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**JUSTICE IN HEALTH: DALYTARIANISM,
EQUALITY OF OPPORTUNITY AND HEALTH POVERTY**

Abstract

The ethical and measure-theoretic foundations of *Disability-Adjusted Life Years* (DALYs) are critically reviewed, focusing on aggregate DALY-minimisation, and its application in the definition of health care priorities. The desirability and feasibility of a single aggregate health measure applicable to (descriptive) burden-of-disease accounting as well as (normative) health-policy design, is questioned. The ethical limitations of the axioms underlying the principle's neutrality with respect to the *distribution* of health *outcomes* and life-long health *achievements*, as well as *opportunities for accessing* health outcomes and achievements, are identified. An alternative approach to distributive justice in health is proposed, based on measures of equal opportunity of health and health poverty, and its practical relevance is illustrated through the problem of specifying an *essential health care package* under conditions of epidemiological polarization.

Resumen

Los fundamentos éticos y de medición de los *Años de Vida Saludable Perdidos* (AVISAs), como medida agregada de la salud, son analizados críticamente, enfocándonos en su aplicación en la definición de las prioridades de salud pública. Se cuestiona la deseabilidad y factibilidad de una medida única para la contabilización (descriptiva) del peso de la enfermedad y el diseño (normativo) de políticas públicas en el sector salud. Se identifican las limitaciones éticas de los axiomas que subyacen la neutralidad de la medida con respecto a la *distribución* de estados de salud en un punto del tiempo, logros en salud a lo largo de vidas enteras, así como *oportunidades para acceder* a estados de salud y vidas saludables. Se propone una concepción alternativa de justicia distributiva en salud, basada en medidas de igualdad de oportunidades y pobreza en el espacio de la salud, y se ilustra su relevancia en el problema de especificar un *paquete esencial de servicios de salud* en condiciones de polarización epidemiológica.

Introduction

The development of this measure, DALYs, was intended to make the ethical dimensions of quantifying health more transparent.

Murray (1997)

When the two principal international organizations responsible for economic development and health issues—the World Bank and the World Health Organization—present a common, new and very precisely specified measure of the burden of disease to identify priorities for health-sector interventions worldwide, one might be forgiven for thinking that three decades of research on *Quality-Adjusted Life Years* (QALYs) measures—if not the two thousand-year search for a universal measure of human functioning following Aristoteles—have finally come to an end. Unfortunately, we shall argue, the proposal of *Disability-Adjusted Life Years* (DALY)¹ as a universal standard for health policy design is not adequately supported by the ethical and measure-theoretic foundations provided on the measure's behalf. In fact, though DALYs may be defensible—though hardly uncontroversial—as a descriptive measure of the aggregate burden of disease affecting a country, region, or the world as a whole, aggregate DALY minimization represents a particularly unfortunate choice of standards when it comes to the normative task of defining health priorities for purposes of resource-allocation and policy design.

Though DALYs have been the subject of some incisive critical reviews since their first appearance, critics and apologists alike have focused on the choice of

¹ A first version of DALYs was used to estimate the global burden of disease (GBD) in a joint WB-WHO background study for World Bank (1993). The final version of the measure and study (to the present date) was presented in the ten volume *Global Burden of Disease and Injury Series*, summarized in Murray and Lopez (1996a). The most detailed methodological defense of DALYs, to which we shall refer here, is presented by Murray (1996).

specific parameters,² rather than the more basic—but largely implicit—ethical assumptions underlying the informational contents of the measure and its additive inter-personal aggregation formula. For example, Anand and Hanson (1997) note—and Murray and Acharya (1997) summarily dismiss—some of the distributional limitations of DALYs we shall discuss below, but neither provides substantive arguments in support of their respective ethical positions, beyond quoting general ethical principles which, as we shall see, turn out to be both unsupported and vacuous. On this point, at least, the recent debate around DALYs has made little progress in relation to earlier debates on the ethics of QALYs and philosophical discussions on health ethics more generally.³

Here we shall focus on four fundamental limitations of DALYs as an aggregate measure of (ill-) health:

- a) the use of a *single* multi-dimensional and multi-purpose measure of health-loss, aggregating loss due to mortality and due to a broad range of disabilities, and applicable simultaneously to problems of descriptive measurement and normative policy design,⁴

² Following Murray and Acharya (1997), DALYs lost due to the incidence of a condition j at time t for person i are defined as:

$$\int_{t_i}^{t_i+L(a_i)} D_j C x e^{-\beta x} e^{-r(x-a_i)} dx,$$

where x is time, $D_j = (0,1)$ is the disability weight associated to condition j , D is 0 for perfect health and 1 for death, β is the age-weighting parameter (with C an age-weighting correction constant introduced to ensure the choice of β will not affect the global number of DALYs), r is the discount rate, a_i^t is the current age, a is the age of onset, $L(a)$ is the duration of the condition in the case of disabilities or the standard life-expectancy at age a_i^t in the case of death (at birth, 82.5 years for females and 80 years for males). Summing first, for each individual, over all the conditions suffered by him/her starting at time t , and then over all individuals in the population, we obtain the aggregate DALY measure for a given society at a given time.

³ On the former, see the contributions to Bell and Mendus (1988), particularly Lockwood, Broome, and Harris. On the latter, see Daniels (1985) and Kamm (1993).

⁴ In a kind comment to a presentation of an earlier version of this paper, Philip Musgrove observed that the World Bank has endorsed DALYs only as a descriptive measure for the burden of disease, not as a normative measure for the allocation of health care resources. However, as Murray (1996, p.3) correctly notes: "The infant mortality rate, life expectancy and, to the extent they are adopted, DALYs, are used normatively and thus become normative measures." Moreover, the World Bank does in fact use DALYs in the 1993 Report with clear and, as we shall argue (section 6), questionable normative purposes, in defining "the essential public health package" (World Bank 1993, p 106-107).

- b) the measure's invariance in relation to the inter-personal *distribution of health outcomes*,
- c) the measure's invariance in relation to the inter-personal *distribution of life-long health achievements*, and
- d) the measure's invariance in relation to *opportunities for access* to health outcomes, and their distribution.

While these restrictions⁵ on the information relevant for measuring aggregate health states are formally independent from each other, their combination is not entirely arbitrary. They amount jointly to a specialized version of a very old conception of aggregate value: *utilitarianism*, redefined in the space of health. We may therefore refer to this as *DALYtarianism*.

Unfortunately, in the context of contemporary moral and political philosophy, especially after Rawls (1971), this classical pedigree can hardly lend moral credibility to this view.⁶ But could the principle turn out to be immune to the traditional objections to preference-based utilitarianism when reinterpreted in the space of health? For example, Roemer (1993) has argued plausibly in favor of a utilitarian principle for health-care resource allocation between countries, taking infant mortality as the relevant minimand. However, with individual persons as the relevant units, and DALYs as the minimand, we shall see that utilitarianism turns out to be even less defensible than in its more traditional form.

Before considering the theoretical limitations of DALYs, however, it is important to be clear about the important practical achievements of the measure. In the context of the enormous multiplicity of alternative health measures currently competing for attention in the literature, DALYs represent an important effort to provide a single, broadly acceptable measure of the burden of disease from premature death and disability. Though we shall argue that the unifying project is over-ambitious, this is not to deny its benefits in more restricted forms. In particular,

⁵ It may not be immediately obvious that the first point—inter-dimensional aggregation constitutes an informational restriction on the measurement of health states. The informational loss here involves inter-dimensional differences. For example, if we think it is relevant to distinguish years of life *lost* (literally) due to premature mortality, from years of life *affected* by disability, reducing these to a common currency like DALYs may benefit us in terms of decision-making expediency, but only at the cost of informational impoverishment. The informational interpretation we shall use in analyzing DALYs owes much to Amartya Sen's informational analysis, critique, and generalization of welfare economics, for which he was awarded the Nobel Prize in Economics for 1998.

⁶ On the limits of utilitarianism, see Smart and Williams (1973), Sen and Williams (1982), and Glover (1990).

DALYs may be well placed to fill the role in macro-epidemiological accounting that the concept of *gross national product* (GNP) does in macroeconomic accounting—even if, like GNP, it is not particularly useful as an indicator of social welfare, nor to define priorities for resource allocation (see section 5).⁷

Again like GNP, DALYs could possibly play this role not so much because their foundations are especially transparent and robust (they are not, as we shall see), but because of their rapid and broad acceptance and use, not only in the noted international organizations, but within an increasing number of countries.⁸ After all, an imperfect but well-established convention, capable of resolving important and urgent coordination problems, is generally a better state of affairs than a multiplicity of competing standards, even if any one of these is as good or better than the established one. And since conventions are generally either imposed or succeed through competition in (very imperfect) “markets of ideas”, rather than through optimal design, imperfection is the norm rather than the exception.

Finally, perhaps the strongest argument in favor of DALYs in this role is its use in the unprecedented WHO-WB effort to quantify the burden of disease globally (in 1990, and projected to 2020), including patterns of mortality and disability from disease and injury—and associated risk factors, including tobacco, alcohol, poor water and sanitation, and unsafe sex—for 240 conditions in eight regions, covering the entire world.

