Author’s response to reviews

Title: Decision-making styles in the context of colorectal cancer screening

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Author’s response to reviews:

Comments from the reviewers

A. Reviewer 1 (Jozef Bavolar)

Comment 1:
I would avoid using the term "which styles are dominantly present among population" used not only in abstract, but also in the article. Lot of studies reporting descriptive statistics provide information about the highest values of the rational and intuitive styles in comparison with the three other styles (dependent, avoidant, spontaneous).

Our response:

We agree with the reviewer that using the phrase of ‘styles being dominantly present’ might not be best suited. However, there are examples of other papers using similar wording (e.g. Bruyn Martin et al 2006, Decision making styles: Classification system, contextual analysis and validation of classification system) or where they refer to the ‘manifestation’ or ‘application’ of a decision-making style (e.g. Fischer et al 2015, Adapting Scott and Bruce’s General Decision-Making Style Inventory to patient decision making in provider choice).

Following these examples together with the reviewer’s comment, we have opted to use “use of decision-making style”. Throughout the entire manuscript, we have made the necessary changes accordingly. As this involves many changes (of often times one or a few words), we will not mention them all in this document. But we have highlighted all of these changes in the revised manuscript. Below, we will only include the revisions pertaining to the abstract to illustrate the changes in wording we made.

Revision (Abstract, lines 27-29, page 2) + at more locations throughout the manuscript:

Our study examined the use of decision-making styles, as identified by Scott and Bruce (1995) (i.e. differentiating between a rational, intuitive, dependent, avoidant and spontaneous decision-making style), within the context of colorectal cancer (CRC) screening participation.
Subsequently, gaining more insight into decision-making styles being used in real life, could improve support to people when making their screening decision. In addition, we examined whether the decision-making style that people used was associated with their experienced decisional conflict.

In our study, people who had to decide about CRC screening scored high on using both a rational and intuitive decision-making style. Respondents scoring higher on using a spontaneous decision-making style were more likely to have participated in CRC screening, while respondents scoring higher on using an avoidant decision-making style were more likely not to have participated in CRC screening.

Our eligible CRC screening population scored high on using both a rational and intuitive decision-making style.

Possible concerns regarding the use of a spontaneous or avoidant decision-making style could be that these styles might be contributing to less informed decisions.

Differences in the same variable (higher vs lower values of the concrete style) are much more important in this design of the study than differences between styles.

We would have to partly disagree with the reviewer on this particular comment. Differences within the same decision-making style are indeed an important outcome. However, we see differences between decision-making styles as equally important. For the context of our research, we believe that it is relevant to a) establish which decision-making style people score high on, and b) establish on which style, on a general level, people score highest on, in comparison to other styles. By addressing both a and b we feel that the gained knowledge can be used for the development of more tailored public education materials. Knowing that on a general level people score highest on using a rational and intuitive decision-making style, signals the significance of addressing both rational and intuitive processes within public education materials. Should we have found that people scored highest on using both a rational and dependent style, for example, it seems it would have been prudent to address both rational and dependent processes within public education materials.

I would not use CRC abbreviation at the beginning abstract without the whole word. So it would be better to write "among the eligible colorectal cancer (CRC) screening population".

Thank you for pointing out this oversight. We have changed it accordingly.

..., within the context of colorectal cancer (CRC) screening participation.
Comment 4:
It is better to use "higher level (or higher score) in the ...style" than "respondents with more of a spontaneous style".

Our response:
Also in connection to comment 1, we agree that it would be better to use ‘scoring higher on using a [specific] decision-making style’. We have changed this accordingly throughout the manuscript.

Revisions – All revisions pertaining to this comment (together with other changes) have been highlighted in the revised document.

Comment 5:
The authors focus mainly on the rational process of making decisions, the other processes (styles) are only marginally mentioned. A more thorough overview of studies relating decision styles (or generally decision processes) and health-related behaviour would be useful to better reason the aim and the rationale behind the study (e.g. the decision-making process of patients).

Our response:
We agree that more background information and a better outline of the rationale behind our study are necessary. In that light, we now start out in a more general matter, added some information about the procedure of colorectal cancer screening, moved up the section where we discuss decision-making in general as well as added some new information on this topic, and connected it more clearly to the decision-making process regarding CRC screening.

However, as we aim to examine decision-making styles in the particular context of colorectal cancer screening (in real life), we believe that the focus should remain on the decision-making process within this context. And with that, on the expressed emphasis of cancer screening experts on people making informed decisions and the rational process that comes with it. Additionally, it should be noted (and we added this in the background section) that we are referring to preventive colorectal cancer screening, which is aimed at healthy individuals, not patients. Furthermore, in the Netherlands, the decision-making process regarding CRC screening participation only involves the individual it concerns and not also a GP or other type of physician.

Revision (Background, lines 78-93, page 4):
Every day people are confronted with health-related decisions they have to make. This can vary from decisions concerning how to achieve a healthy lifestyle to decisions concerning the treatment of existing health conditions. The decision whether or not to undergo preventive colorectal cancer (CRC) screening is also a form of a health-related decision that people at some point in their life are confronted with, especially in developed countries such as the Netherlands. Preventive CRC screening is aimed at healthy individuals who are not experiencing any symptoms in order to detect cancer in an early stage or precursors of it. Its purpose is to reduce the number of cancer cases, treatments (invasive and non-invasive) and cancer deaths. Since January 2014, everyone in the Netherlands between the ages of 55 and 76 years old biennially receives an invitation to participate in CRC screening via a self-administered stool test (immunochemical faecal occult blood test: iFOBT), which is payed for by the government. People are expected to decide for themselves whether or not they want to participate in CRC screening. Thus, no one else other than the individual it concerns is actively involved in the decision-making process. If the stool test gives a positive result, people are referred for a colonoscopy to find out if they actually have (precursors of) colorectal cancer. In 2016, 72% of those invited for the
first time to partake in the CRC screening programme in the Netherlands decided they wanted to be screened [1], which is relatively high compared to other countries.

