VALUE IN HEALTH 16 (2013) 114–123

Available online at www.sciencedirect.com

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Consumer Preferences for Health and Nonhealth Outcomes of Health Promotion: Results from a Discrete Choice Experiment

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ABSTRACT

Objective: Health promotion (HP) interventions have outcomes that go beyond health. Such broader nonhealth outcomes are usually neglected in economic evaluation studies. To allow for their consideration, insights are needed into the types of nonhealth outcomes that HP interventions produce and their relative importance compared with health outcomes. This study explored consumer preferences for health and nonhealth outcomes of HP in the context of lifestyle behavior change. **Methods:** A discrete choice experiment was conducted among participants in a lifestyle intervention (n = 132) and controls (n = 141). Respondents made 16 binary choices between situations that can be experienced after lifestyle behavior change. The situations were described by 10 attributes: future health state value, start point of future health state, life expectancy, clothing size above ideal, days with sufficient relaxation, endurance, experienced control over lifestyle choices, lifestyle improvement of partner and/or children, monetary cost per month, and time cost per week. **Results:** With the exception of "time cost per week" and "start point of future health state," all attributes significantly determined consumer choices. Thus, both health and nonhealth outcomes affected consumer choice. Marginal rates of substitution between the price attribute and the other attributes revealed that the attributes "endurance," "days with sufficient relaxation," and "future health state value" had the greatest impact on consumer choices. The "life expectancy" attribute had a relatively low impact and for increases of less than 3 years, respondents were not willing to trade. **Conclusions:** Health outcomes and nonhealth outcomes of lifestyle behavior change were both important to consumers in this study. Decision makers should respond to consumer preferences and consider nonhealth outcomes when deciding about HP interventions.

Keywords: discrete choice experiment, health promotion, lifestyle, nonhealth outcomes.

Introduction

Health promotion (HP) interventions aim to improve health and well-being through a process of enabling individuals and communities to increase control over their health [1]. A large variety of activities take place under the name of HP, including mass media campaigns to increase awareness of the dangers of smoking and drink-driving, school-based comprehensive health education programs, fluoridation of water, introducing seat-belt legislation, and community development projects to enable disadvantaged mothers to strengthen their parenting skills [2]. Modern HP interventions are increasingly complex, multifactorial interventions, which take place on various levels (e.g., individual, policy, and physical environment) and have multiple outcomes [3,4]. This complexity poses a number of methodological challenges to economic evaluation studies [5–7]. One of the key challenges is that outcome measures commonly used in economic evaluation studies do not capture all outcomes HP interventions aim to achieve. Outcome measurement in economic evaluation studies focuses on individual health outcomes, which are increasingly measured by using quality-adjusted life-years (QALYs) [8,9]. QALYs measure the improvement in life expectancy obtained through a specific intervention adjusted for the health-related quality of life (HRQOL) experienced in that period [10,11]. While improving life expectancy and HRQOL is clearly an important goal of HP, it is not the only goal. Empowerment of individuals and communities is also a central objective of HP [2]. This may involve, for instance, consciousness raising, increased self-esteem, and participation in a group to experience mutual support or engage in collective political action. Life skills, such as health literacy, problem solving and communication skills, stress management, and skills to cope with emotions [12–14], can also be acquired during the empowerment process [12–14]. Neglecting changes to such broader nonhealth outcomes in economic evaluation studies leads to incomplete information about the relative value of HP interventions and may hamper efficient allocation of public resources to such interventions.

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http://dx.doi.org/10.1016/j.jval.2012.08.2211

To improve evidence for future decision making, relevant nonhealth outcomes of HP should also be examined. For an adequate consideration of nonhealth outcomes, insight is needed into a) the range and types of broader outcomes relevant to include in economic evaluation studies and b) the relative importance of health and nonhealth outcomes of HP programs [6,15]. The latter is crucial to determine the relative weight that should be given to the different outcomes in economic evaluation studies. Previous research identified several nonhealth outcomes that are important to participants of HP and other stakeholders [15,16], but the available evidence is scarce and relates to HP interventions in the field of women's health only. Studies examining relative consumer preferences toward nonhealth outcomes of HP interventions are also scarce [17,18] and have so far focused on nonhealth outcomes reflecting the design or process of the intervention (e.g., travel time, extent of physician involvement, intensity of the intervention, and group vs. individual focus). Evidence on consumer or societal preferences toward nonhealth outcomes representing actual consequences of HP interventions is currently lacking.

