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Perceived importance of the benefits and harms of colorectal cancer screening: a best-worst scaling study

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ABSTRACT

Objective: To elicit the relative importance of the benefits and harms of colorectal cancer (CRC) screening among potential screening participants in the Dutch population.
Methods: In a consensus meeting with 11 experts, risk reduction of CRC and CRC deaths (benefits) and complications from colonoscopy, stress of receiving positive fecal immunological test (FIT) results, as well as false positive and false negative FIT results (harms) were selected as determinant end points to consider during decision making. We conducted an online best-worst scaling survey among adults aged 55 to 75 years from the Nivel Dutch Health Care Consumer Panel to elicit preference values for these outcomes. The preference values were estimated using conditional logit regression.

Results: Of 265 participants, 234 (89%) had ever participated in CRC screening. Compared to stress of receiving a positive FIT result, the outcome perceived most important was the risk of CRC death (OR 4.5, 95% CI 3.9 to 5.1), followed by risk of CRC (OR 4.1, 95% CI 3.6 to 4.7), a false negative FIT result (OR 3.1, 95% CI 2.7 to 3.5), colonoscopy complications (OR 1.6, 95% CI 1.4 to 1.8), and a false positive FIT result (OR 1.4, 95% CI 1.3 to 1.6). The magnitude of these differences in perceived importance varied according to age, educational level, ethnic background and whether the individual had previously participated in CRC screening.
Conclusion: Dutch men and women eligible for FIT-based CRC screening perceive the benefits of screening to be more important than the harms.

Highlights

- Colorectal cancer screening is beneficial on a population level, but the benefits do not always outweigh the potential harms on an individual level. Individual preferences play an important role in weighing the benefits and harms of participating in screening.
- In this study, we quantified how important screening invitees perceived the harms of colorectal cancer screening as compared to the benefits.
- The preference values obtained in this study will be used to help screening invitees make an informed decision about participating in screening

Introduction

The Dutch colorectal cancer (CRC) screening program was launched in 2014. Adults aged 55 to 75 years receive a biennial invitation to participate in fecal immunochemical test (FIT) based screening. Participants with a positive FIT are referred for a colonoscopy during which CRC or polyps can be detected and potentially removed.

Screening for CRC decreases its incidence and mortality.[1,2] On a population level, these benefits outweigh the potential harms of screening, such as being unnecessarily referred for colonoscopy and the relatively rare occurrence of post-colonoscopy CRCs.[2-4] On an individual level, however, the benefits do not necessarily outweigh the harms.[5] Individuals with little or no risk of CRC will not profit from screening but may experience its harms. Furthermore, not only the risk profiles of individuals, but also the perceived importance of illnesses or screening endpoints is important in decisions.[6] Some risk accepting individuals may opt to participate in screening despite of having the lowest risk of CRC, whereas other risk-averse individuals may not opt to participate.

Weighing the benefits against the harms of screening is a natural part of decision making, but it is often unguided in many healthcare settings, including CRC screening. Empirical approaches are needed to carefully weigh the benefits and harms to inform the decision to participate in screening. For example, Timmermans stated that individuals would make an informed decision about participating in cancer screening when they understand the details, including the aim, benefits and harms, their baseline level of risk, uncertainty of test results, as well as the medical, social, and financial consequences of positive test results.[7]

Currently, men and women who are invited for CRC screening receive population-level information about the benefits and harms of participating in screening. Screening inviteeswith low health literacy have problems with accessing, comprehending and applying thisinformation material, or lack essential knowledge for informed decision making about participation in CRC screening.[8] This concerns a large group of screening invitees since one out of four Dutch adults have inadequate health literacy skills.[9] Providing less cognitively demanding information, for example through interactive web-based formats incorporating preference elicitation tools, can support informed

decision making among people with inadequate ánd adequate health literacy.[10-12] In The Netherlands, an online decision aid for CRC screening targeted at individuals with low health literacy skills has been developed and pilot-tested.[11] However, the decision aid could be further refined to better support individuals in balancing the benefits and harms of CRC screening. Benefit-harm balance modelling, which incorporates personal risks and preferences, may be an effective approach.[13,14] As a first step in an effort to develop such a benefit-harm balance model, this study aimed to elicit the preferences and examine the preference variations of benefit and harm outcomes of CRC screening across individual characteristics among Dutch men and women eligible for CRC screening.

