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ORIGINAL RESEARCH ARTICLE

Communicating Test Results from a General Health Check: Preferences from a Discrete Choice Experiment Survey

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Abstract

Background Health checks can detect risk factors and initiate prevention of cardiovascular diseases but there is no consensus on how to communicate the results. The aim of this study was to investigate the preferences of the general population for communicating health check results.

Methods A randomly selected sample of the Swedish population aged 40–70 years completed a discrete choice experiment survey that included questions on sociodemographics, lifestyle and health and 15 choice questions consisting of six attributes (written results, notification method, consultation time, waiting time, lifestyle recommendation and cost). Data were analyzed with a latent class analysis (LCA). Relative importance of the attributes and predicted uptake for several scenarios were estimated.

Results In the analysis, 432 individuals were included (response rate 29.6%). A three-class LCA model best fit the data. Cost was the most important attribute in all classes. Preferences heterogeneity was found for the other attributes; in Class 1, receiving consultation time and the written results were important, respondents in Class 2 dominated on costs and respondents in Class 3 found consultation time, waiting time and lifestyle recommendations to be important. Health literate respondents were more likely to belong to Class 3. The predicted uptake rates ranged from 7 to 88% for different health checks with large differences across the classes.

Conclusion Cost was most important when deciding whether to participate in a health check. Although cost was the most important factor, it is not sufficient to offer health checks free-of-charge if other requirements regarding how the test results are communicated are not in place; participants need to be able to understand their results.

1 Introduction

Cardiovascular diseases are multifactorial and in many cases modifiable. Basic health checks, where biomarkers (such as blood pressure, cholesterol and glucose) are measured and lifestyle is assessed, can provide a good estimation of cardiovascular risk and help to detect the often symptom-free risk factors. The European Guidelines on Cardiovascular Disease Prevention in Clinical Practice recommend assessing the total cardiovascular risk in healthy patients [1]. Health checks combined with health counselling have shown to positively impact cardiovascular mortality [2].

Participation rate reflects on the acceptability of the program and is crucial for a prevention program to be effective on a population level. An effective screening program should, according to WHO, have a participation rate of over 70% [3]. A screening program should also be accessible to the whole population [4]. In the EU, the participation rates of health checks have been relatively low. For instance, in Sweden, uptake was 65% or lower [5] and in the UK, 30.1% of the eligible population attended the NHS health checks, indicating a need for understanding of how the participation rates can be increased.

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Key Points

A discrete choice experiment (a choice-based survey) investigated preferences for communicating health check results to the public.

Cost of the health check, consultation time with a medically trained person and inclusion of lifestyle recommendations were most important.

Average predicted uptake rates for health checks ranged from 7 to 88%. Health literacy predicted differences in preferences for communicating health check results.

Lay people have expressed dissatisfaction with how test results are communicated to them and experienced difficulties understanding the test results [6, 7]. Not being able to utilize test results from health checks is a crucial obstacle for prevention. Other factors previously reported by individuals as important when receiving test results are availability and opening hours of the provider, waiting time, the format and framing of the written results (including an overall assessment), recommendations of what to do and where to find more information, consultation time, opportunity to ask questions, confidentiality, how the results are notified and costs [6–18].

However, a formal quantitative assessment of the relative importance of these factors is lacking. This makes it difficult for policy makers to know what to prioritize when developing such national health check programs and to know how different factors will affect the uptake of health checks.

Therefore, this study aimed to investigate the preferences of the general population for communication of health check results. Furthermore, this study investigated preference heterogeneity and the predicted uptake of several health check implementation scenarios.

2 Methods

2.1 Discrete Choice Experiment

This study used a discrete choice experiment (DCE) to assess preferences of the general population. It is a method used to investigate individual preferences and can be used to determine the relative importance of different characteristics of an intervention and predict uptake of different interventions such as health checks [19, 20].

Respondents are presented with a series of choice tasks, each consisting of at least two alternatives that describe different options for the same intervention (e.g. health checks). Each alternative is described by several characteristics or attributes (e.g. consultation time for health checks) with varying levels (e.g. for consultation time: 0, 15 or 30 minutes). Respondents are asked to choose the alternative they prefer most within each choice task.

2.2 Attribute Selection and Experimental Design

The number of attributes that can be included in a DCE is limited. Therefore, attributes need to be carefully selected [21]. We identified a list of possible attributes based on previous research [6–18]. This list was discussed with three experts (physicians and researchers) to ensure the attributes were consistent with current practice. The remaining attributes were discussed with eight individuals from the study population during three focus group interviews using the Nominal Group Technique [22]. This entailed participants discussing and ranking their five most important attributes. An additional 53 individuals from a convenience sample ranked all attributes from most to least important. Total and mean ranking scores were calculated for the attributes. Combining insights from previous research, expert feedback and ranking exercises, six attributes with accompanying levels were selected at a research group consolidation meeting (Table 1). Written results, waiting time, consultation time and lifestyle recommendations were top ranked while cost and notification method were chosen due to their policy relevancy. See Online Resource 1 in the electronic supplementary material (ESM), for more details about the attribute selection.

