

1 Why colorectal screening fails to achieve the uptake rates of breast and cervical cancer  
2 screening: a comparative qualitative study

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## Abstract

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**Background:** In Scotland, the uptake of clinic-based breast (72%) and cervical (73%) screening is higher than home-based colorectal screening (~60%). To inform new approaches to increase uptake of colorectal screening, we compared the perceptions of colorectal screening among women with different screening histories.

**Method:** We purposively sampled women with different screening histories to invite to semi-structured interviews: i) participated in all; ii) participated in breast and cervical but not colorectal ('colorectal-specific non-participants'); iii) participated in none. To identify the sample we linked the data for all women eligible for all three screening programmes in Glasgow, Scotland (aged 51-64 years; n=68,324). Interviews covered perceptions of cancer, screening, and screening decisions. Framework Method was used for analysis.

**Results:** Of the 2,924 women invited, 86 expressed an interest, and 59 were interviewed. The three groups' perceptions differed, with the colorectal-specific non-participants expressing that: i) treatment for colorectal cancer is more severe than for breast or cervical cancer; ii) colorectal symptoms are easier to self-detect than breast or cervical symptoms; iii) they worried about completing the test incorrectly; and iv) the colorectal test could be more easily delayed or forgotten than breast or cervical screening.

**Conclusions:** Our comparative approach suggested targets for future interventions to increase colorectal screening uptake including: i) reducing fear of colorectal cancer treatments; ii) increasing awareness that screening is for the asymptomatic; iii) increasing confidence to self-complete the test; and iv) providing a suggested deadline and/or additional reminders.

67 **BACKGROUND**

68 Colorectal cancer (CRC) is the second leading cause of cancer death worldwide.[1] CRC  
 69 screening by faecal occult blood test (FOBT) can reduce deaths.[2] In Scotland, since 2007,  
 70 people aged 50-74 have been mailed a self-complete FOBT every two years as part of the  
 71 Scottish Bowel Screening Programme. The FOBT requires people to collect two samples from  
 72 each of three separate bowel motions and to mail their completed kit for processing. Women  
 73 in Scotland are also invited to attend a pre-arranged appointment for breast screening using  
 74 mammography and to make an appointment for cervical screening using the Pap smear (Table  
 75 1). All three screening tests are offered at no cost to participants through the National Health  
 76 Service. Uptake of screening is 77% for cervical, 72% for breast but only 59% for colorectal  
 77 among women aged 50 and over.[3-5] Screening uptake rates show similar patterns in  
 78 Australia and the US with uptake of CRC screening lagging behind the participation rates of  
 79 breast and cervical screening.[6, 7]

**Table 1**  
**Invitation procedures in the Scottish cancer screening programmes**

	Screening programme		
	Breast screening by mammography	Cervical screening by smear test	CRC screening by faecal occult blood test
Pre-notification	None	None	2 weeks prior to invitation <sup>a</sup>
Invitation (mailed)	Within 3 years after 50 <sup>th</sup> birthday Until 70 <sup>th</sup> birthday After 70 <sup>th</sup> birthday on request	Before June 2016: After 20 <sup>th</sup> birthday Until 60 <sup>th</sup> birthday From June 2016: After 25 <sup>th</sup> birthday Until 65 <sup>th</sup> birthday	From 50 <sup>th</sup> birthday Until 75 <sup>th</sup> birthday After 75 <sup>th</sup> birthday on request
Reminder (mailed)	Reminder at 3 days following non-attendance	Reminders at 3 months and at 6 months after the invitation	Reminder at 6 weeks after the invitation
Screening interval	Every 3 years	Aged 25-49: every 3 years Aged 50-64: every 5 years	Every 2 years

Notes. <sup>a</sup>pre-notification letters for CRC screening ceased in February 2015.

80 Reasons for the low uptake of CRC screening include lack of awareness, feeling healthy,  
81 negative views of cancer (fear, fatalism), negative attitudes towards colorectal tests, lack of  
82 motivation including other health concerns, and cultural, gender and socioeconomic  
83 influences.[8-11] Many of these potential barriers also apply to breast and cervical  
84 screening,[12] so it is unclear why CRC screening uptake should remain considerably lower.  
85 There have been few comparisons of barriers across these three screening modalities.[13, 14]  
86 We identified only one study that directly compared barriers to breast, cervical and CRC  
87 screening uptake among women eligible for all three tests.[15] This British self-report survey  
88 of 890 women found that among those who participated in breast and cervical but not  
89 colorectal programmes, 23% reported not liking the idea of CRC screening test and 18% said  
90 they 'haven't got round to it, but intend to take part' as explanations for non-participation in  
91 CRC screening.[15] These explanations relate to both motivational influences such as dislike  
92 of the test, and volitional aspects of 'not getting round to it',[16] the latter being particularly  
93 salient for CRC screening which, unlike breast and cervical screening, is self-completed at  
94 home. Our study adds to those data in three main respects. Firstly, rather than using self-  
95 reported data of screening history, we linked cancer screening uptake data for the breast,  
96 cervical and CRC screening programmes for the complete population of Glasgow, Scotland—  
97 a socioeconomically diverse region with low overall screening uptake. Using this linked  
98 dataset, we identified women with three different screening histories: i) participated in all  
99 programmes; ii) participated in breast and cervical but not colorectal programmes; and iii) did  
100 not participate in any programme. Secondly, we invited women across these three groups to  
101 an individual in-depth interview, rather than a questionnaire, to provide the opportunity for  
102 women to speak at length about their perceptions and experiences of cancer screening.

