Copayments and priority setting in health care: balancing equity and efficiency

Peter C. Smith

Centre for Health Economics

University of York

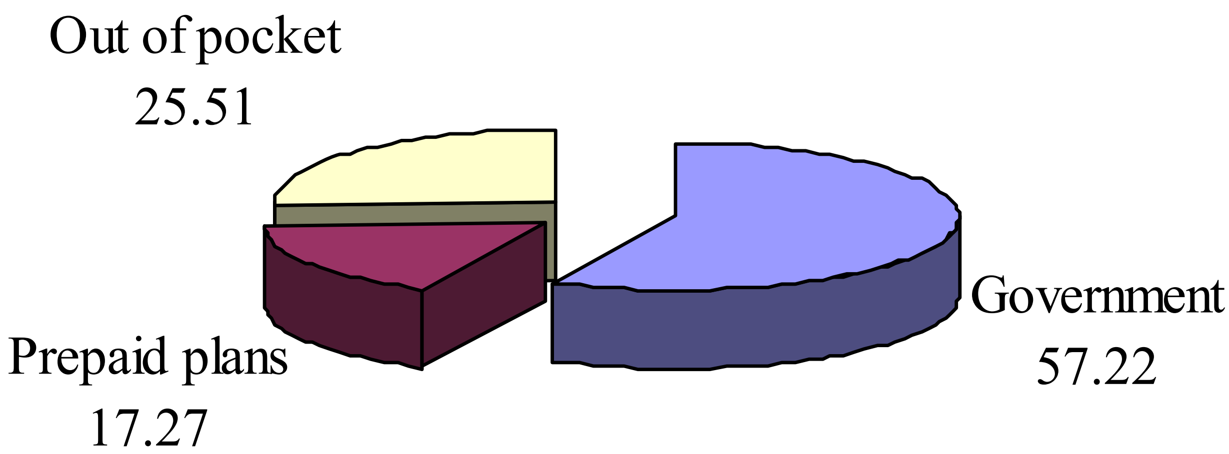
The traditional economic approach to health technology assessment

- Maximize benefits subject to a fixed budget constraint;
- Leads to a “cut-off” cost-effectiveness ratio (cost per QALY), above which technologies are rejected;
- Other constraints ignored;
- Technologies assessed independently;
- Ignores links with the financing system.

This paper

- Assesses implications of
  - adopting a wider definition of benefits;
  - accommodating other constraints into the assessment problem;
  - modelling the links between priority setting and financing.
- It concludes that
  - existing economic methodology may be seriously flawed;
  - it nevertheless remains possible to apply an economic approach to priority setting;
  - but that application may need to be much “smarter” than hitherto.

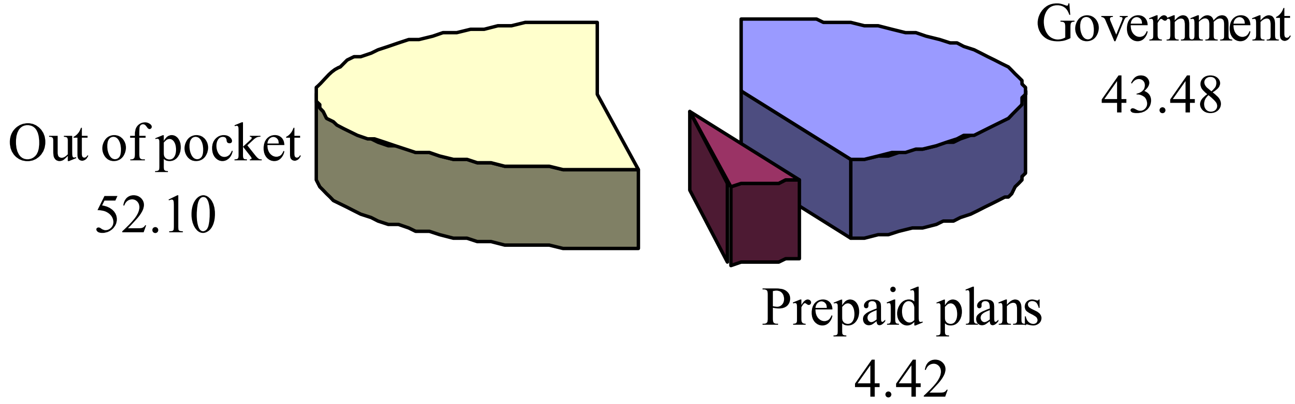
Percentage of world health finance by source, 2000



