

Calibrating Quality to Respect Equality

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Abstract

Comparative valuation of different policy interventions inevitably relies upon inter-personal comparability of benefit. In the field of health economics, the metric used for such comparison, quality adjusted life years (QALYs) gained, has been subject to criticism for failing to respect the principle of the equality of all persons' intrinsic worth, including particularly those with incapacities. This paper proposes a methodology for recalibrating health related quality of life to respect equality. This requires interpreting full health as the maximum function that is achievable for the beneficiary in question: the happy implication being that saving the life of an irremediably blind person of given life expectancy delivers as many QALYs (thus understood) as saving the life of a sighted person. It is shown that this methodology can cope with technical innovation and uncertainty. The proposal is further shown to be consistent both with a welfarist understanding of QALY-maximisation (for a disabled person is likely to be willing to pay as much for an additional year as an able-bodied person) and with plausible extra-welfarist interpretations. It is argued that the latter should be anchored to responses by those in the relevant condition trading their expected years in their current state for the best health state on offer to them for a shorter period. Practical implications are drawn. This egalitarian interpretation of quality of life is already embodied in the refusal to discriminate against the disabled at the clinical level or in guidelines. However, review of assessment of treatments specifically for those with long-term disability or degenerative conditions is recommended.

Normative economists are in the business of making inter-personal comparisons of benefit: few policy recommendations can be made without making someone worse off, if only the taxpayer who funds them (and it is rarely possible in practice for the losers to be compensated, certainly not costlessly).

This paper addresses the question, at root philosophical, of how to construct the currency for making such comparisons in a way that is consistent with the principle of the equality of human worth. The difficulty is that attribution of a greater ability to benefit from an intervention that achieves for each beneficiary the same level of function, seems to imply that absent the intervention that person's life is less valuable than that of comparator lives.

This problem has application across normative economics, but it has been noted particularly health policy. I will therefore use health policy, and particularly the use of a Quality Adjusted Life Year (a QALY) as a basis for the comparison of the benefits

of interventions across different individuals, to illustrate the problem in section 1. In sections 2 and 3, still focusing upon the health economics application, I set out a solution involving calibration of gains to individuals' maximal potential function, and show how it can handle changes in the maximum level with technical innovation or increasing resources, including under uncertainty. In section 4, I return to the philosophical basis for the proposal, relating it to the fundamental ethical truth of the equality of lives, and, with the assistance of some remarks in Adam Smith, show how it can be reconciled to the perspective of both welfarist and extra-welfarist normative economists. Section 5 considers some implications for policy work, particularly considering interventions mitigating the plight of those with limited maximal physical or mental functional capability.

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1. There is widespread (if not universal) consensus in the health economics literature that allocative decisions should be supported by cost-utility analysis and that the QALY is an appropriate unit of health-related utility. The measure enables comparison of achievement in the promotion of health or the cure or palliation of ill-health of different interventions, both for an individual patient and more generally in the allocation of a communal healthcare budget.
2. It is important to understand the way in which equivalence between quality and quantity is elicited with respect to a particular intervention, as it is by the elicitation methodology that the concept is effectively defined in use. This definition in use can then be compared with our intuitions regarding value equivalence for inter-personal comparisons. Typically, the equivalence is obtained through two distinct steps:
 - i. For a particular intervention, the functional health state is ascertained with and without the intervention using a standard metric of health state, for instance the EQ5D or the SF6D – which allocate patients to a health state on respectively five or six dimensions of function.¹
 - ii. The value of the particular improvement in health status is ascertained usually by use of a tariff derived from a survey of the general public, using TTO or SG.
3. Comparison can then be made of interventions to patients with very different prognoses: the tariff is used to value the health prognosis, assigned to a level of functioning using the standard metric, in comparison with the non-intervention prognosis. It is contentious whether the tariff should be derived from members of the general public imagining how they would react if they had an illness, or those who are themselves afflicted. For our purposes, the crucial point is that all respondents respond on the assumption that a cure is available, for that is what they are asked.
4. One general problem with such techniques of benefit transfer, transferring an estimate of the value of a gain elicited from one population group in a particular (or assumed) context to other contexts, is that it ignores heterogeneity of

¹ EQ5D: Mobility, Self-care, ability to carry out usual activities, Pain/discomfort, Anxiety/depression. SF6D: Physical functioning; role limitation; social functioning; pain; mental health; vitality.

circumstances and individual tastes and talents. For example, the loss of a finger is clearly a greater loss to a pianist than to singer. This is uncontentious. Ignoring such heterogeneity may be justified by desire to insulate the clinical context from cost-economy considerations and by the heavy cost and practical difficulty of extracting reliable valuations from patients, who will have a personal interest in the outcome (though such approaches have their advocates). The consequences of ignoring heterogeneity at the policy setting level of decision making can be mitigated by allowing clinical discretion or appeals processes at the local level.

