Testing invitation letter messages to increase the uptake of bowel cancer screening

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Introduction

The Greater Manchester Health and Social Care Partnership (GMHSCP) commissioned the Behavioural Insights Team (BIT) to explore how behavioural insights could be used to improve the uptake of bowel cancer screening. This summary report outlines the background to this particular policy challenge. It then details the design and results of an online experiment, using BIT's Predictiv platform, to test the impact of behaviourally-informed messaging in screening invitation letters on people's intention to complete bowel cancer screening, compared to the standard bowel cancer screening invitation.

Background

Across the UK, all men and women aged 60 to 74 are invited for bowel cancer screening by the NHS bowel cancer screening programme every two years. They are asked to use a home test kit to collect a stool sample which then is used for a faecal occult blood (FOB) test. The test enables early detection of bowel cancer which improves chances for successful treatment and recovery. Despite this, the attendance rates remain low. Only 52.9% of eligible people in Greater Manchester complete the test within 6 months of invitation, which is lower than the England average (56.4%).[1] Evidence suggests that the attendance of bowel cancer screening is lower among men, people who are lower on the socioeconomic gradient (i.e. people with lower income and education levels), and within BME populations.[2]

In this context, GMHSCP commissioned BIT to run a trial with the aim of increasing the uptake of bowel cancer screening within Greater Manchester. We initially designed a field trial to test the effects of changes to messaging in the invitation letters that accompany the kits that are sent to eligible people. These letters were to be sent out to residents eligible for screening in the Greater Manchester area and the impact of the different messages on screening uptake was to be measured. However, the field trial was not approved by the PHE Bowel Cancer Screening Programme Research Advisory Committee. The main reason cited by the committee was that the system could not cope with a trial at the same time as wider restructuring. This meant that we were not able to implement a field trial and instead we looked to alternative testing approaches in order to explore the effects of different messages on bowel screening behaviours. This led us to run an

[1] Source: https://fingertips.phe.org.uk/profile/cancerservices/data#page/0/gid/1938132830/pat/46/par/E39000037/ati/153/are/E38000016

[2] Von Wagner, C., Baio, G., Raine, R., Snowball, J., Morris, S., Atkin, W. ... & Smith, S. (2011). Inequalities in participation in an organized national colorectal cancer screening programme: results from the first 2.6 million invitations in England. International journal of epidemiology, 40(3), 712-718.

online experiment using the Predictiv platform developed by BIT. This approach allowed us to recruit research participants from a UK panel and to examine the effect of different messages on outcomes such as their stated likelihood of personally taking up bowel cancer screening.

In order to inform this project, BIT has conducted a literature review in which we explored behavioural principles that can be applied to encourage patients to attend cancer screening appointments. The full literature review will be provided to GM as part of our partnership's final report. The literature points to a number of potential patient-level barriers to screening uptake including:

- Little knowledge about the test procedure and its indications;
- Considering the test unnecessary or of no benefit;
- Feeling at low personal risk of developing cancer;
- Forgetting to go to the appointment;
- Fear of embarrassment or pain;
- Fear of a positive screen result;
- Dislike of the test;
- Dissatisfaction with previous screening; and
- Socioeconomic and demographic factors.

In the particular case of bowel cancer, the barriers cited most often tend to be disgust (because handling one's stool is required to collect the sample with the kit),[3] embarrassment, and fear of positive result. The latter is particularly a barrier within the BME population.[4][5]

[3] Senore, C., Inadomi, J., Segnan, N., Bellisario, C., & Hassan, C. (2015). Optimising colorectal cancer screening acceptance: a review. *Gut, 64*(7), 1158-1177.; Reynolds, L. M., Consedine, N. S., Pizarro, D. A., & Bissett, I. P. (2013). Disgust and behavioral avoidance in colorectal cancer screening and treatment: a systematic review and research agenda. *Cancer Nursing*, *36*(2), 122-130.
; Jones, R. M., Woolf, S. H., Cunningham, T. D., Johnson, R. E., Krist, A. H., Rothemich, S. F., & Vernon, S. W. (2010). The relative importance of patient-reported barriers to colorectal cancer screening. *American journal of preventive medicine, 38*(5), 499-507.
[4] Robb, K. A., Solarin, I., Power, E., Atkin, W., & Wardle, J. (2008). Attitudes to colorectal cancer screening among ethnic minority groups in the UK. *BMC Public Health, 8*(1), 34.
[5] Waller, J., Robb, K., Stubbings, S., Ramirez, A., Macleod, U., Austoker, J., ... & Wardle, J. (2009). Awareness of cancer symptoms and anticipated help seeking among ethnic minority groups in England. British Journal of Cancer, 101(Suppl 2), S24.

The trial

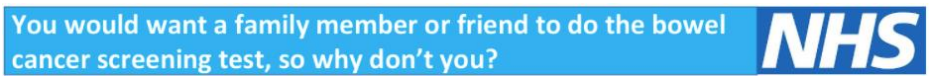
In partnership with the GMHSCP, we designed and ran a randomised, controlled experiment on the Predictiv online experiment platform to test the impact of adapting the existing NHS bowel screening invitation letters. The objective was to evaluate the effectiveness of three behaviourally informed messages, compared to the current standard communication.

Intervention

We summarise the treatment conditions below. The full material can be found in appendix 2.

Message type	Details of intervention
Standard message('Control')	The standard text currently used for inviting people to complete the test kit.
Certainty effect	 'Bowel cancer symptoms can be difficult to spot. Use this opportunity to get some peace of mind.' A simplified message highlighting that the screening test can resolve uncertainty by allowing the potential detection of the *absence* of cancer, i.e. reassuring people that they do not have bowel cancer. This is the reverse of the current detection framing, which is about resolving uncertainty by allowing the potential detection of the *presence* of cancer. Research shows that people can experience uncertainty as worse than being certain about the worst possible outcome[6]. This means that getting reassurance could be an important driver of attendance of cancer screening, both according to literature and GMHSCP's own qualitative research.
Anticipated regret	 'If you were diagnosed with bowel cancer, would you regret not having taken the early detection test?

[6] Gneezy, U., List, J. A., & Wu, G. (2006). The uncertainty effect: When a risky prospect is valued less than its worst possible outcome. *The Quarterly Journal of Economics, 121*(4), 1283-1309.

	Bowel cancer screening aims to spot cancer at an early stage, even in people with no symptoms.' A simplified letter highlighting the regret people might experience if they were diagnosed too late. Anticipated regret (i.e. our tendency to take into account the regret we think we might feel in the future when making decisions[7]) has been found to increase stated intentions to complete cervical[8] and bowel cancer screening.[9]
Consistency	 **'Would you want your family or friends to do the screening? Set an example by doing the bowel cancer screening test.'** A simplified letter prompting people to be consistent with their own recommendation to family and friends to take the test. The research on 'cognitive dissonance' shows that people can experience discomfort when their attitudes and behaviours are inconsistent.[10] This may motivate people to change their behaviours to be consistent with their attitudes (i.e. if they believe that friends or family should take the test, then they may try to align their own behaviour with that attitude and be willing to take the test themselves). Moreover, based on the qualitative research conducted by GMHSCP, people reported completing the test because of the encouragement from their partners and family.

