The Person Trade-Off Approach to Valuing Health Care Programs

Erik Nord
Dr, National Institute of Public Health, Oslo, Norway
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The Co-ordinator
Centre for Health Program Evaluation
PO Box 477
West Heidelberg Vic 3081, Australia

Telephone +61 3 9496 4433/4434 Facsimile +61 3 9496 4424
E-mail CHPE@BusEco.monash.edu.au
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The research described in this paper is made possible through the support of these bodies.
The person trade-off technique is a way of estimating the social value of different health care interventions. Basically it consists in asking people how many outcomes of one kind they consider equivalent in social value to X outcomes of another kind. The paper outlines a number of the author's previous studies using the technique. The studies suggest that while the technique is theoretically appealing for resource allocation purposes, it is in practice quite demanding. It needs to be applied in fairly large groups of subjects to keep random measurement error at an acceptable level. Possible framing effects include the effects of argument presentation and the choice of start points in numerical exercises. To control for these effects, it seems important to take subjects through a multistep procedure, in which they are induced to carefully consider the various arguments that might be relevant in each exercise and to reconsider initial responses in the light of their implications. The investigator must also think through which decision context he/she wishes to study and make his/her choice of context very clear when reporting the results.
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Introduction

The person trade-off technique is a way of estimating the social value of different health care interventions. Basically it consists in asking people how many outcomes of one kind they consider equivalent in social value to X outcomes of another kind. The social value is inferred from the magnitude of X. The technique was first used by Patrick, Bush and Chen (1973), who called it the ‘equivalence of numbers technique'. The name ‘person trade-off' was introduced by Nord (1992). The purpose of this article is to provide some evidence on the reliability and validity of the technique, which has received surprisingly little attention in the health economic literature.

Background

Allocating scarce resources in health care essentially means dealing with person trade-offs (Williams, 1988; Mulley, 1989; Nord, 1992). If treatment A costs twice as much as treatment B, then two people can be given treatment B for the money needed to give one person treatment A. This is the person trade-off in terms of production. Whether or not society would want to spend money on two B's rather than one A, depends on the person trade-off in terms of value: Are two B's valued (appreciated) higher by society than one A?

One way of estimating person trade-offs in terms of social value is to calculate the QALYs gained by different treatments. In this approach, if treatments A and B provide 20 and 5 QALYs respectively per person treated, then one A is assumed to be worth 4 B's. Accordingly, if A's cost only twice as much as B's, then money is better spent on A's (Weinstein and Stason, 1977; Williams, 1987).

I have elsewhere argued that the QALY approach is an indirect way of addressing the issue of person trade-offs in terms of value (Nord, 1992b). It involves assigning numerical scores to health states as such, using techniques like the standard gamble, the time trade-off or the rating scale. On the basis of the health state scores, inferences are made about society’s person trade-offs between different improvements in health (including avoiding death). The basis for such inferences is tenuous, as subjects cannot be expected to have person trade-offs in mind when they value health states by means of the above techniques. Indeed, in the case of the rating scale, it has been shown that they clearly do not have this in mind (Nord, 1991, replicated by Morris and Durand, 1989). Empirical studies also suggest that the inferences may be quite misleading. When entered into the QALY formula, the values assigned to health states by several of the generic multi-attribute instruments available today (the Quality of Well-Being Scale (Kaplan and Bush, 1982), the McMaster Health Classification System (Torrance, Boyle and Horwood, 1982) and the EuroQol Instrument (The EuroQol Group, 1990)) have implications in terms of person trade-offs
that fit quite poorly with directly measured public preferences for programs that help different

The obvious way to make sure that the QALY procedure captures social preferences for person
trade-offs is of course to use person trade-off exercises as the basis for scoring health states in
the first place. However, with very few exceptions (see below) QALY oriented health state
valuation studies have used the standard gamble, the time trade-off and the rating scale - and not
the person trade-off. One may ask why this is so.

A main reason is that the architects of QALYs have thought that the social value of medical
interventions is determined by the amount of individual utility they produce. The standard gamble,
the time trade-off and the rating scale have been assumed to be cardinal measures of such utility.
There are in my view two flaws in this belief. One is that statements in cardinal terms about the
individual utility derived from health care do not carry a clear empirical meaning, particularly when
life saving treatments are concerned (see detailed argument in Nord, 1994). The other flaw is that
society's valuation of different outcomes is a function not only of the sum of individual utilities
(whatever that means), but also of concerns for equity (Broome, 1987; Nord, 1989; Richardson,
1991; Mooney and Olsen, 1991, Wagstaff, 1991). In combination, these two points lead me to
conclude that weights for life years in the QALY procedure should not be derived by asking
individuals to value health states for themselves - be it by means of a rating scale, standard
gamble or personal time trade-off. Such valuations are of interest as measurements of quality of
life at an ordinal level, but they do not seem appropriate as direct inputs in QALY calculations.
Health status indices must then ultimately reflect responses to person trade-off questions asked in
a resource allocation context (Nord, 1994).