Revision (Background, lines 109-121, page 5):
Firstly, research on decision-making in general shows that different people can deal differently with the decisions in their life, which could be described as using different decision-making styles. The decision-making style that people use can be related to personality traits, for example, a 'need-for-cognition', which would promote a more informed and thoughtful process [12, 13], or a 'need-for-closure', which would promote a more speedy process [14, 15]. Additionally, people’s goals and motivation (regarding both their health and the accuracy of their decision) are involved. People who experience a personal relevance, will be held accountable, or have a reason to be accurate are more inclined to make an analytical and well-considered decision [16-19]. However, the decision-making style that people use can also be context-depended and thus be associated with the specific situation or decision at hand. For example, a new or more complex decision often invokes a more thoughtful process, while time constraints can stimulate the use of intuition and heuristics as well as going off other people's behaviour [16-18]. Furthermore, previous research on CRC screening shows that …

Revision (Background, lines 127-129, page 5-6):
The findings of all this previous research combined suggest that those deciding about CRC screening participation could use decision-making styles other than, or in addition to, rational decision-making.

Comment 6:
The sentence "decision-making style is also affected by context cues" does not seem as appropriate. Decision-making styles are, as even authors state, habitual propensities, so not the styles, but the use of concrete style may be affected by the characteristics of decision situation.

Our response:
In line with previous comments, we agree with the reviewer on this point and have changed it accordingly.

Revision (Background, lines 117-118, page 5):
However, the decision-making style that people use can also be context-depended and thus be associated with the specific situation or decision at hand.

Comment 7:
The paragraph concerning the association of the decision-making styles and decisional conflict is too vague - this connection should be more concretely reasoned. Why should be particular styles related to the decisional conflict? No space is devoted to the connection decisional conflict - real behavior.

Our response:
We have provided additional reasoning for why we believe it is relevant to examine a possible association between the use of a certain decision-making style and experienced decisional conflict.

Revision (Background, lines 157-170, page 7):
As previously described, the decision-making style that people use can be affected by both personal and context factors, which influence people may not always be actively aware of. Although the use of a certain decision-making style can be a ‘habit-based reaction’, that does not mean that people are always
satisfied or confident with the style they used to make their decision, nor with the final decision made. People may feel that ideally they would have used a different approach. This possibility may particularly exist regarding people using a spontaneous or avoidant decision-making style, as previous research suggests that the use of these styles are associated with negative life outcomes (e.g. lower decision-satisfaction, less goal-achievement, worse mental health or more negative life events) [32, 36, 38-40]. Should people with these styles experience less satisfaction with their decision and decision-making process, then this is something to consider with regards to how CRC screening is currently being offered in the Netherlands, especially concerning the emphasis on people making their CRC screening decision by themselves without the involvement of any other party. Perhaps some people require more support in order to make their decision in a manner that they feel satisfied with.

Comment 8:
The main research question is too general - again more about differences between particular styles, not about their role in the studied decision. In aim a, I would use plural - decision-making styles - not only one style has been included. Aim b is just of minor importance. The questions are very simple, the current data allow more advanced procedures providing a richer picture of the topic.
To summarise, theoretical instruction should be more related to the aim of the article - why is it important, why some relationships can be expected, what can be a proposed direction of causal effects.

Our response:
We agree with the reviewer that our original research questions are stated in a general manner and that formulating more specific questions are possible based on what we know from previous research into CRC screening decisions and decision-making styles. Therefore, we formulated more specified research questions. We also eliminated aim b (Are people’s education level and health literacy associated with their decision-making style?) as, after consideration, we believe this is mainly a relevant factor to adjust for in the analyses conducted, but not a relevant main research question. Following these changes, we also made adjustments in the first paragraph of our discussion to be more in line with the new formulation of our research questions. As to a proposed direction of (causal) effect, it should be clear from the revised manuscript that the general idea is that people’s decision-making style affects people’s CRC screening participation, and that people’s experienced decisional conflict is the result of making the CRC screening decision concerning participation.

However, we would like to point out that we are conducting correlational research using a cross-sectional design. This means that we are researching possible associations and not possible predictors or causal effects. That is not the intent of our study. This may be seen as a limitation; however, as we are researching the decision-making process concerning CRC screening in real life, we believe the examination of associations can already be very useful for public health practice. Knowing which decision-making styles are used and whether CRC screening participants and non-participants differ in their decision-making approach, provides insights for public health practice regarding possible barriers as well opportunities for how to adequately reach and support the public in their decision-making. Thus, we believe that our current performed analyses already provide useful insights and are a first step in conducting research concerning decision-making styles in the context of colorectal cancer screening (in real life). Applying more advanced procedures could be part of follow-up research.

Revision (Abstract, lines 27-34, page 2):
Background: Our study examined the use of decision-making styles, as identified by Scott and Bruce (1995) (i.e. differentiating between a rational, intuitive, dependent, avoidant and spontaneous decision-making style), within the context of colorectal cancer (CRC) screening participation. In the field of
cancer screening, informed decision-making is considered important, which follows the Rational Decision model. Subsequently, gaining more insight into decision-making styles being used in real life, could improve support to people when making their screening decision. In addition, we examined whether the decision-making style that people used was associated with their experienced decisional conflict.

Revision (Background, lines 185-188, page 8):
When examining the relationship between the decision-making style used and people’s CRC screening participation it would also be relevant to adjust for possible associations with people’s education level and health literacy.

Revision (Background, lines 192-193, page 8):
Additionally, people with a lower education or health literacy level are more likely not to participate in CRC screening [44, 45].

Revision (Background, lines 196-205, page 8-9):

1. When deciding about CRC screening participation, which decision-making styles (as described by Scott and Bruce) do people score high on using, and do they score highest on using a rational decision-making style?