5. A separate but related problem of systematic bias arises, however, once the answers from these questions are used to put a value on the lives of those who have the condition in question incurably, but are now afflicted with some other condition – perhaps one that is life-threatening. Or in circumstances in which the condition itself has become life threatening and only mitigation, not complete cure, is on offer. This is a related problem because there is a heterogeneity of circumstances, that between people with different capacities to benefit, which would certainly affect their personal valuation of what interventions are available for this or other conditions, a heterogeneity which is ignored by the use of standardised valuations, and which systematically undervalues benefits to those with reduced ability to benefit.
6. This problem has been recognised and used as a basis for criticising use of the QALY as a metric of healthgain:
 - ⇒ “The QALY outcome measure has problems. Even if a life-year in which a person has impaired mobility is worse than a healthy life-year, someone adapted to wheelchair use might reasonably value an additional life-year in a wheelchair as much as a non-disabled person would value an additional life-year without disability. Allocators have struggled with this issue.” [Principles for allocation of scarce medical interventions, Govind Persad BS, Alan Wertheimer PhD, Ezekiel J Emanuel MD, *The Lancet*, Volume 373, Issue 9661, Pages 423 431, 31 January 2009
[http://www.thelancet.com/journals/lancet/article/PIIS01406736\(09\)601379/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS01406736(09)601379/fulltext)
7. The use of QALYs based upon a standard valuation of healthstates, irrespective of prospects for improvement, assumes the validity of an absolute standard of quality of life, that would imply that a year in the life of a disabled person is less valuable than that of an able-bodied person. Differentiation based on the quality of life that different people may enjoy maximally is equivalent to differential valuation of their lives. Not only is this an ethical error, it also threatens self respect² by publicly failing to accord equal valuation to every life. Discrimination on grounds of ethnicity or gender or class or disability would clearly fall into this category. Hence it would be inappropriate to give preference to saving the life of a rich or cultured or happy or sighted person because their quality of life is thought greater, such that they will gain more QALYs. Such preference would be inappropriate notwithstanding that almost everyone reckon more of these attributes to improve their own quality of life. Similarly, it is inappropriate to give preference to saving the life of the able-bodied over the life of the disabled.

² Cf. Rawls' insistence upon the importance of avoiding "at almost any cost the social conditions that undermine self-respect" (*Theory of Justice*, 1972, section 67).

8. More constructively, this problem was recognised by Ubel et al (2000) who proposed to adapt cost utility analysis to address it. They attribute the problem to “a preference people have for avoiding discrimination against people who have limited treatment potential...
- ⇒ “For example, suppose the public thinks that saving the lives of people with paraplegia is equally as important as saving the lives of people who can be returned to full health. ... saving the life of either group of patients [would then] bring 1 QALY per patient [per year of life extension]. However, this rescaling would also force us to conclude that people with paraplegia have the same quality of life as people without paraplegia and that curing paraplegia would not improve HRQoL [Health Related Quality of Life]. (No HRQoL is gained by “improving” patients from an HRQoL of 1.0 to an HRQoL of 1.0)” Ubel PA, Nord E, Gold M, Menzel P, Prades JL, Richardson J. Improving value measurement in cost-effectiveness analysis. *Med Care* 2000; **38**: 892.
9. They propose the following corrective:
- ⇒ “The QALY trap exists because HRQoL measurement is being asked to capture not only patients’ quality of life but also the societal value of treating patients with various health conditions. When HRQoL measures are supplemented with separate societal value measures, we will no longer be caught in the QALY trap...
- ⇒ “Suppose the societal value of program A [which cures 100 people of a life threatening illness and returning them to full health] is given an arbitrary value of 1.0. Now suppose people think that program B, which saves the lives of 100 people with paraplegia, should receive the same priority for funding as program A ... Now suppose the same people think that curing 600 patients of paraplegia (program C) is equally as important as saving 100 otherwise healthy people’s lives (program A). Program C therefore has ... a societal value of 0.16. ...
- ⇒ “What is the benefit of separating societal value from HRQoL measurement? ... the HRQoL brought by programs B and C (in conventional CEA [Cost Effectiveness Analysis]) must sum to the number of QALYs brought by program A (1 QALY [per person year]), [thus creating the trap – either to assign less than full value to saving the life of someone with paraplegia or to assign no value to curing someone of paraplegia]. However, ... the societal value of programs B and C add to 1.16. We have escaped the QALY trap. We can now say that saving the lives of people with paraplegia is equally as valuable as saving other people’s lives while still acknowledging that it is beneficial to cure people of paraplegia.”
10. This approach is ethically arbitrary, not attempting to explain why this particular public preference regarding the relative value of bringing different benefits to different people’s lives is justified and should be heeded in resource allocation.

The authors in fact suggest that for certain levels of disability, the public may not wish to attribute full value to saving life. Surprisingly, they rate this a virtue of their approach: “for life-saving treatments that affect people with more severe disabilities, with HRQoL of 0.2 and 0.5, respectively, we specif[y hypothetical] societal valuations of < 1 [specifically, 0.5 and 0.9] to highlight an important point,: Societal value measurement does notforce us to conclude that saving the life of a person with any disability is equally as valuable as saving anyone else’s life.”

