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ORIGINAL RESEARCH ARTICLE

Preferences for Colorectal Cancer Screening Techniques and Intention to Attend: a Multi-Criteria Decision Analysis

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Abstract

Background Despite the expected health benefits of colorectal cancer screening programs, participation rates remain low in countries that have implemented such a screening program. The perceived benefits and risks of the colorectal cancer screening technique are likely to influence the decision to attend the screening program. Besides the diagnostic accuracy and the risks of the screening technique, which can affect the health of the participants, additional factors, such as the burden of the test, may impact the individuals' decisions to participate. To maximise the participation rate of a screening program for a new colorectal cancer program in the Netherlands, it is important to know the preferences of the screening population for alternative screening techniques.

Objective The aim of this study was to explore the impact of preferences for particular attributes of the screening tests on the intention to attend a colorectal cancer screening program.

Methods We used a web-based questionnaire to elicit the preferences of the target population for a selection of colon-screening techniques. The target population consisted of Dutch men and women aged 55–75 years. The analytic hierarchy process (AHP), a technique for multi-criteria analysis, was used to estimate the colorectal cancer screening preferences. Respondents weighted the relevance of five criteria, i.e. the attributes of the screening techniques: sensitivity, specificity, safety, inconvenience, and frequency of the test. With regard to these criteria, preferences were estimated between four alternative screening techniques, namely, immunochemical fecal occult blood test (iFOBT), colonoscopy, sigmoidoscopy, and computerized tomographic (CT) colonography. A five-point ordinal scale was used to estimate the respondents' intention to attend the screening. We conducted a correlation analysis on the preferences for the screening techniques and the intention to attend.

Results We included 167 respondents who were consistent in their judgments of the relevance of the criteria and their preferences for the screening techniques. The most preferred screening method for the national screening program was CT colonography. Sensitivity (weight = 0.26) and safety (weight = 0.26) were the strongest determinants of the overall preferences for the screening techniques. However, the screening test with the highest intention to attend was iFOBT. Inconvenience (correlation [r] = 0.69), safety ($r = 0.58$), and the frequency of the test ($r = 0.58$) were most strongly related to intention to attend.

Conclusions The multi-criteria decision analysis revealed the attributes of the screening techniques that are most important so as to increase intention to participate in a screening program. Even though the respondents may recognize the high importance of diagnostic effectiveness in the long term, their short-term decision to attend the screening tests may be less driven by this consideration. Our analysis suggests that inconvenience, safety, and frequency of the test are the strongest technique-related determinants of the respondents' intention to participate in colorectal screening programs.

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Key Points for Decision Makers

- A multi-criteria decision analysis with the analytic hierarchy process can reveal the impact of preferences on the intention to attend a screening program.
- The intention to attend a colorectal screening program is likely to be higher if the screening technique causes less discomfort and is safer.
- Diagnostic effectiveness is recognized as important, yet it appears it is not the strongest driver of the intention to attend a screening.

1 Introduction

Colorectal cancer forms in the cells of the colon or rectum that make and release mucus and other fluids. Every year, over 11,000 people in the Netherlands are diagnosed with colorectal cancer, and every year almost 5,000 people die from this disease. It is the third most common cancer in men (after prostate and lung cancer) and the second most common cancer in women (after breast cancer) in the Netherlands [1].

The progression of colorectal cancer can be described in stages. In stage 0, the cancer is found only in the innermost lining of the colon or rectum. This type is also known as carcinoma in situ. In stage I, the tumor has grown into the inner wall of the colon or rectum, but not through the wall. This occurs in stage II, where the tumor extends more deeply into and through this wall. The tissue nearby may have been invaded, but the cancer cells have not reached the lymph nodes yet. In stage III, the cancer has spread to the local lymph nodes and, in stage IV, other parts of the body are also affected. The 5-year survival rate for stage I is 95 % (92–98 %), for stage II it is 74 % (71–76 %), for stage III it is 51 % (48–54 %), and for stage IV it is 4 % (3–5 %) [2]. These findings clearly show that early detection of colorectal cancer is important to survive colorectal cancer.

