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Priority-Setting and Personality: Effects of Dispositional Optimism on Preferences for Allocating Healthcare Resources

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Abstract

In a publicly financed health system, it is important that priority-setting reflects social values. Many studies investigate public preferences through surveys taken from samples, but to be representative, these samples must reflect value judgments of all relevant population subgroups. In this study, we explore whether, next to better-understood sources of heterogeneity such as age, education or gender, also differences in personality play a role in how people want to set limits to health care. We investigate the influence of dispositional optimism: whether someone anticipates a good or bad future. This is an important personality dimension that has been shown to widely reverberate into people's lives and that can also be expected to influence people's views on health care. To test our hypothesis, we asked a representative sample of the Belgian population ($N=750$) to complete both the revised life orientation test and a discrete choice experiment about allocating healthcare resources, and we investigated the relationships between both measurements. We found that more pessimistic individuals were less supportive of using patients' age as a selection criterion and more hesitant to invest in prevention. Since individual dispositions are usually not part of the criteria for selecting representative samples, our findings point at a potential non-response bias in studies that elicit social values.

Keywords Resource allocation · Preferences · Equity · Prevention · Fair innings · Responsibility · Optimism · Pessimism

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Introduction

Health policy decision-makers with limited budgets unavoidably have to set priorities over different healthcare interventions (Daniels & Sabin, 2008). These decisions imply several complex trade-offs. For instance, deeply grained intuitions to 'rescue' individual, identifiable patients need to be reconciled with more calculated, utilitarian approaches that focus on cost-effectiveness, maximizing health at the population level. A judgment needs to be made about which illness is more severe, e.g. comparing physical with mental illness. A decision is needed about whether there is a role for personal characteristics of patients such as how old a patient is or whether she has taken good care of her health in the past (Olsen, Richardson, Dolan, & Menzel, 2003). A balance must be struck between investing resources in prevention versus in treatment (Faust & Menzel, 2012). The common element in these questions is that they require value judgments. There is no obvious right or wrong way to make these decisions, and reasonable people can disagree in their answers.

Therefore, many think that there is an important role for the preferences and values of the population in setting limits to public health care. An extensive body of research has emerged describing how people make trade-offs and set priorities [for reviews, see (Schwappach, 2002; Dolan, Shaw, Tsuchiya, & Williams, 2005; Shah, 2009; Gu, Lancsar, Ghijben, Butler, & Donaldson, 2015)]. In the UK, the National Institute for Health and Care Excellence (NICE) regularly organizes 'Citizens Councils' to formulate policy guidance with respect to social values in health care (NICE, 2008). In Belgium, the Federal Healthcare Knowledge Centre recruited a large group of volunteers to develop 'citizen labs' to answer the dilemmas of healthcare rationing (Cleemput, 2014; Standaard, 2014). Similar examples can be found for many other countries, including Canada, the Netherlands or Australia (Mooney & Blackwell, 2004; OMHLTC, 2013). The values that emerge from these studies are increasingly used to assist decision-makers in priority-setting, e.g. in reimbursement decisions. They can be used in a deliberative approach, considering evidence on social values next to other pieces of information (such as medical or economic evidence) or in more algorithmic approaches where social value judgments are quantified, e.g. in the form of equity weights or inequality aversion estimates, which can explicitly be incorporated into decision models (e.g. in a distributive cost-effectiveness analysis) [see e.g. (Lancsar, Wildman, Donaldson, Ryan, & Baker, 2011; Asaria, Griffin, & Cookson, 2016; Cookson, Ali, Tsuchiya, & Asaria, 2018)].

The validity of these studies claiming to elicit the social values of a population depends on the representativeness of the samples used in the study. Usually, sample representativeness is assessed in terms of age, gender, educational attainment, geographical spread and perhaps a few other socio-demographic variables. However, also differences in less visible characteristics can be important. One of these is someone's personality. The role of personality traits in shaping how people think, feel and behave has long been recognized in the field of psychology (Corr & Matthews, 2009). Personality traits have been linked to a substantial series of important life outcomes, including marital status, occupational attainment and even mortality [e.g. (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007)]. If personality influences how someone makes the value judgments inherent to priority-setting, then this has implications for the representativeness of studies that infer social values from (often online) samples of volunteers. These studies might attract particular personality types, leading to social values that are not necessarily representative of a population. Indeed, research has shown that particular personality types are more likely to participate in survey research than others, leading to significant non-response bias (Marcus & Schutz, 2005; Smith, Edens, Epstein, Stiles, & Poythress, 2012). For instance, one study found that non-responders to survey research were less agreeable, less extravert, had a lower openness to experience and lower narcissism than volunteers in both self- and observer ratings (Marcus & Schutz, 2005).

In this study, we explore the effect on preferences for priority-setting of one well-known personality difference between individuals: whether someone generally expects to have a good or a bad future. This difference is coined 'dispositional optimism' in the psychology literature, and there are strong reasons to believe that it matters to people's views on health care (see "Dispositional Optimism" section). We added an established instrument to measure dispositional optimism, the revised life orientation test (LOT-R), to a discrete choice experiment (DCE) about priority-setting that was executed in a sample ($N = 750$) of the general population in Belgium. The "Dispositional Optimism" section summarizes the literature on dispositional optimism and suggests ways in which this personality dimension can influence preferences for healthcare priority-setting. Next, the "Methods" section describes the methods used. Then, the "Results" section presents the results, and finally, the "Discussion" section assesses the relevance of our findings and provides further points for discussion.