The present study contributes to the evidence by assessing consumer preferences toward health outcomes and nonhealth outcomes experienced as a consequence of a lifestyle behavior change intervention.

Methods

A discrete choice experiment (DCE) was conducted among participants of the Hoorn Prevention Study (HPS). The HPS is a randomized controlled trial evaluating the effectiveness of an HP intervention aiming to change lifestyle behaviors (i.e., physical activity, smoking, and dietary behaviors) in adults with an increased risk for developing type 2 diabetes and/or cardiovascular disease [19]. DCE surveys are increasingly used in health economics to elicit preferences toward health interventions, policies, and services [20,21]. The methods involved in DCEs are well described in the literature [20–23] and usually consist of 5 steps: 1) establishing the attributes and levels to be included in the experiment, 2) selecting the experimental design, 3) developing the questionnaire and actual choice tasks presented to respondents, 4) data collection, and 5) analysis of the discrete choice data.

Establishing Attributes and Levels

DCEs in health care have used as many as 12 attributes [22]. In the present study, the DCE consisted of 10 attributes (see Table 1). Three attributes represented health outcomes measured within the QALY framework (i.e., life expectancy, future health state, and timing of future health state) and reflect current economic evaluation practice. The "life expectancy" attribute was based on the current average life expectancy in the Netherlands at birth [24]. It was varied by a maximum of 3 years, because research evidence suggests that a healthier lifestyle can increase life expectancy within this range [25]. Life expectancy was used as an attribute instead of risk of premature death, because research evidence shows that people have difficulties in understanding risk information [26]. The "future health state" attribute was based on the EuroQol five-dimensional (EQ-5D) questionnaire instrument, a widely applied generic preference-based measure of health [27,28], which is used to obtain the HRQOL weight for calculating QALYs on the basis of five dimensions of health (i.e., mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) [28]. The attribute was defined in terms of four HRQOL weights representing 4 of 243 possible EQ-5D health states. First, we selected four HRQOL weights that seemed plausible given the sample's EQ-5D questionnaire scores at baseline of the HPS. Then, we identified the corresponding EQ-5D questionnaire health states by using Dutch population time trade-off value sets [29]. These states were presented in the DCE together with the HRQOL weights. Given that consumers of HP were essentially healthy at the time of participation in the intervention, they would not experience an improvement in their HRQOL immediately. The benefit of HP rather lies in preventing the deterioration of their future health state. To account for the long time horizon required to achieve changes in HRQOL, we included a third attribute representing different start points of the future health state.

Because of a lack of literature on nonhealth outcomes of lifestyle behavior change, nonhealth outcome attributes were derived from semi-structured interviews (n = 12) and focus group discussions (n = 5) with HPS intervention group members (n = 52). Respondents were asked to describe any consequences they experienced from lifestyle behavior changes they made as a result of participating in the HP intervention. Reported consequences included both health outcomes (captured by EQ-5D based QALYs) and broader nonhealth outcomes. From the reported nonhealth outcomes, four attributes were selected for inclusion in the experiment on the basis of their relevance for the total sample. The four nonhealth outcome attributes included body satisfaction, relaxation, endurance, and experienced control over lifestyle choices. In the interviews, a higher body satisfaction was frequently associated with the ability to wear a smaller clothing size. As clothing size can be quantified more easily than body satisfaction, we used clothing size as a proxy attribute for body satisfaction. To allow for the subjective dimension of body satisfaction, clothing size was further specified according to the degree of deviation from the respondent's ideal size from the respondent's perspective. The degree of relaxation was quantified as varying number of days per week during which people experience sufficient relaxation. We did not find useful existing measures to express the attributes "endurance" and "experienced control over lifestyle choices" in quantitative terms. Therefore, qualitative levels were used to describe these attributes, ranging from "poor" to "very good" for endurance and from "little" to "much" for experienced control over lifestyle choices.

Given that many participants in the interviews and focus group discussions described spillover effects of their own lifestyle changes to lifestyle behaviors of their partners and children, we also included an attribute representing these spillover effects. Finally, two attributes were included to reflect the monetary and time costs associated with lifestyle behavior change. The "monetary cost" attribute was based on willingness to pay (WTP) for effective lifestyle change interventions reported during interviews and focus group discussions, as well as market prices for gym subscriptions. The "time cost" attribute had levels ranging from 0 to 6 hours per week, which we considered as a realistic maximum time investment. For each attribute, except for "lifestyle improvement of partner/children," we defined four levels to create sufficient variation in the attribute levels to produce meaningful choices [21].