Given these practical achievements of DALYs, together with the tested robustness of the measure to variations in some of its principal parameters (Murray and Lopez 1996, Ch. 5), the analysis of its general theoretic foundations may appear to be at best an interesting academic exercise, and at worst an unwelcome distraction from the urgent practical need for a single measure to assess the burden of disease, and design effective policies accordingly. Despite the historically unprecedented improvements in health the world has experienced over the latter half of this

⁷ It is important to note, however, that an important characteristic of well established aggregate measures, like GNP, the infant mortality rate, and the poverty headcount ratio, is that they are easily interpretable because they involve a single dimension and a simple additive function. This is of course not the case of DALYs.

⁸ This is consistent with original expectations: “I firmly predict that by the turn of the century the official reporting of health outcomes in dozens of countries and globally will embody the approach and standards described in [*the Global Burden of Disease and Injury Series*]”, Dean T. Jamison, Chairman, *WHO Ad Hoc Committee of Health Relating to Future Intervention Options*, quoted in Murray and Lopez (1996b). At present (end 1998) DALYs appear to have been estimated—though apparently not always with comparable methodologies and rigor—for 24 countries (Musgrove 1998). In Mexico, among the first countries for which the burden of disease was estimated using DALYs, this measure has been used to estimate an “essential health service package” (Bobadilla et al. 1994, Frenk et al. 1994).

century, we will still miss by a rather large margin the "Health for All by the Year 2000" deadline, through basic universal health-care provision, declared at the historic WHO-UNICEF Alma-Ata Conference twenty years ago. Apart from the utopian optimism natural to all such declarations of good intentions at a global scale, this could be interpreted as an international collective action failure due in part to a lack of clear priorities, in turn reflecting the absence of common standards. For example, WHO's own official definition of health as "a state of complete physical, mental, and social well being and not merely the absence of disease or infirmity" (WHO 1996) is clearly not very helpful as a guide for public action. Perhaps DALYs are, despite their foundational limitations, the best practical candidate available for such a guide. To dispel this pessimism, following the theoretical critique of DALYs we explore an alternative measure which is both based on egalitarian foundations and specifically designed to address basic health priorities (rather than the aggregate burden of disease).

II. DALYs: Common Values?

It is to his credit that the principal architect and apologist for DALYs recognized the necessity of providing "a framework for thinking about the normative aspects of DALYs".⁹ Given the claimed centrality of this concern to the whole enterprise, however, his attempt to do so turns out to be surprisingly limited. It may be summarized in two principles of social choice, one—*deliberative consensus*—uncontroversial, but practically vacuous in this application, the other—*invariance to non-health characteristics*—precisely restrictive, but ethically indefensible in the context of other assumptions implicitly underlying the theory. Here we consider the first principle and its implications for the two key parameters of DALYs: age- and disability weighting. Section 3 considers the second and more central principle, in relation to the informational limitations and aggregation structure of DALYtarianism.

Rejecting the idea of grounding DALYs on a specific conception of the good, Murray proposes "a principle of 'filtered consensus' which borrows from the common values [Bok 1995] and 'laundering preferences' [Goodin 1986] approaches".¹⁰ This is in line with the preoccupation in contemporary political philosophy with *procedural vs. substantive* conceptions of social choice in the face of value pluralism, and more specifically with the idea of *deliberative democracy*.

Perhaps the most carefully argued foundation Murray could have found for his principle in contemporary philosophical thought is the work of Rawls (1971, 1993), especially the concepts of "reflective equilibrium" (in the early work) and "overlapping consensus" (in the later one).¹¹ However, while a procedural approach seems reasonable—indeed inescapable—in the context of what Rawls has called "the problem of political liberalism",¹² this is less obvious in the much narrower problem of defining a measure of wellbeing or success for a specific, precisely

⁹ Murray (1996), pp 3-8.

¹⁰ Murray (1996), p. 5.

¹¹ However, Murray explicitly rejects as what he wrongly takes to be an example of the substantive approach those who "inspired by Rawls would argue for a measure that emphasizes the health conditions of those who have the worst health" (p4). For an application of rawlsian concepts in the definition of just health care, see Daniels (1985).

¹² "How is it possible that there may exist over time a stable and just society of free and equal citizens profoundly divided by reasonable though incompatible religious, philosophical, and moral doctrines." (Rawls 1993, p.XX)

defined domain of social choice. This would seem to be especially so in the case of health, which may be as good a candidate for something approximating objective scientific measurement of a human good as we could get.

Though the practical implications of the principle of "filtered consensus" for the definition of DALYs are never actually spelled out by Murray, an apparent methodological implication is a preference for opinion surveys over philosophical, economic, or scientific analysis in the definition of the measure's key parameters, especially age- and disability-weighting.¹³ Consider age first.

Anand and Hanson (1997) (AH) argue against including age (as well as time) as a relevant attribute in the information-set of DALYs, citing a "principle of universalism of life claims...a common intrinsic valuation of human life, regardless of the age at (or time period in) which it is lived". However, the arguments they provide only show, if correct, that Murray's own arguments for age-weighting must be dependent on the human capital approach to valuing life, which both Murray and AH find unappealing. Murray concedes that there is "an unavoidable element of truth in the human capital calculus, however distasteful the logical extension of the argument may be...",¹⁴ but he favors, largely on the basis of opinion polls, a broader non-monetary version: "Adults are widely perceived to play a critical role in the family, community, and society".¹⁵ While it is true that Murray's arguments are at best incomplete here, AH's proposed universalism principle doesn't seem to take us very far either.

First, it seems improbable that anyone would judge the marginal value of *her own* life (MVL) to be constant over her life span. We may well agree on the "common intrinsic valuation of human life". But surely we value our lives not intrinsically but instrumentally, for the experiences and projects it allows us to have (Kamm 1993).¹⁶ And our capacity to form and pursue these may vary systematically

¹³ The third key parameter, time-discounting, has been discussed extensively by Murray, his critics (Anand and Hanson 1997), and previous work on QALYs (e.g. Broome 1993), so we shall concentrate on the other two parameters here.

¹⁴ Murray (1996), p. 59.

¹⁵ Murray and Lopez (1996b), p. 9.

¹⁶ AH appear to fall here into the same "intrinsic value" fallacy as Murray does when he dismisses, against AH, the relevance of distributional information (see below, note 33). Just as inter-personal differences in need (due to differences in the years and quality of life lived) may justify differential valuation of additional life-years for different people, *intra*-personal differences in cognitive development may justify differential valuation of additional life-years at different ages.

over a lifetime as a function of natural stages of cognitive development. For example, it would not seem incoherent for someone to be unwilling to trade additional life years at adulthood or childhood, for an equivalent prolongation of life as a small infant or old person.¹⁷

Secondly, a constant MVL implies that there is a point in embryonic development when value—and all the value life will ever get—suddenly appears out of value-less matter. Unless we want to believe that there is such a discontinuity in the emergence of human life itself, it seems reasonable to suppose that the value of life must also emerge by degrees.

Thirdly, and most importantly, considering now the value of life interpersonally, constant MVL would imply that we should be indifferent between giving 20 more years of life to a 20 year-old than to an 80 year-old, assuming both to offer equally healthy prospects over this period and ignoring discounting. One reason most would favor the younger party is that we naturally assume his quality of life will be higher. But even granting the assumption of equal health prospects, there is a simple and strong fairness case to be made for the younger individual because he has had *less life* to live, and thus has more *need* for additional life-years.¹⁸ Note that this is not equivalent to favoring him because he is farther away from the ideal life expectancy, as measured by the *years of life lost* (YLL) element of DALYs (and so it wouldn't entail double counting in this context). To see this, consider that on this argument we may favor the young even (and perhaps especially) if we expect he will be *less healthy* than the old over this period, thus failing to minimize DALYs.

The combination of increasing MVL early in life (first and second points) and decreasing MVL overall (third) implies an inverted-U value-of-life curve similar to the one used to estimate DALYs.¹⁹ This suggests that age-weighting can be given plausible ethical foundations, in spite of AH. However, as we shall see, the fairness argument is unavailable to Murray due to his second principle.

Consider now disability-weighting, the problem which gave origin to the whole QALY literature. Analytically, there are two problems here: making the loss of quality of life due to different kinds of (non-fatal) health outcomes comparable,

¹⁷ Though, of course, who remembers? Maybe if we did, the experiences of the infant would more than compensate for the projects of the adult. The point is that any such preferences would at least not be incoherent, contrary to what AH's "universalism of life" principle would entail.

¹⁸ See Lockwood (1988) and Kamm (1993)

¹⁹ Cp. the figures in Murray (1996), p 60, and Kamm (1993) p 249.

and making these in turn comparable with life lost due to premature death. Practically, the first problem can be solved through the second one, by taking years of life lost as the common currency. This is the approach adopted by DALYs. The possible variations involved here are such that over 300 instruments have been reported in the literature.²⁰ We shall only be concerned with two issues: the concept of health state, and the source used to define the relative weights of different states.

On the first issue Murray follows WHO's classification of health states into *impairment* (to the organic system), *disability* (in the individual's performance), and *handicap* (taking into account the social environment). He favors the concept of disability on grounds of his second principle (section 3), citing as an example a disability (subnormal intelligence) which may imply only a mild handicap in a poor rural environment, but a very important one in a rich urban one, thus leading, on a handicap-based measure, to more investment per year lived with disability (YLD) in the latter than in the former.