2. Is there an association between people’s actual CRC screening participation and the use of a specific decision-making style? Hereby adjusting for possible associations with people’s education level and health literacy.

3. To what extent do people evaluate their CRC screening decision positively (in terms of decisional conflict), and is this associated with their CRC screening participation or the decision-making style they used? Hereby adjusting for possible associations with people’s education level and health literacy.

Revision (Discussion, lines 382-386, page 18):
Our study examined the use of decision-making styles as identified by Scott and Bruce (1995) [37] (i.e. differentiating between a rational, intuitive, dependent, avoidant and spontaneous decision-making style), within the context of CRC screening participation. Our results showed that most people in our study used a combination of decision-making styles, with scoring high and more or less equally high on using both a rational and intuitive decision-making style.

Comment 9:
The authors should state in methods section data about the similarity of their sample and overall population. Mainly the fact that proportion of people absolving CRC screening differs substantially (89% in the sample, 73% in the population - but in 2015, not in 2017 ). Similar data about education are also only in limitations, not in methods section.

Our response:
We agree with the reviewer that this kind of information should be mentioned. In combination with the suggestion made by reviewer 2, we added this information in the results section, as it can be seen as a finding of the study we conducted. Thus, we have added the information about CRC screening uptake in the results section, as well as in the background section as a prelude, in addition to it begin
mentioned in the limitations section. We have also added the information about education in the results section, in addition to it being mentioned in the limitations section. When writing up our original manuscript data from 2015 regarding CRC screening uptake in the Netherlands was the most recent data available. Currently, data from 2016 is also available, thus we have now included that report as our reference.

Revision (Background, lines 91-93, page 4):
In 2016, 72% of those invited for the first time to partake in the CRC screening programme in the Netherlands decided they wanted to be screened [1], which is relatively high compared to other countries.

Revision (Results, lines 296-299, page 12):
People with a higher education were overrepresented in our sample and the majority of our study sample (98%) had adequate health literacy. Additionally, only 11% of our sample were CRC screening non-participants, compared to 28% of the actual CRC screening population in the Netherlands in 2016 [1].

Comment 10:
One measure deserves a special attention - Decisional Conflict scale. Decisional conflict was rated retrospectively, that brings serious doubts about its results. Rating of such a subjective topic after approximately one year (2016 - March 2017) is not very reliable.

Our response:
It is correct that decisional conflict has been measured retrospectively, which is not uncommon regarding this concept. Especially when the decision has also already been made. The reviewer is right in that for a proportion of our sample this can mean that people were asked about their decisional conflict a year after they made their decision to participate in CRC screening or not. We do not believe this immediately means the measure is not reliable, but it is a serious limitation to mention. Thus, we have included it in our limitations section, what we believe is the correct place to mention this information.

Revision (Discussion, lines 494-499, page 22):
A final limitation is the fact that we measured decisional conflict retrospectively, which is not uncommon regarding this concept. However, for a proportion of our sample this can mean that people were asked about their decisional conflict a year after they made their decision to participate in CRC screening or not. This could have resulted in people feeling more confident about their decision partly because of more time having passed since they made their decision.

Comment 11:
Table 2 should include also descriptive statistics of other variables (conflict, health literacy). Similarly, table 3 should incorporate also correlations with these variables (education could also be used as ordinal variable). The correlations among decision-making styles are just of minor importance.

Our response:
We partly agree with the reviewer’s comment. For a more complete overview, we could include the descriptives for health literacy and decisional conflict in Table 2, as we now did. Additionally, we added the N and % for adequate health literacy in Table 1, as part of the sample characteristics.
However, relationships with other variables are being examined through regression analysis as this provides a bigger picture of the relationship at hand (see Table 4). Table 3 is meant to provide an overview of how the different decision-making styles as part of the GDMS correlate to each other. Although we agree that the correlations among decision-making styles are not of the highest importance, we do believe this information has value from both a theoretical and practical standpoint. It has theoretical value as many other studies researching the GDMS report and discuss these statistics and our results contribute to this body of knowledge. It has practical value because it provides insight into how decision-making in real life looks like. That in itself already contributes to policy makers and screening practice better understanding the complexity they are dealing with. Additionally, it confirms that rational decision-making or any other style of decision-making is not something that stands on its own, but takes place in a context where other styles can also be present and of influence. It also gives insight into whether certain groups or types of people might be distinguished. This then gives insight into barriers as well as opportunities for how to best reach people and support them in their decision-making process. For example, the correlation between rational decision-making style and dependent decision-making style gives rise to the opportunity to also stimulate more rational/informed decision-making by addressing it as part of a dependent decision-making style. Additionally, the correlation between avoidant decision-making style and dependent decision-making style gives supports for the possible positive effect (for a subgroup of people) of incorporating a third party, such as a GP, in the decision-making process, which is currently not yet the situation in the Netherlands. Therefore, we did not exclude reporting about the correlations among decision-making styles i.e. we kept Table 3 as is.

As the reviewer made a related comment pertaining to the discussion section, we have placed the relevant revisions under that comment (see comment 17).

Revision (Results, Table 1, line 303-304, page 12-13):

Health literacy level
Adequate health literacy (sum score below 9) 1262 (98)

Revision (Results, Table 2, 312-315, page 13-14):