There are several screening methods for the early detection of colorectal cancer, and different countries choose to implement different screening techniques. Most of them are cost effective compared with no screening, though no single screening method is optimal [3]. The most common methods are the guaiac fecal occult blood test (gFOBT), sigmoidoscopy, colonoscopy, and the double contrast barium enema (DCBE). Other, newer methods are the immunochemical fecal occult blood test (iFOBT), computerized tomographic (CT) colonography (also known as virtual colonoscopy), and the fecal (or stool) DNA test. An emerging method is capsule endoscopy. Of these methods, the National Health Council in the Netherlands has recommended that the iFOBT be added to the national health program, on account of its estimated cost effectiveness [3].

However, countries that have already implemented colorectal cancer screening report poor screening attendance [3]. The expected cost effectiveness is clearly not the sole criterion for national screening programs to succeed, as several studies have shown [4–9]. The observed cost effectiveness and actual attendance rates may differ from the expected cost effectiveness and attendance rates. Additional decision criteria, such as risks and discomfort are likely to influence an individual's decision to participate in screening programs. Hence, individual preferences for a screening with a specific test co-determine the net benefit of colorectal screening for the population. To maximize the participation rate, it is not only important to know the preferences of the screening population for alternative screening techniques, but also the impact of these preferences on their decision to attend. The impact of these preferences on the intention to attend is still unknown. The aim of this study was to analyze (i) the target population's preferences for alternative screening techniques by means of a multi-criteria decision analysis (MCDA), and (ii) to explore the impact of these preferences on their intention to attend the screening program.

2 Methods

2.1 Study Population

To conform to the advice of the Dutch Health Council on the target population to invite to the screening program, we included men and women aged 55–75 years. From its pool of Dutch respondents, representative for the general population in the Netherlands in terms of age, education, and sex, a large survey sampling organization recruited online men and women aged 55–75 years in April 2011. We excluded people who already have or have had colorectal cancer or an inflammatory bowel disease such as Crohn's disease. Not only was this likely to affect their preferences, these people have individual care plans regarding screening and follow-up and thus are not expected to participate in mass screening. The methodological exclusion criteria were respondents with highly inconsistent answers (consistency ratio >0.3) or repetitive, illogical patterns in their answers.

2.2 The Analytic Hierarchy Process (AHP)

Several techniques for MCDA can be used to estimate preferences for alternative healthcare interventions.

Commonly used techniques that include multiple attributes or criteria are, for example, discrete-choice experiments, the Simple Multi-Attribute Rating Technique (SMART), the ELimination and Choice Expressing Reality (ELECTRE), and the analytic hierarchy process (AHP). These techniques help decision makers to estimate the preferences for a finite number of alternative healthcare interventions under a finite number of decision criteria. Validation experiments showed that no single MCDA method is unambiguously more valid than the others [10].

In this study, we applied the AHP, on the grounds of its user friendliness and its transparent decision analytic support. It structures a decision problem into a hierarchy of decision criteria and decision alternatives, such as healthcare interventions. Based on a pairwise comparison technique, the AHP allows one to compare quantitatively how important the criteria are in assessing alternative healthcare interventions and how these alternative interventions perform in fulfilling these criteria. An ordinal scale refines the pairwise comparisons between two criteria or two healthcare interventions, ranging from the numerical value 1, reflecting equal importance or preference, up to and including 9, reflecting the extremely greater importance of the more important criterion, or extremely higher preference for the more preferred healthcare intervention. The consistency ratio is calculated to assess if each pairwise comparison is logically sound with regard to the remainder of the comparisons. A consistency ratio lower than 0.2 is tolerable, according to Saaty [11]. An eigenvector approach is used to calculate weighting factors that reflect the importance of the criteria and priorities that reflect the preferences for the alternative healthcare interventions. The overall preference priority of a healthcare intervention is estimated with the weighted average of the preference scores on all criteria. The AHP priority estimations are validated by comparing them with verifiable objective results [10, 12, 13], and with subjective results [14, 15]. A more detailed description of the AHP procedures is provided in the electronic supplementary material (Online Resource 1). See Saaty [16] for a full explanation of the mathematical procedures and Dolan [17] for the use of the AHP in a healthcare context.

