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The Integration of Claims to Health-Care: a Programming Approach

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The Integration of Claims to Health Care:

A Programming Approach

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Abstract

The paper contributes to the use of social choice and welfare theory in health economics by developing and applying the integration of claims framework to health-care rationing. Related to Sens critique of neo-classical welfare economics, the integration of claims framework recognises three primitive sources of claim: consequences, deontology and procedures. A taxonomy is presented with the aid of which it is shown that social welfare functions reflecting these claims individually or together, can be specified. Some of the resulting social choice rules can be regarded as generalisations of health-maximisation and all have normative justifications, though the justifications may not be universally acceptable. The paper shows how non-linear programming can be used to operationalize such choice rules and illustrates their differential impacts on the optimal provision of health-care. Following discussion of relations to the capabilities framework and the context in which rationing occurs, the paper concludes that the integration of claims provides a viable framework for modelling health-care rationing that is technically rigorous, general and tractable, as well as being consistent with relevant moral considerations and citizen preferences.

Keywords: non-linear programming, social welfare function, health-care rationing, QALY, capabilities, economic paradox

JEL Classification: D63, I180

The Integration of Claims to Health-Care:
A Programming Approach[1]

Simplified theory-building is an absolute necessity for empirical analysis; but it is a means, not an end.

Arrow (1951 p21)

1 Introduction

In recent years, it has become apparent that health-care systems are beginning to respond to economists calls for more rigorous measurement of intervention benefits. Advocacy of the Quality Adjusted Life Year (QALY), pioneered by Torrance (1976) and Williams (1988), preceded calls for medicine to be evidence based though the QALY fits well into the emerging, if patchy, evidential ethos. However, it is also becoming apparent that there is less support from within economic theory or moral philosophy for health-maximization[2] as the social choice rule of preference in health. Similarly within health economics, as equity has become more important (see for instance Wagstaff (1991), Culyer and Wagstaff (1993), Pereira (1993), Johanneson and Gerdtham (1996), Dolan et al (2000), Williams and Cookson (2000) and Sen (2001)), so the desirability of maximising aggregate health has become less obvious, at least as a goal that should be pursued in many of the rationing problems with which we are currently faced. [3]

The reasons for this change have been articulated by non-economists in a range of disciplines from medicine to philosophy and in some cases, though not all, their views are echoed by patients and voters. The list of concerns to do with rights, duties, procedural considerations and the charges of discrimination will be familiar. However, to go beyond the empirical evidence, we need to ask whether these objections can be articulated in a technically coherent manner and if so, whether such an articulation is conceptually appealing? This paper develops a positive response to both questions. More precisely, the central contribution lies in using three building blocks of social choice, consequences, deontological claims such as rights and duties, and procedural considerations concerning consultation at a macro level to show how different philosophical considerations can be incorporated into a *formal* framework amenable to economic analysis. It will emerge as a consequence of this view that the QALY plays an invaluable role in providing a measure of intervention benefit and that its normative value derives from the wide range of social welfare functions in which a measure of health gain must be employed. This runs counter to the view that the merit of the QALY stands or falls with the desirability of the health-maximisation choice rule in which it was first embedded, a view that is, as noted, less central to the health economics literature than might once have been the case. It also runs counter to the view that the other claims requiring acknowledgement should be incorporated into an expanded measure of health gain [4]. As we shall see, to be sceptical about health-maximisation does not require that one should be against the QALY also. The social choice rules developed

here go beyond utilitarianism, as many considerations of equity suggest they should, but they also allow for a variety of claim types to be reflected in the social rule.

The rest of the paper is structured as follows. Section 2 makes some remarks about the existential status, and variety, of social welfare functions while Section 3 provides additional comments on the various ways in which fairness can be reflected in social choice rules. Section 4 contains the main analytical contributions of the paper. A stylised health-care rationing problem is introduced and nine social choice rules are applied to the problem using non-linear programming. Rationing results are compared and evaluated for different levels of health expenditure, and distributional impacts at a low level of expenditure are examined. Section 5 comments on the relationship between Sen capabilities approach, the integration of claims framework advocated here and health maximisation before offering some remarks on methodological issues raised by attempts to model generalisations of health-maximisation. Section 6 offers some concluding observations and summary remarks.

