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The rule of rescue and the fair innings argument: What do people think when they conflict with one another?

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Abstract

When going beyond simple QALY maximisation, the "fair innings argument" and the "rule of rescue" are often supported in the theoretical and empirical literature. Ceteris paribus, the fair innings argument gives more weight to patients with smaller expected lifetime QALYs, and the rule of rescue prioritises patients with poor future health prospects without treatment. What is missing from the literature is what should be done when these two criteria conflict with each other. This paper reports on an empirical study into this issue. We presented respondents with questions that asked them to simultaneously think about age, past health and future health without treatment, whilst controlling for health benefits. The combinations of these factors are chosen to shed light on how people would weigh health gains to younger people facing a better health profile without treatment against health gains to older people facing a poor profile of health without treatment. While the fair innings argument will support the first patient, the rule of rescue will support the latter. The results indicate that respondents are concerned about past years and give priority to the young, thus lending support to the fair innings argument over the rule of rescue. However, they are not concerned about past health in general, preferring to treat younger people over older ones, even when their expected lifetime QALYs were not the smaller of the two. This suggests that the 'fair innings' weights for the quality-adjustment part of the QALY might be different from those for the life-years component.

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1. Introduction

Cost-utility analysis (CUA) seeks to provide health care policy-makers with information on the health benefits associated with alternative allocation decisions. Since health is a function of both length of life and quality of life, the quality-adjusted life-year (QALY) has been developed in an attempt to combine the value of these attributes into a single index number. Different states of health are represented on an interval scale, where full health is given a value of one and death a value of zero. The QALY is a combination of the value of the health states and their duration, and so one QALY is equivalent to one year of life in full health. In the simplest case, with no uncertainty and no changes in health over time, an individual's health gain from treatment can be represented as $T_1Q_1 – T_0Q_0$, where T is the number of years, Q represents health state values, and the subscripts 1 and 0 represent health with and without treatment, respectively.

The crucial step in CUA is that analysts take this model and use it to represent the social value of health gains. For this to hold, society must be concerned only with the health gains from treatment, and therefore unconcerned about other 'streams of health', such as what happens without treatment *per se* and what health was like before treatment was required (Dolan and Olsen, 2001). But there is evidence to suggest that people are concerned about these other health streams; that is, they have concerns about the 'rule of rescue' and the 'fair innings argument'. In this paper, we report on the results from an empirical study that, for the first time, asks respondents to weigh these concerns against one another. We begin, though, by describing the rule of rescue and fair innings argument in more detail, and then consider the existing empirical evidence relating to them.

2. The rule of rescue and the fair innings argument

There are arguments in favour of treating those whose life expectancy without treatment is low and/or whose quality of life without treatment is poor. Hadorn (1991) suggests that there is a conflict between cost-effectiveness and the 'rule of rescue', which he defines as the "powerful human proclivity to rescue endangered life". This means that small levels of T without treatment will be given very high weights, and thus the value of life would then not be a linear function of the number of added years of life. It has been argued that the Oregon experiment failed because cost-effectiveness analysis does not allow for the 'life-saving imperative' (Blumstein, 1997). In this paper, we refer to such a concern as the 'imminent death' factor. Another aspect of the rule of rescue is that, as Nord (2001) suggests, the social value of a given health gain may be larger when health status is poorer without treatment. Let us call this the 'severity of health' factor.

The stream of health without treatment might be important because of a more general concern for fairness in the distribution of health (Culyer and Walgstaff, 1993). Economists have used the social welfare function (SWF) to consider the trade-off between maximising health and equalising health. The SWF accounts for *both* the absolute health status of individuals and inequalities in health, as the level of social welfare increases with the health of individuals and decreases with inequalities in health (Wagstaff, 1994). If the objective is to reduce inequalities in future health, it follows that QALY gains should be distributed initially to those who can expect the worst prospective health if they are left untreated, which reflects the rule of rescue. It might also be desirable to take into account the number of QALYs that a person has experienced up to the decision point, for instance, in terms of reducing inequalities in lifetime health, and this leads us to consider the fair-innings argument.

In developing the fair innings argument, Williams (1997) suggests that the expected number of QALYs a person enjoys over a lifetime should be taken into account. He argues that there is some amount of quality-adjusted length of life that can be regarded as an ethical entitlement for everybody. Since expected lifetime QALYs increases with age, other things being equal, the fair innings argument leads to equity weights that decline with age. It is worth noting, however, that there are two further reasons for age weighting besides the fair innings argument (Tsuchiya, 1999). The first favours the young over the old simply because they have longer life expectancies (as in simple un-weighted CUA), and the second favours young adults over children and the old because they are more productive.