Given that the reference group (see below) is asked to take into account "the average social response or milieu in the world", Murray notes that in practice the concept used is "the average handicap from disability".²¹ But of course, averaging social conditions between rich and poor just means ignoring them as far as the differences between these two groups are concerned. The above example notwithstanding, it would seem more natural to assume that the production of health measured in the space of handicaps must in general be monotonic in wealth: given a common disability, the rich would appear to be generally better placed than the poor in terms of opportunities to minimize its handicapping impact. Strangely enough, Murray seems to believe that taking such opportunities into account would mostly discriminate against the poor.²²

"In *some* cases, similar disabilities may lead to a greater handicap for an already disadvantaged person than for the more fortunate. In *many* cases, however, allocating resources to avert handicap as opposed to disability could exacerbate inequalities."

We shall come back to the important question of opportunities in the next section. Consider now the second issue. With disability as the chosen health state space, the next problem is to define the relevant informational basis to derive social

²⁰ Spilker et al. (1996), quoted in Murray (1996), p 24.

²¹ Murray (1997), p. 713, n 9.

²² Murray (1996), p. 33. My emphasis.

preferences between different conditions in this space. In principle, this source could be of two general kinds: a) observable data or expert scientific opinion about the causal correlation between specific conditions and failures in general categories of human functioning, and b) preferences over different conditions, reported (or revealed) by patients, patients' families, health-care providers, or the general public. In practice, of course, we lack the necessary epidemiological knowledge, and opinion surveys of the required scale and depth are unfeasible.

Consistent with the concept of "filtered consensus", the problem is resolved in the case of DALYs through a highly structured and deliberative process of preference revelation—the "person trade-off protocol"—applied to small groups of health-care providers. While this seems a good compromise between epistemic efficiency and practical implementability, the *exclusive* reliance on the preferences of health-care providers, however deliberative, has some important limitations.

First, note that this may be an especially unfortunate choice of reference group given the stated aim of DALYs to "decouple epidemiological assessment from advocacy",²³ and the intended application of DALYs for the design of health-sector reforms. However well intentioned, the judgements of health-care providers may reflect as much the priorities which have guided the allocation of health-care resources in the past, as the way they *should* have been assigned. After all, it is a common and well-documented dissociative phenomenon that even expert professional judgements adapt to rationalize prior decisions and practices.

Secondly, practical expediency²⁴ cannot justify *completely* ignoring the other possible sources of information, especially the preferences of those most directly and vividly aware of the loss entailed by particular disabilities, as well as the main affected party: the patient. This restriction would be comparable to defining a measure of consumer satisfaction failing to rely even partly on a consumer survey, in favor of the expert opinion of industrial designers, not about how well different products are expected to satisfy consumers, but how well they *should* satisfy them given their design characteristics. Moreover, the exclusion of patients' opinions is inconsistent with the principle of "filtered consensus", if this is based, as Murray suggests, on Goodin's concept of "laundered preferences". The latter involves reflective and considered judgements on the part of autonomous, rational agents, not a process of *representation* of these preferences by expert authorities. While health-care providers would be important to inform these judgements on the part of

²³ Murray (1996), p. 1.

²⁴ "To speed up the already demanding process, the protocol has been designed to be used with health-care providers..." Murray (1997), p.715.

patients—especially in helping them to compare different disabilities—they can hardly substitute for them.

Murray provides a substantive reason for the paternalistic definition of disability-weights independently of practical expediency: adaptability. Quoting De Tocqueville on "happy slaves", he touches here on an important point which has been revived more recently as the problem of "sour grapes" or "cheap tastes", in rejecting the utilitarian metric in problems of distributive justice.²⁵ This involves the capacity of the poor to attain levels of satisfaction as high as, or even higher than, the more fortunate, by lowering their expectations in the face of chronic deprivation.

But Murray's discussion here confuses three different concepts. One is indeed analogous to sour grapes. This is the paradoxical but common observation that the poor often rate their health as better than do the better off, and are also more satisfied with the health services they receive, despite being characterized by worse objective indicators of both health status and quality of health services. This phenomenon may justify the use of objective health indicators, rather than self-reports or demand studies, in problems of resource allocation, but is not directly relevant to the question of disability-weights.

What is relevant to this problem is the observation that people also tend to adapt to specific disabilities not by lowering their expectations, but through highly *functional* adaptive mechanisms. This is especially common in physical disabilities, with particularly impressive results in the major sensory-deprivation disabilities like deafness and blindness. Since this has nothing to do with "happy slaves", however, paternalism is even less justified in weighting such disabilities.

But Murray confounds both of these very different forms of adaptation, with a third case that is not a form of adaptation at all. This involves the possibility that a cognitive disabled person could be perfectly satisfied with her condition, as a consequence of that condition.²⁶ This is probably more the exception than the rule in cognitive disorders, but it would in any case be a problem of cognitive capacities, rather than adapted preferences. The relevant quote for this case is not from De Tocqueville, but from J.S. Mill, in *Utilitarianism* (p. 237):

²⁵ See Sen (1980), Dworkin (1981), Elster (1983).

²⁶ "It would be exceedingly perverse to argue that we should *not prevent* deafness simply because those who are deaf are able to adapt so well to their loss of hearing. It would be *equally* perverse to argue *against preventing* cognitive impairment due to micronutrient deficiencies because the cognitively impaired are happy" Murray (1996), p.31 (my emphasis). As we shall see, such misleading talk about total denial of treatment, when the issue is one of relative weights and trade-offs, accounts for a fallacy Murray repeatedly falls into, apparently misled by his own rethoric.

It is better to be a human being dissatisfied than a pig satisfied; better to be Socrates dissatisfied than a fool satisfied. And if the fool, or the pig, is of a different opinion, it is because they only know their own side of the question.

Here, at last, paternalism would indeed be justified.

That these distinctions have important practical consequences may be appreciated by noting, for example, that few blind people would probably be prepared to trade their condition for Down Syndrome, much less accept it to be worse than the latter condition in a proportion of more than 6:4, as the actual DALY weights imply. If this is because they have managed a high degree of adaptation to their condition, so much the better. This functional capacity is certainly not a reason to ignore their preferences. If anything, it is a good reason to doubt precise comparative judgements of those who have not themselves experienced this condition.

III. DALYtarianism: Principles and Pumps

The most important of Murray's explicit ethical principles is presented as two propositions, which may be stated more succinctly as a single *invariance* condition:²⁷

the burden calculated for like health outcomes should be independent of all non-health characteristics of the individual (Prop. 1), except age and sex (Prop. 2).

This is not a new idea—in normative theory generally (as we shall see shortly), and in health ethics specifically. Ignoring the qualifying clause on age and sex,²⁸ the principle corresponds to what Williams (1988) has called "the standard rule of QALYs" (p.116):

A unit of health benefit (say 'an additional year of healthy life expectancy') is to be regarded as of equal value no matter who gets it.

Williams claimed this rule "has a strong non-discriminatory egalitarian flavor" (p.117). Echoing this to the word, Murray (1996) also claims his principle has "a strongly egalitarian flavor" which, he adds, "may be unappealing to those who are welfare maximizers or those who believe in maximizing the conditions of the worse off" (p.7). However, not only does he fail to provide any arguments in support of this intuition, but his interpretation of the principle as a "middle-ground" between the latter two reveals a serious, and rather puzzling, conceptual confusion.

A middle-ground implies a *common* ground, but the positions contrasted here differ over *two* dimensions: the assumed concept of individual good or well-being—welfare vs. "conditions"—and the postulated method of inter-personal aggregation—maximization vs. maximin. The concept of DALYs in itself, as an inter-personally comparable measure of the burden of disease suffered by individual persons, only addresses the first problem. In principle, it could be aggregated inter-personally in any way we like, including maximin, or more accurately given that DALYs are a

²⁷ Murray (1996), p 6.

²⁸ Beyond the above comments on age-weighting, we shall not be further concerned with this clause here, except to note that setting a lower maximum life-expectancy for man than for woman in effect violates the concept of equality of opportunity for health to be proposed below, discriminating against man.

bad, *minimax*: minimizing the DALYs of the individual or group accounting for the maximum level of DALYs.

Murray cannot mean, by placing the invariance principle in the "middle-ground", that it is an optimal compromise between equity and efficiency, as he takes these two extremes to be represented among economists—human capital theorists favoring the more productive (and generally rich), and income Rawlsians, like AH, favoring the poor. He can only mean that the principle prohibits discrimination as a function of income or wealth, thus favoring rich and poor alike. Calling this position a middle ground even between the latter, narrower views, is highly misleading, since the principle avoids the question which separates these two positions altogether.

More generally, failing to draw a distinction between the measure of individual success and the rule to aggregate such measures inter-personally, Murray also fails to distinguish two very different ways in which equity considerations might enter into the measurement of health. Bringing in income, or more generally *differential opportunities to access health*, into the measure of health, is one of them. Defining an aggregation rule which takes into account the inter-personal distribution of this measure is another, wholly independent one. While Murray gives only the briefest consideration to the first of these complex questions,²⁹ he—and with him the GBD Study and World Bank (1993)—fails to address the issue of justice *in health* altogether.

I can only think of two possible explanations for this rather major lapse. The first is that it was simply taken for granted that since: 1) DALYs measure bad health outcomes, and 2) bad health outcomes must be minimized in the aggregate, this entails 3) minimizing the *total sum* of DALYs inter-personally. The second is that the invariance principle was taken to imply 3. Both inferences are wrong.