Table 2. Descriptive statistics regarding the different decision-making styles, Decisional Conflict Scale and Health Literacy Scale 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Possible range</th>
<th>Actual range</th>
<th>M (SD)</th>
<th>Median</th>
<th>Mode</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rational decision-making style</td>
<td>5-25</td>
<td>5-25</td>
<td>18.32 (2.71)</td>
<td>19</td>
<td>20</td>
<td>-.56</td>
</tr>
<tr>
<td>Intuitive decision-making style</td>
<td>5-25</td>
<td>5-25</td>
<td>17.72 (3.50)</td>
<td>18</td>
<td>20</td>
<td>-.38</td>
</tr>
<tr>
<td>Dependent decision-making style</td>
<td>5-25</td>
<td>5-25</td>
<td>13.11 (3.74)</td>
<td>13</td>
<td>14</td>
<td>-.07</td>
</tr>
<tr>
<td>Avoidant decision-making style</td>
<td>5-25</td>
<td>5-24</td>
<td>9.91 (3.39)</td>
<td>10</td>
<td>10</td>
<td>.65</td>
</tr>
<tr>
<td>Spontaneous decision-making style</td>
<td>5-25</td>
<td>5-25</td>
<td>13.79 (2.97)</td>
<td>14</td>
<td>13</td>
<td>.13</td>
</tr>
<tr>
<td>Decisional Conflict Scale</td>
<td>1-5</td>
<td>2.25 -5</td>
<td>4.10 (.47)</td>
<td>4</td>
<td>4</td>
<td>-.50</td>
</tr>
<tr>
<td>Health Literacy Scale</td>
<td>1-15</td>
<td>3-12</td>
<td>4.73 (1.61)</td>
<td>4</td>
<td>3</td>
<td>.84</td>
</tr>
</tbody>
</table>

1 N = 1282

Comment 12:
I do not see a valid reason to conduct five separate logistic regressions for each decision-making style as explained by education and health literacy - why should health literacy be a predictor of any style?
If authors want to present information about values of the styles in different age groups, it could be done by simple table reporting mean values of styles in each subgroup with ANOVA comparison.

Our response:
The analyses conducted here were to examine a possible relationship between education and health literacy and the decision-making style being used. However, as mentioned in our response under comment 8, we decided to eliminate this specific research aim (i.e. Are people’s education level and health literacy associated with their decision-making style?) as, after consideration, we believe this is mainly a relevant factor to adjust for in the analyses conducted, but not a relevant main research question. In the background section, reasoning is provided for why education and health literacy might be associated as confounders with the decision-making style being used (lines 158-164). As a result of this decision, we deleted the short paragraph discussing this research question as well as the accompanying Table (Table 4 in the original manuscript) from the revised manuscript.

Revision (Results + Discussion):
Deleted one paragraph in the results section plus the accompanying Table (Table 4 in the original manuscript) as well as one paragraph in the discussion relating to the former research aim ‘Association between decision-making style and education and self-reported health literacy’.

Comment 13:
Generally, the analysis is divided into many partial steps, some of them seem really redundant. In my opinion, a more direct approach would be more useful. After providing descriptive statistics and correlation analysis, two regressions would be enough. Firstly, explaining decisional conflict by the decision-making styles (maybe with demographics and health literacy as controls), secondly, explaining CRC screening using the same variables + decisional conflict. In addition, mediation/moderation analysis investigating the role of health literacy and selected style could bring more interesting, valuable and original results.

By the way, it would also be more reader-friendly to report the results of regressions in tables, not in text.

Our response:
We agree with the ‘by the way’ comment and have now incorporated the results of our regression analyses into one table (the new Table 4). We have also adjusted the accompanying text accordingly. The approach the reviewer is suggesting is to perform a prediction model. Performing a prediction model in the proposed manner would mean that you are examining which set of variables i.e. decision-making styles are predictors for CRC screening participation, while correcting for the existence/influence of all other decision-making styles (and decisional conflict). Not only would this be a totally different research question from what we actually aimed to study, but, after consulting our in-house statistician, we also believe it would complicate the interpretation of the results regarding what it would mean, especially for the practice of CRC screening decision-making. A similar reasoning applies to examining the relationship between decision-making styles and decisional conflict.

Additionally, while we agree that the examination of possible mediation could yield interesting results, there are two main restrictions we have to consider. Firstly, to conduct a meaningful mediation analysis there should be a clear theory of cause and effect, which in our opinion is not yet the case regarding the possible relationship between health literacy, decision-making style and screening participation. There
is simply an expectation of a possible relationship (which may be examined using an association model). Inadequate health literacy may result in the use of a certain decision-making style, but the use of a certain decision-making style could also be contributing to the existence of less adequate health literacy. Secondly, to conduct a meaningful mediation analysis one would ideally be using measures that are reliable. And, as we are mentioning in our limitation section, our health literacy measure shows low internal consistency, cautioning us to, potentially, use it for mediation analysis.

Revision (Results, lines 323-325, page 15):
The spontaneous and avoidant decision-making styles were significantly associated with CRC screening participation (Table 4). People who scored higher on using a spontaneous decision-making style were more likely to have participated in CRC screening.

Revision (Results, lines 327-328, page 15):
People who scored higher on using an avoidant decision-making style were more likely not to have participated in CRC screening.

Revision (Results, lines 330-331, page 15):
No significant associations were found between the rational, intuitive, and dependent decision-making styles and CRC screening participation.

Revision (Results, Table 4, lines 338-366, pages 15-17)

Table 4. Association between: A. Decision-making styles and CRC screening participation (multiple logistic regression); B. Decisional conflict and CRC screening participation (multiple logistic regression); C. Decision-making styles and Decisional conflict (multiple linear regression)

<table>
<thead>
<tr>
<th>Variable</th>
<th>ORa</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Rational decision-making style</td>
<td>.996</td>
<td>.932 – 1.064</td>
</tr>
<tr>
<td>Intuitive decision-making style</td>
<td>.967</td>
<td>.918 – 1.019</td>
</tr>
<tr>
<td>Dependent decision-making style</td>
<td>.992</td>
<td>.946 – 1.041</td>
</tr>
<tr>
<td>Avoidant decision-making style</td>
<td>1.074*</td>
<td>1.021 – 1.129</td>
</tr>
<tr>
<td>Spontaneous decision-making style</td>
<td>.928*</td>
<td>.873 - .987</td>
</tr>
<tr>
<td>B. Decisional conflict</td>
<td>.193**</td>
<td>.132 - .282</td>
</tr>
<tr>
<td>C. Rational decision-making style</td>
<td>.045**</td>
<td>.036 – .054</td>
</tr>
<tr>
<td>Intuitive decision-making style</td>
<td>.017**</td>
<td>.009 – .025</td>
</tr>
<tr>
<td>Dependent decision-making style</td>
<td>-.001</td>
<td>-.008 – .006</td>
</tr>
<tr>
<td>Avoidant decision-making style</td>
<td>-.043**</td>
<td>-.050 – -.036</td>
</tr>
<tr>
<td>Spontaneous decision-making style</td>
<td>.003</td>
<td>-.006 – .011</td>
</tr>
</tbody>
</table>