3. Existing empirical evidence

3.1. Rule of rescue

In general terms, and across a range of decision contexts, the empirical evidence currently available suggests that people are willing to sacrifice quality of life gains in order to give priority to those with shorter life expectancies and to the most severely ill. In relation to the imminent death factor, Dolan and Cookson (2000) found that people were willing to make health gain trade-offs between patient groups once the differences in the number of life year gained went beyond a certain threshold. In relation to severity of QOL factor, Nord (1993) found that a majority of respondents wanted to allocate resources to the very ill, even where they would benefit less. Comparing improvements in health that start at different levels of severity but are equal in size, Nord (1995) reports a preference for movements starting at lower levels over equidistant improvements starting at higher levels. Dolan (1998) asked respondents to trade off severity of the initial condition with the size of health gain, and found a move from 0.2 to 0.4 was equivalent to 0.4 to 0.8.

Ubel et al (1999a) found that subjects placed equal importance on saving the lives of people with pre-existing paraplegia as compared to those who could be returned to perfect health because they did not have pre-existing paraplegia. But interestingly, the same subjects gave lower priority to patients who would experience the onset of paraplegia after having their lives saved. And respondents are not completely insensitive to the size of the health gain. For example, Abellan-Perpinan and Pinto-Prades (1999) found that people were more likely to maximise health gain, the smaller the size of the benefit to one patient. In addition, the *final* health state is also important, particularly in the context of a patient who cannot be returned to full health after treatment but whose health gain will be limited by disability (Dolan and Green, 1998, Nord et al 1999). Threshold effects, then, would appear to play an important part in the social value of gains in T and Q.

3.2. The fair innings argument

The majority of the empirical literature suggests that health gains to the young are weighted more highly than those to the old (see Lewis and Charny (1989) as an early, and representative, study, but also see Anand and Wailoo, 2000, for an exception). A number of studies have also sought to estimate weights for different ages, and many of them report an age profile that has a peak at middle age followed by a gradual decline through the advanced ages (see for example Busschbach et al, 1993; Cropper et al, 1994; Johannesson and Johannsson, 1996; 1997; Nord et al, 1996; Tsuchiya, 2001). Whilst perceived differences in productivity across age groups alone are unlikely to have explained the results in these studies, it is often difficult to tell how much of the preference for the young is due to the benefits to the young being greater (or being perceived to be greater) and how much is due to the young having lived for less time. Tsuchiya et al (2002) presented respondents with a fixed duration of benefit (to control for 'health maximisation' ageism) across a broad range of ages that facilitated discrimination between 'fair-innings' ageism and 'productivity' ageism. The results suggested that 'fair-innings' ageism was the dominant concern but there is also some evidence that the results may have been confounded by 'health maximisation' ageism. Further, even where the fair innings argument is present, to our knowledge, there is no evidence regarding whether this argument is applicable to years of life, or to years of life adjusted for quality of life.

4. The empirical study

Thus, there is now empirical evidence that provides support for both the rule of rescue and the fair innings argument. But what are people's preferences when the two concepts come into conflict with one another? How would people weight health gains to older people facing a poor profile of health without treatment vis-à-vis health gains to younger people facing a better health profile without treatment? We cannot answer these questions on the basis of the existing evidence, and we conducted our own empirical study.

4.1. The questionnaire

The rule of rescue was compared to the fair innings argument by asking respondents to prioritise between groups of patients with different attributes. These patient groups were of equal size, and the health gain if treated was held constant across groups. There were two questions in the study that are relevant here: one about imminent death and the fair innings and one about severity of health and the fair innings. The attributes used to describe the patients in each question were past years (i.e. present age), past health, future years without treatment and future health without treatment. To limit the number of comparisons that each respondent had to make, and to facilitate analysis of the responses, the number of levels within each attribute was set to two. An obvious choice in such a study design would be to use the discrete choice method. However, an orthogonal design of a simple four-dimension two-level model requires 24 pair-wise comparisons, which was felt to be rather demanding (especially given that these questions were part of a larger study).