The first is wrong in both of its steps. 3 does not follow from 2 because, as we have already noted, we can aggregate DALYs through many other possible social choice rules than total-sum minimization, like *minimax*. And 2 does not follow from 1 because DALYs could serve as a measure of a person's burden of disease even if we fail to apply any aggregative SWF at all. This would happen, in particular, if we adopt a *deontological* approach to the evaluation of health interventions, instead of a *consequentialist* one. For example, doctors could be committed to a professional ethic which makes it their duty to act always to prevent, *in every patient they treat*, as much loss of healthy life-years as they can, even if by

²⁹ Murray (1996) devotes 2.5 out of the 98 pages of his article to this issue (pp 61-63).

failing to do so on one occasion they could provide a higher sum of healthy life-years overall.³⁰

Secondly, the invariance principle is compatible with both of the noted alternatives to minimizing DALYs. Minimizing DALYs in contrast to minimizing DALYs for the worst-off identified in terms of some other dimension, as Murray considers—uses no more information in estimating the burden of disease than DALY-information. This would also be true of a deontological DALY-ethic. Indeed, both of these rules have an informational advantage over minimizing DALYs. While the latter requires a cardinal inter-personally comparable health-measure, minimax only requires ordinal (comparable) health-information, and the deontological ethic doesn't require an inter-personally comparable measure at all—since it prohibits inter-personal health trade-offs of any kind—though it still requires an intra-personal (ordinal) measure to identify the best cure for each patient.

So why did Murray take it for granted that the invariance principle rules out all other possible solutions to the health-aggregation problem but total sum minimization? I think this may be explained through the implicit assumption of a further principle. This states that the relevant time-unit of health benefit is a *year*. Though this may seem too obvious in the context of QALYs and DALYs to require explicit statement, the relevant unit could in principle extend to the whole of a person's life. The difference is critical. In the latter case, the (unqualified) invariance principle would entail valuing *whole healthy life* units equally for all. This would be consistent with the noted deontological conception, as it would not allow inter-personal life-year trade-offs: everybody would be treated, in effect, as if they had an inviolable right to a healthy life. Of more practical interest for health policy-making purposes, we could, as we shall suggest below (sections 4 and 5), define a more limited unit of a *minimum healthy life*. Applying the invariance principle at this level, and defining the minimum health line in DALY space, would entail DALY-minimax. By contrast, with a yearly health unit, as with the *util* unit in utilitarianism, treating "like as like" at the level of these intra-personal units rather than of persons' lives, means in effect, as Rawls noted many years ago for the utilitarian case, treating persons as *containers* of these units--and thus contrary to the Kantian dictum, as means rather than ends in themselves--ignoring the *location* of the units between these containers as part of the "non-health characteristic of the individual"

³⁰ This could happen, for example, if the available quantity of a given drug could prevent 10 DALYs for each of three patients, but 40 DALYs if concentrated in only one of them. Deontological doctors would treat the three if they all made a demand on their services (for *this* reason, rather than on consequentialist equity considerations), while a DALY-minimizing health agency would treat the one.

the invariance principle renders morally irrelevant. Applied at the level of this unit, then, the invariance principle implies inter-personal DALY minimization.

In the absence of actual arguments to support of the invariance principle, Murray provides a single simple example, or thought experiment, which is meant to work as what philosophers call an "intuition pump". Since this turns out to rely on largely irrelevant intuitions for the purpose at hand, however, we present a further series of examples designed to bring out some of the issues we have discussed above.

Example 1: tragic choices.

*A scarce, non-divisible resource can only be used to save the life of one of two patients who are identical except that one is rich and the other poor.*³¹

Examples of this kind are irrelevant to the present issue for at least three reasons. First, they appeal to intuitions from professional medical ethics in a deontological tradition, as described above:³² intentionally failing to save either of the patient's lives would violate the obligation to life itself, so the doctor should throw a coin instead. But even if we agreed with this ethic as a professional code of behavior for doctors—and this, of course, is controversial—it can hardly be relevant in supporting a measure of ill-health as the basic currency for a *consequentialist* approach to resource-allocation, as DALYs are meant to be.

Secondly, the principal objective of DALYs is not to determine whom doctors should save in life-or-death, take-it-or-leave-it emergency situations, where by definition no trade-offs are possible, but how health authorities should allocate scarce but *divisible* resources as a function of life-health trade-offs. Such trade-offs are of course the main motivation for the whole QALY enterprise.

³¹ "Imagine a situation where two patients arrive at an emergency room both in coma from meningitis, but there is only enough antibiotics to treat one of them. The two patients are totally identical in every respect, except that one is rich and the other is poor. ... I argue through the restricted information proposition that we should be completely indifferent between one over the other." (Murray 1996, p. 6).

³² This is recognized and interpreted as a positive aspect of the invariance principle by Williams (1988, p. 117): "It seems *prima facie* very close to the official medical ethic when it comes to dealing with people".

Finally, Murray's apparent belief to the contrary,³³ it seems improbable that anybody would argue that the *intrinsic* value we attach to a person's life-years, as such, should depend on her level of income. It is obvious, on the other hand, that income is an important determinant of the *opportunity to access* health outcomes, especially so in poor or middle-income countries with limited and badly distributed public health systems. To address this issue requires another example.

Example 2: opportunity costs.

As Ex. 1, but suppose now *the resource can also be obtained from another source, at a price only the rich can afford.*³⁴

Note that ignoring income here would entail indifference between the two patients' dramatically asymmetric opportunity costs--the cost of private treatment, for the one, vs. his life, for the other.

Both of these examples are unnecessarily restrictive in postulating patients identical in all respects, other than income. To test the principle as applied in the justification of DALYs, it would be sufficient to postulate patients identical in terms of expected health-outcomes, and more specifically, DALYs.

Example 3: your life for my health.

A scarce, non-divisible resource can only be given to one of two patients who would benefit identically in terms of DALYs, but in different forms: the first would gain five more years of healthy life (and otherwise die immediately), the second would gain ten more years of disability-free life (and otherwise die in ten, disabled years).

While it seems reasonable to assume that people can, and often do, choose a shorter healthy life over a longer unhealthy one—though of course they may just as often opt for a short unhealthy life over a longer healthy one, for the benefit of their *other* consumption priorities—such choices seem much more difficult to accept when the life-health trade-offs involve different persons. Imagine the example to

³³ "The death of a poor 40 year-old, according to [Anand and Hanson 1997], is worse than the death of a rich 40 year-old." (Murray 1996, p.7). As we saw above (see note 16), Anand and Hanson also confuse intrinsic and instrumental valuations of life when they propose their "principle of universalism of life claims" against age-weighting.

³⁴ Imagine Murray's original situation with two adjoining emergency rooms, one of them private and thus accessible only to the rich individual (with enough antibiotics to treat her for a price she can afford), the other public and accessible to both.

involve two similarly aged patients facing, in the absence of treatment, immediate death, and a further ten years of life in a blinded state, respectively. Given the high disability-weight DALYs assign to blindness (0.64), moreover, the latter could very well be favored for treatment by a DALY-minimizing agency, even, as we have seen, if he is by now so well adapted to his condition that he subjectively values his disabled life-years as much as most healthy people value theirs.

Example 4: one person's life, many persons' life-years.

A scarce resource can be used to prevent the premature death of someone at 30, in a population with an 80-year life expectancy, or the loss of a single year of life for 50 different 30 year-olds.

Since the invariance principle excludes the "location" of DALYs between persons from the information-set of DALYs, the measure (ignoring age-weighting and time-discounting) is not sensitive to the difference between a major part of a single life, and marginal parts of many lives.

Example 5: fairness in disability adjusted lives (DALs).

A scarce, non-divisible resource can only be given to one of two patients identical in present health-state and future health-prospects, but with sharply contrasting prior medical histories: one has had a perfectly healthy life up to this point, while the other has had a severely disabled one.³⁵

Given that the invariance principle is only stated in terms of expected health outcomes, favoring the second patient over the first on grounds of fairness to compensate her for past suffering/shorter life would not be possible on the basis of DALYs.

Example 6: individual responsibility.

A scarce, non-divisible resource can only be given to one of two patients identical in present and past health-states, as well as future health-prospects, but one of them brought about his current condition on himself through voluntary actions, fully

³⁵ Equivalently, suppose two patients offer identical health prospects, but one has had a long life, while the other is still young. For example, suppose the first is 60 years old but comparatively healthy and the second 20 years but sufficiently less healthy that the resource could prevent the loss of equivalent amounts of DALYs for either of them, taking into account age-weighting and discounting.

informed about their expected health consequences, while the other's condition was caused by involuntary characteristics (including involuntary lack of information) or bad luck.

Given that the invariance principle is only stated in terms of expected health outcomes, favoring the second patient over the first on grounds of responsibility for voluntary actions, would not be possible on the basis of DALYs. To take a well-known example due to Sen, a DALY-minimizer must give equal resource priority to two equally undernourished patients, even if one fasted voluntarily for religious, political, or economic benefit (fully aware of the health implications), while the other is the victim of economic entitlement failures beyond her control in a famine situation. Perhaps of more practical relevance, a DALY-minimizing international agency would have to be indifferent in allocating funds between diseases associated with voluntary, high-consumption *decisions* (e.g. heart attacks), and diseases associated with involuntary, low-consumption *conditions* (e.g. malnutrition), if the DALY/\$ counts happened to coincide (see section 6).

The arguments and examples reviewed above show that the invariance principle underlying DALYs has unduly restrictive implications for the information admissible in the measurement of aggregate (ill-) health. Most relevantly for the purposes of this paper, the measure fails to take into account—and indeed *distinguish*—three different forms of equity in health:

- a) in (yearly) *health outcomes*,
- b) in (life-long) *health achievements*, and
- c) in *opportunities for access* to health outcomes or achievements.

