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ARTICLE

Effects of a modified invitation letter to follow-up colonoscopy for bowel cancer detection

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Abstract

Objective: To investigate whether modifications made to the current National Health Service (NHS) invitation letter for follow-up colonoscopy examination affect participant state anxiety and behavioural intentions to attend.

Methods: Five hundred and thirty-eight adults of bowel cancer-eligible screening age (56–74) were randomized to receive the current NHS invitation letter or the modified version of the letter as a hypothetical scenario. Modifications to the letter included fewer uses of the term cancer and awareness of alternative screening options. The history of the colonoscopy invitation, anticipated state anxiety, behavioural intention to attend the nurse appointment, and colonoscopy concerns upon reading the letter were measured.

Results: Behavioural intentions were high in both conditions; however, participants reading the current letter reported significantly higher behavioural intentions compared to the modified letter. There was no main effect of previous invite status or interaction between previous invite status and letter condition on behavioural intentions. However, the effect of the letter on levels of anxiety depended on the participant's invitation history. Those never invited for a colonoscopy were more anxious when reading the modified letter compared to the current letter. Conversely, previous colonoscopy invitees were less anxious following reading the modified letter than those reading the current letter. Those never invited for a colonoscopy were more concerned about embarrassment and test invasiveness. All findings remained the same when controlling for age and education.

Conclusion: Modifications to the invitation letter were not beneficial to levels of screening intention or anxiety.

KEYWORDS
cancer screening, colonoscopy, early diagnosis, faecal immunochemical test, patient anxiety

Statement of Contribution

What is already known on this subject?

- The uptake of follow-up colonoscopy examinations for bowel cancer detection in England is suboptimal.
- Patient anxiety has been suggested to be a key barrier to follow-up colonoscopy for bowel cancer detection.
- The effect of modifying current NHS invitation materials for follow-up colonoscopy is currently unknown.

What this study adds?

- Modifications to the invitation letter were not beneficial to levels of screening intention or anxiety.
- Anxiety levels after reading the modified invitation materials depended on previous colonoscopy invitation status.
- Previous colonoscopy invitees were less concerned about embarrassment and test invasiveness than never-invited participants.

INTRODUCTION

Colorectal cancer (CRC), also known as bowel cancer, is among the leading causes of cancer morbidity and mortality worldwide. It is the second most common cause of cancer death in the United Kingdom, resulting in 16,800 deaths yearly (Cancer Research UK, 2022). The relative risk of CRC mortality has been reported to be reduced by 25% through patient attendance in at least one round of organized asymptomatic CRC screening (Hewitson et al., 2008). Asymptomatic CRC screening now includes initial faecal immunochemical testing (FIT), a test that looks for traces of blood in a faeces sample, and follow-up colonoscopy examination; a flexible tube called a colonoscope with a camera attached, inserted into the bowel to look for abnormalities. Colonoscopy is the gold standard for the detection of colorectal neoplasia and has been attributed to the long-term reduction in CRC mortality (Nishihara et al., 2013). A colonoscopy examination is currently provisioned by the National Health Service (NHS) in England as part of the Bowel Cancer Screening Programme (BCSP) to screen for abnormalities following a routinely offered positive FIT result.

In a recent international survey completed by 35 screening programmes, the mean colonoscopy completion at 6 months after positive FIT was 79% (Selby et al., 2021). Likewise, earlier findings by Logan et al. (2012) found 83% of 21,106 patients in England with an abnormal test to undergo colonoscopy, with 6% of patients not attending the initial specialist screening practitioner clinic despite reminders. Given that individuals with a positive FIT result are at a heightened risk of CRC, inadequate uptake of follow-up colonoscopy examination undermines the effectiveness of organized asymptomatic screening programmes to reduce CRC morbidity and mortality.

Previous quantitative research provides insight into patient emotional and practical barriers to follow-up colonoscopy (Kaushal et al., 2020; Plumb et al., 2017). For example, Kaushal et al. (2020)

conducted a hypothetical online vignette survey with 953 English participants, asking them to imagine they had received a positive faecal occult blood test (FOBt). Barriers to having a follow-up investigation included time constraints, more frequently cited by participants in employment or from ethnic minority groups, and difficulties with transport among participants living in areas of higher deprivation. To our knowledge, only two qualitative studies in England have investigated the reasons for (non)participation in follow-up colonoscopy examinations offered by the BCSP (Kerrison et al., 2021; Travis et al., 2022). Patient anxieties were found to be a key barrier to follow-up colonoscopy, attributed to the fear of a CRC diagnosis and procedural-related anxieties such as pain and discomfort, bowel preparation procedures, and embarrassment. To our knowledge, these findings were consistent with only two other studies outside of the United Kingdom looking at barriers to follow-up colonoscopy examination in people in Denmark (Bertels et al., 2020, 2022). Through interviews with follow-up colonoscopy attenders and specialist screening practitioners, Travis et al. (2022) also captured recommendations to improve the delivery of NHS procedural information and services. Recommendations included the suggestion that information should be provided earlier to patients within written invitation materials about: (1) the option of pain relief (known as sedation) during the colonoscopy; (2) the possibility to request a same-gender NHS team to carry out the colonoscopy; and (3) it might reduce anxiety levels by including fewer uses of the term cancer within the letter.