11. Whilst, as will be discussed later, there is a level of mental and perhaps physical function beneath which life-saving is of doubtful value, the specification of such a level must be justified as a distinct ethical derogation from the principle of equality of human worth, not left subject to the vagaries of public prejudice. This is not to patronise the public, or to presume that there is an elite with privileged ethical insight who can make these decisions. Rather, to refuse to subject this issue to public opinion is to insist upon the responsibility of the decision maker in each case to determine the ethically justified course – a responsibility we find obvious when confronted by the possible popularity of ethically abhorrent decisions (like racial prejudice) but which applies no less in areas in which ethical judgment is more nuanced.
12. Furthermore, the solution proposed by Ubel et al creates a paradox, which the authors only half acknowledge:
 - ⇒ “Some may worry that the societal value approach to QALYs is inconsistent because it allows the value of programs like B and C to sum to a value >1 . However, if society places the same value on saving the life of a paraplegic and saving the life of a non-paraplegic and if society also values the cure of paraplegia, then our suggestion is consistent with societal values.”
13. The defence does not answer the worry: is the advocated approach inconsistent? That it is at least paradoxical can be seen from considering how it would value a programme D, one that was able, marvellously, to save the lives of those with paraplegia threatened by some fatal illness and cure their paraplegia at the same time. Programme D = B+C in its effect, so should be valued at 1.16 per life year – apparently making the programme more valuable than programme A (which saved the lives of nonparaplegics), notwithstanding that both programmes A and D leave their beneficiaries, who would all otherwise die, with exactly the same HRQoL.
14. If the scheme is inconsistent, then its consistency with society’s values merely shows the latter also to be inconsistent: that fact is scarcely a defence of the scheme. Before drawing that conclusion, however, it is worth considering whether there is an alternative way of interpreting the intuitions to which Ubel et al correctly draw attention.

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15. Valuing mitigations of incapacity appears implicitly to denigrate the value of the lives of those burdened with that incapacity. The key to dissolving the appearance of paradox is to anchor valuation in the perspective of the potential beneficiaries of intervention, recognising how beneficiaries' maximum capacity to benefit is likely systematically to inform option valuation.
- ⇒ ***Principle One: Personalised Maximal Function.*** For any irremediable condition, perfect health includes that condition, and it is against that standard that an individual with that condition will necessarily calibrate any other condition. Others evaluating interventions on behalf of such an individual should do likewise.
16. Consider first someone who has irremediable blindness who suffers from a separate life-threatening condition for which a curative intervention is available. To avoid discrimination against people with disabilities, the assessment of quality of life used in calculating incremental QALYs conferred by an intervention must be calibrated to the maximum health that is available to the person affected. Hence, when confronted with a person whose maximum gain cannot include sight, because no technology is available that can restore this person's sight, an additional year of life without sight but otherwise healthy is counted as a year with full quality of life. As a blind person's life is equally valuable, the years that are in jeopardy for this blind person are full value years.
17. On this conception, it is thus a mistake to consider the health related quality of life used to calculate QALYs as measured against an absolute scale of bodily function: the maximum quality level in a QALY assessment is determined by the limits of what medical technology might do for the prospective beneficiary.
18. The analogy with dexterity or height or intelligence or pulchritude or sanguineness or happiness of disposition may help to render this approach natural. These attributes are generally valued as goods in contexts in which we assess how much human beings can contribute to others' lives (in recruitment or selecting marriage partners for our children), or when confronting hazards that might jeopardise them, or in the exceptional cases where a deficit can be remedied (by a growth hormone, or by therapy of some sort, or by surgery). But for the most part we accept that we are endowed with different levels of these attributes, and that that is our lot, without these differences rendering us less or more valuable intrinsically as human beings. Hence, when assessing relative efficacy of health interventions these differences are irrelevant.
19. Now, consider the position of a person whose blindness is curable. Attainment of sight lies within the capability set of this person, so she assesses options against this standard. Her blindness is not part of her endowment but a condition for which she seeks treatment, and hence she will calibrate other states against a health opportunity set that includes full sight. If she acquires some unrelated illness that threatens her life, she will rate a cure that leaves her blind as giving her less than full quality of life.
20. Suppose this blind person suffers from cataracts which can be removed, but the operation has not yet occurred. Suppose whilst she waits she is indeed subject to a

life-threatening condition. Is saving her as valuable as saving the life of a sighted person? It appears that it is not so, because we established that she reckons her life less than of full quality. But this conclusion is not problematic – for we are in a position to save her life and to restore her sight: and the joint effect of these two procedures will be that she is in the same state as her sighted comparator after the latter's life has been saved. It is nonetheless the case that to bring her to this happy outcome will be more costly than it would be for a sighted person threatened with the same life-threatening condition. But that fact – that some people are more expensive to cure than others – is unavoidable and incontrovertible.

21. Suppose exactly the same scenario arises with a blind person whose blindness is in principle curable except that the budget is not available to cure her: the cost per QALY is above the threshold indicated by the budget constraint. Again, we have to decide whether it would be as valuable to save her life as that of a sighted person. Clearly it is, notwithstanding that in this case we cannot afford to cure her blindness.

22. Hence it appears that:

⇒ ***Principle Two: Maximal Function Defined by Budget Constraint.***

In the assessment of a maximum quality of life achievable by an individual, the maximum is defined not only by technological limits but also by the budget constraint of the decision maker, assuming that the budget constraint is binding.

23. After all, if the budget constraint is binding, it is just as real a constraint as the technological limit.

24. With the aid of this second principle, we are able to review the conundrum posed in Ubel et al of evaluation of a life saving cure for someone with paraplegia in conjunction with a cure for their paraplegia. Ubel et al proposed that the combined value of these two interventions should be assessed as giving benefit of 1.16 QALYs per life year – which it was pointed out render the gain to exceed that bestowed upon someone without paraplegia whose life is saved, notwithstanding that outcomes with and without intervention are identical. Calibrating to maximum function removes this paradox: if both life saving and cure for paraplegia are possible, then the person with paraplegia will receive a QALY per life year, just as would someone without paraplegia whose life was saved, the difference being only that the full cure for the former will include any additional cost of curing the paraplegia.