2 Social Welfare Functions for Health-Care Rationing

To begin, we make some remarks about the sense in which the term social choice is used here. In the first instance, there is no intention of (over) reifying the concept. Though it is customary to talk about social welfare functions as if they exist, many theorists would argue that this is merely a useful metaphor. In empirical work, social welfare functions are unlikely to be found in the mathematical form in which they are stated: populations are constantly changing and individuals make decisions on a stochastic basis. As we shall see, this does not prevent such functions from being useful even if we are using a quantitative approach to derive what are essentially qualitative insights. Finally, we shall implicitly be working under the assumption that the use of social choice rules, even if a particular social welfare function is hard to pin down, can make a substantial contribution by helping to identify information needs.

In conventional social choice theory, the emphasis is on the choice rule, it being taken as given that the primitive to which the rule will apply is preference. By contrast, a number of the social choice rules that have been discussed in the context of health are summarised in Table 1. Broadly speaking, there appear to be three primary sources of claim on health-care resources, each of which gives rise to different possible specific social choice rules. In addition, one can envisage social choice procedures that combine these different sources of claim and four examples of such rules are offered.

Table 1 Social Choice Rules for Priority Setting in Health [13]

Approach	Illustrative Social Choice Rule
Consequentialism	
1. Utiltariansim	$Max \sum_{i \in P} u_i$
2. Health Maximisation	$Max \sum_{i \in N} \hat{q}_i$
Deontology	
3. Need	$Max\ p_i(T) \forall i\ e\ N$
4. Rights and Duties	$Max\ p_i(T) \forall i\ e\ N \setminus D$
Process	
5. Voting	$\partial V / \partial H = 0\ (NecessaryCondition)$
6. Public and Expert Deliberation	$Max\ SWF\left(\{H *_j\}_{j=1}^{j=G}\right)$
Consequentialism plus Process	
7. Rawls	$Max\ Min\{p_i(T)\}_{i-1}^{i=P}$
8. Oregon	$Step1\ Max \sum_{i \in N} \hat{q}_i$ $Step\ 2.\ Consult\ and\ adjust\ some\ rankings$
Consequentialism plus Deontology	
9. Capability Rights	$Max\ SWF\left(\{\mathbf{C}_i \mathbf{A}_i\}_{i=1}^{i=P}\right)$
Consequentialism, Deontology and Process	
10. Integration of Claims	$Max\ SWF\ (\mathbf{u, q, T, H, C})$

Definitions

u, Utilities – subscript i denotes ith individual; P, Set of potential patients (or its cardinality); q, QALYs – hat denotes adjustment to account for various factors; $p_i(T)$. Probability that the ith individual is treated; N, Set of potential patients in the recognised needs group; D, Set of potential patients in the recognised needs group who have not fulfilled duties; V, Number of votes; H, Total health care expenditure; G, Set of treatments (or its cardinality) – subscript j denotes jth group; **H,** 1 x G vector of health care expenditures for each treatment group; **C,** vector of capabilities; **A,** vector of achievements; **u, q, T, H,** vector versions of utilities, QALYs, treatment and health-care expenditure distributions which might be subscripted either for groups or for individuals

The formal rules summarised in Table 1 are illustrative of a wide class of social choice rules that could be applied to the problem of setting health-care priorities. The three primary categories reflect discussions in literatures on moral philosophy and ethics that have particular significance for health-care rationing. Consequentialism is a term that refers to a genus of doctrines that attribute ethical significance to features of states of affairs. Clearly, outcomes must play a central role both in decision-making at the individual and at the institutional level in health-care rationing so plausible social choice rules will require a measure of benefit. Deontology is a somewhat looser term that can be taken to mean any moral claim that is not consequentialist though I shall use it to refer to claims like rights and duties that might be thought of having a universal aspect to them. In this sense, deontological claims are distinguished from those in a third category, namely, procedural issues. These might also be thought of as contractual approaches that involve actual or counterfactual deliberation between agents leading either to claims to health-care that are of a contingent nature or recognition of the existence of universal claims. Though philosophers might regard procedure as de-ontological, the literatures on procedural justice have a clear identity that makes it sensible to distinguish them from those of a more universal, less deliberative nature.

