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Trust in Cervical Screening and Attributions of Blame for Interval Cancers Following a National Controversy

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Abstract

This study investigated levels of trust and attributions of blame in connection with a cervical screening programme following a controversy related to the programme's audit, incorporating an experimental test of the effectiveness of new information materials. We compared responses in Ireland (N=872) to equivalent responses in Scotland (N=400). Participants in Ireland were randomly assigned to either a treatment group that received the information materials or a control group that did not. Participants then responded to questions about their trust in cervical screening and to whom they would attribute blame in a range of scenarios describing women diagnosed with cervical cancer between screening rounds. Results showed that the control group in Ireland had lower trust and attributed higher blame towards screening services than participants in Scotland. However, exposure to information materials in the treatment group improved trust and reduced blame. The findings suggest that public controversies influence perceptions of screening programmes and underscore the importance of transparent, choice-based communication in mitigating these effects. The findings have valuable implications for screening services worldwide as all screening programmes will have associated false negative and false positive results.

Keywords: cervical screening, trust, attributions of blame, false negative and false positive results, interval cancers, public health controversy.

Introduction

The success of population-based screening depends on high participation rates, which require that the public has high levels of trust in screening. Screening programmes are complex and rely on the coordinated efforts of many different people. The screening process has inherent limitations, and achieving zero-error screening in standard practice is impossible, no matter how high the quality is (International Agency for Research on Cancer, 2023). It is, therefore, essential to understand the implications when errors occur and to find ways to restore lost trust.

To our knowledge, no research has investigated the effect of inaccurate screening results on public perceptions of screening. Existing research has focused on related but not equivalent topics, such as medical mistakes and the personal experiences of those directly affected by them (e.g., Prentice et al., 2020; Smith, 2017; Suzuki et al., 2022). Studies that examine the collective perceptions of services in the aftermath of controversies and mitigation efforts are scarce. Our study addresses this gap by investigating the impact of the controversy surrounding CervicalCheck[1] - the Irish cervical screening programme – on trust and attributions of blame in connection with the cervical screening programme. Additionally, we used a controlled experiment to examine whether trust and blame attributions are affected by updated information materials developed by the programme for screening participants.

To capture the effect of controversy, we set up a comparative study between Ireland (affected) and Scotland (unaffected). Of course, in adopting this research design, we could not be sure that perceptions of the screening programmes in these two countries would have been the same in the absence of Ireland's public controversy. However, the two countries share similar population profiles, nearly identical screening programmes, and comparable levels of institutional trust and satisfaction with healthcare services generally (Central Statistics Office, 2021; Scottish Centre for Social Research, 2022). We, therefore, deemed it likely that substantive differences in perceptions of the respective cervical screening programmes would be due to the public controversy.

To gauge the effect of updated information materials, we randomly assigned the Irish sample either to read information materials about cervical screening or not. Participants then answered questions about their trust levels towards various aspects of the screening service and attributed blame based on the information presented in fictional vignettes that portrayed women diagnosed with cervical cancer between screening appointments. The vignettes varied based on three factors: (a) the woman's past attendance at screening, (b) the outcome of a retrospective cytology review, and (c) the stage of the cancer.

Our predictions were as follows. First, we expected that the controversy had decreased trust and increased blame attributed to those involved in the screening service's administration, testing and oversight. Hence, we anticipated lower levels of trust and higher levels of blame in the Irish control group than in the Scottish sample. Second, we anticipated that exposure to redesigned information materials would positively affect trust and diminish blame. So, we hypothesised higher levels of trust and lower levels of blame in the Irish treatment group compared to the Irish control group. Third, we predicted that the vignette factors would influence attributions of blame. Specifically, we expected participants to attribute more blame to the screening system if abnormal cell changes could be seen on retrospective

[1] In 2018, Irish Health Service Executive revealed that some women diagnosed with invasive cervical cancer were not informed that their earlier smear tests had been reviewed after their diagnosis and deemed false negative. This prompted the government to start a scoping inquiry into CervicalCheck – the Irish cervical screening programme – and gave rise to a national controversy that received a great deal of media attention.

cytology review (a "positive review") and if the interval cancer was advanced (i.e., with treatment options unlikely to lead to cure), and more blame to the screening participant if their past screening attendance was inconsistent.