This conclusion also applies to the Healthy Year Equivalents (HYE) procedure, which assigns
values to health scenarios rather than to health states (Mehrez and Gafni, 1989). If health scenario
values are to be used to estimate the social value of different medical interventions, they must
reflect community preferences in terms of person trade-offs.

**Studies using the person trade-off**

The study by Patrick, Bush and Chen (1973) is the only person trade-off study mentioned in a
review by Torrance (1986). In this study, subjects were presented with a variety of health states.
For each state the subjects were asked how many lives saved of people being in that state they
would consider equivalent to saving the lives of 100 healthy people. Kaplan, Bush and Berry
(1979) later used the results to validate health state valuations based on category rating.

Rosser and Kind (1978) asked subject to value health states by means of a magnitude estimation
technique and then gave them a chance to adjust their responses in the light of their implications
in terms of equivalence of numbers of people treated. This effectively turned their magnitude
estimation approach into something very similar to the person trade-off approach.

Later studies using the person trade-off technique include Nord (1991;1993b,1993c) and Nord,
Richardson and Macarounas-Kirchmann (1993).
The person trade-off approach is the very essence of the SAVE procedure, which has been proposed as an alternative to the QALY procedure (Nord, 1992b). Saving a young person from dying and restoring him/her to a life as healthy is chosen as a reference outcome - called the SAVE. This outcome is assigned the value 1. Other outcomes are described in terms of (a) how severely ill the patients are before treatment and (b) how much they are helped. People are asked to compare pairs of outcomes in terms of equivalence of numbers of people treated, see frame 1. This establishes the person trade-offs in terms of value in a direct way. Outcomes - rather than health states - are then assigned values on a 0-1 scale such as to encapsulate the observed trade-offs (Nord, 1993b).

**Aim of the paper**

While intuitively attractive in terms of relevance for resource allocation decisions, the person trade-off approach needs to be assessed more generally in terms of reliability and possible biases. The purpose of this paper is to shed some light on these issues. It uses results from various small scale studies conducted in Norway over the last two years. None of them justify firm conclusions. It is hoped that the results nevertheless may be of interest given the fact that very little seems to have been published previously on the subject.

The first section briefly addresses the issue of reliability. The ensuing sections suggest that person trade-off responses may be sensitive to arguments mentioned in the questions, to the choice of start point numbers in pairwise comparisons, and to the choice of decision context. It is also shown that some subjects may be reluctant to making the kind of difficult choices that person trade-off exercises presuppose.

In the concluding section, some implications of these various findings are pointed out.

**Reliability**

There seems to be a strong random element in individuals' choice of equivalence numbers. In a pilot study (Nord, unpublished data), a group of 20 people were asked to compare the same two projects in terms of a person trade-off at a few weeks interval. The difference between the first and the second equivalence number given, calculated as a percentage of the first number, ranged from 0 to 133, with a mean of 40 %.

Nord (1993b) hypothesized that the equivalence numbers given by individuals in a series of 14 pairs of projects could be explained by a model using difference in the initial severity of illness and difference in treatment effect (the size of the improvement in health) as explanatory factors. The framing of the questions (see frame 1) was such that the subjects would necessarily have only these two factors in mind when they responded. Yet linear regression analysis for each of ten individuals resulted in an explained variance of the equivalence number ranging from only 7 % to 73 %, with a mean of 31 %, again suggesting a strong random element in individual responses.

Since random error does not introduce systematic bias, median equivalence numbers in groups of people may be more reliable. This was indeed indicated in the study just mentioned, where the model's ability to explain the variance in the median responses in ten people was as high as 77 %. Similar levels of explained variance of the median were later found in six other groups of 10-13
people (Nord, 1993d). However, the reliability of the median seems to be associated with its size. The high levels of explained variance mentioned above were obtained in groups where the individual equivalence numbers ranged from 20 to 300. In three groups of people where the individual equivalence numbers ranged from 100 - 10,000 (due to a different start point in the exercise, see below), the model could not explain any of the variance at the median level. Obviously, the greater the variance in the individual responses, the greater must the group be for the median to become reliable.

