongst the wealthy, in the extreme leading to tax evasion or emigration.

Loss of the tax base can readily be modelled within the framework set up above. Assume that tax collection costs $f(\cdot)$ amongst the rich increase with the difference

between tax payment and an actuarially fare premium, $f = f\left\{t^R - \sum_i \lambda_i x_i \pi_i^R\right\}$,

where $f'(\cdot) \geq 0$. That is, the effective size of the tax base depends to some extent on the mix of interventions included in the statutory insurance package. Under these circumstances, the priority setting rules should be amended in order to mitigate the loss of tax revenue associated with a more redistributive statutory package.

For example, the budget constraint with statutory insurance only then becomes:

$$\sum_i \lambda_i \{\rho \pi_i^R + (1 - \rho) \pi_i^P\} x_i = \rho t^R + (1 - \rho) t^P - f\left\{t^R - \sum_i \lambda_i x_i \pi_i^R\right\}$$

and the associated decision rule is:

$$\frac{b_i}{x_i} \geq \frac{\mu [\rho \pi_i^R \{1 - f'\} + (1 - \rho) \pi_i^P]}{[\rho \beta_R \pi_i^R + (1 - \rho) \beta_P \pi_i^P]}$$

The additional term $\{1 - f'\}$ on the top line serves to reduce the hurdle rate for procedures with relatively high prevalence amongst the rich, and may to some extent counteract any pro-poor implications of the bottom line.

CONTINUOUS WEALTH DISTRIBUTION

So far, we have considered a dichotomous distribution of rich and poor. This representation highlights some of the key issues underlying the policy problem, and may be a reasonable reflection of reality in many low income countries. However, it is less realistic in higher income countries with large middle income groups. It also conceals important subtleties underlying policy choices. In particular, the analysis to date has assumed that a government can secure any preferred redistribution of wealth. In practice, the range of tax instruments is often severely restricted. In this section I therefore consider a situation with a continuous distribution of wealth y , distributed as $\gamma(y)$ and a linear wealth tax. The incidence of disease i is distributed as $\pi_i(y)$.

Then a given statutory package $\{\lambda_i\}$ will generate total costs

$$\sum_i \lambda_i x_i \int_0^{\infty} \pi_i(y) \gamma(y) dy$$

Assuming a linear wealth tax rate t , this will be financed by tax revenue

$$\int_0^{\infty} t y \gamma(y) dy = tT.$$

where T is the tax base. The results of the previous sections can be readily generalized to this situation. For example, the social welfare function could be written as an additive function:

$$\int_0^{\infty} w(y) \gamma(y) U(h(y), y) dy$$

where $w(y)$ is the social weight attached to someone with wealth y . Then – with no voluntary insurance – procedures are included in the package if and only if:

$$\frac{b_i}{x_i} \geq \frac{\mu \int_0^{\infty} \gamma(y) \pi_i(y) dy}{\int_0^{\infty} \gamma(y) \beta(y) \pi_i(y) dy}$$

where $\beta(y)$ is the marginal social value of an improvement in health for a person of wealth level y . Assuming a pro-poor social welfare function, other things equal this criterion favours procedures with highest prevalence amongst the poorest. Note that the opportunity cost of public funds is:

$$\mu = \frac{\int_0^{\infty} \alpha(y) \gamma(y) y dy}{\int_0^{\infty} \gamma(y) y dy}$$

where $\alpha(y)$ is the marginal social value placed on wealth.⁴

Suppose now that complementary voluntary health insurance is available, and there is a complete market in private insurance. Define the set $S \subseteq [0, \infty)$ to be the subset of wealth values at which voluntary insurance is declined. The statutory package comprises procedures for which:

$$\frac{b_i}{x_i} \geq \frac{\mu \int_S \gamma(y) \pi_i(y) dy}{\int_S \gamma(y) \beta(y) \pi_i(y) dy}$$

That is, the statutory package is determined by the characteristics of the population that declines voluntary insurance, and favours conditions concentrated amongst the poorest who decline VHI.

Those who accept voluntary insurance will seek a complementary package that comprises all procedures that do not fall within the statutory package, and for

$$\text{which } \frac{\partial U}{\partial y} \Big/ \frac{\partial U}{\partial h} < \frac{b_i}{x_i}.$$

There will in general be at least one critical wealth level y^* at which VHI becomes accepted. Because the incidence of diseases is not always highest in low wealth groups (that is, $\pi_i(y)$ does not always decrease monotonically with y), there is no guarantee that there exists a unique y^* at all levels of y . It is however probably reasonable to say that the probability of VHI being accepted increases with wealth (see below).

