Patient Education and Counseling 102 (2019) 1621–1628

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.elsevier.com/locate/pateducou

The impact of descriptive norms on motivation to participate in cancer screening – Evidence from online experiments

Christian von Wagner[a,*], Yasemin Hirst[a], Jo Waller[a], Alex Ghanouni[a], Lesley M. McGregor[a], Robert S. Kerrison[a], Wouter Verstraete[a], Ivo Vlaev[b], Monika Sieverding[c], Sandro T. Stoffel[a]

[a] University College London, ResearchDepartment of Behavioural Science and Health, 1-19 Torrington Place, WC1E 6BT, London, UK
[b] University of Warwick, Warwick Business School, Scarman Road, CV4 7AL, Coventry, UK
[c] University of Heidelberg, Institute of Psychology, Hauptstraße 47-51, 69117, Heidelberg, Germany

ARTICLE INFO

Article history:
Received 29 October 2018
Received in revised form 29 March 2019
Accepted 1 April 2019

Keywords:
Descriptive norm information
Social norms
Decision making
Behaviour change
Health behaviour
Cancer screening

ABSTRACT

Objective: The current study tested in two online experiments whether manipulating normative beliefs about cancer screening uptake increases intention to attend colorectal screening among previously disinclined individuals.
Methods: 2461 men and women from an Internet panel (Experiment 1 $N = 1032$; Experiment 2, $N = 1423$) who initially stated that they did not intend to take up screening were asked to guess how many men and women they believe to get screened for colorectal cancer. Across participants, we varied the presence/absence of feedback on the participant's estimate, as well as the stated proportion of men and women doing the screening test.
Results: Across the two experiments, we found that receiving one of the experimental messages stating that uptake is higher than estimated significantly increased the proportion of disinclined men and women becoming intenders. While, we found a positive relationship between the communicated uptake and screening intentions, we did not find evidence that providing feedback on the estimate has an added benefit.
Conclusion: Screening intention can be effectively manipulated through a high uptake message.
Practice implications: Communication of high screening uptake is an easy and effective way to motivate disinclined individuals to engage in colorectal cancer screening.
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1. Introduction

There is an extensive body of research aiming to better understand and improve participation in cancer screening programmes [1,2]. Social norms have received particular attention as a determinant of health-related behaviours [3–7] including cancer screening [8] and as a target for interventions and campaigns to increase uptake [9]. There are two different types of normative belief: those concerning the prevalence of a behaviour among comparable people (descriptive norms) and those concerning the perception of what other important people expect someone to do (injunctive norms) [10–12]. Cross-sectional observational studies have been influential in expanding existing social cognition models to give more emphasis to normative beliefs [13]. For example, a study of 2426 German men revealed that social norms play an important role in men's cancer screening intention and behavior. For intention formation, descriptive norm was influential over and above subjective norm. Descriptive norms (assessed as estimates of the prevalence of participation in cancer screening) varied as a function of the men's own participation [12]. Non-attenders estimated that only 28% of other men would undergo cancer screening, whereas irregular attenders estimated that 36% would, and regular attenders estimated that 45% would. Perhaps more importantly, these theories have given rise to studies examining the circumstances in which descriptive or injunctive norms can be used to increase the subjective value of a behaviour, as a function of the prevalence with which people engage in it [14–18].

In the context of colorectal cancer screening (CRC) for example, Sieverding et al. [8] conducted a study with 185 men (M = 53 years) who had never attended a cancer screening examination before. The experiment aimed to demonstrate a causal influence of

* Corresponding author at: Research Department of Behavioural Science and Health, University College London, 1-19 Torrington Place, WC1E 6BT, UK.
E-mail address: c.wagner@ucl.ac.uk (C. von Wagner).

https://doi.org/10.1016/j.pec.2019.04.001
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descriptive norms on interest in cancer screening by providing either low or high uptake information. Two experimental groups received different (true) statistics about 1-year (18%) or lifetime (65%) cancer screening uptake of other men in Germany; the control group received no uptake information. Men who had received the low uptake information showed less intention to screen and less active interest (leaving name and address) in further information on cancer screening compared to men in the control and high prevalence groups [8].

Similarly, a recent US study, that used verbal information about people's choice of bowel cancer screening tests, such as *many people*, did not find any effect on intention, test preference, or uptake [11]. These non-significant results suggest that communicating high descriptive norms does not appear to motivate or encourage screening uptake. However, due to the scarcity of studies, the range of descriptive norm message that have been tested so far is limited.