2.3 Decision Criteria

The following decision criteria, which were included in the AHP structure (see Fig. 1), were identified by means of a literature search on preferences for colorectal cancer screening techniques [4, 5, 7, 8]

1. Sensitivity: If people DO have malignant pathological changes indicating colorectal cancer, the test gives correct positive results.
2. Specificity: If people do NOT have malignant pathological changes indicating colorectal cancer, the tests should not give false positive results; otherwise an unnecessary follow-up test with a colonoscopy is carried out, and anxiety is caused.
3. Safety: Side effects and the probabilities of complications.
4. Convenience: Low discomfort as caused by the individual's preparation for the test, the test procedure itself, and the possible follow-up procedures.
5. Frequency: Low discomfort as caused by how often people need to be screened with the test.

2.4 Decision Alternatives

We included screening tests that are expected to have acceptable cost-effectiveness ratios [3], and are discerning

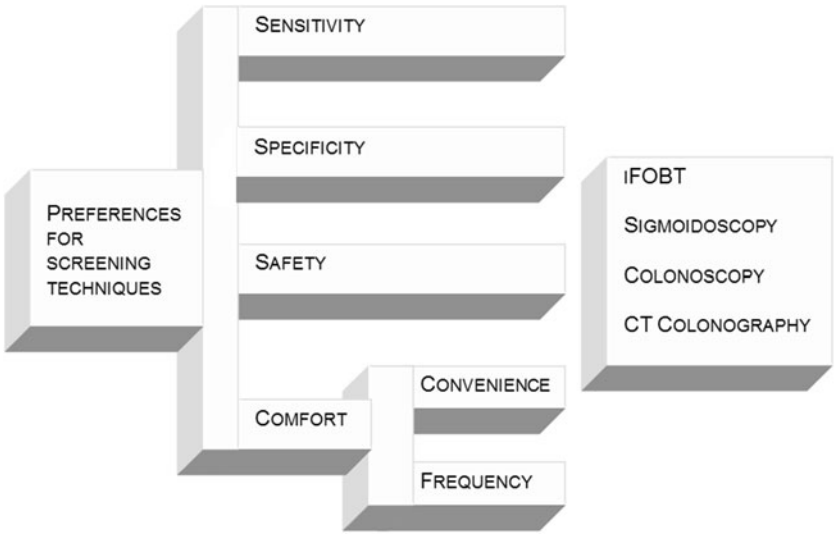

Fig. 1 Analytic hierarchy process structure with criteria and alternatives. *CT* computerized tomographic, *iFOBT* immunochemical fecal occult blood test

Table 1 Attributes of the screening tests

	Sensitivity	Specificity	Safety	Convenience	Frequency
iFOBT	14/20	19/20	No risk	Non-invasive	Every 2 years
Colonoscopy	19/20	20/20	Low risk	Invasive	Every 10 years
Sigmoidoscopy	13/20	20/20	Low risk	Invasive	Every 5 years
CT colonography	19/20	19/20	Very low risk	Non-invasive	Every 5 years