Material and methods

Study design and participants

We conducted an online case 1 best-worst scaling survey,[15] a variant of a discrete choice experiment, among potential participants of the Dutch CRC program. Participants were recruited from the Dutch Health Care Consumer Panel of the Netherlands Institute for Health Services Research (Nivel). At the start of the study (April 2020), the panel consisted of more than 11,000 adults aged 18 years and older. The panel is renewed on a regular basis to maintain a representative sample of the Dutch population.[16]

There is no standard sample size estimation for best-worst scaling surveys. Anchoring on experiences from similar previous studies,17,18 we aimed to include 200 respondents to achieve enough power to provide precise estimates of preferences and to explore variation in preferences. We invited a random sample of 500 participants aged 55 to 75 years to meet our sample size, expecting a participation rate of >50%.

Selection of benefits and harms

We reviewed benefits and harms from the literature as a basis for the selection of outcomes during a consensus meeting among experts. Eleven experts in the field of CRC and CRC screening participated in the meeting, including two gastroenterologists, one manager of the Dutch Centre for Population Screening, two managers of the regional screening organizations, three epidemiologists, one health scientist, one mathematical modelling expert, and one expert in medical decision making. Each expert wrote down benefits and harms of CRC screening on a memo. Memos which contained similar benefits or harms were grouped together, after which each unique benefit and harm was written down on a whiteboard and discussed plenary. This resulted in an initial list of 11 items. During the plenary discussion, it became clear that the experts listed not only benefits and harms of CRC screening, but also practical barriers (e.g. extra costs when being referred for colonoscopy) and facilitators (e.g. receiving participation reminders) that may limit or enable people in participating in CRC screening.

As we aimed to include the benefits and harms in a risk-based benefit-harm model, we excluded the barriers and facilitators. The final list of two benefits and four harms was expressed in terms of the risk to experience each benefit or harm (see selection process in Appendix A). The benefits of CRC screening were: a lower risk to develop CRC and a lower risk to die from CRC. The harms of CRC screening were: the risk of receiving a false positive FIT result, the risk of receiving a false negative FIT result, the risk of complications during colonoscopy and the risk of stress after receiving a positive FIT result.

Best-worst scaling questionnaire

Descriptions of benefits and harms

For each of the two benefits and four harms, we developed short lay-descriptions, supported by visuals representing absolute risk information. Respondents were asked to read the descriptions before answering the best-worst scaling questions. The descriptions were aligned with the standard information material that CRC screening invitees receive with their invitation. For ease of understanding, we communicated absolute risks of benefits and harms for participants and non-participants separately, instead of relative risks of benefits and harms for participants compared to non-participants.[19,20] Since absolute risks of developing CRC and dying from CRC are not communicated in the official information brochure of the Dutch CRC screening program, we consulted a colleague and first author of a microsimulation study in which these absolute risks were estimated based on data from the Dutch CRC screening program.[21] Our colleague re-ran the original analysis while assuming that all participants would participate every two year.

The absolute risk of a false negative FIT result is not communicated in the official information brochure either. Therefore, we estimated this risk based on the FIT's sensitivity of 84% at the cut-off level of 47 µg haemoglobin per g faeces as applied in the Dutch CRC screening program.22,23 We received feedback on the lay descriptions from the Dutch Bowel

Cancer Foundation (Stichting Darmkanker in Dutch) and from the Centre for Population Screening, which coordinates the Dutch CRC screening program and develops the information materials.

