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Is more health always better for society? Exploring public preferences that violate monotonicity

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Abstract There has recently been some literature on the properties of a Health-Related Social Welfare Function (HRSWF). The aim of this article is to contribute to the analysis of the different properties of a HRSWF, paying particular attention to the monotonicity principle. For monotonicity to be fulfilled, any increase in individual health—other things equal—should result in an increase in social welfare. We elicit public preferences concerning trade-offs between the total level of health (concern for efficiency) and its distribution (concern for equality), under different hypothetical scenarios through face-to-face interviews. Of key interests are: the distinction between non-monotonic preferences and Rawlsian preferences; symmetry of HRSWF; and the extent of inequality neutral preferences. The results indicate strong support for non-monotonic preferences, over Rawlsian preferences. Furthermore, the majority of those surveyed had preferences that were consistent with a symmetric and inequality averse HRSWF.

Keywords Health-Related Social Welfare Functions · Monotonicity · Rawlsian · Equality-efficiency trade-off

JEL Classification D39 · D63 · I10

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1 Introduction

The two main objectives of publicly funded health care are, subject to resource constraints, to maximise population health and to reduce inequality in health across groups within the population. This leads to an interesting question regarding the relationship between these two objectives: what is the relevant efficiency-equality trade-off in health policy decisions. Whilst there are several ways in which to address this issue, in this article we will explore the relationship between equality and efficiency supported by members of the public. This builds on Williams (1997), where the possibility of applying weights to health gains to different socioeconomic groups to reflect the varying prospects of achieving a 'fair innings' is discussed, but has also been further developed by Dolan (1998), Abásolo and Tsuchiya (2004), Dolan and Tsuchiya (2005) and Dolan and Tsuchiya (2011).

A Health-Related Social Welfare Function (HRSWF) is proposed as a way to explicitly represent the trade-off between the total level of health (concern for efficiency) and its distribution (concern for equality) (see Dolan 1998). The HRSWF would be defined not over individual utility levels but over health of subpopulations (Wagstaff 1994). The relevant subpopulations 1 and 2 are of equal size and homogeneous. Then, we will define social welfare as a function of the health of both the groups:

$$W = W(H_1, H_2), \quad \text{where } H_1, H_2 > 0 \tag{1}$$

where W is the level of social welfare associated with the health distribution (H_1, H_2), and H_1 and H_2 represent the health of groups 1 and 2, respectively (which in turn represents individual well-being in the calculus of W). Externalities are assumed to be absent.

The traditional HRSWF approach assumes the fulfilment of several conventional welfare properties. Briefly, *individualism* refers to social welfare depending on the health of all and each of the individuals of society; *comparability* requires that a rank ordering of individuals in terms of the levels of health can be determined; *symmetry* refers to the fact that only the health levels, and not which individual gets such health, should matter in socially ranking the different states; *monotonicity* requires that any increase in individual health results in an increase in social welfare.

Within this framework, Abásolo and Tsuchiya (2004) propose a HRSWF specification that fulfils the main properties of conventional social welfare functions (i.e. individualism, comparability, symmetry and monotonicity), but also allows for non-monotonic preferences that might arise where socioeconomic health inequalities are regarded as being too large. This HRSWF specification is motivated by an empirical study that elicits social preferences regarding the efficiency-equality trade-off in health, in a way that can be translated into the HRSWF space.

The basic idea used in Abásolo and Tsuchiya (2004) can be described as follows (also see Shaw et al. 2001; Dolan and Tsuchiya 2011). The questionnaire presents a situation where there is a 5-year difference in the health of two socioeconomic groups, lower socioeconomic group (H_1) and higher socioeconomic group (H_2), measured in terms of life expectancy at birth: viz. point ***I*** in Fig. 1.

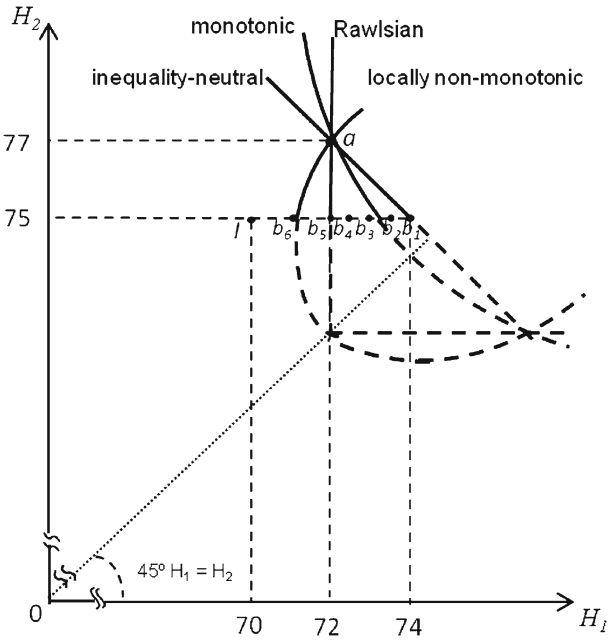

Fig. 1 Types of indifference curves around point *a*

In the first question, the respondent is asked to choose between two health programmes which have exactly the same cost. Health programme A increases the life expectancy of both socioeconomic groups by 2 years each (point *a* in Fig. 1); and health programme B increases the life expectancy of the worse-off group by 4 years (point b_1). Let us denote the choice between these two programmes as '*a* (+2, +2) versus b_1 (+0, +4)', indicating health gains for higher and lower socioeconomic groups, respectively. If the respondent chooses programme A, then no further questions are asked.

Those respondents who answer programme B to the above are referred to a follow-up set of questions in which they are asked to choose between programme A and a modified programme B which gives smaller and smaller life expectancy gains to the lower class, in 6-month decrements. In other words, programme A is always *a* (+2, +2), whilst programme B changes from b_2 (+0, +3.5), to b_3 (+0, +3), to b_4 (+0, +2.5) and to b_5 (+0, +2.0). The expectation is that the respondent would 'switch' to programme A at some point. These choices represent different degrees of the equality-efficiency trade-off. The larger the sacrifice in terms of efficiency that one is ready to make to reduce inequalities, the later would be one's switching point. Once the individual has switched, an indifference point can be worked out along the horizontal line b_1–***I***. If, for instance, a respondent chooses programme B when the choice *a* (+2, +2) versus b_2 (+0, +3.5) is offered, but switches to programme A for the choice *a* (+2, +2) versus b_3 (+0, +3), then it is assumed that the respondent is indifferent between *a* (+2, +2) and (+0, +3.25), the mid-point between b_2 and b_3. The interpretation is that we have identified two points lying on the same social welfare contour which in this case corresponds to the *monotonic* indifference curve drawn in Fig. 1.

To not switch at the very last question and to prefer b_5 $(+0, +2)$ over a $(+2, +2)$ implies a violation of the *strong monotonicity* principle. *Strong monotonicity* requires that if the health of one group ($i = 1, 2$) increases, ceteris paribus, the level of social welfare also increases, i.e.:

$$\partial W/\partial Hi > 0 \quad \text{for all } i \tag{2}$$

As reported in Abásolo and Tsuchiya (2004), a representative sample of the Spanish population ($N = 973$ valid responses) is interviewed on a face-to-face basis and the results show that the majority (57%) of those with valid responses still prefer programme B when the choice a $(+2, +2)$ versus b_5 $(+0, +2)$ is offered, i.e. have preferences that violate the strong monotonicity principle. However, the questionnaire design used has several drawbacks that cast some doubts on the results regarding violation of monotonicity (see for example Olsen 2004; Dutta 2006a,b).