The “strongly egalitarian flavor” claimed for the invariance principle is in fact just the formal egalitarianism implicit in all *anonymous* social choice rules, postulating simply that the interests of all matter symmetrically.³⁶ This is a condition that would seem necessary for something to count as a normative theory in the moral and political realms in the first place.³⁷ While it is certainly not an empty condition—in addition to dictatorial rules, it is violated, for example, by perfectionist theories, which would on this account count as non-moral, perhaps

³⁶ Formally, the condition of anonymity in social choice theory makes the social ordering of alternatives invariant to permutations of the individual welfare measures. It is of course satisfied by maximin as well as utilitarianism, but violated by dictatorial social choice rules. For good surveys of this literature and its implications for distributive justice see Sen (1970) and Roemer (1996).

³⁷ See Dworkin (1977) and Kymlicka (1990).

aesthetic, normative theories—substantive moral and political theories take it for granted, and differ instead on the condition's *interpretation*.

Far from being especially strong, the egalitarianism of DALYs lies at the weakest extreme of this spectrum. Rules which are *only* egalitarian in the purely formal sense include the traditional conservative conception of formal equality of opportunity, or “negative” liberty and simple majority voting (*one person, one vote*), in addition to utilitarianism and DALYtarianism. But note an important difference between these rules. While the first two assign an equal part of the good they are concerned with to every individual, in the case of the latter two, equal respect applies only to *intra-personal* outcomes—utilities and DALY-years—rather than persons. The first two are of limited value for purposes of distributive justice because they are invariant to inter-personal differences in, respectively, the positive capacity to *realize* formal opportunities and liberties, and preference intensities as well as the causes underlying preference orderings (e.g. urgent needs vs. mild pleasures). On the other hand, their informational austerity makes them easily and efficiently implementable principles of social choice. In contrast, the two latter principles are doubly limited: their informational requirements makes them difficult and costly to implement, and yet their informational limitations combined with their lack of respect for persons make them, if anything, even more irrelevant for purposes of distributive justice than the more austere principles: after all, under both utilitarianism and DALYtarianism a *majority* of losers can be trumped by a minority of winners if the gains to the latter are sufficiently large, even if the losers were worse-off than the winners to begin with.

Like utilitarianism, DALYtarianism entails that if I happen to be better (per dollar) by genetic constitution or exceptional past access to health-care facilities at reducing (my) DALYs than you are, a DALY-minimizing agency should allocate more resources to me than to you, even if your lower efficiency is due to a long past history of unattended ill-health, and I have already achieved many more healthy life years than you have. And this applies to countries or regions, as well as persons: those with better developed health systems could well be assigned more health aid under this rule than those who still need to develop effective health institutions, or whose comparable capacities are limited by more intractable geographical or climatic conditions.

Taking now a more propositive stance, there are two possible ways to go beyond DALYtarianism in the distribution of health resources: dropping the inter-personal DALY-sum aggregation rule, and dropping (or enriching) the DALY measure itself. The first decision-node—the *aggregation* problem—allows the introduction of (substantive) egalitarianism in the distribution of health-outcomes; the second—the *currency* problem—allows the introduction of opportunities for health-outcomes as the relevant currency for distributive justice in health. Jointly,

these moves entail *equal opportunity of health*. The following section explores this concept.

IV. Equal Opportunity of Health

Following Rawls (1971) in political philosophy, and the informational (utilitarian) generalization of social choice theory in economics (pioneered by Sen 1970), the last thirty years have witnessed a major revival in the theory of distributive justice, which had shown little conceptual innovation since classical utilitarianism. Given that the DALYtarian project in health evaluation appears to have missed these post-Rawlsian developments altogether, and I will apply them to the problem of equitable health evaluation, a brief summary may not be out of place here.

Although the philosophical and economic literatures have borrowed much from each other, they still offer very different perspectives on distributive justice.³⁸ Of the two general problems that the Rawlsian critique of utilitarianism opened up—the aggregation and currency problems—formal social choice theory has been concerned exclusively with the former. In the late 70's and early 80's, just as economists began to axiomatize the full (equity-efficiency) spectrum of possible preference-aggregation rules, from maximizing the total sum to maximin, political philosophers began to take the idea of (substantive) egalitarianism for granted as the relevant aggregative basis for distributive justice, turning instead to the currency problem—*equality of what?*

The central issue here involves finding the relevant partition between those characteristics of individuals which should be taken into account and those which should be ignored for purposes of distributive justice, taking into account individual *responsibility*. The basic egalitarian invariance principle is that justice should *compensate individuals for differential characteristics beyond their control, but not for those that are voluntarily determined*.

A useful point of reference to start with is *equality of welfare*, which compensates for all possible characteristics, not only involuntary ones like socio-economic position and (inborn) talents, but also voluntary ones like effort (including ambition and risk-taking), and cultivated expensive tastes. Conversely, it fails to compensate individuals who (involuntarily) develop “cheap” tastes, achieving average welfare levels despite low levels of resources by lowering their expectations to match their (chronic) poverty.

Given these limitations, Rawls “difference principle” proposed equality (more precisely, maximin) of external, alienable *resources*, like income or wealth,

³⁸ See Roemer (1996), for a comprehensive survey of both, from an economist's perspective.

which together with other, more basic goods, Rawls called *primary goods*. While this takes care of voluntary and involuntary differences in tastes, it still fails to take into account differences in effort. It also fails to take into account handicaps, and more generally differences in the capacities of individuals to transform resources into welfare. Responding to the latter failure, Sen (1980) proposed the concept of *capabilities*, as a level of functional success intermediate between resources and welfare. Responding to the former failure, Dworkin (1979) redefined the idea of equality of resources, including (involuntarily generated) internal or inalienable resources—talents and capabilities—but excluding effort.³⁹ Note that if we take the idea of internal resources to its logical limit, including the capacity for effort itself as a resource, (generalized) equality of resources converges into equality of welfare (Roemer 1985). The current debate is centered on the cut between choice and circumstances which best satisfies the responsibility invariance principle, and the relevant definition of the concept of “midfare”.⁴⁰

Following the original Rawlsian project, these developments have been motivated by the problem of distributive justice “globally” conceived, but they can of course also be applied to “local” problems of distributive justice, defined in specific domains like health.⁴¹ Indeed, given the present state of the art, problems of local justice could well offer the most fertile research frontier in the theory of distributive justice generally.

First, we cannot easily form relevant judgements on the relative merits of the axioms underlying alternative social choice rules—and thus the rules themselves—in their general, uninterpreted form. We have seen, for example, that aggregating the sum total of an objective across units may be reasonable when the measure is infant mortality and the unit countries, but not when we are concerned with DALYs and persons. The reason for this, in Kantian terms, is that in the former case we use countries as means to minimize infant deaths, in the latter we use persons as means

³⁹ To equalize inalienable resources, Dworkin postulated the idea of an insurance scheme against bad luck in the original talent lottery, behind a “thin” veil of ignorance where we know our preferences but not our resource position (including talents), in contrast to Rawls’ “thick” veil where even the former information is barred. In practice, this would be implemented through the tax-transfer system. But note that such insurance can only be partial, not only because many handicaps may not be fully (or even partially) compensated even with infinite resources, given technological restrictions, but also for the standard incentive restrictions of optimal tax theory.

⁴⁰For example, Arneson (1990) proposes “equal opportunity for welfare”, while Cohen (1989) suggests “equal access to advantage”. The terminology of “mid-fare” and “currency” in this context are due to Cohen.

⁴¹ On local justice see Walzer (1983), Elster (1992), and Young (1994).

to minimize loss of healthy life years. Similarly, the choice of the relevant currency—outcomes, mid-fare, or resources may depend largely on the distributive domain in question. Thus capabilities or resources would be more relevant in cases where circumstances leave comparatively little room for effort, and outcomes where effort is determinant.

Finally, given the institutional complexity of modern societies, principles of global justice could in fact only be *implemented* (approximated) in such societies in local domains, through decentralized mechanisms. The interest of these results for the theory of distributive justice may thus depend on local interpretations.

It is important to distinguish two different ways of deriving conceptions of justice in local domains from global principles. Local principles may be derived instrumentally, as partial inputs in global conceptions of distributive justice. For example, Daniels (1998) postulates an “equal opportunity account of justice and health care”, where the extent and forms of access to health care are derived instrumentally, as a function of their impact on a Rawlsian account of equal opportunity, globally conceived.⁴² In contrast, here we will be concerned with the just distribution of health as *intrinsically* valuable (depending only on the value of health itself, which as we have noted we take to be instrumentally dependent on other goals). We are thus not primarily concerned with the justice of health within a broader account of human functionings or primary goods, which we shall take for granted here, but with justice *in* health.

We will apply to the case of health a simple formalization of equal opportunity recently proposed by Roemer (1998). Suppose we have a measure of health outcomes, like DALYs. It seems reasonable to suppose that this measure varies as a function of three kinds of determinants: a) circumstantial health-risk factors not subject to voluntary control on the part of patients, including genetic inheritance, socio-economic conditions, and environmental factors; b) individual efforts, including all health-affecting behavior subject to voluntary control; and c) health policy variables, which for simplicity we may take to be the allocation of health care resources. If we partition the population into classes of individuals facing identical circumstantial determinants, or *types*, we may represent the average health outcome achieved by individuals of type t , with effort e , and health care allocation a , as:

$$h^t(e, a),$$

⁴² “...we may think about the impact on individuals’ fair share of the normal opportunity range as a guide to the relative importance of health care needs” (Daniels 1998, p.30).

where we shall assume effort to be distributed, *within each type*, according to a probability density function $f^l(\epsilon; a)$.

