

Introduction

23
24 Since 2013, the National Health Service (NHS) in England has been offering a once-only
25 endoscopic inspection of the lower part of the bowel (Bowel Scope Screening; BSS) to men
26 and women aged 55 years to reduce incidence of colorectal cancer (CRC). However, uptake
27 is notably lower than that of pre-existing, non-preventive methods of bowel screening based
28 on stool testing (43% vs 54%; McGregor et al., 2016; von Wagner et al., 2011).

29 In order to mitigate practical barriers around booking and attending a screening appointment,
30 the invitation letter for BSS offers a screening appointment with a given date, time, and
31 location that people are asked to confirm if they want to participate. It is suggested that using
32 fixed or specified appointments with a single default option reduces individuals' decisions to
33 a simple binary choice i.e. "yes, I can make that appointment" vs "no, I can't make that
34 appointment". This approach has been found to be more effective in motivating women to
35 attend breast screening than an open invitation that does not feature a specific date and time
36 (Allgood et al. 2017; Hudson, Brazil, The, Duffy & Myles, 2016; Offman et al., 2013).

37 However, single appointments will inevitably propose times that are inconvenient, which
38 means that many invitees will ultimately have to contact the screening centre to schedule a
39 new appointment. Recent data from BSS show that attendance at the exact appointment
40 offered is as low as 18% and re-scheduled appointments with multiple slots account for more
41 than half of those who have subsequently attended screening (McGregor et al., 2016). While
42 those with strong intentions are likely to contact the screening programme to reschedule,
43 those less committed may be discouraged by the inconvenience of the task. A potential way
44 of overcoming the loss of participation at the first suggested appointment is to offer multiple
45 appointment slots when people are invited for screening. However, there is currently no
46 evidence in the screening context about the potential benefits of offering more than one timed
47 appointment.

48 Based on the Traditional Economic Theory (THE) of rational choice (Simon, 1955) and Self-
49 Determination Theory (SDT; Deci & Ryan, 1980), it is plausible that offering choice is better
50 than a simple allocation: alternative appointments may create a stronger feeling of autonomy
51 which could increase intrinsic motivation to participate (Iyengar & Lepper, 2000; Katz &
52 Assor, 2007; Patall, Cooper & Robinson, 2008; Zuckerman, Porac, Lathin, & Deci, 1978).
53 SDT is focused on the person acquiring motivation by developing a sense of autonomy and
54 competence. SDT based interventions have been tested in the of tobacco dependence, diet,
55 physical activity and dental care (Fortier et al., 2007; Halvari & Halvari, 2006; Ryan & Deci,
56 2007; Williams et al., 1998; Williams et al., 2006).

57 Similarly, presenting a service or product as part of two options can increase its perceived
58 value (Szrek & Baron, 2007). However, Shah and Wolford (2007) suggest an inverse U-
59 shaped curve between selection behaviour and choice set size in which choice has a positive
60 or negative effect depending on the number of options. More choice can complicate the
61 decision-making process by causing confusion and inceasing perceived difficulty. According
62 to the Choice Overload Hypothesis (COH), offering additional timed appointments would
63 therefore decrease motivation to engage with the screening invitation and choose an option.

64 Although choice overload has been observed in a range of contexts (Iyengar & Lepper, 2000;
65 Schwartz, 2004), it is likely to be moderated by the intricacies of the decision such as
66 familiarity with the decision-making context and prior preference over the alternatives
67 (Scheibehenne, Greifender & Todd, 2010, Chernev, Boeckenholt & Goodman, 2015).

68 Specifically, choice overload is likely to be amplified where decision makers do not have
69 prior preferences and lack familiarity with the overall context (e.g. the screening test). While
70 many research studies have examined the impact of large choice sets, Tversky and Shafir
71 (1992) have shown that choice overload can occur even with as few as two options. So far,
72 only two studies have discussed offereing choice in the context of CRC screening (Partin et

73 al., 2012; ,van Dam et al., 2013). While the later study discusses arguments in favour and
74 against offering a choice of screening strategies, the first concludes, that based on evidence
75 from seven randomized trials, the number of CRC screening options offered is unlikely to
76 affect adherence and patient satisfaction either positively or negatively.

77 The aim of this study was to investigate how the size of the choice set influences intention to
78 confirm a given hypothetical appointment in an online experiment. Specifically, we compared
79 a standard screening invitation with a single BSS appointment with alternative invitations that
80 featured either two, four or six appointments to choose from. We tested whether offering
81 more than one timed appointment increased or decreased intentions to confirm an
82 appointment.