First, the last question offered to the respondents in the follow-up page (i.e. the choice between a $(+2, +2)$ and b_5 $(+0, +2)$), is not sufficient to rule out Rawlsian preferences, as an indifference option is not given in the follow-up page. Actually, amongst those who choose b_5 $(+0, +2)$ over a $(+2, +2)$, and thus violate strong monotonicity, there could be two different types of respondents. The first type would consist of those who have a non-monotonic preference and are indifferent between a and a point like b_6 in Fig. 1 (i.e. 'locally non-monotonic' social welfare contour with a backward bending segment around a); in their view, increasing the health of the better-off group at this point will decrease social welfare (and thus their preferences violate (2)). The second type would consist of those who are Rawlsians, and are indifferent between a and b_5 (i.e. 'Rawlslian' social welfare contour with a vertical slope through a and b_5); so, increasing the health of the better-off group at this point will not change the level of social welfare (and thus their preferences violate (2)). Since there is no indifference option given in the questionnaire, they choose b_5 over a (and there may have been other Rawlsians who choose a over b_5 at the same junction).

Second, regarding the design of the first question, the choice between a $(+2, +2)$ versus b_1 $(+0, +4)$ forces the respondent to choose one or the other programme, therefore, not allowing for *inequality neutral* preferences; insofar as individuals with such preferences choose programme b_1, the proportion of those who violate monotonicity may be overestimated. In addition, option b_1 $(+0, +4)$ gives no health gain to the better-off and if this is a reason to choose a over b_1, results would underestimate the proportion of individuals violating monotonicity.

Third, the titration sequence in which the follow-up questions are presented could 'invite' respondents to delay switching to programme A beyond the point at which they are indifferent between the two programmes, resulting in more respondents appearing as if they violate the monotonicity principle.

On the other hand, there may be a tendency for survey respondents to favour the first—or the left-hand side—option over alternatives that they see subsequently, if 'response order effect' takes place. Therefore, fourth, there is the possibility that there is a bias towards a $(+2, +2)$, which always appears on the left-hand side, thus possibly leading to an *under*report of the extent of the violation of monotonicity. Finally,

the questionnaire does not undertake any question to check whether preferences are symmetric.

The aim of this article is to design a new questionnaire built on previous work and to empirically test for monotonicity under different hypothetical scenarios and, where monotonicity is violated, to distinguish between non-monotonic preferences or Rawlsian preferences. In addition, other HRSWF properties such as symmetry and the presence of inequality neutral preferences are examined, together with several framing issues. Details of the methods are presented in Section 2. Section 3 reports the results of the new survey. Section 4 presents a general discussion of the results and the main conclusions are summarised in Section 5.

2 Methods and data

2.1 Methods

Throughout the interview questionnaire used in this article, the respondent is asked to think as if s/he were a decision maker who has to choose between alternative health programmes involving a tension between efficiency and equality in health. With a visual aid, the respondent is presented with a 5-year difference in life expectancy at birth between higher and lower socioeconomic classes (78 and 73 years, respectively). Social class is defined on the basis of occupation: high social class is represented by professions like doctors or lawyers, whilst low social class is represented by road sweepers or cleaners. The first main question of the questionnaire (see Q.1.1 in the Appendix) corresponds to a choice between two health programmes that have exactly the same cost: programme A increases the life expectancy of both classes by 2 years each and programme B increases the life expectancy of the worse-off class by 4 years (therefore reducing the health inequality between both the groups). The questionnaire includes an indifference option on the first page 'A and B are equally good'. The individuals are directed to one of the three follow-up pages depending on the choice in the initial question (A, B or indifferent). The follow-up questions do not include the indifference option, given the smaller sample size and also given that it might be an invitation for some respondents to choose the option as an easy way out of the questionnaire.

Throughout the follow-up page, the individuals can switch from A to B or the other way round (depending on the question as specified below) but once switched, they are regarded as 'invalid' responses and excluded from all analyses if they switch back again.

2.1.1 Testing for monotonicity: Rawlsian or non-monotonic preferences?

The individuals who choose programme B in Q.1.1 are directed to a follow-up page (Q.1.2 in the Appendix) where programme A remains constant but programme B gives smaller and smaller life expectancy gains to the lower socioeconomic group, showing the efficiency equality trade-off, with the expectation that the individual will switch to

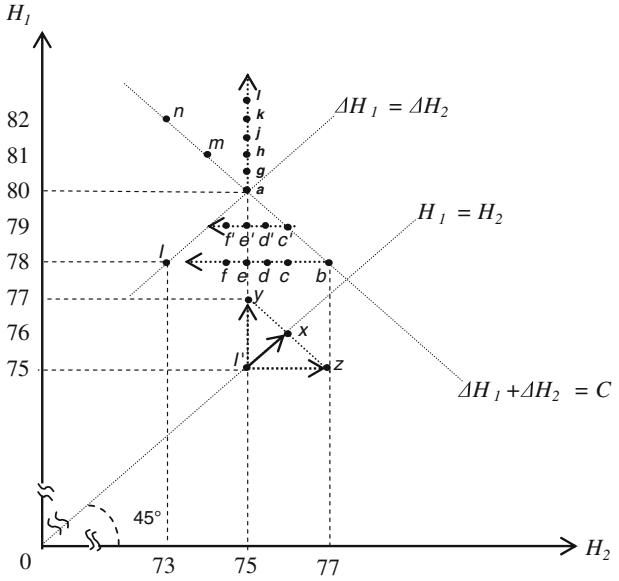

Fig. 2 Ordering health distributions into HRSWF framework

programme A at some point beyond which further sacrifices in efficiency to improve equality are no longer worthwhile.

Figure 2 illustrates how it works in the HRSWF framework. H_1 and H_2 represent the life expectancy at birth of the high socioeconomic group and the low socioeconomic group, along the vertical and horizontal axes, respectively. Point $\boldsymbol{I}$ (78, 73) represents the current situation. The question on the first page corresponds to a choice between a move from point $\boldsymbol{I}$ to point a 'programme A' $(+2, +2)$ versus a move from point $\boldsymbol{I}$ to point b 'programme B' $(+0, +4)$. If the respondents prefer the latter, then the subsequent choices are between a move from $\boldsymbol{I}$ to point a versus a move to points to the left of b on the horizontal line. The point at which the respondent 'switches' from programme B to A will indicate where the indifference curve through point a $(+2, +2)$ intersects the horizontal line $\boldsymbol{I} - b$. In order to allow an unambiguous distinction between non-monotonic preferences and Rawlsian preferences, the final choice offered is between options a $(+2, +2)$ and f $(+0, +1.5)$.

In this follow-up page, respondents can switch from programme B to A. If the majority of individuals still prefers option f to option a in the last question, that would indicate that the median respondent has non-monotonic, rather than Rawlsian preferences. We will refer to this question (Q.1.2) as the *main titration* question.

2.1.2 Testing for inequality neutral preferences

Those who reveal themselves to be indifferent between programmes A and B in Q.1.1 are directed to another follow-up page (see Q.1.3). As with the follow-up page (Q.1.2), programme A continues to represent the move from $\boldsymbol{I}$ to a $(+2, +2)$, but now, pro-

gramme B represents the move from $\boldsymbol{I}$ to three points c' $(+1, +3)$, m $(+3, +1)$ and n $(+4, +0)$ along the straight line $\Delta H_1 + \Delta H_2 = C$ (see Fig. 2). We refer to this question as *inequality neutral*. Respondents can switch from programme A to B, or from programme B to A.