103 Thirdly, we organised our findings using the route MAP approach which is a useful tool to  
104 summarise the central tenets of multiple models of behaviour change [17]. The MAP describes  
105 three routes to behaviour: i) Motivation—strategies that increase and sustain motivation (e.g.  
106 information about the behaviour, reassurance); Action-on-motivation—strategies that  
107 strengthen and elaborate skills needed to translate motivations into action (e.g. setting  
108 behavioural goals, action and coping planning); and Prompted or cued routes—strategies that  
109 support behaviour change without the continuous cognitive effort required by the Motivation  
110 and Action-on-motivation routes (e.g. prompt, change the environment to facilitate the target  
111 behaviour). The MAP approach therefore provides a theoretically informed framework to  
112 identify targets for intervention.

113 The present study was designed to 1) identify why women (who are eligible for all three types  
114 of screening) choose to participate in breast and cervical screening but not CRC screening, and  
115 2) gain insight into how CRC screening uptake can achieve the uptake rates of breast and  
116 cervical screening.

117

## 118 **METHODS**

### 119 **Participants and recruitment strategy**

120 This study was conducted alongside a quantitative study exploring cancer screening uptake  
121 among women living in Glasgow, Scotland. Data on screening participation for the breast,  
122 cervical and CRC screening programmes were linked for all women aged 20 to 74 (n=430,591)  
123 who were registered with NHS Greater Glasgow and Clyde Health Board and invited to  
124 screening during the period 2009 to 2013. This linked dataset was used as a sampling frame  
125 for the present study to select women who were eligible for breast, cervical and CRC screening

126 (n=68,324). Because we expected screening experiences to differ by screening history and on  
 127 socioeconomic position we aimed to interview women in each of six groups (Table 2).

**Table 2**  
**Sampling frame**

	Screening behaviour		
	Screening participants (screened for breast, cervical and CRC)	CRC specific non-participants (screened for breast and cervical, but not CRC)	Non-participants (not screened for breast, cervical or CRC)
Living in			
Most socioeconomically deprived areas (SIMD <sup>a</sup> quintiles 1-2)	Invited = 119 Expressed interest = 13 Interviewed = 11 Response rate = 10.92%	Invited = 244 Expressed interest = 13 Interviewed = 9 Response rate = 5.33%	Invited = 1,611 Expressed interest = 14 Interviewed = 10 Response rate = 0.87%
Least socioeconomically deprived areas (SIMD <sup>a</sup> quintiles 4-5)	Invited = 20 Expressed interest = 11 Interviewed = 10 Response rate = 55.00%	Invited = 159 Expressed interest = 14 Interviewed = 9 Response rate = 8.81%	Invited = 771 Expressed interest = 13 Interviewed = 10 Response rate = 1.69%

<sup>a</sup>Scottish Index of Multiple Deprivation

128  
 129 Purposive sampling was used to randomly identify and invite to interview women with three  
 130 different screening histories: i) women who participated in all programmes (screening  
 131 participants); ii) women who participated in breast and cervical but not colorectal  
 132 programmes (CRC-specific non-participants); and iii) women who participated in none (non-  
 133 participants). The sample was also stratified to obtain a mix of women from areas of high or  
 134 low socioeconomic deprivation (Table 2). Socioeconomic deprivation was indexed by the  
 135 Scottish Index of Multiple Deprivation (SIMD), an area-based measure of multiple deprivation  
 136 linked to each individual's home address.[18] The aim was to obtain approximately ten  
 137 interviews across the six stratified groups (Table 2). It was anticipated that recruiting non-  
 138 participants and women living in deprived areas would be more challenging.[19] To ensure  
 139 we achieved equal numbers of participants across the six groups we significantly over-  
 140 sampled non-participants and women living in deprived areas. In total, 2,924 women were  
 141 invited (Table 2).

142

143 The research team provided the Glasgow Clinical Research Facility with the sampling frame to  
144 identify 2,924 women of the 68,324 eligible for all three screening tests to be sent invitation  
145 packs. Invitation packs contained a letter inviting women to participate in a study exploring  
146 views on bowel, breast and cervical cancer screening, a participant information sheet, and a  
147 response form with options to indicate interest by email, phone or using a pre-paid envelope  
148 enclosed. Participants were offered £20 for participation and to cover the cost of  
149 refreshments and travel to the interview. Only women responding to the invitation pack were  
150 subsequently identified to the research team. Ethical approval was obtained from the NHS  
151 Health Research Authority (NRES Committee North West – Liverpool Central, REC reference:  
152 4/NW/1300).

153

#### 154 **Interview procedure and materials**

155 The interviewer (MK) met with respondents at locations of their choice: home (n = 35), the  
156 University Of Glasgow (n = 15), work (n=3), community centre (n=5), a parish house (n=1). MK  
157 had spoken to the participants by phone prior to the interview, but had no relationship with  
158 them otherwise. MK is female and had previous experience of conducting interviews and  
159 focus groups with women about cancer screening. All participants provided informed consent  
160 before the semi-structured interview started. The interview followed a topic guide and began  
161 with an open question, '*What comes to mind when you think about cancer?*' This was followed  
162 in turn with questions on what comes to mind in relation to bowel, breast and cervical  
163 cancers. The next question asked how they felt about their chances of developing breast,  
164 cervical or CRC. Participants were then asked for their thoughts and feelings about cancer  
165 screening. The interviewer asked, '*What comes to mind when you think about bowel cancer*

166 *screening?’* with supplementary questions on their understanding of what the test involves  
167 and the purpose. This was followed by the same questions in relation to breast and cervical  
168 screening. Finally, participants were shown example invitation letters and leaflets and were  
169 asked how they felt when they received these and how they decided what to do next. The  
170 interviews took place between November 2015 and April 2016, were an average length of 43  
171 minutes, audio recorded and transcribed verbatim.