Perceived importance of benefits and harms

We used a balanced incomplete block design to obtain efficiently designed sets of the benefits and harms in different blocks in the best-worst scaling approach (see Appendix B).[15] In 10 of the blocks (i.e., questions) generated by the balanced incomplete block design, there were three outcomes per block, with each of the six outcomes appearing five times in different blocks and co-occurred with another once. Respondents were asked to select two outcomes at a time from each block: the least important outcome (i.e., the worst) and most important outcome (i.e., the best) for their decision to participate in CRC screening (see Appendix C for an example question).

Other variables

Sociodemographic data (sex, age, educational level, ethnicity) were collected by Nivel. We assessed the level of health literacy using the set of Set of Brief Screening Questions (SBSQ),[24] validated in the Dutch population (see Appendix D for a more detailed explanation).[25] Previous participation in CRC screening was assessed by asking: "'Did you ever participate in the national CRC screening program?' With answering options 'yes', 'no but I was invited' and 'no but I have not been invited yet'. Whether someone had undergone colonoscopy during screening was assessed by asking: 'Were you ever diagnosed with CRC during screening?' With answering options 'yes', 'no, but I have undergone colonoscopy' and 'no, but I have not undergone colonoscopy'. In addition, we assessed whether respondents read the lay descriptions before doing the best-worst scaling exercise and whether they would use an online decision aid to decide on participation in CRC screening. We piloted the questionnaire using the three-step test-interview method in [15] individuals from the target population of CRC screening. We first asked the respondent to think aloud during completion of the questionnaire and made notes of observations on response behavior.

As a second step, we interviewed the respondent to resolve gaps in the observational data. As a third step, we conducted a semi-structured interview aimed at eliciting experiences and opinions. Small adjustments in the questionnaire were made according to the observations.[26]

Data analysis

Count analysis

We estimated aggregate and individual-based best-worst score (BW score) based on the counts of best and worst answers.[27] Standardized mean difference between the frequency with which an outcome was selected as most important across all blocks, and the frequency with which it was selected as least important was calculated. The best and worst scores ranged from -5 to +5 or -1 to +1, depending on how the scores were standardized, either with respect to the total number of respondents (N) or with respect to the total number of responses (N x five blocks to which respondents had to give answers), respectively. See footnote to Table 3 for more details. The higher the BW score, the more important the outcome was perceived.

Modeling-based analysis

We performed conditional logit regression analysis, which is a well-established method for discrete choice data, to obtain the relative preference values for the outcomes.[27] In the model we included 'stress of receiving a positive FIT result' as a reference, which was perceived as the least important outcome of all. The higher the estimates (odds ratio) for an outcome, the more important that outcome was perceived as compared to the reference.

Where adequate data were available, we investigated the effect of respondent characteristics (i.e. gender, education, ethnicity, previous screening) on preference values by conducting linear regression analyses separately for each benefit and harm outcome, in which the dependent variable was the best-worst score for that outcome and the independent variable was the characteristic of interest. The number of respondents with inadequate health literacy was too low to compare preference values between respondents with adequate and inadequate health literacy (see results Table 1).

The influence of missing values

We investigated the influence of missing values in the best-worst scaling questions by comparing characteristics of the 217 respondents included in the analysis to those 48 respondents who were excluded because either preference data were completely missing or because only unpaired responses were given.

Ethical review

The study was exempted from review by a medical research ethics committee in accordance with local regulatory guidelines and standards for human subjects' protection in the Netherlands (Medical Research Involving Human Subjects Act (WMO), 2005).

Results

Study participant characteristics

Of the 500 Nivel panel members invited for this study, 265 (53%) responded, of which the majority were native Dutch (229, 86.7%) (Table 1) The gender distribution was nearly equal, with 128 (48.3%) men. The average age was 68.1 (SD 6.1) years. Most of the respondents (234, 89%) had ever participated in a national CRC screening program, of whom 27 of them (11.6%) underwent a colonoscopy after a positive FIT at least once. CRC had been detected during screening in three (1.3%) respondents. Educational level was low in 88 (34.0%) respondents, intermediate in 95 (36.7%) and high in 76 (29.3%) respondents. Health literacy was inadequate in 18 (9.0%) respondents. Those 235 invited panel members who did not participate in this study had similar distributions of gender,

age, educational level, ethnicity and self-reported health status as those 265 who did participate in the study (appendix table E.1).