A SOCIAL CHOICE PERSPECTIVE

Rather than seek to optimize social welfare, one might examine the choice of statutory package from a public choice perspective. Different social groups will have different preferences as to the size and constitution of the statutory health insurance package, and different attitudes towards the associated tax payments. When there is a limited tax instrument (such as a linear wealth tax), governments will not in general be able to secure a first-best solution from a social welfare perspective, and will have to take

cognisance of different attitudes towards tax expenditure and health gains amongst different wealth groups.

We can illustrate in very broad terms an individual's preferences by constructing a utility map, as shown in Figure 3 (Epple and Romano 1996b). This indicates utility indifference between tax rates and expenditure on the statutory package for an individual with wealth y . It assumes that at each level of expenditure the government chooses statutory provision in line with the policy rule of ranking procedures according to cost-effectiveness. Also, in the first instance, I make the strong assumption that the incidence of disease i relative to the population average, $\pi_i(y)/\Pi_i$ for wealth group y is the same for each diseases i . This assumption ensures that all groups agree on the ranking of treatments for inclusion in the statutory package.

< Figure 3 about here >

The indifference curve for wealth group y is constructed as follows. At each tax rate there is a unique critical level of expenditure y^* on the statutory package above which the individual prefers to forego voluntary insurance. Below that level of expenditure, the cash benefits to the individual of the marginal removal of a procedure from the statutory package are proportional to the individual's wealth (the basis for her contribution to the tax cost). So the local slope of the indifference curve is proportional to $1/y$. Above the critical level of expenditure, the indifference curve reflects the trade off between additional tax payments and health gains $\pi_i(y)b_i$. The assumption of constant $\pi_i(y)/\Pi_i$ ensures this segment is concave. The curve $M(y)$ indicates the locus of critical values y^* – to the left of the curve, voluntary insurance is purchased, above the curve the citizen relies solely on the statutory scheme. It has everywhere a negative slope. The feasible expansion of the government package is indicated by the budget line OB.

Under our assumptions, for any level of tax rate t the critical value of expenditure on the statutory package at which voluntary insurance is abandoned increase with wealth. That is, the curve $M(y_1)$ will lie strictly to the right of the curve $M(y_2)$ for all $y_1 > y_2$. The implications for the preferred statutory package are illustrated in Figure 4, which shows the utility-maximizing indifference curves for three individuals, with critical expenditure levels for each indicated by the blob. The poor person (a) switches to reliance on the statutory package at low levels of provision, but also has low levels of tolerance for tax payments. The high wealth individual (c) suffers a loss of utility at all levels of social provision (as tax payments exceed the cost of voluntary insurance) and would therefore prefer zero statutory expenditure. The middle wealth person (b) is better able to tolerate tax expenditure than the poor person, and enjoys benefits in excess of tax payments for lower levels of the statutory package. She therefore prefers a larger statutory package than either the rich or the poor person. Then, if the size of the statutory package is chosen through majority voting, the crucial determinant of the outcome will be the distribution of wealth – specifically, the extent to which middle income voters (preferring higher expenditure levels) dominate an alliance of rich and poor (preferring lower levels) (Epple and Romano 1996b).

< Figure 4 about here >

For an individual with wealth y , the tax cost of including intervention i in the package is $x_i \Pi_i y / Y$, where Y indicates total national wealth, whilst health benefits are $\pi_i(y) b_i$. The individual therefore ranks interventions for inclusion in the statutory package according to the ratio $b_i \pi_i(y) / x_i \Pi_i$. I have assumed that the procedures enter the statutory package in strictly decreasing benefit/cost order b_i / x_i as expenditure increases. However, the benefits to particular wealth groups also depend on the relative epidemiology of the disease for those groups, $\pi_i(y) / \Pi_i$, which is not in general constant between interventions i . So any one wealth group will not necessarily rank interventions for inclusion in a fixed budget package in the same way as other groups. Thus although an individual's indifference curve will have a non-negative slope, and is likely *on average* to exhibit decreasing marginal benefits of treatments (as b_i/x_i decreases), local variations in the relative prevalence of diseases $\pi_i(y) / \Pi_i$ may render the curve non-concave.

This rudimentary exploration indicates that there may not in general be a unique level of expenditure on the statutory package at which the individual abandons voluntary insurance. Even when voluntary insurance is purchased, the individual may wish to see in the statutory package certain additional treatments for which she suffers relatively high incidence $\pi_i(y) / \Pi_i$, because the personal tax cost of including them is less than the cost of purchasing risk-rated voluntary insurance. The introduction of non-concavity complicates the technical analysis considerably, and implies the existence of multiple social equilibria. However, it is unlikely in practice to alter the general pattern of results shown here.