Source: World Health Report 2002

Percentage of world health finance by source, 2000

Weighted by population



Source: World Health Report 2002

Total health annual expenditure 2000: per capita international $

1.	USA	4499	140.	Myanmar	24
2.	Switzerland	3229	141.	Niger	22
3.	Germany	2754	142.	Congo	21
4.	Canada	2534	143.	Nigeria	20
5.	Denmark	2428	144.	Chad	19
6.	Norway	2373	145.	Ethiopia	17
7.	Israel	2338	146.	Burundi	16
8.	France	2335	147.	Afghanistan	9
9.	Belgium	2269	148.	Somalia	7
10.	Netherlands	2255	149.	Liberia	3

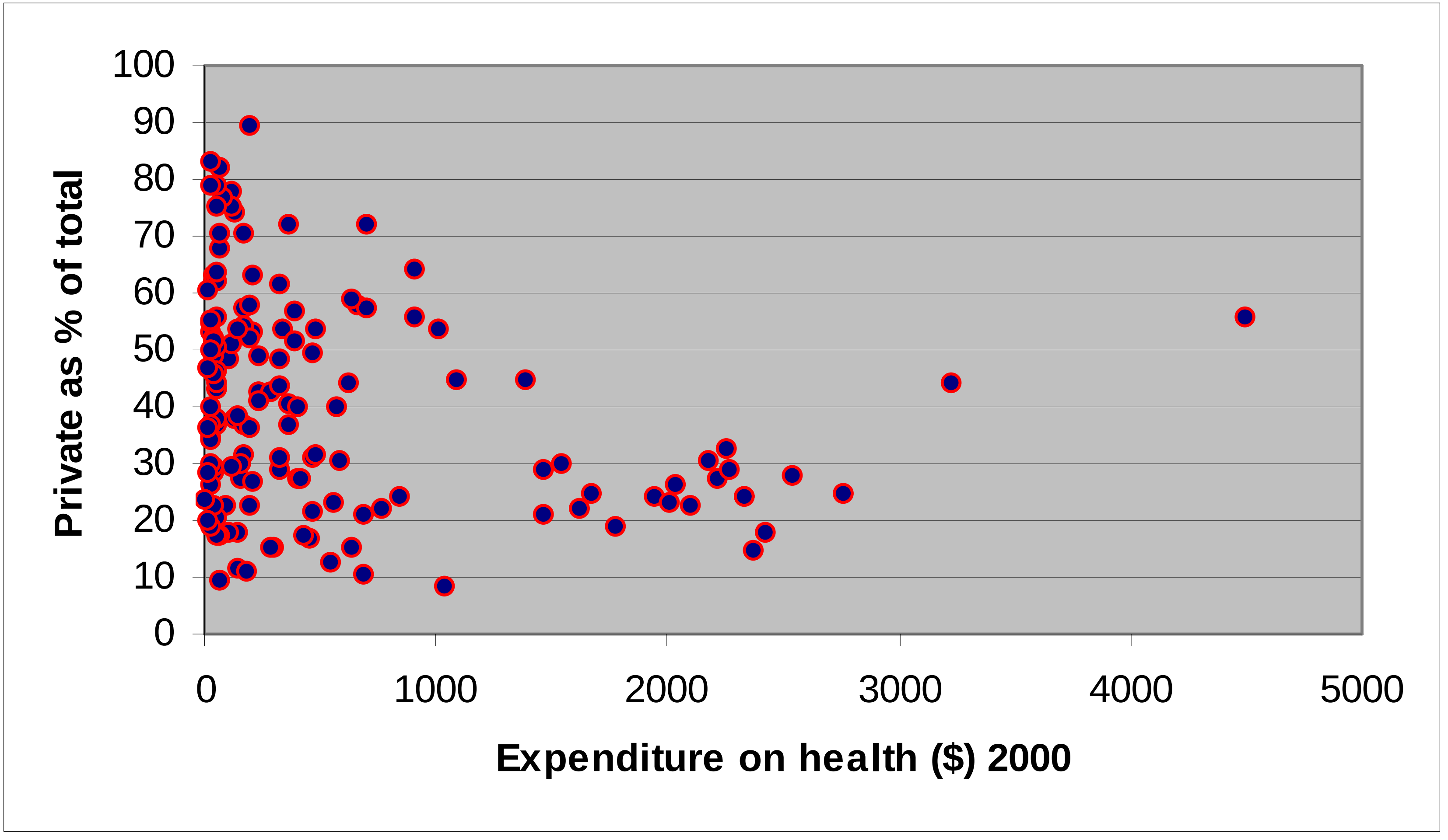
Source: World Health Report 2002
(Population > 1 million only)