83 *Methods*

84 *Study Design*

85 A randomised online experiment was designed to measure the effect of appointment choice set
86 size on intention to confirm a BSS appointment. A survey company (ResearchNow) invited
87 men and women from their online panel to take part in a survey on BSS if they were aged 35-
88 54 years, living in England, without a previous diagnosis of bowel cancer. This population was
89 assumed to be naïve to BSS with the aim of ensuring that the task was unfamiliar to participants
90 (Stoffel et al, 2019; von Wagner et al., 2019).

91 Once people agreed to participate in the survey, they were given a brief description about BSS
92 and asked to respond to a question that tested their comprehension. If they answered correctly,
93 they were asked to indicate their intention to take part in BSS: *Would you take up the offer if*
94 *you were invited to have the bowel scope screening test?"* with responses on a fully-labelled
95 four-point scale (‘*definitely not*’, ‘*probably not*’, ‘*probably, yes*’ and ‘*definitely, yes*’).

96 Those who intended to take part were excluded from the survey in order to *i*) test the effects of
97 the manipulation among those who do not intend to take part and *ii*) minimise ceiling and social
98 desirability effects often associated with self-reported intention measures (Michie & Abraham,
99 2004; Stoffel et al, 2018; Stoffel et al., 2019; von Wagner et al., 2019).

100 Once eligibility had been established, participants were then allocated at random to one of
101 four experimental conditions in which they were asked to read a hypothetical vignette (See
102 Supplementary Materials). Depending on the condition, the vignette stated that participants
103 should imagine that they had received an invitation letter from their screening centre that
104 contained either one or two, four or six possible appointment dates in eight weeks' time to
105 choose from. Each vignette was followed by a second comprehension question on the main
106 feature of the experimental manipulation. Upon answering correctly, participants were asked
107 to indicate their intention to book an appointment: "*Would you call up your local screening*
108 *centre to confirm (one of) the offered appointment(s)?"* using a four-point Likert scale
109 (*'definitely not'*, *'probably not'*, *'probably, yes'* and *'definitely, yes'*).

110 Perceptions of the invitation process was assessed through three questions on the perceived
111 difficulty of deciding whether to confirm the offered appointment(s), the convenience of the
112 offered alternative(s), and complexity of the invitation process. All three questions used the
113 same fully labelled five-point Likert scale (*'not at all'*, *'slightly'*, *'moderately'*, *'very much'*
114 and *'extremely'*) and were adapted from a 12-item subjective measurement of mental load
115 and mental effort (Krell & Hui, 2017).

116 Details of respondents' age, gender, ethnicity, employment status, living arrangement,
117 education, car ownership, home ownership, and self-reported health status were collected at
118 the end of the survey (see S1 Table for details about participants' characteristics). Participants

119 received a small financial incentive of around 50 pence from the survey company for
120 completing the survey.

121 *The selection of appointment times*

122 Each appointment time offered was drawn from a set of six half-hour slots on Tuesday,
123 Wednesday, and Thursday mornings between 9.30 and 11.30. The six appointments were
124 chosen through three rounds of pilot testing with 464 participants in which BSS non-intenders
125 had to indicate their preferred appointment among a list. Starting with 10 appointments in the
126 first round, we asked responders which appointment they would prefer. After each round, the
127 two most frequently preferred appointments were removed, resulting in the six appointments
128 that shared the lowest preference rates. This approach was chosen to identify and remove
129 potential dominating appointments to ensure a homogenous choice set.

130 *Statistical analysis*

131 Our main outcome was intention to book the offered appointment using a dichotomised scale
132 (*'probably, yes'* or *'definitely, yes'* vs *'probably not'* or *'definitely not'*) after exposure to the
133 experimental manipulation. Sample size of this study was calculated prior to data collection
134 based on the results of a soft launch. We calculated that we needed approximately 450
135 completes per condition to detect differences of at least 8% in proportion of non-intenders
136 effect size between conditions, with a power of 80% and an alpha value of 0.05 (Cohen,
137 1988). We report all measures, manipulations, and exclusions in these studies. All statistical
138 analysis was conducted with Stata/SE version 15.1 (StataCorp LP, College Station, TX). The
139 survey, data and Stata codes for the experiment are available via OSF:
140 https://osf.io/exbtk/?view_only=1b2f34b492744df69c11b7ab1a62998e.

141 We used unadjusted and adjusted ordinal logistic regression to investigate the effect of the
142 number of appointments offered on confirmation intentions and perception of the decision

143 task and appointments. Covariates that were included in the adjusted analyses included initial
144 intention, age, gender, ethnicity, employment status, living arrangement, education, car
145 ownership, home ownership, and self-reported health status.