Dispositional Optimism

The categorization of individuals in optimists and pessimists is deeply rooted in popular culture and folk psychology (e.g. the glass half–full or half–empty metaphor) (Carver & Scheier, 2014). In previous decades, it has become the subject of extensive scientific research, mainly through the development of the life orientation test (LOT), a self-report measure of optimism and pessimism, which was revised in 1994 (LOT-R) (Scheier & Carver, 1985; Scheier, Carver, & Bridges, 1994). This body of research resolves that 'dispositional optimism' is a personality trait, which remains relatively stable over one's lifespan, provided it is not substantially manipulated or exposed to disruptive life changes (Carver, Scheier, & Segerstrom, 2010). There is converging evidence that optimism has a neurobiological basis, with pessimistic and optimistic views being primarily determined by higher activity in the right and the left cerebral hemisphere (Hecht, 2013). Moreover, studies that investigate the genetic origins of dispositional optimism find heritability estimates of 20–30% (Mosing et al. 2009; Rius-Ottenheim et al. 2012a, b). However, nurture matters too with for instance higher socio-economic status in childhood being predictive of a more optimistic nature in adulthood (Heinonen et al. 2006).

There is ample evidence that dispositional optimism strongly affects our mental, physical, economic and social state (Carver et al. 2010; Hecht, 2013). Optimism is associated with increased protection against stroke (Kim, Park, & Peterson 2011), carotid artery blockage (Matthews, Raikkonen, Sutton-Tyrrell, & Kuller, 2004) and rehospitalization after coronary artery bypass grafting (Tindle et al. 2009) and yields better immune responses (Segerstrom, 2007). One study followed a cohort of 95,000 healthy women and found that more optimistic individuals are less likely to develop coronary heart disease (CHD) or die from CHD-related causes or any cause over an 8-year period (Tindle et al. 2009). Optimists are also less likely to smoke, more likely to exercise and have more healthy diets (Carver & Scheier, 2014). Furthermore, outside of the health domain, optimism is also associated with better socio-economic outcomes. More optimistic students (measured before starting higher education) have lower dropout rates in their college years (Nes, Evans, & Segerstrom, 2009) and later earn more than their less optimistic counterparts (Segerstrom, 2007). Also, optimists indicate greater satisfaction in their romantic relationships, and so do their partners (Srivastava, McGonigal, Richards, Butler, & Gross, 2006). They have a broader social network (Andersson, 2012) and are more resilient towards developing loneliness late in life (Rius-Ottenheim et al. 2012a, b). They even invest in different stock portfolios (Puri & Robinson, 2007) and make different financial and accounting decisions as managers (Heaton, 2002). One study suggests that optimists are also more vulnerable to problematic gambling behaviour (Gibson & Sanbonmatsu, 2004). Issues of reverse causation (that success determines optimism and not vice versa) and unmeasured confounding (that both optimism and success are caused by an omitted variable) cannot be fully ruled out in these studies due to their observational nature and often relatively short follow-up periods. However, many studies use extensive strategies to mitigate these issues and are confident that the causal relationship runs (at least partly) from optimism to the variable under study.

An explanation for the more positive outcomes associated with optimism is that optimists and pessimists are fundamentally different in their problem-solving attitude (Carver et al. 2010; Hecht, 2013). Optimism is shown to be associated with more efficient scanning for risks, more effective coping with adversity and taking a more proactive approach in confronting possible problems. The mechanism behind this difference in attitude, it is argued, operates mainly through differences between optimists and pessimists in their motivation for reaching objectives (Carver & Scheier, 2014). Optimists are more confident that goals (small or big ones) are achievable, see fewer impediments and therefore do more effort, whereas pessimists easier disengage. This attitudinal difference reverberates into different degrees of dedication to goals, more experience in reaching these goals, which will in turn reinforce motivation and become a source of support in achieving new goals or coping with adversity. Moreover, research shows that in the simultaneous pursuit of multiple goals, where trade-offs in investing effort are needed, optimists also do better in allocating more effort to high-priority goals and disengaging from either low-priority goals or goals with unfavourable odds (Segerstrom, 2007; Geers, Wellman, & Lassiter 2009; Geers, Wellman, Seligman, Wuyek, & Neff, 2010; Pavlova & Silbereisen, 2013). There is also a relationship between optimism and time preference. Although both are related concepts, optimism deals with someone's valuing of positive or negative future events, whereas time preference readjusts this value for distance in time with events further ahead receiving a lower value than more proximate events. Research has investigated the link between these two concepts and has found that higher levels of optimism are associated with higher discounting for time preference (Berndsen & van der Pligt, 2001). The underlying mechanism, it is argued, is that optimists are keener on immediate gains because they are optimistic that these gains will be followed by additional gains, whereas they are keener to delay losses because they are more confident that these will be avoidable in future.