In the example of Sieverding and Colleagues' study [8], the high uptake message stated uptake as 65%, which might not be perceived as high enough, and is in fact lower than actual screening uptake reported for established programmes [19]. In the case of Schwartz et al. [11], the message referred to a sub-set of the total screening eligible population (e.g. people who were uncertain about colonoscopy) making the message more difficult to interpret. Furthermore, given that the studies did not assess baseline normative beliefs or intentions, it is not clear whether they were adequately powered to detect the impact of a high uptake message among those individuals who would be most likely to benefit (i.e. non-intenders with low to moderate baseline expectations of uptake).

2. Study overview, objectives and hypothesis

In the present study, we investigated the influence of different social norm messages, presented in a hypothetical vignette, on intention to participate in NHS bowel scope screening, BSS. BSS (also more widely known as Flexible Sigmoidoscopy screening) is a one-off test for people in their 50 s that helps prevent bowel cancer by finding and removing small pre-cancerous growths from the lower bowel. Specifically, we tested in two online experiments whether social norm messages would positively affect people who estimated uptake to be no more than 50% and who did not intend to have the test when presented with a short description of BSS (baseline). To explore this further, we varied the content of the social norm message.

2.1. Giving feedback

Previous research has found that giving personalised normative feedback is effective in the context of changing drinking behaviour [20]. Providing personalised feedback has been suggested to have greater impact because it is more salient and explicit in revealing discrepancies between one's own estimate and the target message [21,22]. Here, we tested the impact of giving feedback on the original uptake estimate (i.e. '*you guessed uptake was x, in reality uptake is . . .* ').

2.2. Increasing perceived uptake

Relatedly, we also wanted to compare different formats of descriptive norm messages, namely that of a standard high uptake message ('*uptake is 8 out of* 10′) vs. a message in which the baseline estimate ('uptake is x out of 10′) was increased by a constant of 'three out of ten' (constant increase message).

Currently, studies in the cancer screening domain communicate that uptake is high by providing an absolute uptake estimate e.g. uptake is 8 out of 10 (standard high uptake message). Theories of persuasion stipulate that highlighting discrepancies between an initial expected uptake and projected uptake can increase message engagement [22,23]. So a standard high uptake message should be particularly effective among people with a low baseline expectation. However, one potential drawback of such an indiscriminate approach is that it could undermine message credibility, especially among people with a very low initial estimate. Having a wide discrepancy between the person's expectation and reported uptake could lead to message rejection and ultimately undermine intention change. In the present study, we compared a standard high uptake message (uptake in the normative message always equals 8) with a message in which the increase was proportional to the responder's initial estimate (if estimated uptake equals x_i, then uptake in the proportional norm message = x_i+3)

In summary, our study had the following hypothesis and research question:

H1. Providing a descriptive norm message that increases a low-to-moderate baseline expectation of uptake will lead to an increased proportion of people intending to take part in screening compared with a descriptive norm message confirming the original estimate.

H2. Providing personalised and explicit feedback on the baseline estimate will further enhance the impact of a descriptive norm message that increases a low–to-moderate baseline expectation.

Note that none of our messages described uptake as exceeding 8 out of 10, thereby remaining reasonably close with uptake statistics reported for well-established UK cancer screening programmes [24,25]. This research project was approved by the UCL Research Ethics Committee (approval number 13113/001). We report all measures, manipulations, and exclusions in these experiments. All statistical analysis was conducted with Stata/SE version 15.1 (StataCorp LP, College Station, TX). Survey questionnaires, data and Stata codes for the experiments are available via OSF: https:/osf.io/twes3.

Sample sizes were calculated prior to data collection based on estimates obtained from pilot studies. Both experiments were powered to detect differences of at least 10% in proportion of non-intenders effect size between conditions, with a power of 80% and an alpha value of 0.05 [26]. We used Chi-Square test of independence and multivariable logistic regression adjusting for baseline intentions, baseline perceived uptake and sociodemographic variables to investigate the effect of condition on dichotomised post-exposure intention to take part (probably and definitely yes vs probably and definitely not) and perceived credibility of the communicated social norm items (agree and strongly agree vs neither agree nor disagree, disagree and strongly disagree). The reclassification of the outcome variables was due to low frequencies in some answer categories. Bonferroni adjusted significance levels were used for multiple comparisons.