Experimental design

The experiment was conducted entirely online using the Predictiv platform which enables BIT and its clients to to test different communication approaches side by side and evaluate indications of which approach might have the biggest impact on behaviour The tests are specifically designed to capture key drivers that affect

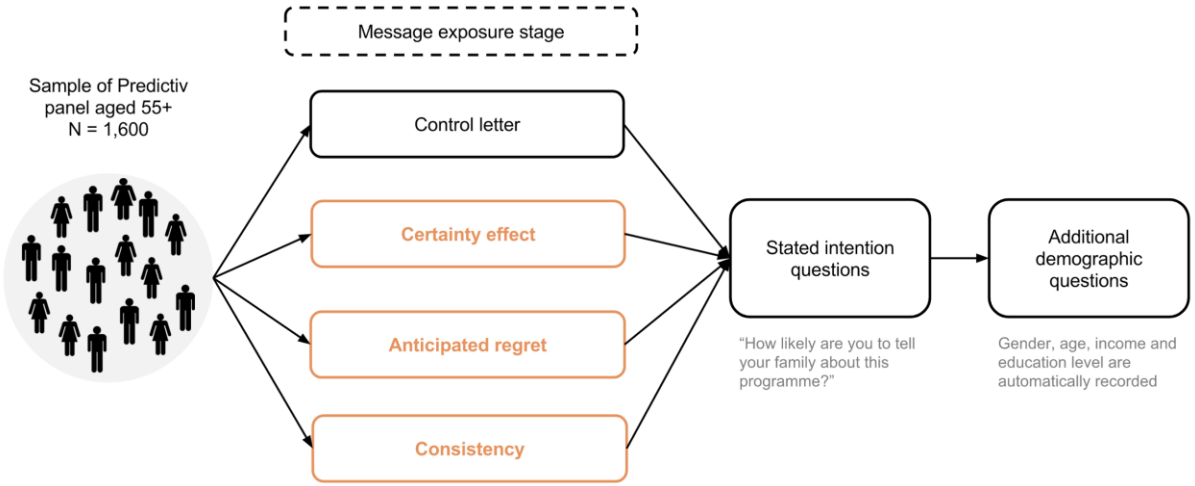
[7] Zeelenberg, M. (1999). Anticipated regret, expected feedback and behavioral decision making. *Journal of behavioral decision making, 12*(2), 93.
[8] Sandberg, T., & Conner, M. (2009). A mere measurement effect for anticipated regret: Impacts on cervical screening attendance. *British Journal of Social Psychology, 48*(2), 221-236.
[9] Ferrer, R. A., Klein, W. M., Zajac, L. E., Land, S. R., & Ling, B. S. (2012). An affective booster moderates the effect of gain-and loss-framed messages on behavioral intentions for colorectal cancer screening. *Journal of behavioral medicine, 35*(4), 452-461.
[10] Festinger, L. (1962). *A theory of cognitive dissonance* (Vol. 2). Stanford university press.

behavioural outcomes, such as comprehension of a letter or beliefs about what other people are doing on receipt of a given communication.

Sample

Potential participants could select to participate in this experiment through the panel survey website on which they are registered. We recruited 1,600 participants aged 55+ to reflect targeting of the NHS bowel cancer screening programme.

Figure 1: Test overview - Participants are randomly assigned to a condition in the message exposure stage



Process

- **Message exposure:** Participants were randomly allocated into one of four arms: three intervention arms (certainty effect, anticipated regret, consistency) and a control arm. Participants in each arm viewed a different set of materials, i.e. a different version of a letter that could accompany the bowel cancer screening kit. Participants could spend as much time as they wanted viewing the material.
- **Stated intention questions:** Participants were asked a series of questions capturing their intentions to use the home kit to collect a sample for screening. These self-reported measures were:

  ***Primary outcome measure**: Stated intention (binary measure)* - the proportion of participants answering 'yes' vs. 'no' to the question of whether they would complete the screening kit and send it back.

  ***Secondary Outcome measures**:*

  - *Stated intention (scale)* - the likelihood (on a 5-point scale) of completing the screening kit and sending it back

- *Likelihood of recommending the screening to family and friends* (on a scale of 1 = very unlikely to 5 = very likely)
- *Stated support for the programme* (on a scale of 1 = very unsupportive to 5 = very supportive).

- **Additional demographic questions:** Finally, participants were given several demographic questions which captured characteristics which could, based on our literature review, influence the participant's stated intentions, as well as their response to the intervention material (see Appendix 1).

Limitations: It should be noted that this experiment examined stated intentions rather than measuring actual behaviour. Research shows that there is often a gap between what people say they would do and what they actually do.[11] Therefore, the results expressed via stated intentions should be interpreted with this in mind.

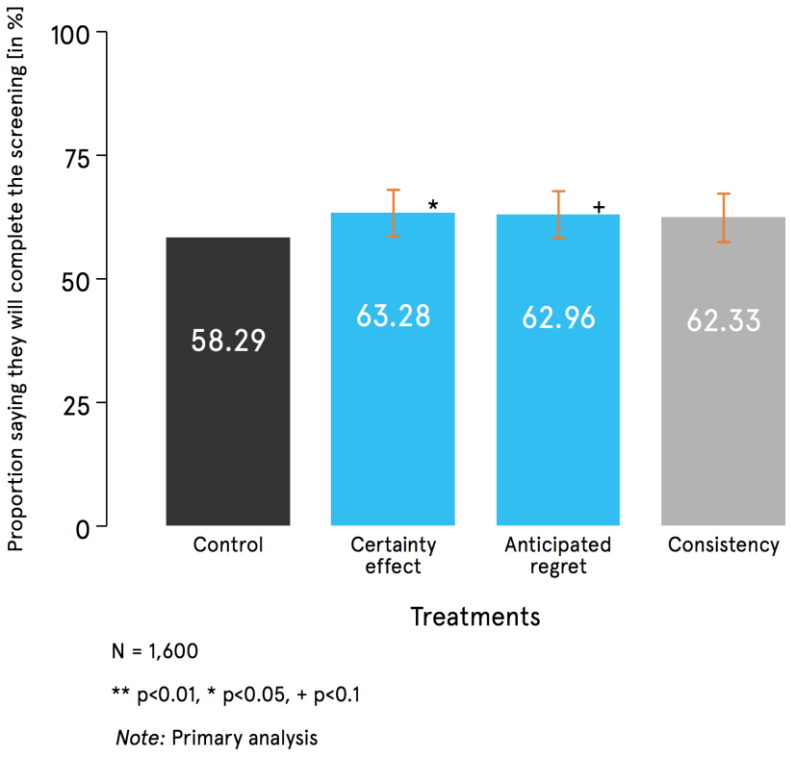
[11] Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological bulletin*, *132*(2), 249. According to this meta-analysis of 47 studies, a medium-to-large change in intention leads to a small-to-medium change in behavior.

Results

Stated intentions

The primary outcome measure was the proportion of participants answering 'yes' vs. 'no' to the question of whether they would complete the screening kit and send it back. Compared to a baseline of 58.3%,[12] 63.3% of participants in the certainty effect condition stated that they would complete the kit. This represents an increase of 8.6%, which is a statistically significant change ($p < .05$). In the anticipated regret condition, 63.0% of participants stated that they would complete the kit, an increase of 8%. However, this change is only significant at the $p < .10$ level. There was no statistically significant difference between the consistency letter and the control letter. Results are shown in Figure 1 below. This analysis of the primary outcome measure suggests that both the certainty effect and anticipated regret messages are effective at increasing the number of people who state that they would be willing to complete the screening.