Based on the literature described above, we hypothesized that dispositional optimism can also be an important driver of how people approach the problem of setting limits to health care. More specifically, we expect dispositional optimism to influence (1) the extent to which individuals value prevention over treatment, (2) the extent to which they take into account the known effectiveness of an intervention, (3) their valuation of health gains occurring in distant versus proximal futures (time preference) and (4) the extent to which they favour age-based rationing. First, the more proactive problem-solving attitude of optimists (Carver et al. 2010; Hecht, 2013) suggests that optimists will prefer higher investments in prevention and in avoiding bad outcomes in the future rather than paying for a wait-and-treat scenario later on. Observations from health behaviour research also show that pessimists are less prevention-oriented when it comes to their own health behaviours. Studies have documented this in the context of, e.g., preventing heart attacks (Radcliffe & Klein, 2002), taking vitamins, eating low-fat foods and enrolment in a cardiac rehabilitation programme after a bypass grafting (Scheier et al. 1999) and sexual risk-taking behaviour (Taylor et al. 1992). Second, optimists' easier disengagement from goals with unfavourable odds (Geers et al. 2009) suggests that optimists will set lower priorities for less effective health care, or for health care of which the health benefits are more uncertain. Third, the higher levels of time discounting of optimists (Berndsen & van der Pligt, 2001) suggest that optimists will set higher priorities for health care with more immediate benefits. And, finally, as optimists, by definition, expect a better future, they may therefore also anticipate a lower need of health care at older age. Research indeed shows that at older age pessimists have worse health outcomes than optimists (Carver et al. 2010; Carver & Scheier, 2014) and fewer economic and social resources: lower incomes, a smaller social network, fewer close relationships and they perceive less social support from their partners, relatives and friends (Brissette, Scheier, & Carver, 2002; Carver, Lehman, & Antoni, 2003; Macleod & Conway, 2005), all of which are important sources of health and well-being at older age [e.g. (Giles, Glonek, Luszcz, & Andrews, 2005; Sirven & Debrand, 2012). This might affect their views on age-based priority-setting.

To test these hypotheses, we conducted a large-scale discrete choice experiment among a sample of the Belgian population. In the next sections, we summarize our study and the answers it gave regarding those hypotheses.

Methods

Sample

A sample from an online panel of 10,753 Belgians was recruited via a market research company of which a total of 3160 individuals (30%) agreed to participate in our study. From this group, 750 respondents were retained, by random filling of predetermined quota for age, gender, province, rural versus urban spread and level of educational attainment. Only participants aged 18–75 years were included. Table 1 summarizes the sample's representativeness relative to the Belgian population. All these respondents provided answers to the LOT-R and DCE questions.

The Revised Life Orientation Test (LOT-R)

The standard instrument to measure dispositional optimism is the revised life orientation test (LOT-R) (Scheier et al. 1994). This is a revised version of the earlier life orientation test (Scheier & Carver, 1985) and focuses more on the conceptual core of the trait (i.e. expectations about one's future). The scale consists of ten items, three of which measure optimism, three measure pessimism and four of which are filler items to disguise the underlying purpose of the test (see Fig. 1). Respondents have to answer on a Likert scale (in our case, a five-point scale), ranging from 'strongly disagree' to 'strongly agree'. Numerous studies have documented the reliability and the validity of the scale, reporting adequate measures of internal consistency, test–retest reliability and construct and predictive validity (for a review, see (Carver et al. 2010). In empirical studies, test–retest correlations range from 0.58 to 0.79 over periods ranging from several weeks, years to more than a decade (Carver et al. 2010).

There is discussion in the literature about whether optimism and pessimism are two polar opposites on a one-dimensional continuum (RobinsonWhelen, Kim, MacCallum, & KiecoltGlaser, 1997; Rauch, Schweizer, & Moosbrugger, 2007; Segerstrom, Evans, & Eisenlohr-Moul, 2011; Chiesi, Galli, Primi, Borgi, & Bonacchi, 2013) or whether both are two separable dimensions, one pertaining to affirmation versus disavowal of optimism and the other to affirmation or disavowal of pessimism (Glaesmer et al. 2012). Although virtually all bipolar trait scales that contain both positively and negatively framed items typically form two dimensions in factor analyses, for some researchers these statistical grounds are enough to also treat optimism and pessimism as two conceptually different dimensions (Carver et al. 2010; Carver & Scheier, 2014). Others think the split is a product of method variance in responding and question the conceptual possibility of people to be pessimistic and optimistic at the same time. Studies aimed at settling the issue reached opposite conclusions: some claim a unidimensional view is best (RobinsonWhelen et al. 1997; Rauch et al. 2007; Segerstrom et al. 2011; Chiesi et al. 2013), others claim the two dimensions should be treated separately (Glaesmer et al. 2012). To accommodate for these different views and in line with recommendations in the literature (Carver et al. 2010), we used three different LOT-R outcomes in our analyses: a total LOT-R score (the one-dimensional construct, termed LO henceforth) based on the three optimistic and

Table 1 Characteristics of the sample relative to those of the Belgian population. Source Belgian Data: Federale Overheidsdienst Economie (FOD-economie 2012)