25. The condition that the interventions have to be affordable does however produce its own paradox. Consider again someone who has a curable paraplegia together with a life threatening condition, in comparison with an able-bodied person with the same life-threatening condition. Suppose the cost per QALY involved in curing the latter person is just below the threshold imposed by the binding budget constraint. Now, to save the person with paraplegia and to restore her mobility will cost more than the threshold. To save her without restoring her mobility would also cost more than the threshold (given that she would receive less than a full QALY). So she seems condemned to die; yet paradoxically had she had a paraplegia that

was incurable, saving her life would have been reckoned as giving full quality of life (for by Principle One, her full quality of life included paraplegia), and she would have been saved!

26. One might be tempted to answer that in this condition, by Principle Two, she is incurably paraplegic, for as she is dying, the cost per QALY of curing her paraplegia must be prohibitive (else we could cure her and then save her). But this is not correct, for in evaluating the potential to save her life and cure her paraplegia as a single treatment we are required to consider how her life would be were the intervention affordable. This means that in her current condition we are forced to assess her maximum function as including mobility, and hence saving her is not affordable within the budget constraint. Saving her life without curing her paraplegia, which gives her a HRQoL (using Ubel et al's hypothetical valuation) of only 0.84, is also unaffordable. So she is indeed without salvation, notwithstanding that her peer, whose paraplegia is incurable, would find herself benefiting from a favourable assessment.

⇒ ***First Paradox. The Existence of a Cost-effective cure for Comorbidities reduces the Value of Saving Someone's Life.***

27. Note two mitigating facts about this paradox:

- ⇒ The person with curable paraplegia is not assessed as having a less valuable life to save; merely to have a condition that makes their life, at full quality, more expensive to secure. The discrimination here is one forced by the circumstances not by the perspective of the evaluator.
- ⇒ In practice, a non-discriminatory override tends rightly to be applied in particular rescue contexts, inhibiting the application of person by person cost-effectiveness criteria, so that the full force of this paradox would only be felt were there a different treatment to be evaluated to save the life of the person with curable paraplegia.

28. Given that maximum function is determined by the budget constraint, the budget constraint itself must be set in tandem with the determination of maximum function for the potential beneficiaries. Suppose the budget is determined exogenously, to determine of any particular intervention whether it is affordable, we can first determine how the budget would be allocated to maximise life years – on the assumption that all non-life-threatening conditions are incurable and hence everybody always has full value lives. Potential morbidity reducing interventions are then introduced one by one if and only if the enhancement to QALYs realised within the budget, on the assumption that that intervention is now included, is greater than would be achieved without including that intervention. Once such an intervention is introduced, saving the life of any person with that condition and restoring them to full function becomes more expensive. More generally, as the budget constraint is now found to bite at a lower cost per QALY, there will be some amongst all those whose lives could be saved within budget whose salvation is now unaffordable.

29. (Note again that although it is easier on the tongue and more evocative to talk of life saving, what is really at issue is the authorisation of treatments that will extend

life. In circumstances in which a life is currently in imminent jeopardy, the desiderata of the rule of rescue would apply.)

30. Suppose we have enough resources to give ten people ten extra years. So our starting point is a potential to achieve 100 QALYs from our budget. The threshold cost per QALY is provisionally set by the cost per QALY of the most expensive QALY gained by that set. Suppose someone has a condition that, were it curable, they would rate at HRQoL of 0.5. This should be included in the set if its inclusion would raise the total QALYs gained beyond 100, notwithstanding that its inclusion will cut short the life years added to some beneficiary in the initial theoretical distribution.

⇒ ***Principle Three: Application of the Budget Constraint Determined Counterfactually.*** When determining whether an intervention is affordable within the budget constraint, the maximum quality of life is set on the assumption that the intervention is affordable. If the analysis shows the intervention to be unaffordable, then the remaining treatment option for that patient becomes the maximum within which in turn its cost-effectiveness is assessed.

31. What framework should be used when determining the size of the budget itself against rival uses of funds? It might seem that if the health budget is set at zero, then every person's HRQoL is automatically set at 1, and there is nothing to be gained by expanding the budget. But the principle that maximal function is determined taking account of the budget constraint only applies if the budget constraint is actually binding. If there is resource allocated to some other activity which can be vired into health, then that condition does not hold, and the allocation between that other good and health must be set using some metric of value that encompasses both health function and whatever good is realised by the other budget.

32. Whose budget constraint should be applied? Budgets are particular to budget holders. The maximum potential health state for the same beneficiary depends upon the resources available to the decision maker. Consider the valuation of a wealthy aid agency versus the valuation of a impecunious health system. The latter is forced to take as fixed incapacities that from the perspective of a wealthy donor are better seen as ailments requiring cure.

⇒ ***Principle Four: Funder-dependence of Maximum Function of Beneficiaries.*** Each funder of healthcare must allocate its budget so as to maximise health gain, regarding any unaffordable improvement of health condition as an incurable condition not derogating from the value of the lives afflicted.

33. The equality principle dictates that saving the life of a person with unavoidable (future) blindness is just as valuable as saving the life of a sighted person. Where a full cure is unaffordable, the blindness is unavoidable, so the future years that a less effective treatment offers are the best available to this patient, and we (or she) should therefore be willing to pay the same price for such an inferior treatment,

notwithstanding that we would not have rated it less valuable in the presence of an affordable full cure.