NGene 1.0 software was used to generate a Bayesian D-efficient design including best guess priors, which minimizes the sample size and the number of choice tasks every respondent is asked to complete based on optimizing the variance–covariance matrix. The design included an interaction between lifestyle recommendations and consultation time. Sixty unique choice tasks were generated. To limit the burden on respondents, the choice tasks were divided into four blocks of 15 unique choice tasks. Respondents were randomized to one of the blocks.

Each choice task consisted of two alternatives, so respondents were forced to choose between two health check alternatives. After that, respondents were asked if they would actually participate in the selected health check in real life or whether they preferred to opt-out (dual response design). An example of a choice task is presented in Fig. 1.

2.3 The Survey

The survey was web-based and constructed with the program Sawtooth Light House Studio 9.6.1 software. The first part of the survey included questions about sociodemographic factors; sex, age, education level, occupation, medical training,

Table 1 Attributes and levels included in the DCE

Attributes	Levels
Written results: how your test results are presented to you in a written format	Numerical test results with reference values of what is considered normal for the population
	Numerical test results and everyday words. Besides numerical values, your test results are also presented in everyday words
	Numerical test results, everyday words and overall assessment. Besides numerical values and everyday words, your test results include an overall assessment where all test results are included, as well as lifestyle factors and individual factors such as age and sex
Notification method: your test results are documented in your medical health record. You can access your test results by logging in to your electronic health record online	Only electronic health record. You will receive your written test result only by personally logging in to your electronic health record
	Electronic health record and letter. Besides having access to your written test results through your electronic health record, you will also receive a letter to your home address or e-mail
Waiting time: how long you will have to wait for your written test results	2 days
	1 week
	2 weeks
	3 weeks
Lifestyle recommendations: there are actions you can take yourself to influence your cardiovascular risk, thing related to your lifestyle	No, lifestyle recommendations are not included
	Yes, lifestyle recommendations are included
Consultation time: time with a medically trained person with high competence within the area, to get the opportunity to discuss and ask questions regarding your test results	No consultation time. You will only receive written results
	15 min. Face-to-face or over the phone
	30 min. Face-to-face or over the phone
Cost[a]: what you pay out of your own pocket	Free of charge
	€15 (150 SEK)
	€30 (300 SEK)
	€60 (600 SEK)
	€90 (900 SEK)
	€120 (1200 SEK)

DCE discrete choice experiment, *SEK* Swedish kroner

[a]In the Swedish version, only SEK was presented

cohabitation and country of birth. The next part of the survey was the DCE. Before respondents were asked to complete the choice tasks, they received detailed information on the meaning of all attributes and levels as well as an example of how to complete a choice task. In addition, the context of the health check in the DCE was explained before the choice tasks; "Imagine being invited to a health check by the public health care authorities. The health check would take place at the local Primary Health Care Center. The testing would include analysis of glucose, blood lipids, blood pressure, as well as measurement of waist circumference, height and weight. You would also be asked to fill out a survey regarding your lifestyle habits. In the following DCE, imagine that no serious clinical findings were detected, but in any such case, you would be referred to health care immediately."

The final part of the survey included additional questions about health status, risk perception, medical history and lifestyle (smoking, stress, physical activity and body mass index [BMI, kg/m^2]). Understanding of test results is influenced by individuals' health literacy, which relates to an individual's ability to access, understand, appraise and apply health information and influences the use of health services [23]. Health literacy (HL) was measured using the validated Swedish Functional Health Literacy Scale [24].

To test for wording of the survey and to ensure that the respondents grasped the DCE, the survey was pilot tested with respondents from the target population ($n = 32$). Three think-aloud interviews were also conducted. The pilot resulted in minor changes in wording. Based on the pilot-test data, priors were updated to ensure the efficiency of the experimental design of the final DCE.

2.4 Study Population and Data Collection

A letter was sent to a random sample of individuals ($n = 1650$) from the Swedish population aged 40–70 years inviting them to participate in the study. The letter included a link to a web survey together with information about the study. Consent to participate was obtained for all respondents. The respondents were informed that a paper survey