Private expenditure: highest & lowest as percent of total health expenditure

1.	Georgia	89.5	140.	Yugoslavia	15.5
2.	Myanmar	82.9	141.	Croatia	15.4
3.	India	82.2	142.	Turkmenistan	15.1
4.	Nigeria	79.2	143.	Norway	14.8
5.	Sudan	78.8	144.	Kuwait	12.8
6.	Kenya	77.8	145.	Papua New Guinea	11.4
7.	Pakistan	77.1	146.	Cuba	10.8
8.	Indonesia	76.3	147.	Slovakia	10.4
9.	Cambodia	75.5	148.	Bhutan	9.4
10.	Cameroon	75.3	149.	Czech Republic	8.6

Source: World Health Report 2002
(Population > 1 million only)

Total expenditure on health (int $) and private expenditure %



Source: World Health Report 2002 (Population > 1 million only)

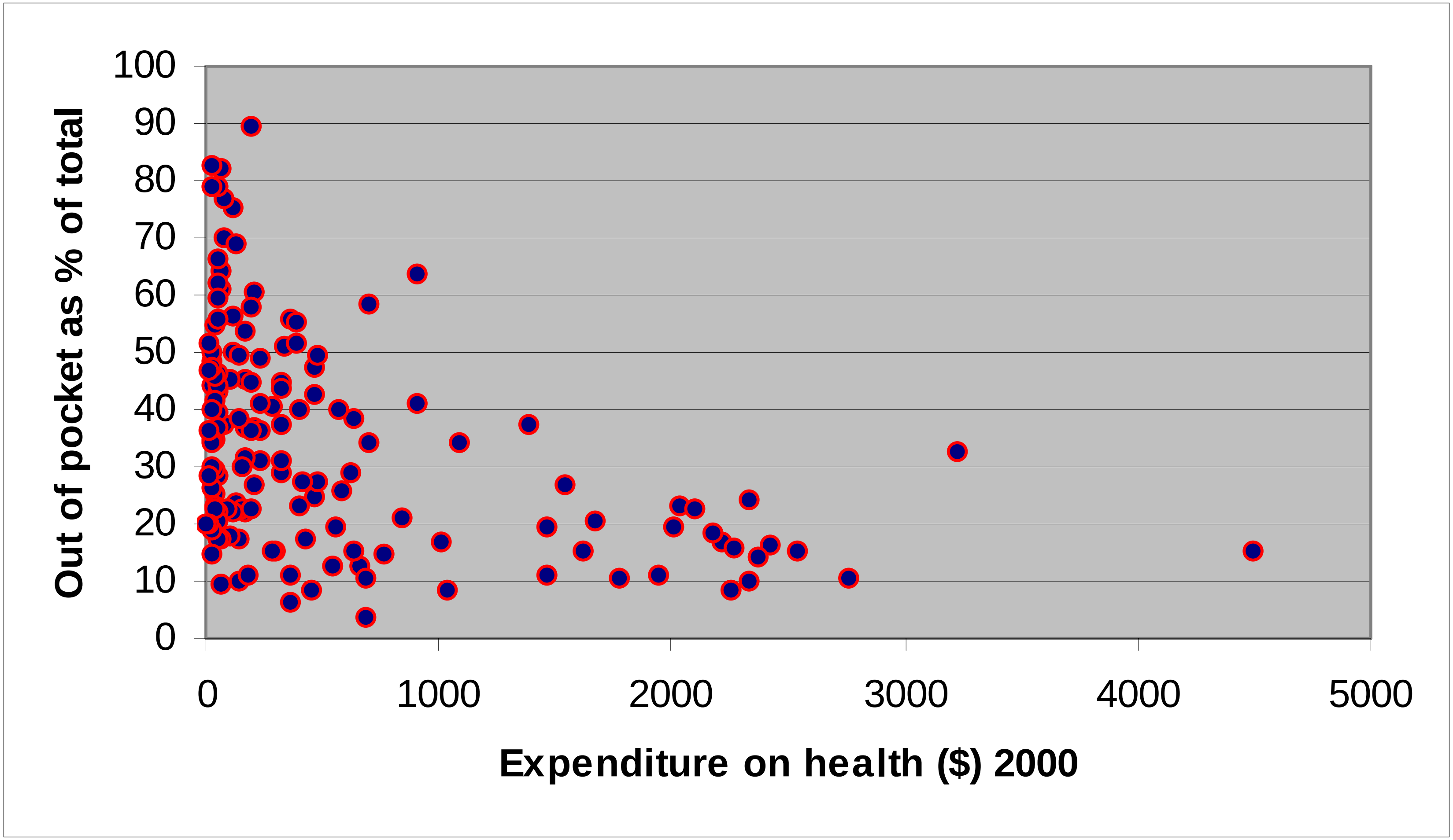
Out of pocket: highest & lowest as percent of total health expenditure

1.	Georgia	89.5	140.	United Kingdom	10.6
2.	Myanmar	82.6	141.	Slovakia	10.4
3.	India	82.2	142.	France	10.2
4.	Nigeria	79.2	143.	Papua New Guinea	9.8
5.	Sudan	78.8	144.	Bhutan	9.4
6.	Pakistan	77.1	145.	Netherlands	8.6
7.	Cambodia	75.5	146.	Czech Republic	8.6
8.	Indonesia	70.1	147.	Oman	8.4
9.	Viet Nam	68.7	148.	Namibia	6.5
10.	Cameroon	66.3	149.	Saudi Arabia	3.8

Source: World Health Report 2002
(Population > 1 million only)

96. Italy: 22.9%

Total expenditure on health (int $) and out of pocket expenditure %



Source: World Health Report 2002 (Population > 1 million only)

The arguments for user charges

- Moral hazard, managing demand
- Funding health care
- Absence of an insurance function
- Often no alternative.

The evidence on user charges

- The ‘RAND’ experiment
- Quite low price elasticities
- Disproportionate effect on low income families
- Limited evidence on specific interventions.

From: P. Gertler and J. Hammer (1997), *Strategies For Pricing Publicly Provided Health Services*, World Bank.