CT computerized tomographic, *iFOBT* immunochemical fecal occult blood test

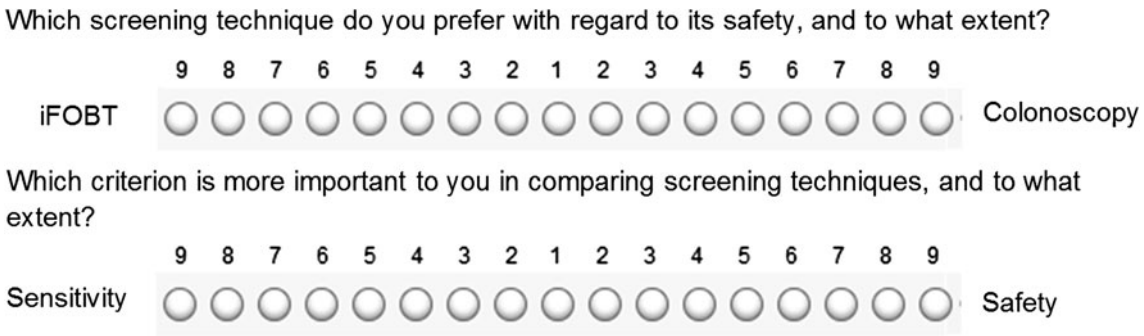

Fig. 2 Pairwise comparisons. *iFOBT* immunochemical fecal occult blood test

regarding their discomfort to participants and risks involved. Therefore, the possible, implementable colorectal cancer screening methods included in our study are as follows:

1. The iFOBT checks for hidden blood in fecal material (stool). The iFOBT uses antibodies to detect the human hemoglobin protein. In the case of a positive test result, a colonoscopy is carried out as a follow-up test.
2. Sigmoidoscopy is used to examine the rectum and lower colon by means of a lit instrument (sigmoidoscope) for precancerous and cancerous growths. During the procedure, it is possible to remove the growths, or to do a biopsy.
3. An optical colonoscopy allows one to examine the entire colon as well as the rectum. It is also possible to remove growths and to perform a biopsy with a colonoscope.
4. The CT colonography (or virtual colonoscopy) uses x-ray equipment to produce pictures of the rectum and colon. The pictures are assembled on a computer as detailed images showing possible polyps and other abnormalities. In the case of a positive test result, a colonoscopy is carried out as a follow-up test.

Table 1 shows a summary of the attributes of these screening tests [18].

2.5 Preference Elicitation

Preferences for the screening techniques were elicited through an online survey. The online questionnaire included an AHP example to demonstrate to the participants how to score their preferences for the screening techniques, and the relative importance of the criteria. Subsequently, general information about colorectal cancer and the main attributes of the screening techniques were described in words and numbers (see the summary of the attributes of the screening techniques in Table 1). As a first step of the preference elicitation, the respondents were asked to score their preferences online for the screening techniques regarding each criterion. As a second step, the respondents judged the relative importance of the decision criteria. Figure 2 shows an example of two pairwise comparisons to judge the relative preference for two alternatives regarding their safety, and respectively the relative importance of the two criteria.

The judgments were given using the double nine-point scale ranging from equally important/preferred to extremely more important/preferred. The respondents were asked to judge 37 pairwise comparisons in order to weight all the criteria and to prioritize all the screening techniques. The priorities for the screening techniques and the weighting factors for the criteria were calculated with the standard eigenvector approach of the AHP [16] (see Online Resource 1). The overall priority of a screening technique is the weighted average of all the priorities of this screening technique on each criterion. The Netherlands does not have a gold standard for screening colorectal cancer. Therefore, the overall priorities of the screening techniques were not relative to a benchmark alternative, but relative to all the screening techniques included in the analysis. Accordingly, the priorities of all the screening techniques were normalized to sum up to one. The weights of all the criteria also summed up to one.

2.6 Intention to Attend

Uninformed of, and therefore unguided by, the AHP-derived priorities of the screening techniques, the respondents were asked to estimate their intention to attend each of the colorectal cancer screenings. An example of this question is: "Imagine you have been invited for a free colorectal cancer screening by means of a colonoscopy. Do you intend to participate?" The estimations were given on a five-point ordinal scale (1 = will definitely not attend; 3 = perhaps will attend/perhaps not; 5 = will definitely attend), this scale is commonly used to measure intention to attend a screening [19].

2.7 Statistical Analysis

The correlations between the priorities for the different screening techniques and intentions to attend a screening with these techniques were calculated with Microsoft® Excel version 2010 for each respondent. In the case of a skewed distribution of the respondents' correlations, the median correlation was described. Bootstrap was used to calculate 95 % confidence intervals for the median correlations.