Instead, we decided to fix one of the four attributes. Future years without treatment were fixed for the 'imminent death' question factor and future health without treatment was fixed for the 'severity of health' question. The two levels for past years were set at 40 and 60 to represent two distinct stages of life. Past health was set at 100% and 50% so that when 60 years is combined with 50%, this amounts to 30 undiscounted QALYs, which is less than the 40 undiscounted QALYs from 40 years at 100% health. Future years without treatment were set at one and six, and future health without treatment was set at 10% and 60%. Of the eight possible combinations of two levels across the three attributes, we decided to drop the two that contained 40 past years with 50% past health, as these did not contribute to the issue of whether the fair innings argument was applicable to life years or quality adjusted life years. The structure of the descriptive system in the two questions is presented in Table 1. The questionnaire presented these groups in a randomised order. Respondents were asked to rank order these six groups, which allows us to infer 15 pair-wise comparisons.

As can be seen from the Appendix, which reproduces the questions, a health maximising respondent would be indifferent across all six of them. But if people are concerned about the rule of rescue or the fair innings argument, they prefer some groups to others. If a respondent's ranking is not affected by past years but is affected by future years without treatment in question one (or future health without treatment in question two), then this implies support for the rule of rescue. Alternatively, if a respondent's ranking is affected by past years but not by future years (or future health) without treatment, then this provides support for the fair innings argument. Further, by looking at the ranking between 60 year olds in 50% and 40 year olds in full health, we are able to look at the extent to which the fair innings argument is being applied to QALYs in general or life years in particular.

The questionnaire was self-completed by respondents in groups of 6-8, after the questions had been explained to them. Respondents were told that there are not enough resources to treat all of these six groups and initially asked to choose *one* group to treat. They were then asked to imagine that more resources were made available and to rank the remaining groups in order of preference from the second to the sixth. No ties in the rankings were allowed. Respondents were prompted by the facilitator to check whether they understood the issues and the descriptions of the patient groups.

4.2. The analysis

The results are reported in terms of the distribution of respondents who rank a given group at a given ordering, and Borda scores are used to represent the aggregate ranks of the groups. Two different regression analyses are employed. First, probit regressions are run based on the inferred pair-wise comparisons obtained from the rankings. Individual level data are used, where each respondent contributes 15 pieces of information. The dependent variable is whether or not the "first group of a pair" is ranked above the "second group of a pair". The explanatory variables are the differences in the levels of each attribute between the first and second group of the pair. In short, this is the standard procedure used in conjoint analyses. The performance of the regression is tested by examining the proportion of pair-wise choices that are correctly predicted from the model.

The second regression is the ordered probit, again using individual data, but this time with the rank for a group as the dependent variable and the combination of the group attributes as the explanatory variables. Thus, each individual contributes six pieces of information. Note that ranking data are more restricted than ordered probit regressions because the latter can allow for the same value to be assigned to more than one scenario. For instance, imagine the case where six items were valued on a categorical scale between "very good" and "very poor": one item being valued as "very good" does not preclude another item also being valued as "very good"; while in the present context, once a given group is ranked "first", no other group can be given this ranking. The performance of the regression is tested by calculating the implied Borda scores and comparing this with the actual Borda scores.

The effect of background variables is explored by chi-square tests. Throughout, a significance level of 5% is used unless otherwise stated.

4.3. The respondents

The study was carried out in Sheffield in summer 2002. Letters of invitation were sent out to 2000 people on the electoral register in two wards in Sheffield inviting them to participate in the study. In total, 257 people (13.2%) agreed to participate. To ensure that the sample was broadly representative of the wider population, 192 respondents were selected for interview based on information on a broad range of characteristics obtained from their reply slips. Of these, 128 (66.7%) participants attended the group sessions. Questions 1 and 2 went through a few revisions, and so data are reported for only 19 of the 24 groups, and the characteristics of the participants to these sessions compare favourably with those of Sheffield (see Table 2). Five respondents had missing or unusable data, so these have been excluded from subsequent analysis, leaving 101 usable responses.

5. The results

Tables 3 and 4 show how the respondents ranked the six options in Questions 1 and 2. It is very clear to see that the current age of the people in the groups is the most important attribute to respondents, who show a clear preference for 40 year olds over 60 year olds. The length of time a person will live without treatment is the next important attribute, with respondents ranking the 40 year old who will live for a year over the 40 year old who will live for six years.

Results of the probit regressions based on inferred pair-wise choice data are summarised in Table 5. For the first question on imminent death, past years and future years were found to have significant effects, while for the second question on severity of health, past years and future health were significant. In both cases, past health had no significant effects. The explanatory power is low in both cases, suggesting that the ranking was affected by many other factors beyond the descriptions of the groups. The model predicted successfully the choice of a particular pair in 66% of the data in both questions 1 and 2.