The problem of just health care resource allocation then is to approximate as much as feasible the allocation that equalizes the value of the health measure *across types, for each level of effort*. This protects individuals from bad health outcomes due to factors beyond their control, but not from voluntarily determined health outcomes for which individuals are held responsible.

Since we take the *distribution* of effort to be determined by type, we need a measure of degree of effort that is inter-type comparable. Taking the *centile* (or quantile, more generally) of this distributions as the relevant measure,⁴³ and defining the "indirect health function" as the average health outcome achieved by individuals of type l , in the ϵ^{th} effort centile, with allocation a , $h^l(\epsilon; a)$, we may write the objective of *Equal Opportunity of Health* as follows:

$$\text{Max}_a \int_0^1 \text{Min}_l h^l(\epsilon; a) d\epsilon.$$

Note that this implies maximin across types at each level of effort, but total sum maximization across effort levels. In the limit, when success depends only on circumstances this implies maximin; when only effort matters, total sum maximization. The latter extreme would thus be defensible in two types of cases: a) where outcomes are only a function of effort, or b) where circumstances, though not causally irrelevant, are taken to be *morally* irrelevant.

Both possibilities offer interesting interpretations of global maximizing conceptions. Consider utilitarianism, interpreting the relevant outcome as the degree of success in realizing one's overall life-plan. Corresponding to the first possibility, it may be assumed a minimum bundle of resources exists, such that, once this is available to all, all remaining differences in utility must be due to effort. Call a society that can support a welfare state large enough to guarantee this universal bundle, *rich*. Under this interpretation, maximin would be relevant to poor societies and utilitarianism to rich ones.

Alternatively, corresponding to the second possibility, suppose that, like their realization, the *formation* of life-plans may be subject to circumstantial and voluntary determinants. Following Kant, call life-plans which have been formed free

⁴³ This means, for example, that all who are in the median of their respective effort distributions will be taken to spend equivalent degrees of effort, though actual levels of effort will not coincide.

from circumstantial determinants, *autonomous*. Again, it may be plausibly assumed that a minimum bundle of resources exists which is necessary for any (human) individual to be *able* to form autonomous life-plans, whether or not such plans are actually so formed, and eventually pursued. It is obvious that there are minimum levels of human functioning below which the only life-plans conceivable, let alone realizable, are ones narrowly centered on the achievement of these levels. We may postulate a similar rule-differentiation between poor and rich societies as in the first interpretation, but the minimum bundle is of course here a more modest one. Thus, paradoxically, this Kantian interpretation may offer both the most credible and the most realistic interpretation of equal opportunity in utility space.

Consider now health. If we were concerned with deriving the justice of health within a global utilitarian conception, and assuming health outcomes to be strongly determined by involuntary circumstances, in comparison to success in broader personal life-goals (or utility), maximin would on this account be defensible in the space of health. But considering health in itself, the implications are more complex.

Note first that health outcomes can face similar limitations as a measure for justice in health as utility does as a measure for global justice. With an open-ended definition of health as adopted by WHO (sect. 1), we may have problems of cheap and expensive health needs, similar to the problems of cheap and expensive tastes noted above. Conversely, as we have already seen, some chronically disabled may perceive themselves to be quite able under conditions which the more fortunate would consider severely disabling. On the other, some of the latter may come to regard themselves as severely disabled because they have developed extravagant health-needs, in their pursuit of "a state of complete physical, mental and social well-being".

But obviously health, unlike utility, may also be conceived more narrowly, and is indeed most commonly so conceived. In particular, it may be defined as a set of limited, well-defined physical, mental and social functionings, in line with Sen's concept of capabilities. This would imply a minimum bundle of health care resources, and we can as above postulate health functioning minimax in (health) poor societies, and health outcome maximization in (health) rich societies, on the basis of the prevalence of circumstantial vs. voluntary health risk factors.

The issue of individual responsibility is central to global theories not only because of the problem of expensive tastes, but also because individuals can differ in their productive efforts. There are clearly many important health-risks where individual effort is critical to the production of health, notably in the case of injuries, substance abuse, physical inactivity, and unsafe sex. But there is a third way in which choice is relevant to health outcomes, which does not apply to the global case,

precisely by the assumption of globality. Individuals may fail to produce health because they choose, fully informed of the health-risks, to pursue *other* goals.

Individual responsibility does not seem to be a relevant issue at all in traditional medical ethics, nor in most public health systems. The underlying reason for this may be that health is conceived to be such a basic good (right) that either individual responsibility pales into normative insignificance, or differences in effort are ultimately taken to be involuntary. But this intuition seems to be no more justifiable here than in the global case: it seems *prima facie* unfair to take health care resources away from those who have made efforts to achieve their current health condition to those who have decided, in full consciousness of the consequences, to neglect their health in favor of other, more valued objectives.

But what would be the practical implications of this distinction, given that we can rarely observe effort. A broad but important implication would be a bias in favor of *preventive* over curative interventions, to the extent that the former address opportunities for health, independently of effort, while the latter will tend (statistically) to benefit more those who invest less effort, as long as the probability of the incidence of the affection in question is monotonic in effort. Preventive interventions may of course be, and generally is, favored over curative ones on cost-effective grounds, using a measure of aggregate health outcomes, like DALYs, as the objective function. The point here is that equality of opportunities in health would imply favoring a preventive intervention over a curative one even when these happened to be equally cost-effective in terms of DALYs.

Secondly, note that to make the above framework operational we only need to estimate the effort quantile in which individuals fall. Given that, by assumption, we have already bracketed all circumstantial determinants in the type-partition, and assuming that health outcomes are monotonic in effort, effort quantiles must correspond to health outcome quantiles, as measured, for example, by DALYs. So to estimate the degree of equality in opportunities for health we only need to compare *inter-type* (circumstantial) with *intra-type* (voluntary) variations in observed health outcomes.

Though it is thus possible to estimate both, a measure of equal opportunity for health, and the level and allocation of health care resources which would be necessary to implement this objective, health care reforms on this scale are not likely to be a practical possibility. This is clearly the case globally, as well as in many developing countries, where the distribution of health opportunities is not just inequitable, but inversely related to the distribution of health needs (see below, section 6). The next section considers a more pragmatic policy target for this context.

V. Health Poverty

We have emphasized in the previous sections the structural similarity between the objective of minimizing aggregate DALYs and utilitarianism. Interpreting DALYs as a descriptive measure of aggregate health, the comparison with the most common measure of aggregate economic activity becomes more relevant. GNP provides a measure of the aggregate yearly economic product of a nation, just as the *national burden of disease* (NBD) provides an (inverse) measure of the aggregate yearly health product of a nation. And just as GNP is a poor measure of the economic welfare of a society because it ignores the distribution of income, NBD is, as we have seen, a poor measure of social welfare in the domain of health because it ignores the distribution of health. Though it would be quite possible to revise the traditional GNP measure to make it sensitive to distributional information (Sen 1976a), thus maintaining a single aggregate measure for descriptive and prescriptive purposes, it is interesting that the theory and practice of aggregate economic measurement has opted instead for developing and using additional, distributive measures of inequality, polarization, and poverty. This plurality of measures—each specifically designed for its intended specialized application—is, I believe, an example which should be followed in aggregate health measurement. Here we shall propose a measure of health poverty.

The measurement of poverty generally requires the definition of a) a relevant dimension of achievement, b) a minimum level, or "poverty line", specified in this dimension, and c) a function to aggregate the levels of achievement of those who fall below this line. The first two issues—together known as the "identification problem"—are generally resolved with income as the relevant dimension and the cost of a minimum consumption basket (often defined in reference to minimum nutrition requirements), as the poverty line. Most of the recent literature on poverty measures has focused on the third issue—the "aggregation problem"—and in particular, following Sen's (1976b) pioneering work, on *distribution-sensitive* solutions to the problem.⁴⁴

But consider first the identification problem for the case of health. An obvious possibility would be to take an index of health outcome, like DALYs, and define a minimum level of this index as the poverty line. Indeed, since DALYs measure *deprivation* in the space of health relative to a norm, the measure itself can be interpreted as a health poverty measure with the poverty line set at 80 (82.5) years of healthy life for a man (woman). This choice of line is arbitrary in some

⁴⁴See Zheng (1997) for a comprehensive survey.

respects which shall not concern us here, but its main limitation as a health poverty line is of course that it represents a *maximum* norm of health achievement, rather than a minimum. This would be like estimating global income deprivation by taking as the poverty line the highest national income per capita level in the world.