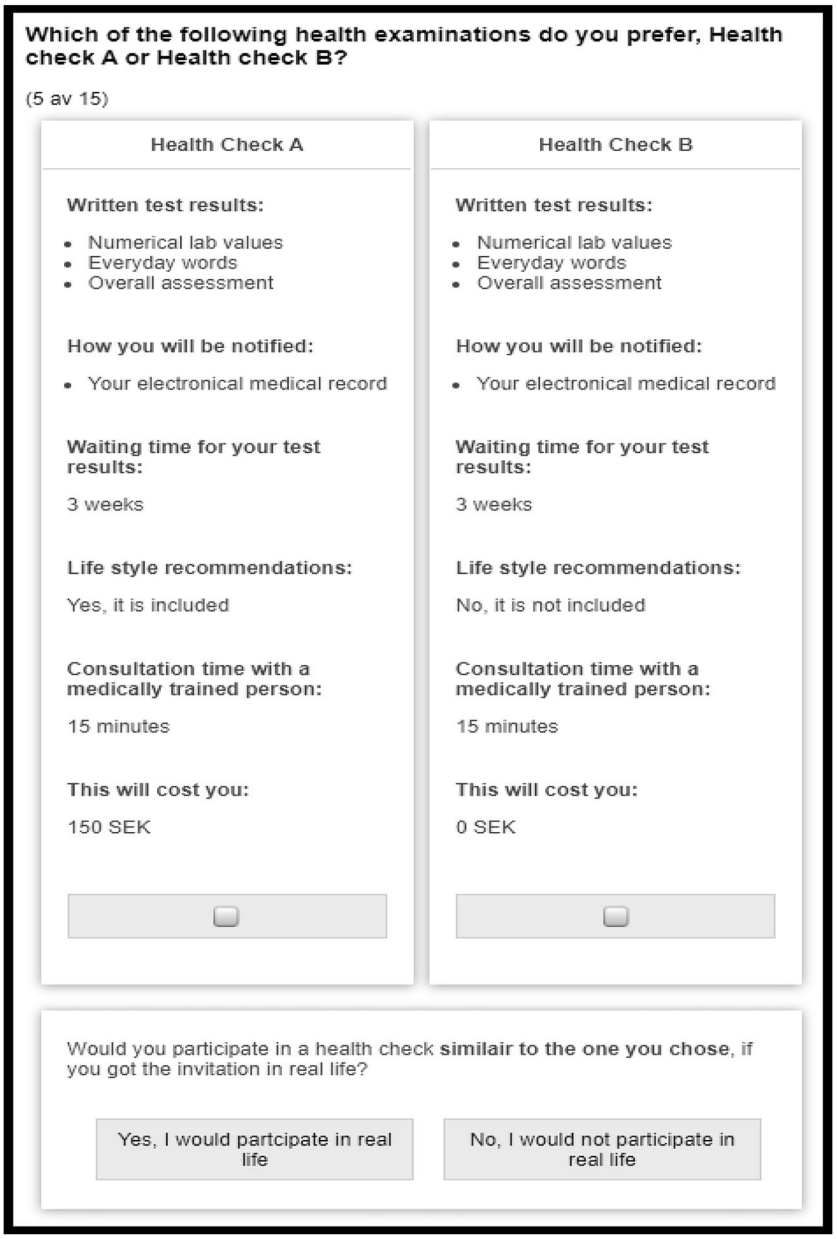

Figure 1 Example of a choice task. Note: this is a translation. The survey was administered in Swedish

could be sent to their home if they preferred. Two reminders were sent out after 3 and 6 weeks. Data was collected during January–March 2020. Ethical approval for this study was granted by the Swedish Ethical Review Authority (dnr:2019:03843). A flowchart of the study population is shown in Online Resource 2 (see ESM).

In Sweden, the 21 autonomous regions have responsibility for health care and decide on whether to offer subsidized general health checkups for their population. Among the regions that offer these, the design and the out-of-pocket costs for the health checkups differ. Most regions offer checkups for the general population from the age of 40 years. General health checkups include some level of testing (e.g., blood pressure and glucose) and is often followed up by a health counseling session with a trained nurse that focuses on lifestyle changes. The out-of-pocket cost for the citizens varies between 200 and 300 Swedish kroner (SEK) (free-of-charge in some regions). In addition to general health checkups, there are various private options available where the price is considerably higher. Most regions have implemented electronic health records.

2.5 Statistical Analysis

The analyses were performed using SPSS 25 and Nlogit 5. Descriptive statistics are presented with mean and standard deviation for continuous variables and as frequencies and percentages for categorical variables. All results were

considered statistically significant when $p < 0.05$. Correlations between covariates were tested with χ^2-test and Spearman's correlation. The statistical analyses were restricted to subjects who completed a minimum of 13 out of 15 choice tasks (i.e. < 10% missing data on their choice tasks). Waiting time, consultation time and cost were tested for linearity by adding a linearly coded attribute in a conditional logit model as well as a dummy variable representing the highest level of the attribute. If the dummy was significant, the highest attribute level significantly deviated from the expected linear line and therefore was treated as a categorical variable. Nonlinear attributes were effects coded [25]. Cost was treated as a linear attribute.

Based on the attribute levels presented in each choice task, respondents were assumed to choose the alternative that provides them with the highest utility. Therefore, data were analyzed with a panel latent class model. In addition, this model accounted for the multilevel structure of the data as each respondent answered 15 choice tasks. For this study, a latent class analysis was performed so we could investigate not only respondents' preferences but also preference heterogeneity. The model estimates unobserved 'latent' preferences of the respondents by using the data to identify segments of the sample with similar choice patterns [26]. Several models were estimated including different numbers of classes (2–5). The models were compared based on model fit tests (Akaike information criteria [AIC] and log likelihood) and practical consideration (for instance, class membership of > 10%).