**Considerations mentioned in the questions**

The questionnaire in frame 1 - in the following called questionnaire A - was designed to make it easier for subjects to grasp a potentially complex problem involving two different movements between different levels of health. The questionnaire is purely descriptive, in the sense that it leaves it entirely to potential respondents to determine what considerations might be relevant for their choices. It was hypothesized that while the diagrammatic form could simplify the comparison of the projects, the numbers and arrows in the diagram might lead subjects to overlook concerns for equity and instead base judgements entirely on the size of the health benefits. To test this hypothesis, 14 people who had previously completed questionnaire A received a modified version - hereafter called questionnaire B. The distance in time between the two questionnaires was 2-3 months. In questionnaire B, arguments (details below) in favour of high and low equivalence numbers respectively were inserted (after the the arrow diagram in questionnaire A).

The subjects were presented with two pairs of projects. In the first pair, project X would take patients with one illness from level 7 to level 4, while project Y would take patients with another illness from level 4 to level 1. There was, in other words, a clear difference in terms of severity at the outset (level 7 versus level 4), while the treatment effects appeared to be equally significant (the arrows being equally long). The arguments introduced were those of frame 2.

In the second pair of projects, project X would take patients from level 7 to level 2, while project Y would take patients (with a different illness) from level 7 to level 5. That is, the severity at the outset was the same in both cases (level 7), while treatment effect was clearly different (five steps up versus 2 steps up). The arguments introduced here are shown in frame 3.

With each pair of projects, the subjects were asked to tick the argument with which they agreed most. Only after they had considered the arguments and made a choice were they asked what number of people treated in project Y they would find equivalent to 10 people treated in project X. This question was posed only to those who ticked arguments 1 or 2. Preference for argument 3 was assumed to imply an equivalence number of 10.

The results of questionnaires A and B are shown in table 1. In the first pair of projects, there is a very strong (and statistically significant) tendency for questionnaire B to produce lower equivalence numbers than did questionnaire A. The same tendency is present in the second pair, although less strongly. With this pair, when questionnaire B was used, 5 out of 14 people chose the ‘equal priority’ option, while with questionnaire A, all 14 subjects said 10 people in project X were equivalent to 15 or more people in project Y. Altogether the results suggests that the responses to person trade-off questions may be quite sensitive to question framing.
**Start point bias**

In willingness to pay studies, one approach is to ask subjects whether they are willing to pay a specific amount to obtain the good in question. If they say yes (no), the amount is increased (decreased) and the question repeated. The process continues until the subject's maximum willingness to pay is found.

There is some evidence of so-called start point bias in this approach: The higher the amount asked in the first question, the higher the final answer (Boyle et al, 1985). It seems reasonable that such a bias could also occur in the person trade-off exercise, in which people in effect are being asked how many outcomes of one kind they would be willing to sacrifice (= pay) to achieve X outcomes of another kind.

Questionnaire A (see frame 1) has been used in a series of 8 seminars with groups of 10-13 people recruited from health politicians, planners and professionals in different counties of Norway. In addition there was one seminar with a group of 8 patients with chronical illnesses or disabilities.

In the seminars, subjects first filled in questionnaire A individually. All individual responses were then fed back to the subjects on a whiteboard, and a discussion ensued, in which people were asked to explain their initial responses and possibly adjust them in the light of the others’ comments and arguments. Adjustments were made in 5-10 percent of all cases.

In the first 5 seminars, with each pair of projects the subjects were initially asked to choose between 10 people in project X and either 10 or 11 people in project Y (depending on whether there was a difference in severity within the pair). It was thought that these start points would minimize any implicit expectation that the subjects’ preferences should go in a particular direction or have a particular strength. In other words, these start points were viewed as the most neutral.

However, in the sixth seminar, some participants said that they felt they were being led to select relatively low equivalence numbers due to these start points. They believed that if, instead, they had first been asked to choose between for instance 10 people in project X and 100 in project Y, they would have ended up with higher equivalence numbers.

This possibility was examined in the next three seminars. Two of them were composed of health politicians and planners much like the previous seminars. The third one only included disabled people. In pairs of projects where severity at the outset differed, 10 people in project X versus 100 people in project Y was chosen as a new start point (cfr. frame 1). In pairs where severity was the same, while treatment effect differed, 10 people in project X versus 20 people in project Y was chosen as the start point.

The result of this procedure was a dramatic increase in the median equivalence numbers in comparisons where severity differed. This is shown in table 2, columns A1-A5, groups 1-6 versus 7-9. Given the similarity between the composition of groups 7 and 8 and several of the previous groups, the increase seems largely attributable to the change in start point.
In comparisons where severity was the same, there was no significant change, see table 2, columns E6-E10.