On the other hand, note that even if we are concerned with poverty in *outcomes*, like incomes or DALYs, the line in this space must generally be grounded on a non-outcome space, like rights or opportunities. For example, the income poverty line is sometimes interpreted as a level of consumption that must be guaranteed to all as a matter of *right* (Atkinson 1987). The ambitious reference norm used in the definition of DALYs may be similarly interpreted as a universal right to a full, healthy life span, taking the maximum national average life expectancy as an estimate of current technological possibilities. More commonly, and plausibly, as we have already noted, the income poverty line is derived with reference to basic functionings or capabilities, from nutrition to a broad capacity to function in society. This is consistent with the partition between basic and non-basic health needs we have obtained from the idea of equality of opportunity in the previous section, as the minimum conditions required to form and pursue autonomous life-plans. Rather than trying to determine what these conditions might be in the case of health, it may be more practical to borrow from DALYs the idea of estimating the reference point on the basis of current technological possibilities. Instead of the *maximum level of average health achievement*, however, we suggest focusing on a *minimum level of universal health opportunities*. What is intolerable, after all, is not that everybody in the world today cannot expect to live 80 (82.5) healthy years, but that many millions of people are still dying from easily preventable causes, lacking access to basic health opportunities which have long been universal or near-universal in the rest of the world.⁴⁵

Consider now the aggregation problem. Suppose we have a measure of health outcomes or opportunities, and a minimum level, or poverty line z , defined in this space. We will use "poor" and "non-poor" here to refer to *health* poverty, rather than economic poverty. We can represent the distribution of health, thus measured, by a non-decreasingly ordered vector of individual health levels, $x=(x_1, x_2, \dots, x_n)$, where $x_1 \leq x_2 \leq \dots \leq x_n$. A health poverty measure can then be defined as a function

⁴⁵ "If death rates among children in poor countries were reduced to those prevailing in rich countries, 11 million fewer children would die each year... In addition, every year 7 million adults die of conditions that could be inexpensively prevented or cured... Maternal mortality ratios are, on average, thirty times as high in developing countries as in high-income countries." World Bank (1993, p.1). Thus, since the publication of that estimate more than 85 million died in the world from lack of basic, cheaply available health opportunities.

of this vector, and the health poverty line: $P(x; z)$. We may postulate the following normative axioms to restrict the structure of H :

Focus: $P(x; z) = P(y; z)$ whenever x is obtained from y by an increment to a non-poor person.

This means simply that the measure of health poverty should be indifferent to the distribution of health among the non-poor, thus codifying the idea of assigning absolute priority to universal access to basic health.

Anonymity: $P(x; z) = P(y; z)$ whenever x is obtained from y by a permutation of health levels between persons.

This is equivalent, as noted before, to Murray's invariance principle.

Monotonicity: $P(x; z) > P(y; z)$ whenever x is obtained from y by a reduction in the health level of a poor person.

This simply says that health poverty should increase when, other things being equal, the health level of a poor person diminishes.

Transfer: $P(x; z) < P(y; z)$ whenever x is obtained from y by a *progressive transfer* of health with at least the recipient being poor, where a "progressive transfer" means a reduction in health level for a richer person compensated by an equivalent increment in the health level of a poorer person.

This says that an equalizing health transfer to the poor should decrease health poverty, and represents the minimal equity axiom necessary to make a measure distributive-sensitivity.

Transfer Sensitivity: $P(x; z) > P(x'; z)$ whenever x and x' are obtained from y by transferring health γ (>0) from y_i to y_j , and from y_k to y_l , respectively, with $y_j - y_i = y_l - y_k > \gamma$, $y_k > y_i$, and $y_l < z$.

This says that, other things being equal, the measure of health poverty should be more (negatively) sensitive to (regressive) health transfers at the lower end of the health distribution within the poor.

Decomposability: For $x = (x', x'')$, with $n(x) = n(x') + n(x'')$, where $n(x)$ is the population size corresponding to x ,

$$P(x; z) = \frac{n(x')}{n(x)} P(x'; z) + \frac{n(x'')}{n(x)} P(x''; z).$$

This requires the overall health poverty measure to be decomposable into the poverty of subgroups with different characteristics (geographic, socio-economic, epidemiological, etc.), allowing the design of a decentralized strategy of health provision, and optimal targeting of health care resources as a function of their relative contribution to global health deprivation.

The simplest and most commonly used poverty measure in the space of income as well as health is the *headcount ratio*,

$$H = q/n,$$

where q is the number of the poor and n the population size. A popular example in the case of health is the *infant mortality rate* (IMR). More generally, this functional form is represented by measures of mortality and disease prevalence. The problem with such measures, of course, is that they are insensitive to the distance of the poor from the poverty line: a prematurely dead person (or someone affected by a given condition) counts equally in such measures no matter how young she died within the relevant mortality age line (or how long she has been ill). This measure satisfies the focus and anonymity axioms, but violates the monotonicity, transfer and sensitivity axioms.

The next simplest health poverty measure is the *health gap ratio*,

$$G = \frac{z - x}{z},$$

where x is the mean health level of the poor. This represents the average intensity of health poverty, and is represented by YLL and QALY measures. Multiplying G by nz , gives us the *aggregate health poverty gap*. With DALYs as the relevant measure this would be the measure corresponding to the burden of disease. It satisfies monotonicity, but neither of the distributive, or transfer axioms.

A very general and simple class of decomposable poverty measures was defined by Foster, Greer and Thorbecke (1984), and is today probably the most widely used class in income poverty studies. This is defined as:

$$F(\alpha) = \frac{1}{n} \sum_{i=1}^q \left(\frac{z - x_i}{z} \right)^\alpha,$$

where $\alpha \geq 0$, is a parameter of society's degree of health poverty aversion. $F(0)$ is H . $F(1)$ is the *poverty gap ratio*, HG . The set of measures $F(\alpha > 1)$ satisfies the transfer axiom, and the set $F(\alpha > 2)$ satisfies *transfer sensitivity* as well. At the limit, when $\alpha \rightarrow \infty$, F approaches maximin, and the aggregate health level is dictated by the health level of the poorest person.

Unlike the headcount ratio, which only requires an ordinal measure of success, but like G , $F(\alpha > 1)$ requires cardinal measurability. An important advantage of DALYs is that they satisfy this informational condition. Except for monetarily quantified health resources, measures of health opportunities may not be cardinal. Probably the most practical approach in such cases would be to use basic health opportunities to estimate a true poverty line on an outcome space of *minimum disability adjusted life years* (MINDALYs). The aggregate level of health poverty, or global burden of *basic disease* (GBBD), could then be measured by applying $F(2)$ or $F(3)$ in the space of MINDALYs.

VI. Prioritizing Health Interventions

We have identified the informational limitations of DALYtarianism as a standard for distributional justice in health, and we have suggested two alternative but related approaches based on the concepts of equal opportunity of health, and health poverty. We must leave the actual development and empirical estimation of these measures for future work. To conclude, we consider briefly the practical *relevance* of this critique of DALYtarianism and the suggested revisionist agenda. For this purpose, we contrast the implications of DALYs for cost-effectiveness analysis of health interventions, and specifically for the definition of an *essential public health package*—which we may take to represent the DALY approach to basic health opportunities with an alternative cost-effectiveness approach based on the suggested alternatives.

DALYs are used to define an “essential public health package” for developing countries in World Bank (1993). The method is developed in more detail and applied to the case of Mexico in Bobadilla et al (1994). It involves two steps: first, identifying the most significant conditions or risk-factors in terms of their weight in the overall DALY burden of disease; secondly, identifying the most cost-effective interventions for these conditions in terms of DALYs saved per dollar. Assuming precise cut-off points for both of these identification problems, a list of significant interventions ordered by relative cost-efficiency can be obtained.

We can identify three general difficulties which are unresolved by this approach: a) justifying the relevant cut-off points, b) justifying the appropriate trade-off between significance and cost-effectiveness, and most importantly in the present context, c) the identification of urgent health priorities without consideration of distributive information on health opportunities and outcomes, given that both the identification of significant conditions, and the prioritization of cost-effective interventions within these conditions, are in this approach derived from aggregate DALY measures.

Given these limitations, we suggest an alternative, more direct approach to the prioritizing of health interventions, based on the proposals put forward in the last two sections. Very broadly, this would involve: first, using the measure of equality of opportunity in health to distinguish between basic and non-basic opportunities; secondly, using the set of basic opportunities to define a health poverty line in health outcomes; thirdly, applying a decomposable, distributive-sensitive health poverty measure in this space to prioritize the health needs to be addressed; and finally, and

only at this point, using cost-effectiveness analysis to order interventions within these priority classes.

To illustrate the practical implications of the two approaches, consider a middle-income region which can be a middle-income country or the world as a whole, in the middle of a process of epidemiological transition, where lower respiratory infections, diarrhoeal diseases, perinatal conditions and nutritional deficiencies still account for a substantial part of the burden of disease, but conditions like ischaemic heart disease and cerebrovascular disease have already emerged as significant threats. As commonly interpreted, the epidemiological transition is associated with a process of demographic transition involving declining mortality and—with a substantial time gap—in the more recent transitions—fertility rates, associated in turn with broadly based economic growth and technological and institutional advances in basic health care (massive immunization programs, universal health services, etc.). Under these conditions, DALY cost-effectiveness would in all likelihood recommend extending the coverage of basic health care services until the transition is so well advanced that the health conditions associated with poverty become sufficiently insignificant for non-basic interventions to become cost-effective. In economic terms, in this scenario the epidemiological transition would be achieved equitably, through a transition from the extensive to the intensive margin in the production of health only when the former is exhausted, where the extensive margin involves increments in aggregate health achieved by extending the coverage of basic health opportunities, while the intensive margin involves extending health opportunities beyond the basic level. Given these probable equitable implications, the fact that in the DALY approach they would be recommended for the wrong reasons may be of little practical importance.