Experimental Design

Using a full factorial design containing all possible combinations ($4^9 \times 2^1$) of attribute levels for the selected attributes was not feasible. Hence, a fractional factorial design was created following design principles of Street and Burgess [30]. An orthogonal main effects starting design was selected from a design catalogue [31]. The starting design had level balance and consisted of 32 rows and nine attributes, of which eight had four levels and one had eight levels. The eight-level attribute was collapsed into a

Table 1 – Attributes and levels.

	Attribute	Levels	Description	Hypothesized direction of preference
1	Future health state value	0.5* 0.7 0.8 1.0	Your health state in the future depends on your lifestyle behavior. By means of a healthy lifestyle you can contribute to a better health state in the future. In this questionnaire we distinguish two characteristics of your future health state: 1) the value and 2) the start point of your future health state. With a value of 0.5, you have the following future health state: I have some problems in walking about I am unable to wash or dress myself I have no problems performing my usual activities I have no pain or discomfort I am not anxious or depressed With a value of 0.7, you have the following future health state: I have some problems in walking about I have some problems washing or dressing myself I have some problems performing my usual activities I have moderate pain or discomfort I am not anxious or depressed With a value of 0.8, you have the following future health state: I have no problems in walking about I have no problems with self-care I have no problems performing my usual activities I have no pain or discomfort I am moderately anxious or depressed With a value of 1, you have the following future health state: I have no problems in walking about I have no problems with self-care I have no problems performing my usual activities I have no pain or discomfort I am not anxious or depressed	Positive
2	Start point of future health state	In 2 y In 5 y In 10 y In 20 y*	The start point of future health indicates in how many years your future health state starts. When you change your lifestyle it can take some time until this leads to a noticeable improvement in your health.	Negative when future health state value increases and positive when future health state value decreases
3	Life expectancy	80 y* 81 y 82 y 83 y	An unhealthy lifestyle goes together with an increased risk of premature death. Because of changing your lifestyle you can reduce this risk and increase your life expectancy.	Positive, but to a lesser degree when future health state value decreases

(*continued on next page*)

Table 1 – *continued*

	Attribute	Levels	Description	Hypothesized direction of preference
4	Clothing size above ideal	0 sizes $^{1}/_{2}$ size 1 size 2 sizes*	Most people have a conception of an ideal clothing size with which they feel comfortable in their body. Lifestyle change can help you come closer to this ideal size.	Positive
5	Days with sufficient relaxation	0–1 per week* 2–3 per week 4–5 per week 6–7 per week	Changing your lifestyle can increase the days on which you experience sufficient relaxation. On a day with sufficient relaxation, you have at least 1 h during which you can really calm down and clear your head. You are not tense and experience no stress during that time.	Positive
6	Endurance	Poor* Modest Good Very good	The better your endurance, the longer you can sustain intense physical strain. You get less out of breath and recover faster. A good endurance also comes with more muscular strength and flexibility.	Positive
7	Experienced control over lifestyle choices	Little* Some Moderate Much	Participating in a lifestyle program can increase the extent to which you experience control over lifestyle choices. The more control you experience, the better you manage to make personally desirable lifestyle choices.	Positive
8	Lifestyle improvement of potential partner/children	Yes No*	Living together in one household with a partner and/or children can result in influencing each other's behavior. When you change your lifestyle, this can also stimulate lifestyle change in your partner/children.	Positive
9	Time per week	0 h 2 h 4 h 6 h	Changing your lifestyle may involve giving up spare time. For example, being more physically active and preparing healthier meals may cost you time, which you used to spend on other things (e.g., watching TV).	Positive
10	Money per month	€0 €25 €50 €100	Changing your lifestyle may involve giving up some of your income. You can, for example, think about money you spend on a subscription at a gym or for dietary advice, which you did not do before changing your lifestyle.	Positive

* Base level of effect-coded variables.

two-level attribute. An additional four-level attribute was created by adding a new column to the design. The design was then repeated three times, so that each of the four levels of the new attribute occurred together with all attribute-level combinations of the starting design. This resulted in a design with 128 rows. Expanding the design in this way allowed us to estimate two-factor interactions between the new attribute (here: future health state value) and all other attributes.

