

Health versus disability: stylistic difference or substantive disagreement?

Alec Morton

London School of Economics and Political Science

Abstract

Over the last few years, the WHO has proposed a family of approaches to healthcare planning based on the population-based epidemiological models of disease and Disability-Adjusted Life Year (DALY) concept. Despite criticisms from the proponents of (to health economists) the more familiar QALY concept, this approach seems to have found some favour among health planners throughout the world. However, the way that the DALY-based approaches have evolved (e.g. the de-emphasis of age weighting, the inclusion of cost information, and a greater focus on interventions) means that recent work undertaken in this tradition is much closer in spirit to that of traditional QALY-style economic evaluation. At the same time, recent developments have seen mainstream economic approaches increasingly used in conjunction with population-based models of disease. Thus, arguably, the difference between the QALY and DALY traditions is now a primarily conceptual one: is one to think of healthcare as increasing a stock of health or mitigating the disabling effects of disease? I argue that for healthcare planning as it is currently conducted, this is a stylistic difference, and planners should feel free to use the language of health or of disability, as seems more natural to them. However, I also argue that there is a real difference between the two concepts as the basis for a general normative theory of how to allocate healthcare resources, and I demonstrate this by showing how a health-related and disability-related social welfare function might differ.

1. Introduction

Over the years, a vast array of tools have been developed and proposed for public servants responsible for planning healthcare provision. The approaches recommended have included Cost-Effectiveness, -Utility and –Benefit Analysis (Drummond, Sculpher, Torrance, O' Brien, & Stoddart, 2005), Program Budgeting (Mitton & Donaldson, 2001), and mathematical programming (Stinnett & Paltiel, 1996). Within the health economic community, the QALY concept (e.g. Drummond, Sculpher, Torrance et al., 2005; Williams, 1985) has been the basis for much applied work, and approaches to prioritisation such as cost-per-QALY league tables have been a major focus of attention.

The Global Burden of Disease approach, and its successor, Generalised Cost-Effectiveness (GCEA) promulgated by the World Health Organisation (Tan-Torres Edejer, Baltussen, Adam, Hutubessy, Acharya, Evans et al., 2003) are relatively recent arrivals to this already vast family of planning methods. The original Global Burden of Disease studies (Murray & Lopez, 1996) attempted to map out the extent of disability attributable to disease throughout the world, rendering all such disability commensurable through a common unit of time-integrated disability, the Disability-Adjusted Life Year or DALY. These studies attracted critical commentary in the health economic literature (Anand & Hanson, 1997; Bevan & Hollinghurst, 2003; Mooney & Wiseman, 2000; Williams, 1999) which has in turn drawn robust responses from the framers of the Global Burden of Disease studies (Murray & Acharya, 1997; Murray & Lopez, 2000).

One of the primary criticisms of the Global Burden of Disease (GBoD) project from an economic point of view was that it encouraged decision makers to focus on diseases rather than interventions, and to decide on priorities without reference to cost. This interpretation has been disputed by Murray and Lopez (1997). However, the most recent incarnation of the WHO approach, GCEA (Tan-Torres Edejer, Baltussen, Adam et al., 2003), does address both these points, recommending an approach to prioritisation based on cost-effectiveness league tables, where costs are financial inputs, and benefits are reductions in disability, measured in DALYs. Age-weighting, another controversial feature of the method, has been soft-pedalled in subsequent implementations, and is currently presented as a discretionary, rather than a core, feature.

At the same time, a central motivation for the GBoD programme was a perceived lack of interest within the economic paradigm in the assessment of population need and epidemiological modelling generally (Hollinghurst, Bevan, & Bowie, 2000). How far this was ever true is contestable, but it certainly seems to be less true now than ever. For example, a high profile policy document, The Depression Report (Centre for Economic Performance's Mental Health

Policy Group, 2006), has recently argued for a large and innovative expansion in the provision of mental health services based a combination of economic modelling and epidemiological evidence (including the GBoD studies), and renewed emphasis on the finiteness of the NHS budget (Maynard, Bloor, & Freemantle, 2004) has led NICE to develop population-based costing tools to support NHS organisations to quantify the impact of NICE guidelines on their finances (National Institute for Health and Clinical Excellence, 2006). Moreover, current policy developments such as the increasing focus on NHS productivity (Dawson, Gravelle, O'Mahony, Street, Weale, Castelli et al., 2005; Department of Health, 2005) suggest sizing up gains in health at the population level will become more, rather than less necessary in years to come.