3 Results

3.1 Inclusion of Respondents

A total of 1,542 questionnaires were sent, and the response rate was 97 % (1,494 respondents). Of the 1,284 respondents (86 %) that met the inclusion criteria, 650 respondents (51 %) completed the questionnaire. Of these 650 respondents, 167 (26 %) met the ample threshold of a consistency ratio lower than 0.3, and these were included in the analysis. Of the 167 respondents, 62 % were male and 38 % female. The mean age was 63 years, ranging from 55 to 75 years. Of the respondents, 17 % had a lower level education (comparable to elementary school and high school), 35 % an intermediate level (comparable to selective secondary education and short cycle tertiary education), and 40 % a higher level (Bachelor, Master, or equivalent).

3.2 AHP-Derived Priorities

On comparing the four screening techniques, sensitivity (weight = 0.26) and safety (weight = 0.26) were considered to be most important, followed by specificity (weight = 0.24), frequency (weight = 0.15), and convenience (weight = 0.09). The priorities assigned to the alternative screening tests in the AHP analysis indicate that the respondents prefer CT colonography (priority = 0.36) most strongly, followed by iFOBT (priority = 0.26), colonoscopy (priority = 0.22), and sigmoidoscopy (priority = 0.17). CT colonography is particularly preferred due to its perceived sensitivity and safety. The advantages of iFOBT are more related to the safety and less to the convenience of the test. Table 2 shows all weights of the criteria and priorities of the screening techniques.

3.3 Intention to Attend

As shown in Table 3, the most frequent answer of intention to attend was 'probably yes' and 'definitely yes' for screening with iFOBT (both 36 % of the respondents), 'probably yes' for CT colonoscopy (44 %), and 'perhaps yes/perhaps not' for both colonoscopy (35 %) and sigmoidoscopy (37 %). Regarding iFOBT, 72 % of the respondents were positive about attending ('probably intend to attend' and 'definitely intend to attend'), 65 % for CT colonography, 32 % for colonoscopy, and 31 % of the respondents were inclined towards undergoing sigmoidoscopy.

3.4 Correlations between Preferences and Intention to Attend

The intention to attend a screening of 81 % of all respondents depended on which screening technique would be applied. Their scores on the five-point scale of intention to

Table 2 Analytic hierarchy process-derived preferences for the screening techniques [mean (standard deviation)]

Mean weights	Sensitivity 0.26 (0.20)	Specificity 0.24 (0.14)	Safety 0.26 (0.14)	Convenience 0.09 (0.09)	Frequency 0.15 (0.15)	Overall priority
iFOBT	0.19 (0.16)	0.23 (0.19)	0.32 (0.22)	0.38 (0.23)	0.32 (0.23)	0.26 (0.16)
Colonoscopy	0.27 (0.16)	0.23 (0.15)	0.16 (0.12)	0.16 (0.11)	0.18 (0.13)	0.22 (0.11)
Sigmoidoscopy	0.14 (0.09)	0.22 (0.13)	0.17 (0.10)	0.16 (0.10)	0.18 (0.10)	0.17 (0.08)
CT colonography	0.40 (0.19)	0.31 (0.20)	0.35 (0.19)	0.31 (0.19)	0.33 (0.17)	0.36 (0.15)

Note: The cells show the mean priorities. Under the criteria are the mean weights. The standard deviations are shown between brackets.

CT computerized tomographic, *iFOBT* immunochemical fecal occult blood test

Table 3 Frequencies of intention to attend [n (%)]

	Definitely no	Probably no	Perhaps yes/no	Probably yes	Definitely yes
iFOBT	1 (0.6)	14 (8.4)	32 (19.2)	60 (35.9)	60 (35.9)
Colonoscopy	9 (5.4)	46 (27.5)	59 (35.3)	39 (23.4)	14 (8.4)
Sigmoidoscopy	14 (8.4)	40 (24.0)	61 (36.5)	41 (24.6)	11 (6.6)
CT Colonography	5 (3.0)	15 (9.0)	39 (23.4)	73 (43.7)	35 (21.0)

Note: The percentages of respondents are shown between brackets.