The final utility functions for alternative A, alternative B and the opt-out were

$$U_{\mathrm{a}} = V + \varepsilon = \beta_{2|\mathrm{C}} \times \text{Written information}_{\text{numerical and everydaywords rta|c}} + \beta_{3|\mathrm{C}} \times \text{Written information}_{\text{numerical, everyday words and overall assessment rta|c}} + \beta_{4|\mathrm{C}} \times \text{Notification method}_{\text{letter rta|c}} + \beta_{5|\mathrm{C}} \times \text{Waiting time}_{\text{1 week rta|c}} + \beta_{6|\mathrm{C}} \times \text{Waiting time}_{\text{2 weeks rta|c}} + \beta_{7|\mathrm{C}} \times \text{Waiting time}_{\text{3 weeks rta|c}} + \beta_{8|\mathrm{C}} \times \text{Lifestyle recommendations}_{\text{yes rta|c}} + \beta_{9|\mathrm{C}} \times \text{Consultation time}_{\text{15 minutes rta|c}} + \beta_{10|\mathrm{C}} \times \text{Consultation time}_{\text{30 minutes rta|c}} + \beta_{11|\mathrm{C}} \times \text{Cost} + \varepsilon.$$

$$U_{\mathrm{b}} = V + \varepsilon = \beta_{1|\mathrm{C}} + \beta_{2|\mathrm{C}} \times \text{Written information}_{\text{numerical and everydaywords rta|c}} + \beta_{3|\mathrm{C}} \times \text{Written information}_{\text{numerical, everyday words and overall assessment rta|c}} + \beta_{4|\mathrm{C}} \times \text{Notification method}_{\text{letter rta|c}} + \beta_{5|\mathrm{C}} \times \text{Waiting time}_{\text{1week rta|c}} + \beta_{6|\mathrm{C}} \times \text{Waiting time}_{\text{2 weeks rta|c}} + \beta_{7|\mathrm{C}} \times \text{Waiting time}_{\text{3 weeks rta|c}} + \beta_{8|\mathrm{C}} \times \text{Lifestyle recommendations}_{\text{yes rta|c}} + \beta_{9|\mathrm{C}} \times \text{Consultation time}_{\text{15 minutes rta|c}} + \beta_{10|\mathrm{C}} \times \text{Consultation time}_{\text{30 minutes rta|c}} + \beta_{11|\mathrm{C}} \times \text{Cost} + \varepsilon.$$

$$U_{\mathrm{c}} = V + \varepsilon = \beta_{0|C} + \varepsilon.$$

U describes the latent utility of participating in a health check. The systematic utility component (V) describes the measurable utility that respondent 'r' belonging to class 'c' reported for alternative 'a' in choice task 't'. β_2–β_{11} represent the attribute level estimates that indicate the relative importance of each attribute (level). The sign of the estimate indicates whether the attribute level has a positive or a negative influence on the utility as compared to the reference level. The constant β_1 in the utility function for alternative B was added to adjust for a left–right bias. β_0 represents respondents' preference for the opt-out over participating in a health check. The ε-term describes the unmeasured and unmeasurable variation in respondent's preferences.

As part of the latent class model, a class assignment model was fitted and personal characteristics to predict class membership was used. In this study, we tested class membership predictions for age, educational level, HL, civil status, country of birth, economic constrains, lifestyle, medical history, risk perception, family history of myocardial infarction (MI) and self-perceived general health.

The relative importance of the attributes was calculated and compared across the different classes. In order to do so, the difference value for each attribute was calculated by subtracting the lowest estimate from the highest estimate within one attribute. The attribute with the largest difference value received an importance score of 1, representing the attribute that was deemed most important by respondents. The other difference values were divided by the largest difference value

resulting in a relative distance between all other attributes and the most important attribute.

Predicted uptake was calculated for several hypothetical health check scenarios using $\frac{1}{(1+\exp^{-V})}$, both for each latent class and as an average class-adjusted uptake (including all coefficients in the model). Based on existing health checks in Sweden, a 'realistic scenario' for the implementation of a national health check was formulated; cost 30 euro, 30 min consultation time, a letter besides accessing the results online, 2 weeks waiting time, written in everyday words, lifestyle recommendations included. Predicted uptake was then calculated for this realistic scenario as well as for several scenarios with a change in one of the attribute levels. By comparing the uptake rates of the different scenarios, the effect of changing one attribute at a time on the predicted uptake of the 'realistic scenario' was estimated. Based on the estimates of the latent class model, the least and most preferred health check scenarios were determined.

3 Results

In total, 482 respondents started the survey (response rate 29.6%). Seven respondents asked for a paper version of the survey. A total of 59 respondents were excluded from the analysis because they dropped out before the choice tasks ($n = 36$) or dropped out between choice tasks 1 and 10 ($n = 23$). These respondents included a higher proportion of younger individuals ($p = 0.02$) and individuals born outside of Sweden ($p = 0.01$) than respondents who completed the survey. The final analysis included 423 individuals.