There may, then, be greater commonality between what may be summarily referred to as the DALY and QALY approaches than may have been the case in previous years. This is not to say that either approach is uncontroversial. Philosophically, both approaches are open to objections on the grounds that they are not consistent with ethical intuitions such as the rule of rescue (Mooney & Wiseman, 2000). Nor are such approaches in general compatible with conventional welfare economics (Garber, Weinstein, Torrance, & Kamlet, 1996). This is not so much a weakness of the approaches, but simply a reminder of the difficulty of achieving a consensus on the principles which should guide policy when life and death are at stake.

Such controversies notwithstanding, it is now clear that the approaches of the WHO have fallen on fertile ground, both in Ministries of Health around the world, and in the global health community (e.g. Andrews, Issakidis, Sanderson, Corry, & Lapsey, 2004; Chisholm, 2005; Fox-Rushby, 2002; Hutubessy, Chisholm, Edejer, & WHO-CHOICE, 2003; Melse, Essink-Bot, Kramers, & Hoeymans, 2000). At the same time, utilisation of the more familiar (in the health economics context) tools of QALY-based cost-effectiveness analysis (Drummond, Sculpher, Torrance et al., 2005; Gold, Siegel, Russell, & Weinstein, 1996) has also grown apace, particularly in Health Technology Assessment centres, like NICE in the UK. This leaves government planners in an awkward situation, with similar-yet-different approaches being applied to similar-yet-different problems in different countries (and sometimes in the same country).

Gold, Stephenson and Fryback (2002) and Bevan and Hollinghurst (2003) (among others) have surveyed the differences between the QALY and DALY approaches, and the reader is referred to their papers for deeper discussions of the differences between these two traditions. As discussed above, however, as of 2006, many of these distinctions do not seem as sharp as they may have done a few years ago. Accordingly, this paper takes as its focus what is the most obtrusive (but also, oddly, the least discussed) difference between the two families of approaches, namely the

use of the language of “health” or “disability”. The question I seek to address is whether this difference is an essentially presentational or stylistic difference, or whether it reflects some fundamental philosophical disagreement about what is at stake.

2. Health versus Disability

The most prominent difference between the standard health economic approach and that of the WHO is the former’s focus on *health* and the latter’s focus on *disability*, measured relative to some normative benchmark. Typically this baseline has been effectively the population life-expectancy of some particular healthy population, and thus it makes sense to refer to a “baseline age”, although conceptually, more complex benchmarks could be envisaged (e.g. a lifecourse which involves a particular pattern of progressive degradation in health over time).

This notion of disability seems to have considerable appeal for those trained in public health and epidemiology, disciplines for which the natural unit of analysis is the disease. As propounded by the WHO, the DALY concept originates in an attempt to supplement a commonly used measure of this health deficit attributable to diseases, Years of Life Lost (YLLs), with a second component, Years of Life with Disability (YLDs), which captures morbidity. Economics, on the other hand, suggests a different frame, oriented around agents capable of making economic decisions. Considering health (or more precisely, life years at different levels of health) as a good held by an agent, and the recipient of healthcare as a consumer and co-producer of her own health, is natural way of thinking within this frame.

The measurement of disability, as opposed to health, poses two particular conceptual challenges. The first is that of determining the baseline age for measurement. Murray and Lopez (2000, p73) suggest that this baseline age represents a *target*: while this suggests the role that the baseline age might play in the management of the healthcare system, it does not provide much insight into how it might be derived. For purposes of international comparison, the GBoD studies use the life-expectancy of the best performing nation, although for other purposes more local comparators might be relevant. On the other hand, a health ministry may wish to set the baseline age based, not on external comparators, but on internal standards, such as a life might be one which allows one to realise certain personal goals, or fulfill certain family roles such as child, parent, and grandparent. This would correspond to a well-established way of measuring of poverty (Atkinson, 1987), with reference to a stipulated basket of goods felt to be a practical minimum for subsistence.