⇒ **Second Paradox:** the same price is payable to the best cure available and affordable irrespective of the level of function achievable following the cure.

34. And the same price would of course be payable for any treatment that saved life (even the inferior treatment) when administered to someone who has already gone blind.
35. There is an appearance of inconsistency here: avoidance of death that leaves a disability is valued less highly when giving the less effective treatment if a full cure is available, than where there is none. Treatments are valuable only for the benefits they confer on patients; how can it be consistent to claim that the treatment is less valuable if it leaves a patient blind in one case but not in the other?
36. The explanation is this: when we first estimated what the value would arise from producing a cure for this ailment, we implicitly reckoned the quality scale to a maximum that included maintained sight, for in valuing the possible results of intervention the possibility of this gain had to be assumed. However, when confronted with a person whose maximum gain cannot include sight (because no technology is available that can preserve this person's sight within the available budget), we have to reckon the maximum quality available to be a life without sight. Thus the treatment is just as effective in delivering QALYs to the blind person as to the sighted person, for the value of the blind person's lifetime potential is as great as the sighted person's.
37. Two objections to the proposal to calibrate quality of life to maximum potential function should now be addressed:
 - The implications become counter-intuitive when applied to those with very low potential quality of life.
 - The proposal responds to alleged discrimination against the disabled implicit in use of the QALY as a measure of benefit. But a similar discrimination argument is also applied to those who differ not in their physical capability but in their life expectancy.
38. Suppose someone is in a permanent vegetative state and the possibility emerges to restore to them some minimum level of brain function still short of consciousness. To the extent that that represents both an improvement and the maximum function that can be attained for such a person, it might seem to follow from the equality of persons that such an intervention should be reckoned as if it was conferring full quality of life.
39. To avoid this outcome, it is open to us to stipulate a minimum level of mental function as delimiting the ambit of the principle of equality. Whilst such a restriction may seem *ad hoc* and arbitrary stated thus baldly, it is not without philosophical merit, given what can be said to justify the principle of equality itself. This will be discussed in Section 4, but for now merely note that the notional

trading that underpins our assignment of quality levels to different health states – willingness to trade time spent at inferior for full quality health states – presupposes a certain cogitative capacity.

40. Regarding the second issue, are we bound by the principle of equality also to calibrate potential gain in years of life to the maximum potential years of life available to each patient?
41. Though such recalibration would be technically feasible, the results would be strikingly counterintuitive.
42. Suppose of two patients whose lives are at risk, one's life expectancy is dramatically shorter: she only has a day or two to live before she will be killed by a pre-existing condition. Here it is apparent that an intervention to secure one life is more valuable than one to save the other. Once life expectancy is allowed to play a rôle in determining the value of the intervention, argument is needed to avoid it playing a proportionate rôle, as the QALY metric of health benefit (even with the calibration of quality proposed above) demands.
43. A similar argument cannot be launched to undermine equal valuation of the life of a paraplegic and able-bodied human being. We would not equate prolonging the life of someone in a permanent coma with prolonging the life of a conscious person, for there is a qualitative difference between the two states – and the paraplegic is clearly on the right side of it. The argument for calibrating the measure of quality such that the maximum possible quality is always equal to unity may apply only to forms of disability that do not impair ethical personhood. It is not obvious how to stipulate a minimum period of time in a principled way.
44. Whilst the calibration of potential years of life to maximum potential years of life is thus to be resisted, there is another form of age discrimination that can perhaps inadvertently be imported into the use of QALYs as a metric of health gain that can be avoided by use of the calibration here proposed. Full health for a twenty year old is a different state from full health for an eighty year old. (This is one explanation for the strikingly different values attributed to health gains for different age groups³.) This might be thought less problematic than incapacity discrimination on the basis that the eighty year old was once twenty. However, if there is a principled objection to the comparison of life value involved in disparaging the value of the paraplegic's life, it should also apply to the age case.
45. It is worth emphasising that of two possible arguments that might underpin refusal to discriminate against the disabled, the argument here deployed is based upon the second:

³ Nord et al (1996) find a ten year life extension for a twenty year old to be valued at 2.5 times that given to a sixty year old and 10 times that of an eighty year old. Dolan et al (2005) summarise a number of studies that give similar results. Many also give somewhat or markedly lower weights to the value of additional QALYs for the very young (age five or two relative to ten or twenty). Sassi et al (2001) notes many similar results.

- **although the paraplegic’s life is less valuable, we decide, compassionately, to treat it as if it were the same.** On this view, we may decide not to exercise that compassion with regard to the elderly – since they were once young
- **the paraplegic’s life is viewed as equally valuable.** Whatever the rationale for that view, it may apply equally to the aged.