**Table 1:
Econometric Estimates of Own Price Elasticities of the Demand For Medical Care in Developing Countries**

Country	Data	Service Type	Own Price Elasticity			Source
			Overall	Low Income	High Income	
Burkina Faso	1985	Public Provider				Sauerborn et al. (1994)
	All Ages		-0.79	-1.44	-0.12	
	Age 0-1		-3.64			
	Age 1-14		-1.73			
	Age 15+		-0.27			
Cote d'Ivoire	1985	Health Clinic		-0.61	-0.38	Gertler & Van der Gaag (1990)
		Hospital Outpatient		-0.47	-0.29	
Cote d'Ivoire	1985-87	Health Clinic	-0.37			Dow (1996)
		Hospital Outpatient	-0.15			
Ghana	1987	Hospital Inpatient	-1.82			Lavy & Quigley (1993)
		Hospital Outpatient	-0.25			
		Dispensary	-0.34			
		Pharmacy	-0.20			
		Health Clinic	-0.22			
Kenya	1980-81	Government provider	-0.10			Mwabu et al. (1993)

Gertler and Hammer Table 1 continued

		Mission provider	-1.57			
		Private provider	-1.94			
Indonesia	1991-93					Gertler and Molyneaux (1997)
	Children	Health Center	-1.07			
		Health Subcenter	-0.35			
	Adults	Health Center	-1.04			
		Health Subcenter	-0.47			
	Elderly	Health Center	-0.47			
		Health Subcenter	-0.11			
Mali	1982		-0.98			Birdsall et al. (1983)
Nigeria						Akin et al. (1995)
Pakistan	1986					Alderman & Gertler (1997)
	Female Children	Traditional Healer		-0.43	-0.24	
		Public Clinic		-0.43	-0.23	
		Pharmacist		-0.44	-0.25	
		Private Doctor		-0.17	-0.09	
	Male Children	Traditional Healer		-0.60	-0.26	
		Public Clinic		-0.61	-0.27	
		Pharmacist		-0.63	-0.27	
		Private Doctor		-0.25	-0.10	
Peru	1985	Private Doctor		-0.44	-0.12	Gertler & Van der Gaag (1990)
		Hospital Outpatient		-0.67	-0.33	
		Health Clinic		-0.76	-0.30	
Philippines	1981	Public Providers		-2.26	-1.28	Chin (1995)
		Private Providers		-3.93	-2.23	
Philippines	1981	Prenatal Care	-0.01			Akin et al. (1986)
Philippines	1983-84	Urban Maternity	-0.24			Schwatz et al. (1988)
		Rural Maternity	-0.05			

This model

- N health care technologies i
- Technology i yields benefits b_i
- Technology i has cost x_i
- Population distributed by income $\gamma(y)$
- Incidence of each disease varies by income $\pi_i(y)$
- Copayment c_i in range [0,1]
- Individual maximizes utility based on health & wealth
- Government maximizes social welfare by choosing copayment rate