The characteristics of the respondents are summarized in Table 2. Most respondents were working, living together with a partner, had a university education and were born in Sweden. A fourth of the respondents were obese and 30% were diagnosed with or treated for hypertension.

3.1 Preferences for Cardiovascular Risk Information

On average (class-adjusted results), respondents' decision to take part in a health check was mostly driven by the cost of the health check, followed by consultation time, inclusion of lifestyle recommendations, details of written results, waiting time and notification method. However, differences in preferences were found.

The latent class analysis identified three classes. The average probability was 43% of belonging to Class 1 while this was 11% for Class 2 and 46% for Class 3 (Table 3).

Classes 1 and 3 had a negative coefficient on the opt-out alternative (meaning that they were positive to participation) while Class 2 was positive to opt-out (negative to participating). In all classes, cost was the most important attribute considered; with increasing costs, the willingness to participate in the health check significantly decreased. At the attribute level, all attributes except for waiting time contributed to utility in Class 1, while cost and notification method were the only attributes contributing to the utility of respondents in Class 2 and notification method was the only attribute not contributing to utility in Class 3 (Table 3). More specifically, respondents in Class 3 preferred 15 minutes and 30 minutes of consultation time over no consultation, written results consisting of numerical values, everyday words and an overall assessment over only numerical values and receiving lifestyle recommendations. Additionally, respondents in Classes 1 and 2 preferred receiving their test results by letter over only being able to access their results through their electronic health records. Class 3 preferred waiting 2 days over 2 weeks. Respondents in Classes 1 and 2 were less likely to have sufficient HL compared with respondents in Class 3. The relative importance of each attribute is presented in Fig. 2.

3.2 Predicted Uptake

On average, the predicted uptake ranged from 7 to 88% between least and most preferred scenarios (Table 4). Class 1 had the highest predicted uptake for all the calculated scenarios. The predicted uptake for the realistic scenario was 66% but when made free of charge the uptake increased to 75%.

The effect of changing one attribute at a time on the predicted uptake of the 'realistic scenario' was estimated (Fig. 3). Increasing the cost of the health examination and excluding the consultation and lifestyle recommendation, while keeping all other attributes constant, decreased the predicted uptake the most.

4 Discussion

This study revealed three different patterns of preferences for taking part in a health check and communication of test results. Cost was the most important factor for all respondents and, together with notification method, the only attribute of importance for a minority (11%) group of respondents (Class 2). The other respondents specifically preferred consultation time and more comprehensive written results (Class 1) or consultation time, shorter waiting time and lifestyle recommendations (Class 3). Class membership was predicted by health literacy (HL). Individuals with sufficient HL were more likely to belong to Class 3. The higher emphasis on longer consultation time and more comprehensive written results in Class 1 might be a sign of a need for more support from the health care provider to utilize the test results due to a lower HL level. Respondents with lower

Table 2 Characteristics of respondents. $N = 423$

Variable (*n*)	*N* (%)	Mean (SD)
Age (423)		57.3 (8.7)
Sex (422)		
Female	209 (49.5)	
Male	213 (50.5)	
Other		
Education (419)		
Primary school	31 (7.4)	
High school	187 (44.6)	
University	201 (47.5)	
Health literacy (421)		
Sufficient	132 (31.4)	
Problematic	176 (41.8)	
Insufficient	113 (26.8)	
Medical training (421)		
Yes	84 (19.9)	
Born in Sweden (423)		
No	66 (15.6)	
Years lived in Sweden		29.8 (15.3)
Financially strained (422)		
Yes	28 (6.6)	
Marital status (423)		
Married, co-habiting	336 (79.4)	
Living apart from partner	17 (4.0)	
Single	70 (16.5)	
Occupation (421)		
Working	264 (62.7)	
Student	4 (1.0)	
Retired	131 (31.1)	
Long-term sick leave	6 (1.4)	
Unemployed	13 (3.1)	
Other	3 (0.3)	
Family history of MI (411)		
Yes	103 (25.1)	
Self-perceived general health (420)		
Bad	12 (3.7)	
Somewhat good	52 (16.2)	
Good	109 (34.0)	
Very good	106 (33.0)	
Excellent	42 (13.1)	
Perceived risk of MI compared with people of same sex and age (399)		
Much lower	66 (16.5)	
A bit lower	90 (22.6)	
Same	169 (42.4)	
A bit higher	65 (16.3)	
Much higher	9 (2.3)	
Body mass index (BMI) (405)		26.3 (4.3)
≥ 25 (overweight)	283 (69.9)	
≥ 30 (obesity)	97 (24.0)	
Smoking (417)		
Yes	21 (5.0)	
Experienced stressful period (416)		

Table 2 (continued)