Based on this design, choice sets with two options were generated by using design software developed by Burgess [32]. Generators were used to create the second option by shifting the attribute levels of the starting design a specified number of levels [30]. One set of shift generators was required to estimate main effects and a second to estimate the two-factor interactions of interest. This resulted in a final design with 256 choice sets. The D-efficiency of the constructed 256 choice sets for estimating main effects was 87.9%. The D-efficiency of the design for estimating main effects plus specified two-factor interactions could not be calculated. All main and interaction effects, however, were orthogonal (i.e., the levels of each attribute varied independently of each other and of their two-way interactions) and could be estimated [30]. The design was blocked into 16 versions to achieve a number of choice tasks (n = 16) respondents can handle without problems [33–35].

Questionnaire and Choice Tasks

To increase flexibility in the presentation of the choice tasks, an online questionnaire was used [36]. This allowed, for instance, the use of hyperlinks, which could be used by respondents to look up EQ-5D health state descriptions (i.e., definitions of the levels of the attribute "future health state value") throughout the experiment. Online administration of the survey also facilitated the use of a flexible random allocation procedure to ensure equal representation of the 16 versions among respondents. The questionnaire commenced with a number of background questions. Then, the choice task was introduced. Each respondent was asked to make 16 forced choices involving two unlabeled alternatives (see Table 2). A generic context was used to be concordant with the generic approach to outcome evaluation in EQ-5D based QALYs. The alternatives were presented as potential situations that may be experienced after lifestyle change and characterized by different consequences (i.e., the attributes and levels). Respondents were asked to imagine themselves in these situations and to choose the situation they preferred most.

A forced choice approach was used in this exploratory study to encourage respondents to make trade-offs between the attributes of interest and ensure that they cannot choose the opt-out option to avoid making difficult choices [37]. This approach was also in line with our objective to study preferences for outcomes experienced given that lifestyle behavior changes have taken place. Respondents were instructed to assume that they have to spend the money and time continuously for the rest of their lives and that they could not spend this time and money for other purposes anymore. It was emphasized that all consequences of lifestyle change would be experienced immediately, except for future health state, which would be experienced only after some years indicated by the attribute start point of future health state. To neutralize the potential impact of attribute ordering on the relative importance of attributes, which has been suggested by previous research [38], the ordering of health and nonhealth attributes was varied across the different versions of the experiment. The monetary and time cost attributes were always presented last, because this is regarded the most realistic place for a cost attribute in DCEs [38].

After completion of the choice tasks, respondents were asked how difficult they perceived the choice task on a five-point scale ranging from "very easy" to "very difficult." Respondents were also asked to indicate any other consequences of lifestyle change not being included in the choice task, which they considered while making the choices. The final questionnaire, which is available on request from the authors, was piloted (n = 7) to assess understandability and possible ambiguity in interpretations. This led to minor adaptations of survey layout and wording of questions and instructions.

Table 2 – Example choice task.

	Situation A	Situation B
Future health state: start point and value	In 2 y → 0.8	In 5 y → 0.7
Life expectancy	I become 81 y	I become 80 y
Clothing size	$^1/_2$ size above my ideal	1 size above my ideal
Sufficient relaxation	2–3 d per week	0–1 d per week
Endurance	Good	Modest
Experienced control over lifestyle choices	Some	Little
Lifestyle improvement potential partner/children	No	Yes
I spend on lifestyle change:		
Time	6 h per week	4 h per week
Money	€50 per month	€25 per month
Which situation do you prefer?	☐	☐

Data Collection and Participants

Respondents were recruited from participants of the HPS. The HPS started in February 2008 and included men and women aged between 30 and 50 years living in the semirural region of West-Friesland in the Netherlands. Study participants had an increased risk for type 2 diabetes and/or cardiovascular disease. They were selected by means of a two-step screening procedure, which is described in more detail elsewhere [19]. Participants included in the study were randomly assigned to an intervention group and a control group. The intervention group received a theory-based cognitive behavioral program delivered by trained practice nurses applying counseling techniques of motivational interviewing and problem solving treatment. The control group received written information about their risk of developing type 2 diabetes and cardiovascular disease, and existing brochures containing guideline recommendations for a healthy diet and physical activity as well as advice on smoking cessation [19].

Invitations for participation in the present study were mailed to all participants still included in the HPS cohort in June 2010 (n = 515). In this sample, intervention (49.3%) and control groups were equally distributed (50.7%). Participants with known e-mail addresses (n = 499) also received an invitation by e-mail including a direct link to the survey. Participants who did not complete the survey nor indicated that they did not wish to participate received a reminder after 1 week and in case of nonresponse a second reminder after 2 weeks. Ethical approval for this research was granted by the VU University Medical Centre Research Ethics Committee.