This tripartite distinction can be used to impose some order on the otherwise slightly chaotic set of arguments for and against particular choice rules, as I have sought to demonstrate elsewhere, Anand (1999). For present purposes, it is important to note that aspects of these different approaches have been the subject of considerable discussion in the literature – see especially Johanneson and Johansson (1997) and Tsuchiya (2000) on the treatment of age, Mooney (1998) on communitarian perspectives, Dolan et al (1999) and Wailoo and Anand (2001) on procedural issues, and Dolan (2001) and Olsen (1997) on issues related to justice and health. Showing ways in which the issues discussed in these literatures can be formulated in an optimisation framework is a primary aim of the paper.

A number of the specific rules serve to demonstrate that measures of health care play a role even in non-consequentialist approaches to rationing. Conversely, they suggest that health maximisation is but one possible approach to the problem of priority setting. There is a slight tendency for some debates (especially by non-economists) to associate fairness and other ethical issues with the principal argument and perhaps one constraint. However, the social choice rules here show that fairness can be reflected in a variety of ways. The summand reflects fairness both in terms of the arguments it includes as well as the coefficients attached to them. Fairness, in this sense, is a matter of recognising legitimate claims and giving them due weight. In reality, the relative weights given to considerations may have just as significant an impact on the distribution of health as the variables included in summand. Secondly, a

number of decision rules reflect fairness as a constraint. For example, equality of access to health-care (equality of opportunity) can naturally be reflected as a constraint in which case it takes priority over other goals. If the constraint is broadly defined, this might be what is intended. However we should be careful for it is plausible that a large set of detailed fairness constraints would render the feasible set of resource allocations completely empty.

3 Social Welfare and Fairness

Conventional welfare economics might be thought to have a somewhat bifurcated view about issues of equity. On the one hand, it *permits* parametric analyses such as those reflected in the widespread use of Gini-coefficients and applies cost-benefit analysis that makes assumptions about the utility of money for different groups within society. However, the mathematical approach to welfare theory has tended to emphasise the *difficulties* of making inter-personal comparisons of utility and the importance of using information based only preference rankings. Indeed, Sen and others have commented on the existence of a gap between practice and theory and have noted the difficulties that arise from doctrines that prohibit interpersonal comparisons and cardinality.[5] It is, however, perfectly possible to deny the possibility of interpersonal comparisons of utility and yet be concerned about, and willing to make, prescriptions about distribution. If, for example, the aim of public policy is to establish equality of access, or opportunity, then it is the entitlements, rather than the subsequent actions, which matter. Put another way, the assertion that interpersonal comparisons are not possible simply highlights the need to understand on what basis interpersonal allocations are, and should be, made.

Although I and others, have argued against health-maximisation, one advantage that it does have over the conventional wisdom in welfare economics is that it permits interpersonal comparisons on the basis of quantitative information. Our concerns should not be that quantitative information is used and interpersonal comparisons are made but rather with the particular priorities that result and the variables on which they are grounded. For instance, it is generally argued that reduced life expectancy due to socio-economic status should not restrict patients' access to treatment. However, if health-gain maximisation were used to rank diseases affecting two groups identical except with respect to socio-economic status, it would accord priority to the disease that afflicts those who were better off.

What might be called the *Economic Paradox* is perhaps the least intended or sustainable consequence of the QALYs application but it is not the only one as well-known discussions about life values and disability have shown. In this particular case, we could use a single average life expectancy for both rich and poor but in doing so the maximand becomes something other than a simple measure of actual benefit. Sometimes the literature suggests this is a minor modification and whilst it is true that the formal expression is very similar, the conceptual and empirical differences are substantial. Once we begin to move away from *actual* consequences, we enter a space of moral theories that lies outside consequentialism. The question that remains less well understood is whether such non-consequentialist considerations can be handled in a tractable manner: this issue lies at the centre of the paper and is the focus of attention in the following section.

4 Programming and Social Choice

The impact of different social choice rules on total health-care outputs and allocations can usefully be demonstrated with the aid of specific social choice rules and a concrete rationing problem (summarised in Table 2). In this choice problem, there are seven treatment areas relating to different health-care episodes in the life span: in vitro fertilisation, neo-natal care, vaccination, malignant neo-plasms, coronary surgery (CS), hip replacement (HR) and residential care (RC). For each treatment area, data relevant to life expectancy, quality of opportunities, probability of treatment success, cost of treatment and total population who might benefit are provided. These figures are hypothetical but designed to be sufficiently plausible to help develop an intuitive understanding of the kinds of consequences that would follow from implementing different social welfare functions.