But now suppose that neither economic growth, nor health care services are broadly distributed in the population, but both are concentrated in a (urban/northern) sector of the population, as is the case today both within many developing countries, especially in Latin America and Africa, and globally, between developed and developing regions. To illustrate this scenario more concretely, consider the share of Sub-Saharan Africa in world health outcomes and opportunities in 1990:⁴⁶

⁴⁶ Data on DALYs are from Murray and Lopez (1996a); on the WHO budget, from Roemer (1993); and on the other variables from World Bank (1993). The latter data exclude South-Africa, which accounts for a small share of the regions DALYs but a disproportionate share of its economic resources.

Table 1

Measures of Health Outcomes and Opportunities	SSA as % of the World (1990)
DALY	21.49
DALY Group I	32.83
Health Aid	38.46
Regionalized WHO Budget for Africa	26.57
GNP*	0.81
Doctors*	0.55
Health Expenditure + Aid*	0.45

Note that SSA accounts for a fifth of the GBD in DALYs from all sources, but a third in “extensive”, cheaply preventable DALYs caused by communicable, maternal, perinatal, and nutritional conditions. Given that this group of conditions as a whole is intensive in early deaths in relation to the rest, and should thus account for the bulk of the total DALY count for the region, the distributional difference between the two outcome indicators, and the implied policy implications, is quite important. Note that if international aid resources were budgeted regionally in proportion to the regional share in the GBD,⁴⁷ total DALYs would recommend *reducing* both WHO’s SSA budget and total health aid allocated to SSA from current (1990) levels. Note finally the extent of the gap between health needs and health opportunities in the region, as reflected by the region’s share in current and (human) capital resources, especially, despite the concentration of aid in the region, health care resources.

In this world, the structure and speed of the epidemiological transition is a function not only of aggregate economic, technologic and demographic trends, but also of the *distribution* of these trends. In particular, in comparison to the first, counterfactual scenario, the epidemiological transition must proceed more slowly and inequitably, with the bulk of productive health investments concentrated at the intensive rather than the extensive margin.

This scenario corresponds to what Bobadilla et al. (1993) call the “protracted-polarized model” of epidemiological transition, differentiated from the more traditional model by a) an “overlap of eras”, where the incidence of infectious diseases remains high while non-communicable diseases are on the increase, b)

⁴⁷This would be a reasonable decentralized allocation strategy, leaving cost-effectiveness considerations for the selection of projects within each regional budget. Part of WHO’s budget, for example, is thus regionally allocated, though not, as far as I know, using GBD shares.

“epidemiologic polarization”, a widening of the gap in health status between poor and rich populations, and c) a “counter-transition”, the reemergence of previously controlled epidemic diseases. What is most relevant about this state of the world for our present purposes, is that populations suffering from conditions associated with the two extremes of the epidemiological transition, or the extensive and intensive margins, must compete frontally for scarce health care resources.

Now, given the prevailing inequities in health outcomes and, most extremely, opportunities, it would seem obvious that health policy should be aimed at *compensating*, however marginally, rather than adding to, these gaps. As Bobadilla et al. (1993) note, however, “important segments of the health-planning community—both at the national and international levels—have themselves become polarized in two hands”, and one of them actually “see in the rising prevalence of chronic ailments and injuries the need for a shift in priorities”. Indeed, the authors themselves reluctantly agree that “the complex reality of many countries means that there is no alternative but to address the pre-transitional and the post-transitional problems simultaneously”. But restrictions cannot become objectives. It is critical to distinguish between the *norms* used to define health priorities, and “the complex reality” constraining their application. A norm which would itself recommend adding to the prevailing health opportunity gap would appear to be in the extreme perverse. In fact, DALYtarianism comes dangerously close to this, and as such represents perhaps the best foundation those favoring a shift in priorities to post-transitional conditions could have found.

First, note that given equal costs, pre-transition conditions would compete on *equal* footing with conditions associated with the intensive margin, DALYs saved at any point in the epidemiological spectrum counting equally.

Secondly, given equally efficient technologies, the current concentration of complementary economic and health resources on post-transitional conditions implies that marginal DALY productivity must be higher here than in pre-transitional conditions.

Finally, given the parallel concentration of the bulk of health R&D resources on post-transitional conditions, future *technological innovation* must be expected to favor the latter, so that even if currently available technology for interventions for pre-transitional conditions is generally more efficient per DALY saved than technology for post-transitional interventions, the trend is against it.

In short, we need to prioritize basic health opportunities *on principle*.

References

- Anand, S. and Hanson, F. 1997, "Disability-adjusted life years: a critical review", *Journal of Health Economics*, 16:685-702.
- Arneson, R. 1990, "Liberalism, distributive subjectivism, and equal opportunity for welfare", *Philosophy and Public Affairs*, 19:159-194.
- Bell, J.M. and Mendus, S. (eds) 1988, *Philosophy and Medical Welfare*, CUP.
- Bobadilla, J.L., Frenk, J. et al. 1993, "The epidemiological transition and health priorities", in Jamison, T. et al. (eds.), *Disease Control Priorities in Developing Countries*, Oxford.
- Bobadilla, J.L., Frenk, J., et al., 1994, "El Paquete Universal de Servicios de Salud", *Economía y Salud: documentos para el análisis y la convergencia*, #11, FUNSALUD, Mexico.
- Brock, D. 1993, "Quality of Life Measures in Health Care and Medical Ethics", in Nussbaum and Sen (1993).
- Broome, J. 1988, "Quality of Life and Resource Allocation", in Bell and Mendus (1988).
- ___ 1993, "Qalys", *Journal of Public Economics*, 50:149-167. Cohen (1993)
- Cohen, G.A. 1989, "On the currency of egalitarian justice", *Ethics* 99:906-944.
- Daniels, N. 1985, *Just Health Care*, CUP.
- ___ 1998, "Rationing medical care: a philosopher's perspective on outcomes and process", *Economics and Philosophy*, 14:27-50.
- Dworkin, G. 1977, *Taking Rights Seriously*, Duckworth.
- ___ 1981, "What is equality? Part 2: Equality of resources", *Philosophy and Public Affairs*, 10:283-345.
- Elster, J. 1983, *Sour Grapes: Studies in the Subversion of Rationality*, CUP.
- ___ 1992, *Local Justice: How Institutions Allocate Scarce Goods and Necessary Burdens*, Russell Sage Foundation.
- Frenk J., Lozano, R., González-Block MA et al. 1994, *Economía y salud: propuesta para el avance del sistema de salud en México. Informe Final*. FUNSALUD, Mexico.
- Glover, J. 1990, *Utilitarianism and its Critics*, McMillan.

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- Harris, J. 1988, "More and Better Justice", in Bell and Mendus (1988).
- Kamm, F.M. 1993, *Morality, Motrality. Volume I: Death and Whom to Save from It* OUP.
- Kymlicka, W. 1990, *Contemporary Political Philosophy*, OUP.
- Lockwood, M. 1988, "Quality of Life and Resource Allocation", in Bell and Mendus (1988).
- Murray, J.L. 1996, "Rethinking DALYs", in Murray and Lopez (1996)
- ___ and Acharya, A.K. 1997, "Understanding DALYs", *Journal of Health Economics*, 16:703-730.
- ___ and Lopez, A.D. (eds) 1996a, *The Global Burden Of Disease: A comprehensive assessment of mortality and disability from diseases, injutries, and risk factors in 1990 and proyected to 2020*, Harvard School of Public Health, World Health Organization, World Bank.
- ___ 1996b, *The Global Burden Of Disease: Summary*, Harvard School of Public Health, World Health Organization, World Bank.
- Musgrove, P. 1998, "Unas reflexiones personales sobre 16 años de investigación y enseñanza en economía de la salud y su aplicación al mundo real", presentation in the seminar "Health Economics: Research Agenda and Strategies for Public Policy", CIDE, Mexico, September 1998.
- Nussbaum, M, and Sen, A. 1993, *The Quality of Life*, Oxford: Clarendon P.
- Rawls, J. 1971, *A Theory of Justice*, Harvard UP.
- ___ 1993, *Political Liberalism*, Columbia.
- Roemer, J.E. 1993, "Distributing health: the allocation of resources by an international agency", in Nussbaum and Sen (1993).
- ___ 1996, *Theories of Distributive Justice*, Harvard UP.
- ___ 1998, *Equality of Opportunity*, Harvard UP.
- Sen, A., *Collective Choice and Social Welfare*, North-Holland.
- ___ 1976a, "Real National Income", in Sen (1982).
- ___ 1976b, "Poverty: An ordinal approach to measurement", in Sen (1982).
- ___ 1980, "Equality of what?", in Sen (1982).
- ___ 1982, *Choice, Welfare and Measurement*, Blackwell.

- and Williams, B. 1982 (eds.), *Utilitarianism and Beyond*, CUP.
- Smart, J.J.C. and Williams, B. 1973, *Utilitarianism: For and Against*, CUP.
- Spilker, B. et al. 1996, "Quality of life bibliography and indexes", *Medical care*, 28 (12 Suppl):D51-77.
- Walzer, M. 1983, *Spheres of Justice: A Defense of Pluralism and Equality*, Basic Books,
- Williams, A. 1988, "Ethics and Efficiency in the Provision of Health Care", in Bell and Mendus (1988).
- World Bank 1993, *World Development Report: Investing in Health*, OUP.
- World Health Organization 1996, *Constitution, Basic documents*, 40th ed., WHO, Geneva.
- Young, H.P. 1994, *Equity: In Theory and Practice*, Princeton UP.
- Zheng, B. 1997, "Aggregate Poverty Measures", *Journal of Economic Surveys*, 11(2): 123-162.