To our knowledge, interventions, including modifications to written materials in England that relate specifically to follow-up colonoscopy invitations, are yet to be trialled. The effects of alternate written materials on levels of patient anxiety and behavioural intention to attend follow-up colonoscopy are therefore currently unknown. The current study is informed by wider international work that demonstrates the effectiveness of providing procedural information and education in reducing procedural-related anxiety, pain, and adherence to colonoscopy (Denberg et al., 2006; Hsueh et al., 2016; Shaikh et al., 2010). Having no previous history of undergoing a colonoscopy has also been found to be associated with higher levels of procedural anxiety, with recommendations for well-designed education materials to improve patient understanding of the procedure (Coombes et al., 2008; Shafer et al., 2018). This study therefore sought to investigate and compare the effect of screening history on patient anxiety and intention following reading invitation material. A supporting theory that specifically considers the sequence of screening behaviours that an individual goes through is the integrated screening action model (I-SAM) introduced by Robb (2021). The I-SAM aims to improve uptake of cancer screening by providing a framework that outlines the sequence of stages a person passes through when engaging in a screening behaviour. These include participants being unaware of screening, repeating a screening behaviour through re-invitation, or deciding not to screen. The I-SAM is directly informed by the Precaution Adoption Process Model (Weinstein et al., 2020) to explain how individuals at the same screening stage face common barriers to one another and therefore that interventions should be targeted per screening stage. Furthermore, individuals at different screening stages will face different barriers and health beliefs and therefore require different interventions (Robb, 2021). This integrated model draws upon behaviour change theory to identify potential targets and policies to increase access to screening, derived from the Capability, Opportunity, Motivation-Behaviour (COM-B) model (Michie et al., 2011) and other existing literature. This study sought to investigate whether providing additional procedural-related information, such as the option of pain relief during the colonoscopy, would, as per the I-SAM framework (Robb, 2021), change participant levels of motivation and capability (participant influences), measured through participant expected levels of anxiety (negative emotional responses) and behavioural intentions to attend the nurse appointment when invited to attend further tests.

To examine whether modifying the letter could positively impact levels of behavioural intention and anxiety we made a series of modifications to the current NHS BCSP invitation letter, following a positive FIT result. These modifications were based on recent qualitative research by Travis et al. (2022), which outlined suggestions from specialist screening practitioners and colonoscopy screening patients within the BCSP. Suggestions were specifically informed by the barriers and facilitators patients experienced and observed by nurses when patients were invited and attended a colonoscopy following a routine positive FIT result (Travis et al., 2022). Modifications included fewer uses of the term cancer, making it known that pain

relief was an option (known as sedation) during the colonoscopy, highlighting that there was an option to request a same-gender NHS team to carry out the colonoscopy, and that alternative screening options are available should (for whatever reason) having a colonoscopy be of concern to the participant.

The current study is novel in its aim to investigate whether providing modified information to the current NHS Bowel Cancer Screening Programme (BCSP) invitation letter for follow-up colonoscopy reduced participant self-reported state anxiety and increased behavioural intention levels to attend the nurse appointment to discuss further medical tests. For exploratory reasons, the study also investigated whether a history of colonoscopy invitations (for any medical reason) affected self-reported state anxiety and behavioural intention levels to attend the nurse appointment by letter condition. Specifically, it was hypothesized that participants who receive the modified invitation letter will report significantly lower levels of state anxiety, higher levels of behavioural intention, and significantly lower levels of concern regarding different aspects of the colonoscopy procedure (e.g., pain and discomfort, the gender of the NHS staff performing the colonoscopy, test invasiveness) compared to those participants who receive the current NHS BCSP invitation letter.