	Sample (%)	Belgian population (%)
Language		
Dutch	56	56
French	44	44
Gender		
Male (M)	50	50
Female (F)	50	50
Gender per age group[a]		
18–25 M	6	6
18–25 F	6	6
25–34 M	9	9
25–34 F	10	9
35–44 M	10	11
35–44 F	10	10
45–54 M	10	10
45–54 F	11	10
55–64 M	9	8
55–64 F	10	8
65–74 M	6	6
65–74 F	4	6
Level of education[b]		
None or primary	8	19
Lower secondary education	10	20
Higher secondary education	31	33
Higher non-university education	35	18
(Post-)university	15	10
Province		
Antwerp	15	16
West Flanders	10	11
East Flanders	13	13
Limburg	8	8
Hainault	13	12
Liege	10	10
Luxemburg	3	2
Namur	5	4
Brussels	10	10
Flemish Brabant	11	10
Walloon Brabant	3	3

Table 1 (continued)

	Sample (%)	Belgian population (%)
Smoking status[c]		
Never smoked	45	54
Ex-smoker	30	22
Smoker	25	25

[a]Age: the percentages reported are proportions in the selected population (18–75), representing 71% of the total Belgian population

[b]Education: the percentages reported for the Belgian population are for the age group 15 years or older. The percentages for our sample are only for the age group between 18 and 75 years. The overrepresentation of higher educated respondents in our sample as compared to the total population can be explained by our exclusion of the age group between 15 and 18 years that is too young for higher education, and the age group 75 years or older for which higher education was less democratically accessible

[c]Smoking percentages from the population are based upon the study (SIPH 2008) and are representative of the population aged 15 years or older

1. In uncertain times, I usually expect the best.
[2. It's easy for me to relax.]
3. If something can go wrong for me, it will.
4. I'm always optimistic about my future.
[5. I enjoy my friends a lot.]
[6. It's important for me to keep busy.]
7. I hardly ever expect things to go my way.
[8. I don't get upset too easily.]
9. I rarely count on good things happening to me.
10. Overall, I expect more good things to happen to me than bad.

Note: Items 2, 5, 6 and 8 are fillers.

Fig. 1 Revised life orientation test (LOT-R)

the three pessimistic items, and two separate constructs: an optimism score (OPT) based only on the three optimistic items and a pessimism score (PES) based on the three pessimistic items. To obtain the LO and OPT scores, we summed the scores of the items under consideration. To obtain the PES score, we summed the scores of the pessimistic items and reversed the scaling so that a high PES score stands for a more pessimistic attitude.

Discrete Choice Experiment on Priority-Setting

DCEs are a widely used survey method to quantify individuals' preferences (Ryan, Gerard, & Amaya-Amaya, 2008). Participants are presented with a series of choices, usually between two goods described by the same attributes but differing in their attribute levels. By observing respondents' preferred choices, researchers can infer how the value of the competing options is determined by the attributes of the product. We carried out a DCE in which all 750 respondents had to complete 14 choice sets consisting of two competing healthcare interventions of which they were told that only one could be subsidized (completely) by the government. We described the health programmes in terms of seven attributes: effectiveness of the programme, severity of the illness, when health benefits are expected to occur (timing), possibility of adverse effects from the intervention, age group of patients, link between disease and patients' lifestyle and the curative or preventive nature of the programme (see the first column in Table 3). In all other respects (e.g. costs), both programmes were equal. These seven attributes were chosen because they represent salient, generic dimensions of health care, comprising a wide range of possible healthcare programmes. The attributes that are most relevant to our hypotheses were effectiveness, timing, curative or preventive type and patients' age group. Our expectation was that respondents differing in their LOT-R score will attach a different importance to these attributes in their choices which healthcare programme to subsidize.

"Appendix A" shows one of the 42 choice sets that we constructed (14 per respondent, three survey versions, in total 10,500 choice observations (14 * 750)). The full descriptive results of the DCE and its conclusions for all attributes regardless of LOT-R are summarized elsewhere (Luyten, Kessels, Goos, & Beutels, 2015).

Other Variables in the Survey

Background information collected from respondents included their age, sex, height, weight (to calculate the body mass index), province, language, professional group, educational attainment, household size, age of youngest family member (indicating whether respondents have children as well as their age), experience as healthcare worker, smoking status and experience with severe illness (personal or within the family). Respondents also provided self-assessments of their health through a standardized health-related quality of life instrument, the EQ-5D-5L (Herdman et al. 2011).

Statistical Analysis

We assessed the internal consistency of the LOT-R using Cronbach's alphas and described the correlation between the LO, OPT and PES scores using Pearson's correlation coefficients. We constructed multiple linear regression equations to identify significant associations between LO, OPT and PES and the other respondent characteristics surveyed (see "Psychometric Properties of and Variables Associated with LOT-R" section). We analysed the relationship between the DCE data and the three

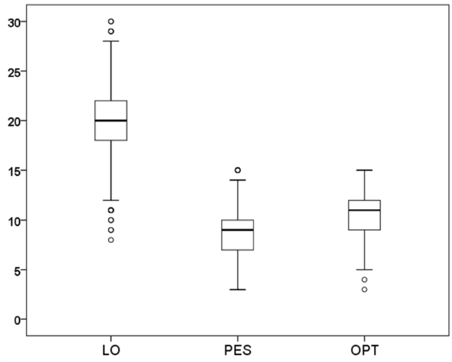

Fig. 2 Boxplots of LO, PES and OPT scores ($N=750$)

LOT-R scores using a multinomial logit model (MNL), also called McFadden's conditional logit model (McFadden, 1974) (see "Associations Between Dispositional Optimism and Preferences for Priority-Setting" section). This model allows assessing the relative weight of each of the seven attributes in predicting a choice, but also, by adding an interaction term—for instance with LO—it allows assessing whether respondents who differ in LO also differ in their valuation of the attributes. To control for confounding via other respondent variables associated with LO, OPT and PES, we also added interactions with these other variables in the model. In "Appendix B", we provide further information about the MNL model.