3. Experiment 1

3.1. Sample

We recruited participants through an internet-based survey company (Survey Sampling International). We purposefully sampled individuals who were initially disinclined to participate in cancer screening (i.e. respondents who stated that they would either probably or definitely not intend to attend their BSS appointment) to simulate a targeted intervention aimed at non-attenders. Furthermore, we only included individuals who estimated uptake to be between 0 and 5 out of 10, as responders

in the condition that featured a message with proportional increase otherwise would get descriptive normative messages that exceed 8 out of 10. In total, 4964 panel members (2019 men and 2945 women) aged 35–54 without a bowel cancer diagnosis started the internet-based survey and read about bowel scope screening (see Fig. 1). Of the 4946 who passed the first comprehension check by identifying BSS as a test that involves inserting a flexible tube into the back passage and answered the intention question, most (N = 3,808, 77.0%) either stated that they would probably (N = 2,322, 47.0%) or definitely (N = 1,486, 30.0%) do the BSS test and were excluded. 1138 (23.0%) indicated that they would either definitely not (N = 237, 4.8%) or probably not (N = 901, 18.2%) do it.

Of these, 1032 (90.7%) estimated uptake to be between 0–5 and were randomised, with equal probability, to one of three descriptive norm conditions (see Appendix 1 in the online supplementary materials for the descriptive statistics of the final sample).

Table 1 summarises the main characteristics of the three conditions. The control condition, acknowledged the baseline estimate and confirmed it *('You guessed that on average x_i out 10 eligible men and women participate in the programme. In reality, x_i out of 10 men and women who are eligible to participate do so.')*. The first experimental condition E1, also acknowledged respondent's estimate but corrected it upwards by a moderate amount *('You guessed that on average x_i out 10 eligible men and women participate in the programme. In reality, x_i+3 out of 10 men and women who are eligible to participate do so.')*. The second experimental condition (E2) communicated that uptake 8 out of 10 without referring to the individuals' estimation *('In reality, 8 out of 10 men and women who are eligible to participate do so.')*.

After receiving information about uptake, respondents had a second comprehension check that required them to correctly repeat the communicated uptake before completing the rest of the survey.

3.2. Measures

Screening intention was assessed both before and after exposure to the social norms messages with the question *"Would you take up*