An individual utility model

- Utility based on health and wealth

$$U = U(h,y)$$

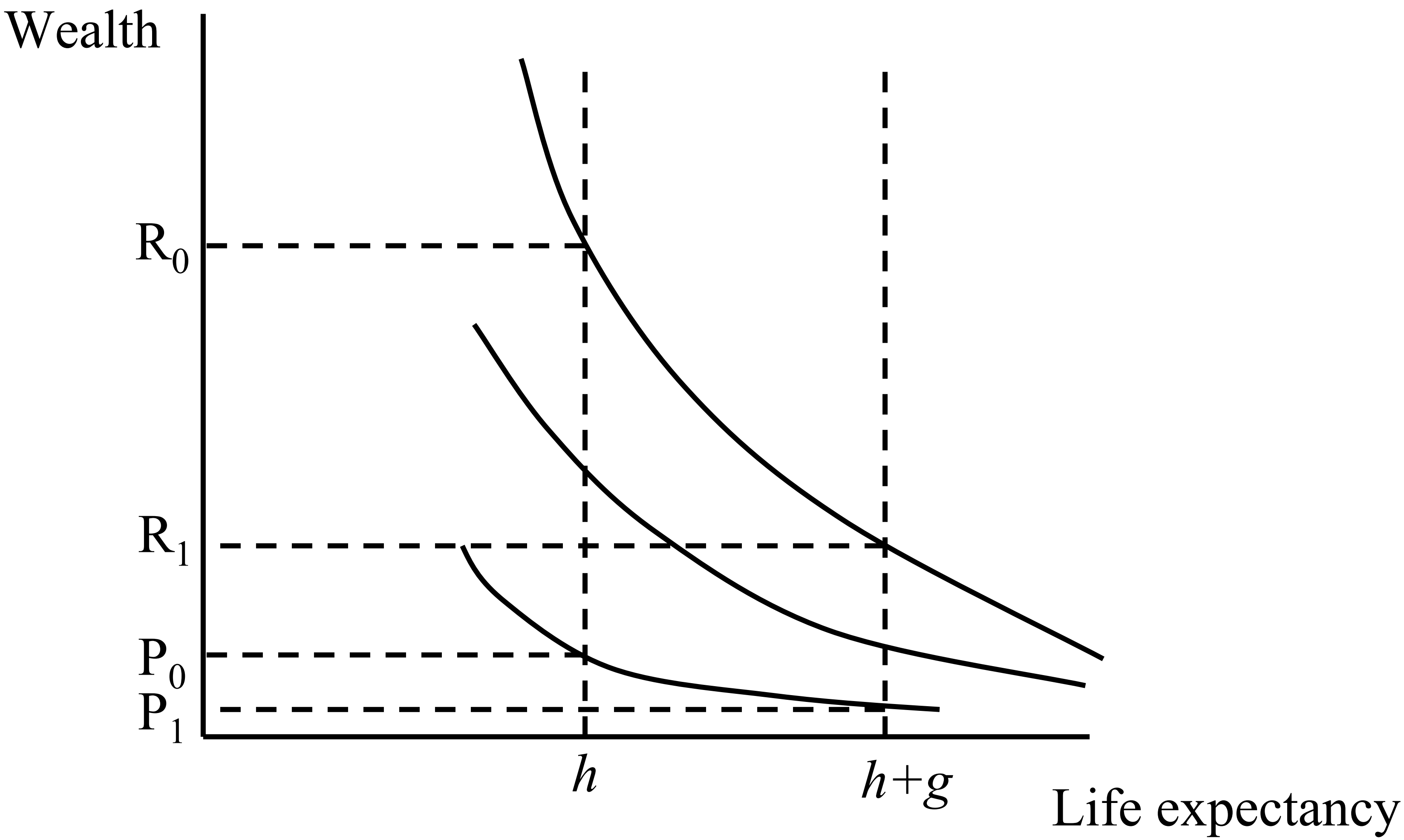
- If a particular intervention offers an increase in health from h to $h+b$ at price p_i.
- Then there exists a critical value of wealth y^*_i such that

$$u(h, y_i^*) = u(h+b, y_i^* - p_i)$$

- Define critical level of wealth:

$$\psi_i(c_i) = y^*(c_i x_i, h, b) \quad \text{where } c_i x_i = p_i$$

Figure 1: Trade off between wealth and health amongst rich and poor



Total annual demand for intervention i can be expressed as a function of the copayment rate c_i:

$$\theta_i(c_i) = \int_{\psi_i(c_i)}^{\infty} \pi_i(y)\gamma(y)dy.$$

- population is distributed according to density function $\gamma(y)$
- annual incidence of the condition requiring intervention is distributed as $\pi_i(y)$

The total need for intervention *i* can be thought of as

$$n_i = \theta_i(0) = \int_0^{\infty} \pi_i(y)\gamma(y)dy.$$

Elasticity

$$\eta_i = \frac{c_i}{\theta_i} \cdot \frac{d\theta_i}{dc_i} = -\frac{c_i}{\theta_i} . \pi_i(\psi(c_i)).\gamma(\psi(c_i)).\psi'(c_i)$$

The conventional priority setting model

$$\text{Maximize}: \sum_i \phi_{\mathrm{i}} n_i b_i$$

$$\text{subject to}: \sum_i \phi_{\mathrm{i}} n_i x_i \leq X^*$$

where

- $\{\phi_i\}_{i=1}^{K}$ are the decision variables, indicating the proportion of total need n_i met for intervention i,
- b_i are the annual benefits (health gains) arising from technology i for each patient treated
- x_i are the associated unit costs
- X^* is the total budget available.