Results

Psychometric Properties of and Variables Associated with LOT-R

Figure 2 summarizes the LO, PES and OPT variables using boxplots. LO values ranged from 8 to 30 and PES and OPT values from 3 to 15. Our sample had an average (and median) life orientation score of 20. Respondents scored higher on the OPT than on the PES scale. The average (and median) optimism score was 11; the average (and median) pessimism score was 9. The internal consistency of the three variables was acceptable [Cronbach's $\alpha=0.75$ (LO), 0.78 (PES) and 0.72 (OPT)]. A factor analysis clearly indicated OPT and PES as two unique factors (describing about 67% of the variation). The OPT score correlated weakly with the three pessimistic items (between 0.24 and 0.30), and the PES score correlated weakly with the optimistic items (between -0.36 and -0.17).

Results from multiple linear regression analysis (see Table 2) revealed that five variables were positively associated with a higher LO score: a higher EQ-5D-5L score, being older, non-smoker, a university degree and having a relatively younger-aged youngest household member. Higher OPT scores (optimistic items only) are associated with higher EQ-5D-5L scores, older age and having a younger-aged youngest household member. Higher PES scores are associated with lower EQ-5D-5L scores, younger age, smoking and having no or only a lower secondary education degree.

Table 2 Variables associated with an individual's LOT-R score

	LO		OPT		PES	
	Estimate	*p* value	Estimate	*p* value	Estimate	*p* value
EQ-5D-5L score	5.7778	< 0.0001	3.3713	< 0.0001	− 2.5052	< 0.0001
Respondent age	0.0485	< 0.0001	0.0286	< 0.0001	− 0.0138	0.0096
Smoking status						
Yes	− 0.4975	0.0005	NS	NS	0.4593	< 0.0001
No	0.4975	0.0005	NS	NS	− 0.4593	< 0.0001
Level of education						
None or lower secondary education	− 0.6833	0.0062	NS	NS	0.5572	0.0005
Higher secondary education	− 0.1865	0.3529	NS	NS	0.1791	0.1623
Higher non-university degree	0.0752	0.6997	NS	NS	− 0.1374	0.2685
(Post-)university degree	0.7946	0.0022	NS	NS	− 0.5989	0.0003
Age youngest household member	− 0.0157	0.0276	− 0.0095	0.0272	NS	NS

NS means that the variable is non-significant at the 5% level

Variables that we also investigated but were found to be non-significant at the 5% level are the following: gender, province, occupational status, language, experience as healthcare worker, personal experience with severe illness, experience with severe illness in the family, respondent's body length and respondent's weight

Associations Between Dispositional Optimism and Preferences for Priority-Setting

We estimated three models, shown in Table 3. Model I is the basic model of the DCE analysis that best describes the average preference of the sample, quantifying the extent to which the utility of an intervention (or, in other words, the respondent's choice) depends on the seven attributes of the intervention [see (Luyten et al. 2015) for further discussion]. As can be inferred from the largest estimates (in magnitude) of the levels of each attribute, the average respondent's choice can mainly be predicted on the basis of the patient's age and lifestyle, followed by concerns about effectiveness and severity of illness. Models II and III focus on the link between these priority-setting preferences and respondents' LOT-R scores. Introducing the LO variable in Model II in interaction with each of the seven attributes, we found that it interacts significantly with two attributes: 'patient's age' ($p = 0.07$) and 'type of intervention' ($p = 0.01$). However, using the OPT and PES subscales instead of the complete LO scale revealed that the OPT variable does not interact with any of the attributes, whereas the PES variable interacts with the same attributes 'patient's age' ($p < 0.01$) and 'type of intervention' ($p < 0.01$) with which LO interacts (see Model III). Because OPT and PES were identified as only weakly correlated clusters of which only PES interacted with the DCE attributes, we focus the rest of our analysis on PES instead of LO. However, this does not necessarily mean that we only investigate pessimism as the separation between optimism and pessimism may be a mere measurement artefact. The interactions with PES remained significant when we controlled for the effect of the respondent variables that are associated with PES

Table 3 Estimates of coefficients in the MNL models and overall significances of the attributes using p values obtained from likelihood ratio tests