146 *Ethical approval*

147 The study was approved by the university's research ethics committee (approval number
148 13113/002).

149 **Results**

150 *Study Population*

151 Figure 1 demonstrates the flow of participants through the study. In total, 9,129 men and
152 women aged 35-54 years were invited to participate. Out of the 8,386 (91.9%) who correctly
153 identified BSS as a test which involves inserting a flexible tube into the back passage, 2,125
154 (23.3%) indicated that they would either '*probably not*' (n=1,717) or '*definitely not*' (n=408)
155 do the test. 6,261 who intended to do the test by either saying that they would probably
156 (n=3,947) or definitely (n=2,314) do the test were excluded. 217 participants (10.2%) did not
157 finish the survey. The final sample consisted of 1,908 respondents of whom 57.8% were
158 female, 82.1% White-British, 65.5% married or cohabiting, 76.3% in paid employment, and
159 63.6% in good or excellent self-reported health (63.6%). Drop-outs post-randomisation did not
160 create imbalances (Appendix 1).

161 [Insert Figure 1 here]

162 *Intention to book BSS appointment*

163 The unadjusted and adjusted logistic regression in Table 1 shows the negative effect of
164 offering a choice on intention (Odds Ratios, ORs) varied between 0.69 and 0.75, indicating

165 that presenting individuals with more than one appointment option reduced the intention to
166 book an appointment (Table 1 and 2).

167 [Insert Table 1 here]

168 There were no statistically significant differences between conditions whose choice sets
169 contained more than one appointment.

170 *Perception of screening invitation*

171 Most participants (89.1%) did not perceive the decision task to be very or extremely difficult,
172 irrespective of experimental group (Table 2).

173 [Insert Table 2 here]

174 Approximately half of the sample perceived the invitation process to be very or extremely
175 complex (52.2%). However, the adjusted logistic regression did not reveal a statistically
176 significant effect of offering choices among appointments on these two perception items
177 (Table 3).

178 Conversely, individuals who were presented with more than one appointment option were
179 more likely to perceive their choice sets to be convenient. Specifically, those who were
180 offered four or six options perceived them to be more convenient than those who only got one
181 option (OR: 1.57; 95% CI: 1.25-1.97, $p < 0.001$ and OR: 1.53; 95% CI: 1.1-1.93, $p < 0.001$).

182 Conversely, offering two appointments to choose from was not associated with greater
183 perceived convenience (OR: 1.15; 95% CI: 0.91-1.45).

184 [Insert Table 3 here]

185 **Discussion**

186 This study investigated whether the size of the appointment choice set affects BSS
187 confirmation intentions among disinclined men and women. The study was tested on two

188 opposing concepts: Self-Determination Theory and Traditional Economic Theory, which both
189 advocate choice, versus the Choice Overload Hypothesis, which stipulates that ‘less is more’
190 when it comes to offering alternative screening appointments. Consistent with literature on
191 choice overload (Scheibehenne et al., 2010, Chernev et al. 2015), our experiment suggests
192 that offering choice has a negative effect on intentions to confirm an appointment.

193 Furthermore, similar to Tversky and Shafir (1992), we found that offering as few as two
194 options decreases confirmation intentions.

195 A strength of our experiment was the use of a series of comprehension checks to ensure that
196 all participants in the final sample correctly understood the decision task, providing a high
197 level of internal validity. However, this study also has some limitations. Firstly, we used an
198 online experiment with hypothetical scenarios and participants aged 35 to 54 who were not
199 yet eligible for screening, potentially reducing the relevance of their responses and limiting
200 external validity of our findings.

201 The next step would be to test external validity through a randomised controlled trial within
202 the screening programme, in which eligible individuals are invited for screening with one or
203 more appointment times.

204 Secondly, our experiment does not explain why offering choice between different screening
205 appointments had a negative effect on screening intentions as our results suggest that offering
206 choice did not increase the difficulty of the participation decision or the complexity of the
207 screening invitation. Furthermore, the positive effect of offering choice among four or more
208 alternatives on perceived convenience of the appointments suggests that choice is not
209 unambiguously bad. Future research could look at other subjective and behavioural outcomes
210 such as choice satisfaction, decision regret, decision confidence, and choice deferral (Chernev
211 et al. 2015). In addition, we deliberately chose to remove potentially dominating choice

212 options by offering appointment times within relatively short time slots. Future research would
213 need to determine the extent to which there are strong preferences for appointment slots,
214 including day of the week, time of the day and whether these could still be used to optimise
215 invitation strategies.

216 Finally, the role of familiarity with the decision task should be addressed before extrapolating
217 our findings to other health services such as dental checks, immunization and breast and
218 cervical cancer screening where individuals are invited regularly. In these situations,
219 individuals who have participated previously may already be familiar with the invitation
220 process and have specific preferences and expectations.

221 **Conclusions**

222 The results from this online experimental survey support the current practice of the NHS Bowel
223 Scope Screening Programme to send a single fixed appointment by showing that offering
224 choice without addressing pre-determined preferences for specific times and days is likely to
225 reduce rather than increase motivation to book an appointment.