Table 3 – Background characteristics of responders and nonresponders.

Characteristic	N (valid %)	
	Responders (n = 273)	Nonresponders (n = 242)
Intervention experience		
Yes	132 (48.4)	122 (50.4)
Gender		
Female	163 (59.7)	132 (55.0)
Age (y)		
30–39	33 (12.1)	33 (13.6)
40–49	140 (51.3)	145 (60.0)
50–59	100 (36.6)	64 (26.4)
Household income (net/month)		
Low (≤€1100)	13 (4.8)	—
Middle (≤€3500)	79 (28.9)	—
High (>3500)	135 (49.5)	—
Do not want to tell	46 (16.8)	—
Work situation		
Having paid work	233 (85.4)	211 (88.3)
Living circumstances		
Living alone	17 (6.2)	14 (5.9)
Living with partner	36 (13.2)	24 (10.1)
Living with child(ren)	13 (4.8)	12 (5.0)
Living with partner and child(ren)	207 (75.8)	188 (79.0)
EQ-5D questionnaire health state utility, mean ± SD	0.89 ± 0.137	0.92 ± 0.132

Notes. Background characteristics of nonresponders were derived from questionnaire data collected at baseline of the HPS. Several items of the HPS questionnaire differed from items used in the present study. Hence, income data were not comparable.
EQ-5D, EuroQol five dimensional; HPS; Hoorn Prevention study.

Data Analyses

The discrete choice data were analyzed by using Nlogit Version 4. The effect of changes in attribute levels on consumer preferences was initially estimated by means of a multinomial logit (MNL) model. By using this model, we tested for hypothesized interactions between attributes (see Table 1) and interactions between attributes and intervention experience, sociodemographics, and attribute ordering. To account for the panel nature of the data and allow for possible preference heterogeneity across respondents, a random parameter logit (RPL) model was estimated [22]. First, the RPL model was estimated with the constant term as the only random parameter. This is a common way of capturing heterogeneity in repeated measures or panel data [39] and provides a test for left-to-right bias (i.e., the tendency to consistently choose either the first alternative or the second alternative in the choice task). Because respondents differed regarding their free time and available income, it is likely that their preferences for investing time and money for lifestyle change differ as well. So, an RPL model including additional random parameters for the attributes "time" and "money" was also estimated. Finally, we estimated an RPL model including additional random parameters for the attribute "clothing size above ideal," because respondents disagreed most on the importance of this attribute during qualitative interviews and focus groups.

For all three models, the estimation was conducted by using 2000 Halton draws. The random parameter of the constant was drawn from a normal distribution. All other random parameters were drawn from a constrained triangular distribution. Following recommendations in the literature, effects coding was applied for categorical attributes [23,40,41]. Linear coding was used for the attributes "time per week" (0 hours = 0, 2 hours = 2, 4 hours = 4, 6 hours = 6) and "money per month spent on lifestyle change" (€0 = 0, €25 = 0.25, €50 = 0.5, €100 = 1). To investigate the relative impact of each attribute on the utility respondents derived from the alternatives, we calculated WTP estimates on the basis of marginal rates of substitution between the "cost" attribute and all other attributes [42]. Confidence intervals for WTP values were derived by using the Delta method [43].

Results

In total 273 respondents (53%) completed the DCE survey. The majority had performed all 16 choice tasks (n = 264). Nine respondents did not fully complete the choice tasks, leading to 42 missing observations. The 16 different versions of the survey were spread fairly evenly across respondents. Most versions (n = 14) were completed by 13 to 20 respondents, and two versions were completed by 23 and 24 respondents, respectively. A summary of respondent background characteristics is presented in Table 3. As can be seen from this table, responders were similar to nonresponders.

Table 4 provides a comparison of model fit across the alternative models that were estimated. The likelihood ratio test shows that the MNL model including parameters for the attributes has significantly

Table 4 – Goodness-of-fit statistics for alternative models.