CT computerized tomographic, *iFOBT* immunochemical fecal occult blood test

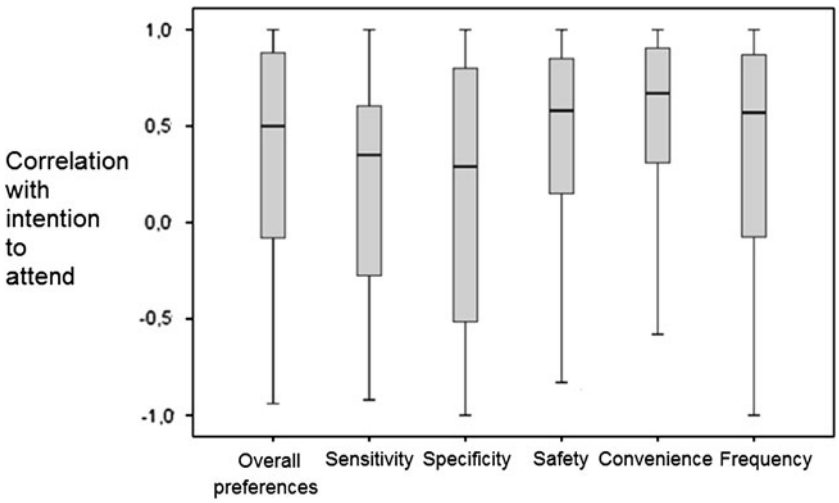

Fig. 3 Box plots of the correlation between preferences and intention to attend

attend a screening were not the same for all four screening techniques. The most positive and the most negative score on the intention to attend one of the tests differed one point for 37 % of all respondents. These scores differed by two points for 34 % of the respondents, three points for 7 % of the respondents, and four points for 4 % of the respondents. For each respondent, the correlation was analysed between his or her scores on the intention to attend the four screening techniques and his or her preferences for these screening techniques. The results show that preferences regarding convenience (median correlation = 0.69, 95 % CI 0.57–0.78), safety (median correlation = 0.58, 95 % CI 0.45–0.72), and frequency (median correlation = 0.58, 95 % CI 0.44–0.70) have the strongest positive correlations with intention to attend. The median correlations of the remainder of the preferences with intention to attend are, respectively, 0.56 (95 % CI 0.41–0.67) for the overall preferences, 0.36 (95 % CI 0.07–0.42) for sensitivity, and 0.35 (95 % CI −0.05 to 0.57) for specificity. As for all correlations, except for the correlations with respect to specificity, the confidence bounds do not contain zero, all median correlations are statistically larger than 0.

Figure 3 shows the boxplots of the distribution of the individual respondents' correlations between intention to attend the four alternative screenings and preferences for these screening techniques. Regarding the preferences on sensitivity, for example, each respondent's priorities assigned to the four screening techniques on sensitivity are correlated with this respondent's scores on intention to attend these screening techniques. The bar within the box represents the median correlation, the outer values of the box are the 25th and 75th percentile of the distributions and the end of the lines represents the minimum and maximum correlation observed. The distribution of the correlations is highly skewed towards the higher correlations.

4 Discussion

To maximize participation and the health benefits of a colorectal screening program, it is important to listen to the preferences of the screening population. Our results show that the intention to attend a screening program of 81 % of the respondents depended on their preferences for the attributes of the screening test. The respondents in our study preferred CT colonography to be included in the national screening program. The intention to attend a screening with CT colonography was relatively high. However, intention to attend a screening program with iFOBT was even higher.

The AHP analysis revealed the considerations underpinning this apparent contradiction. Sensitivity and safety of the screening techniques were the strongest determinants of the overall preferences for the screening techniques. Conversely, inconvenience, safety, and frequency of the test were most strongly related to intention to attend. Accordingly, our findings might be explained by a two-stage decision model. In this decision model, the first stage is the choice to be willing to attend a screening with one of the screening techniques. The second stage is the evaluation of the most preferred technique to attend.