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320

321 *Table 1 Ordinal logistic regressions on intentions to confirm appointment (N=1,908)*

	Unadjusted model		Adjusted model [†]	
	Odds ratio	95% CI	Odds ratio	95% CI
<i>Appointment(s) offered</i>				
1 option	Ref.		Ref.	
2 options	0.753	0.585 - 0.948*	0.685	0.529 - 0.888**
4 options	0.689	0.535 - 0.886**	0.691	0.533 - 0.896**
6 options	0.749	0.581 - 0.966*	0.710	0.546 - 0.923*

322 [†]Adjusted for initial intentions, gender, age, marital status, ethnicity, education, employment, car and house ownership and
 323 self-reported health status. Full model is reported in S2 Table in the supplementary file.

324 (* $p < 0.05$; ** $p < 0.01$)

325 *Table 2 Effect of offering choice on confirmation intentions and perception of the decision task and appointments*

	1 option (N=438)		2 options (N=488)		4 options (N=506)		6 options (N=476)		Overall (N=1,908)		p-value [†]
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	
Intention to confirm appointment											
Definitely not	68	(15.5%)	67	(13.7%)	85	(16.8%)	64	(13.4%)	284	(14.9%)	0.001
Probably not	219	(50.0%)	295	(60.5%)	293	(57.9%)	294	(61.8%)	1101	(57.7%)	
Probably yes	104	(23.8%)	105	(21.5%)	100	(19.8%)	89	(18.7%)	398	(20.9%)	
Definitely yes	47	(10.7%)	21	(4.3%)	28	(5.5%)	29	(6.1%)	125	(6.5%)	
Difficulty of decision task											
Not at all	190	(43.4%)	233	(47.8%)	235	(46.4%)	219	(46.0%)	877	(46.0%)	0.550
Slightly	104	(23.7%)	109	(22.3%)	127	(25.1%)	129	(27.1%)	469	(24.6%)	
Moderately	95	(21.7%)	94	(19.3%)	88	(17.4%)	76	(16.0%)	353	(18.5%)	
Very much	33	(7.5%)	32	(6.6%)	41	(8.1%)	39	(8.2%)	145	(7.6%)	
Extremely	16	(3.7%)	20	(4.1%)	15	(3.0%)	13	(2.7%)	64	(3.3%)	
Complexity of invitation process											
Not at all	32	(7.3%)	26	(5.3%)	35	(6.9%)	30	(6.3%)	123	(6.5%)	0.778
Slightly	59	(13.5%)	72	(14.8%)	85	(16.8%)	70	(14.7%)	286	(15.0%)	
Moderately	125	(28.5%)	130	(26.6%)	131	(25.9%)	117	(24.6%)	503	(26.4%)	
Very much	159	(36.3%)	193	(39.6%)	197	(38.9%)	189	(39.7%)	738	(38.7%)	
Extremely	63	(14.4%)	67	(13.7%)	58	(11.5%)	70	(14.7%)	258	(13.5%)	
Convenience of appointment(s)											
Not at all	122	(27.9%)	130	(26.7%)	102	(20.2%)	107	(22.5%)	461	(24.2%)	0.003
Slightly	97	(22.1%)	108	(22.1%)	110	(21.7%)	98	(20.6%)	413	(21.6%)	
Moderately	142	(32.4%)	140	(28.7%)	145	(28.7%)	131	(27.5%)	558	(29.3%)	
Very much	57	(13.0%)	86	(17.6%)	120	(23.7%)	106	(22.3%)	369	(19.3%)	
Extremely	20	(4.6%)	24	(4.9%)	129	(5.7%)	34	(7.1%)	107	(5.6%)	

† Chi-Square test

326

327

328 *Table 3 Adjusted ordinal logistic regressions on perception items (N=1,908)*

	Difficulty making decision [†]		Complexity of invitation process [†]		Convenience of appointment(s) [†]	
	OR	95% CI	OR	95% CI	OR	95% CI
<i>Appointment(s) offered</i>						
1 option	Ref.		Ref.		Ref.	
2 options	0.854	0.670 - 1.088	1.100	0.870 - 1.391	1.148	0.912 - 1.446
4 options	0.903	0.710 - 1.147	0.919	0.729 - 1.159	1.571	1.250 - 1.974**
6 options	0.856	0.672 - 1.091	1.111	0.876 - 1.408	1.530	1.211 - 1.934**

329 [†] Adjusted for initial intentions, gender, age, marital status, ethnicity, education, employment, car and house ownership and
 330 self-reported health status. Full model is reported in S2 Table in the supplementary file. (* $p < 0.05$; ** $p < 0.01$)

Figure 1 Flow through the study