Best-worst scores

Results of the best-worst (BW) score analysis are shown in Table 2. Adequate preference data were available for 217 of the 265 respondents (81.9%). The others answered none of the BW scaling questions (7.2%) or provided incomplete responses, i.e., chose only a best or a worst outcome in each of the ten scenario's (10.9%).

Having a lower risk of dying from CRC was perceived as the most important outcome of CRC screening, with a mean BW score of 1.69, followed by having a lower risk of CRC, with a mean BW score of 1.52. The most important perceived harm was the risk of a false negative FIT result (BW score 0.81). Negative BW scores were observed for the other three harm outcomes, which means that those outcomes were more often chosen as least important than as most important outcomes. The least important harm of CRC screening was the risk of stress after receiving a positive FIT result (BW score -1.97), followed by the risk of a false positive FIT result (BW score -1.08) and the risk of complications from colonoscopy (BW score -0.98).

Relative importance of the benefits and harms

The ranking of preferences estimated with the conditional logit model were consistent with the BW scores (Table 3). Compared to the risk of stress after receiving a positive FIT result, the odds of selecting the risk of CRC death as most important was 4.5 times higher (95% CI 3.9 to 5.1) and the odds of selecting the risk of CRC as most important was 4.1 times higher (95% CI 3.6 to 4.7). The probability of perceived importance of a false negative (OR 3.1; 95% CI 2.7 to 3.5) and false positive FIT result (OR 1.4; 95% CI 1.3 to 1.6), as well as risk of colonoscopy complications (OR 1.6; 95% CI 1.4 to 1.8), was higher than that of the risk of stress after a positive FIT result.

Subgroup differences in preferences

Preferences differed according to age, educational level, having previously participated in CRC screening and ethnicity (Table 4). With each 1 year increase in age, having a lower risk of developing CRC and dying from CRC were perceived less important (BW scores -0.05; 95% CI -0.09 to -0.00 and -0.06; 95% CI -0.11 to -0.02, respectively) and having a risk of complications from colonoscopy was perceived more important (BW score 0.07; 95% CI 0.03 to 0.11). Respondents with a high educational level perceived the risk of stress after a positive FIT result (BW score -1.81; 95% CI -2.52 to -1.11), the risk of complications from colonoscopy (BW score -0.73; 95% CI -1.35 to -0.11), and the risk of a false positive FIT result (BW score -0.94; 95% CI -1.50 to -0.39) less important than respondents with a low educational level. The risk of developing CRC and the risk of dying from CRC were perceived more important among highly educated respondents than among those with a lower educational level (BW scores 1.79; 95% CI 1.15 to 2.43 and 1.89; 95% CI 1.25 to 2.53, respectively). Respondents with a history of participating in CRC screening perceived the risk of stress after a positive FIT result (BW score 1.12; 95% CI 0.36 to 1.88) and the risk of a false positive FIT result (BW score 0.78; 95% CI 0.20 to 1.36) more important, and the risk of dying from CRC (BW score -0.88; 95% CI -1.59 to -0.18) less important than those without a history of participation. Respondents with a migrant background perceived the risk of stress after a positive FIT result less important (BW score -1.11; 95% CI -2.04 to -0.18) than native Dutch respondents.

Influence of missing preference values

Best and worst values were missing for respectively 15.8% and 16.6% of respondents in the first choice block and this increased respectively to 43% and 34.3% of respondents in the 10th choice block. There were no statistically significant differences in age, gender, previous participation in CRC

screening, educational level, and ethnicity between those 217 respondents included and those 48 respondents excluded from the analysis (appendix table E.2).

Intention to use an online decision tool

Most respondents answered to certainly not (53.1%) or probably not (22.7%) needing help with weighing the benefits and harms of CRC screening (appendix table E.3). Almost a quarter of respondents (22.7%) reported to certainly or probably use an online decision aid to help them to decide on participating in CRC screening.