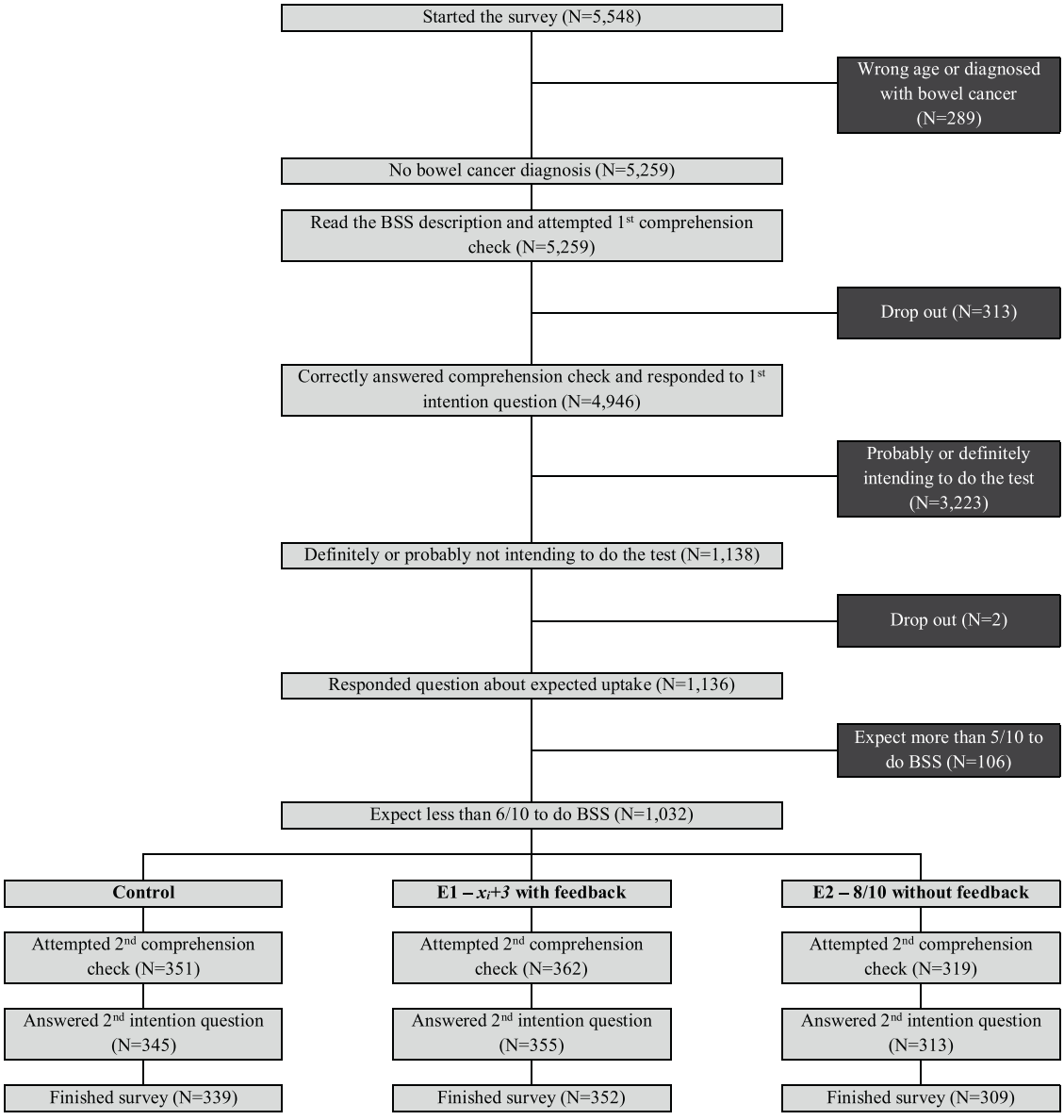

Fig. 1. Flow through experiment 1.

Table 1
Characteristics of the three experimental conditions.

Experimental condition	N	Acknowledgement of individual guess (x_i)	Communicated uptake
Control	339	yes	x_i out of 10
E1	352	yes	x_i+3 out of 10
E2	309	no	8 out of 10

the offer of bowel scope screening?" on a fully labelled 4-point Likert scale ('*definitely not*', '*probably not*', '*probably yes*' and '*definitely yes*').

Descriptive social norms were assessed using the question "Thinking about 10 men and women who are eligible to participate, how many do you think participate on average in the bowel scope screening test?" Possible response answer options included: 'none'; '1 in every 10′ up to '9 in every 10′; and 'everyone (10 out of 10)'. Individuals who estimated BSS uptake as being at least 6 out of 10 were excluded from the survey at this point.

Message credibility was measured with the statement "I find it easy to believe that x out of 10 do the test" on a fully labelled five-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

3.3. Demographics

Details of respondents' age, ethnicity, marital status, education, employment, car and house ownership, and health status were collected at the end of the survey.

4. Results

4.1. Effect of experimental condition on intentions

Table 2 shows the proportion of people in each experimental condition who stated that they would probably or definitely intend to participate in bowel scope screening. In line with our hypothesis H1, both augmented messages led to a significantly greater proportion of previous non-intenders stating that they would have the screening test (*E1*: 15.28%; *E2*: 25.2%) compared to the control condition that acknowledged but did not correct the person's estimate (10.5%, $p < 0.001$).

The fully adjusted logistic regression model in Table 2 show the effect sizes of the two augmented conditions compared to the baseline (*E1*: Odds Ratio [OR] 2.38, 95% confidence intervals [CI] 1.41–4.03, p=0.001 and *E2*: OR 5.34 95% CI: 3.21–8.89, p<0.001). Thus, the standard social norm message was more effective than a message providing modest increase on the respondent's baseline estimate (Fig. 2).

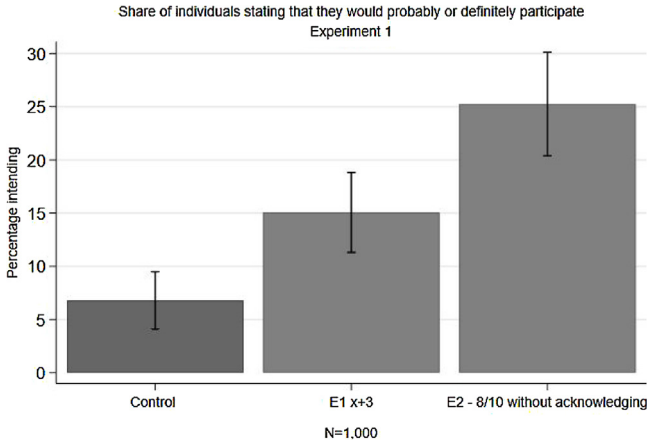

Fig. 2. Effect on dichotomised screening intentions – Experiment 1.