## 172 **Analysis**

173 The transcripts were analysed using the Framework Method, which takes a matrix based  
174 analytic approach to facilitate rigorous and transparent data management.[20] This approach  
175 permitted comparisons of accounts between women with different screening histories and  
176 living in different socioeconomic circumstances.

177 MK, KR and SM read and re-read the data. A mind-mapping process was developed based on  
178 the one-sheet-of-paper method.[21] From these mind maps, MK identified themes as the  
179 basis of the framework matrix. The themes were organised into the three MAP routes:  
180 motivation; action-on-motivation; and prompts.[17] As described by Ritchie and  
181 colleagues,[20] the framework matrix was organised in a MS Excel spreadsheet containing  
182 one theme per worksheet with sub-themes in the columns. The rows contained individual  
183 participants, grouped by screening history and socioeconomic status. The themes and sub-  
184 themes within the framework matrix were discussed within the research team. Two  
185 researchers (MK and LG) coded the transcript in full and populated the framework matrix with  
186 relevant data extracts. They discussed comments and queries using web-based collaboration  
187 software (Trello), thus creating an audit trail. MK summarised each theme by comparing  
188 patterns within the pre-identified participant categories (screening history and socioeconomic

189 status) and noting representative data extracts. KR reviewed and discussed the summaries  
190 with MK to ensure consistency with the data.

## 191 **RESULTS**

### 192 **Sample characteristics**

193 Of the 2,924 women sent an invitation to participate; 2,629 did not respond, 129 declined, 76  
194 invitations were returned undelivered, four women had died, and 86 expressed an interest in  
195 being interviewed of which four were excluded (due to becoming uncontactable, residing  
196 primarily outside the UK, or having a stoma). In total, 61 interviews were scheduled and 59  
197 women were interviewed.

198 Response rates varied considerably across the six groups; 55% of people who had participated  
199 in all three programmes, and who lived in the least deprived areas agreed to be interviewed,  
200 whereas only 0.9% of people who had participated in none of the programmes and lived in  
201 the most deprived areas agreed to be interviewed (Table 2). The respondents' age ranged  
202 from 51 to 64 years. The respondents' views varied most commonly by screening participation  
203 history (screening participants, CRC-specific non-participants, non-participants), which  
204 formed our main comparison category. Comparisons by socioeconomic deprivation did not  
205 show clear differences in respondents' views but are highlighted where differences were  
206 found.

207 The results were organised into the three routes of behaviour change described by the MAP  
208 approach: motivational challenges to CRC screening; action-on-motivation challenges to CRC  
209 screening; and prompts to CRC screening.[17, 22]. The results are summarised in Table 3.

**Table 3****Summary of results identifying unique challenges to colorectal cancer screening in comparison to breast and cervical screening**

	Screening participants (screened for breast, cervical and CRC)	Screening behaviour CRC specific non-participants (screened for breast and cervical, but not CRC)	Non-participants (not screened for breast, cervical or CRC)
<b>Motivational challenges to colorectal screening</b>			
Treatment beliefs	Less negative view of treatment than in other two groups	CRC treatment perceived as more severe than breast or cervical	Treatment most threatening aspect of cancer
Beliefs about the value of screening	Valued screening	Some questioned value of CRC screening and self-sampling reduced credibility	Questioned value as intolerable cancer treatment would still be necessary
Disgust and embarrassment	Acknowledged but overcome	Frequently discussed as barriers, avoided talking about CRC screening with others	Frequently discussed as barriers
Symptom beliefs	Acknowledged screening is for asymptomatic as more treatable at earlier stage of diagnosis	Screening to check existing symptoms, CRC symptoms more visible and detectable reducing need for CRC screening	Screening to check existing symptoms, therefore unnecessary in the absence of symptoms
Comorbidities and previous colorectal investigations	Comorbidities mentioned less frequently	Felt less need for CRC screening because of previous colorectal investigations	Psychological and physical comorbidities made less willing to screen
<b>Action-on-motivation challenges to colorectal screening</b>			
Lack of health professional involvement	Acknowledged CRC self-sampling was awkward, but overcome	Worried about completing FOBt incorrectly, CRC burdensome and complicated, disengagement from process possible for breast and cervical but not CRC	Worried about completing FOBt incorrectly, CRC burdensome and complicated
Colorectal screening requires planning	Detailed planning	Rarely described making plans to screen	Rarely described making plans to screen
Comorbidities	Comorbidities mentioned less frequently	Comorbidities impediments to CRC self-completion	Comorbidities impediments to CRC self-completion and to a lesser extent breast and cervical screening
<b>Prompts to colorectal screening</b>			
Postponing and forgetting	Described using prompts to avoid forgetting	Lack of appointment time or deadline made CRC more easily delayed or forgotten	Lack of appointment time or deadline made CRC more easily delayed or forgotten

211 **Motivational challenges to CRC screening**

212 Treatment beliefs

213 CRC-specific non-participants considered CRC treatment to be more severe than breast or  
214 cervical cancer treatment.