2.1.3 Testing if 'nobody should get nothing' is a concern

In the above, whilst under programme A both population groups receive something, under programme B the better-off will receive no health benefit, and there may be those who find it unacceptable that a public policy programme should exclude a whole population subgroup from benefiting. If so, this might be an invitation for some to choose programme A (therefore underestimating preferences that violate strong monotonicity). In order to explore this possibility, a follow-up page for those who choose programme A on the first page is designed (see Q.1.4). On this page, programme A represents the move from point $\boldsymbol{I}$ to a $(+2, +2)$ as before, but programme B now represents moves from $\boldsymbol{I}$ to a series of points on the horizontal line along point c' $(+1, +3)$ to f' $(+1, +1.5)$ of Fig. 2, so that the better-off will receive a small health benefit, and a trade-off exercise similar to the original follow-up page could be carried out (aimed just at those who are concerned with 'everybody getting something'). In the follow-up page respondents can switch from B to A. We refer to this question as *everybody gets something.*

2.1.4 Testing for two framing issues

First, the titration sequence in which the follow-up questions are presented could invite respondents to delay switching to programme A beyond the point at which they are indifferent between the two programmes, resulting in more respondents appearing as if they violate the monotonicity principle. For instance, if in the follow-up page, the first choice that the respondent faces is between A $(+2, +2)$ and B $(+0, +2)$, the individual's propensity to choose $(+2, +2)$ might be higher than if such a choice is preceded by several choices with a titration sequence such as: $(+2, +2)$ versus $(+0, +3)$; $(+2, +2)$ versus $(+0, +2, 5)$; and $(+2, +2)$ versus $(+0, +2)$. This is the so-called boiling frog bias.[1] This would be an artefact of the questionnaire design, and not their genuine preferences. In order to explore this possibility, in addition to the titration version of the follow-up page (Q.1.2), an alternative variant is designed (*main random*), where the order of the programme pairs in the follow-up page appears random (see Q.1.5) in such a way that now the respondent faces a bigger gap between the successive programme B options (e.g. from $+0, +3$ to $+0, +1.5$). The aim is to compare the proportion of individuals that choose programme B at corresponding stages of the two variants and see if there are differences. Once the data are put in the titration ordering, the responses can switch from programme B to A as in the main titration variant.

[1] The story of the boiling frog states that a frog can be boiled alive if the water is heated slowly enough—it is said that if a frog is placed in boiling water, it will jump out, but if it is placed in cold water that is slowly heated, it will never jump out (see for example, Scripture 1897).

Second, there may be a tendency for survey respondents to favour the first (or the left-hand side) option over alternatives that they see subsequently, in what has been called a 'response order effect' (e.g. Krosnik 1999). If so, there is the possibility that there is a bias towards (+2, +2), which always appears on the left-hand side (thus possibly leading to an *under*reporting of the extent of the violation of monotonicity). In order to test the extent to which the results are affected by the location of the two programmes on the page, the first page with programme A (+2, +2) on the left-hand side and programme B (+0,+4) on the right-hand side (*original alignment*) is reproduced with (+2,+2) on the right-hand side and labelled programme B, and (+0,+4) on the left-hand side and labelled programme A (*flipped alignment*; see Q.2). Again, the indifference option is given. There is no follow-up page under this format. We will refer to this question as the *left–right effect*.

2.1.5 An alternative question to test for violation of strong monotonicity

An additional question is introduced to further explore whether or not the results of the first and follow-up questions (Q.1.1 and Q.1.2) are robust regarding violation of strong monotonicity. Unlike the follow-up question (Q.1.2) where health gains to the worse-off became lower and lower keeping constant the health of the better-off, in this question health gains to the better-off are made larger and larger, whilst keeping the health of the worse-off constant (see Q.3). Respondents are asked in effect to compare on Fig. 2 a move from $\boldsymbol{I}$ to a modified programme B which is located at points between g (+2.5,+2) and l (+4.5,+2), with reference to a fixed programme A at point a (+2,+2). This means that on the first page, where there is an indifferent option, we have a direct test of Rawlsian preferences. Furthermore, on the follow-up page, programme B becomes increasingly more attractive relative to the fixed reference programme A in terms of efficiency but increasingly less attractive in terms of equality. Respondents can switch from programme A to B, or from programme B to A. This question is referred to as the *alternative monotonicity*. Monotonicity requires that points between g and l are preferred over a regardless of its increased inequality.

2.1.6 Testing for symmetry of preferences

A question that arises at this point is whether or not the HRSWF is symmetric. The better-off in terms of health in these scenarios are also better-off in terms of socioeconomic status, so if respondents think this is a relevant consideration, then they may well have an asymmetric HRSWF regarding the determination of public health care resource allocation. In other words public preferences may be not only non-monotonic, but also asymmetric. In order to test for symmetry of preferences, a new question is designed (see Q.4), which refers to two subgroups of 100 individuals selected from two population groups (the rich and the poor), and these two groups have the same life expectancy at birth (i.e. 75 years). Income subgroups as opposed to whole social class groups are chosen, since whilst it is unrealistic to assume that the outcomes involved in this question can apply to whole social class groups, it is quite possible to select 100 individuals from each group who have the health features described here. Now, in Fig. 2, the initial point is $\boldsymbol{I}'$ on the 45° ray and any increments are related to this

Table 1 Sample sizes and questionnaires

	Variant 1	Variant 2	Variant 3
First question	Main question (Q.1.1)	Main random (Q.1.5)	Alternative monotonicity (Q.3)
Follow-up questions	Main titration (Q.1.2)		
	Inequality neutral (Q.1.3)		
	Everybody gets something (Q.1.4)		
Second question	Left–right effect (Q.2)		Symmetry (Q.4)
Total $N = 1,211$	$N_1 = 407$	$N_2 = 395$	$N_3 = 409$
Excluded[a]	80 (19.7%)	50 (12.7%)	68 (16.6%)
Valid $N = 1,013$	$N_1 = 327$	$N_2 = 345$	$N_3 = 341$

[a] Respondents were excluded if they had invalid responses to at least one question, or had missing values (i.e. did not respond to at least one question)

new $\boldsymbol{I}'$ point. In effect, the questions ask respondents to first compare a move from point $\boldsymbol{I}'$ to point x (+1,+1) with a move from $\boldsymbol{I}'$ to y (+2,+0) and secondly compare the move from $\boldsymbol{I}'$ to x (+1,+1) with a move from $\boldsymbol{I}'$ to z (+0,+2). We refer to this question as *symmetry*. If symmetry around point $\boldsymbol{I}'$ holds, then those who prefer x (+1,+1) to y (+2,+0) will prefer x (+1,+1) to z (+0,+2); and those who prefer y (+2,+0) to x (+1,+1) will prefer z (+0,+2) to x (+1,+1); in addition, symmetry requires that those who are indifferent in one question should also be indifferent in the other question. Note that satisfying one of these is a necessary but not sufficient condition for an individual to support a symmetric HRSWF.

2.2 Data

A survey of 1,211 individuals over 18 years of age was undertaken in Spain in December 2004. Spain has a National Health Care System characterised by universal coverage and tax funding. Face-to-face interviews were assigned across the 17 Comunidades Autonomas ('Regions' for short), reflecting the local resident population proportionally. Within each of the regions, interviewees were randomly selected so that the achieved sample was representative of the general Spanish population in terms of sociodemographic characteristics. Of these, 83.6% provided complete data ($N = 1013$); 48% of the individuals were male, with average age of 45.15 (SD 18.10); and 52% female, with average age of 46.45 (SD 18.04). The overall questionnaire consisted of three different variants which were allocated to respondents randomly ($N_1 = 327$, $N_2 = 345$, $N_3 = 341$; see Table 1). The first variant had the main question with the indifference option after which respondents were diverted to one of the four follow-up pages: one to test for non-monotonicity of preferences (*main titration*); one to test inequality neutral preferences (*inequality neutral*); one to test whether everybody should get some health benefit (*everybody gets something*); and another to test whether the results are affected by the location of the programmes in the first page (*left–right effect*). The second variant had the first page of the main

Table 2 Break down of excluded respondents by question

	Invalid (%)	Missings (%)	Total *N*
Variant 1 ($N = 407$)			
First page main question (Q.1.1)	–	17 (4.2)	407
Follow-up main titration (Q.1.2)	13 (4.6)	8 (2.8)	283
Follow-up inequality neutral (Q.1.3)	4 (10.3)	11 (28.2)	39
Follow-up everybody gets STH (Q.1.4)	14 (20.9)	7 (10.4)	67
Left–right question (Q.2)	–	21 (5.2)	407
Total	31 (7.6)	49 (12.0)[a]	407
Variant 2 ($N = 395$)			
Main random question (Q.1.5)	20 (5.1)	30 (7.6)	395
Variant 3 ($N = 409$)			
Alternative monotonicity question (Q.3)	27 (6.6)	35 (8.6)	409
Symmetry question (Q.4)	–	25 (6.1)	409
Total	27 (6.6)	41 (10.0)[a]	409

[a] The totals are lower than the actual sum of the column where some respondents have been missing in more than one question

question, followed by the random version of the main question (*main random*) and further questions not addressed in this article. The third variant started with the alternative monotonicity question (*alternative monotonicity*) and then moved on to the symmetry question (*symmetry*).