4.2. Effect of experimental condition on perception of the social norms message

Table 2 reveals that those who received any of the two experimental messages were less likely to agree that the message was credible than those in the baseline condition (*E1*: 34.4% OR 0.22 95% CI: 0.16-0.30, p<0.001 and *E2*: 22.0% OR 0.12 95% CI: 0.08-0.17, p<0.001 vs *Control*: 70.6%). Furthermore, participants in the moderate increase condition (*E1)* were significantly more likely to perceive the message as credible (34.4%), compared those who received the high uptake message (22.0%, $p <$ 0.001).

Results of the first experiment supported the hypothesis that descriptive social norms can be used to increase screening intentions among previously disinclined men and women. However, as experiment 1 did not manipulate feedback, it is unclear whether and to what extent referring to the person's own estimate actually influenced the perceived credibility of the message and influence on screening intentions. Increasing the salience of the difference between own estimate and communicated norm could increase the effect of the social norm message. Experiment 2 addressed this gap by adding an additional experimental condition that acknowledged their estimate and communicated that 8 out of 10 do the test. Furthermore, the second experiment tried to replicate the results of the first experiment. Replicability of research findings is an important aspect for empirical science to challenge or support established assumptions [27,28].

Table 2
Multivariate analysis of dichotomised participation intention and perception of communicated norms – Experiment 1.

	N	Intentions			Credible		
		%	OR	95% CI	%	OR	95% CI
Condition							
Control	339	6.78%	Ref.		70.62%	Ref.	
E1 – x_i+3 with feedback	352	15.06%	2.383	1.410 – 4.028**	34.38%	0.215	0.155 - 0.298**
E2 - 8/10 no feedback	309	25.24%	5.343	3.211 – 8.891**	22.01%	0.116	0.081 - 0.167**
Baseline intention							
Definitely not			Ref.			Ref.	
Probably not			5.219	2.562 – 10.632**		1.160	0.813 - 1.657
Initial expectation			1.242	1.092 - 1.412**		1.049	0.951 - 1.157
N			1,000			1,000	
R^2			0.159			0.232	

Logistic regressions adjusted for gender, age group, marital status, ethnicity, education, working status, car and house ownership and self-reported health status (* p<0.05; ** p<0.01) The full models are presented in Appendix 4.

5. Experiment 2

5.1. Sample

Experiment 2 used the same recruitment method as experiment 1. In total, 7187 panel members (2552 men and 4635 women) aged 35–54 without a bowel cancer diagnosis started the internet-based survey and read about bowel scope screening (see Fig. 3). Of the 6649 who passed the first comprehension check by identifying BSS as a test that involves inserting a flexible tube into the back passage and answered the intention question, most (N = 4,916, 73.9%) either stated that they would probably (N = 3,065, 46.1%) or definitely (N = 1,851, 27.8%) do the BSS test and were excluded. 1733 (26.1%) indicated that they would either definitely not (N = 402, 6.1%) or probably not (N = 1,331, 20.0%) do it. Of these, 1494 (86.2%) estimated uptake to be between 0–5 and were randomised, with equal probability, to one of four descriptive norm conditions (see Appendix 3 in the online supplementary materials shows the descriptive statistics of the final sample).

Experiment 2 featured four conditions of which three (Control, E1 and E2) were identical to the ones used in experiment 1. The new experimental condition E3 was a variation of E2 in that it also communicated that 8 out of 10 do the screening test, but also acknowledged their initial belief about uptake ('*You guessed that on average x_i out 10 eligible men and women participate in the programme. In reality, 8 out of 10 men and women who are eligible to participate do so.*').