Discussion

In this survey among respondents who were eligible for participation in the Dutch national FIT-based CRC screening program, the benefits of screening were perceived more important than its potential harms. Of the four harms of screening, respondents perceived the risk of a false negative FIT result considerably more important than the risk of complications from colonoscopy, the risk of a false positive FIT result and the risk of stress after receiving a positive FIT result.

The degree to which the benefits were preferred over the harms differed between subgroups of age and educational level. Older adults perceived the lower risk of developing CRC and dying from CRC less important, and the higher risk of complications from colonoscopy more important than younger individuals. This is not surprising, since both the risk of dying from any cause and the risk of complications from colonoscopy increase with age.[28,29] Highly educated men and women perceived the benefits of CRC screening more important, and some of the harms of screening less important than lower educated people. This is in line with findings from a large population-based study, in which individuals with a lower socioeconomic status (SES) rated the benefits of CRC screening lower and were more fearful and fatalistic about cancer.[32] In addition, individuals with a lower SES are less health conscious, have stronger beliefs in the influence of chance on health, think less about the future and have a lower life expectancy than people with a higher SES.[30,31.]Health literacy plays an important role in this as well, as individuals who experience difficulties accessing and understanding information about CRC and CRC screening have less positive attitudes towards CRC screening than individuals who do not experience such difficulties.[33-35] These observed age and education-related differences in perceived importance of benefits and harms may inform targeted communication of the CRC screening program.

In other screening programs such as cervical cancer screening and breast cancer screening, the benefits of screening are also perceived more important than the harms.[36-38] However, while we observed that a false negative FIT result was perceived as most important harm in CRC screening, a false positive test result was perceived as most important harm in cervical screening.[36] Numerical risk information may explain this difference in perceived importance of harms between screening programs, as in cervical screening the risk of a false positive HPV test is much higher than the risk of a false negative HPV test,[36] while in CRC screening the risk of a false positive FIT is similar to the risk of a false negative FIT.[39] Recently, it was observed among screening participants and screening naïve individuals that the majority of people do not change their decision whether or not to participate in CRC screening on the basis of numerical risk information on the benefits and harms of screening.[40] Prior perceptions of screening and, for those who participate in screening, their opinion that screening is worthwhile as long as one person might benefit, are more important for this decision.[40] This is in line with a review of personalized cancer risk communication, which reported that decisions are often influenced by emotions and attitudes and not by quantitative risk-based information.[41] Interestingly, communicating numeric risk information solely to screening naïve individuals did impact intention to participate in CRC screening in one study.[42] Numeric false negative risk information reduced people's interest in screening as compared to no numeric risk information, while numeric false positive risk information did not affect attitudes towards screening.[42] This helps

to explain our finding that the risk of a false negative FIT result was perceived more important than the risk of a false positive FIT result. In the Netherlands, the standard information material used in the national CRC screening program does not provide numeric false negative risk information. The risk of a false negative FIT result is communicated as "The national CRC screening program does not offer 100% certainty. There is always a risk that CRC is not being detected." It would be relevant to investigate the impact of providing numeric false negative risk information in the Dutch information materials on informed decision making and on attitudes towards CRC screening.

A limitation of this study is that there were missing values in the best-worst scaling questions. Even though the best-worst scaling method efficiently measures preferences and overcomes the methodological and psychometric weaknesses of other methods,[43,44] 58% of respondents had at least one missing value in one of the ten choice sets. The increase in missing values with increasing number of choice sets indicates that respondents became bored or annoyed rather than experiencing difficulty with answering the questions. Nevertheless, characteristics such as age, gender, educational level and previous participation in CRC screening of those included and excluded from the best-worst scaling analysis were similar, suggesting that perceived importance of benefits and harms of CRC screening was unlikely different among those excluded from the analysis.