Case 1: Copayments, no concern with equity

If there is no concern with equity, then the priority setting problem with a fixed net public budget is to select a set of $\{c_i\}_{i=1}^{K}$ that optimizes the following programme:

$$\text{Maximize}: \sum_i \theta_{\text{i}}(c_i) b_i$$

$$\text{subject to}: \sum_i (1-c_i)\theta_{\text{i}}(c_i) x_i \leq \overline{X}$$

$$c_i \in [0,1] \quad \forall i$$

Case 1: first order conditions

$$L(c,\lambda,\mu) = \sum_i \theta_{\mathrm{i}}(c_i)b_i + \lambda\left\{\bar{X} - \sum_i (1-c_i)\theta_{\mathrm{i}}(c_i)x_i\right\}$$

yielding

$$\frac{\partial L}{\partial c_i} = \theta_{\mathrm{i}}'(c_i)b_i + \lambda x_i\{\theta_{\mathrm{i}}(c_i) - (1-c_i)\theta_{\mathrm{i}}'(c_i)\} - \mu_i$$

The parameter λ is the shadow price (expressed in terms of health) of the budget constraint.

Case 1: boundary solutions

Case A: No user charge, $c_i^* = 0$; $\mu_i = 0$

Then $\theta_{\mathrm{i}}'(0)b_i + \lambda x_i\{\theta_{\mathrm{i}}(0) - \theta_{\mathrm{i}}'(0)\} \leq 0$

Then $\frac{b_i}{x_i} \geq \lim_{c \to 0} \lambda.\left(1 - \frac{c}{\eta_i(c)}\right)$ and the intervention is cost-effective without user charges.

Case B: Full user charge, $c_i^* = 1$**;** $\mu_i \geq 0$

Then $\theta_{\mathrm{i}}'(1)b_i + \lambda x_i \theta_{\mathrm{i}}(1) \leq 0$

In this case $\frac{b_i}{x_i} \leq -\lim_{c \to 1} \lambda \frac{1}{\eta_i(c)}$ and the intervention is not cost-effective at any level of user charges.

Case 1: internal solution

Case C: Intermediate charge, $1 > c_i^* > 0$**;** $\mu_i = 0$

Neither boundary condition is binding and

$$\theta_{\mathrm{i}}'(c_i)b_i + \lambda x_i\{\theta_{\mathrm{i}}(c_i) - (1 - c_i)\theta_{\mathrm{i}}'(c_i)\} = 0$$

So

$$\frac{b_i}{x_i} = -\frac{\lambda\{\theta_{\mathrm{i}}(c_i) - (1 - c_i)\theta_{\mathrm{i}}'(c_i)\}}{\theta_{\mathrm{i}}'(c_i)} = \lambda\left[1 - c_i^*(1 + \eta_i^{-1})\right]$$

The elasticity at the optimal user charge is

$$\eta_i^* = \frac{-\lambda x_i c_i^*}{b_i - \lambda x_i(1 - c_i^*)}.$$

Case 1: conclusions

- For sufficiently high values of the benefit:cost ratio b_i/x_i no zero user charge will be levied, as the benefits of free access outweigh any foregone revenue;
- For sufficiently low values of b_i/x_i the full market price copayment will be levied, as the benefits of the technology are never sufficient to justify any user charge subsidy;
- For moderate levels of b_i/x_i an intermediate copayment may be levied, as the benefits of user charge revenue compensate for some reduction in utilisation;
- Where an intermediate copayment is levied, it will increase as elasticity approaches zero (when increased revenue outweighs reduced benefits);
- Where an intermediate copayment is levied, it will be decreasing in b_i/x_i.