5.2. Measures

All outcome variables were the same as in experiment 1. We collected information about the participants' sociodemographic

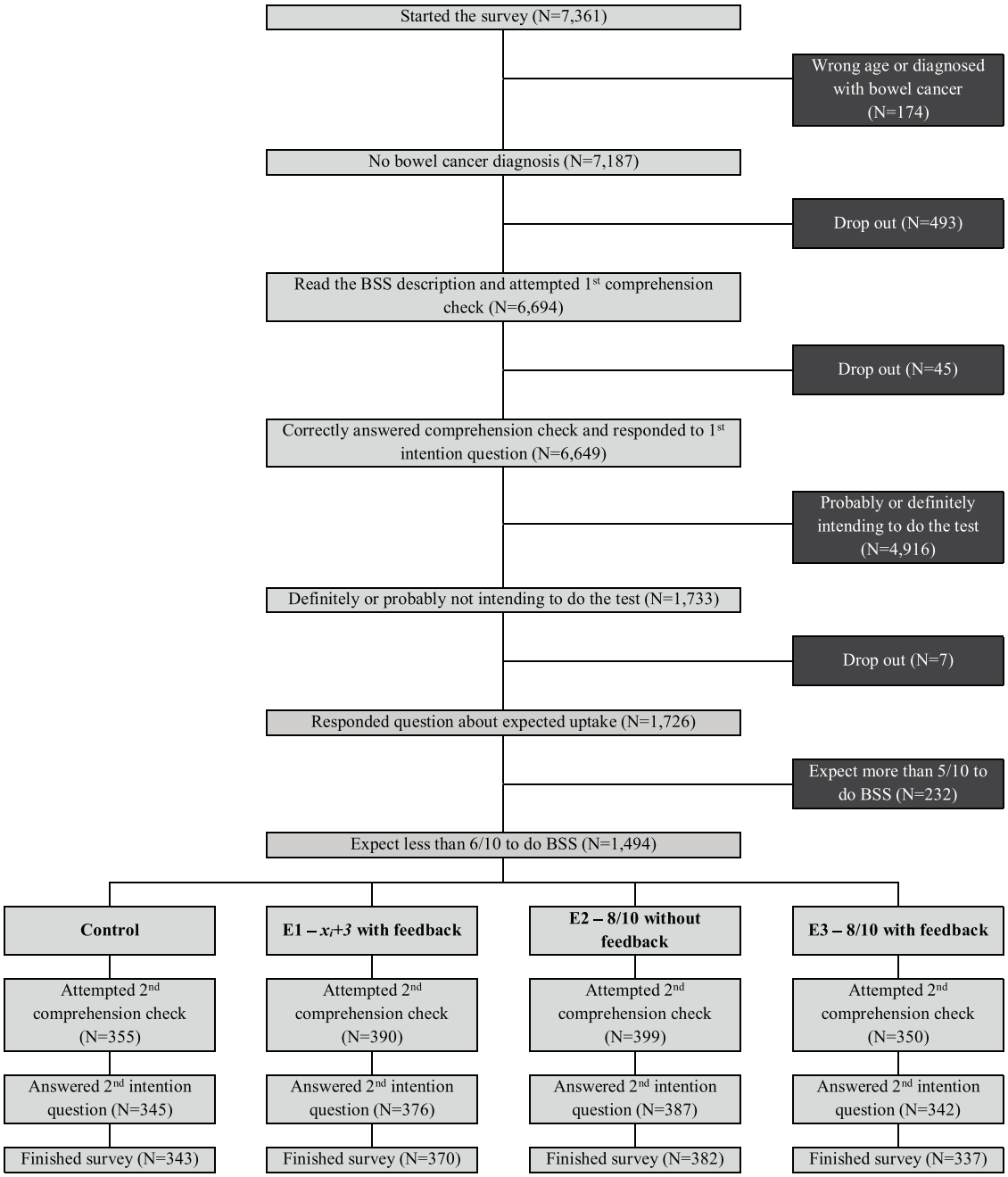

Fig. 3. Flow through experiment 2.

characteristics, initial beliefs about uptake as well as screening intentions before and after exposure to the social norms messages and perceived credibility of the messages.