**Decision context**

Nord (1993c) found that, when comparing two programs that treated different patients with equal initial severity of illness, people tended to give equal priority to the programs even if one provided its patients with a greater health improvement than the other. The subjects argued that with equal initial severity, the two groups of patients were equally entitled to treatment and that the size of the improvement was of less importance. They expressed this preference for equal priority by saying that they would prefer the ‘less effective’ program even if it treated only one person more than the ‘more effective’ program.

This finding was not confirmed in the series of seminars where questionnaire A was used, see table 2. In pairs of projects with equal initial severity and different treatment effect (columns E1-E5), the median numbers of patients in project Y viewed as equivalent to 10 patients in project X were mostly in the order of 20-30. With for instance pair E1, only six individuals answered less than 15 (not shown in the table).

A reason for this discrepancy between the study results could be that questionnaire A places subjects in the role of a health planner. They are asked to distribute resources between groups of other people. It was hypothesized that if people were to choose between different sets of rules for prioritising that could have consequences for themselves as potential future patients - i.e. to choose behind a Rawlsian veil of ignorance (Rawls, 1971) - then they might choose differently. To test this hypothesis, a questionnaire C was constructed in which the presentation was as in questionnaire A, but in which the perspective was a different one, see frame 4. The essence of the questionnaire is: Which of two hospitals A and B would you rather belong to - one that gives equal priority to patients with equal initial severity of illness as long as the treatment effect is substantive in either case (hospital A) or one that gives priority to those with a greater potential for improvement (hospital B). In seminars no 4-8 (table 2) 53 subjects filled in this questionnaire. 51 of these had given priority to the ‘better outcome’ option in pair E1 in questionnaire. 31 of the subjects preferred to belong to hospital A. This means that a majority of those who gave priority to the ‘better outcome’ option in questionnaire A did not themselves wish to belong to a hospital that followed such a practice. In ensuing discussions it appeared that most people believed that the strength of their desire to receive treatment would be primarily determined by how ill they were and not as much by how much they could be helped as long the help would be substantive.

**Reluctance to rank some patient groups before others**

In the person trade-off approach, subjects are asked very directly to decide what sacrifices they are prepared to make in the lives of some people in order to provide health benefits to some other people. Quite understandably, many subjects find it difficult and unpleasant to make such decisions (Rosser and Kind, 1978; Nord, 1993b). It would not be surprising if some avoided the issue simply by maintaining that all patients should be equally entitled to treatment, even if this is not possible in the real world. To the extent that this occurs, public responses to person trade-off questions will not be of very great help in decision making about resource allocation.
The evidence suggests that this may be a problem, but not a significant one. People are generally prepared to extend very strong priority to the more severely ill at the expense of the less severely ill (Rosser and Kind, 1978; Nord, 1991; Nord, Richardson and Macarounas-Kirchmann, 1993), and in those cases where people have a preference for extending equal priority, they seem to have good reasons (see previous section on `decision context').

However, data from a study among health care politicians in Norway may reflect some aversion to making difficult choices. 52 politically elected members of County Health Care Commissions, of which there are 19, filled in a self administered questionnaire of type A (see frame 1) with arguments as in frames 2 and 3 inserted after the arrow diagrams. The subjects were asked to consider three pairs of projects. In the first pair, patients in project X were much more severely ill than patients in project Y, while treatment effect could be viewed as being of the same order of magnitude. Here the arguments of frame 2 were presented. In the second pair, initial severity was the same, while treatment effect was much greater in project X than in project Y. Here the arguments of frame 3 were presented. In the third pair, project X treated patients in their twenties while project Y treated patients in their sixties. Here the arguments were as in frame 5.

The results suggested that a majority of the politicians were in fact willing to prioritize, insofar as 36 out of 53 chose to extend priority to one of the projects in at least one of the three pairs of choices. On the other hand, 17 subjects ticked the `equal priority' option in all three cases. One could argue that the responses of these 17 subjects are surprising and counterintuitive, given the fact that in each pair, there was a clear difference between the two projects on a dimension normally considered to be of relevance for prioritising (initial severity, treatment effect and age respectively). Of course, these 17 subjects may have had good reasons for making the choices they did. But it is tempting to infer that at least some of them were in fact not willing to make any difficult choices at all.

**Conclusion**

At the end of the day, any procedure for estimating the social value of a health care outcome, be it in terms of QALYs, HYEs or SAVES, must reflect community views on the trade-offs between treating different groups of patients. The only way to make sure that the procedures actually do so is of course - at some stage in the procedures - to ask members of the community person trade-off questions.