Since the majority of our study respondents had ever participated in CRC screening, we cannot generalize these findings to screening naïve adults and to screening refusers. Refusers of CRC screening likely perceive the harms, i.e. complications from colonoscopy, false negative FIT and false positive FIT, more important than the benefits, but there is no evidence supporting this hypothesis. According to findings of a systematic review of 94 qualitative studies, screening refusers believed that a negative test result is just a snapshot and that CRC can still rapidly develop after screening participation.45 This might suggest that screening refusers perceive the benefits less important than screening participants, but this does not shed light on whether screening refusers also perceive the benefits less important than the harms. Furthermore, our study was focused on the national CRC screening situation. Individuals with a CRC diagnosis are not eligible for FIT-based screening but will remain under treatment or surveillance. Therefore, our study does not provide information about the perceived importance of benefits and harms of screening for the population with a previous CRC diagnosis.

The preference values obtained in this study will be used in a benefit-harm analysis, which will then be incorporated into an existing online decision aid that has previously been developed and piloted among individuals with varying health literacy levels.[11] The benefit-harm analysis aims to improve informed decision making about participating in CRC screening as it will show an individual whether the benefits of screening outweigh the harms or vice versa, while accounting for the individual's preferences. In the decision aid, individual risk profile will be assessed with a questionnaire and importance of benefits and harms will be assessed with a best-worst scaling questionnaire. The answers from the decision aid, the preference values from the current study and the estimated risks from our planned benefit-harm analysis study, will be used to calculate the probability to achieve a net benefit by participating in CRC screening. This probability will be converted into a traffic light scheme, in which an index of >60% means that the benefits likely outweigh the harms (green color), an index of 40-60% indicates uncertainty about whether benefits outweigh the harms (orange color) and an index of <40% indicates that the harms likely outweigh the benefits (red color).[14]

Conclusion

Dutch men and women eligible for FIT-based CRC screening perceived the benefits of CRC screening more important than the harms. The preference values obtained in this study can be used to assess the individual benefit-harm balance of participating in screening, thereby enabling informed decision making.

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Tables and figures

Table 1. Characteristics of the 265 respondents in this study

	N (%)
Male	128 (48.3)
Age, mean (SD)	68.1 (6.1)
Ever participated in the national screening program	263 (99.2)
Yes	234 (89.0)
No, but was invited	22 (8.4)
No, not invited yet	7 (2.6)
Colorectal cancer detected during screening?	234 (89.0)
Yes	3 (1.3)
No, but I did undergo a colonoscopy	24 (10.3)
No, I did not undergo a colonoscopy	207 (88.5)
Self-reported health status in general	254 (95.8)
Excellent	20 (7.9)
Very good	46 (18.1)
Good	142 (55.9)
Moderate	41 (16.1)
Bad	5 (2.0)
Educational level[a]	259 (97.7)
Low	88 (34.0)
Intermediate	95 (36.7)
High	76 (29.3)
Health literacy	201 (75.8)
Adequate	183 (91.0)
Inadequate	18 (9.0)
Ethnicity[b]	264 (99.6)
Native Dutch	229 (86.7)
Western ethnic background	29 (11.0)
Non-western ethnic background	6 (2.3)

SD, standard deviation.

[a] low educational level: until pre-vocational secondary education (VMBO); intermediate educational level: secondary vocational education (MBO), higher general secondary education (HAVO) or pre-university education (VWO); high educational level: higher professional education (HBO) or higher.

[b] According to the definition of Statistics Netherlands (CBS). Western ethnic background: at least one parent born in foreign country in Europe (excl. Turkey), North America, Oceania, Indonesia or Japan; non-western ethnic background: at least one parent born in foreign country in Africa, Latin America, Asia (excl. Indonesia and Japan) or Turkey.

Table 2. Ranking importance of benefits and harms of CRC screening using count analysis

	Most important outcome[a]	Mean most important[b]	Least important outcome[c]	Mean least important[d]	Best-worst score[e]	standardized best-worst score[f]
Lower risk of developing CRC	450	2.07	119	0.55	1.52	0.30
Lower risk of dying from CRC	454	2.09	86	0.40	1.69	0.34
Risk of stress after positive FIT	103	0.47	530	2.44	-1.97	-0.39
Risk of colonoscopy complications	145	0.67	358	1.65	-0.98	-0.20
Risk of false negative FIT	312	1.44	175	0.63	0.81	0.16
Risk of false positive FIT	148	0.68	382	1.76	-1.08	-0.22

CRC, colorectal cancer; FIT, fecal immunological test.