215 “I know that breast cancer caught early is really treatable. {...} I think cervical  
216 cancer’s totally curable. {...} I don’t really know that much about the bowel one. I  
217 mean, I know that bowel cancer’s very, very serious. I mean, you can live without  
218 your breasts, you know, you can, you know, have a hysterectomy {...} you cannae  
219 [cannot] really live without the bowels “ (P134, 53 years, CRC-specific non-  
220 participant)

221 Similarly, for non-participants the most threatening aspect of cancer appeared to be its  
222 treatment. They questioned the effectiveness of cancer treatments to reduce mortality and  
223 expressed concern over side effects, such as hair loss, nausea, fatigue, and the quality of life  
224 that patients experienced during and after treatment. These respondents questioned  
225 whether they would accept treatment if they were diagnosed with cancer. Further, non-  
226 participants, mostly from those living in the least deprived areas, did not believe early  
227 detection could help them avoid cancer treatments that would reduce their quality of life.

228 “you just don’t want to think of bowel cancer, and getting colostomies or  
229 whatever. Just the very thought. Sometimes I think I’d rather just not know and  
230 die, rather than be diagnosed with that and having a colostomy. {...} I would rather  
231 just die than go about like that, that’s not living” (P45, 64 years, non-participant)

232 In contrast, the screening participants viewed cancer treatment more positively.

233 “If you are unlucky enough and you lose the whole bowel and you have to have  
234 a colostomy bag then are you not better having that than dying?” (P58, 59 years,  
235 screening participant)

236 Beliefs about the value of CRC screening

237 CRC-specific non-participants questioned the value of CRC screening. These respondents  
238 doubted the efficacy of FOBt after having heard of others who had false negative FOBt results.  
239 They also believed that self-sampling reduced the credibility of CRC screening and completing  
240 the test in their own bathrooms seemed incongruent with the respondents’ schemata for  
241 medical tests.

242 “if somebody [in health care team] had said ... you know, “Come along and sit on  
243 the toilet and we’ll collect your poo,” somehow it would have felt a little bit more  
244 detached, a little bit more kind of clinical {...} they’d probably have worked out  
245 some sort of system that they can do that more easily without needing plastic  
246 bags and God knows what else” (P121, 53 years, CRC-specific non-participant)

247 Disgust and embarrassment

248 The only test described as disgusting was FOBt. CRC-specific and non-participants spoke about  
249 disgust more often than screening participants. Participants’ disgust related to FOBt being a  
250 self-completed test, the involvement of faeces and its association with bowel functions. In  
251 each group, participants described CRC screening to be embarrassing, with embarrassment  
252 relating to handling their faeces, storing the test kit and concern about other people (such as  
253 grandchildren) finding the FOBt kit, or postal workers having to handle the envelopes  
254 containing completed kits. Breast and cervical screening were perceived to be more  
255 acceptable and easier to discuss than CRC screening.

256 “you would think getting your tits out or, you know, opening your legs for some  
257 speculum, you would feel as though both of those things ought to be more  
258 intimate [laughs] but actually, I think it’s probably because the way that we are  
259 brought up not to discuss bowels in this country” (P95, 55 years, CRC-specific non-  
260 participant)

261 CRC-specific non-participants reported talking about cancer screening less often and  
262 specifically avoided talking about CRC screening, which respondents living in more deprived  
263 areas reported as off-limits for discussion. Respondents tended to describe talking about FOBt  
264 as immature, likening it to children laughing about “farts and smells” (P121, 53 years, CRC-  
265 specific non-participant).

266 “you’re told when you’re young [laughs] not tae talk about stuff like that {...}  
267 except for when you’re a boy when all bodily functions are, you know, extremely  
268 funny in your mind” (P134, 53 years, CRC-specific non-participant)

## 269 Symptom beliefs

270 A theme among CRC-specific and non-participants was that they felt they would be  
271 better able to detect CRC symptoms, like indigestion or blood in their faeces than breast  
272 or cervical cancer symptoms. Similarly, non-participants also reported that they would  
273 ‘know’ if they had cancer making screening unnecessary, particularly in the absence of  
274 symptoms.

275 “it [smear test] picks up any issues if you’re not aware of issues {...} I think the  
276 bowel cancer one, you kind of know, most people know what the symptoms would  
277 be and therefore you assume that if you – since it’s easy to see, that you’re okay

278 {...} ‘cos you’re not aware of any symptoms.” (P165, 54 years, CRC-specific non-  
279 participant)

280 Screening participants believed that by the time cancer caused symptoms it would be  
281 advanced and less treatable. In contrast to CRC-specific and non-participants, screening  
282 participants thought they would have difficulty detecting CRC without FOBt.

283 Comorbidities and previous colorectal investigations

284 Some CRC-specific non-participants reported having had colorectal investigations and  
285 therefore felt less need for bowel screening. Non-participants also described how  
286 psychological and physical comorbidities made them less willing to complete screening.  
287 Physical comorbidities meant participants felt unable to cope with the prospect of additional  
288 investigations and/or treatment. Anxiety prevented some non-participants from deciding for  
289 or against cancer screening. A few reported depressive symptoms and thoughts of suicide; in  
290 this context cancer seemed to be an ‘easier’ (or, at least, a blameless) way to die—negating  
291 any perceived need for cancer screening.

292 **Action-on motivation challenges to CRC screening**

293 Lack of health professional involvement

294 CRC-specific non-participants and non-participants expressed worry about completing FOBt  
295 incorrectly without the support of a health professional. This set CRC screening apart from  
296 breast or cervical screening where health professionals conduct the tests.