Conclusions

A conventional welfare economics perspective might suggest that - setting aside concerns of moral hazard or adverse selection - a first-best solution in health insurance can be secured by implementing a competitive insurance market, with no requirement for a government package. Equity concerns could be addressed by suitable financial transfers from rich to poor, or from healthy to sick. In practice this view appears to be untenable. Most developed countries offer some basic guarantee of health care to all citizens, regardless of their personal preferences. The arguments for such a policy are diverse, including market failures (often due to information weaknesses), transaction costs, altruism, solidarity and merit goods, but do not strictly concern us here. Rather we assume that such a policy is required, and examine the consequent optimal choice of statutory package.

The analysis indicates that – under some limiting assumptions – a social planner can replicate the preferred first best outcome by implementing a statutory package alongside complementary insurance for the rich. However, deployment of substitute private insurance alongside a statutory package is more problematic. It requires either a transfer to the rich (diluting the redistributive function of the statutory package) or reduced quality in the public sector, neither of which is likely to be an attractive policy. The paper has also noted that mobility of the tax base and electoral considerations may constrain the planner's ability to secure a preferred outcome.

The results have important implications for those evaluating health care technologies. They imply that a concern with equity may not be a major concern when choosing which technologies to include in a statutory package if the rich are able to purchase complementary insurance. The relevant instrument for addressing equity concerns in this case is through the tax system rather than through the health care package. However, equity concerns may become important if there is no voluntary insurance.

The models presented here are highly stylized, and may need to be amended according to policy interests. For example, there may be a policy imperative allow only community-rated voluntary insurance premiums, or inadequate information for insurers to set fair voluntary premiums. Under such circumstances, adverse selection may become important in the voluntary market, and the models should be amended to accommodate this. Other possible extensions include the use of copayments in either statutory or voluntary sector, and variations in health within a single wealth group.

I believe the results presented here offer a useful framework for thinking about voluntary health insurance alongside a statutory package of health care. However, it is important to note that psychological and sociological as much as economic considerations may affect policy in this domain. The sustainability of social health insurance relies on the willingness of citizens to tolerate large transfers from rich to poor and from healthy to sick. An apparent failure explicitly to reflect citizens' equity concerns in the health system may compromise support for the mix of statutory and voluntary insurance that empirically appears to be associated with high-performing health systems (World Health Organization 2000). Policy makers should therefore exercise extreme caution in this domain.