Variable (*n*)	*N* (%)	Mean (SD)
Never	21 (5.0)	
Some periods	117 (28.1)	
Some periods the last 5 years	183 (44.0)	
Constant stress	44 (10.6)	
Constant stress the last 5 years	51 (12.3)	
Physical activity (418)		
Never	77 (18.2)	
Time to time	72 (17.0)	
1–2/week	98 (23.4)	
2–3/week	92 (22.0)	
> 3 week	79 (18.9)	
One or more lifestyle risk factors (stressed, obese, never PA) (397)	193 (48.6)	
Hypertension (treated or diagnosed) (423)	119 (28.1)	
Cholesterol (treated or diagnosed) (423)	62 (14.7)	
Diabetes (treated or diagnosed)	30 (7.1)	
One or more risk factors (hypertension, high cholesterol, diabetes type 2) (423)	145 (34.3)	
CVD (treated or diagnosed) (423)	30	
MI	10 (2.4)	
Valvular	2 (0.5)	
Atrial fibrillation	9 (2.1)	
Heart failure	6 (1.4)	
Angina	7 (1.7)	
Stroke	6 (1.4)	
Other chronic disease (423)	68 (16.1)	

CVD cardiovascular disease, *MI* myocardial infarction

HL level (Classes 1 and 2) also valued receiving a letter alongside accessing their results online as important, while respondents with sufficient HL (Class 3) did not.

The predicted uptake rate ranged between 7 and 88% from the least preferred to the most preferred health check scenario. The predicted uptake for the realistic scenario was on average 66%, which is similar to the observed uptake of 65% in a Swedish health check program [5]. About 43% of the respondents (Class 1) were very positive to participation and showed high willingness regardless of the condition of the health check. A higher willingness to participate in health programs from people with lower health literacy has been reported in previous studies on vaccination [27]. This might be an indication of a lower capacity to consider the details of health information when making informed decisions, but could also indicate a greater confidence in health institutes offering these programs. These individuals might also perceive the health check as an opportunity to learn more about cardiovascular risk factors and health in general [6]. Tailoring the health check based on preferences will not have a major impact on the uptake rate for such individuals. However, since respondents in this class are more likely to have low HL, meeting their needs is crucial for the utilization of the test results. Another group of respondents (Class 3) was positive to participation but sensitive to the conditions of the health check and showed the greatest variation in predicted uptake depending on the design of the health check. This might be explained by the higher HL level of this class, as these respondents are expected to have better understood the information in the DCE.

To reach the participation rate of > 70% recommended for screening programs by WHO, the 'realistic scenario' included in this study will need to be adjusted; either the cost will need to be decreased, an overall assessment added or waiting time decreased (Fig. 2). Although cost was the most important factor, it is not sufficient to offer health checks free of charge if other requirements regarding how the test results are communicated are not in place (enough consultation time, lifestyle recommendations and comprehensive, easy-to-read written results). The predicted uptake rate for the group that mainly took cost into consideration and were consistently negative to participation reached a maximum of 20%, even in cases where the health check was free of charge. This indicates that there are other factors not considered in this study, explaining why this group is reluctant to participate. Previous studies have found age [28] and living alone [5] to be associated with non-participation. No such associations were found in this study. Low income

Table 3 Latent class model ($n = 423$)

	Class 1			Class 2			Class 3		
	Mean	SE	95% CI	Mean	SE	95% CI	Mean	SE	95% CI
Written results									
Numerical (ref)	−0.55	0.08	−0.39 to −0.71	−0.26	0.00	−0.25 to −0.27	−0.42	0.02	−0.38 to −0.46
And everyday words	−0.09	0.05	−0.96 to 0.01	0.11	0.19	−0.26 to 0.48	−0.10	0.05	−0.20 to 0.01
And overall assessment	0.64**	0.07	0.50 to 0.78	0.15	0.20	−0.25 to 0.55	0.52**	0.05	0.42 to 0.61
Notification method									
EHR (ref)	−0.24	0.09	−0.07 to −0.41	−0.35	0.02	−0.31 to −0.39	−0.05	0.02	0.03 to −0.04
EHR and letter	0.24**	0.04	0.15 to 0.32	0.35*	0.17	0.01 to 0.68	0.05	0.04	−0.03 to 0.13
Waiting time									
2 days (ref)	0.33	0.12	0.56 to 0.10	−0.07	0.04	0.01 to −0.15	0.61	0.04	0.69 to 0.55
1 week	0.04	0.07	−0.11 to 0.18	0.19	0.26	−0.32 to 0.70	0.10	0.07	−0.04 to 0.24
2 weeks	−0.17	0.09	−0.35 to 0.0	−0.01	0.29	−0.57 to 0.56	−0.79**	0.09	−0.96 to −0.63
3 weeks	−0.20	0.14	−0.45 to 0.06	−0.25	0.33	−0.90 to 0.39	0.08	0.08	−0.08 to 0.25
Lifestyle recommendations									
No (ref)	−0.49	0.06	−0.36 to −0.62	0.28	0.03	0.34 to 0.22	−0.67	0.01	−0.64 to −0.70
Yes	0.49**	0.06	0.37 to 0.62	−0.28	0.19	−0.66 to 0.11	0.67**	0.05	0.58 to 0.76
Consultations time									
No consultation (ref)	−1.01	0.10	−0.82 to −1.20	−0.13	0.01	−0.12 to −0.14	−0.94	0.02	−0.90 to −0.98
15 min	0.40**	0.07	0.27 to 0.53	0.21	0.21	−0.20 to 0.61	0.42 **	0.06	0.30 to 0.54
30 min	0.61**	0.08	0.46 to 0.75	−0.07	0.21	−0.48 to 0.33	0.52**	0.05	0.42 to 0.62
Cost	−2.62**	0.26	−3.14 to −2.11	−4.64**	0.84	−6.28 to −3.00	−2.20**	0.20	−2.60 to −1.79
Opt-out	−3.65 **	0.23	−4.10 to −3.21	1.60**	0.27	1.07 to 2.13	−0.30*	0.14	−0.57 to −0.03
Constant alternative B	0.17	0.09	−0.00 to 0.34	−0.26	0.33	−0.92 to 0.38	0.46**	0.08	0.30 to 0.61
Average class probability	0.43			0.11			0.46		
Sufficient health literacy	−0.58*	0.26	−1.08 to −0.08	−0.92**	0.26	−1.42 to −0.42	Ref.		