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46. The examples and argumentation used so far assumes certainty of outcome depending upon treatment. In practice, both with and without treatment outcomes will be subject to uncertainty. This section explores calibration to maximum function under conditions of uncertainty by analysing valuation of the introduction of a new treatment that carries risk of adverse outcome.
47. If a technology emerges that allows a particular person’s blindness to be corrected, her maximum quality of life shifts upwards, and the technology that saves such a person’s life without relieving her of her blindness becomes less valuable.
48. This gives rise to a
 ⇒ *Third Paradox. The Discovery of a Cost-effective cure for a Condition reduces the value of Existing Treatments.*
49. The appearance of paradox arises because we fail readily to grasp the radical shift in the status of the person - from one of disability-demanding-respect to one of affliction-demanding-treatment. She is now unable to realise her potential without intervention, because her potential in life has expanded. Existing treatments are therefore now seen correctly as inadequate to her need. We may wish to say that the cure, and the potential for improvement were there all the time, and we merely underestimated her potential, persistently over-valuing her quality of life. This account is consistent with attributing value to the discovery itself.
50. Under certainty, valuation of the benefit conferred by the new technology is unproblematic, following the approach described in the previous section. The quality improvement would correspond to the value that would be attributed to that gain of sight in the circumstance in which a cure proved cost-effective: what risk of death would be undergone to avoid/recover-from blindness.⁴ Or how much time in a current health state would be sacrificed to achieve relief from or avoidance of blindness. These elicitation techniques rest on a presumption that cure or

⁴ I.e. the risk a sighted person would take to avoid blindness, or the risk a blind person would take to have sight restored: the former is likely to be much greater, but may be coloured by salience and failure to take account of unanticipated constructive adaptation; the latter however may suffer from adaptive expectations and diminished aspirations. The difficulty of distinguishing which of these factors is in play is orthogonal to the matters discussed in this paper – at least if we assume that the difficulties are merely epistemological. See Menzel P, Dolan P, Richardson J, Olsen JA. The role of adaptation to disability and disease in health state valuation: a preliminary normative analysis. *Soc Sci Med* 2002; 55: 2149.

avoidance is a real option, whose price is respectively risk or truncation of life; hence the respondent is required seriously to assess the appropriate sacrifice, and implicitly to reckon the value of life with the disability at less than one – notwithstanding that were a cure unavailable they would of course wish to have full value accorded to their life-state, notwithstanding the disability suffered. Suppose, as before, that people are generally willing to trade eight years with sight for ten years with blindness, or to take a 20% risk of death to avoid or be cured from blindness -- then the new intervention that does with certainty offer a cure can be valued at 0.2 QALYs per annum.

51. Now consider how we would evaluate an intervention which did indeed present a risk of death to the patient as a possible outcome, against a promise of a cure for blindness if the intervention is successful. If the intervention is successful, it is clear that the HRQoL absent the intervention would have been 0.8, whilst with the intervention a HRQoL of 1 is achieved. However, if the intervention fails, the cure promised proves to have been chimerical – hence on the principle of equality the life that would then be lost also had a HRQoL of 1.0. Effectively, the intervention is conducted to discover whether the patient’s current HRQoL is 0.8 or 1.0.
52. If death is the outcome, a full quality life has been lost, the life that they had was as good as it could get – and that is the life they have lost. So, compared with the do nothing option, death is valued at -1 QALY per life year. Hence:

⇒ ***Principle Five, Evaluation under Uncertainty of Maximum Function.*** Interventions with uncertain outcomes must be valued against parallel calibrations of maximum function, depending upon the outcome of the intervention.

53. The upshot is that to value an intervention with an 80% chance of success of restoring sight for a blind person with a life expectancy of 10 years, and with blindness assessed by someone with the potential of sight as giving an HRQoL of 0.8, it is necessary to calculate the expected QALY gain against the two separate calibrations of maximum function, thus:

⇒ Product of Probability of success and expected QALY gain under success: $0.8*(+0.2)*10$
 +
 ⇒ Product of probability of failure and expected QALY loss on failure: $0.2*(-1)*10$
 =1.6-2
 =-.4 QALYs.

54. Thus the risk proves too great, irrespective of cost! In fact, to justify the intervention (again, regardless of the budget constraint) the risk of failure (α) would have had to be less than 2/12 (16.7%):

⇒ $(1-\alpha)*(+0.2)*10+(\alpha)*(-1)*10 \geq 0$
 ⇒ $-2\alpha - 10 \alpha \geq -2$
 ⇒ $\alpha \leq 2/12$

55. How are we to understand this result given that the blind person herself responded that she was willing to take a 20 % risk of death to achieve sight?

56. Effectively, such patients are undervaluing their own lives. This under-valuation is attributable to the fact that they are seized by the possibility of improvement to their life capabilities. The respondents to the questions are being asked to assume that they can be cured, and assessing how much this would be worth to them; but the decision maker, perhaps the patient herself, should recall that if the intervention fails, it will have been established that they cannot be cured, and they must assess how much would have been lost in that event—surely nothing less than a life!
57. In general, if a patient says that she is willing to undertake a risk of death of β ($0 \leq \beta \leq 1$) to recover full function from a state, she should only undertake the operation if the risk is in fact less than $\beta/(1+\beta)$:
- $$\Rightarrow (1-\alpha)\beta + (\alpha)(-1) \geq 0$$
- $$\Rightarrow \beta - \alpha\beta - \alpha \geq 0$$
- $$\Rightarrow -\beta + (1+\beta)\alpha \leq 0$$
- $$\Rightarrow \alpha \leq \beta/(1+\beta)$$
58. The required adjustment to the naïve risk tolerance assessment is more substantial, the greater is β . For example, if a patient states willingness to undergo a risk of 50% to secure a cure, intervention is not justified unless the risk falls short of one in three, and:
- \Rightarrow Third Paradox: For no patient who would otherwise certainly survive, should an intervention be justified that carries a risk of death of 50% or higher, irrespective of the risk the patient themselves claims to be willing to take. Any higher risk would undervalue the life of the patient absent intervention.***
59. If there are exceptions to this rule, they must relate to states that represent exceptions to the general principle of equality of human worth, or cases, if there are any, where pain and distress are such as to vitiate life's value.
60. A similar approach, following Principle Five, must be taken to the valuation of interventions that carry risks of enhanced disability. The correct calibration for quality by which to judge the loss is against the maximum function that prevailed before the intervention, not the maximum function that would have prevailed had the intervention been successful: for the intervention's failure proves the potential for improvement to have been lacking.
61. In general, given the principle of equality, in valuing hazards, all losses of life are of equal value, and drops in quality are reckoned as a proportion of prior expected quality. Thus loss of half one's quality of life is equally bad whatever the starting position (above the minimum functional threshold alluded to above). However, gains of quality are reckoned as a proportion of the attained state – as only with success will it turn out that that was the true maximum quality of life.
62. A further paradox emerges if we consider the possibility of multiple losses of function. Someone who loses half their physical function has lost half their prior quality of life. If they had a ten year life expectancy, they will have lost five QALYs. If they then lose half their function again, they will have lost additional