Figure 2: Stated likelihood of completing the test (yes/no) across treatments



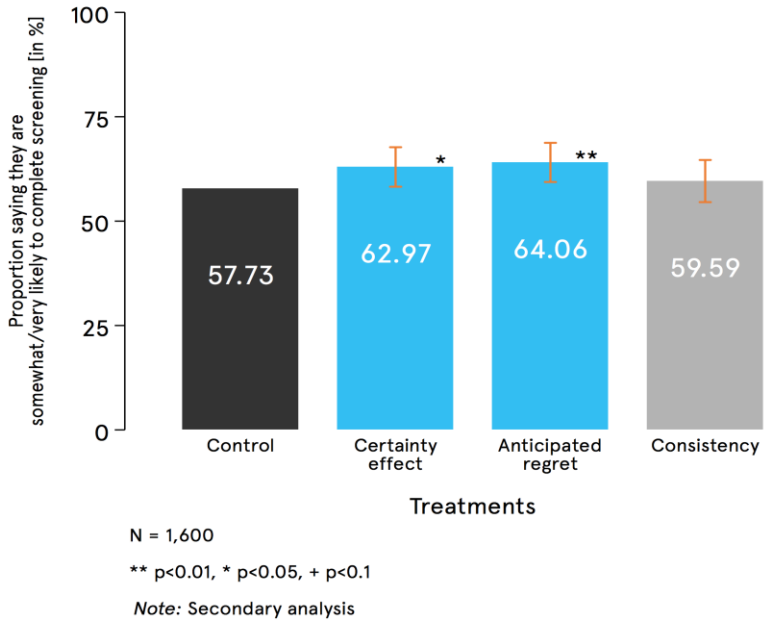
[12] Note that this baseline stated intention to complete the test is consistent with the actual attendance rates which are between 57.8% (for 60-69 years old) and 58.5% (for 70-74 years old) in 2015/2016 in England (according to the Public Health England's fingertips data).

We also looked at a series of secondary outcome measures to explore the effect of the different letters on participants' responses. In particular, we were interested in how likely they would be to complete the home kit (using a 5-point response scale, as opposed to the binary 'yes' vs. 'no' response option used as the primary outcome measure), whether the participant would recommend the programme to friends and family, as well as whether they support the screening programme. Responses to all these questions were measured using a 5-point Likert scale. For stated likelihood of completing the screening or recommending the programme to friends and family, a response of 1 on the scale corresponds to 'not at all likely' and 5 to 'very likely'. For stated support for the screening programme, a response of 1 on the scale corresponds to 'not at all supportive' and 5 to 'very supportive'. For reporting purposes, we grouped the share of participants responding that they are 'likely' (4) and 'very likely' (5) to complete the screening together.

We found that the anticipated regret letter had a positive and significant effect, consistently across all the measures. The proportion of participants who reported to be likely or very likely to complete the screening was 10.9% higher than control, a statistically significant change ($p < .01$) (Figure 2). The proportion of those likely to recommend the programme to their friends and family was 11.4% greater than control (Figure 3) and the proportion of those supporting the programme was 5% greater than control (Figure 4). However, these latter two results were only significant at the $p < .10$ level.

The certainty effect letter resulted in a positive significant effect only in the stated likelihood measure (an increase of 9.1%, $p < .05$), while the consistency letter was not significantly more effective than the control letter on any of the secondary outcome measures.

Figure 3: Stated likelihood of completing the screening (the share of 'likely' and 'very likely' responses

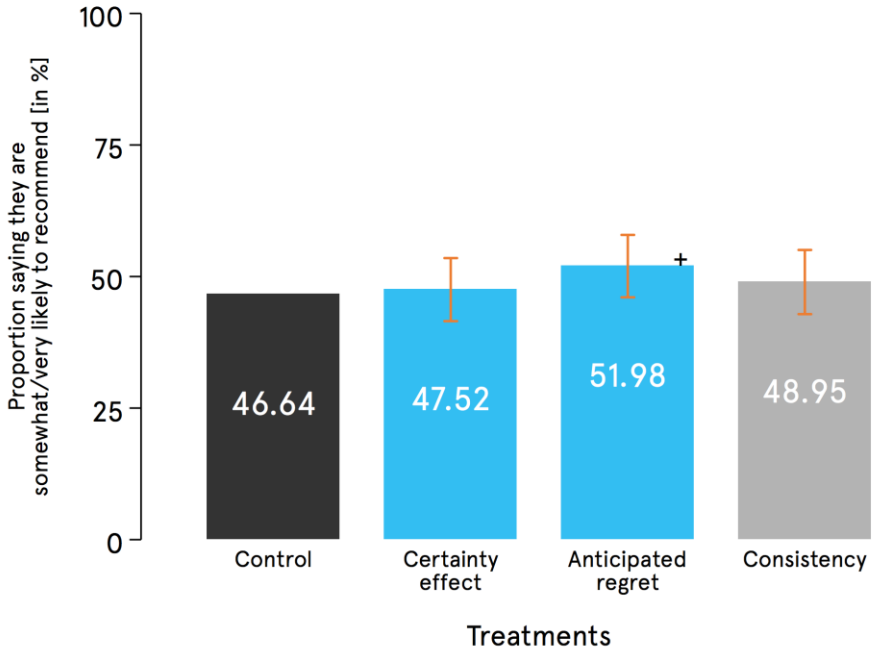


N = 1,600

** p<0.01, * p<0.05, + p<0.1

Note: Secondary analysis

Figure 4: Stated likelihood of recommending the programme to friends and family (the share of 'likely' and 'very likely' responses)

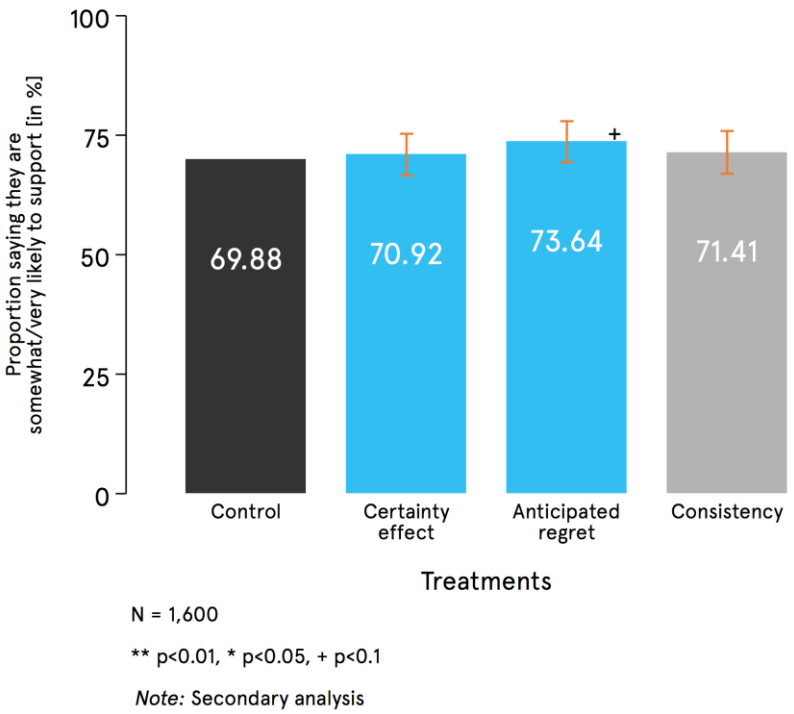


N = 1,600

** p<0.01, * p<0.05, + p<0.1

Note: Secondary analysis

Figure 5: Stated support for the programme (the share of 'likely' and 'very likely' responses)