In addition to these hypotheses, we asked several exploratory research questions. First, we were interested in whether the effects of vignette factors, if present, were uniform across all three groups of participants. Further, we explored whether background characteristics – age, education, social grade, minority status and experiences of screening limitations – affected trust and attributions of blame. Finally, we planned to test whether educational attainment moderated how exposure to information materials influenced trust. All hypotheses and research questions were pre-registered.

The contribution of our study is threefold. First, it provides insights into the effect of a public controversy on collective trust towards an important public health activity, specifically a cervical screening programme. In addition to studying overall trust, we differentiated between trust towards different elements of the screening system. This allowed for a more granular answer to our question and a deeper understanding of the mechanisms involved. Second, to the best of our knowledge, this study is the first to shed light on the attribution processes in relation to limitations of screening, identifying factors that affect how people assign blame for adverse outcomes. Finally, assessing the effect of the updated cervical screening information materials gives insight into the extent to which public perceptions can be restored through greater transparency about the limitations of screening and emphasising openness in communication between the screening service and screening participants.

Method

The study's design and materials were approved by the institutional ethics board. Study materials can be found here.

Participants

We collected data from an approximately representative sample of people eligible or soon-to-become eligible to participate in cervical screening in Ireland and Scotland, respectively. Our inclusion criteria were sex assigned at birth (females) and age (23-65 years old in Ireland, 23-64 years old in Scotland[2]). We excluded individuals who had undergone total hysterectomy, were undergoing treatment for cervical cancer, had previously had cervical cancer or had undergone treatment for abnormal cells in the past. All participants gave informed consent prior to their participation.

We recruited participants using RED-C online panel in Ireland and Y Live panel of Yonder Data Solutions in Scotland. The data were collected online in December 2022. Our final sample sizes were 872 participants in Ireland and 400 participants in Scotland. We aimed for 400 participants in Ireland[3] (in the control condition), 400 in Scotland, and an additional 400 participants in the treatment group in Ireland. These sample sizes allowed sufficient power to detect meaningful effects. Table A1 presents descriptive information about the participants in the three subsamples by background characteristics.

[2] In Ireland, screening in offered to women and anyone with a cervix aged between 25 and 65 years, while in Scotland, to women and anyone with a cervix aged between 25 and 64 years.

[3] During data collection, quota monitoring revealed that the market research company had inadvertently collected a sample that was slightly imbalanced towards higher social grades in Ireland. Before the dataset was opened, we collected an additional 72 participants from lower social grades to ensure that the sample was nationally representative. The final sample size in Ireland was therefore 872.

Experimental Design and Procedure[4]

The procedure of the experiment is summarised in Figure 1. Participants in Ireland were initially randomised into treatment and control groups. The treatment group received information materials about cervical screening. The control group in Ireland and the Scottish sample proceeded straight to the second stage. In the second stage, all participants answered questions to assess their trust. In the third stage[5], they answered a comprehension quiz. In the fourth stage, the participants were presented with vignettes describing individual cancer screening experiences, focusing on screening participants diagnosed with interval cancer. Vignettes systematically varied on three binary factors: (a) past attendance at the cervical screening of the person who was diagnosed with interval cancer (attended all previous screening appointments vs. have missed some appointments), (b) result of retrospective review (false negative result on the last screening vs. interval cancer that developed after the last screening appointment), (c) stage of cancer (early-stage vs. advanced). We also included one "control" vignette without information about these dimensions. Hence, there was a total of nine vignettes. Each participant read and assessed five vignettes – the control one plus four vignettes randomly selected from the full vignette universe. At the end of the experiment, the participants filled out the questionnaire containing background measures, questions on their willingness to participate in future cervical screening, and an open question about their awareness and perceptions of the controversy surrounding cervical screening in Ireland.

Information materials about cervical screening

The materials comprised a somewhat shortened version of the information leaflet that women in Ireland receive when invited to participate in screening. This leaflet was updated by the NSS communications department after the controversy to correct for specific misperceptions that were apparent in the media and political commentary about cervical screening during the controversy.