297 “I suppose it’s different, it’s like a self-kit, you know? ... compared to the other two  
298 are being done by professionals. That’s their job and maybe you just feel like  
299 they’re doing it right.” (P150, 54 years, CRC-specific non-participant)

300 To complete FOBt correctly, CRC-specific non-participants felt they needed to be fully  
301 engaged and 'pay attention'. In contrast, with breast and cervical screening they could  
302 disengage to some extent as the health professional completed these tests for them.

303 "When you go and get a cervical screen you don't have to do anything, you just  
304 turn up. For bowel screening, you've got to go that extra step. {...} you've actually  
305 to make the effort to do it and collect the sample and seal it up and all whatever,  
306 and send it away." (P165, 54 years, CRC-specific non-participant)

307 CRC-specific non-participants described using disengagement during breast or cervical  
308 screening to cope with physical or psychological discomfort, but disengagement to overcome  
309 disgust or displeasure was not possible with self-completed CRC screening.

310 CRC-specific non-participants and non-participants reported CRC screening to be  
311 burdensome. Having to read instructions was considered to be a "hurdle" (P165, 54 years,  
312 CRC-specific non-participant) and FOBt to be complicated and effortful. Having to take three  
313 samples added to FOBt seeming burdensome. In contrast, screening participants rarely  
314 reported that FOBt was time consuming or complicated, but they agreed that taking faecal  
315 samples by themselves was awkward to do.

316 "If somebody was to {...} make it [FOBt] easy for me, I would have done it because  
317 I approve of the principle" (P166, 57 years, CRC-specific non-participant)

318 CRC screening requires planning

319 CRC-specific and non-participants rarely described making plans to do screening. In contrast,  
320 screening participants described detailed planning strategies to overcome practical barriers.

321 They reported dealing with CRC screening invitations promptly and planned specific days to  
322 do the FOBt. Screening participants living in the least deprived areas also described routines

323 for cleaning after FOBt completion and using gloves and wipes to make FOBt less disgusting  
324 to them.

### 325 Impact of comorbidities

326 Illnesses and other conditions were an additional challenge to the self-completion of FOBt.  
327 Non-participants most often reported unpredictable bowel movements, diarrhoea, IBS,  
328 coeliac disease, multiple sclerosis and other health conditions as impediments to CRC  
329 screening although such conditions were also mentioned by CRC-specific non-respondents. A  
330 further two respondents with visual impairments reported abandoning half-completed FOBt  
331 kits or waiting for a support worker to organise help with doing FOBt.

332 “I’ve got coeliacs, so, it’s very, very seldom my bowel, my my my toilet is... what’s  
333 the word? Solid. {...} so it’s quite difficult that way. So, maybe once I get the  
334 coeliacs and everything under control then it might be different” (P130, 54 years,  
335 CRC-specific non-participant)

### 336 Prompts to CRC screening

#### 337 Postponing and forgetting

338 Unlike breast and cervical screening, CRC screening is completed at home and does not  
339 require an appointed time. CRC-specific and non-participants reported that CRC  
340 screening could be more easily delayed or forgotten than cervical screening which only  
341 required them to make an appointment, and even more easily than breast screening  
342 where the appointment is pre-arranged. Some CRC-specific non-participants and non-  
343 participants living in the least deprived areas explained that they would put their FOBt  
344 invitation to one side and, as a result, forget about it.

345 “if it’s a bowel screening one, yep, put it somewhere and think ‘Yes, I’ll do that’  
346 and then forget about it because it doesn’t have an appointment date. I think if  
347 something has an appointment date, you’re forced to act.” (P165, 54 years, CRC-  
348 specific non-participant)

349 Screening participants living in the least deprived areas described creating CRC screening  
350 reminders: leaving the FOBt material near their bathroom or within their view as a cue.

351 “I just usually take the pack, read the instructions again leave it in the loo until the  
352 next time I have to go {...} I just usually take all the bits in and just leave them there  
353 to remind me what I’ve to do” (P172, 57 years, screening participant)

## 354 **DISCUSSION**

355 Our findings show that women who participated in breast and cervical but not CRC screening  
356 (CRC-specific non-participants) differed in their barriers to CRC screening compared to  
357 screening participants and to a lesser extent, non-participants. CRC-specific non-participants  
358 reported that treatment for CRC was more severe than for breast or cervical cancer, and  
359 colorectal symptoms were easier to detect oneself than breast or cervical symptoms, which  
360 influenced their motivation to complete CRC screening. CRC-specific non-participants also  
361 worried about incorrectly completing the test without the support of a health professional,  
362 and that they felt the home-based CRC screening test could be more easily delayed or  
363 forgotten than breast or cervical screening, which challenged the translation of their  
364 motivation into action.[16]

365

366 A key strength of our study was in achieving a sample of women whose screening histories  
367 were objectively established by linking three cancer screening programmes’ data for the

368 entire population of Glasgow, Scotland. To our knowledge, this has not previously been done.  
369 Among the CRC-specific non-participants and the non-participants the response rate to the  
370 invitations to be interviewed was extremely low (0.9-5.3%) reflecting the difficulty of engaging  
371 all population groups in research, and the value of the data that has been obtained. The study  
372 has limitations; the SIMD measure used to assess socioeconomic deprivation was an area-  
373 based measure which offers a relatively blunt assessment and may offer one explanation for  
374 the limited number of socioeconomic deprivation differences noted in the analysis. The study  
375 focused on women due to the design, and so it is yet to be determined if the same specific  
376 CRC challenges apply to men. It is also noted that this study focused on increasing uptake of  
377 CRC and does not consider explicitly the role of informed choice principles. Some women  
378 make an informed choice not to engage in cancer screening which is entirely appropriate.[23]  
379 Our approach does not conflict with the principles of informed choice. For example providing  
380 more information reflecting advances in colorectal cancer treatment would increase  
381 knowledge.[24] However, interventions to address the identified motivational challenges  
382 would aim to improve knowledge and understanding and so support informed choice. The  
383 action-on-motivation targets would be aimed at supporting people who intend to screen to  
384 put their intentions into action and so would not compromise informed choice.