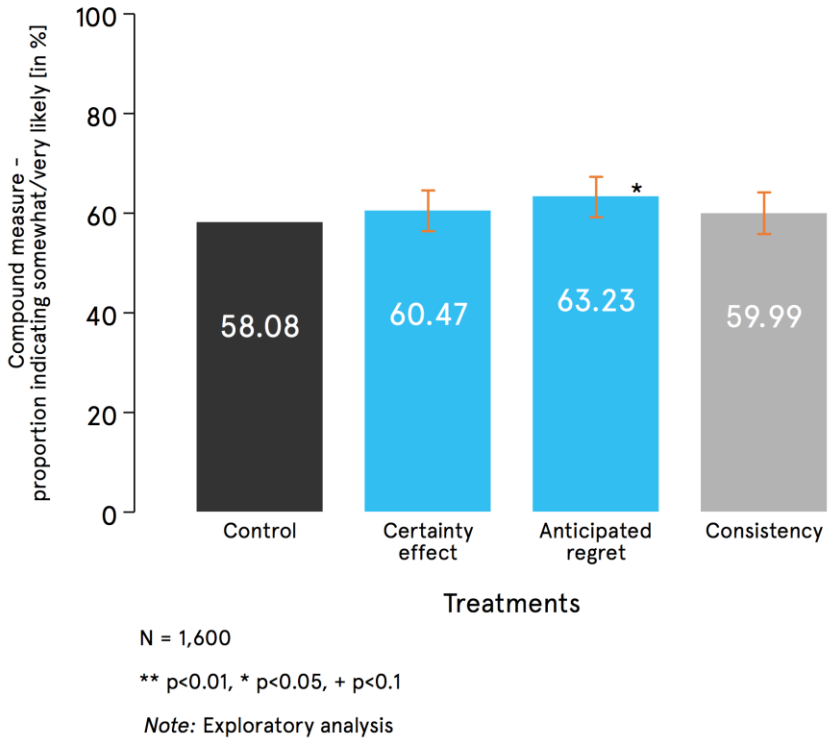


Compound measure of beliefs

We investigated the extent to which these secondary outcome measures correlated with each other and found that the correlations were significant ($p < .001$) and ranged from 0.53 to 0.73 (where 0 means no correlation at all and 1 indicates a perfect correlation between the measures). These significant correlations mean that the measures are, to some extent, likely to be capturing similar aspects of people's beliefs and attitudes towards screening. As exploratory analysis, we created a compound measure of stated sentiment towards screening, which was done by averaging each participant's scores on the three measures. Results of this analysis are shown in Figure 6, plotting this composite measure on the Y-axis, with a score of 0 generally indicating a negative sentiment (i.e. very unlikely to do the screening, very unlikely to recommend the screening, low support of the screening programme) and a score of 5 indicating a positive sentiment (i.e. very likely to do the screening, very likely to recommend the screening, high support of the screening programme).

Using this measure, we again found that the anticipated regret letter resulted in an 8.7% improvement in stated sentiment, meaning that participants became more positive towards the bowel screening in the anticipated regret condition, relative to control. This difference was statistically significant ($p < .05$). The certainty effect and consistency letters were not significantly better than the control letter.

Figure 6: Compound measure of stated likelihood across treatments

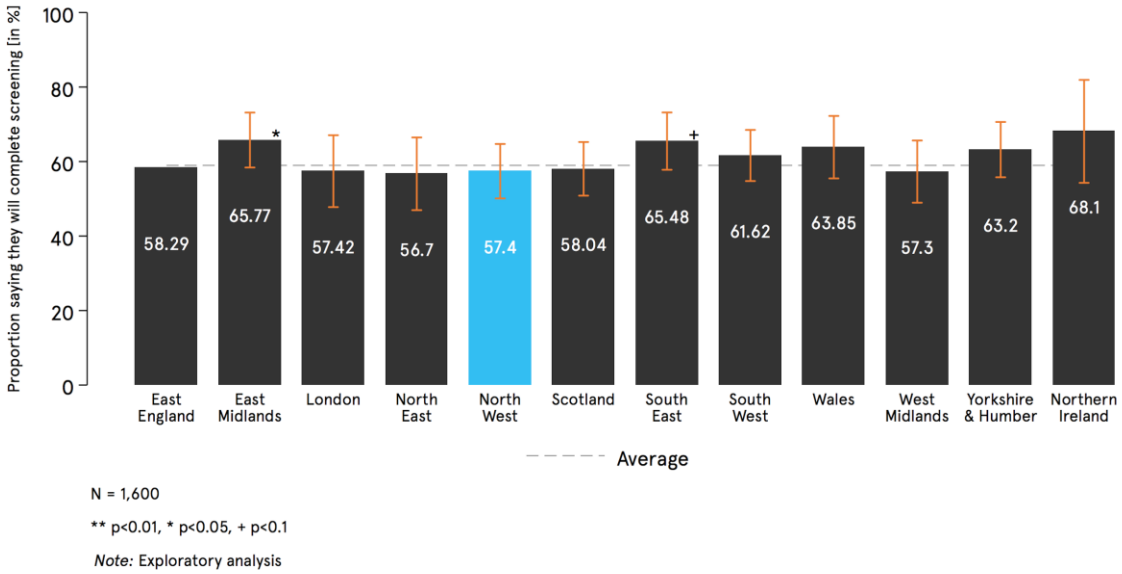


Factors related to the stated likelihood of completing bowel cancer screening

We also examined the relationship between demographic variables and the stated likelihood of completing the bowel cancer screening, to explore whether the messages had different impacts for people depending on factors such as the person's age or the region they live in.

We examined the North West of England to see if there were any differences between that area and others in England. However, we found no significant differences (Figure 7).

Figure 7: The difference in proportion saying that they will complete the screening between NUTS location



In line with the existing literature, we saw significant effects of previous attendance and age on stated likelihood and directional effects of income and education levels on stated likelihood to complete the screening. However, our sample size is too small to run subgroup analyses by each demographic in a robust way, so these patterns should be only taken as indicative.

As shown in Figure 8, a significantly greater proportion of participants who had previously had the screening said that they would complete the screening, relative to people who had not previously completed the screening. Figure 9 shows that a significantly smaller proportion of participants aged 65+ said they would complete the screening relative to those aged 55-64.

Figure 8: The difference in proportion saying that they will complete the screening between those who have been previously screened and those that have not.