Table 2 Data for Choice Problem

Condition	Incremental Life Expectancy (a)	Incremental Capabilities (Health Gain) (Dh)	Probability that Treatment will Succeed (p)	Cost/ Treatment (c)	Maximum Number of Patients
In Vitro Fertilisation	81	0.99	0.3	2000	50
Neo-Natal Care	20	0.05	0.7	5000	100
Vaccination	25	0.05	0.9	10	1000
Malignant Neo-Plasm	35	0.40	0.6	4000	200
Coronary Surgery	8	0.20	0.5	10000	100
Hip Replacement	5	0.50	0.8	5000	50
Residential Care	1	0.30	1	140000	150
Total					1650

The nine specific social welfare functions to be applied to this problem are described below and their formal versions appear in the appendix. C1 is a probabilistic version of health-maximisation where quality of life is measured by a statistic summarising incremental health. It is natural to think of this as QALY based measure but it could in principle be a capability measure. (Although some aspects of quality of life might be deemed to be achievements (the extent to which one is in pain) others, like physical mobility, are both integral to QALYs and capabilities.) C2 is also consequentialist but adds an equality constraint, in this case one that ensures patients suffering from different conditions have equal probabilities of being treated.[6] The rule illustrates the fact that equity can be modelled as a constraint though of course it might more efficiently be recognised as a variable in the maximand itself depending on the nature of the equity issue involved and the priority assigned to it.

A second pair of rules reflects non-consequential considerations. D1 maximises the total number of patients treated and is perhaps the simplest need based rule one can imagine. This seems to characterise the way in which some people feel, and articulate their views, about the allocation of health-care resources. And even for those with more sophisticated approaches to the social choice problem, the number of patients treated often seems to be a significant element of what it is that that they wish to maximise. D2 is related and restricts the

set over which maximisation takes place by excluding a particular treatment. In this case, the rationale for excluding patients from treatment for malignant neo-plasms could be that they were felt to be responsible for their condition. Although the concept of responsibility is far from trivial where causes are multiple, there is mounting evidence from health (Dolan et al 1999) Brower Exel and Stolk (2002), economics (Schokkaert and Devooght, undated) as well as empirical ethics (Miller 1992) that responsibility and cognate issues such as dessert are relevant to social choice.

P1 is a procedural rule in which the aim is to maximise the number of treatments undertaken where treatments are weighed in direct proportion to the number of people in each treatment category. P2 seeks to maximise the number of treatments given directly to people in three categories where patients might plausibly be particularly active voters. As such, it characterises direct political influence of the kind that tends to be shunned by health-care purchasers (again at least in England).[7] Nonetheless, both rules illustrate a category of claim for which there is growing evidence and argument in economics, Frey (1994) and political science, Dryzek and List (2002) as well as in health Peter (2002), Wailoo and Anand (2001).

The last three rules are explicitly integrationist. CD and CP combine elements of consequentialism with deontology and procedure and examples of each can be found in work of Rawls and the experience of Oregon State respectively. For Rawls, the just society is a set of institutions that serve to maximise the outcomes of those least well off whilst the procedural element is counterfactual. Decisions are made from behind a veil of ignorance that denies people knowledge of their particular position in the social arrangements to which they consent. Oregon State, by contrast, began with a ranking of treatments based on their outcome values measured in terms of QALY gain and then adjusted some of these rankings in response to an actual consultation process. The final rule, CDP, combines claims from all three approaches. Consequences are reflected by measures of quality adjusted life years, responsibilities lead to an excluded treatment category and procedural considerations give rise to a weighting of treatments according to the number of people possibly affected. This final rule illustrates the kind of approach that would be needed if one wanted to construct a model of the rationing process in practice though I would also argue that it must also play a key role in any normative theory.

To understand the implications of using these different social welfare functions, standard non-linear programming techniques were used to determine optimal treatment patterns at different levels of expenditure ranging from 10% to 90% of the budget required to treat everyone (the maximal budget). Results appear in Table 3 below.