1 Association models, with CRC screening participation entered as dependent variable (score 1 = participation, score 2 = non participation). Each decision-making style separately entered as independent variable; higher scores mean the style is used more frequently (scores range from 5 to 25)
2 Association model, with CRC screening participation entered as dependent variable. Decisional conflict as independent variable; a higher score means less experienced decisional conflict (scores range from 1 to 5)
3 Association models, with decisional conflict entered as dependent variable. Each decision-making style separately entered as independent variable.
a Rational style: OR adjusted for education and self-reported HL, significant confounding found regarding both variables
Intuitive style: OR adjusted for education and self-reported HL, significant confounding found regarding education
Dependent style: OR adjusted for education and self-reported HL, significant confounding found regarding self-reported HL
Avoidant style: OR adjusted for education and self-reported HL, significant confounding found regarding both variables
Spontaneous style: OR adjusted for education and self-reported HL, no significant confounding found regarding both variables

Decisional conflict: OR adjusted for education and self-reported HL, no significant confounding found regarding both variables

b Concerning all styles: betas adjusted for education and self-reported HL, no significant confounding found regarding both variables

* Significant at p < .05
** Significant at p < .001

Revision (Results, lines 369-372, page 17):
Generally, people experienced low decisional conflict (which is represented by a higher score on the decisional conflict scale) regarding their CRC screening decision (Table 2). However, there was a significant difference associated with participation, with those experiencing less decisional conflict being more likely to have participated in CRC screening (Table 4).

Revision (Results, lines 375-379, page 17-18):
Three of the five decision-making styles were significantly associated with experienced decisional conflict (Table 4), with the exception of the dependent and spontaneous decision-making styles. People who scored higher on using a rational or intuitive decision-making style generally experienced less decisional conflict. People who scored higher on using an avoidant decision-making style, however, experienced more decisional conflict.

Comment 14:
How was the participation in CRC screening coded? As can be induced from "People who scored higher on a spontaneous decision-making style were more likely to have participated in CRC screening (OR = .918...)", participation was probably coded as zero, not participation as 1. Usually, the coding is reversed.

Our response:
Thank you to the reviewer for pointing out that we omitted to mention how we coded CRC screening participation. We have now included it in the methods section as well as in the legend of (the new) Table 4.

Revision (Methods, lines 225-228, page 9):
Relevant to the present study, respondents were first presented with the question whether they had participated in CRC screening or not (dichotomous variable: score 1 = participated, score 2 = did not participate), […]

Revision (Results, Table 4, lines 342-345, page 16):
Association models, with CRC screening participation entered as dependent variable (score 1 = participation, score 2 = non participation).

Comment 15:
I see no sense in dividing sample according to the levels of the decision-making styles (below and over 15 - why was the sample divided according to this value.

Our response:
This was done for descriptive purposes as knowing how large the group is that scores relatively high (i.e. 15 or above with 15 being the midpoint) on using a specific decision-making style can be useful for screening practice. We included this in the manuscript after receiving feedback on this from screening practice professionals. A short reference to this was already included in the original manuscript (line 438). We have now included an additional short reference in the conclusion section and additional reasoning in the methods section.

Revision (Methods, lines 275-278, page 11):
We analysed the proportion of people scoring 15 or higher on the use of a specific decision-making style (15 being the midpoint). Of them, we analysed the proportion that participated in CRC screening. This was done for descriptive purposes as knowing how large the group is that scores relatively high on using a specific decision-making style can be useful for screening practice.

Revision (Conclusion, lines 515-517, page 23):
However, it is relevant to consider that the found differences are small and that any possible concern related to this finding applies to a relatively small group of people.

Comment 16:
The results are often described in terms of associations, while reporting regression results (term "predictors" would suit here more).

Our response:
Regression analysis is per definition used to examine relationships. In that light, it can be used, and is widely being used, for conducting both association models and prediction models (Twisk JWR. Inleiding in de toegepaste biostatistiek [Introduction into applied biostatistics]). Our research questions, and our use of a cross-sectional design, pertain to the examination of possible associations, not predictors. We have tried to make this clearer by adding the word ‘association model’ in our statistical analysis section, as well as in the legend of Table 4.

Revision (Methods, lines 279-281, page 11):
Logistic regression analysis (association model) was performed to examine the relationship between people’s decision-making style and their CRC screening participation.

Revision (Methods, lines 282-284, page 11-12):
Linear regression analysis (association model) was performed to examine the relationship between people’s decision-making style and decisional conflict

Revision (Results, legend Table 4, lines 342-350, page 16):
1 Association models, with CRC screening participation entered as dependent variable (score 1 =
participation, score 2 = non participation). Each decision-making style separately entered as independent variable; higher scores mean the style is used more frequently (scores range from 5 to 25)

2 Association model, with CRC screening participation entered as dependent variable. Decisional conflict as independent variable; a higher score means less experienced decisional conflict (scores range from 1 to 5)

3 Association models, with decisional conflict entered as dependent variable. Each decision-making style separately entered as independent variable

Comment 17:
As I noted in Results section, the intercorrelations of the decision making styles are of minor importance, there is just low need to discuss them in the current space.

Our response:
We would like to refer to our response under comment 11. We have added the reasoning as outlined in that response as part of the discussion section.