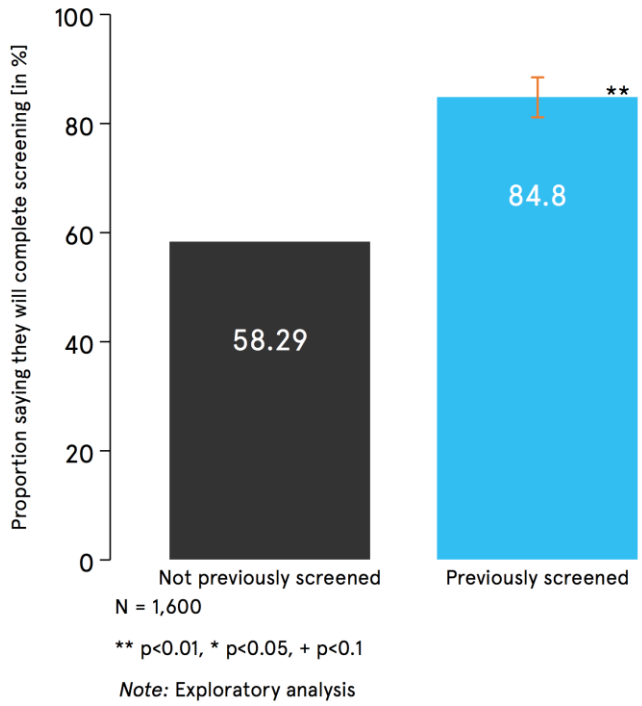
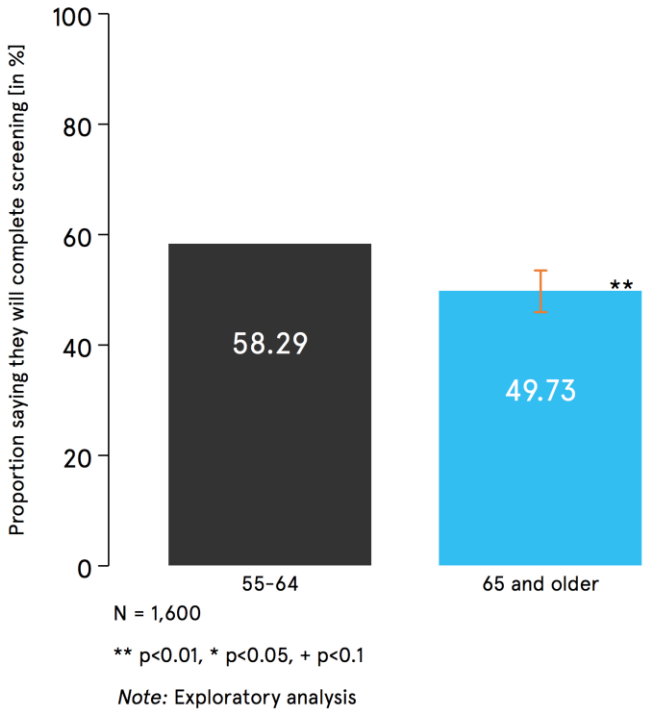


Figure 9: The difference in proportion saying that they will complete the screening between those 55-64 years old and 65 and older.



We also examined the influence of other factors that have been identified by research to have an impact on screening uptake, such as gender and ethnicity. However, in our sample of participants, we found that these factors were not significantly correlated with the stated likelihood of completing the screening. In the case of ethnicity, the absence of an effect can be explained by a low proportion (2%) of non-white participants in our sample. This was both because we prioritised a segmentation of the sample based on age (to reflect the NHS programme target group) and due to the small share of non-white participants available in the old age group on Predictiv.

Perceptions about bowel cancer

We also analysed the relationship between people's perceptions about the incidence and the survival rate of bowel cancer and their screening behaviour. We were interested in this as some people's unwillingness to attend screening may be related to misperceptions of incidence or survival, and correcting those misperceptions in future awareness efforts or communications may be an effective way to increase uptake.

In order to find out about participants' perceptions, we asked them how many people out of a hundred develop bowel cancer (incidence rate) and how many are cured of bowel cancer (survival rate). The actual statistics for these rates are 5/100[13] and 57/100,[14] respectively.

We found that the majority (75%) of participants overestimated the incidence of bowel cancer. In terms of the perceptions of survival rate, the majority of people (57%) underestimated the curability of bowel cancer. This is in contrast with a previous British survey (N=2018) which suggested people had broadly realistic perceptions (i.e. the modal estimate of survival rate was 50-60/100).[15] Overall, this suggests that participants in our study held rather pessimistic beliefs about bowel cancer, believing it was more common and less treatable than it actually is.

[13] NHS Cancer Screening Programmes. Bowel cancer screening: the facts. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/598271/BOSP01_bowel_cancer_facts.pdf

[14] Cancer Research UK. (2017). Bowel cancer survival statistics. Retrieved from http://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/bowel-cancer/survival#heading-Zero

[15] Whitaker, K. L., Simon, A. E., Beeken, R. J., & Wardle, J. (2012). Do the British public recognise differences in survival between three common cancers?. *British journal of cancer, 106*(12), 1907.

Figure 10: Distribution of beliefs about the incidence rate of bowel cancer. The x-axis represents participants' responses about the % incidence rate in the population (grouped into buckets of 5, e.g. 0-4%, 5-9%, 10-14%).

The actual incidence rate is indicated by the orange line.