Table 3 Programming Results – Numbers Treated for Different Social Choice Rules and Levels of Expenditure

	Levels of Expenditure								
Social Choice Rules	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
C1	1470.6	1514.8	1531.7	1548.6	1565.5	1582.4	1599.3	1616.2	1633.1
C2	165	330	495	660	825	990	1155	1320	1485
D1	1470.6	1514.8	1531.7	1548.6	1565.5	1582.4	1599.3	1616.2	1633.1
D2	1303.6	1320.5	1337.4	1354.3	1371.2	1388.1	1405.0	1421.9	1438.8
P1	1445.6	1514.8	1531.7	1548.6	1565.5	1582.4	15599.3	1616.2	1633.1
P2	350	350	350	350	350	350	350	350	350
CD	1450.6	1514.8	1531.7	1548.6	1565.5	1582.4	1599.3	1616.2	1633.1
CP	1470.6	1514.8	1531.7	1548.6	1565.5	1582.4	1599.3	1616.2	1633.1
CDP	1303.6	1320.5	1337.4	1354.3	1371.2	1388.1	1405.0	1421.9	1438.8

The results of this exercise serve to make a number of points. Perhaps most striking are the similarities, rather than the differences, between the choice rules. For many rules (P2 is an exception), the pattern of outcomes converges as the amount of money spent increases: in some cases, differences have already disappeared once one is spending 10% of the budget required to treat everyone (the maximal budget). A second point emerges from comparing rules within particular classes. For instance, if one compares the consequentialist social welfare functions C1 with C2, or the procedural functions P1 with P2, it is apparent that there is considerable *within* class variation. Conversely, some rules in different classes, C1, D1, CD and CP for example, produce identical results for a substantial part of their domain. This suggests that analysing foundational issues and possible consequences without reference to the parametric details of particular rules, may lead to results that are inconclusive or misleading. On the other hand, from a policy perspective, there may be some comfort in learning that different approaches to social choice can have similar prescriptions i.e. that a proceduralist and a consequentialist might agree to a considerable extent.

To ascertain more about the distributive consequences of these rules, one can examine their impacts on health-care allocations at relatively low levels of expenditure (see Table 4). For this exercise we examine the distribution of resources between treatments that results from

applying the nine social choice rules subject to cost constraint being set at 10% of the maximal budget.

Table 4 Programming Results – Numbers Treated by Condition for Different Social Choice Rules at 10% of Maximum Expenditure

Social Choice Rules	Conditions						
	In Vitro Fertiliz-ation	Neo-Natal Care	Vaccin-ation	Malignant Neo-Plasm	Coronary Surgery	Hip Replacement	Residential Care
C1	50	41.2	1000	200	100	50	0
C2	5	10	100	20	10	5	15
D1	50	100	1000	200	70.6	50	0
D2	50	100	1000	0	100	50	3.6
P1	50	100	1000	200	95.6	0	0
P2	0	0	0	200	100	50	0
CD	50	41	1000	200	100	50	0
CP	50	100	1000	20	70.6	50	0
CDP	50	100	1000	0	100	50	3.6

A number of the results are worth highlighting. VA (Vaccination) is the most robust form of treatment in the sense that the optimal quantity remains the same for 7 out of 10 social welfare functions. RC (Residential Care) proves nearly as robust, though in a negative sense, as it is excluded from consideration by 6 out of 10 social welfare functions. These results demonstrate, for example, that there is a consequentialist justification (C2) for allocating funds to RC[8] even though services for the elderly are thought generally to be discriminated against by QALY maximisation. Perhaps most significant from a political perspective is that for 6 out of 10 treatments there is at least one social choice rule that is consistent with zero expenditure on that form of care. Whilst it would be necessary to compare more rules to support more definitive generalisations, it is interesting to note that one of the procedural rules, P2, appears to be the first to diverge, a result that is driven by the exclusion of several categories of treatment. From this perspective the view that rational deliberating agents might reach a consensus appears unduly optimistic.

Taken together, these simulations suggest that a normative rationale can be found for rationing most kinds of health-care. Usually the results are as expected but occasionally this

is not so. The only treatment never completely excluded from being offered, for instance, is coronary surgery. However, there is no sense of personal responsibility for the condition as there is with malignant neo-plasms and sufferers might be thought to be in a relatively strong position in political terms when compared with those seeking hip replacement. In any case, the differences between the rules will become greater as the total cost constraint is made tighter which it is likely to happen given technological change, ageing populations and increasing competition between nation states with respect to taxation systems. Once we know that ethical considerations of this sort can be so formalised, it remains open to question as to whether they should so be taken into account.