Revision (Discussion, lines 417-429, page 19-20):
Discussing the association patterns we found, contributes to the existing body of knowledge regarding research using the GDMS. However, more importantly, it shows the complexity of decision-making regarding CRC screening in real life. It confirms that the use of a rational or any other decision-making style takes place within a context of the existence of other styles. Additionally, it gives insight into whether certain groups or types of people might be distinguished, which subsequently offers insight into barriers as well as opportunities for how to best reach people and support them in their decision-making process. For example, the correlation between the rational and dependent decision-making styles gives rise to the opportunity to also stimulate rational/informed decision-making by addressing it as part of a dependent decision-making style (e.g. by asking relevant others for advice). Additionally, the correlation between the avoidant and dependent decision-making styles gives offers support for the potential that, for a subgroup of people, incorporating a third party in the decision-making process, such as a general practitioner, which is currently not yet the situation in the Netherlands, could have a positive effect.

Comment 18:
Authors state, that there is no single objective decision? Is it right? Is not always better to take a test to be diagnosed sooner?

Our response:
It is not always better to take a test to be potentially diagnosed sooner. As outlined in our Background section, CRC screening involves both possible benefits and downsides. Whether for an individual the potential benefits weigh up against the potential harms and risks is a complex issue, which has been the topic of an ongoing debate among experts. We have added a few sentences on this topic to be clearer on this aspect.

Revision (Background, lines 95-99, page 4):
Reducing the incidence and mortality of CRC are considered the main possible benefits of CRC screening [2-5]. However, CRC screening also involves possible downsides, such as false-negatives,
false-positives, overdiagnosis, overtreatment, and risks associated with colonoscopy [6-10]. Especially on an individual level, it is not apparent whether the possible benefits outweigh the possible downsides of screening as different people could weigh these differently [8, 10-12]. This has led to experts in the field of cancer screening presently considering it important that people make an informed decision concerning CRC screening participation [11, 13-15].

B. Reviewer 2 (Zoe Moon)

Comment 1:
This paper compares different decision making styles and their relationship with CRC screening participation. It is likely to be of interest to researchers in the field of decision making. However the rationale for the study is currently not clear. e.g. in lines 112-123 there isn't enough explanation of why it is important to see what decision making styles people are using - how would this lead to development of education strategies and materials? Would different materials be produced depending on people's decision making styles?

Our response:
We thank the reviewer for their comment and have added an explanation of how a better insight in people’s decision-making style being used regarding CRC screening could possibly contribute to the further development of education strategies and materials.

Revision (Background, lines 178-184, page 7-8):
The current education strategies and materials are aimed at fostering informed decision-making. However, people using a different decision-making style than a rational style might fare better with strategies and materials adjusted to their decision-making style (e.g. by providing different formats, appealing more to the role of intuition or other people, offering layered information (especially in combination with online facilities), or actively involving an expert/physician in the decision-making process) [19, 35].

Comment 2:
The conclusion states "Although the differences are small, in view of informed decision-making, further research could focus on examining whether people's decision-making style is associated with their extent of making an informed and well-considered CRC screening decision." - it is not clear what this future research would be, or how it would differ from the current study. Similarly, there is little on how this current study adds to the literature base or what it can tell us specifically about how to improve uptake / the decision making process.

Our response:
In our present study, we focused on assessing decision-making styles being used and their possible association with CRC screening participation. We did not assess people’s actual knowledge and thus their extent of making an informed decision about CRC screening. Therefore, in view of informed decision-making i.e. if we want people to make informed decisions, further research is needed to establish whether using a spontaneous or avoidant decision-making style is actually a concern for making informed and well-considered CRC screening decisions. We have added a bit more explanation on this aspect in the discussion section. Additionally, we have added reasoning on how the results of our study could be contributing to a better insight into how to better reach people.
Regarding the conclusion, we have explicated the connection between our findings and what this might mean for the development of education materials. Additionally, we made some changes as a result of acknowledging more that the ORs found are reflecting small differences/effects (see also comment 9).

Revision (Abstract, lines 45-52, page 2-3):
Conclusion: Our eligible CRC screening population scored high on using both a rational and intuitive decision-making style. To optimise support to people, public education materials could be appealing more to the intuitive processes at hand. That being said, the current education materials aimed at informed/rational decision-making do not necessarily seem to create a problem, as people generally experienced low decisional conflict. Possible concerns regarding the use of a spontaneous or avoidant decision-making style could be that these styles might be contributing to less informed decisions. However, it is relevant to consider that the found differences are small and that any possible concern applies to a relatively small group of people.

Revision (Discussion, lines 417-429, page 19-20):
Discussing the association patterns we found, contributes to the existing body of knowledge regarding research using the GDMS. However, more importantly, it shows the complexity of decision-making regarding CRC screening in real life. It confirms that the use of a rational or any other decision-making style takes place within a context of the existence of other styles. Additionally, it gives insight into whether certain groups or types of people might be distinguished, which subsequently offers insight into barriers as well as opportunities for how to best reach people and support them in their decision-making process. For example, the correlation between the rational and dependent decision-making styles gives rise to the opportunity to also stimulate rational/informed decision-making by addressing it as part of a dependent decision-making style (e.g. by asking relevant others for advice). Additionally, the correlation between the avoidant and dependent decision-making styles gives offers support for the potential that, for a subgroup of people, incorporating a third party in the decision-making process, such as a general practitioner, which is currently not yet the situation in the Netherlands, could have a positive effect.

Revision (Discussion, lines 457-464, page 21):
However, in our present study, we focused on assessing whether or not people used a rational decision-making style, and whether the use of a specific decision-making style was associated with participating in CRC screening or not. We did not assess people’s actual knowledge concerning CRC and CRC screening, and thus their extent of making an informed decision about CRC screening, and whether this might be related to the use of a particular decision-making style. Therefore, further research is needed to establish whether using a spontaneous or avoidant decision-making style is actually a concern for making informed and well-considered CRC screening decisions.