6. Results

6.1. Effect of experimental condition on intentions

Table 3 shows that also experiment 2 supports H1 as all three augmented messages led to a significantly greater proportion of previous non-intenders stating that they would probably or definitely have the screening test (*E1*: 17.8%; *E2*: 28.2% and *E3*: 27.7%) compared to the control condition that acknowledged but did not correct the person's estimate (10.5%, $p < 0.001$). Table 3 shows the effect sizes of the three augmented conditions compared to the baseline condition in a fully adjusted logistic regression model (*E1*: OR 1.92, 95% CI 1.23–2.98, p=0.004; *E2*: OR 3.48, 95% CI: 2.27–5.35, p<0.001 and E3: OR 3.40, 95% CI: 2.23–5.19, p<0.001). *E2* and *E3* were also associated with a significantly greater proportion of intenders compared with *E1* (*C3* vs *C2*: x^2 (1, N = 707) = 10.75, p=0.001 and *C4* vs *C2*: x^2 (1, N = 752) = 10.47, p=0.001) thus showing that a standard social norm message was more effective than a message providing modest increase on the respondent's baseline estimate. However, there was no difference between the two standard high uptake message conditions *E2* and *E3* (x^2 (1, N = 719) = 0.02, p=0.895) thus failing to support the prediction that personalised and explicit feedback about the baseline uptake estimate would lead to a greater share of respondents becoming intenders post exposure (*H2*) (Fig. 4).

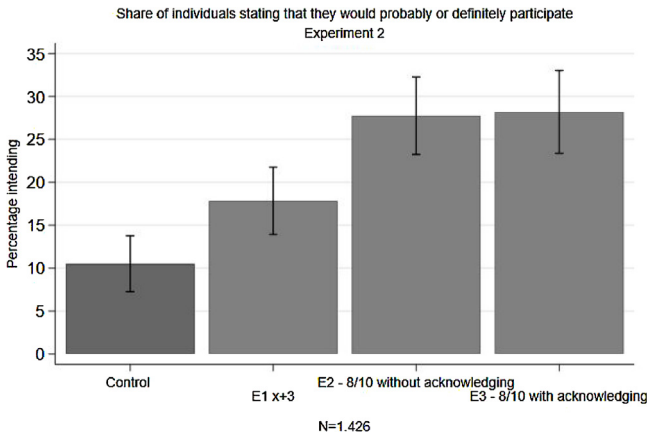

Fig. 4. Effect on dichotomised screening intentions.

6.2. Effect of experimental condition on perception of the social norms message

Participants in all three high uptake message conditions were less likely to agree that the message was credible than those in the baseline condition (*E1*: 45.7%, *E2*: 21.4% and *E3*: 27.5% vs *E2*: 67.1%, p<0.001 for all comparisons with the controls). People in the moderate increase condition (*E1)* were significantly more likely to perceive the message as credible (45.7%), compared with the high uptake message conditions (21.5% and 27.5% for *E3* and *E4* respectively, $p <$ .001, see Table 3).

7. Discussion

Two separate online experiments aimed to test the effect of presenting people with descriptive social norm messages on intention to attend BSS though two online experiments. We found that correcting the initial belief about BSS uptake upwards increased screening intentions among previously disinclined individuals. Specifically, telling individuals, independently of their own beliefs that 8 out of 10 participate in the screening programme yielded the highest impact on intention. Interestingly, providing personalised feedback by referring to the person's own belief did not augment this effect.

Furthermore, we did not find evidence that a modest increment was superior to the standard high uptake message. Overall, our findings therefore suggest that the traditional approach of providing a simple message indicating a high level of participation is most effective and does not require any direct recourse to people's prior beliefs. The fact that highlighting discrepancy did not add anything to the impact of a high uptake message was at odds with our hypothesis (based on theories of persuasion) [21]. However, far from being disappointing, at least at a practical level, it is encouraging that the simplest method of communicating descriptive norms also turned out to be the most effective.

One potential caveat here was the inverse relationship between reported uptake and message credibility in both experiments (see Tables 2 and 3). While the lack of credibility did not seem to undermine the experimental effects on intention, it is important to understand the precise role (if any) message credibility plays. Future research should therefore address whether there are ways in which high uptake messages can be made to appear more credible and whether increasing credibility of these message could further increase their impact.

Overall, the results from two studies support the hypothesis that descriptive norms beliefs can influence intention to participate in cancer screening and are a putative target for effecting

Table 3
Multivariate analysis of dichotomised participation intention and perception of communicated norms – Experiment 2.