[a] The total number of responses selected as the most important outcome that was counted among the 217 respondents, each of whom gave a response in five blocks/questions. For example, there were 450 responses selecting CRC risk as the most important outcome out of 1085 possible responses (217 respondents x 5 blocks).

[b] The mean number of responses selected as the most important outcome (e.g., 450/217=2.07 for CRC risk).

[c] It was calculated as in the column[a], but this time for the least important responses (e.g., 119 for CRC risk, most likely when it appeared with CRC death).

[d] Calculated as in column[b], but this time for least important responses (e.g., 119/217=0.55).

[e] Best-worst score standardized with respect to number of respondents. It was calculated as the difference between the frequency with which an outcome was selected as most important across all blocks (column[b]) and the frequency with which it was selected as least important across all blocks (column[d]). The values range from -5 to +5.

[f] Best-worst score standardized with respect to total possible responses. For example, CRC risk was selected 450 as the most important and 119 as the least important (best-worst difference of 331) out of 1085 possible responses (217 participants x 5 blocks=10850) which equals 0.30 (331/1085). Values range from -1 to +1.

Table 3. Relative importance of benefits and harms of CRC screening using model-based analysis

	Odds ratio (95% CI)
Risk of stress after positive FIT result	1.00
Lower risk of developing CRC	4.1 (3.6 to 4.7)
Lower risk of dying from CRC	4.5 (3.9 to 5.1)
Risk of complications from colonoscopy	1.6 (1.4 to 1.8)
Risk of false negative FIT result	3.1 (2.7 to 3.5)
Risk of false positive FIT result	1.4 (1.3 to 1.6)

FI, fecal immunochemical test; CRC, colorectal cancer; CI, confidence interval.

Table 4. Subgroup differences in best-worst scores for the perceived importance of the benefits and harms of CRC screening

	Risk of stress after positive test result	Lower risk of developing CRC	Lower risk of dying from CRC	Risk of complications colonoscopy	Risk of false negative FIT result	Risk of false positive FIT result
	BW score (95% CI)	*BW score (95% CI)*	*BW score (95% CI)*	*BW score (95% CI)*	*BW score (95% CI)*	*BW score (95% CI)*
Female vs. male	-0.57 (-1.15 to 0.02)	0.47 (-0.06 to 1.00)	0.12 (-0.42 to 0.66)	0.15 (-0.35 to 0.64)	0.15 (-0.37 to 0.66)	-0.32 (-0.76 to 0.13)
Older age (in single years)	0.04 (-0.01 to 0.08)	-0.05* (-0.09 to -0.00)	-0.06* (-0.11 to -0.02)	0.07* (0.03 to 0.11)	-0.03 (-0.07 to 0.02)	0.03 (-0.01 to 0.07)
High vs. low educational level	-1.81* (-2.52 to -1.11)	1.79* (1.15 to 2.43)	1.89* (1.25 to 2.53)	-0.73* (-1.35 to -0.11)	-0.20 (-0.85 to 0.46)	-0.94* (-1.50 to -0.39)
Ever vs. never participated	1.12* (0.36 to 1.88)	-0.68 (-1.38 to 0.03)	-0.88* (-1.59 to -0.18)	0.15 (-0.51 to 0.80)	-0.49 (-1.16 to 0.19)	0.78* (0.20 to 1.36)
Migrant background vs. native Dutch	-1.11* (-2.04 to -0.18)	0.63 (-0.23 to 1.48)	0.44 (-0.43 to 1.30)	0.04 (-0.75 to 0.83)	-1.46 (-0.52 to 1.10)	-0.28 (-0.98 to 0.43)

CRC, colorectal cancer; FIT, fecal immunological test; BW, best-worst; CI, confidence interval.

** p-value < 0.05*