Summary statistics	Pseudo R^2	Log-likelihood	χ^2 LL ratio-test (df)	AIC	BIC
RPL clothing size above ideal	0.169	−2490.799	1.24 (3)	1.16	1.20
RPL time and money	0.170	−2489.131	5.16 (2)	1.16	1.20
RPL constant	0.169	−2491.71	74.14 (1)*	1.16	1.20
MNL	0.157	−2528.78	939.49 (24)*	1.18	1.22
Constant only	—	−2998.53	—	1.39	1.39

Notes. The constant-only MNL model was used as the null model for pseudo R^2; χ^2 LL ratio-test statistic is presented for comparisons with the next less sophisticated model.
AIC, Akaike information criterion; BIC, Bayesian information criterion; MNL, multinomial logit; RPL, random parameter logit.
* Exceeds critical value for $\alpha = 0.05$.

more explanatory power than the constant-only model. This indicates that the attributes contribute to the capability of the model to predict choices of respondents. The RPL model with the constant term as the only random parameter in turn performed significantly better than the MNL model, demonstrating the presence of preference heterogeneity. Even when adjusting for the loss of degrees of freedom that occurs when a model is expanded, the RPL model performed best. This appears from reductions in the Akaike information criterion and Bayesian information criterion [44] (see Table 4).

Table 5 – Results from the main effects RPL model.

Attribute	Coefficient	SE	WTP (in € per month)	
			Mean	CI
Random parameters				
Constant	0.000	0.050	—	—
SD	0.578†	0.055		
Nonrandom parameters				
Future health state value				
0.5 (referent)	—	—	—	—
0.7	−0.042	0.056	45.54*	9.96–81.12
0.8	0.029	0.056	59.82†	17.98–101.65
1.0	0.283†	0.056	110.85†	67.98–153.71
Start point of future health state				
In 2 y (referent)	—	—	—	—
In 5 y	0.008	0.040	16.77	−8.39–41.94
In 10 y	0.064	0.040	27.92	−1.15–56.98
In 20 y	0.003	0.041	15.63	−10.54–41.80
Life expectancy				
80 y (referent)	—	—	—	—
81 y	0.006	0.043	13.85	−11.82–39.52
82 y	−0.039	0.040	4.86	−23.09–32.81
83 y	0.096*	0.041	31.98*	6.28–57.68
Clothing size above ideal				
2 sizes (referent)	—	—	—	—
1 size	0.017	0.042	56.67†	29.20–84.13
½ size	0.130†	0.041	79.29†	44.04–114.53
0 sizes	0.118†	0.039	77.01†	46.05–107.97
Days with sufficient relaxation				
0—1 per week (referent)	—	—	—	—
2—3 per week	−0.059	0.040	53.68†	26.63–80.73
4—5 per week	0.125†	0.041	90.61†	55.11–126.11
6—7 per week	0.261†	0.041	117.98†	82.05–153.91
Endurance				
Poor (referent)	—	—	—	—
Modest	−0.130†	0.040	159.75†	114.04–205.46
Good	0.491†	0.039	284.26†	211.12–357.39
Very good	0.564†	0.041	298.94†	223.55–374.32
Experienced control over lifestyle choices				
Little (referent)	—	—	—	—
Some	−0.021	0.039	22.86	−1.91–47.63
Moderate	0.009	0.044	28.88	−3.02–60.78
Much	0.146†	0.041	56.22†	28.07–84.37
Lifestyle improvement of potential partner/children				
No (referent)	—	—	—	—
Yes	0.181†	0.018	72.75†	50.48–95.03
Time per week	0.004	0.010	0.85	−3.22–4.91
Money per month	−0.498†	0.063	—	—

CI, confidence interval; SE, standard error; RPL, random parameter logit; WTP, willingness to pay.

* $P < 0.05$.

† $P < 0.01$.

Specifying additional random parameters did not significantly improve the model fit. Hence, the RPL model with the constant term as the only random parameter was used to estimate the effect of the attributes on consumer choices. We present results of only the main effects RPL model here, as most of the tested interaction terms were nonsignificant and including significant interactions did not improve the model.

The health outcome attributes "future health state" and "life expectancy" significantly determined consumer choices in the expected direction (see Table 5). Furthermore, all nonhealth outcome attributes (i.e., clothing size above ideal, days with sufficient relaxation, endurance, and experienced control over lifestyle choices), spillover effects to partner/children, and the "monetary cost" attribute had a significant impact on consumer choices. Two attributes were found to be nonsignificant. These were "start point of the future health state" and "time per week required for lifestyle behavior change."