METHODS

Design and participants

The current study used a between-participants cross-sectional online questionnaire design. Participants were recruited using an online participant database (Prolific) and were required to be aged 56–74 years old (the existing BCSP eligible screening age for CRC) and to currently live in the United Kingdom. No other eligibility criteria were specified. Participants were randomized using the Qualtrics questionnaire randomizer function to receive and read one of two letter conditions: The current NHS BCSP letter or a modified version of the NHS BCSP letter. Participants were given a hypothetical situation in which they were asked to imagine that they had received a letter in the post inviting them to attend a nurse appointment to talk about having a colonoscopy. After reading the letter, participants were asked to rate their expected levels of state anxiety, behavioural intention, and the nature their concerns with being invited to attend a nurse appointment to talk about having a colonoscopy. Note that prior to the study commencing, patient and public engagement work was carried out with 15 adults of eligible screening age (between 56 and 74), to gain further feedback on both the current NHS and the modified invitation letter, with minor changes made to the modified letter. For the current NHS letter and the modified version of the NHS BCSP letter, see Appendix S1 file. The study received ethical approval from the University of *Leeds* Ethics Committee on the 21 March 2022 (Reference: PSYC-501) and was preregistered on AsPredicted (#97222) on the 16 May 2022 ahead of data collection (AsPredicted, 2022). Data were collected twice due to a technical error with the position of the behavioural intention anchors on the questionnaire being incorrect. The questionnaire was repeated with the behavioural intention scale anchors corrected. Data from both questionnaires were combined to analyse the state anxiety and colonoscopy concerns scales ($n = 538$), whilst only data from the repeated second questionnaire were used to analyse the behavioural intention scale ($n = 268$). Participant characteristics are shown in Table 1.

Sample size justification

Given there were no previous studies, the sample size calculation was informed by a related study that measured the effect of social norm messages on screening intention for endoscopic screening for CRC (von Wagner et al., 2019). This study reported odds ratios of 2.38 and 5.34 for two messages compared to the control condition (von Wagner et al., 2019). Therefore, using G*Power, the current study used the smaller effect size to calculate the sample size for analysis of covariance (ANCOVA) and multivariate analysis of covariance (MANOVA). The analyses suggested a total sample size of 230 respondents

TABLE 1 Participant characteristics for each study and for total sample.

Participants characteristics	Study 1 (N=270)	Study 2 (N=268)	Total (N=538)
Gender			
Female	154 (57.0)	136 (50.7)	290 (53.9)
Male	116 (42.9)	132 (49.3)	248 (46.1)
Age (years)			
Mean (range)	61.87 (56–74)	61.85 (56–74)	61.86 (56–74)
History of colonoscopy invitation			
Previously been invited to attend a colonoscopy	91 (33.7)	103 (38.4)	194 (36.1)
Never been invited to attend a colonoscopy	179 (66.3)	165 (61.6)	344 (63.9)
Ethnicity			
White British or White other	259 (95.9)	261 (97.4)	520 (96.7)
Black or mixed Black or Black other	5 (1.9)	4 (1.5)	9 (1.7)
Asian or mixed Asian or Asian other	5 (1.9)	1 (.4)	6 (1.1)
Any other ethnic group	1 (.4)	2 (.7)	3 (.6)
Education			
Below degree level educated	147 (54.4)	137 (51.1)	284 (52.8)
Degree level educated and above	123 (45.6)	131 (48.9)	254 (47.2)
Employment status (last 7 days)			
Employed	127 (47.0)	131 (48.9)	258 (48.0)
Retired	92 (34.1)	93 (34.7)	185 (34.4)
Looking after home or family	23 (8.5)	22 (8.2)	45 (8.4)
Long term sick or disabled	12 (4.4)	10 (3.7)	22 (4.1)
Other	16 (5.9)	12 (4.5)	28 (5.2)
Legal marital or registered civil partnership status			
In a relationship	158 (58.5)	169 (63.1)	327 (60.8)
Single	104 (38.5)	89 (33.2)	193 (35.9)
Widowed	8 (3.0)	10 (3.7)	18 (3.3)

would be required to achieve 80% power at $\alpha = .05$. The researchers then added 20 participants per condition to account for any missing data or unforeseen technical difficulties. The overall target sample size was 270. See Table 1 for participant characteristics.

Measures

History of colonoscopy invitation recorded whether participants had ever been invited for a colonoscopy for any medical reason. Options of response were: (1) I have never been invited for a colonoscopy; (2) I have previously been invited for a colonoscopy but did not attend; or (3) I have previously been invited for and have attended a colonoscopy. Participants who had previously attended a colonoscopy and those who had been invited but did not attend were grouped together as previous invitees. This allowed for a direct comparison based on different stages of screening, comparing the effects on first-time invitees and invitees repeating a screening behaviour through re-invitation.

State Anxiety was assessed using the Spielberger six-item short-form state anxiety inventory (STAI-6) scale (Marteau & Bekker, 1992). This scale measures state anxiety levels 'right now' on a 4-point Likert scale [not at all (0), somewhat (1), moderately (2) and very much (3)]. A mean state anxiety score was computed. The Cronbach's alpha for this scale in the current sample was $a = .92$.

Behavioural intention to attend the nurse appointment to discuss further medical tests was measured using 4 item statements rated on an 11-point Likert scale (ranging from strongly disagree- 0 to strongly agree- 10). For example, 'I will go to the nurse appointment', 'I plan to go to the nurse appointment'. A mean behavioural intention score was computed. The Cronbach's alpha for this scale in the current sample was $a = .84$.