	N	Intentions			Credible		
		%	OR	95% CI	%	OR	95% CI
Condition							
Control	343	10.50%	Ref.		67.06%	Ref.	
E1 – x_i+3 with feedback	370	17.84%	1.920	1.230 - 2.997**	45.68%	0.415	0.305 - 0.563**
E2 - 8/10 no feedback	337	27.75%	3.398	2.228 – 5.185**	27.49%	0.188	0.136 - 0.258**
E3 - 8/10 with feedback	382	28.19%	3.481	2.265 - 5.352**	21.36%	0.133	0.094 - 0.189**
Baseline intention							
Definitely not			Ref.			Ref.	
Probably not			2.857	1.916 - 4.260**		1.164	0.879 - 1.540
Initial expectation			1.057	0.963 - 1.160		1.089	1.006 - 1.178*
N			1,432			1,432	
R^2			0.127			0.179	

Logistic regressions adjusted for gender, age group, marital status, ethnicity, education, working status, car and house ownership and self-reported health status (* p<0.05; ** p<0.01) The full models are presented in Appendix 5.

behaviour change [29,37]. This is very important because this is the first time an experiment showed a positive motivational change in screening participation as a result of increasing perceived descriptive norms. One strength of the experiments was the oversampling of non-intenders which allowed us to amplify the signal among members of an internet-based panel which were generally skewed towards holding positive views about the test. Among the screening-eligible population non-intenders form a very important subgroup as the vast majority of non-attenders of bowel scope screening never engage with their screening invitation, i.e. never respond to the initial invitation or show any sign of intention to have the test [30,31]. A final strength of this study is that experiment 2 replicated the findings of the first experiment, supporting the consistent effect of communicating descriptive social norms on screening intentions.

7.1. Limitations and future directions

The main limitation of this study is that its findings are limited to intention change rather than behaviour change. Several studies have identified what has become known as the intention-behaviour gap [32]. As such motivational interventions are a necessary but not sufficient condition for behaviour change. The effect observed on intention associated with social norm messages would therefore likely need to be supplemented with volitional strategies like implementation intentions [33,34] or coping plans [35,36].

Another important consideration is that the messages used in this study were specifically designed to test the effect of different types of descriptive norm messages, i.e. prove that in principle manipulating normative beliefs has an effect on intention rather than test a specific application. For this purpose, we chose messages that mapped on to our pre-conceived hypothesis rather than actual uptake. As such our messages could not be used in field experiments or campaigns, since the uptake in the programme is considerably lower than the 8 out 10 message used here.

The next step in translating our findings should be to follow the pathway to intervention design suggested by the Experimental Medicine Approach [29,37]. Here, the current study identified social norms as a putative target. Going forward would involve developing a validated measure for this target (i.e. descriptive normative beliefs) and use it to assess the impact of alternative message formats (target engagement). Potential formats in which to communicate descriptive norms would include describing social acceptability through narrative messages (which could include other aspects such as satisfaction with screening) or by presenting uptake rate, e.g. the number of people taking part in a programme over a given time period.

8. Conclusion

This is the first study supporting the idea that social norm messages can be used to motivate BSS non-intenders to show interest in the test. It suggests that people respond most strongly to messages portraying high uptake irrespective of their initial estimate and without making reference to the initial estimate. Before being able to measure the impact on uptake the next step will be to use an Experimental Medicine Approach to develop and test messages that could be used in future campaigns or used to enhance invitation materials.

9. Practice implications

Telling people that a large proportion of comparable peers have participated in cancer screening is a simple intervention that could easily be implemented in a variety of screening programmes that have high uptake. This may be particularly true for new screening programmes with low levels of awareness of either the programme or the target disease. Whether this powerful communication tool could be used for programmes with low uptake, however, needs to be tested in future studies. Based on previous studies, providing descriptive norm information in such circumstances could demotivate people from engaging with the communicated behaviour [8]. If, however, the intervention is aimed at non-attenders who tend to have low beliefs about uptake [12], even communicating low uptake could increase motivation to get screened. Furthermore, there may be alternative ways of communicating even modest levels of uptake which could encourage people to take part.

Author contributions

CW and SS developed the study concept. All authors contributed to the study design. CW and SS performed the data analysis and interpretation. CW drafted the manuscript, and IV, MS and SS provided critical revisions. All authors approved the final version of the manuscript for submission.

Funding

This work was supported by Cancer Research UK [grant number UK C1418/A14134]· The funding agreement ensured the authors' independence in designing the study, interpreting the data, writing, and publishing the report.

Open practices

The experiment in this article earned Open Materials and Open Data badges for transparent practices. Materials and data for the experiments are available at OSF: https://osf.io/twes3

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.pec.2019.04.001.

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