Term	Model I			Model II Z = LO			Model III Z = PES		
	Estimate	LR Chi-square	*p* value	Estimate	LR Chi-square	*p* value	Estimate	LR Chi-square	*p* value
Age of patient (80–90 years)	−0.6200	205.919	< 0.0001	−0.3547	7.967	0.0928	−1.0583	59.451	< 0.0001
Age of patient (60–70 years)	−0.0185			0.4075			−0.3567		
Age of patient (40–50 years)	0.1210			0.0493			0.1727		
Age of patient (20–30 years)	0.2363			0.1307			0.3516		
Age of patient (0–10 years)	*0.2812*			*−0.2327*			*0.8906*		
Lifestyle of patient (fully)	−0.3730	184.143	< 0.0001	−0.3737	184.558	< 0.0001	−0.3744	184.763	< 0.0001
Lifestyle of patient (partly)	0.0574			0.0582			0.0591		
Lifestyle of patient (not at all)	*0.3156*			*0.3155*			*0.3153*		
Effectiveness (33%)	−0.2440	88.775	< 0.0001	−0.2436	88.386	< 0.0001	−0.2434	88.120	< 0.0001
Effectiveness (66%)	0.0117			0.0119			0.0118		
Effectiveness (100%)	*0.2323*			*0.2317*			*0.2316*		
Severity of illness (not severe)	−0.2351	46.545	< 0.0001	−0.2343	46.295	< 0.0001	0.2340	46.122	< 0.0001
Severity of illness (severe)	0.0758			0.0758			0.0759		
Severity of illness (lethal)	*0.1594*			*0.1585*			*0.1581*		
Adverse effects (often)	−0.1383	27.869	< 0.0001	−0.1374	27.485	< 0.0001	−0.1367	27.112	< 0.0001
Adverse effects (rarely)	0.0776			0.0774			0.0769		
Adverse effects (never)	*0.0607*			*0.0600*			*0.0598*		
Time span (after 20 years)	−0.0617	4.771	0.0920	−0.0609	4.807	0.0904	−0.0606	4.892	0.0867
Time span (after 5 years)	0.0039			0.0026			0.0015		
Time span (within a year)	*0.0579*			*0.0583*			*0.0591*		
Type (preventive)	0.0127	0.348	0.5552	−0.1736	4.799	0.0285	0.1848	9.952	0.0016
Type (curative)	*−0.0127*			*0.1736*			*−0.1848*		

Table 3 (continued)

Term	Model I			Model II Z = LO			Model III Z = PES		
	Estimate	LR Chi-square	*p* value	Estimate	LR Chi-square	*p* value	Estimate	LR Chi-square	*p* value
Z * age of patient (80–90 years)	NA		NA	−0.0135	8.661	0.0702	0.0497	21.259	0.0003
Z * age of patient (60–70 years)	NA			−0.0216			0.0386		
Z * age of patient (40–50 years)	NA	NA		0.0036			−0.0058		
Z * age of patient (20–30 years)	NA			0.0053			−0.0133		
Z * age of patient (0–10 years)	NA			*0.0261*			*−0.0692*		
Z * type (preventive)	NA	NA	NA	0.0095	5.984	0.0144	−0.0194	9.909	0.0016
Z * type (curative)	NA			*−0.0095*			*0.0194*		
−2 * Loglikelihood	14,006			13,987			13,968		
BIC	14,145			14,172			14,153		

Model I: basic model with attributes of the DCE only, Model II: Model I + significant interactions with total LOT-R score (LO), Model III: Model I + significant interactions with partial LOT-R score (PES)

Coefficient estimates corresponding to the last level of an attribute, either as a main effect or involved in an interaction, are italicized and calculated as minus the sum of the estimates for the other levels of that attribute

NA means not applicable

The models are the final models after a stepwise removal of interactions between Z and the attributes lifestyle of patient, effectiveness, severity of illness, adverse effects and time span, which are non-significant at the 5% level

The modelling results are robust to the inclusion of control variables such as ‘Gender’ (M/F) and ‘Language’ (Dutch/French)

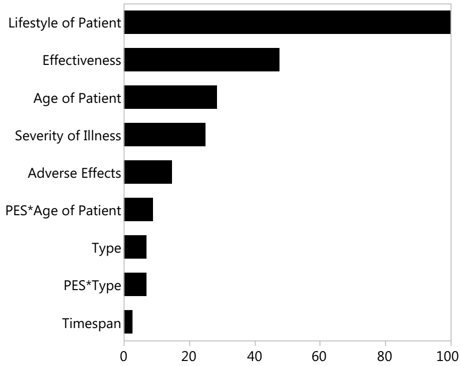

Fig. 3 Importance of the seven attributes and their significant interactions with PES (Model III in Table 3) to the social value of a healthcare programme relative to the most important attribute 'Lifestyle of Patient', the importance of which is set to 100

(EQ-5D-5L, age, education and smoking status), indicating an independent relationship between pessimism and preferences for age-based priority-setting and prevention versus cure. As indicated by the likelihood ratio (LR) test statistics in Table 3, demonstrating the predictive power of the attributes and attributes' interactions, we see that the interactions with PES are substantial. The predictive power of the PES interactions was 12% for PES * age (LR Chi-square = 21) and 5% for PES * type (LR Chi-square = 10) as compared to the predictive power of the lifestyle attribute, i.e. the attribute with highest predictive power in Model III (LR Chi-square = 184). As shown in Fig. 3, the most influential attribute (based on the LR test) is the patient's health-related lifestyle, which is about twice as important as the intervention's effectiveness and about four times as important as the patient's age and severity of illness. Among the least important attributes (or attribute interactions) are adverse effects, the intervention's type and the PES interactions with patient's age and type, where the former has more impact than the latter. Time span is the attribute that is least important. Model III in Table 3 shows that the main effects and the PES interaction effects with 'Age of Patient' are of opposite sign. The same holds for the main effects and the PES interaction effects with 'Type of Intervention'. To assess whether the overall effects disappear when the main and PES interaction effects are combined for 'Age of Patient' or 'Type of Intervention', we tested for their significance. We found that the main and interaction effects are jointly significant at a 5% level for both attributes, illustrating that they do not cancel each other out.