The second conceptual challenge arises in addressing how to consider persons who survive beyond the baseline age in the disability measurement framework? Obviously, supposing that

individuals who have survived to this baseline age have had their “fair innings” and therefore their needs no longer matter for purposes of health planning, is morally repugnant. The GBoD studies tackle this effectively by setting the baseline age differently for each age cohort, based on life expectancy conditional on survival up to current age. One can think of other ways of handling this situation, perhaps by allowing disability for such individuals to go into the negative domain, so that individuals surviving beyond the reference age and taken to have “negative disability”. Alternatively, one could take the view that one plans for the average case, and the empirical existence of long-lived healthy individuals need not obtrude in planning.

These difficulties in setting a baseline age call to mind Bowley’s famous description of the poverty line as at bottom “arbitrary, but intelligible” (cited in Atkinson, 1987). It should be borne in mind, however, that health measurement also requires the specification of a similarly arbitrary baseline – that of “full health”. The greater precision with which we are able to measure lifetimes relative to health states means that the difficulties posed by the arbitrariness of this baseline this are not shown into quite as stark focus as in the case of age, but conceptually, they are exactly parallel.

Supposing that the challenges of establishing baselines have been overcome, a natural question is whether viewing the allocation of healthcare resources from a health perspective leads one to different conclusions from those which one would reach if one views the same problem from a disability perspective. To make this problem concrete, I will in this section contrast a government planner who takes the view that her role is maximise health (a “health utilitarian”) with another who considers that minimising disability is a more appropriate objective (a “disability utilitarian”).

To formalise this, I will think of a particular individual, i , (the object or beneficiary of planning activity) as progressing through a series of discrete states (which can be ordered from best to worst) from birth until death. This collection of states, together with the transition times, comprises the life profile of i , κ_i . The reader will note that in the DALY literature, the underlying model which is typically presented as a basis for disability measurement is a model of a population, rather than a model of the individual: I take the view, however, that any model of a population must implicitly contain a model of the individual as a special case.

An example of such a κ_i is depicted in Figure 1. This individual experiences three transitions, from full health to some degraded condition a' at age t_1 , to some further degraded condition at age t_2 , to death at age t_3 . Formally speaking, κ_i can be thought of as a function, $\kappa_i(s)$, $0 \leq s \leq 1$, which maps points on a timeline to some health state $a \in A$, where A is the set of health states

(including a state representing death).

Figure 1 about here

The quality of i 's journey can be measured, either from the point of view of health, or from the point of view of disability. In this paper, I suppose that health is measured from a life of zero duration: thus, a person who dies at birth experiences 0 health. Similarly, disability is measured from a baseline of a life of length 1, with a person who lives to age 1 in full health experiencing 0 disability (the length of the reference lifetime is thus the measure of health, an arbitrary assumption simplifies some of the formulae presented later on). In keeping with convention, I will assume that the health weight for full health is 1 and for death is 0; and the disability weight for full health is 0 and for death is 1, and states worse than death or better than full health cannot be valued.

The planner who wishes to take a health-utilitarian point of view will have to have some way of rendering health states commensurable so that she can aggregate health over time and over persons. To do this, she might assume that *health measurements exist*, in the sense that there exists a real valued function over health states $h(\cdot), 0 \leq h(\cdot) \leq 1$, and her preferences for i 's life

profiles κ_i can be represented by a function $H(\kappa_i) = \int_0^1 h(\kappa_i(s)) ds$, in the sense that she (non-

strictly) prefers profile κ_i to profile φ_i iff $H(\kappa_i) \geq H(\varphi_i)$. In order for such measurements to exist, the health-utilitarian's preferences have to exhibit certain sets of conditions which have been well-explored in the theoretic literature (e.g. Johannesson, Pliskin, & Weinstein, 1994; Østerdahl, 2005; Pliskin, Shepard, & Weinstein, 1980).