Estimates of WTP for changes in attribute levels obtained from the marginal rates of substitution are displayed in Table 5. They show that the "endurance" attribute had the biggest impact on utility respondents derived from alternative post–lifestyle change situations. For an improvement from "poor" to "very good" endurance, respondents were willing to trade €298.94 per month and for an improvement from "poor" to "modest" endurance, respondents were willing to trade €159.75 per month. The attribute "days with sufficient relaxation" had the second largest impact on utility, with respondents being willing to trade €117.98 per month for an increase from 0 to 1 to 6 to 7 days with sufficient relaxation per week. The attribute "future health state" value is on the third place, with respondents being willing to trade €110.85 per month for an improvement in the future health state value from 0.5 to 1.0. WTP for changes in the "life expectancy" attribute was relatively low. Respondents were willing to pay €31.98 per month for an increase in life expectancy from 80 to 83 years. For smaller increases in life expectancy, respondents were not willing to trade.

Validity of the Findings

The majority of the respondents (97%) filled in the DCE survey completely. However, many respondents perceived the choice tasks as difficult or very difficult (59.1%), which raises the question whether respondents gave valid answers. Theoretical validity was tested by examining signs and significance levels of parameter estimates. With the exception of the attribute "start point of future health state" and "time per week," all attributes significantly determined choices (see Table 5). Generally, attributes in the estimated utility function behaved in line with a priori expectations (see hypothesized direction of preferences in Table 1). There was only one exception. We found that a reduction in clothing size to zero sizes above ideal was somewhat less preferred than a reduction to half a size above ideal.

Interactions between respondents' income and the two cost attributes also provided support for the validity of our findings. As could be expected, a higher income was associated with a less negative preference for an increase in money respondents had to spend per month on lifestyle behavior change (β = 0.423; t = 3.173). As the "time cost" attribute itself, the interaction between income and time spent on lifestyle change per week was nonsignificant (β = 0.003; t = 0.140). Tested interactions between trial arm and attributes (data not shown) did not provide clear evidence for differences in preferences between members of the intervention and control groups of the HPS. Tested interactions between the ordering variable and the attributes (data not shown) indicated that attribute ordering did not systematically affect the relative importance of the attributes.

The constant term was not significant, which suggests that, on average, respondents considered the attributes described in the choice task and did not simply choose the same alternative repeatedly. In concordance with this finding, qualitative data from open questions suggest that only three respondents did not trade between all attributes. One of them did not trade in order to simplify the choice task, but the other two respondents behaved rationally. They considered only those attributes that they found personally relevant. So, their choices reflect actual preferences. Qualitative data also suggest that only few respondents considered additional attributes not included in the experiment. These were personal attainability on the long term (n = 1), the possibility to have a comfortable way of life without the need to consider all sorts of things (n = 1), current health state (n = 2), and more specific outcomes for respondents' partner and/or children (n = 3). In line with recommendations in the literature, we did not remove respondents from the analyses on the basis of their decision strategies [45].

Discussion

The present DCE study provides evidence that in the context of lifestyle behavior change, consumers of HP are concerned with a broader number of benefits than health benefits only. In addition to the health outcome attributes "life expectancy" and "future health state" value, the following nonhealth outcome attributes significantly influenced consumer choices: clothing size above ideal, the number of days with sufficient relaxation, endurance, and the degree of experienced control over lifestyle choices. Lifestyle changes that occur in consumer's partners and/or children were also found to significantly influence consumer choices. This is concordant with earlier research by Basu and Meltzer [46], suggesting that spillover effects to family members affect patient preferences. Additional qualitative data provided by respondents in the present study suggest that consumers value spillover effects because they provide both health and nonhealth effects to their loved ones. But more targeted research is needed to unravel why individual consumers value spillover effects.

Overall, we found that health and nonhealth improvements in HP outcomes both influenced consumer choices. Marginal rates of substitution between the price attribute and other attributes revealed that consumers' WTP for nonhealth outcomes and spillover effects was in a similar range as WTP for health outcomes. This finding suggests that consumers attach value to outcomes that are not captured by economic evaluation studies using the EQ-5D based QALYs as an outcome measure. It also has important implications for HP practice. Because consumers attach value to nonhealth outcomes, emphasizing nonhealth benefits in HP interventions may increase uptake and motivation for behavior change.

Respondents were willing to pay most for improvements in endurance, second most for an increase in days with sufficient relaxation, and third most for improvements in future health state value. WTP for life expectancy was relatively low and for increases smaller than 3 years, respondents were not willing to trade. This finding confirms results of a recent Norwegian study, showing that people attach little value to small gains in life expectancy [47].