Table 2 presents the breakdown of excluded respondents by question. It can be seen that the percentage of invalid and missing cases varies across questions. The proportion of excluded cases goes from the 4.2% of the first question (Q.1.1) to the 38.5% of the *inequality neutral* follow-up (Q.1.3). Regarding the reason of exclusion, for Q.1.4 the percentage of invalid cases is relatively high (20.9%) suggesting that a higher proportion of respondents have difficulties to understand the *everybody gets something* follow-up. Something similar happens with the percentage of missing cases in the *inequality neutral* follow-up: the proportion of missing cases is 28.2%.

3 Results

3.1 Rawlsian or non-monotonic preferences?

Table 3 is made up of two parts. The top part relates to the 327 respondents that answer the first page of the main question (Q.1.1). On the first page of the questionnaire, where the relevant question is between points *a* versus *b* in Fig. 2, with programme A (78+2, 73+2) and programme B (78+0, 73+4), 44 choose A, 261 choose B, and 22 (6.7%) are indifferent. The bottom part of Table 3 relates to the 261 (79.8%) who choose programme B on the first page, and shows whether those who violate strong monotonicity have Rawlsian or non-monotonic preferences.

Moving down the rows, as programme B becomes less efficient, more and more individuals shift to programme A showing a pattern of the efficiency-equality trade-

Table 3 Main question and follow-up main titration question: testing for non-monotonicity

Number of respondents answering the first variant ($N = 327$)					
	Programme A	Programme B	Choose A	Choose B	Indifferent
a versus *b*	78+2, 73+2	78+0, 73+4	44 (13.5)	261 (79.8)	22 (6.7)

Those respondents who chose Programme B on the first page ($N = 261$)				
	Programme A	Programme B	Choose A	Choose B
a versus *c*	78+2, 73+2	78+0, 73+3	12 (4.6)	249 (95.4)
a versus *d*	78+2, 73+2	78+0, 73+2.5	28 (10.7)	233 (89.3)
a versus *e*	78+2, 73+2	78+0, 73+2	61 (23.4)	200 (76.6)
a versus *f*	78+2, 73+2	78+0, 73+1.5	96 (36.8)	165 (63.2)

Percentages sum to 100% along each row

Table 4 Follow-up inequality neutral

Respondents answering the first variant ($N = 327$)					
	Programme A	Programme B	Choose A	Choose B	Indifferent
a versus *b*	78+2, 73+2	78+0, 73+4	44 (13.5)	261 (79.8)	22 (6.7)

Those respondents who chose indifferent on the first page ($N = 22$)				
	Programme A	Programme B	Choose A	Choose B
a versus c'	78+2, 73+2	78+1, 73+3	10 (45.5)	12 (54.5)
a versus *m*	78+2, 73+2	78+3, 73+1	18 (81.8)	4 (18.2)
a versus *n*	78+2, 73+2	78+4, 73+0	20 (90.9)	2 (9.1)

Percentages sum to 100% along each row

off. However, a clear majority (76.6% of this group of respondents) remains preferring *e* (+0,+2) over *a* (+2,+2), therefore violating the strong monotonicity principle represented in Eq. 2. More importantly, 63.2% of this group (50.5% of the overall sample for this question $N = 327$) still prefer *f* (+0,+1.5) over *a* (+2,+2); i.e., they have non-monotonic preferences rather than Rawlsian preferences. A necessary (but not sufficient) condition for an individual respondent to hold Rawlsian preferences is to prefer *d* (+0,+2.5) over *a* (+2,+2), and to prefer *a* (+2,+2) over *f* (+0,+1.5). Since there are 68 (21% of 327) such respondents, this is the upper limit of the proportion of individuals with Rawlsian preferences in this sample under this question.

3.2 Inequality neutral preferences

The bottom part of Table 4 relates to the 22 respondents who are indifferent between programmes A and B in the first question (Q.1.1). Each row presents the distribution

Table 5 Follow-up everybody gets something

Respondents answering the first variant ($N = 327$)

	Programme A	Programme B	Choose A	Choose B	Indifferent
a versus b	78+2, 73+2	78+0, 73+4	44 (13.5)	261 (79.8)	22 (6.7)

Those respondents who chose Programme A on the first page ($N = 44$)

	Programme A	Programme B	Choose A	Choose B
a versus c'	78+2, 73+2	78+1, 73+3	29 (65.9)	15 (34.1)
a versus d'	78+2, 73+2	78+1, 73+2.5	34 (77.3)	10 (22.7)
a versus e'	78+2, 73+2	78+1, 73+2	35 (79.5)	9 (20.5)
a versus f'	78+2, 73+2	78+1, 73+1.5	37 (84.1)	7 (15.9)

Percentages sum to 100% along each row

of respondents when different combinations of programmes A and B are presented. So, the potential presence of health maximisers does not rule out violation of strong monotonicity of the majority. In addition, in the follow-up, the proportion of those who prefer programme B is much larger when it is represented by point c' compared to points that are further way from the 45° line (m and n in Fig. 2) suggesting that distribution neutrality may only be relevant when the programme does not increase the current inequality in health.

3.3 Everybody should get something

The questionnaire accommodates those who are willing to target the worse-off but are also reluctant to give nothing to one party. The top part of Table 5 replicates the top part of Table 4. The bottom part relates to the 44 respondents who choose programme A on the first question (Q.1.1). Of these, a majority remains preferring programme A. Therefore, rearranging the benefits so that no group gets no health gain is not enough to invite these respondents to target the worse-off.

3.4 Framing issues

As it can be seen in Fig. 3, comparing the results from the *main titration* question (Q.1.2) and the *main random* question (Q.1.5), there are no statistically significant differences ($p > 0.05$) between the proportion of individuals choosing programme B at corresponding stages of the two versions of the questionnaire. Thus the hypothesis that violation of strong monotonicity is caused by the titration sequence of the questionnaire is rejected.

Figure 4 presents the distribution of responses on the first page contrasting the original left–right alignment and the flipped alignment. In the original left–right alignment, 13.5% of respondents choose (+2,+2), whilst 79.8% choose (+0,+4) and 6.8%

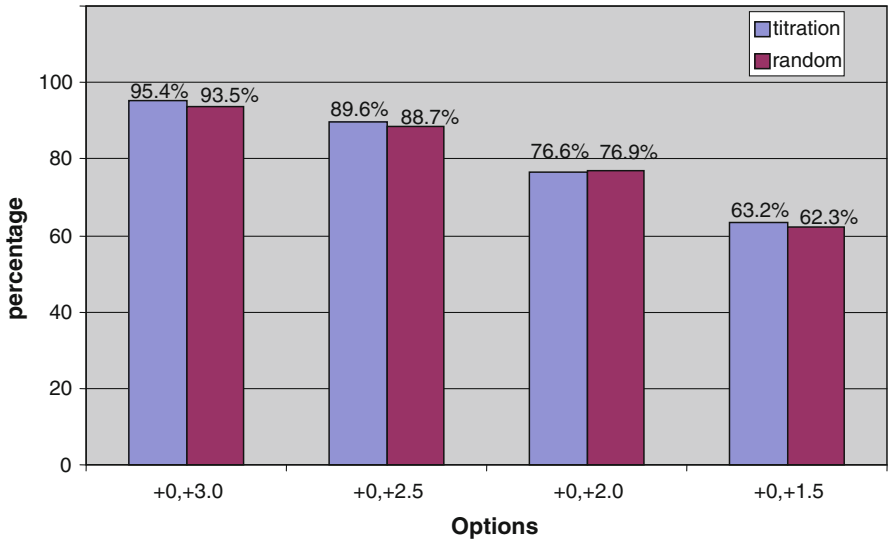

Fig. 3 Comparison of % individuals choosing programme B: titration versus random versions. Number of respondents answering the second variant = 345