Colonoscopy concerns were assessed using eight items rated on an 8-point Likert scale (0—not at all to 7—very much). Colonoscopy concerns were taken from key barriers reported by patients in previous literature when invited to attend follow-up colonoscopy (Kerrison et al., 2021; Travis et al., 2022). For example, participants were asked to what degree they would be concerned about different aspects of the colonoscopy procedure, such as pain and discomfort, test invasiveness, and also about being at risk of bowel cancer. A mean colonoscopy concern score was computed. The Cronbach's alpha for this scale in the current sample was $a = .80$.

All measures with Likert scales and scoring used in the questionnaire can be found in the Appendix S1 file.

Data analysis

A 2 (current letter vs. modified letter) × 2 (previously invited vs. never invited for a colonoscopy) between-participants analysis of variance (ANOVA) was used with level of self-reported state anxiety and behavioural intention as the dependent variables. Note that one-way ANOVAs and multivariate analysis of variances (MANOVAs) were preregistered as the planned analyses on AsPredicted; however, for exploratory reasons, the current study also included the participant's previous history of colonoscopy invitation as a factor in the main analyses. The analyses were run a second time, controlling for covariates using the analysis of covariance (ANCOVA). Finally, a 2 (current letter vs. modified letter) × 2 (previously invited vs. never invited for a colonoscopy) between-participants MANOVA was conducted on the eight colonoscopy concern items. These analyses were also run a second time, controlling for covariates using multivariate analysis of covariance (MANCOVA).

Treatment of data

Histograms and box plots of outcome variables were run to check for data normality and identify potential outliers (Mishra et al., 2019). To limit the effect of any outliers, we used a form of Winsorization and replaced outliers with the mean plus 3 standard deviations (Kennedy et al., 1992; Kwak & Kim, 2017). We chose mean plus 3 standard deviations, as this approach ensures that the outlier is replaced by the value of the data at the 97.5th percentile (Kennedy et al., 1992; Kwak & Kim, 2017). Assumptions for MANOVA included checking for the absence of multivariate outliers, multicollinearity, linear relationships between groups, and the test of equality of covariance (Pituch & Stevens, 2015). Assumptions for MANOVA were satisfied. Data remained heavily skewed after removing outliers, and a logarithmic transformation was applied (i.e., $\log_{10}$) for the behavioural intention and colonoscopy concerns scales (Osborne, 2010). We ran the analyses on datasets with and without transformations, and the results were substantively the same. Therefore, we elected to report the results based on these data with the outliers removed.

Before reading the letter, the statement 'Please take your time to read the letter from start to finish' was included in bold. The participant then had to click the next button to continue with the survey after reading the letter. The questionnaire included an attention check. An attention check identifies participants who are not engaged with the questions and allows researchers to screen out those participants prior to conducting analyses (Maniaci & Rogge, 2014). The attention check had to be completed by the participant for the data to be included. The attention check specifically stated, 'Please type the word "letter" into the box below', participants could choose whether to read and complete this task or

not, and when to click next to continue with the survey. Two participants were removed from the data because they did not complete the attention check, shown on the data output as a blank field.

RESULTS

Descriptive statistics

The means and standard deviations for the main study variables for each condition are shown in Table 2. For both letter conditions, the average state anxiety was scored 'somewhat' to 'moderately' ($M = 1.76$ SD = .83). The average behavioural intention was high ($M = 8.70$ SD = 1.65). Being at risk of bowel cancer was scored of most concern to participants in both conditions ($M = 5.10$ SD = 1.84), then procedural related concerns, with little concern given for practical issues (travel costs and other commitments).

Participant characteristics

See Table 1 for participant characteristics, *n* (%).

Effects of letter condition and previous invitation status on state anxiety levels

A 2 (current letter vs. modified letter) × 2 (previously invited vs. never been invited for a colonoscopy) factorial ANOVA found no main effect of letter condition F (1, 534) = .17 $p = .68$ $\eta_p^2 = .00$ on state anxiety levels (current letter: $M = 1.74$ $SE = .05$; modified letter: $M = 1.71$ $SE = .05$). However, a main effect of history of colonoscopy invitation, F (1, 534) = 9.94 $p = .002$ $\eta_p^2 = .02$, was found on state anxiety, with anxiety significantly higher in previous invitees ($M = 1.85$, $SE = .04$) than those never invited ($M = 1.61$, $SE = .06$). The interaction between letter condition and history of colonoscopy invitation was also significant: F (1, 534) = 8.01 $p = .005$ $\eta_p^2 = .02$. As shown in Figure 1 and through follow-up simple effects analysis, previous invitees were significantly less anxious when reading the modified letter ($M = 1.49$ $SE = .08$) than those reading the current letter ($M = 1.73$ $SE = .08$), F (1, 534) = 4.13 $p = .043$. Conversely, those never invited were significantly more anxious when reading the modified letter ($M = 1.93$ $SE = .06$) compared to the current letter ($M = 1.76$ $SE = .06$) F (1, 534) = 4.10 $p = .043$. When controlling for age and education level, there continued to be no main effect of the letter condition F (1, 532) = .63 $p = .63$ $\eta_p^2 = .00$. The main effect of history of colonoscopy invitation F (1, 532) = 9.48 $p = .002$ $\eta_p^2 = .02$ remained statistically significant, as did the interaction effect between history of colonoscopy invitation and letter condition F (1, 532) = 8.21 $p = .004$ $\eta_p^2 = .02$.