We did not modify the content of the information. However, we removed some information not directly related to comprehension, trust and attribution, namely the text that explained what happens during the screening appointment and standard information on data protection. On average, the participants spent approximately five minutes reading the materials.

*** Figure 1 about here ***

Measures

Independent variables

Our primary independent variable was the group: (1) Irish control group, (2) Scotland, (3) Irish treatment group. We were interested in the comparisons between the Irish control group and Scotland and between the Irish control and treatment groups.

Covariates

Sociodemographic variables. We used age (1 = 23-34 years old, 2 = 35-44 years old, 3 = 45-64/65 years old), education (0 = no degree, 1 = degree), majority status (0 = ethnic minority

[4] The study reported here was part of a bigger study on cervical screening where we studied a variety of outcomes. Not to confuse the reader, we omit details related to the design and variables not directly relevant.

[5] The order of the third and the fourth stages was counterbalanced.

member, 1 = ethnic majority member) and social class (0 = manual workers, state pensioners, casual and lowest grade workers, unemployed; 1 = individuals occupying administrative and professional jobs in managerial, supervisory or clerical roles, or students) as covariates. For the full description of the original questions that were used, please refer to Appendix B.

Having experienced limitations of cervical screening in the past. The participants could choose from the following response options: (1) My result was positive, (2) My result was positive at first, but it was later found to be clear, (3) My result was negative, (4) I experienced anxiety and stress waiting for the result, (5) I experienced poor communication regarding my results, (6) None of the above. For the analyses, we created a dichotomous variable: (1) those who chose options 2, 4 or 5, (0) those who chose options 1,3 or 6.

Knowing someone who experienced limitations of cervical screening in the past. The participants could choose from the following response options: (1) Their result was positive, (2) Their result was positive at first, but it was later found to be clear, (3) Their result was negative, (4) They experienced anxiety and stress waiting for the result, (5) They experienced poor communication regarding their results, (6) None of the above. For the analyses, we created a dichotomous variable: (1) those who chose at least one of the options 2, 4 or 5, (0) those who chose options 1,3 or 6.

Comprehension of cervical screening. The participants answered 15 questions designed to assess their comprehension of cervical screening. We created a total comprehension score that consisted of a sum of all correct answers to comprehension questions.

Knowledge and perceptions of CervicalCheck controversy. We asked whether the participants knew the Cervical Check controversy in Ireland: (1) yes, (2) no. Additionally, we asked an open-ended question to understand what exactly people knew about the controversy. We coded the responses inductively. The coding was done independently by two researchers who then compared the two versions, discussed any disagreements, and generated the final version together. The final codes included: (1) Incorrect results/mistakes, (2) women died, (3) coverup/ hiding mistakes, (4) not telling women that abnormal cells were found, which led to delay in diagnosis and treatment, (5) lab negligence, (6) outsourcing testing to labs overseas, (7) Vicky Phelan[6], (8) women misdiagnosed, (9) abnormal cells missed, (10) negligence/incompetence of those organising screening, (11) false negatives, (12) results of retrospective review not communicated.

Outcome variables

Trust

The participants answered 14 questions to assess different aspects of trust and perceived credibility of the cervical screening system. The responses to all items were given on a 1-7 rating scale, with higher scores indicating greater levels of trust. Five questions (four in Scotland) were single-item measures of overall trust towards different actors involved in screening: (1) CervicalCheck or the Scottish Cervical screening programme, (2) the National Screening Service – asked only in Ireland, (3) GPs and nurses that take test samples, (4) laboratories that analyse test samples of screening participants, (5) the Health Service Executive in Ireland/National Health Service Scotland.

[6] A healthcare advocate who campaigned in the CervicalCheck controversy. Diagnosed with terminal cervical cancer, she was not informed that her screening sample was found to be false negative on a routine post-diagnosis retrospective review.