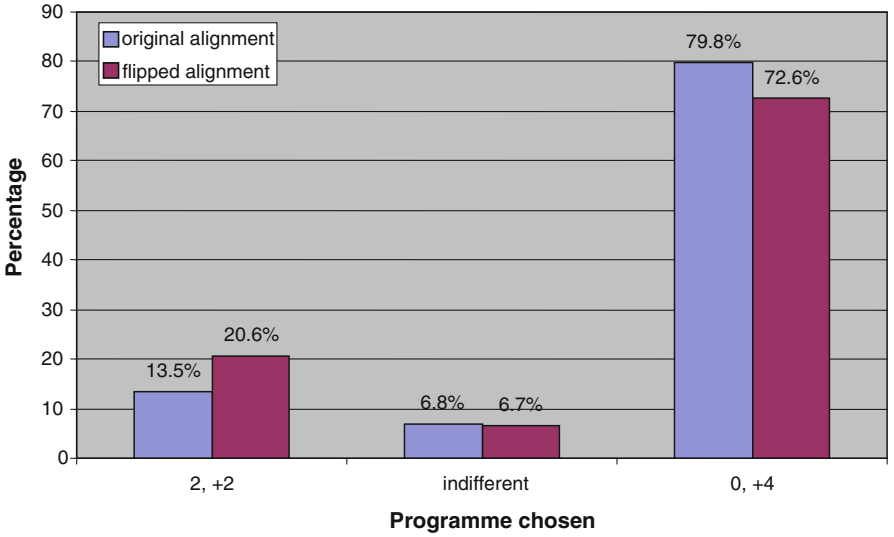

Fig. 4 Comparison of distribution of responses between original and flipped alignments. Number of respondents answering the second variant = 345

are indifferent between the options. With the flipped alignment, the proportions are 20.6, 72.6 and 6.7%, respectively. In order to test the response order effect, a test for homogeneity is undertaken (Rohatgi 1976). With a 95% confidence level, the hypothesis of equality of proportions in relation with options A, B and indifference (considered jointly) cannot be rejected.

Table 6 Alternative question to test for non-monotonicity

	A	B	Number of respondents (%)[a]		
			Choose A	Choose B	Indifferent
a versus *g*	78+2, 73+2	78+2.5, 73+2	168 (49.4)	128 (37.5)	45 (13.2)
a versus *h*	78+2, 73+2	78+3, 73+2	209 (61.3)	132 (38.7)	
a versus *j*	78+2, 73+2	78+3.5, 73+2	212 (62.1)	129 (37.9)	
a versus *k*	78+2, 73+2	78+4, 73+2	213 (62.4)	128 (37.6)	
a versus *l*	78+2, 73+2	78+4.5, 73+2	214 (62.7)	127 (37.3)	

Number of respondents answering the third variant = 341
[a] Percentages sum to 100% along each row

Table 7 Testing for symmetry of preferences

	$x > y$	$x \sim y$	$y > x$	Total
$x > z$	172 (50.4)	6 (1.8)	2 (0.6)	180 (52.8)
$x \sim z$	2 (0.6)	14 (4.1)	0 (0.0)	16 (4.7)
$z > x$	98 (28.7)	6 (1.8)	41 (12.0)	145 (42.5)
Total	272 (79.8)	26 (7.6)	43 (12.6)	341 (100.0)

Number of respondents answering the third variant = 341

3.5 Alternative monotonicity test

Table 6 presents the results for the alternative monotonicity question: 49.4% of individuals are found to choose *a* (+2,+2) over the closest alternative in the north direction *g* (+2.5,+2), thereby violating monotonicity. Furthermore, 13.2% have preferences consistent with a Rawlsian HRSWF. In the follow-up sheet, the indifference option is removed, and a clear majority (61.3%) chooses programme A. Once programme B reaches *j* (+3.5, +2), there is little further change between programmes. This alternative question adds robustness to the results related to the preferences of the majority of respondents violating strong monotonicity.

3.6 Symmetry

Finally, Table 7 summarises the distribution of respondents across the nine possible combinations of preferences illustrated in Fig. 2 (regarding the new reference point $\boldsymbol{I}'$). Symmetry requires respondents to be in one of the three diagonal cells from the left-hand side top to the right-hand side bottom, and a total of 66.5% of those who are given these questions satisfy this. If we exclude those who prefer *y* (+2,+0) over *x* (+1,+1) and at the same time *z* (+0,+2) over *x* (+1,+1), i.e. excluding those preferences with welfare contours around *x* that are concave to the origin, this will reduce the proportion of those who is in line with the necessary condition for symmetry to 54.5%. Of those who support asymmetry, it should be noted that the majority (31.1% of overall) is in the expected direction (i.e. in favour of the worse-off) and just 2.4% of the total would be in favour of the higher socioeconomic group. Similarly,

79.8% of individuals prefer x to y, whilst the proportion of those who prefer x to z are just 52.8%. That is, equal distributions are more preferred to unequal ones (by 26% points) when the inequality favours the higher socioeconomic group.

4 Discussion

In an earlier study, Abásolo and Tsuchiya (2004) suggest that monotonicity may be questionable as a welfare principle in the context of health. This conclusion remains when a revised version of the questionnaire is used to explore a wider range of preferences and other hypotheses that might have affected their findings regarding preferences that violate strong monotonicity.

One of the central aims of this article was to distinguish between non-monotonic and Rawlsian preferences amongst those who violate the strong monotonicity principle. First of all, the results of the very last choice offered in the *main titration* version in this study show that the majority still prefers programme B (+0,+1.5) which reduces health inequalities but gives the worse-off less health gain than would be achieved through programme A (+2,+2) where health inequalities would remain constant. A Rawlsian respondent should, however, choose programme A (+2,+2) over programme B (+0,+1.5). Therefore, our empirical exercise shows that the majority of respondents has preferences which are consistent with non-monotonic preferences (i.e. violate the weak monotonicity principle as well), rather than with Rawlsian preferences. In addition, our results suggest that the upper limit of the proportion of respondents with Rawlsian preferences in this sample is 21%. On the other hand, these results are also compatible with a HRSWF that violates monotonicity globally (i.e. with contours with no downward sloping sections). At the extreme, such an HRSWF has a single contour along the 45° line, and distinguishes between just two levels of social welfare: high, with equal health at whatever level; and low, with unequal health of whatever distribution. However, distinguishing between local and global violation of monotonicity would require identifying at least three points lying along a social welfare contour, which is beyond our study design.

Regarding those who do choose not to target the worse-off at the first choice, the questionnaire accommodates two types of individuals: those who are inequality neutral and those who prefer to avoid not giving anything to a group. With respect to the former, only a small minority of individuals reports to be inequality neutral when the indifference option is offered in the first page of the main questionnaire; as a consequence, the potential presence of distribution-neutral health maximisers does not affect the violation of strong monotonicity by the majority. It would have been desirable to offer an indifference option in subsequent questions of the follow-up page as well. However, the indifference option is not included there as this would make the questionnaire more complicated and could be an invitation for some respondents to choose the indifference option as an easy way out of the questionnaire. Indeed, the relatively higher rate of non-response or missing in the follow-up page to the *inequality neutral* question (see Table 2) may reflect the fact that this page does not include indifference options. The excess proportion of those who do not answer this particular follow-up page may be attributable to those whose view are distribution-neutral along the $\Delta H_1 + \Delta H_2 =$ constant line, and therefore do not find either option on offer to be appropriate.