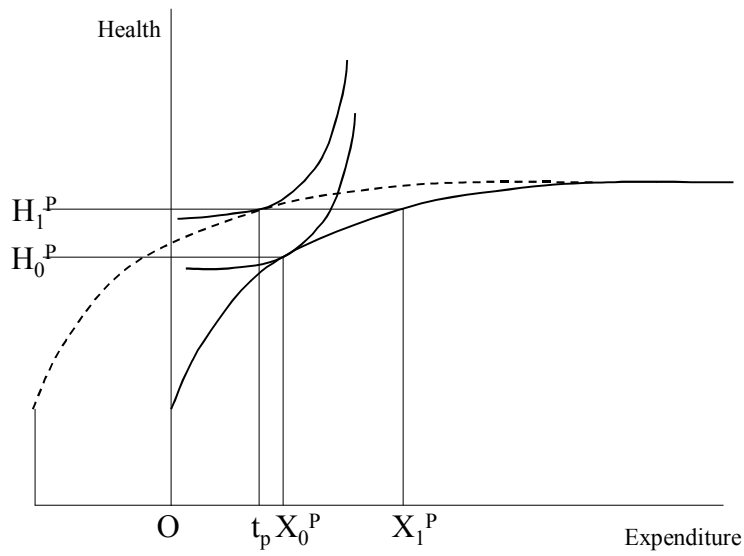


Figure 1: Extent of the statutory package for the poor

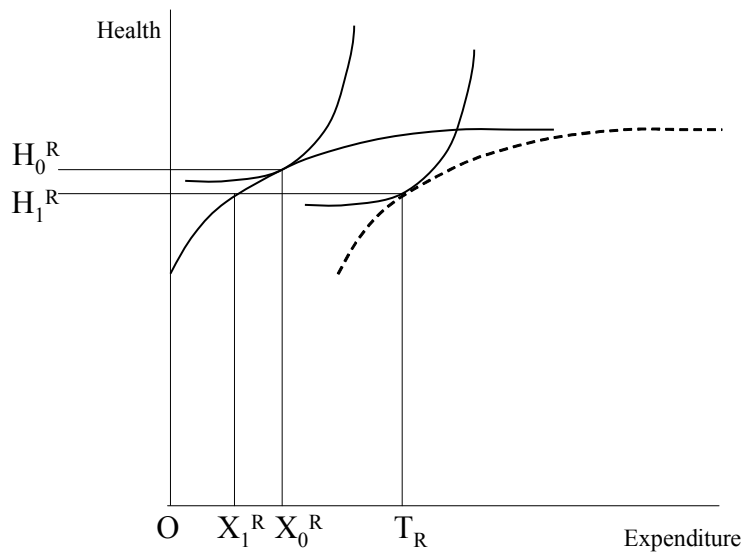


Figure 2: Expenditure choices of the rich

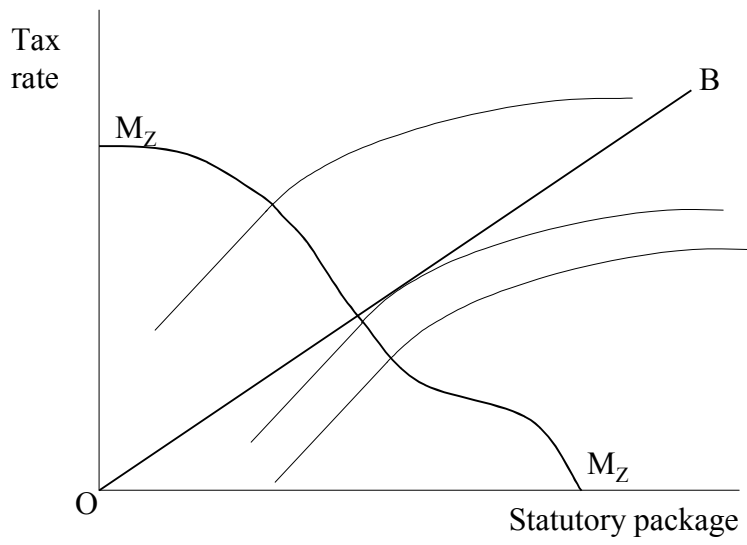


Figure 3: Indifference curves with voluntary insurance

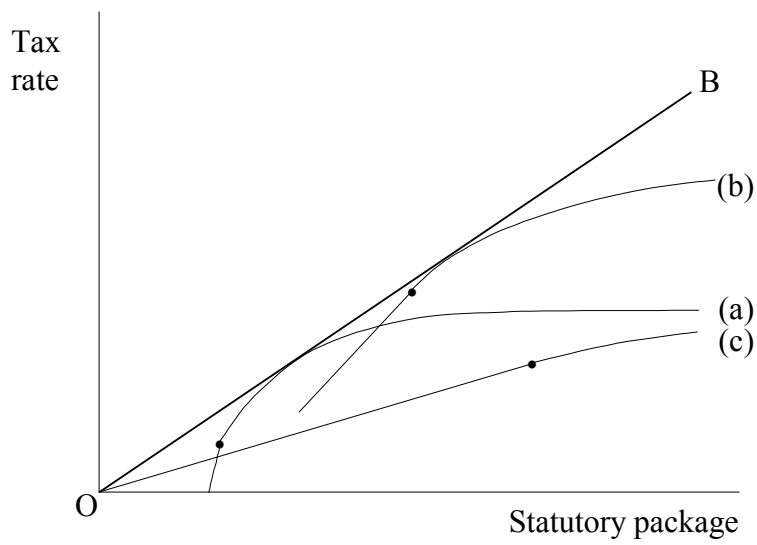


Figure 4: Preferences of (a) low wealth (b) middle wealth (c) high wealth citizens

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Footnotes

¹ Some efforts have been made to confine the receipt of statutory health benefits to the poor. However, such means testing has often been found to be impractical, and is not commonly used. See: Bitrán, R. and U. Giedion (2002). *Waivers and exemptions for health services in developing countries*. Washington DC: World Bank..

² The nature of the social welfare function appropriate for modelling health care has been a matter of debate, and has not yet been entirely resolved Fleurbaey, M. (forthcoming). "Health, wealth and fairness." *Journal of Public Economic Theory*.. Much of the literature in health economics merely seeks to maximize (equity weighted) health, whilst others argue that health is merely one argument in an individual's utility function that should not be afforded privileged status. This paper adopts an intermediate position that remains reasonably general.

³ This formulation ignores the potential distortionary costs to the economy associated with an income tax, but if necessary this is readily incorporated into the analysis.

⁴ In principle, under a distortionary income tax, one should also increase the cost of public funds in order to capture the dead weight loss of tax funding. This refinement is not germane to this paper.