5 Capability Rights and Rationing in Practice

Although the range of rules discussed here is inspired by Sen (1993) synthesis of deontological and consequential considerations, the programming approach leaves unexploited a number of consequences that capabilities have for health-care rationing. The most obvious point, perhaps, is that freedom can play a significant and positive role in public health-caring rationing. Previously, comparative debates (between public and private systems) saw taxation, income taxes especially, as a violation of freedom that counted against the public health-care system. The point holds good for negative definitions that characterise freedom as the absence of constraints imposed by other agents. However, and as Isaiah Berlin (1969) famously notes, the notion of positive freedom focuses on what people can do –a focus that capability rights shares. Furthermore, this seems to be a natural interpretation of health-care systems during peace-time –they are, in an important way, about giving people new capabilities or improving or maintaining those they have.

Like health maximisation, the capability approach rejects desire fulfilment as the primary goal and in this it seems they share a rejection of utilitarianism, though the motivation is different. Health maximisation rejects utilitarianism from within consequentialism (the wrong sort) whilst the capabilities approach emphasises the importance of deontological claims, such as rights. Unlike the QALY approach, at least as it is coming to be used, the capabilities approach is subjective. Potentially, QALYs might be subjective, but their aggregation over people to provide an evaluation for a particular treatment suggests either that advocates believe there is considerable inter-subjective agreement about their value, or that an average value is an appropriate basis on which to establish entitlements. Health and the value of the treatments are no more objective than this implies, and that in turn appears to argue the capabilities approach which has objective elements given subjective weights. Furthermore, the basic categories of achievement, wellbeing and agency give us a strong clue about what health is for and hence what priority should be given to particular treatments. Notions of agency and wellbeing indicate for example, why we might support the right of people to die when suffering from painful incurable conditions in a way that health-maximisation does not. Designing buildings with wheel-chair access might not produce any QALYs as conventionally measured but it clearly does add to the capabilities that some people would enjoy as a result.

All models have their limits and one that relates to the capabilities approach concerns the extent to which particular allocations are stable, in the sense of being supported by taxpayers. Voting theory, using the conventional framework might shed light on some of the issues. For example, if a health-care budget were subject to real fluctuations for which a vote maximising politician was held responsible, budget increases might be spread thinly over a wide population whilst cuts could be aimed at a small group benefiting from very expensive treatment. Over time, budget fluctuations might therefore leads to the spreading of entitlements across the population. It is important to understand dynamics such as these when designing policies that establish entitlements and game theory may well have something to offer here.

Second Best Arguments and the Significance of Institutional Contexts

There has been a debate as to whether one should try to input non-consequentialist considerations into the measure of health gain. The position that one should not, is often taken as a rejection of the QALY approach *tout court*. However, we have tried to show that another possibility is open to us. We might accept that a QALY is a reasonably good measure of health gain and yet deny the need to tie its fate to that of the health maximisation rule. Whilst that is our position, we should also note that an even more radical one has been advocated and implemented by Murray and colleagues, (e.g. Murray and Lopez, 1996) who argue a) that the QALY should be replaced by a disability adjusted life year *and* b) that this should be embedded in a more complicated social choice rule.

Economists are likely to argue against the DALY on the grounds that it is not a measure because it has elements of a particular social choice rule that are embedded in it. Indeed, Anand and Hanson (1998) have done so. For one thing, the DALY contains a discount rate that one might wish to extract from a measure of health-gain. For another, the DALY employs a system of weights devised by a panel of experts but there is little reason to think that these weights would be attract universal consent. Of course, one could argue that due to institutional constraints, it might be rational to pursue an approach that appears to be sub-optimal. Given the cultural orientation of health and medicine, the DALY and its various adjustments might lead to a more extensive use of health gain ideas – so the argument would go. Indeed, DALY advocates are careful to point out that their measure needs to be embedded in a social choice rule, whatever that rule is (i.e. that they are not advocating sum maximisation of DALYs). However, that is not the view proposed here and Cookson (2002) takes a very similar line. As he puts it, incorporating non-welfarist information into a measure of health gain runs counter to the spirit of Sen (1979) critique of welfarism because it calls for the information set to be enlarged in a way that makes transparent, by keeping them distinct, the different reasons and sources of claim. These justifications operate in scientific and political realms respectively so a direct evaluation is difficult, if not inappropriate, though we might tolerate pragmatic justifications in the short-term if they lead to the uptake of good science over the longer term.