This study also investigated the impact of costs induced by lifestyle behavior change. As expected, respondents had a lower preference for situations with higher monetary costs than for situations with lower monetary costs. It was striking, however, that time investment for lifestyle change did not influence consumer choices, because consumers reported time investment as an important negative consequence of and barrier to lifestyle behavior change during interviews conducted prior to the choice experiment. It is possible that although time investment was not relevant on average, latent classes of respondents can be distinguished: one consisting of respondents who are willing to invest time for lifestyle change and one consisting of respondents who are averse to do so.

A number of limitations of this study are worth mentioning. First, we defined health outcomes as pertaining to life expectancy and EQ-5D questionnaire health state dimensions. While this definition represents current economic evaluation practice, health outcomes could also be defined in a broader fashion. In addition, we cannot preclude the possibility that there is a relation or overlap between the nonhealth outcomes examined and EQ-5D questionnaire dimensions (e.g., between endurance and the mobility dimension of the EQ-5D questionnaire). More research is required to disentangle relationships between the different outcomes produced by HP interventions and to clarify definitions of health, nonhealth, and process outcomes.

Second, the study sample consisted of participants aged between 30 and 50 years in a lifestyle intervention trial. Therefore, the study results may not be generalized to regular consumers of HP, other HP interventions, or other age groups.

Third, because of the generic context used in the study, preferences toward outcomes of lifestyle behavior change were assessed without considering the process by which outcomes are produced. Respondents may value outcomes differently depending on whether these are produced by, for instance, physical activity or dietary changes.

Fourth, by not including an opt-out option in the choice task, we implicitly assumed that respondents would always choose to make lifestyle changes. This may not be realistic and limits the possibility to use our findings to predict adoption of lifestyle changes and participation in HP interventions [22,37].

Fifth, although attributes in the estimated discrete choice model significantly contribute to the prediction of consumer choices, the explanatory power of the model was only moderate with a pseudo R^2 of 0.17. According to Hensher et al. [23], a decent R^2 would be around 0.3. The moderate explanatory power may be because we failed to include some key attributes having an impact on consumer choices. It is natural that a DCE cannot cover every attribute that is important to every respondent, because it generates a model of preferences over a group [45]. Additional qualitative data suggest, however, that only few respondents considered omitted attributes. The low model fit may also be caused in part by scale heterogeneity in the data set (i.e., choice behavior of some respondents is more random than that of others) [48]. In situations in which scale heterogeneity is important, the RPL model is likely to provide suboptimal approximation of discrete choice data. Hence, alternatives have been proposed describing heterogeneity either as pure scale effect or using a generalized MNL model that can accommodate both scale and residual taste heterogeneity [48]. The application of such models should be tested in future research, as it may yield a more accurate representation of the data and a better model fit. Recent research suggests, however, that failure to account for taste heterogeneity has greater consequences for behavioral outputs, such as WTP, than failure to account for scale heterogeneity [49].

Finally, we used qualitative levels for two nonhealth attributes that were difficult to quantify (i.e., endurance and experienced control). If not well defined, qualitative levels may be interpreted differently by respondents [21]. Overall, qualitative attributes behaved in line with a priori expectations in this study. Further testing is needed, however, to optimize the description of nonhealth attributes in the future. Quantifying nonhealth outcomes is a challenging task that has so far received little attention and needs further exploration [15].

DCEs only provide stated preference data. Therefore, it would be helpful for cross-validation to collect additional revealed preference data on actual lifestyle choices of consumers. Such research is challenging and rare in the health sector, but out-of-pocket payments for lifestyle changes make it possible [50].

Conclusions

The present study used a DCE to explore consumer preferences for different outcomes of lifestyle behavior change. The findings show that previously identified nonhealth outcomes and spillover effects of lifestyle behavior change were as important to participants of an HP intervention trial as health outcomes. This has potentially important implications for decision makers, who should respond to consumer preferences and consider relevant nonhealth outcomes and spillover effects when deciding about HP interventions. Nonhealth outcomes and spillover effects could either be incorporated directly within economic evaluations or considered as separate source of evidence during the appraisal phase of the decision-making process. Future research needs to provide insights into relevant nonhealth outcomes and spillover effects in other application areas of HP and test methods to account for them in decision making.

Acknowledgments

The authors thank Michiel Bliemer for his advice regarding the analysis of the discrete choice data and The Netherlands Organisation for Scientific Research (NWO) for funding the study.

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