4.1 Stage 1: Willingness to Consider Attending a Screening Program

Our analysis suggests that, besides diagnostic effectiveness, inconvenience and safety are relevant criteria when selecting screening tests. These criteria are even likely to be the strongest technique-related determinants of the respondents' intention to participate in the new colorectal cancer screening program in the Netherlands. These criteria often have short-term, yet direct consequences on the health and quality of life of the participants. Negative consequences at the time of the screening test in the near future appear to be more important for the decision to attend a screening program than uncertain advantages in the future for the individual at stake. None of the other studies on preferences of colorectal cancer screening techniques [4, 5, 7, 8] have indicated that inconvenience and safety could be so essential for the intention to participate in colorectal cancer screenings.

4.2 Stage 2: Preferred Screening Technique to be Included in the National Screening Program

In general, the respondents indicated that, with respect to the selection of a new screening technique in the national screening program, the most important decision criteria should be diagnostic sensitivity, safety, specificity, frequency, and inconvenience of the screening tests, respectively. This rank order is reasonably in line with the outcomes of previous studies on preferences for colorectal cancer screening techniques [4, 12]. Regarding the specific screening techniques included in our study, the diagnostic effectiveness of CT colonography, and the safety and convenience of both iFOBT and CT colonography were perceived to be the main advantages of these two screening techniques.

Our analysis suggests that respondents recognize that a high sensitivity is the most relevant decision criterion when selecting a screening technique for the national screening program. Nevertheless, the intention to attend a screening program appears to be less driven by this benefit of a screening technique, and somewhat more by the desire to prevent risks and inconvenience. A two-stage decision model could explain why the most preferred technique might not, for all respondents, be the same technique as the one to which they are most willing to go in a screening program. Such a two-stage decision model is similar to the double-hurdle model previously found by Cragg [21] in the uptake of consumer products, and alluded to by Marshall et al. [5] regarding the uptake of medical interventions. In the double-hurdle model, people first consider uptake of any of the alternative products, and secondly evaluate the most preferred product to consume.

The selection of criteria to explain this two-stage decision model covers at least the most important criteria used in other preference studies on colorectal cancer screenings [22–24]. However, in contrast to the studies by Dolan et al. [22] and Marshall et al. [23], we did not explicitly relate diagnostic sensitivity to the potential number of lives saved. Even though diagnostic sensitivity was rated to be the most important criterion, the respondents might have used this information to assign an even higher weight to sensitivity, and to increase the impact of sensitivity on the intention to attend.

The conclusions of our study need to be interpreted with care, considering the high exclusion rate of respondents due to inconsistent judgments, and the high variance in weights, priorities, and correlations. This high exclusion rate could have hampered the content validity of the results. It is currently debated in the scientific literature, e.g. regarding discrete-choice experiments, whether inconsistent respondents should be removed from the analysis [20]. Furthermore, for this type of study, one could question whether the AHP inconsistency check should be so rigid. To this regard, it is important to note that a post hoc analysis, including all the respondents who had completed the questionnaire, showed the same rank order of the screening tests. The priorities of the screening techniques for all respondents were, respectively, CT colonography 0.38; iFOBT 0.22; colonoscopy 0.21; and sigmoidoscopy 0.20. The greatest difference in priority between the complete group of respondents and the included respondents concerns iFOBT and is 0.04. In addition, the intention to attend a screening follows the same pattern in both groups of respondents. On average, the complete group of respondents is most positive towards attending a screening with iFOBT, closely followed by CT colonography, then colonoscopy, and finally sigmoidoscopy. The overall outcomes thus appear to be representative for a less restrictive sample of respondents.

The standard deviations of the weights of the criteria and the priorities of the screening techniques are high. One cause could be the limited sample size of respondents who were included in the analysis. It could also partly be a true

reflection of high variety in individual preferences for colorectal screening tests, as previously found by Dolan and colleagues [4, 22]. Dolan et al. distinguished several clusters of patients. Each cluster of patients found another criterion to be the most important decision criterion [22]. Despite the high variance in preferences, the overall priority of CT colonography was significantly higher than the priorities of the other screening techniques. Furthermore, when prioritizing CT colonography only relative to iFOBT as a benchmark alternative, the priority of CT colonography would be higher. This strong preference for CT colonography was also found in a discrete-choice experiment by Marshall et al. [23] on the same topic.