Effects of letter condition and previous invitation status on behavioural intention

A 2 (current letter vs. modified letter) × 2 (previously invited vs. never been invited for a colonoscopy) factorial ANOVA found a main effect of letter condition on behavioural intention F (1, 264) = 5.15 $p = .024$ $\eta_p^2 = .02$ with intention significantly higher in the current letter ($M = 8.98$ $SE = .15$) compared to the modified letter condition ($M = 8.51$ $SE = .14$). There was no main effect of history of colonoscopy invitation, F (1, 264) = .3.27 $p = .072$ $\eta_p^2 = .01$, between previous invitees ($M = 8.93$ $SE = .16$) and those never invited ($M = 8.56$ $SE = .13$) on behavioural intention. There was also no interaction effect between history of colonoscopy invitation and letter condition on behavioural intention, F (1, 264) = 2.31 $p = .130$ $\eta_p^2 = .01$. When controlling for age and education, there continued to be a main effect of letter condition

TABLE 2 Means and standard deviations for state anxiety, behavioural intention, and colonoscopy concerns measures by letter condition.

	Total			Letter 1—existing letter.			Letter 2—modified letter		
Dependent variable	***n***	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***	**Mean**	**SD**
State anxiety									
Overall	538	1.76	.83	269	1.75	.8	269	1.77	.85
Previously invited to attend a colonoscopy	194	1.61	.88	93	1.73	.83	101	1.5	.91
Never been invited to attend a colonoscopy	344	1.84	.78	176	1.76	.79	168	1.93	.77
Behavioural intention									
Overall	268	8.70	1.65	133	8.89	1.47	135	8.51	1.80
Previously invited to attend a colonoscopy	103	8.91	1.61	49	9.32	.97	54	8.54	1.96
Never been invited to attend a colonoscopy	165	8.56	1.67	84	8.64	1.65	81	8.48	1.70
Colonoscopy concerns									
Overall									
Being at risk of bowel cancer	538	5.10	1.84	269	5.06	1.83	269	5.14	1.86
Pain and discomfort	538	3.83	2.25	269	3.87	2.24	269	3.78	2.27
Test invasiveness	538	3.61	2.45	269	3.58	2.43	269	3.63	2.48
Bowel preparation	538	3.25	2.40	269	3.24	2.41	269	3.27	2.4
Embarrassment	538	2.80	2.48	269	2.85	2.54	269	2.76	2.42
Gender of NHS nurse	538	1.45	2.04	269	1.57	2.2	269	1.33	1.87
Travel costs	538	1.10	1.74	269	1.1	1.74	269	1.1	1.74
Other commitments	538	.84	1.54	269	.86	1.57	269	.82	1.51
Previously invited to attend a colonoscopy									
Being at risk of bowel cancer	194	4.96	1.88	93	5.09	1.78	101	4.84	1.97
Pain and discomfort	194	3.71	2.34	93	3.75	2.4	101	3.67	2.3
Test invasiveness	194	3.20	2.47	93	3.24	2.43	101	3.16	2.51
Bowel preparation	194	3.28	2.46	93	3.33	2.55	101	3.24	2.4
Embarrassment	194	2.28	2.33	93	2.28	2.37	101	2.29	2.31
Gender of NHS nurse	194	1.27	2.02	93	1.52	2.3	101	1.04	1.71

TABLE 2 (Continued)

	Total			Letter 1—existing letter.			Letter 2—modified letter		
Dependent variable	***n***	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***	**Mean**	**SD**
Travel costs	194	1.36	1.94	93	1.38	2.02	101	1.34	1.87
Other commitments	194	.88	1.61	93	1.08	1.82	101	.69	1.38
Never been invited to attend a colonoscopy									
Being at risk of bowel cancer	344	5.18	1.82	176	5.05	1.86	168	5.32	1.77
Pain and discomfort	344	3.89	2.20	176	3.93	2.15	168	3.85	2.25
Test invasiveness	344	3.84	2.41	176	3.77	2.41	168	3.92	2.42
Bowel preparation	344	3.24	2.37	176	3.19	2.34	168	3.29	2.41
Embarrassment	344	3.10	2.51	176	3.15	2.58	168	3.05	2.45
Gender of NHS nurse	344	1.55	2.04	176	1.6	2.15	168	1.5	1.94
Travel costs	344	.95	1.60	176	.95	1.56	168	.95	1.64
Other commitments	344	.82	1.50	176	.75	1.41	168	.89	1.58