five QALYs – for following the first loss, by the principle of equality, their remaining life must be reckoned as a life of full value. Yet this person still has ten QALYs to lose!

⇒ ***Fourth Paradox: It is possible to lose more QALYs than one's remaining life expectancy.***

63. How else can we reckon the intermediate state as having a full life value?

4

64. Economists over at least the last thirty years have increasingly recognised that the attempt to formulate a value free foundation for policy prescription based on no more than the Pareto principle has failed.⁵ A metric of value that enables interpersonal comparisons must be found.

65. The most sustained attack both on the presumption that policy can be made without interpersonal comparison, and upon the self-denying ordinance preventing economists from embracing a substantial theory of value has been made by Amartya Sen, in particular by his championing of a capability measure of success in social welfare [References]. However, whilst attention has been focused upon the need to develop implementable metrics of capability, a job remains to be done to establish a social value function that recognises that, notwithstanding best endeavours, persons' maximal capability varies dramatically on any possible absolute measure of functioning. In other words, it is necessary to fend off the possibility of an elitist interpretation of any metric of capability, one that values the social sum of capability against absolute measures of functioning.

66. Against this background, I propose to take as a starting point, to operate as a meta-principle governing the derivation of any social welfare function, the equality of human worth of different persons:

⇒ **Principle of Equality: Every Individual is of Equal Value⁶.**

67. Work is needed to derive normative implications from this principle. Elsewhere at length I have attempted to establish a ground for the principle of equality, and hence to derive consequences in the domain of distributive justice.⁷ Normative consequences are shown to flow from the (substantiated) claim that “What is of equal worth for all human beings is the ethical achievement that each has the

⁵ . [References, including [The new welfare economics 1939-1974](#) JS Chipman, JC Moore - [International Economic Review](#), 1978]

⁶ Cf. "We believe that every individual – whatever part of the world they come from or live in – is of equal value." Health is Global: A UK Government Strategy 2008–13 Department of Health, 2008, p.16 http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_088702

⁷ Franklin, Donald (2008), *Groups in Conflict: Equality versus Community*, University of Wales Press. See particularly Chapter One: “The Doctrine of Equal Human Worth”.

- potential to realise” together with a recognition that achievement, whether of experience or relationship or action value, is heavily dependent upon support from others – given the contingencies of circumstantial ethical luck. Hence, contributions towards enabling any individual to lead a fulfilling life against whatever metric of value is adopted is of value proportionate to the scale of contribution calibrated against their maximal possible achievement.
68. Principle One, above, requiring calibration of contributions towards individuals’ health to their maximal health, an enabler for much other ethical achievement, follows.
69. There is of course much else to be integrated into a social value function, including possible inequality aversion, and considerations of social and natural justice. The point here is not to complete the story but to suggest how it might be started – one person’s ethical achievement is as valuable as another’s and therefore enablement for one person is as valuable as for another.
70. Note that QALYs as they are currently assessed provide a plausible candidate for a measure of opportunity. In other words, the “quality adjustment” used in deriving quality adjusted life years can plausibly be interpreted as a measure of the damage to opportunities to live a fulfilling life consequent upon different levels of physical functioning, role limitation, social functioning, pain, mental health, vitality (to use the SF6D dimensions).
71. This grounding for the equality of value of the calibrated QALY (by which is meant the QALY calibrated as proposed above) underpins the extra-welfarist tradition in modern health economics.⁸
72. It can equally be used to support an understanding of QALYs rooted in the welfarist tradition that uses willingness to pay as its instrument of choice for eliciting individuals’ valuation for incorporation into cost benefit analysis.
73. As official guidance indicates⁹, willingness to pay assessments of value need adjustment to take account of the different financial circumstances of different persons. The needed adjustment is conventionally understood as necessary to take account of the diminishing marginal utility of consumption. It is plausible that individuals will assign similar valuations to proportionate improvements in their health using calibrated-QALYs once allowance is made for the diminishing marginal utility of income. It is certainly a much more plausible hypothesis than a similar judgement regarding QALYs taken as an absolute metric of physical functioning – a fully sighted person is unlikely to assign the same value to the removal of a single cataract as a one-eyed person.
74. However, there are three problems with this approach to anchoring the use of calibrated-QALYs as a metric of social value:

⁸ [Labelle and Hurley 1992-- Discussion of welfarist and extra-welfarist approaches to healthcare in the health economics literature. [other Refs]

⁹ Treasure Green Book, Annex 5, Distributional Adjustment

- ⇒ the assumption of equal valuation is no more than that, and is thus subject to challenge by any individual or group that claims to assign more or less value to health than average
- ⇒ there is evidence of systematically higher valuation of health by people on higher incomes even beyond what can be explained by the diminishing marginal utility of income; yet we are reluctant to attribute more value to the health of the rich
- ⇒ the concept of utility itself is a rather flimsy base for the construction of interpersonal comparisons of the value of different policies.