Model fit (AIC: 1.12, log likelihood: −3526, pseudo *r*-square: 0.49)

ERH Electronic Health Record

*$p > 0.05$, **$p > 0.01$

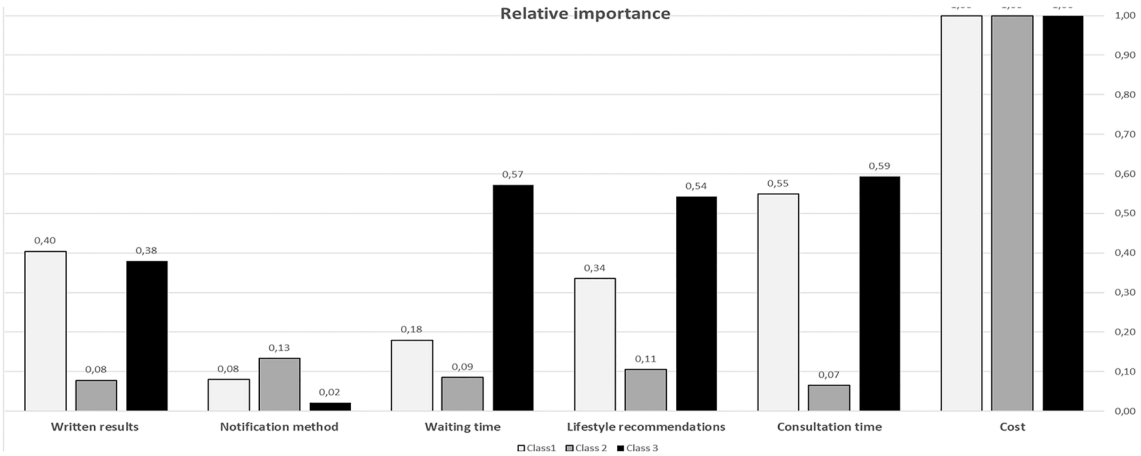

Fig. 2 Relative importance scores of the attributes in all three classes

Table 4 Predicted uptake probabilities per class of the latent class model as well as adjusted for class assignment

	Class 1 (%)	Class 2 (%)	Class 3 (%)	Average (%)
1. Most preferred: overall written assessment, letter, 2 days waiting time, lifestyle recommendations, 30-min consultation time, free of charge	100	20	93	88
2. Least preferred: only numerical information, no letter, 3 weeks waiting time, no lifestyle recommendations, no consultation, €120	15	0	2	7
3. Realistic: everyday words, letter, 2 weeks waiting time, lifestyle recommendations, 30-min consultation time, €30	98	5	50	66
4. Realistic €15: written in everyday words, letter, 2 weeks waiting time, lifestyle recommendations, 30-min consultation time, €15	99	10	58	70
5. Realistic Free of charge: everyday words, letter, 2 weeks waiting time, lifestyle recommendations, 30-min consultation, free of charge	99	18	66	75
6. Realistic €60: everyday words, letter, 2 weeks waiting time, lifestyle recommendations, 30-min consultation time, €60	96	1	34	57