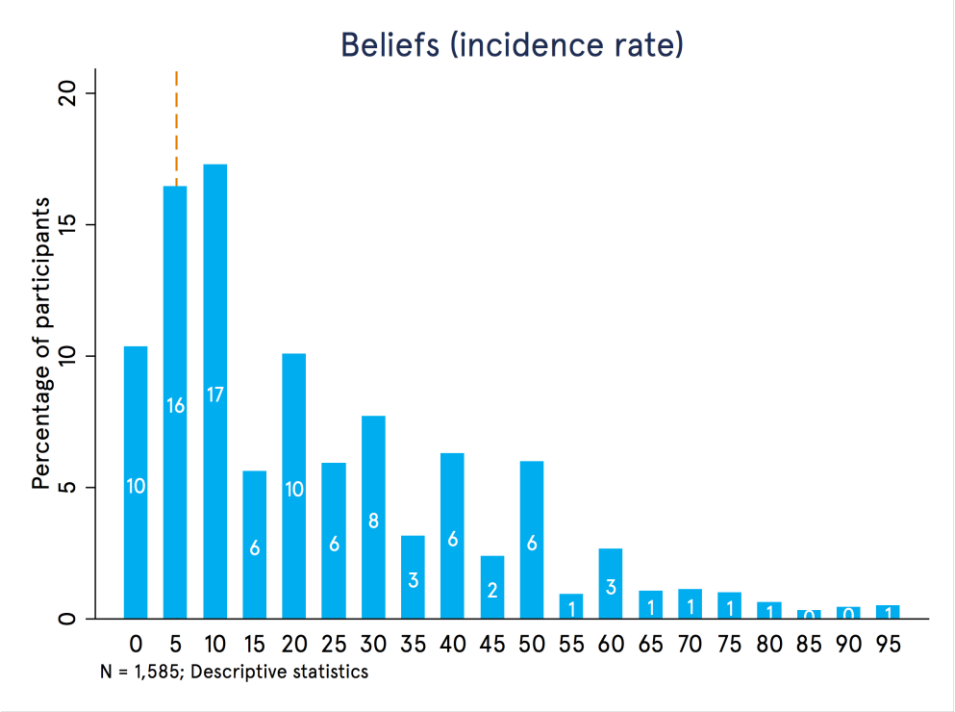
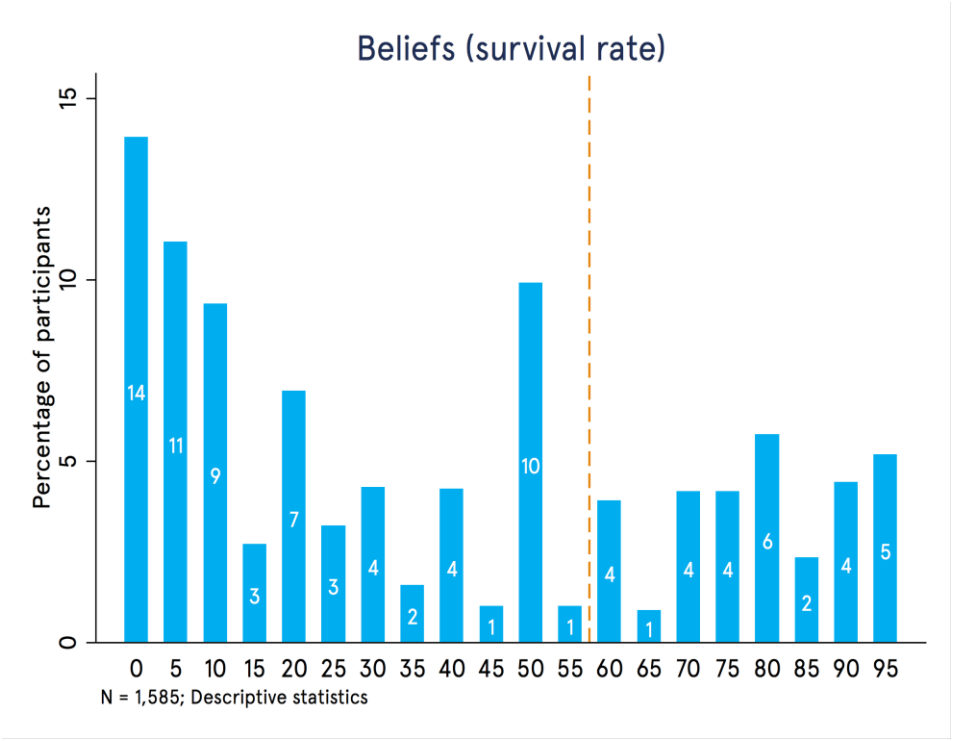


Figure 11: Distribution of beliefs about the survival rate of bowel cancer. The x-axis represents participants' responses about the % survival rate in the population (grouped into buckets of 5, e.g. 0-4%, 5-9%, 10-14%).

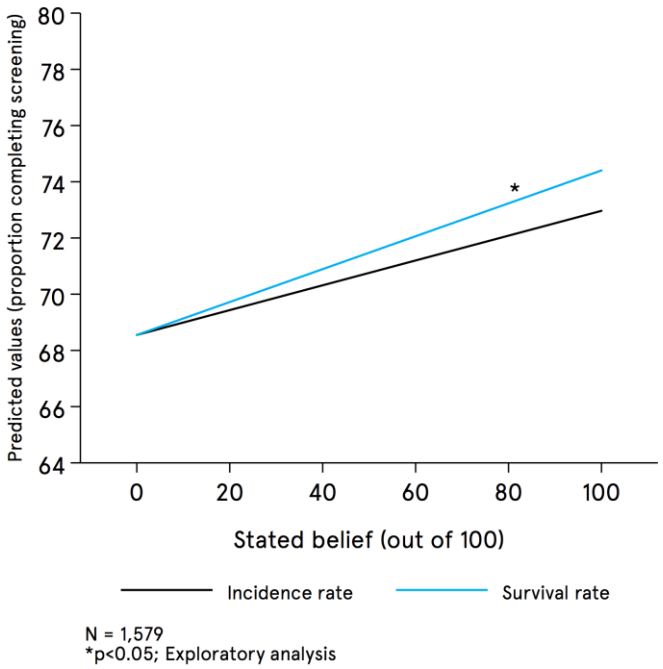
The actual survival rate is indicated by the orange line.



Next, we looked at the relationship between the perceptions and stated screening behaviour (Figure 12). Consistent with cancer literature,[16] we found that the belief about the *survival* rate has a significant positive correlation with the stated likelihood of completing the test. However, the belief regarding the *incidence* rate was not significantly correlated with the stated likelihood. In other words, this suggests that the more that people believe that bowel cancer is curable, the more likely they are to report an intention to complete the screening. However, people's intention to complete bowel screening is not significantly influenced by perceptions of how common bowel cancer is in the population.

[16] Donovan, R. J., Carter, O. B., & Byrne, M. J. (2006). People's perceptions of cancer survivability: implications for oncologists. *The Lancet Oncology, 7*(8), 668-675.; Harewood, G. C., Wiersema, M. J., & Melton III, L. J. (2002). A prospective, controlled assessment of factors influencing acceptance of screening colonoscopy. *The American journal of gastroenterology, 97*(12), 3186-3194.; Pearlman, D. N., Clark, M. A., Rakowski, W., & Ehrich, B. (1999). Screening for breast and cervical cancers: the importance of knowledge and perceived cancer survivability. *Women & health, 28*(4), 93-112; Burgess, C., Hunter, M. S., & Ramirez, A. J. (2001). A qualitative study of delay among women reporting symptoms of breast cancer. Br J Gen Pract, 51(473), 967-971.

Figure 12: Predicted values of beliefs for respondent saying that they will complete the test



Provisional analysis: the relationship between perceptions about bowel cancer and screening behaviour

We provisionally explored the impact of the different messages based on people's perceptions about the bowel cancer survival rate. In order to do so, we split our participants into two groups:

- *Optimists* - participants who who overestimate the proportion of people cured of bowel cancer, relative to the actual statistic (N=488)
- *Pessimists* - participants who underestimate the proportion of people cured of bowel cancer, relative to the actual statistic (N=1090).

Finally, we created a measure which captures the difference between the actual survival rate and the respondent's perception. The size of difference indicated how much people's perceptions deviated from the actual rate, i.e. how strongly optimistic or pessimistic they were about the bowel cancer survival rate.

The analysis shows a small interaction effect of the treatment for respondents who are strongly optimistic or pessimistic about the survival rate of bowel cancer. Extreme optimists who received the anticipated regret letter were more likely to report they would complete the screening, while strongly pessimistic participants responded more to the certainty effect letter. This finding corresponds with the rationale behind our behavioural messages.

Firstly, the anticipated regret letter highlights the costs of failing to get screened and to have cancer detected early on, when there is a high chance of successful treatment and recovery. Optimists may be more moved by anticipated regret because of their stronger belief in the curability of cancer. In contrast, this message appeals less to fatalistic pessimists who perceive the chances of survival as so low that they think even early detection cannot help at all.

Secondly, the certainty effect message is based on the insight that some people prefer to be certain about a bad outcome over being unsure about their situation. In line with this rationale, pessimists responded more to the 'get peace of mind' message because they perceived the screening as a way to gain certainty about a poor diagnosis.