385

386 Understanding why CRC screening fails to achieve the uptake rates of breast and cervical has  
387 been explored in one previous self-report, survey study.[15] We are able to expand on the  
388 survey's results, as our findings explain that screening participants also dislike the self-  
389 completed FOBT, but manage these feelings; our findings show that medical reasons to for  
390 non-participation in CRC screening can include comorbidities that impede self-completed CRC  
391 screening, but also that women with previous colorectal investigations feel less need for CRC

392 screening. Other studies have considered the relatively low uptake of CRC in isolation, and  
393 while they have identified similar barriers to the present study around, for example, fears  
394 about treatment, being asymptomatic, concerns about self-completion[8-11] etc., the present  
395 study adds a more nuanced understanding, which informs potential targets for future  
396 interventions to increase CRC screening uptake. While it is acknowledged that people are  
397 fearful of cancer treatment,[11, 25] the present study identified that women fear of  
398 treatments for CRC more than breast or cervical cancer, which may partly explain their  
399 reluctance to engage in CRC screening. Similarly, being asymptomatic is a commonly  
400 recognised barrier in the screening literature.[8, 26] Surveys have established that awareness  
401 of CRC symptoms is low,[27] but it was previously unknown that there may be a  
402 misunderstanding that colorectal symptoms are more easily self-detected than breast and  
403 cervical symptoms. Furthermore, the present study has illustrated the unique challenges of  
404 self-completion of CRC screening in the absence of a health professional, and the greater  
405 chance of procrastinating or forgetting the test in the absence of a specified appointment  
406 time. We note that similar barriers have been identified for Human Papillomavirus self-  
407 sampling for cervical screening.[28, 29]

408

409 We have identified potential targets for interventions to increase CRC screening uptake and  
410 drafted example policy recommendations (Table 4). For example, to reduce fear and  
411 misconceptions of CRC treatments, we recommend a concerted information campaign  
412 reflecting advances in CRC treatment and success stories.[30] To increase awareness that CRC  
413 screening is for people who are asymptomatic, we recommend a concerted information  
414 campaign to reiterate and reinforce existing messages that CRC screening is for the  
415 asymptomatic, and symptoms may only appear at an advanced stage. To reduce postponing

416 and forgetting, we recommend providing a further reminder and potentially a suggested  
417 deadline for kit return. It is important to note that Scotland replaced FOBt bowel screening  
418 with Faecal Immunochemical Testing (FIT) in November 2017 and FIT will be introduced in  
419 England and Wales in 2019. FIT requires only one faecal sample and, based on evidence from  
420 pilot studies[31] and the initial months since its introduction in Scotland,[32] it is likely this  
421 easier to complete test will increase uptake. Nonetheless, FIT alone is not sufficient to address  
422 the other identified challenges to CRC screening uptake, and complementary interventions  
423 are recommended.

**Table 4**  
**Potential targets to increase colorectal cancer screening**

Challenges to successful colorectal cancer screening	Potential targets to increase CRC screening uptake	Example policy recommendation
<b>Motivational challenges to colorectal screening</b>		
Treatment beliefs	Reduce fear and misconceptions of colorectal cancer treatments	Concerted information campaign reflecting advances in colorectal cancer treatment and success stories
Beliefs about the value of screening	Increase credibility of self-sample test	Concerted information campaign emphasising value of the self-sample test
Disgust and embarrassment	Reduce disgust and embarrassment	Concerted information campaign modelling people talking about the test to support positive social norms
Symptom beliefs	Increase awareness that colorectal screening for asymptomatic	Concerted information campaign reiterating that colorectal screening for asymptomatic
Comorbidities and previous colorectal investigations	Increase support for those with other health priorities	Increase awareness within primary care to provide support for colorectal screening among people with other health conditions
<b>Action-on-motivation challenges to colorectal screening</b>		
Lack of health professional involvement	Increase people's confidence to self-complete the test correctly	Provide examples of others' experiences of completing the self-sample test to model successful completion
Colorectal screening requires planning	Increase people's ability to plan how, when and where they will complete their test	Provide planning support tool with the self-sample test
Comorbidities	Increase support for those with other health priorities	Increase awareness within primary care to provide support for colorectal screening among people with other health conditions
<b>Prompts to colorectal screening</b>		
Postponing and forgetting	Increase prompts to avoid postponing and forgetting	Provide further reminders Provide a suggested deadline for kit return

425

426 This study represents the first step in a process by identifying potential targets to increase

427 CRC screening uptake.[22] It will be necessary to test in a randomised controlled trial whether

428 an intervention strategy increases uptake by affecting the specified targets.[22] This  
429 systematic approach is in line with current best practice guidance on the development of  
430 complex interventions,[33, 34] and will build on and expand existing knowledge of effective  
431 strategies to improve cancer screening uptake.[35]

432

## 433 **ADDITIONAL INFORMATION**

### 434 **Ethical approval and consent to participation**

435 Ethical approval was obtained from the NHS Health Research Authority (NRES Committee  
436 North West – Liverpool Central, REC reference: 4/NW/1300). Participants provided informed  
437 consent to take part in the study which was performed in accordance with the Declaration of  
438 Helsinki.