The correlations between the preferences for the screening techniques and intention to attend a screening with these screening techniques are reasonably strong, yet have a wide distribution. For many respondents, the scores on intention to attend varied little, which may have lowered their correlations. However, when looking at the distribution of the correlations between the preferences and intention to attend, we see that these are all skewed towards the higher correlations. Our conclusions are therefore supported by the highest concentration of the respondents' outcomes, yet they can be considered preliminary conclusions. Again, limited sample size may have had an impact on the distribution of the correlations.

Another possible explanation for the high degree of inconsistency in judgments and variance in outcomes is that the respondents may have filled out the relatively long questionnaire about this hypothetical decision problem too hastily. More consistent or precise judgments could be gained in an online survey with fewer decision criteria and/or decision alternatives, or if feedback on inconsistencies are given online. Revision suggestions for highly inconsistent judgments could then be automatic. Instead of collecting data by means of an online survey, it could be more beneficial to apply the AHP to support group discussions, or to interview individual decision makers, as organized by Dolan [22]. Correspondingly, the exclusion rate due to inconsistent judgments was much lower in this study. A face-to-face setting enables a discussion of the validity of the arguments underlying the judgments, and direct feedback on excessive inconsistencies. These discussions could have tempered the high expectations on the performance of CT colonography that cannot be solely explained by the factual performance data provided.

Colorectal cancer screening has not yet been implemented in the Netherlands. Consequently, respondents were asked to state their intention to attend a hypothetical screening and not to provide information on actual attendance. Montano and Taplin [25] found that intention to attend cancer screening was highly correlated with actual attendance. However, they found that additional factors such as facilitating conditions also significantly impact actual attendance [24]. Our study only reveals information on the possible impact of the attributes of the screening techniques itself on attendance, which is separate from any facilitating conditions for undergoing a screening test.

The National Health Council in the Netherlands has recommended the inclusion of colorectal cancer screening in the national screening program in the Netherlands. The screening technique selected for this new program is iFOBT. The reasons to include this technique in the program are related to its potential health benefits and the estimated attendance rate of 60 %. This study suggests that iFOBT is indeed likely to have a relatively high attendance rate in comparison with other screening techniques available in the Netherlands, but, by design, cannot confirm that iFOBT is likely to have the highest health benefits. One available screening technique in the Netherlands that was not included in our study is the gFOBT, which uses the chemical guaiac to detect an iron-containing component of the hemoglobin blood protein. The exclusion of gFOBT is not likely to have affected our conclusions on the screening techniques. Pilots in the Netherlands showed that both the diagnostic effectiveness and attendance rate of screening with gFOBT were lower than with iFOBT [26]. If DNA blood testing becomes available in the Netherlands in the future, preferences for this technique could be favorable compared with the current strategies, as was found in the study by Marshall et al. [23]. Our results suggest that the development of a diagnostically accurate, yet non-invasive technique is likely to fit the preferences as stated by our respondents.

Techniques for MCDA, such as the AHP, can be valuable to gain more insight into the preferences of the population or patients who have an impact on the uptake of healthcare interventions. It can provide insight into the motivation behind these preferences for the screening techniques, and the intention to attend. When applying the AHP to assess the actual risks and benefits of these healthcare interventions, we suggest weighting the decision criteria in a representative panel, yet directly using clinical evidence to assess the risks and benefits. This would avoid the assessment of healthcare interventions based on unrealistic expectations. Further research is recommended on the two-stage decision process of attending screening programs. Research can focus on how the importance of decision criteria changes over time, and the implications of these time-related changes to health technology assessment.

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Groothuis-Oudshoorn. Maarten IJzerman facilitated the project. All authors contributed to writing and commenting on the paper. Marjan Hummel acts as guarantor for the content of the paper.

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