However, these interesting findings are only indicative and are subject to several limitations. The effects are small and hold only for the respondents with strong (optimistic or pessimistic) beliefs. Moreover, the questions about perceptions featured right after the main stated intention outcome measures which could create consistency bias. Simply put, participants who stated they would complete the test might feel compelled to increase their estimate of survival rate so that their willingness to get screened seems justified (and vice versa).

Attrition

Lastly, Predictiv also allows us to take into account the number of respondents within different message conditions who decided to leave the survey at each stage. Out of the total number of drop-outs (132), the consistency letter discouraged the highest share of participants (18) - significantly more than the standard current letter.[17] This suggests that participants may have been actively turned off by the framing of this message.

[17] This difference between consistency and the control condition (13.6% vs 7.6%) is significant at the 5% level according to an equality of proportions test (p=0.044).

Summary

<table>
<tr><td colspan="2">Stated intentions to complete the screening as measured by a yes/no response are highest when people are told that they can reduce their uncertainty about whether or not they have cancer.</td></tr>
<tr><td colspan="2">The most effective message highlighted that screening can remove uncertainty about cancer (certainty effect). It resulted in 8.6% more people saying that they intended to complete screening, compared to the current standard text.

The message highlighting the costs of not getting screened (the anticipated regret) resulted in an indicative 8% increase of the number of people reporting they would complete the test (although this was not statistically significant).</td></tr>
<tr><td colspan="2">The share of participants who responded positively (with saying they would be likely or very likely to complete, recommend or support the screening) is highest when people are told that they can avoid feeling regret later if they get screened now.</td></tr>
<tr><td>Stated intentions</td><td>The most effective message on these measures highlighted the the opportunity to avoid regret in case cancer is detected at a later stage in future. This message encouraged 10.9% more people to say they would be likely or very likely to complete the screening, compared to those who read the current standard text.

The message highlighting that screening can remove uncertainty about cancer (certainty effect) also resulted in a 9.1% increase in the number of people reporting they are likely or very likely to get screened, compared to those who read the current standard text.</td></tr>
<tr><td>Recommendation to family and friends</td><td>The only effective message on this measure was the message which highlighted what you could lose and regret in future if you do not get screened now (anticipated regret) which resulted in 11.4% more people saying they are likely or very likely to recommend the programme, compared to those who read the standard invitation text.</td></tr>
<tr><td>Support for the programme</td><td>The anticipated regret message led to 5% more people saying they are somewhat or very supportive of the programme. However, this result was only indicative (i.e. not statistically significant).</td></tr>
<tr><td>Compound measure</td><td>Because of the high overlap between the three secondary measures, we also looked at a compound measure of stated sentiment towards screening. It was created by averaging each participant's scores on the three measures.

The anticipated regret message which resulted in an overall 8.7% improvement in stated intentions to get screened, compared to the standard message.</td></tr>
<tr><td colspan="2">Conclusion about the messages</td></tr>
<tr><td colspan="2">Given the consistent results across all measures, the anticipated regret message seems to be the most successful in shifting people's intentions about bowel cancer screening. The message about reducing</td></tr>
</table>

uncertainty also showed promising performance compared to the current standard text. Ineffective across all our measures was the consistency message which prompted people to complete the screening in order to be consistent with their own recommendation to their family and friends was not effective.	
Demographic factors	No significant difference in responses was found between the population of the North West and the rest of England.Previous attendance and age, as well as income and education levels, were associated with increased intentions to undertake screening.
Perceptions about bowel cancer	Participants overestimated the incidence and underestimated the survival rate of bowel cancer. Perceptions about survival rate were significantly and positively related with intended uptake of the test (i.e. the more people believe that bowel cancer is curable, the more likely they are to report an intention to complete the screening).

Conclusion and recommendations

Recommendations

To increase the uptake of bowel cancer screening, we recommend that GMHSCP:

- Considers using certainty effect and anticipated regret messages in new cancer communications
- Focuses on communicating the actual cancer survival rate, rather than the incidence rate

In this online Predictiv experiment, we found that particular behaviourally informed invitation messages are more effective than the current letter text (the standard message) at increasing the stated intention to complete the bowel cancer screening.

The certainty effect message outperformed the control significantly in terms of increasing the proportion of people who said that they would complete the screening. It increased this proportion when stated intentions were measured using binary ("yes" vs. "no") responses, which was our primary outcome measure, as well as when using a 5-point scale ratings of likelihood, which was a secondary outcome measure. This suggests that letters incorporating certainty effect messaging are most promising in their potential to increase uptake of screening. However, this experiment only examined stated intentions rather than measuring actual behaviour, and there is often a gap between what people say they would do

and what they actually do. Where possible we suggest collecting further evidence (such as by running a field experiment) to be able to more accurately determine the effect of such messaging on actual screening uptake.

The anticipated regret message consistently performed well relative the control across all outcome measures (primary and secondary). It achieves robust significant results on the secondary outcome measure of stated intention to complete the screening, as measured by a 5-point scale. Its superiority to the control letter was less strong for the primary outcome measure (binary "yes" vs. "no" response on whether the participant intended to complete screening) and for the secondary outcome measures looking at the likelihood of the participant recommending the screening to friends and family, as well as the level of support the participant had for the programme. Interestingly, the potentially emotive wording of the message did not generate negative feedback. The results here again suggest that incorporating messaging that uses anticipated regret is a promising way to potentially increase screening uptake. Again, ideally, further evidence would be collected in order to understand how effective this messaging is for actual behaviour rather than just stated intention.

The consistency message was the least effective behavioural text, as it did not generate any results that were significantly different from the control. Moreover, it also generated the highest levels of attrition – this message had the highest share of participants who chose to drop out of the online test. The consistency message actually led to a significantly higher dropout rate compared to the control text which suggests that participants found the framing of the message off-putting or discouraging. This result showcases the merits of robust evaluation of new ideas to increase cancer screening attendance.

Based on the existing literature, we also looked at the impact of **demographic factors** on the uptake of bowel cancer screening. We found no significant difference between participants from the North West and the rest of England. Our analysis showed a significant negative relationship between age and stated intention to complete screening (increasing age was associated with decreased intended screening uptake). We also identified a significant positive relationship between previous screening attendance and the stated intention to complete the test (having previously completed the screening was associated with being more likely to complete the test this time round). Due to the limitations of our sample, the well-documented role of ethnicity on the screening behaviour could not be meaningfully evaluated.

We explored the **relationship between people's perceptions about bowel cancer and their screening behaviour** and found that the majority of participants held quite pessimistic beliefs: they overestimated the incidence and underestimated the survival rate of bowel cancer. Interestingly, only the perceptions about survival

rate were significantly and positively related with the intended uptake of the test (i.e. the more people believe that bowel cancer is curable, the more likely they are to report an intention to complete the screening). Within our exploratory analysis, we also looked at how different messages fared with participants who were very pessimistic or optimistic about the bowel cancer survival rate. We found that participants who strongly overestimated the survival rate were more responsive to the anticipated regret message, while the strongly pessimistic participants responded more to the certainty effect letter.

These results suggest additional avenues to increasing bowel cancer screening uptake rates. Firstly, efforts could focus on addressing people's pessimism - that is, their tendency to underestimate the bowel cancer survival rate. It is plausible that the more people become aware of the true survival rate of bowel cancer, the more likely they are to complete the screening. Secondly, adjusting people's beliefs about the curability of cancer could further boost the effect of the anticipated regret letter.