The various studies presented in this paper suggest that the person trade-off technique is quite demanding. The technique needs to be applied in fairly large groups of subjects to keep random measurement error at an acceptable level. Possible framing effects include the effects of argument presentation and the choice of start points in numerical exercises. To control for these effects, it seems important to take subjects through a multistep procedure, in which they are induced to carefully consider the various arguments that might be relevant in each exercise and to reconsider initial responses in the light of their implications. In other words, the investigator should ideally be seeking to establish a `reflective equilibrium' (Rawls, 1971) in his or her subjects. Start point bias may possibly be kept at a minimum by presenting the subjects first with a very low
equivalence number and then with a very high one and then by `ping-pong' between narrowing extremes until a point of indifference is found.

It is, of course, very difficult to fulfill these requirements using self administered questionnaires. Direct, personal communication seems necessary. The individual interviews reported in Rosser and Kind (1978) are one example of how this may be done. The seminars referred to in this paper are another example.

The choice of decision context is essential. It seems to me that in a democratic society, the reflective preferences of potential users of the health services, expressed behind a veil of ignorance about their own future health, ought to count heavily in decision making. Others may view this differently. But the investigator should as a minimum carefully think through which decision context he/she wishes to study and make his/her choice very clear when reporting the results.
REFERENCES


Imagine yourself in a position where you are to choose between two health care projects. Net economic costs to society are the same in both cases. One of the projects will increase treatment capacity for patient group X, the other for patient group Y. The patients are in both cases in their sixties. The arrows below indicate what kind of health improvement the patients in each project will obtain. The first project (X) will help 10 patients. At what number of patients of type Y would you be indifferent between the two projects?

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
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<tbody>
<tr>
<td>1</td>
<td>No problems walking.</td>
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<tr>
<td>2</td>
<td>Can move about without difficulty anywhere, but has difficulties walking more than 1 K.</td>
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<tr>
<td>3</td>
<td>Can move about without difficulty at home, but has difficulties in stairs and outdoors.</td>
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<tr>
<td>4</td>
<td>Moves about with difficulty at home. Needs assistance in stairs and outdoors.</td>
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<tr>
<td>5</td>
<td>Can sit. Needs assistance to move about - both at home and outdoors.</td>
</tr>
<tr>
<td>6</td>
<td>To some degree bedridden. Can sit in a chair if helped up by others.</td>
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<tr>
<td>7</td>
<td>Completely bedridden.</td>
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Frame 2

1. Since the patients in project X are worse off to start with, project X should have priority unless considerably more people would be helped in project Y.

2. All else equal, project X should have priority, but project Y should have priority if it would help a few more people than would project X.

3. The two projects should have the same priority, on the grounds that the two patient groups would be helped about equally much.

Frame 3

1. Since the health benefit is clearly greater for patients in project X, project X should have priority unless considerably more people would be helped in project Y.

2. All else equal, project X should have priority, but project Y should have priority if it would help a few more people than would project X.

3. The two projects should have the same priority, on the grounds that the two patient groups are equally ill to start with and therefore have the same right to treatment.
Imagine that you live in an area where you are to choose which of two hospitals A and B you want to belong to. The hospitals are in all respects equal, except that they place different emphasis on severity of illness and treatment effect when they prioritise between patients. The difference may be demonstrated by taking the treatment possibilities for two hypothetical illnesses X and Y as an example:

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</table>

If you belong to hospital A, you will be given the same priority whether you get illness X or Y. This means that the waiting time for treatment will be about the same. If you belong to hospital B, you will be given higher priority if you get illness X than if you get illness Y. This means that in hospital B, the waiting time for treatment will be longer for illness Y than for illness X.

There is no difference between the hospitals in terms of average waiting times or in terms of treatment results.

You do not know what illnesses you personally might get in the future. If you were to think only of your personal interests as a potential patient, which of the two hospitals would you rather belong to?
1. Project Y should have priority on the grounds that elderly patients deserve to have priority over young patients.

2. Project X should have priority unless considerably more people would be helped in project Y. Reason: 20 years olds get to enjoy improvements in health more years than 60 year olds, i.e. the benefits of project X are greater.

3. The two projects should have the same priority, on the grounds that the two patient groups are equally ill to start with and therefore have the same right to treatment.

3. All else equal, project X should have priority, but project Y should have priority if it would help a few more people than would project X.

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First Pair (7 - 4 Versus 4 - 1)

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* The entry in the table shows the number of persons receiving the second health improvement that were considered equivalent to 10 people receiving the first health improvement. For example, in the first seminar, helping 75 people from level 2 to 1 was considered equivalent to helping 10 people from level 6 to 5. Similar for other pairs.