75. A rather more direct approach to relationship between QALYs and value is hinted at by Adam Smith:

- ⇒ "Equal quantities of labour, at all times and places, may be said to be of equal value to the labourer. In his ordinary state of health, strength and spirits; in the ordinary degree of his skill and dexterity, he must always lay down the same portion of his ease, his liberty and his happiness. The price which he pays must always be the same, whatever may be the quantity of goods which he receives in return for it." Adam Smith (1776) *Wealth of Nations*, Book One, Chapter V. (Page 136 of Penguin Classics edition, 1982, London

76. Remembering that the metric of the contribution of labour is time, and that the contribution in time is subject to adjustment for "health, strength and spirits", perhaps using a metric like the EQ5-D, and that this is to be calibrated against the "ordinary state" of each individual, Smith seems to be suggesting that the appropriate metric of value for all other goods is something remarkably similar to the calibrated QALY.

77. According to this insight, the metric for interpersonal comparison between different individuals' willingness to pay for different goods resides not in a complex set of assumptions regarding the utility derived from a marginal unit of money, but rather in the fact that money itself is valued by the sacrifice in health-adjusted time that must be sacrificed to accumulate it. From this perspective, willingness to pay represents social value to the extent that it represents individuals' willingness to sacrifice marginal calibrated QALYs.

78. Incidentally, finding a monetary value for a QALY, an enterprise upon which many economists have broken their teeth of late (reference: Donaldson et al 2008) using willingness to pay techniques with the QALY as the good to be purchased, might profitably turn to consider the monetary valuation of a QALY implicit in the the sacrifice of time for money represented by wages. If we want an average value for a calibrated QALY across a population, we might start with the average wage, net of taxes and make adjustments:

- i. To include non-work time
- ii. To allow for job satisfaction (given that rare is the job that has no intrinsic value to the labourer, underpinning her self-respect)
- iii. To deduct any rent (producer surplus).

79. What of those who do not earn? They are still in the business of substituting goods for time – when they engage in time consuming activities with little intrinsic value to accumulate goods.¹⁰
80. But whilst differences in rates of substitution across individuals are important in the derivation of a social value of a QALY, which is needed for more general cost benefit analysis, it is essential to recall that the anchor of value is the calibrated person-year. Hence, for example, that wealthier people have more goods to start with, and additional utility arising from further goods enhancement is accordingly diminished, and for these reasons they are less willing to sacrifice time for goods, and more willing to sacrifice goods for QALYs, nevertheless a rich person's hour is still worth just an hour, and has no more intrinsic value than anyone else's hour.

5

81. What difference does this proposal make in practice?
82. Suppose that the degenerative disease threatens blindness after one year, paraplegia after two and death after three. The full cure prevents any deterioration; the partial cure leaves the patient blind from the second year onwards. The table below illustrates the conventional and calibrated valuation of the partial cure (where there is no full cure).

¹⁰ Reference Becker – integrating time into valuation of all goods

<i>YEARS</i>	<i>First</i>	<i>Second</i>	<i>Third</i>	<i>Fourth</i>
<i>Without Treatment</i>	Able bodied	Blind	Blind and Paraplegic	Dead
<i>With Full Cure</i>	Able bodied	Able bodied	Able bodied	Able bodied
<i>Valuation of Full Cure</i>	$\Delta Q = 1 - 1 = 0$	$\Delta Q = 1 - 0.8 = 0.2$	$\Delta Q = 1 - 0.5 = 0.5$	$\Delta Q = 1 - 0 = 1$
<i>Partial Cure (all that is available)</i>	Able bodied	Blind	Blind	Blind
<i>Conventional Evaluation</i>	$\Delta Q = 1 - 1 = 0$	$\Delta Q = 0.8 - 0.8 = 0$	$\Delta Q = 0.8 - 0.5 = 0.3$	$\Delta Q = 0.8 - 0 = 0.8$
<i>Calibrated Evaluation</i>	$\Delta Q = 1 - 1 = 0$	$\Delta Q = 1 - 1 = 0$	$\Delta Q = 1 - 0.625 = 0.375$	$\Delta Q = 1 - 0 = 1$

83. Like implications may be relevant to other public services. For example, if life time earnings are taken not just as a consumption value, but also as a very partial indicator of lifetime achievement, and the value the individual has realised in her life, then the contribution of an intervention to future earnings (e.g. through education or training) must be constructed relative to the maximal potential of the individual. This might mean that a £5,000 earnings enhancement bestowed on someone with a maximal earnings potential of £20,000 is twice as valuable as the same earnings enhancement bestowed upon someone with a maximal potential of £40,000.

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Views expressed do not necessary represent those of the Department.

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