Case 2: weighting for equity

The policy problem now becomes one of maximizing weighted health benefits:

$$\text{Maximize}: \sum_i b_i \int_{\psi_i(c_i)}^{\infty} w(y)\pi_i(y)\gamma(s)dy$$

$$\text{subject to}: \sum_i (1-c_i)x_i \int_{\psi_i(c_i)}^{\infty} \pi_i(y)\gamma(y)dy \le \bar{X}$$

$$c_i \in [0,1] \quad \forall i$$

where *w(y)* is the social weight attached to a unit of health gain for wealth group *y*, and $w'(y) \le 0$.

Equity weighted solution

Differentiating the Lagrangean gives rise to the optimality conditions for interior solutions

$$b_i \psi_i'(c_i^*)\left[w(y)\pi(y)\gamma(y)\right]_{y=\psi_i(c_i^*)} +$$
$$\lambda x_i \left\{\theta_i(c_i^*) - (1-c_i^*)\psi_i'(c_i^*)\left[\pi(y)\gamma(y)\right]_{y=\psi_i(c_i^*)}\right\} = 0$$

Implying

$$\eta_i^* = \frac{-\lambda x_i c_i^*}{b_i . w(\psi_i(c_i^*)) - \lambda x_i (1-c_i^*)}$$

That is the benefit of treatment b_i is scaled in proportion to the social weight attached to the marginal patient deterred. If there is a concern with equity, charges will be reduced on interventions on which deter relatively 'needy' people (that is, for which $\psi_i(c_i^*)$ is low).

Case 3: exemptions for low income

$$\text{Maximize:}\quad \sum_i b_i \left\{ \int_0^{d_i} w(y)\pi_i(y)\gamma(y)dy + \int_{\psi_i(c_i)}^{\infty} w(y)\pi_i(y)\gamma(y)dy \right\}$$

$$\text{subject to:}\quad \sum_i x_i \left\{ \int_0^{d_i} \pi_i(y)\gamma(y)dy + (1-c_i) \int_{\psi_i(c_i)}^{\infty} \pi_i(y)\gamma(y)dy \right\} \le \overline{X}$$

$$d_i \le \psi_i(c_i) \quad \forall i$$

$$c_i \in [0,1] \quad \forall i$$

Exemptions solution

Differentiating with respect to d_i gives

$$b_i\left[w(s)\pi(s)\gamma(s)\right]_{s=d_i^*} - \lambda x_i\left[\pi(s)\gamma(s)\right]_{s=d_i^*} - \omega_i = 0$$

Assuming the constraint $d_i \leq \psi_i(c_i)$ is not binding

(that is, $\omega_i = 0$), this gives $w(d_i^*) = \dfrac{\lambda x_i}{b_i}$. So the

threshold for exemptions increases as the benefit

cost ratio increases.

If $d_i = \psi_i(c_i^*)$, then $\omega_i \geq 0$ and the social weight

attached to the marginal patient may increase.

Single exemption threshold

If the exemption threshold cannot vary between interventions, then d^* must be chosen such that

$$w(d^*) = \lambda \frac{\sum_i \pi_i(d^*) x_i}{\sum_i \pi_i(d^*) b_i}.$$

Case 4: subsidized access

Trivial matter to amend problem to incorporate subsidized access by allowing $c_i < 0$. Then policy makers may wish to subsidize interventions with high benefit-cost ratios for which price elasticity of demand is high at $c_i = 0$.

Implications

- Charging the sick almost always a 'second best' solution.
- Welfare benefits of *any* reliable insurance function.
- Analysis has fundamental implications for:
  - Charging policy
  - Priority setting
  - Evaluation of health technologies
- Cannot set health priorities in isolation from financing decisions
- Priorities will vary between settings
- Universal benefit/cost data of only limited help
- Must be considered alongside charging policy, epidemiology, and equity preferences.