If, on the other hand, the planner takes a disability-utilitarian viewpoint, she might wish to make the corresponding assumption that *disability measurements exist*, here taken to mean that there exists a real valued function over health states $d(\cdot), 0 \leq d(\cdot) \leq 1$, such that her preferences for

life profiles κ_i can be represented by a function $D(\kappa_i) = \int_0^1 d(\kappa_i(s)) ds$, in the sense that if she

(non-strictly) prefers profile κ_i to profile φ_i iff $D(\kappa_i) \leq D(\varphi_i)$. It is easy to see that if the government planner's preferences meet the condition for health measurements exist, then disability measurements also exist, as $D_i(\cdot)$ can be found by setting $d(a) = 1 - h(a)$, and *vice versa*. Accordingly, the conditions for health measurements to exist, and those for disability measurements to exist, must be the same.

A consequence of this is that any elicitation which establishes a set of health weights, also establishes a set of disability weights; and if the set of health weights is unique, the set of disability weights is also unique. Figure 2 shows the equivalence established in the von Neumann-Morgenstern utility elicitation (between a sure health state and a gamble yielding full health or death), and the equivalence established in the time-trade-off elicitation (between a short healthy life and a longer but less healthy one). It is interesting to note that both equivalences can equally easily be interpreted from a health and from a disability point of view, depending on whether attention is drawn to the p or t as the health state weight, or the $1-p$ or $1-t$ as the disability weight. I will call a set of health and disability weights which stand in this $d(a) = 1 - h(a)$ relationship a *consistent* set of weights.

Figure 2 about here

Graphically, the existence of health/ disability measurement entail that i 's total (time-integrated) lifetime health in profile κ_i , $H(\kappa_i)$, can be measured by finding the area to the left of the staggered line in Figure 1, with the vertical dimension measured by the scale on the left axis; and i 's total (time-integrated) lifetime disability, $D(\kappa_i)$, can be found by finding the total area to the right of the same line, with the vertical dimension measured by the scale on the right axis.

Given a consistent set of health weights and disability weights, $H(\kappa_i) + D(\kappa_i)$, is equal to 1 (to see this, compute the areas of the health and disability components of each vertical strip, then sum over all strips). Operations which affect i 's health (e.g. performing a surgical procedure on i or eliminating an illness) can be thought of as replacing κ_i with an alternative profile φ_i . However, since $H(\kappa_i) + D(\kappa_i) = H(\varphi_i) + D(\varphi_i) = 1$, by simple algebra, any increase in health ($H(\varphi_i) - H(\kappa_i)$) must be matched with an exactly proportionate decrease in disability ($D(\varphi_i) - D(\kappa_i)$).

Of course, the health and disability weights which are used in practice may not be consistent and so practical calculations of health gains and disability reductions may not match (Sassi, 2006: note that Sassi also includes age weighting in his DALY calculations). However, this suggests that the key dispute is not between a health or disability framing but rather concerns the appropriate methodology for weight elicitation. If one were to use consistent weights, one would arrive at the same ordering whether one ranks interventions from the greatest to the least associated increase in health, or from the greatest to the least decrease in disability.

3. Equity-adjusted aggregation over persons: a social welfare function approach

Historically, the focus of the research community has been on the development of planning approaches which allow health planners to prioritise resources based on goals such as maximising health, or minimising disability (what I have called above a health- or disability-utilitarian approach). As a result of these approaches, health planning generally has become more explicit, transparent, and orderly.

Yet health- or disability-utilitarianism, interpreted strictly, has a number of unsettling and even repugnant consequences related to the neglect of distributional issues: the optimal allocation of healthcare may be one in which allows for considerable variance in experienced health or disability across persons. One of the most perverse of these consequences is that people who have worse health, and thus lower capacity to benefit from healthcare, have less of an entitlement to receive healthcare than their healthy neighbours.

There is no question that this is an issue of absolutely fundamental importance for health planning, as the attention which this issue has received in the literature attests (Culyer, 1989; Dolan, 1998; Wagstaff, 1991; Williams, 1997; Williams & Cookson, 2000). In the GBoD studies, Murray and Lopez also agonised the incorporation of distributional concerns. However, Williams' (1999) criticisms of the particular method of accounting for such concerns used in the GBoD studies (which appear to be accepted by Murray and Lopez) underline the counterintuitive implications of introducing ad hoc fixes into benefit measurement.