Finally, we also conducted additional textual analysis of participants' reasons for stating that they will (not) be using the kit. In line with literature on bowel cancer screening barriers and facilitators, we found that the participants who would get tested appreciated the opportunity of early detection and referred to positive experiences of privacy and convenience of a home test. In contrast, those who would not complete the test mostly mentioned disgust or lack of comfort with using the kit, fear of cancer results and general anxiety around the topic.

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Appendix 1. Outcome measures and additional demographic questions

Stated intentions

This stage consists of three questions which were presented in randomised order.

The next questions ask for your opinion about the material you've seen. Your responses will be used to design the programme, so please respond as closely as possible to your actual beliefs.
1. Would you use the the kit at home to complete a screening test and send it back in the post? a. Yes b. No 2. How likely would you say you are to use the kit at home to complete a screening test and send it back in the post? a. Very unlikely b. Somewhat unlikely c. Neither unlikely or likely d. Somewhat likely e. Very likely 3. How likely are you to tell your family and friends about the screening programme? a. Very unlikely b. Somewhat unlikely c. Neither unlikely or likely d. Somewhat likely e. Very likely 4. The NHS is considering sending this letter to individuals like you aged 55 and up. How supportive are you of this programme? a. Not at all supportive b. Somewhat unsupportive c. Neutral d. Somewhat supportive e. Very supportive
Can you please tell us more about why you would or wouldn't use the kit to complete the screening? [free-text box response]

Additional demographic questions

This stage asks participants for more background information about themselves.

You're nearly done. It would be helpful if you could answer the following questions.
1. Have you previously completed a bowel cancer screening? a. Yes b. No 2. How willing are you to take risks, in general? Please tick a box on the scale, where 0 means: `unwilling to take risks' and a 10 means: `fully prepared to take risk'. [18] a. [Scale from 0 to 10] 3. How many people out of a 100 do you think develop bowel cancer in their lifetime? 4. To what degree do you agree with the following statement: *'My chances of getting bowel cancer in the next few years are great.'*? a. Strongly disagree b. Somewhat disagree c. Neither disagree or agree d. Somewhat agree e. Strongly agree 5. How many people out of 100 do you think would be cured if they have bowel cancer in their lifetime? 6. What is your ethnicity? a. African b. Caribbean c. Caucasian d. East Asian e. Latino / Hispanic f. Middle Eastern g. Mixed h. Other i. South Asian j. Prefer not to say 7. What is your location? a. East Midlands (England) b. East of England c. London d. North East (England) e. North West (England) f. Northern Ireland g. Scotland h. South East (England) i. South West (England) j. Wales k. West Midlands (England) l. Yorkshire And The Humber

[18] This question is taken directly from Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, *9*(3), 522-550.

Appendix 2. Control and treatment messages

Current standard text ('Control')

Following the recent letter inviting you to take part in the NHS Bowel Cancer Screening Programme, please find enclosed your test kit together with full instructions on how to use it.

The test kit is used to detect tiny traces of blood, invisible to the naked eye, in your bowel motions. This test will identify people who may need further investigations. This could mean a repeat test and/or having a colonoscopy. Colonoscopy is an investigation looking at the inside of the large bowel with a small camera. Most people who complete a test kit do not need a colonoscopy.

Once you have completed the test kit, please return it in the reply paid packaging provided. No stamp is needed and the kit is safe to send through the post. Results from the test kit will normally be sent to you within two weeks. If you have not heard anything after this time, please call the Freephone number at the top of this letter (calls are free from UK landlines).

We do not have your medical history, and screening is not appropriate for everyone. If you have already been referred to hospital by your GP for bowel investigations, or if you have had previous bowel surgery, then screening may not be appropriate for you. Please call us for advice using the Freephone number.

You can also call the Freephone number if you have any queries about using the test kit, or if you need to request a replacement. If you need help from family or a carer in order to use the kit, please call us (or ask them to call us) for further important information. You can also use the Freephone number if you have any questions about taking part in the programme.

Yours sincerely,
Director of Bowel Cancer Screening Programme

Treatment message 1: Certainty effect

Be on the safe side. Take your bowel cancer test. NHS

Bowel cancer symptoms can be difficult to spot.
Use this opportunity to get some peace of mind.

You are due for your NHS bowel screening. This screening is offered for free by the NHS to all people aged 60-74 in England. It checks for the presence of early signs of bowel cancer in a stool sample, before symptoms appear. Catching these signs early improves chances for successful treatment and recovery.

Your home test kit and full instructions on how to collect a sample are included. The kit is easy to use and can be completed in the privacy and comfort of your home. This saves you a GP visit. You then send the kit and sample back to us, so we can see if things are fine or if other tests might be needed.

Please return the completed home test kit in the reply paid packaging provided. Results from the test will then normally be sent to you within two weeks.

If you have already been referred to hospital for bowel tests, or if you have previously had bowel surgery, then this screening might not be right for you. If these things apply to you, or if you have any other questions, call us using the Freephone number: 0800 707 60 60.

Yours sincerely,
Director of Bowel Cancer Screening Programme

Treatment message 2: Anticipated regret

You would want a family member or friend to do the bowel cancer screening test, so why don't you? NHS

Would you want your family or friends to do the screening?
Set an example by doing the bowel cancer screening test.

You are due for your NHS bowel screening. This screening is offered for free by the NHS to all people aged 60-74 in England. It checks for the presence of early signs of bowel cancer in a stool sample, before symptoms appear. Catching these signs early improves chances for successful treatment and recovery.

Your home test kit and full instructions on how to collect a sample are included. The kit is easy to use and can be completed in the privacy and comfort of your home. This saves you a GP visit. You then send the kit and sample back to us, so we can see if things are fine or if other tests might be needed.

Please return the completed home test kit in the reply paid packaging provided. Results from the test will then normally be sent to you within two weeks.

If you have already been referred to hospital for bowel tests, or if you have previously had bowel surgery, then this screening might not be right for you. If these things apply to you, or if you have any other questions, call us using the Freephone number: 0800 707 60 60.

Yours sincerely,
Director of Bowel Cancer Screening Programme

Treatment message 3: Consistency

Avoid regretting it later. Take your bowel cancer test now. NHS

If you were diagnosed with bowel cancer, would you regret not having taken the early detection test?
Bowel cancer screening aims to spot cancer at an early stage, even in people with no symptoms.

You are due for your NHS bowel screening. This screening is offered for free by the NHS to all people aged 60-74 in England. It checks for the presence of early signs of bowel cancer in a stool sample, before symptoms appear. Catching these signs early improves chances for successful treatment and recovery.

Your home test kit and full instructions on how to collect a sample are included. The kit is easy to use and can be completed in the privacy and comfort of your home. This saves you a GP visit. You then send the kit and sample back to us, so we can see if things are fine or if other tests might be needed.

Please return the completed home test kit in the reply paid packaging provided. Results from the test will then normally be sent to you within two weeks.

If you have already been referred to hospital for bowel tests, or if you have previously had bowel surgery, then this screening might not be right for you. If these things apply to you, or if you have any other questions, call us using the Freephone number: 0800 707 60 60.

Yours sincerely,
Director of Bowel Cancer Screening Programme