Revision (Conclusion, lines 503-511, page 22-23):
Thus, the strong emphasis on making an informed CRC screening decision, which follows the Rational Decision model, does not appear to be congruent with decision-making in real life. To optimise support to people when making their CRC screening decision, public education materials could be appealing more to the intuitive processes at hand. That being said, from a personal evaluation perspective, the current education materials that are attuned to a rational decision-making style do not necessarily seem to create a problem, as people generally experienced low decisional conflict, independent of decision-making style, indicating that they felt certain about their CRC screening decision and positive about its quality.
Revision (Conclusion, lines 513-517, page 23):
Possible concerns in view of informed decision-making could be that both these decision-making styles might be contributing to less informed decisions. However, it is relevant to consider that the found differences are small and that any possible concern related to this finding applies to a relatively small group of people.

Comment 3:
The results should state the percentage of those who attended screening in the text. This should also be highlighted in the discussion as the percentage seems high.

Our response:
We have now included it in the results section and also in the background section, where we mention the uptake percentage is relatively high compared to other countries. It was already being mentioned as a limitation in our discussion section, but we added information about the uptake being relatively high. We believe this is sufficient highlighting of this aspect, as other than a limitation to generalizability it should not have an effect on the actual analysis or results (as long as the number of non-participants taking part in our study is high enough to conduct reliable statistical analysis on, which is the case).

Revision (Background, lines 91-93, page 4):
In 2016, 72% of those invited for the first time to partake in the CRC screening programme in the Netherlands decided they wanted to be screened [1], which is relatively high compared to other countries.

Revision (Results, lines 297-299, page 12):
Additionally, only 11% of our sample were CRC screening non-participants, compared to 28% of the actual CRC screening population in the Netherlands in 2016 [1].

Revision (Discussion, lines 487-488, page 22):
Also considering that, CRC screening uptake in the Netherlands is already relatively high compared to other countries.

Comment 4:
Page 11 - it is not clear if the decision making styles were entered into a model together or separately? Can the authors please make it clear and explain the rationale for the approach. Entering the results into a table would make this clearer.

Our response:
The decision-making styles were entered separately into the association models as they are independent variables and we are interested in the association between them and CRC screening participation, not in these styles as a set of predictors for CRC screening participation. Furthermore, performing a prediction model would mean that you are examining which set of variables i.e. decision-making styles are predictors for CRC screening participation, while correcting for the existence/influence of all other decision-making styles. Is would not be clear to us how to interpret this result and what it would mean (especially for the practice of CRC screening decision-making).
We have made a new Table 4, which shows the results of all of our regression analyses. We have added a better explanation regarding how we performed these analyses in the methods section as well as in the legend of our new Table 4.

Revision (Methods, lines 279-286, page 11-12):

Logistic regression analysis (association model) was performed to examine the relationship between people’s decision-making style and their CRC screening participation. Multiple logistic regression analysis was used to examine possible confounding by education and self-reported health literacy. Linear regression analysis (association model) was performed to examine the relationship between people’s decision-making style and decisional conflict. Multiple linear regression analysis was used to examine possible confounding by education and self-reported health literacy. As all decision-making styles are independent variables, association models were computed for each decision-making style separately.

Revision (Results, Table 4, lines 338-366, pages 15-17)

Table 4. Association between: A. Decision-making styles and CRC screening participation (multiple logistic regression); B. Decisional conflict1 and CRC screening participation (multiple logistic regression); C. Decision-making styles and Decisional conflict (multiple linear regression)

<table>
<thead>
<tr>
<th>Variable</th>
<th>ORa</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Decision-making styles – CRC screening participation1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rational decision-making style</td>
<td>.996</td>
<td>.932 – 1.064</td>
</tr>
<tr>
<td>Intuitive decision-making style</td>
<td>.967</td>
<td>.918 – 1.019</td>
</tr>
<tr>
<td>Dependent decision-making style</td>
<td>.992</td>
<td>.946 – 1.041</td>
</tr>
<tr>
<td>Avoidant decision-making style</td>
<td>1.074*</td>
<td>1.021 – 1.129</td>
</tr>
<tr>
<td>Spontaneous decision-making style</td>
<td>.928*</td>
<td>.873 – .987</td>
</tr>
<tr>
<td>B. Decisional conflict – CRC screening participation2</td>
<td>.193**</td>
<td>.132 - .282</td>
</tr>
<tr>
<td>Bb 95% CI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Decision-making styles – Decisional conflict3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rational decision-making style</td>
<td>.045**</td>
<td>.036 – .054</td>
</tr>
<tr>
<td>Intuitive decision-making style</td>
<td>.017**</td>
<td>.009 – .025</td>
</tr>
<tr>
<td>Dependent decision-making style</td>
<td>-.001</td>
<td>-.008 – .006</td>
</tr>
<tr>
<td>Avoidant decision-making style</td>
<td>-.043**</td>
<td>-.050 – -.036</td>
</tr>
<tr>
<td>Spontaneous decision-making style</td>
<td>.003</td>
<td>-.006 – .011</td>
</tr>
</tbody>
</table>

1 Association models, with CRC screening participation entered as dependent variable (score 1 = participation, score 2 = non participation). Each decision-making style separately entered as independent variable; higher scores mean the style is used more frequently (scores range from 5 to 25).

2 Association model, with CRC screening participation entered as dependent variable. Decisional conflict as independent variable; a higher score means less experienced decisional conflict (scores range from 1 to 5).