In terms of model interpretation, the following example can be instructive to assess the effect size of the PES interactions. When asked to choose between (1) a curative healthcare programme for 0–10 year olds with 100% effectiveness, no side effects, for a serious disease with no link with lifestyle occurring within a year, and (2) the exact same programme targeted at 80–90 instead of 0–10 year olds, someone with a maximal pessimism score has a marginal probability of choosing the younger patient group over the older one of 55%. Someone with minimal pessimism will have a chance of choosing the youngest group of 88%. Regarding the interaction between PES and type, when asked to choose between a curative healthcare programme for 30–50 year olds with 100% effectiveness and no side effects, for a severe disease with no link with lifestyle occurring within a year and (2) the exact same

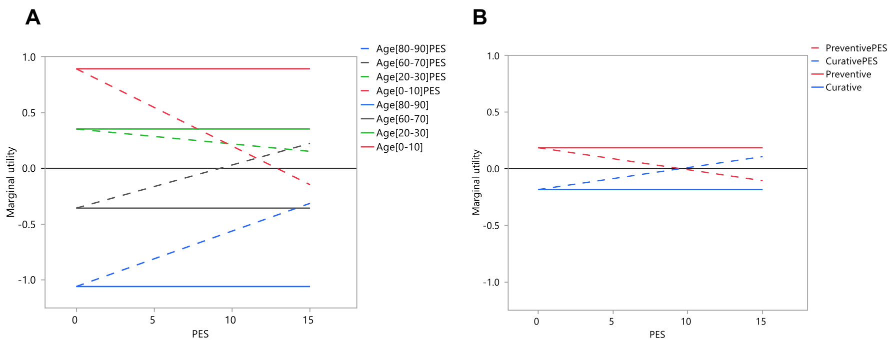

Fig. 4 Marginal utility values for the levels of the attributes 'Age of Patient' (**a**) and 'Type of Intervention' (**b**) in interaction with respondents' pessimism scores (PES, dashed lines) and as main effects only, independent of PES (solid lines)

programme that is preventive instead of curative, someone with maximal pessimism will have 45% chance of preferring the preventive programme. Someone with minimal pessimism will have a 60% chance of preferring the preventive programme.

We found no difference in optimists' and pessimists' views on priority-setting when it comes to the criteria of the programme's effectiveness, health-related lifestyle, severity of illness or risk of adverse effects.

Figure 4 shows the relation between respondents having different PES scores and the different utilities they attribute to health programmes according to the recipient's age (Panel A) or the preventive or curative nature of the programme (Panel B). The solid lines indicate the main effect (for a PES score of zero), showing younger age groups taking priority over older ones, and prevention over cure. The dashed lines indicate how this main effect changes when we add the interaction with the respondent's PES score. The higher the respondent's PES score, the more the bonus for interventions in young people diminishes and the more equal the prioritization of different age groups becomes. The more pessimistic the respondent, the greater cure will be valued, and the lower the level of pessimism, the higher the utility of prevention. A PES score of ten represents a point of indifference, with scores below preferring prevention and scores above preferring cure.

Discussion

It is widely acknowledged that decisions to prioritize or deprioritize health care should, in one way or another, take into account social values. A wide body of research has emerged that investigates how people think about setting limits to health care. Typically, studies use samples that are representative of a population in terms of basic, socio-demographic characteristics such as age or gender but a sample could be non-representative in many more ways. In this study, we explored the influence of personality as a source of heterogeneity in how people want priorities to be set and potentially bias in how samples are recruited. We investigated whether differences in the personality trait of dispositional optimism translated into different views on how to set healthcare priorities. Our general hypothesis that dispositional optimism matters was confirmed, but not fully in the way we expected.

On the one hand, respondents who had a more negative outlook on the future were indeed less likely to favour prevention over cure (with cure even being more desirable for very pessimistic individuals) and had a lower willingness to prioritize younger generations (e.g. through age-weighting of health benefits). These findings are in line with those from other studies. As hypothesized in the "Dispositional Optimism" section, studies showing that pessimists have a less proactive problem-solving attitude indeed suggest a lower appreciation of prevention. This is also confirmed in research showing that pessimists are less prevention-oriented when it comes to their own health behaviours [see e.g. (Radcliffe & Klein, 2002; Scheier et al. 1999; Taylor et al. 1992)]. In our survey, we also observed that pessimists were more likely to smoke. The finding regarding age-based priority-setting is compatible with the view that pessimists expect a worse future for themselves. Many studies indeed document that pessimists face a less healthy old age than optimists and need more health care [see e.g. (Carver et al. 2010; Carver & Scheier, 2014; Brissette et al. 2002; Carver et al. 2003; Macleod & Conway, 2005)].