A relatively recent literature has explored the properties of various Health-Related Social Welfare Functions or HR-SWFs (Bleichrodt, 1997; Dolan, 1998; Østerdahl, 2005; Wagstaff, 1991; Williams & Cookson, 2000). This literature supposes that a government planner may wish to evaluate health related interventions by defining an explicit HR-SWF over all possible levels of health (thought of, for example, as a lifetime QALY endowment) of everyone in some population. Such a function can take into account various concerns about distributional equity in a systematic way. While, to my knowledge, no one has proposed the construction of an explicit Disability-Related Social Welfare Function (DR-SWF), there seems no *a priori* reason why this possibility should not be entertained.

A common functional form proposed for the HR-SWF is the Bergson function, which, supposing person anonymity holds, take the form $\sum_{i \in N} (H(\kappa_i))^p$, where N is the index set of all the members

of the population of interest (Wagstaff, 1991; see Østerdahl, 2005 for an axiomatisation).

Similarly, a Bergson DR-SWF might be $\sum_{i \in N} (D(\kappa_i))^q$. Given the relationship between health

and disability, a Bergson HR-SWF can be expressed in terms of disability as $\sum_{i \in N} (1 - D(\kappa_i))^p$

and a Bergson DR-SWF can be expressed in terms of health as $\sum_{i \in N} (1 - H(\kappa_i))^q$.

An interesting feature of the Bergson HR-SWF and DR-SWF is that the p and q parameters admit of a particularly easy elicitation, based on an old idea in inequality measurement (Atkinson, 1970; Sen, 1997), namely that of seeking an equivalent equally distributed collection of health or disability levels. Consider presenting an elicitee with the following scenario:

“Suppose congenital condition C has treatment T, which must be administered at birth. One dose of T enables survival in full health up to age x ; two doses enables survival until the population reference age. You are faced with two otherwise indistinguishable newly born individuals with C and have enough resource for two applications of T. Do you prefer to apply T once to each individual, or twice to the same individual?”

Making the reasonable assumption that the elicitee feels that that more health is preferred to less (less disability is preferred to more), the lower the value of x , the more likely she is to want T to be applied twice to the same individual (perhaps determined by some mechanism such as tossing a coin), and the higher the value of x , the more likely she is to want T to be divided between the two persons. If the elicitee’s preferences obey this assumption, it should be possible to establish a critical value of x where the decision will switch from sharing T to allocating T to a single individual.

Given such an indifference age x^o as a fraction of the reference age (taken throughout this paper as 1), the implied values of the parameters in the Bergson model are those which satisfy

$2(x^o)^p = 1$ and $2(1 - x^o)^q = 1$ respectively. Taking logs and rearranging gives $p = \frac{1}{\log_{1/2}(x^o)}$

and $q = \frac{1}{\log_{1/2}(1 - x^o)}$. Thus, just as the same question (either time-trade-off or standard

gamble) can be used to elicit health and disability weights, the same question can be used to derive the p and q parameters. However, the relationship is clearly somewhat less straightforward than the relationship between the set of age weights $h(\cdot)$ and the set of disability weights $d(\cdot)$.

Taking the implied HR-SWFs (DR-SWFs) for an inequity-averse planner for a number of different values of x^0 gives a family of functions with $p > 1$ ($q < 1$). Figure 3 shows one of the summands of these Bergson HR-SWFs and DR-SWFs expressed as functions of health: the reader who wishes to see the corresponding figure the valuations of disability can imagine the figure flipped on both axes.

Figure 3 about here

As Figure 3 shows, although the curves of both functions are concave, they differ appreciably in their third-order properties. The indifference (iso-welfare) curves for particular health levels in a two person health economy generated by a Bergson HR-SWF and a Bergson DR-SWF (both parameterised by $x^0 = 0.25$) are shown in Figure 4.

Figure 4 about here

The Bergson form of the HR-SWF is a positive monotonic transformation of the Constant Elasticity of Substitution function (e.g. Varian, 1992), and so the indifference curves generated by this function are radial translations of one another. However, the shape of the indifference curves generated by the DR-SWF are quite different, becoming flatter towards the origin, indicating that a health planner who took a disability oriented, rather than a health-oriented point of view, may make a quite different pattern of resource allocation decisions.