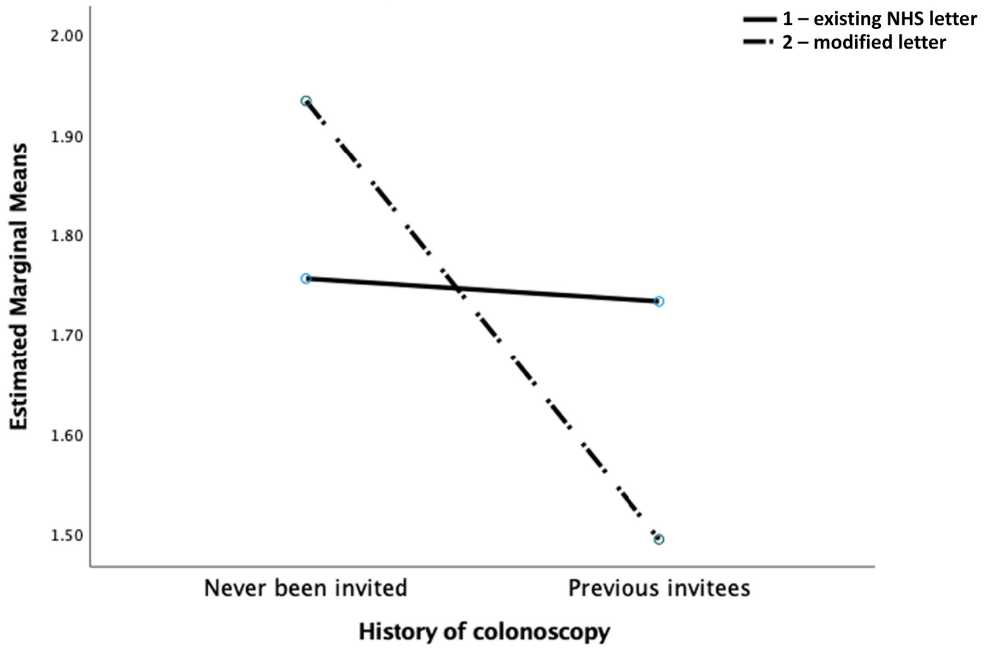

FIGURE 1 The interaction between letter condition and history of colonoscopy invitation on state anxiety.

F (1, 262) = .5.10 p = .025 η_p^2 = .02, and a main effect of history of colonoscopy invitation F (1, 262) = 3.23 p = .073 η_p^2 = .01. There also continued to be no interaction between letter condition and history of colonoscopy invitation F (1, 262) = 2.32 p = .129 η_p^2 = .01.

Colonoscopy concerns

A 2 (current letter vs. modified letter) × 2 (previously invited vs. never been invited for a colonoscopy) factorial MANOVA found no overall effect of letter condition F (8, 527) = .544 p = .824 η_p^2 = .01, on the colonoscopy concerns. An overall effect of history of colonoscopy invitation F (7, 527) = 4.26 p < .001 η_p^2 = .06 was found on colonoscopy concerns, with concerns about embarrassment significantly higher for those never invited (M = 3.10 SD = 2.51) than those previously invited [(M = 2.28 SD = 2.33) F (1, 534) = 13.64 p < .001 η_p^2 = .03]. Concerns about test invasiveness were significantly higher for those never invited (M = 3.84 SD = 2.41) than those previously invited (M = 3.20 SD = 2.47) F (1, 534) = 8.68 p = .003 η_p^2 = .02. Concerns of travel cost were in contrast significantly lower for those never invited (M = .95 SD = 1.60) than those previously invited (M = 1.36 SD = 1.94) F (1, 534) = 6.80 p = .009 η_p^2 = .01. Concerns of pain and discomfort, being at risk of bowel cancer, bowel preparation, and the gender of the NHS nurse found no significant differences in the effect of history of colonoscopy invitation. There was no interaction effect between letter condition and history of colonoscopy invitation F (8, 527) = 1.09 p = .370 η_p^2 = .01. When controlling for age and education, there continued to be no overall effect of letter condition F (8, 525) = .611 p = .769 η_p^2 = .01, an overall effect of history of colonoscopy invitation F (8, 525) = 4.40 p < .001 η_p^2 = .06 and no interaction effect F (8, 525) = 1.11 p = .354 η_p^2 = .02 on colonoscopy concerns.