On the other hand, we did not find any relationship between levels of dispositional optimism and time preference, as indicated by a non-significant interaction between respondents' dispositional optimism and the timing attribute in the DCE. Also, although our initial expectation was that optimists would be more in favour of a differentiation according to (cost-)effectiveness because of their easier disengagement from goals with unfavourable odds, no effect was found in our DCE regarding the effectiveness of health programmes. Moreover, another noteworthy finding was that the effect of optimism was driven by the pessimism items: the pessimistic items and not the optimistic ones mattered. As mentioned in the Methods section, there is an ongoing debate about the dimensionality of the LOT-R. Whereas factor analyses have often revealed two separate dimensions, hereby providing statistical arguments for why our variables PES and OPT may diverge, scholars have also argued that the divergence between both constructs may have methodological reasons. Item wording and valence may explain different effects of pessimism and optimism scales (see e.g. (McPherson & Mohr, 2005; Kam & Meyer, 2012). Apart from methodological reasons and statistical observations, however, the literature does not provide many conceptual arguments for why the concepts of pessimism and optimism are different and why different effects should be expected for PES and OPT. The fact that we observe effects for PES yet not for OPT may therefore give an indication of conceptual differences between OPT and PES, but it may also be explained by the question wording of both scales.

To our knowledge, our study is the first to establish a relation between personality and how people set priorities in health care. Yet our study also has several limitations. Although dispositional optimism is a well-established individual difference in the literature, it is likely entangled with other dispositional variables. Our study only allowed controlling for a limited number of more common factors such as age, education or health. Future studies could explore (interactions with) other personality variables. Also, we surveyed our respondents on a complex topic, in a single recording. Although our sample was broadly representative of the Belgian population according to usual demographics, we recruited respondents from an online panel, excluding those who are younger than 18 and older than 75 years. Membership to the panel, as we have discussed, may be associated with unobservable characteristics. Moreover, there are general criticisms against using DCEs to elicit social preferences (Bryan & Dolan, 2004). Future studies could use more longitudinal and experimental study designs in which the consistency of the results can be assessed and where optimism can be manipulated in a treatment and control group. This can provide meaningful insights into how optimism or pessimism can be (transiently) stimulated and whether this leads to higher or lower support for particular forms of health care. Use of qualitative methods to understand the motivations behind respondents' choices can also be insightful. However, notwithstanding these limitations, we think that our results and suggested explanations open up possibilities for further research. Although we acknowledge that selecting representative samples based on personality can be impractical or even unrealistic, our results do call for more discussion on how to understand the representativeness of social values studies.

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Authors' Contributions JL, PD and PB framed the research question and set up the experiment. RK and PG designed the experiment. RK and JL analysed the data. All authors were involved in the writing of the text.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Ethical Standards The Committee for Medical Ethics of the University of Antwerp reviewed the study protocol, the questionnaire and the information letter for participants and approved them on 16 March 2015. The market research company Ipsos conducted the survey and provided the responses for analysis in anonymous form only.

Appendix A: Example of a Choice Set

Medical interventions A and B are exactly equally expensive, and they apply to a similar number of patients. If you were forced to make a choice, which of both interventions should be reimbursed by the government? To make it easier for you, we have highlighted in yellow the characteristics that differ between both interventions. There are no right or wrong answers; we are interested in your opinion.

	A	B
What type of intervention is it?	Curative (meant to cure patients who are ill)	Preventive (meant to prevent healthy persons from becoming ill)
How big is the probability of success of the intervention?	2 in 3 is successful	Always successful
How often do adverse effects occur?	Often	Often
How severe is the illness for which the intervention is developed?	Not lethal, but everyone who gets the disease will experience a severe and lasting reduction in quality of life	Lethal, everyone who gets the disease will die from it
Does the patient cause the disease through his or her own lifestyle?	Not at all	Not at all
How long does it take before the patient becomes ill/shows signs/symptoms of illness?	Within a year	Within a year
At what age does the patient become ill?	0–10 years	40–50 years
Your preference	◘	◘

Appendix B: MNL Model

Formally, the MNL model employs random utility theory which describes the utility that a respondent attaches to intervention j ($j = 1, 2$) in choice set s ($s = 1, \ldots, 14$) as the sum of a systematic and a stochastic component:

$$U_{js} = \mathbf{x}'_{js}\boldsymbol{\beta} + \varepsilon_{js}.$$

In the systematic component, $\mathbf{x}'_{js}\boldsymbol{\beta}$, $\mathbf{x}_{js}$ is a vector containing the attribute levels of intervention j in choice set s. Additionally, in our analysis, this vector includes the interactions between the attribute levels and the LOT-R score or any other respondent variable under investigation. The vector $\boldsymbol{\beta}$ is the vector of parameter values indicating the importance respondents attach to the different attribute levels and interactions. The stochastic component ε_{js} is the error term capturing the unobserved sources of utility. Under the assumption that the error terms are independently and identically Gumbel distributed, the MNL probability that a respondent chooses intervention j in choice set s is

$$p_{js} = \frac{\exp\left(\mathbf{x'}_{js}\boldsymbol{\beta}\right)}{\exp\left(\mathbf{x'}_{1s}\boldsymbol{\beta}\right) + \exp\left(\mathbf{x'}_{2s}\boldsymbol{\beta}\right)}.$$

To estimate the parameter vector $\boldsymbol{\beta}$, we used a maximum likelihood estimation approach, which maximizes the probability of obtaining the responses from the selected data sample. A positive estimate has a positive effect on the total utility, whereas a negative estimate has a negative effect. We computed the overall significance of the attributes and interactions by means of likelihood ratio (LR) tests. Such tests evaluate the difference in goodness of fit between nested models. More specifically, they compare the goodness of fit of an unrestricted or full model to a restricted model in which one or more parameters have been set to zero.

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