### 439 **Availability of data and material**

440 The datasets generated and/or analysed during the current study are available from the  
441 corresponding author on request.

### 442 **Conflict of Interest**

443 The authors declare no conflicts of interest.

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451

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454

455 **REFERENCES**

- 456 1. Ferlay J, Ervik M, Lam, F, et al. *Cancer Today (powered by GLOBOCAN 2018)*. IARC  
457 CancerBase. Number: 15. Available from <http://publications.iarc.fr/577> [Accessed 26<sup>th</sup>  
458 March 2019].
- 459 2. Steele RJC, McClements PL, Libby G, et al. Results from the first three rounds of the  
460 Scottish demonstration pilot of FOBT screening for colorectal cancer. *Gut* 2009; 58(4):  
461 530—35. Available from: doi:10.1136/gut.2008.162883.
- 462 3. Information Services Division. *Scottish Cervical Screening Programme Statistics*  
463 *2017/18*. 2018. Available from: [https://www.isdscotland.org/Health-  
464 Topics/Cancer/Publications/2018-09-04/2018-09-04-Cervical-Screening-Report.pdf](https://www.isdscotland.org/Health-Topics/Cancer/Publications/2018-09-04/2018-09-04-Cervical-Screening-Report.pdf)  
465 [Accessed 26th March 2019].
- 466 4. Information Services Division. *Scottish Breast Screening Programme Statistics*  
467 *2015/16*. 2017. Available from: [https://www.isdscotland.org/Health-  
468 Topics/Cancer/Publications/2017-04-25/2017-04-25-SBSP-Cancer-Report.pdf](https://www.isdscotland.org/Health-Topics/Cancer/Publications/2017-04-25/2017-04-25-SBSP-Cancer-Report.pdf).  
469 [Accessed 26th March 2019].
- 470 5. Information Services Division. *Scottish Bowel Screening Programme Statistics*. 2018.  
471 Available from: [https://www.isdscotland.org/Health-  
472 Topics/Cancer/Publications/2018-08-07/2018-08-07-Bowel-Screening-Publication-  
473 Report.pdf?](https://www.isdscotland.org/Health-Topics/Cancer/Publications/2018-08-07/2018-08-07-Bowel-Screening-Publication-Report.pdf?) [Accessed 27th March 2019].
- 474 6. Centers for Disease Control and Prevention. Cancer screening—United States, 2010.  
475 *Morbidity and Mortality Weekly Report* 2012; 61(3): 41—5.
- 476 7. Australian Institute of Health and Welfare. *National cancer screening programs*  
477 *participation data*. 2019. Available from: <https://www.aihw.gov.au/reports/cancer->

- 478 screening/national-cancer-screening-programs-participation/data [Accessed 26th  
479 March 2019].
- 480 8. Honein-AbouHaidar GN, Kastner M, Vuong V, et al. Systematic review and meta-study  
481 synthesis of qualitative studies evaluating facilitators and barriers to participation in  
482 colorectal cancer screening. *Cancer Epidemiology and Prevention Biomarkers* 2016;  
483 25: 907—17.
- 484 9. Hall N, Rubin G, Dobson C, et al. Attitudes and beliefs of non-participants in a  
485 population-based screening programme for colorectal cancer. *Health Expectations: An  
486 International Journal of Public Participation in Health Care and Health Policy* 2013;  
487 18(5): 1645—57.
- 488 10. Jones RM, Woolf SH, Cunningham TD, et al. The relative importance of patient-  
489 reported barriers to colorectal cancer screening. *American journal of preventive  
490 medicine* 2010; 38(5): 499—5.
- 491 11. Chapple A, Ziebland S, Hewitson P, et al. What affects the uptake of screening for  
492 bowel cancer using a faecal occult blood test (FOBT): A qualitative study. *Social Science  
493 & Medicine* 2008; 66(12): 2425—35.
- 494 12. Wardle J, Robb K, Vernon S, et al. Screening for prevention and early diagnosis of  
495 cancer. *American psychologist* 2015; 70(2): 119—33. Available from:  
496 doi:10.1037/a0037357.
- 497 13. Young B, L Bedford L, Kendrick D, et al. Factors influencing the decision to attend  
498 screening for cancer in the UK: a meta-ethnography of qualitative research. *Journal of  
499 Public Health* 2013; 40(2): 315—39. Available from: 10.1093/pubmed/fdx026
- 500 14. Mema SC, Yang H, Vaska M, et al. Integrated cancer screening performance indicators:  
501 a systematic review. *PloS one* 2016; 11(8): e0161187.