DISCUSSION

This study is the first quantitative study to examine whether providing modified information to the current NHS Bowel Cancer Screening Programme (BCSP) letter inviting participants for follow-up

colonoscopy reduced participant self-reported state anxiety and increased behavioural intention levels to attend the nurse appointment to discuss further medical tests. It is also the first study to investigate the effect of the history of colonoscopy invitations on participants levels of state anxiety, behavioural intention, and colonoscopy concerns within the context of being invited to attend follow-up colonoscopy for bowel cancer detection.

A key finding of the current study was that behavioural intentions to attend the nurse appointment were scored lower by participants who received the modified letter compared to the current letter. Modifications to the letter included fewer uses of the term cancer, which may have reduced the perceived need for and importance placed by some participants in attending the appointment. An individual's perceived susceptibility to a threat is a key component of many health behaviour change theories and is both a theoretical and empirical driver of health behaviour (Dillard et al., 2012; Ferrer et al., 2016; Sheeran et al., 2014). For example, Dillard et al. (2012) found risk perception to be positively correlated with intention and attitudes in 3689 participants, all due for CRC screening, who were asked to read an online message about the importance of screening in reducing their chance of cancer. Recent theory has introduced and tested a tripartite model of risk perception to consider deliberative, affective, and experiential components of risk perception (Ferrer et al., 2016). Findings recommend a need to consider different ways to target risk perception in future health behaviour change interventions and communications (Ferrer et al., 2016). Intention levels; however, in the current study for both letter conditions, irrespective of previous invite status, were high. It is possible that a ceiling effect in behavioural intention score ratings could have occurred, given most of the data were skewed towards the upper limit of the 11-point behavioural intention scale used, with 87% of participants scoring intention high between 7 and 10 (Cramer & Howitt, 2004). Caution is therefore advised when drawing conclusions from the effects of the letter condition found on behavioural intention. Future work should explore the use of alternative scales for measuring behavioural intention and look to also measure intention to attend the colonoscopy procedure, in addition to the initial nurse appointment. A suggested reason for the high behavioural intention ratings could be taken from Construal-Level Theory, which states that events in the future, such as taking part in screening for the detection of CRC, are viewed by people in abstract and desirable (as opposed to concrete) terms (Trope & Liberman, 2010; Von Wagner et al., 2010). Furthermore, participants in the current study were older in age (56–74 years) and age has been found to be associated with higher levels of uptake in CRC screening (Young & Robb, 2021).

Depending on previous colonoscopy invitee status, modifications to the current NHS letter were found to significantly influence state anxiety levels. Previous colonoscopy invitees were significantly less anxious when reading the modified letter than those reading the current NHS letter. Conversely, those never invited for a colonoscopy were significantly more anxious when reading the modified letter compared to the current NHS letter. Suggestions for modifications to the current NHS letter were taken from interviews with nurses and previous invitees to colonoscopy (Travis et al., 2022). Reflections and views were therefore informed by the issues and barriers they (previous invitees) had faced when invited and attended a colonoscopy. Two in one hundred people who complete the FIT kit will have a positive result, meaning approximately 2% of all screeners will also have previous colonoscopy invitee status (GOV.UK, 2023). In comparison, 36.1% of participants in the current sample had previous colonoscopy invitee status, and 63.9% of participants had never been invited to a colonoscopy before. For participants never invited before, providing information on procedural-related concerns such as pain and discomfort, test invasiveness, the gender of the NHS team may not have been instinctively of immediate concern. Bringing other concerns to the participants' attention, as presented within the modified letter, may have resulted in raised levels of state anxiety. Whether the modified letter provides participants never invited to colonoscopy with too much medical information and thus is a contributing factor to increased levels of state anxiety should be investigated further. For first-time invitees, additional procedural information and risks about colonoscopy may be best to be handled through in-person consultation. The role of the specialist screening practitioner is multifaceted, and as an advanced nursing role, it is pivotal in providing patients with the information and reassurance needed (Kerrison et al., 2021). During the patient appointment, the specialist screening practitioner explains the bowel preparation procedure and provides

instructions, providing the required medication to the patient. The specialist screening practitioner also explains the colonoscopy screening test itself and confirms that the patient is medically suitable to undergo the procedure. Conducting a think-aloud study on tailored invitation materials would allow for immediate utterances, thoughts, and comparisons to be drawn from participants with and without past screening experience (Smith et al., 2015). Findings suggest that there may be a need to tailor future invitation materials based on colonoscopy invitation history. Future research ought to further explore the feasibility and acceptability of tailoring invitation materials to individuals' past screening experiences.