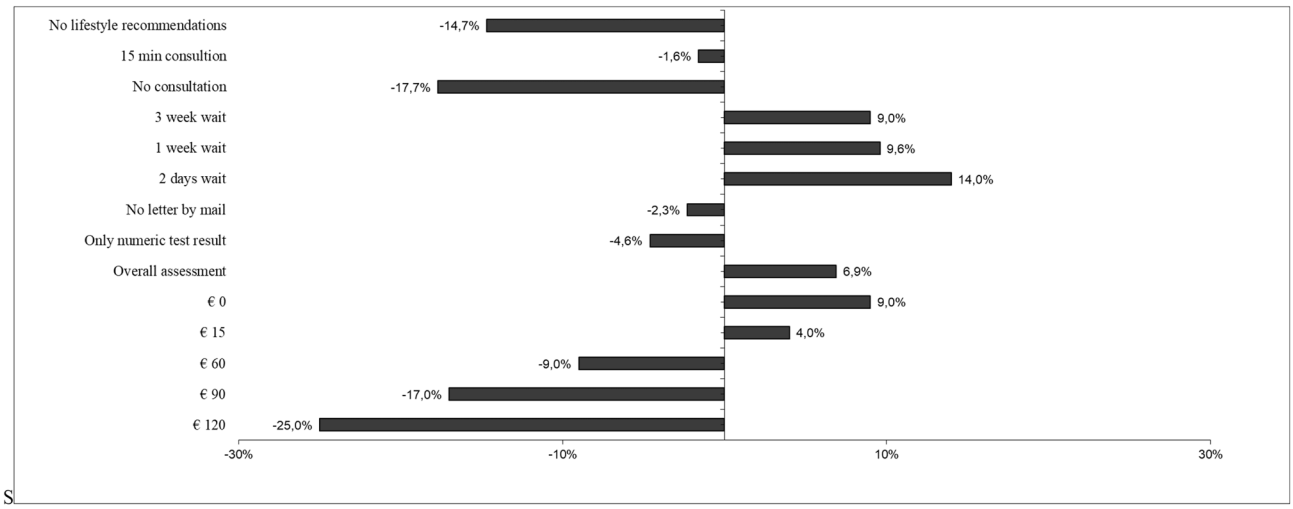

Fig. 3 Effect on 'realistic scenario' with one attribute level change*. *Change in predicted uptake if the 'realistic scenario' (average predicted uptake 66%) changed in one attribute level (written result in numerical and everyday words, notification through electronic health record and letter, 2 weeks waiting time, lifestyle recommendations included, 30-min consultation time, 300 SEK out-of-pocket cost)

has also been associated with non-participation [5]. In this study, being financially strained was associated with class membership. People with financial strains were more likely to belong to class 2 (results not shown). Due to the correlation between financial constraints and health literacy, these variables could not be included in the LCM simultaneously.

We suggest that policy makers adapt the communication of test results based on the needs of individuals with low health literacy. Guidelines on how to communicate risk and to improve health literacy recommend, for example, re-writing the test results at a lower reading level and removing medical terminology, providing the information in multiple languages but also strengthening the counselling skills of health professionals by adapting techniques such as teach back [29, 30]. Furthermore, it is recommended to ensure that test results are accompanied by information about what to do next and to offer consultation time that supports informed decisions [29]. Also, a well-planned design of how test results from health checks are communicated will not only meet the needs of the of low-HL individuals but can also be a way to increase their HL [31]. Finally, when deciding on the price for health checks, consider the consequences for people with financial difficulties since they have a higher cardiovascular risk and therefore are important to recruit to health checks.

4.1 Strengths and Limitations

A random sample was used in this study. However, the response rate was only 29.9%, which may make it problematic to generalize the results to the whole population since some groups in society might not have been reached by this

study. Six individuals contacted us, declining participation due to language difficulties or because they found it too exhausting. Additionally, ten individuals were lacking internet access and asked for a paper version of the survey. It is possible that more individuals did not participate of this reason. However, we think that the results apply for the majority of the population but acknowledge the fact that the preferences of minority groups probably were not adequately captured by this study. We suggest that future research investigate the preferences of these groups and use adapted recruitment strategies for that specific aim. We did not assess the respondents' prior experience with health checks, which may have contributed to explaining differences in preferences.

5 Conclusion

Cost was most important when deciding whether to participate in a health check. Although cost was the most important factor, it is not sufficient to offer health checks free of charge if other requirements regarding how the test results are communicated are not in place; participants need to be able to understand their results. To optimize the use of health check test results, especially for low health literate people, health checks could be accompanied by tailored written reports, consultations and lifestyle recommendations.

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Declarations

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Conflict of interest The authors declare no conflict of interest.

Ethics approval Ethical approval for this study was granted by the Swedish Ethical Review Authority (dnr:2019:03843).

Consent
Informed consent to participate was obtained for all respondents participating in the study.

Availability of data and material The datasets generated and analyzed during the current study are not publicly available due to the data management protocol included in the ethical application, but may be available from the corresponding author upon reasonable request.

Code availability Not applicable.

Author contributions All authors contributed to the study conception and design. ÅG and JV conducted the experimental design, ÅG constructed the survey and conducted the data collection. ÅG, JV and BH planned the statistical analysis. The first draft of the manuscript was written by ÅG and all authors commented and contributed intellectually to previous versions of the manuscript. All authors read and approved the final manuscript and agreed on all the steps taken in the project.

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