With regard to the second issue above, addressed by the *everybody gets something* question, the majority of those who prefers programme A in the very first page remains preferring this programme on the follow-up page despite programme B which now gives something to the better-off. This indicates that the 'nobody should get nothing' argument is not a strong concern and, therefore, does not affect the main conclusions regarding violation of strong monotonicity.

Violation of strong monotonicity is not affected by the titration sequence of the questionnaire (*main titration*). Small incremental reductions in the health gain of the worse-off in programme B do not seem to postpone the shift to programme A as compared with the *main random* version where the respondents face bigger decrements. Regarding the *left–right effect* the results do not show evidence of a bias towards (+2,+2) insofar as it is the first option that the respondent can see (as it is located on the left-hand side); rather, the original and the flipped alignments do not give significantly different results.

The *alternative monotonicity* question adds new evidence to the existence of non-monotonic preferences. First, on the first page, just about half of individuals (49%) prefer programme A (+2,+2) to programme B (+2.5,+2) thus failing to maximise overall health, and having non-monotonic preferences. The indifference option consistent with Rawlsian preferences, which is offered to the respondents in this first question, is chosen by 13% of individuals (which further narrows down the upper limit of 21% identified in the *main titration* version). The rest of respondents prefers programme B (i.e. have monotonic preferences). At this stage, the result is consistent with a Rawlsian preference for the median voter. However, when, in subsequent choices, programme B gives the better-off more and more health gains (keeping constant the health of the worse-off), then a larger proportion of respondents chooses programme A, exceeding the majority by a substantial margin ($> 60\%$). The proportion of those choosing between the two programmes in the bottom three rows of Table 6 is relatively fixed, which may reflect the tension between increasing efficiency on the one hand and increasing inequality on the other. The results suggest that it is when health inequalities are regarded as being 'too large' that concern for equality may override concern for efficiency, resulting in non-monotonic preferences. In other words, there is a point beyond which increasing overall health any further at the expense of health equality would begin to reduce overall health-related social welfare. An interesting issue to explore would be to estimate where that tipping point might be located.

One of the features of the visual aid used in the exercise is that the scale illustrating the levels of life expectancy is truncated at 68 years. This means that the degree of inequality between the two groups appears larger than they actually are. If, as we suggest, violation of monotonicity is something that comes into effect when the extent of inequality is perceived to be beyond an acceptable limit, then the visual aid used may have exacerbated this. In other words, violation of monotonicity may not be applicable at the 5-year difference in life expectancy used in this study. If so, this may suggest that under realistic levels of inequalities in health between socioeconomic groups the median Spaniard does not support a health-related social welfare contour that is upward sloping. On the other hand, however, this is still compatible with a non-monotonic HRSWF that has a backward-bending segment.

A further issue relates to a possibility akin to 'loss aversion' for individual choices (Tversky and Kahneman 1991). The questions used are formulated in terms of life expectancy gains, and thus capture non-monotonic preferences in gains. However, loss aversion may make people who violate monotonicity in gain contexts not do so in loss contexts. In other words, the results from this study cannot be interpreted to mean people would regard a reduction in the life expectancy of the high social class with no corresponding gains elsewhere as an improvement in health-related social welfare.[2]

In addition, the main questionnaire is based in the comparison of high and low social class. In the real world there are more than two social classes and the middle social class would comprise a substantial part of society. Thus, the non-existence of a middle class in the hypothetical scenarios is a substantial simplification. However, it is not known whether this simplification makes respondents more or less likely to violate monotonicity, and adapting the exercise to scenarios with three or more population subgroups would be of interest.

Another issue regarding the interpretation of results is the role of *symmetry*. The fact that those with better health are also those in a higher socioeconomic position—with, say, greater ability to pay for private care—might have conditioned the responses of some individuals who may have used the health outcome to compensate the worse-off group. The results of the test for symmetry show that the majority of respondents has symmetric preferences across subgroups of rich and poor individuals. This question, however, allows to test for symmetry around point $\boldsymbol{I}'$ only, and not with respect to the current situation (point $\boldsymbol{I}$), thus being a necessary but not sufficient condition of symmetry. In other words, it only gives an upper bound of those who support symmetry, or a lower bound for those who support asymmetry. To test whether non-monotonicity of preferences would be symmetrically reproduced in the area to the right of the 45° line will face problems of credibility, as it would require the assumption that the socioeconomically better-off (worse-off) have worse (better) health; a situation which does not correspond to the current state of the world.[3]

Finally, the extent to which the respondents have taken the citizen's perspective as opposed to the consumers' is of interest. Regarding the earlier data, Abásolo and Tsuchiya (2008) find that respondent socioeconomic background characteristics do not explain the variation in the propensity to choose the egalitarian option, suggesting that selfish motivations do not have a significant role in answering the questionnaire. However, alternative approaches to test selfish motivations in the exercise should be explored by including more questions on symmetry of preferences and by presenting the two groups defined by factors other than income or socioeconomic status.

Furthermore, if one regards the best evidence of people's preferences to be those *revealed* through *personal consumption* behaviour, then these studies are based on preferences that fall short of this in two ways: they are *stated* and not revealed; and they are about *collective public* outcomes and not outcomes to private consumers. On

[2] We are grateful to one of the referees for raising this issue.

[3] All our examples are rank preserving in that the ranking of the two population groups relative to each other remain unaffected after either programme. Perhaps a more interesting exercise might be to examine scenarios where health gains to the worse-off are big enough to catch up with or even to overtake the better-off.

the other hand, it should be noted that the market and real-world choices are where individual utility functions are revealed, and there is no place where individuals reveal their preferences regarding specific parameters of a social welfare function.

5 Conclusions

Standard social welfare functions require (alongside other conventional properties) the satisfaction of monotonicity, so that any increase in someone's health, ceteris paribus, should always lead to an improvement in social welfare regardless of the increase in inequality it would cause. However, this assumption, particularly in the health context, is questionable as has been shown in this research. We have found that public preferences regarding the efficiency-equality trade-off in health violate the strong monotonicity principle. This conclusion remains once we take into account the presence of inequality neutral preferences and other possible sources of bias. In addition, the majority of respondents has non-monotonic preferences rather than Rawlsian preferences. Finally, symmetry is satisfied by the majority of respondents, so there is no evidence that non-monotonicity would have an asymmetric pattern for the range tested. Thus, to conclude, more health is not always regarded as better for society, as it crucially depends on its distribution and on the extent of social aversion to health inequalities.