6 Concluding Remarks

Health-maximisation is less important than once it was as the social rule of choice in health and in this paper I have shown that a panoply of claims which attract growing attention from economists can indeed be formalised. At least some of these alternatives also make use of measures of health gain, though some rules are not consequentialist, let alone utilitarian in nature. The overall message is that many claims or arguments used to oppose health-maximisation can be formulated within tractable social welfare functions amenable to optimisation using programming techniques. The integration of claims view developed here is closely related to the capabilities approach devised by Sen, is capable of addressing a number of the limitations of conventional welfare economics and helps make sense of health-maximisation violations articulated in literatures ranging from medical ethics through to social science and medicine. From a technical perspective, the paper offers a generalisation of the health maximisation choice rule.

A comment about the use of axiomatic theory is warranted. Such methods are invaluable in many respects but they cannot be regarded either as infallible or as necessarily efficient generators of mathematics designed to structure empirical work. It is clear from the way in which decision theorists have rejected the normative interpretation of expected utility axioms such as transitivity, linearity and completeness[9] that axiomatisations do not always guarantee that axiom interpretations will be logically sound.[10] On the empirical side, simple models are excellent places to begin our analysis of the real world but they rarely provide a satisfactory end point for many important and/or interesting empirical phenomena, as Arrow pointed out half a century ago. Furthermore in social choice, axiomatic methods have centred on logical impossibilities whereas empirical work also needs theory that provides structure for what *is* possible. Finally, axiomatic methods have not, for the most part, shed much light on multivariate functions or the particular functional forms that would follow from the adoption of particular ethical positions, though both are important for understanding how best to model rationing.

There is, as always, room for more research. First, it would be useful to extend and develop the programming model by applying it to real intervention data. Combining this with survey evidence relating to voters social welfare functions would also seem to be of value. Second, it would be interesting to see what happens if one uses different approaches to deontological claims. A Kantian approach does not sit well with ranking of patients by cost of treatment but is more likely to specify a set of people who should be treated [11]. The question of how many people to treat, and hence what health-care budget to set, has not been addressed in this paper explicitly though it too deserves attention. Third, it seems that at least some of the approaches mentioned here suggest the desirability of a game-theoretic [12] analysis. The social welfare function approach is useful for describing what should happen but it does not tell us about features such as stability or envy-freeness. These questions need to be addressed if we are to understand whether certain distributions and procedures will be supported by the citizenry over time.

At a practical level, and notwithstanding the attention attracted by the National Institute of Clinical Excellence (NICE) approach to rationing, probably the most decision relevant algorithms remain the formulae for distributing national resources to regions, hospitals and

general practitioners. These formulae tend to have been devised by operations researchers and medical statisticians and draw heavily on demographic and morbidity data. However, what this paper demonstrates is that a wide range of ethical issues to do with efficiency and fairness that lie at the centre of new approaches to welfare economics can be formulated in a way that could profoundly influence the design of such resource allocation algorithms.

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Appendix – Key to Social Choice Rules

$$C1 \quad \sum_{i\ e\ \Omega} a.\Delta h.p$$

$$C2 \quad \sum_{i\ e\ \Omega} a.\Delta h.p \ st \ \#(t_G)/\#(G) = k \ \forall \ G$$

$$D1 \quad \sum_{i\ e\ \Omega} \#(t)$$

$$D2 \quad \sum_{i\ e\ \Omega \setminus MN} \#(t)$$

$$P1 \quad \sum_{i\ e\ \Omega} w.\#(t) where\ w = \begin{cases} 50\ if\ \ i\ e\ IV \\ 100\ if\ \ i\ e\ NC \\ 1000\ if\ \ i\ e\ VA \\ 200\ if\ \ i\ e\ MN \\ 100\ if\ \ i\ e\ CS \\ 50\ if\ \ i\ e\ HR \\ 150\ if\ \ i\ e\ RC \end{cases}$$