- 502 15. Lo SH, Waller J, Wardle J, et al. Comparing barriers to colorectal cancer screening with  
503 barriers to breast and cervical screening: a population-based survey of screening-age  
504 women in Great Britain. *Journal of Medical Screening* 2013; 20(2): 73—9. Available  
505 from: doi:10.1177/0969141313492508.
- 506 16. Schwarzer R. Modeling health behavior change: How to predict and modify the  
507 adoption and maintenance of health behaviors. *Applied Psychology* 2008; 57(1): 1—  
508 29.
- 509 17. Dixon D, Johnston M. *Health Behaviour Change Competency Framework: Competences*  
510 *to deliver interventions to change lifestyle behaviours that affect health*. 2010.  
511 Available from: [http://www.healthscotland.com/uploads/documents/4877-](http://www.healthscotland.com/uploads/documents/4877-Health_behaviour_change_competency_framework.pdf)  
512 [Health\\_behaviour\\_change\\_competency\\_framework.pdf](http://www.healthscotland.com/uploads/documents/4877-Health_behaviour_change_competency_framework.pdf). [Accessed 26th March  
513 2019].
- 514 18. Scottish Government. *Introducing the Scottish Index of Multiple Deprivation 2016*,  
515 Available from: <http://www.gov.scot/Resource/0050/00504809.pdf> [Accessed 26th  
516 March 2019].
- 517 19. McCaffery K, Wardle J, Nadel M, et al. Socioeconomic variation in participation in  
518 colorectal cancer screening. *Journal of Medical Screening* 2002; 9(3): 104—8.
- 519 20. Ritchie J, Spencer L, O'Connor W. Carrying out qualitative analysis. In: Ritchie J, Lewis  
520 J, editors. *Qualitative research practice: A guide for social science students and*  
521 *researchers*. London: SAGE Publications 2003:219—62.
- 522 21. Ziebland S, McPherson A. Making sense of qualitative data analysis: an introduction  
523 with illustrations from DIPEX (personal experiences of health and illness). *Medical*  
524 *Education* 2006; 40(5): 405—14. Available from: doi:10.1111/j.1365-  
525 2929.2006.02467.x.

- 526 22. Sheeran P, Klein WM, Rothman AJ. Health Behavior Change: Moving From Observation  
527 to Intervention. *Annual Review of Psychology* 2017; 68(1): 573—600.
- 528 23. Jepson RG, Hewison J, Thompson AG, Weller D. How should we measure informed  
529 choice? The case of cancer screening. *Journal of medical ethics*. 2005; 31(4): 192-6.
- 530 24. Ghanouni A, Renzi C, Meisel SF, Waller J. Common methods of measuring ‘informed  
531 choice’ in screening participation: challenges and future directions. *Preventive  
532 medicine reports*. 2016; 4: 601-7.
- 533 25. Robb KA, Simon AE, Miles A, et al. Public perceptions of cancer: a qualitative study of  
534 the balance of positive and negative beliefs *BMJ open* 2014; 4(7), e005434.
- 535 26. Power E, Miles A, Von Wagner C, et al. Uptake of colorectal cancer screening: system,  
536 provider and individual factors and strategies to improve participation. *Future  
537 Oncology* 2009; 5(9): 1371—88.
- 538 27. Power E, Simon A, Juszcyk D, Hiom S, Wardle J. Assessing awareness of colorectal  
539 cancer symptoms: measure development and results from a population survey in the  
540 UK. *BMC cancer*. 2011; 11(1): 366—75.
- 541 28. Forrest S, McCaffery K, Waller J, Desai M, Szarewski A, Cadman L, Wardle J. Attitudes  
542 to self-sampling for HPV among Indian, Pakistani, African-Caribbean and white British  
543 women in Manchester, UK. *Journal of medical screening*. 2004; 11(2): 85-8.
- 544 29. Nelson EJ, Maynard BR, Loux T, Fatla J, Gordon R, Arnold LD. The acceptability of self-  
545 sampled screening for HPV DNA: a systematic review and meta-analysis. *Sex Transm  
546 Infect*. 2017; 93(1): 56-61.
- 547 30. McGregor LM, von Wagner C, Vart G, et al. The impact of supplementary narrative-  
548 based information on colorectal cancer screening beliefs and intention. *BMC cancer*  
549 2015; 15(1): 162—70.

- 550 31. Digby J, McDonald PJ, Strachan JA et al. Use of a faecal immunochemical test narrows  
551 current gaps in uptake for sex, age and deprivation in a bowel cancer screening  
552 programme. *Journal of Medical Screening* 2013; 20(2), 80—5.
- 553 32. Information Services Division. *Scottish Bowel Screening Programme Statistics*. 2019.  
554 Available from: [https://www.isdscotland.org/Health-](https://www.isdscotland.org/Health-Topics/Cancer/Publications/2019-02-05/2019-02-05-Bowel-Screening-Publication-Summary.pdf)  
555 [Topics/Cancer/Publications/2019-02-05/2019-02-05-Bowel-Screening-Publication-](https://www.isdscotland.org/Health-Topics/Cancer/Publications/2019-02-05/2019-02-05-Bowel-Screening-Publication-Summary.pdf)  
556 [Summary.pdf](https://www.isdscotland.org/Health-Topics/Cancer/Publications/2019-02-05/2019-02-05-Bowel-Screening-Publication-Summary.pdf)? [Accessed 26th March 2019].
- 557 33. Craig P, Dieppe P, Macintyre S, et al. Developing and evaluating complex interventions:  
558 The new Medical Research Council Guidance. *British Medical Journal* 2008; 337: 979—  
559 83.
- 560 34. Moore GF, Audrey S, Barker M, et al. Process evaluation of complex interventions:  
561 Medical Research Council guidance. *British Medical Journal* 2015; 350: h1258.
- 562 35. Duffy SW, Myles JP, Maroni R, et al. Rapid review of evaluation of interventions to  
563 improve participation in cancer screening services. *Journal of medical screening* 2017;  
564 24(3): 127—45.