4. Conclusion

The focus of the current paper has been a contrast between the concept of health and disability in health planning with a particular focus on contrasting approaches based on QALY-type ideas with those based on Burden of Disease-type ideas. The background for this is an apparent convergence in practice between the sort of work conducted under both traditions. Accordingly, the sort of *rapprochement* hoped for by Gold, Stephenson and Fryback (2002) now seems possible.

The question asked in the title is whether the most obtrusive difference between the two methods – the focus on health versus disability – is a substantive or a stylistic difference. In this paper, I have argued that consistent health and disability weights will lead to identical cost-benefit rankings of interventions, whether QALYs or DALYs are used, and in this sense the question is a purely stylistic one. However, once one starts to attempt more conceptually ambitious undertakings, such as introducing preferences for equity, the framing which one uses does make a real difference.

This has practical purposes when working with health planners. Planners with a public health or epidemiological background, may find using the language of DALYs and disability avoided more natural. Health planners with an economic training may be more comfortable with the language of QALYs and health gained. Since practical planning, as it is done currently, tends not to involve explicit assessment of equity attitudes, it is legitimate to switch between these alternate languages, depending on the audience which one is addressing.

However, from the point of view of the development of the normative basis for healthcare resource allocation, the current paper does not provide any such reassuring conclusion. Whether one builds from a foundation of health or a foundation of disability will have real implications. Accordingly, some definite choice between health and disability as a basic concept, or some creative reframing of the problem in terms of some entirely other concept (e.g. Sennian capability) may be in order. .

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Figure 1. Health and disability measurement on a life profile