$$P2 \quad \sum_{i\ e\ MN \cup CS \cup HR} \#(t)$$

$$CD \quad \sum_{i\ e\ \Omega} \Delta h.p$$

$$CP \quad \Sigma_{i\,e\,\Omega} w.a.\Delta h.p \text{ where } w = \begin{cases} 50 \text{ if } i\,e\ IV \\ 100 \text{ if } i\,e\ NC \\ 1000 \text{ if } i\,e\ VA \\ 200 \text{ if } i\,e\ MN \\ 100 \text{ if } i\,e\ HC \\ 50 \text{ if } i\,e\ HR \\ 150 \text{ if } i\,e\ RC \end{cases}$$

$$CDP \quad \Sigma_{i\,e\,\Omega \setminus MN} w.a.\Delta h.p \text{ where } w = \begin{cases} 50 \text{ if } i\,e\ IV \\ 100 \text{ if } i\,e\ NC \\ 1000 \text{ if } i\,e\ VA \\ 100 \text{ if } ie\ CS \\ 50 \text{ if } i\,e\ HR \\ 150 \text{ if } i\,e\ RC \end{cases}$$

Definitions

A, additional life expectancy if treatment successful; Δh, health increment following successful treatment; p, probability that treatment will success; U, set of all potential patients; t_G, set of treated patients in jth group; G, set of potential patients in treatment group G $\left(\bigcup G \equiv \Omega\right)$; k, a constant. Weights: In Vitro Fertilization (IV); Neo-Natal Care (NC); Vaccination (VA); Malignant Neo-Plasm (MN); Coronory Surgery (CS); Hip Replacement (HR); Residential Care (RC).

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[2] For the purposes of this paper, I shall use health-maximisation when referring to the social choice rule, and the QALY as a measure of health gain. A clear distinction between the two will be maintained so that rejection of health maximisation can be separated from the use of the QALY in other, more appealing social choice rules. Nothing in this paper depends on how the QALY is operationalized.

[3] I am grateful to one of the referees for making this point. Where there are substantial medium term threats to the population, health-maximisation might yet be appropriate – civil war and HIV/AIDs are examples that come to mind.

[4] The disability adjusted life year (DALY) is an example.

[5] One issue that I shall not discuss is the distinction between equity in health, and equity in health-care, discussed recently by Sen (2001).

[6] This might be thought to imply the existence of group rights, which are certainly contestable. However, one could think of them applying only to groups that can be identified on statistical grounds, a move that is less costly in terms of moral ontology than the assignation of such rights on the basis of group identity. I am grateful to Jack Dowie for raising this issue.

[7] There is a tendency to avoid outright refusals to fund a treatment area – the preference seems to be for saying that treatments would not *normally* be funded with the implication that exceptions may be made if merited by the case. This is not to deny that rationing has become more explicit Edwards, (1996).

[8] Williams (1997) has for some been arguing that are many reasons for discriminating against the elderly. This may be so, but C2 demonstrates that it is possible to give a consequentialist justification for treating the elderly like any other group, a result driven in this case largely by the equity constraint. The point is just that we *can* construct a consequentialist justification for excluding age of patient from any entitlement calculation, not that we *must* do so. The elderly in the UK might be entitled to treatment for procedural reasons – there is an actual social contract from cradle to grave – which could take priority over a fair innings argument.

[9] The consequences of incompleteness for health are subject of a useful discussion by Shiell et al (2000).

[10] In the past the literature on axiomatic methods has tended to divide starkly into for and against lobbies. More recently the atmosphere does seem, both in mathematical economics and in applications to health and choice under risk, to have responded to many of the normative concerns that decision theorists have raised (see for instance Anand (1987), Gendin (1996), Machina (1989), McClennen (1987) and Sugden (1985). Miyamoto et al (1998) and Osterdal (2002) provide excellent examples of axiomatic applications to health that are both constructive and, in interpretational terms, complementary to the kind of approach developed here.

[11] I am grateful to Aki Tsuchiya for highlighting this point.

[12] The term should be taken to include experimental game theory or behavioural game theory.

[13] Cost, feasibility and non-negativity constraints are omitted throughout the paper.

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