3 Association models, with decisional conflict entered as dependent variable. Each decision-making style separately entered as independent variable. a Rational style: OR adjusted for education and self-reported HL, significant confounding found regarding both variables

Intuitive style: OR adjusted for education and self-reported HL, significant confounding found regarding education

Dependent style: OR adjusted for education and self-reported HL, significant confounding found regarding self-reported HL.
Avoidant style: OR adjusted for education and self-reported HL, significant confounding found regarding both variables
Spontaneous style: OR adjusted for education and self-reported HL, no significant confounding found regarding both variables
Decisional conflict: OR adjusted for education and self-reported HL, no significant confounding found regarding both variables
b Concerning all styles: betas adjusted for education and self-reported HL, no significant confounding found regarding both variables
* Significant at p < .05
** Significant at p < .001

Comment 5:
As health literacy is associated with decision making styles it would be interesting to look at the interactions between these variables (or control for education/literacy in the regressions).

Our response:
We have made changes to the wording used in the background and results section to make more clear that the regression analyses were being controlled for possible confounding by health literacy and education.

We should also mention that in response to a comment from reviewer 1 we made some changes to our research questions. Firstly, we formulated more specific questions based on what we know from previous research into CRC screening decisions and decision-making styles. Secondly, we eliminated aim b (Are people’s education level and health literacy associated with their decision-making style?) as, after consideration, we believe this is mainly a relevant factor to adjust for in the analyses conducted, but not a relevant main research question.

Revision (Background, lines 185-188, page 8):
When examining the relationship between the decision-making style used and people’s CRC screening participation it would also be relevant to adjust for possible associations with people’s education level and health literacy.

Revision (Background, research questions, lines 199-205, page 8):
2. Is there an association between people’s actual CRC screening participation and the use of a specific decision-making style? Hereby adjusting for possible associations with people’s education level and health literacy.
3. To what extent do people evaluate their CRC screening decision positively (in terms of decisional conflict), and is this associated with their CRC screening participation or the decision-making style they used? Hereby adjusting for possible associations with people’s education level and health literacy.

Revision (Methods, lines 281-282, page 11):
Multiple logistic regression analysis was used to examine possible confounding by education and self-reported health literacy.

Revision (Methods, lines 284-285, page 12):
Multiple linear regression analysis was used to examine possible confounding by education and self-reported health literacy.
Revision (Results, legend Table 4, 351-364, page 17):
a Rational style: OR adjusted for education and self-reported HL, significant confounding found regarding both variables
Intuitive style: OR adjusted for education and self-reported HL, significant confounding found regarding education
Dependent style: OR adjusted for education and self-reported HL, significant confounding found regarding self-reported HL
Avoidant style: OR adjusted for education and self-reported HL, significant confounding found regarding both variables
Spontaneous style: OR adjusted for education and self-reported HL, no significant confounding found regarding both variables
Decisional conflict: OR adjusted for education and self-reported HL, no significant confounding found regarding both variables
b Concerning all styles: betas adjusted for education and self-reported HL, no significant confounding found regarding both variables

Comment 6:
There should be a definition of CRC in the abstract.

Our response:
Thank you for pointing out this oversight. We have changed it accordingly.

Revision (Abstract, line 29, page 2):
…, within the context of colorectal cancer (CRC) screening participation.

Comment 7:
More detail on the content of CRC / CRC screening could be added to the background.

Our response:
We agree with the reviewer that this would be a valuable addition, and changes have been made accordingly.

Revision (Background, lines 82-99, page 4):
Preventive CRC screening is aimed at healthy individuals who are not experiencing any symptoms in order to detect cancer in an early stage or precursors of it. Its purpose is to reduce the number of cancer cases, treatments (invasive and non-invasive) and cancer deaths. Since January 2014, everyone in the Netherlands between the ages of 55 and 76 years old biennially receives an invitation to participate in CRC screening via a self-administered stool test (immunochemical faecal occult blood test: iFOBT), which is payed for by the government. People are expected to decide for themselves whether or not they want to participate in CRC screening. Thus, no one else other than the individual it concerns is actively involved in the decision-making process. If the stool test gives a positive result, people are referred for a colonoscopy to find out if they actually have (precursors of) colorectal cancer. In 2016, 72% of those invited for the first time to partake in the CRC screening programme in the Netherlands decided they wanted to be screened [1], which is relatively high compared to other countries.

Reducing the incidence and mortality of CRC are considered the main possible benefits of CRC screening [2-5]. However, CRC screening also involves possible downsides, such as false-negatives,
false-positives, overdiagnosis, overtreatment, and risks associated with colonoscopy [6-10]. Especially on an individual level, it is not apparent whether the possible benefits outweigh the possible downsides of screening as different people could weigh these differently [8, 10-12].

Comment 8:
Lines 94-97 - why is this particularly related to CRC screening?

Our response:
We made slight changes to the wording and made clearer what the connection is between the factors involved in the CRC screening decision and especially the rational, intuitive and dependent decision-making styles from the GDMS.

Revision (Background, lines 146-149, page 6):
The decision-making styles identified by Scott and Bruce, especially the rational, intuitive and dependent style, seem applicable to the decision about CRC screening participation, because it involves dealing with information and weighing of the pros and cons of screening, but also people’s beliefs, experiences, intuition, feelings and social environment [13, 28-35].

Comment 9:
The majority of the ORs looking at screening participation by different decision making styles are quite small effects - this should be discussed.

Our response:
We have added some additional lines in where we discuss further the implications of the found differences (i.e. ORs) being relatively small.

Revision (Discussion, lines 433-437, page 20):
However, the differences are small, as are the proportions of people in our study scoring relatively high (i.e. 15 or higher on the subscale) on using a spontaneous (28%) or avoidant decision-making style (6%). Thus, the effect is not very strong and especially from a screening practice perspective, it is relevant to consider that any possible concern related to this finding applies to a relatively small group of people.

Revision (Discussion, lines 468-470, page 21):
However, although again a small difference, people who had not participated in CRC screening were more likely to experience relatively more decisional conflict than people who had participated in CRC screening.

Revision (Conclusion, lines 513-517, page 23):
Possible concerns in view of informed decision-making could be that both these decision-making styles might be contributing to less informed decisions. However, it is relevant to consider that the found differences are small and that any possible concern related to this finding applies to a relatively small group of people.