Those never invited for a colonoscopy were found to be significantly more concerned about embarrassment and test invasiveness, yet they were significantly less concerned about travel costs compared to previous invitees. These findings are consistent with Shafer et al. (2018), who reported patients with no previous history of a colonoscopy to have higher levels of procedural anxiety. There is a lack of research into the effect of previous invitee status on colonoscopy concerns, and future work should aim to explore and compare the nature of concerns based on people's previous colonoscopy invitee status. For both letters, being at risk of bowel cancer was scored of greatest concern to participants, followed by procedural-related concerns, with the lowest levels of concern scored for practical issues (travel costs and other commitments). Higher levels of concern attributed to being at risk of cancer and procedural-related anxieties by patients invited to follow-up colonoscopy are consistent with previous quantitative and qualitative findings (Kerrison et al., 2021; Plumb et al., 2017; Travis et al., 2022). Taken together with the previous research, it is important that potential future interventions explore ways to reduce these concerns and mitigate known barriers.

It is important that the identification of future interventions also draw upon existing theory (O'Cathain et al., 2019). The recent introduction of the integrated screening action model (I-SAM) aims to predict screening behaviour and support the development of interventions that improve the screening process (Robb, 2021). The Precaution Adoption Process Model (PAPM) (Weinstein et al., 2020) is a key component of I-SAM, and describes the stages that people pass through from 'unaware' to 'unengaged' to 'deciding' to 'intending' to 'acting' to 'repeat'. Adopting a behaviour for the first time, such as participants in the current study who had never invited for a colonoscopy, is very different to repeating the behaviour. It is therefore advised that researchers take this into consideration when developing interventions (Weinstein et al., 2020).

Strengths and limitations

A key strength of the current study is that data were collected from an equal representation of male and female participants with a full range of screening appropriate age, and participants had varying levels of education attainment and a good representation employed compared to retired (see Table 1). Unfortunately, it was not possible to assess indices of multiple deprivation (IMD) as a measure of relative deprivation in areas of the United Kingdom due to the collection of participant postcodes not being permitted on Prolific. The current study has three additional limitations: First, participants were given a hypothetical situation in which they were asked to imagine that they had received the letter in the post; findings therefore may lack ecological validity. Upon reading, participants were asked to rate their expected levels of state anxiety, behavioural intention, and the nature of concerns they would have. For instance, participants were asked to imagine and rate their expected concern about travel costs to a hypothetical place they may have never visited before, and they were also asked to record anticipated rather than actual state anxiety experiences. However, it is worth noting that other recent research has successfully adopted a similar design to the current study, asking participants to imagine they had received a positive FOBt or to imagine cancer symptom presentation (Goodwin et al., 2021; Kaushal et al., 2020; Marcu et al., 2019; Saab et al., 2021). Moreover, conducting research with this particular patient population in real life is challenging given the reduced number of people invited to attend further tests following routine screening; therefore, utilizing hypothetical vignette approaches represents a useful research tool

in this context. Second, participants were only recruited through the Prolific platform, which may not be representative of the screening population. Participants of the Prolific are required to have Internet access and possess a certain level of literacy to be allowed to be part of the panel. In a recent review by Dalton (2018), patient characteristics of incomplete diagnostic follow-up after positive colorectal cancer screening tests showed minority ethnic groups to have lower uptake, with evidence from South Asian groups in the United Kingdom. Furthermore, those whose first language was not the predominant language and those belonging to lower socio-economic position groups were also associated with lower uptake rates (Dalton, 2018). The current study included 24 participants (4.5%) who had previously been invited for a colonoscopy but did not attend, providing a degree of input from non-attenders. Third, almost all participants (96%) were White, which is not fully representative of the screening population in England, given that 81% of the population in England identify as White (Office for National Statistics, 2022). Under-recruitment of minority ethnic groups in health research is a commonly experienced difficulty (Ashley et al., 2021; Rockliffe et al., 2018; Shaghaghi et al., 2011; Wilding et al., 2022). Nevertheless, uptake for follow-up colonoscopy has been shown to be lower among those with an ethnic minority background compared to those with a white British ethnicity (Morris et al., 2012). Future research should aim to work with an ethnic minority group sample to establish to what extent the collective findings thus far are generalizable or differ.

CONCLUSION

Behavioural intentions to attend the nurse appointment were rated lower by participants who received the modified letter compared to the current letter, intention was however high for both letter conditions. Modifications to the letter may have reduced the perceived need for and importance some participants placed on attending the appointment. Depending on previous colonoscopy invitation status, modifications to the current NHS letter were found to significantly influence state anxiety levels. For first-time invitees, procedural information about colonoscopy and risks may be best handled through in-person consultation as opposed to written forms of communication. Future research ought to seek further feedback on tailored invitation materials based on people's past screening experiences and do so among under-represented groups.

AUTHOR CONTRIBUTIONS

Elizabeth Travis: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Writing—original draft; Writing—review and editing. **Laura Ashley**: Conceptualization; Investigation; Methodology; Writing—review and editing. **Daryl B. O'Connor**: Conceptualization; Investigation; Methodology; Writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Authors agree to make data and materials supporting the results or analyses presented in their paper available upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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