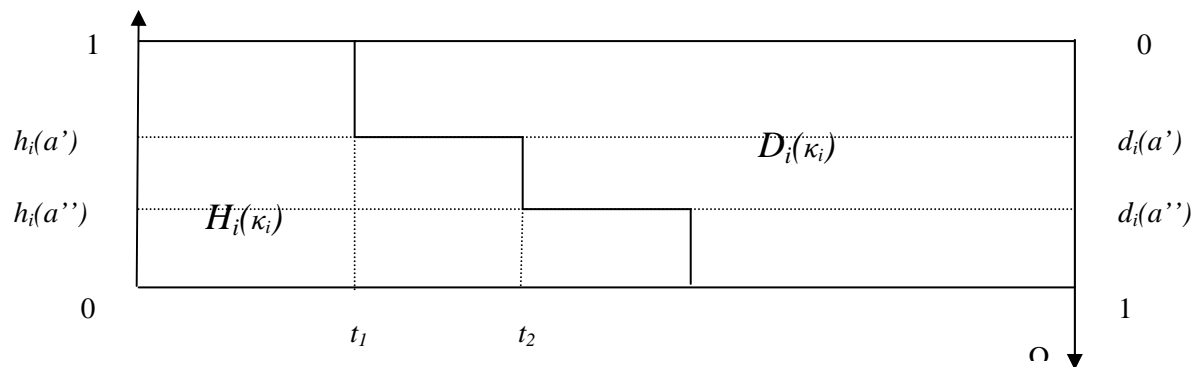


Figure 2. von Neumann-Morgenstern and time-tradeoff elicitation

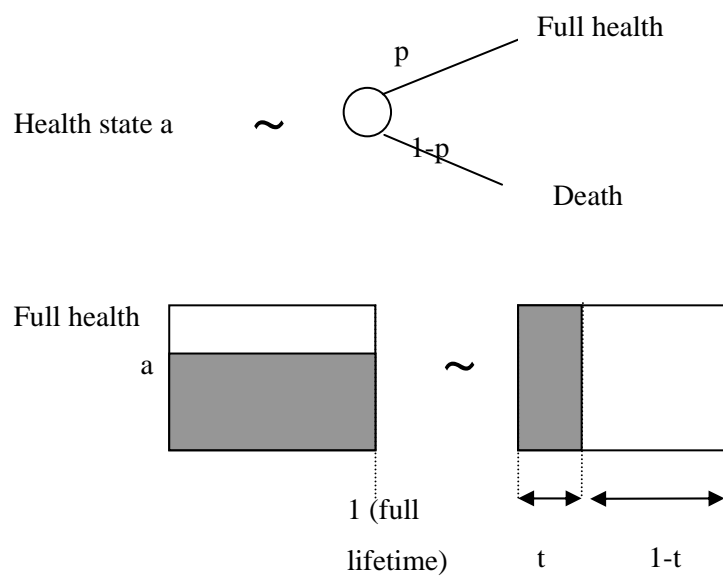


Figure 3. HR-SWFs and DR-SWFs for a range of inequity preferences

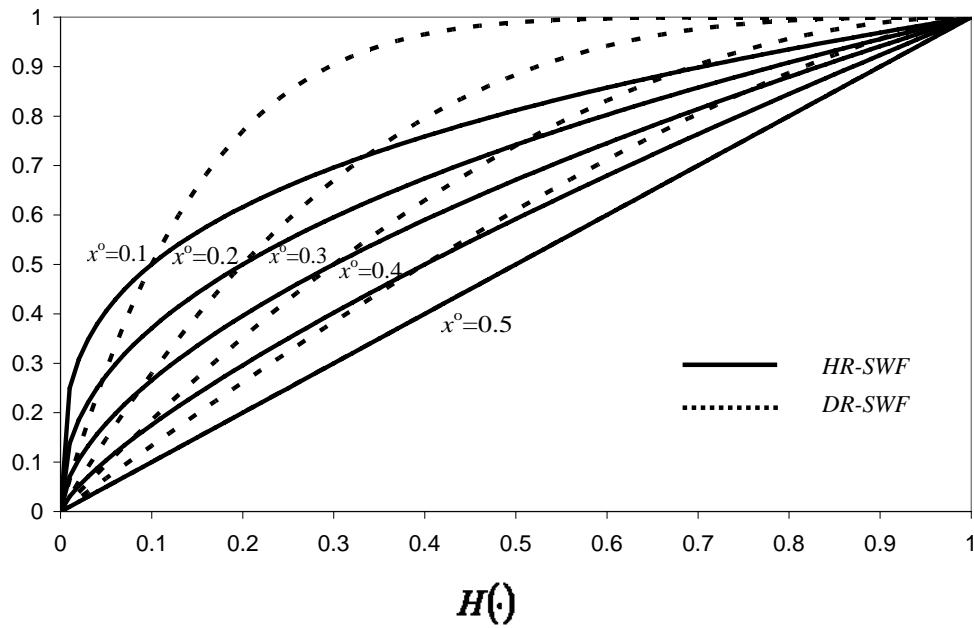
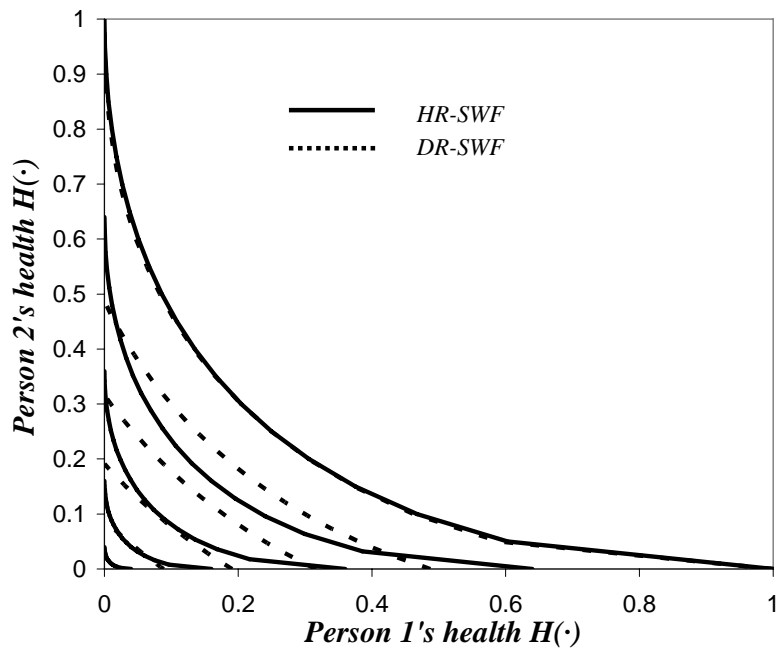


Figure 4. Indifference curves in a two person health economy generated by a HR-SWF and a DR-SWF



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