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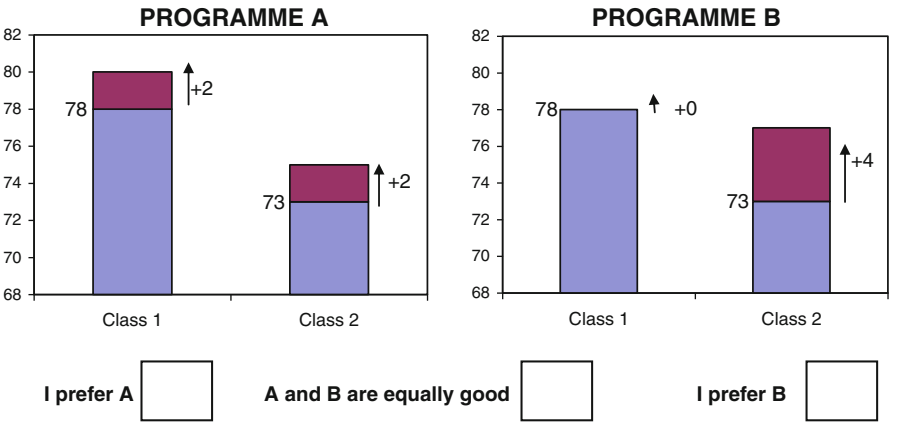
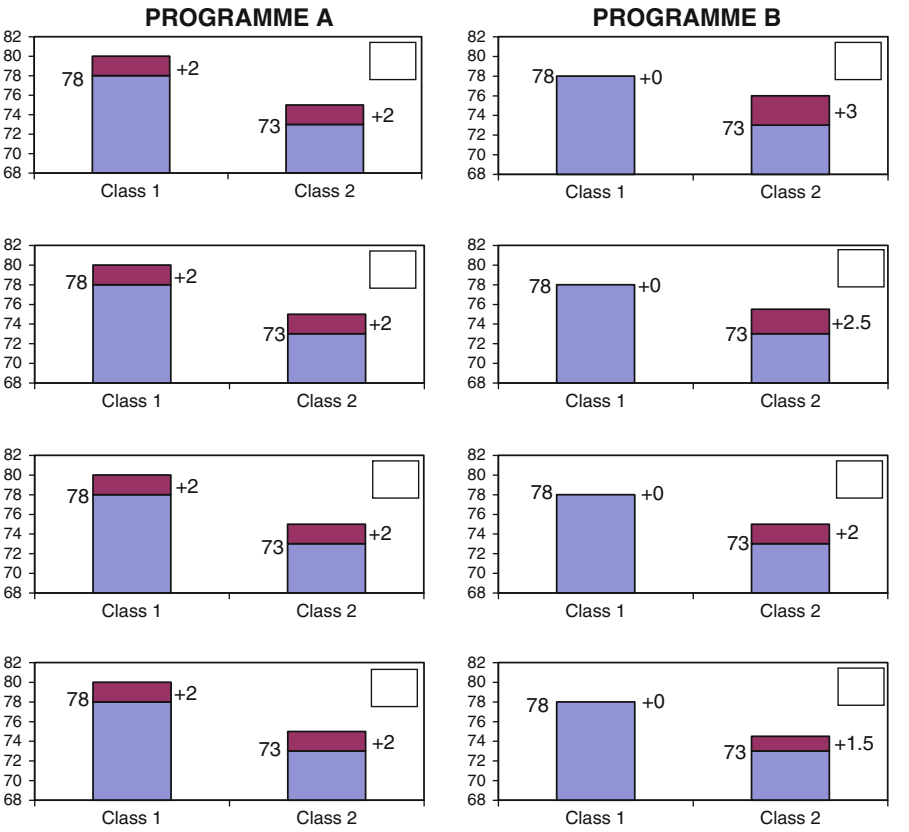
Appendix

Q.1.1 First main question of the questionnaire (original alignment)



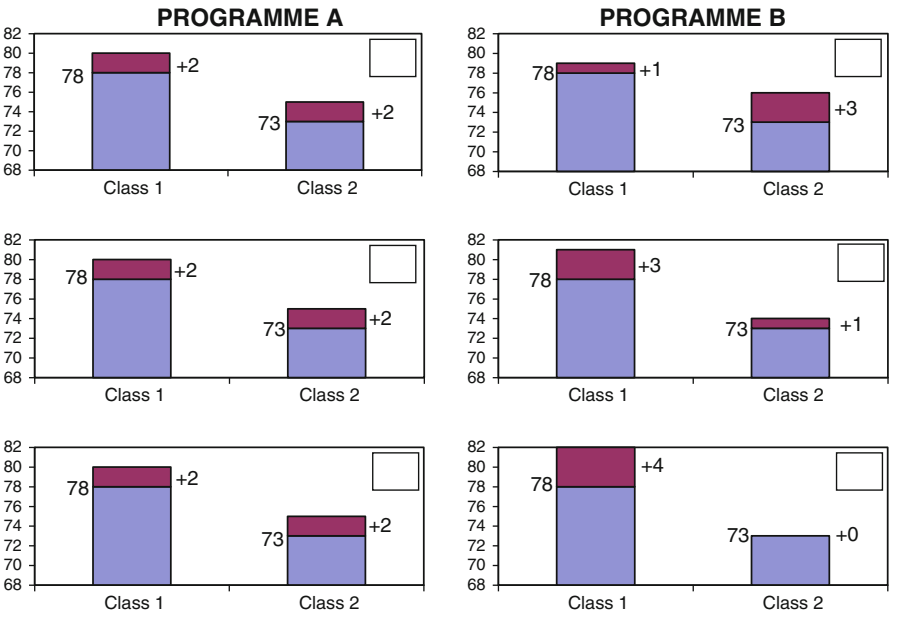
Q.1.2 Follow-up of those who choose B in the 1st question of main questionnaire (*main titration*)

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:



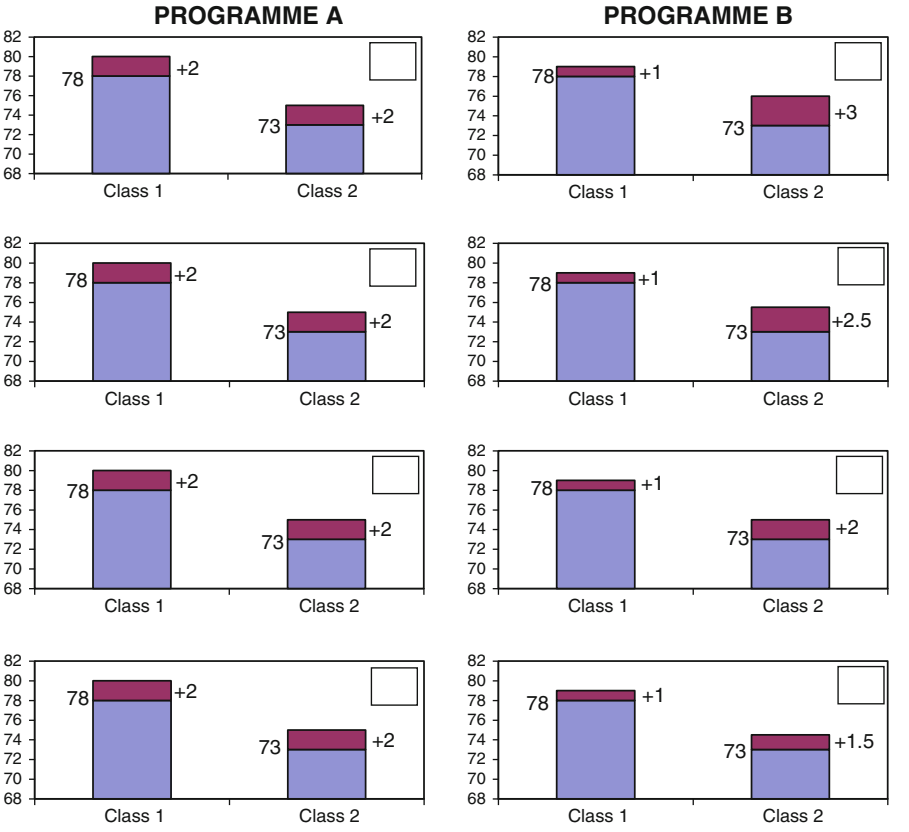
Q.1.3 Follow up of those who are indifferent in the first question of the main questionnaire (*inequality neutral*)

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:



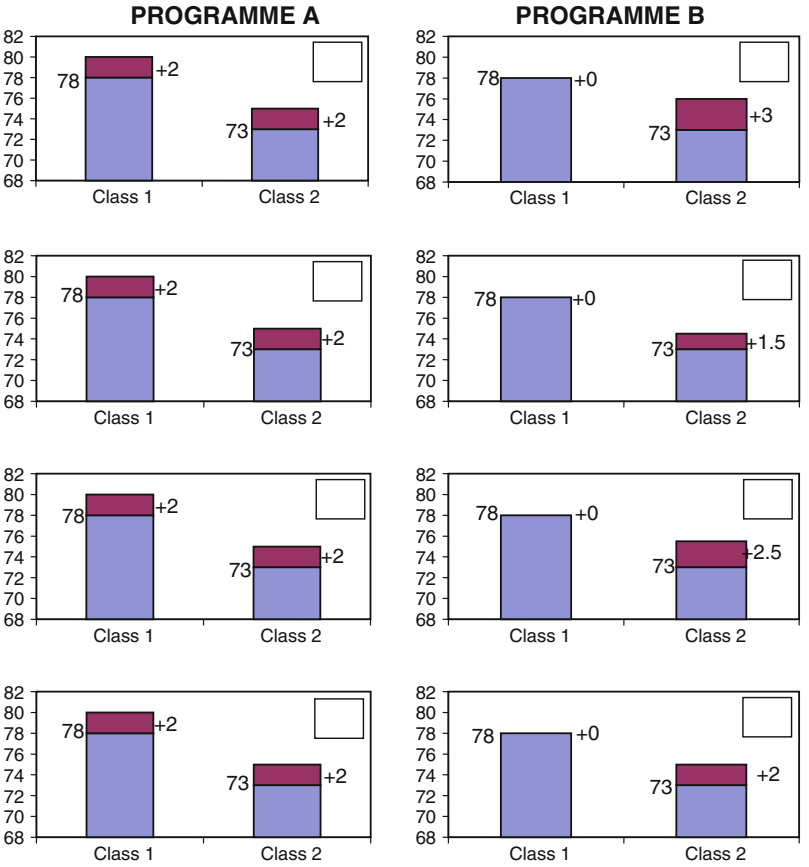
Q.1.4 Follow-up of those who choose A in the first question of the main questionnaire (*everybody gets something*)

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:

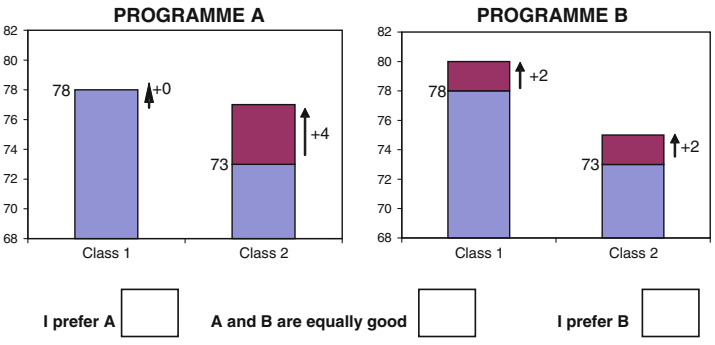


Q.1.5. Follow-up of those who choose B in the main questionnaire (*main random*)

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:

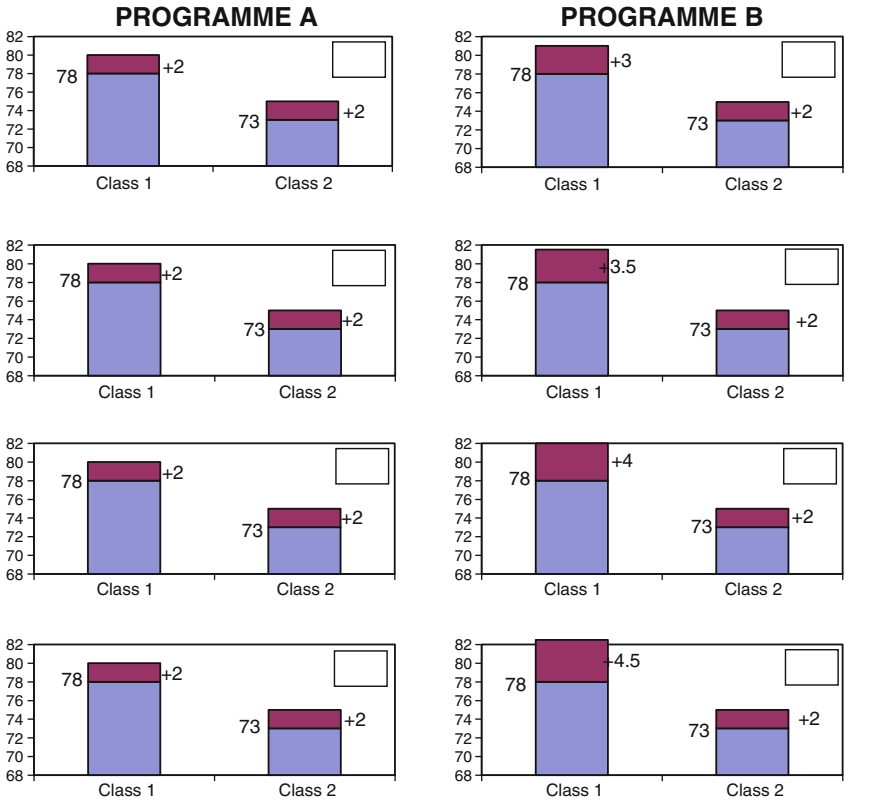


Q.2 First page of the main questionnaire (flipped alignment)

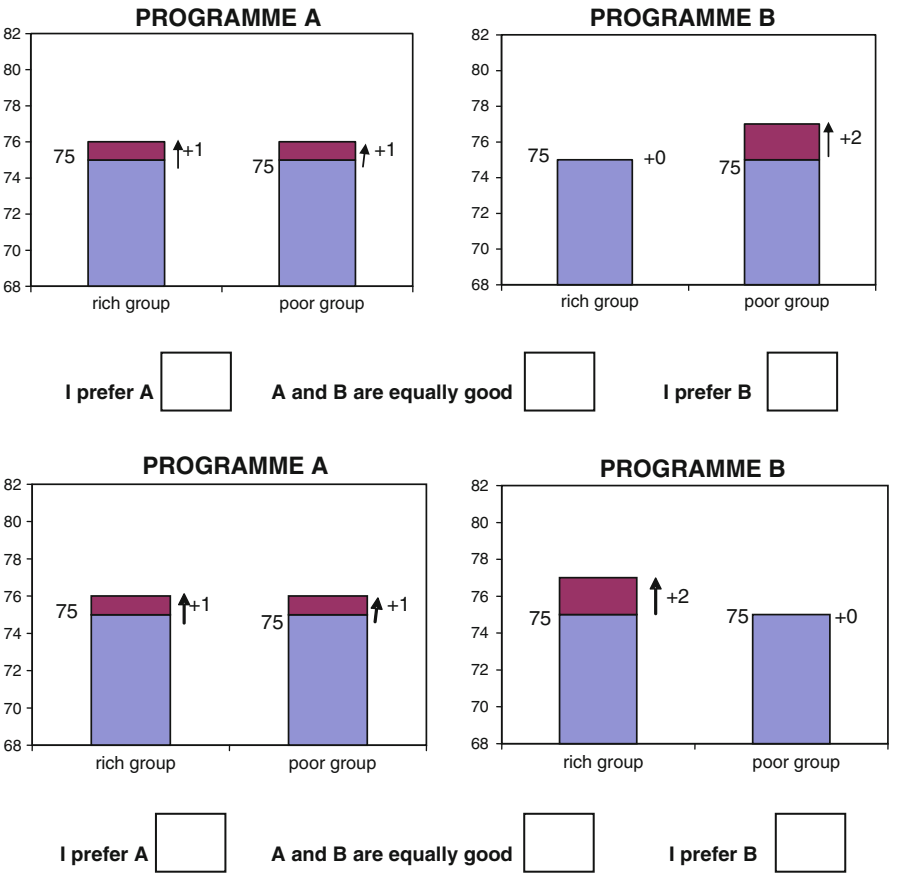


Q.3 Alternative question to test for monotonicity (*alternative monotonicity*)

Now, please tick in the corresponding box whether you prefer programme A or B in each of the following options:



Q.4 Question to test for symmetry of preferences (*symmetry*)



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