The results of the ordered probit regressions with the rank as the dependent variable are summarised in Table 6. The same set of explanatory variables was found to be significant, and the of results are in very good agreement with those in Table 5 (due to the coding, the sign of corresponding β coefficients are expected to be reversed). For both questions, the ranking of the implied Borda scores calculated based on the predicted probabilities of the second model agree completely with the observed ranking of the Borda scores, and the Pearson correlation coefficient indices are 0.99.

These regression results indicate that, in both questions, past years (i.e. present age) is the factor that carried the most weight: 40 year olds are given priority over 60 year olds. In the imminent death question, future years without treatment have a smaller effect: those with a six-year life expectancy without treatment are preferred over those with a one-year life expectancy. In the severity question, future health without treatment has a similar effect in that those with a 60%-level of health without treatment are preferred to those with a 10%-level of health without treatment. In both questions, past health has a very small effect.

For Question 1, women were more likely to rank first the 40 year olds with past health of 100% who will live for a year without treatment; whereas men were more likely to rank first the 60 year olds with past health of 100% who will live for six years without treatment. Furthermore, a person's educational attainment and age significantly affected their rankings such that those over 45 and those without a degree (or equivalent) were more likely to rank the 60 year olds who will live for six years without treatment first. However, for Question 2, the only background characteristic that showed any effect was educational attainment. Those with minimum schooling and those with no university degrees chose 60 year olds with 100%

past health and 60% future health without treatment first, whilst those with degrees chose 60 year olds with 50% past health and 10% future health without treatment first.

6. Conclusion

There is now plenty of evidence to suggest that people are willing to sacrifice QALYs in order to give priority to those who future health prospects and lifetime health prospects are poor. That is, there is general support for a rule a rescue and the fair innings argument. In the study reported here, we presented respondents with questions that asked them to simultaneously think about age, past health and future health without treatment, whilst controlling for health benefits. The results indicate that respondents are concerned about past years and give priority to the young, but are not concerned about past health in general, preferring to treat younger people over older ones, even if they would enjoy a greater number of QALYs over their lifetime. This is a potentially important finding in that the ‘fair innings’ weights for the quality-adjustment part of the QALY might be different from those for the life-years component.

Respondents gave higher priority to those with a longer life expectancy (preferring to give 3 years to a group who would otherwise live for 6 years rather than to a group who would otherwise die in a year), and to those with better future health (preferring to give a 0.3 benefit in health status to a group who would otherwise live in 0.6 rather than to a group who would otherwise live in 0.1). This suggests that there are thresholds between 4 and 9 years, and between 0.4 and 0.9. Future research on should seek to narrow this threshold down a bit more and, once again, to show how it might vary depending on the context. In conclusion, then, the results reported here suggest that the fair innings argument has very strong support (at least, a fair innings based simply on age, rather than lifetime QALYs, does).

A methodological finding from this study is that ranking exercises may be a practical alternative to pair-wise comparisons, and that the results can be analysed both directly as ranking data (using ordered probit regressions) or indirectly via inferred pair-wise choice data (using probit regressions). Further work is necessary to understand the relationship between these regressions, but given that an important concern regarding conjoint analysis is the often prohibitively high costs to cover all scenario combinations prescribed by an orthogonal design, the ranking exercise seems to be an interesting and attractive alternative.

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Table 1: The study design

Parameters in question 1 : imminent death factor vs the fair innings argument

– the benefits from treatment were fixed at three years in full health

Past *T*	Past *Q*	Future *T* no treatment	Future *Q* no treatment
40	1	1	1
40	1	6	1
60	1	1	1
60	1	6	1
60	0.5	1	1
60	0.5	6	1

Parameters in question 2 : severity of health vs the fair innings argument

– the benefits from treatment were fixed at 0.3 in *Q* for the remaining ten years

Past *T*	Past *Q*	Future *T* no treatment	Future *Q* no treatment
40	1	10	0.1
40	1	10	0.6
60	1	10	0.1
60	1	10	0.6
60	0.5	10	0.1
60	0.5	10	0.6

Table 2: Respondent characteristics

Characteristic	respondents (n=106) n	%
Sex: [a]		
Male	45	42
Female	61	58
School age children: [b]		
Yes	21	20
No	85	80
Age group:		
16-44	39	37
45-64	36	34
65+	31	29
Employment status:		
Employed	44	42
Retired	38	36
Other	24	22
School beyond min. age:		
Yes	53	50
No	53	50
Degree or equivalent:		
Yes	40	38
No	66	62
Smoker:		
Yes	23	22
No	83	78
Long-term illness:		
Yes	33	31
No	73	69
Ethnic origin:		
White	91	86
Black	8	8
Pakistani and other	7	6

a: significantly higher proportion of men in main study
b: significantly lower proportion of people with school age children in main study

Table 3: Ranking results for 'imminent death' questions

Past T, Q; Future T, Q=100	Rank 1 (%)	Rank 2 (%)	Rank 3 (%)	Rank 4 (%)	Rank 5 (%)	Rank 6 (%)	Borda score
60, 100; 1	3	7	10	17	**36**	27	2.47
40, 100; 6	26	**39**	12	11	10	2	4.54
60, 100; 6	21	11	24	7	12	**25**	3.47
60, 50; 6	13	12	20	**34**	13	8	3.54
40, 100; 1	**30**	29	10	21	13	7	4.11
60, 50; 1	7	12	24	10	16	**31**	2.91

Table 4: Ranking results for 'severity of health' questions

Past T, Q; Future T=10, Q	Rank 1 (%)	Rank 2 (%)	Rank 3 (%)	Rank 4 (%)	Rank 5 (%)	Rank 6 (%)	Borda score
60, 100; 60	13	20	21	6	12	**28**	3.32
40, 100; 10	**39**	17	12	13	15	4	4.40
40, 100; 60	31	**32**	15	8	10	4	4.54
60, 50; 10	5	14	15	19	15	**31**	2.79
60, 100; 10	5	4	14	**33**	26	18	2.75
60, 50; 60	7	13	**23**	21	22	14	3.20

Table 5: The results of the conjoint probit regressions

	question 1 imminent death	question 2 severity of health
difference in past years (0 = 40yrs, 1 = 60yrs)	-0.64*	-0.60*
difference in past QOL (0 = 50%, 1 = 100%)	-0.05	-0.10
difference in future years without treatment (0 = 1yr, 1 = 6yrs)	-	0.33*
difference in future QOL without treatment (0 = 10%, 1 = 60%)	0.15*	-
constant	0.09*	-0.03
Pseudo R^2	0.08	0.09

The table presents the β coefficients with * for $p < 0.05$.

Table 6: The results of the ordered probit regressions

	question 1 imminent death	question 2 severity of health
past years (0 = 40yrs, 1 = 60yrs)	0.96*	0.80*
past QOL (0 = 50%, 1 = 100%)	-0.04	0.17
future years without treatment (0 = 1yr, 1 = 6yrs)	-	-0.44*
future QOL without treatment (0 = 10%, 1 = 60%)	-0.21*	-
μ_1	-0.57	-0.59
μ_2	0.04	0.01
μ_3	0.53	0.48
μ_4	1.00	0.96
μ_5	1.58	1.55
Pseudo R^2	0.05	0.05

The upper half of the table presents the β coefficients with * for $p < 0.05$. The lower half of the table gives the thresholds for a given scenario being in a particular ranking. The probabilities of a given scenario being ranked differently are given by:

$\Pr[\text{rank} = 1] = \Phi(\mu_k - \boldsymbol{\beta}'\mathbf{x})$,

$\Pr[\text{rank} = k] = \Phi(\mu_k - \boldsymbol{\beta}'\mathbf{x}) - \Phi(\mu_{k-1} - \boldsymbol{\beta}'\mathbf{x})$, where $1 < k < 6$, and

$\Pr[\text{rank} = 6] = \Phi(\boldsymbol{\beta}'\mathbf{x} - \mu_k)$,

where Φ stands for the standard normal cumulative distribution.

Appendix: the questionnaire

Question 1

With treatment all groups will get an additional 3 years in 100% health.

	Years	Health	
Past health	60	100%	☐
Future health without treatment	1	100%	

	Years	Health	
Past health	40	100%	☐
Future health without treatment	6	100%	

	Years	Health	
Past health	60	100%	☐
Future health without treatment	6	100%	

	Years	Health	
Past health	60	50%	☐
Future health without treatment	6	100%	

	Years	Health	
Past health	40	100%	☐
Future health without treatment	1	100%	

	Years	Health	
Past health	60	50%	☐
Future health without treatment	1	100%	

Question 2

With treatment all ll groups will get a 30% benefit during their remaining 10 years.

	Years	Health
Past health	60	100%
Future health without treatment	10	60%

☐

	Years	Health
Past health	40	100%
Future health without treatment	10	10%

☐

	Years	Health
Past health	40	100%
Future health without treatment	10	60%

☐

	Years	Health
Past health	60	50%
Future health without treatment	10	10%

☐

	Years	Health
Past health	60	100%
Future health without treatment	10	10%

☐

	Years	Health
Past health	60	50%
Future health without treatment	10	60%

☐