Six other items assessed beliefs that the information about the purpose, benefits and limitations of screening women receive when they are invited to participate is sufficient and can be trusted. One more item assessed beliefs that the results of screening can be trusted.
We took an average score of trust items, excluding the question asked only in Ireland and those assessing trust towards HSE and NHS Scotland, to create a single measure of trust to use as the primary dependent variable. These items were highly correlated (Cronbach's alpha = 0.93). We report descriptive statistics for each item in Table C1. This variable had very few responses in the last category (the highest level of trust), so we transformed it into a variable with six levels for the modelling: (1) a score less than 2, (2) a score between 2 and 3, (3) a score between 3 and 4, (4) a score between 4 and 5, (5) a score between 5 and 6, (6) a score of 6 and above.
Two additional items assessed the belief that the screening service would be open with participants if an error occurred (e.g., in case a person participating in screening experienced one of the limitations): (1) If when someone has participated in cervical screening, the cervical screening programme will be open about it and inform the person who suffered the harm promptly, and (2) If something goes wrong when someone has participated in cervical screening, the cervical screening programme will try to hide it from the general public and press. Both distributions were left-skewed. We planned to take an average score of these two items to create a single measure of perceived openness. However, preliminary analyses showed they were not highly correlated, so we ran two sets of models. The pattern of results was the same, so we present only one set of models with the first item as a dependent variable.

Attribution of blame
After reading each vignette, participants answered how much each of the four actors was to blame for the situation described (on a 7-point rating scale): (1) the woman who was described in the vignette, (2) the GP or nurse who took the screening sample, (3) the laboratory that tested the sample, (4) the National Screening Service that organised screening in Ireland/Scotland.
We calculated the mean of the last three items to create an "attribution of blame to the screening system" variable (Cronbach's alpha = 0.81) that we used as the primary dependent variable for attribution of blame. We also looked at the attribution of blame to the person diagnosed with interval cancer. Distributions of both variables were non-normal. Attribution of blame to the screening system was strongly right-skewed. To avoid small cell sizes, we recoded it to create a variable with four levels: (1) a score of 1, (2) a score greater than 1 up to 3, (3) a score greater than 3 up to 4, (4) a score above 4.

Analyses
As distributions of our dependent variables were non-normal, we used ordinal regression. Models used either original non-transformed scales (for the belief that CervicalCheck will be open and attribution of blame to the vignette character) or recategorisations of dependent variables, as described in the previous subsection. However, we repeated the analysis for alternative transformations and ran sensitivity analyses to ensure the robustness of the results.
Additional sensitivity checks included running the same set of models, excluding those who spent very little time reading information materials (less than 1 minute = about 10% of the

sample, less than 2 minutes = about 25% of the sample). The pattern of results remained the same.

Trust

We compared differences in mean levels of overall trust and perceived openness of the cervical screening service between the control group in Ireland, the Scottish sample and the treatment group in Ireland. We then ran ordinal logistic regression with trust as the dependent variable, group as the main independent variable and age and educational attainment as covariates (Model 1 in the results - pre-registered). Model 2 was pre-registered as an exploratory analysis and included interactions between condition and educational attainment, and condition and some other covariates: majority status, a score on a quiz assessing comprehension of cervical screening, having experienced limitations of cervical screening in the past and knowing someone who experienced limitations of screening in the past.

Attributions of blame

We compared differences in mean attributions of blame assigned to the screening service and in attributions of blame assigned to the person described in the vignette between the control group in Ireland, the Scottish sample and the treatment group in Ireland. We then ran mixed-effects ordinal logistic regression models with attributions of blame as the dependent variable, group (control vs. treatment vs. Scottish sample) and type of vignette (control vs. "information") as the main independent variables, a random effect for individual differences and age and educational attainment as covariates (Model 1 in the results). Model 2 was pre-registered as an exploratory analysis and included interactions between the group and type of vignette and between the group and some other covariates: majority status, a score on a quiz assessing comprehension of cervical screening, having experienced limitations of cervical screening in the past and knowing someone who experienced limitations of screening in the past. We ran these models for attributions of blame to the screening system and the vignette character.

To test whether the vignette factors influenced the attribution of blame, we ran mixed-effects ordinal logistic regression models using these factors (past attendance at screening, type of interval cancer and severity) and group (control vs. treatment vs. Scottish sample) as independent variables, age and educational attainment as covariates, and a random effect for individual differences (Model 3 in the results – pre-registered). Model 4 was pre-registered as exploratory analysis and included interactions between group and vignette factors and between the group and some other covariates: majority status, a score on a quiz assessing comprehension of cervical screening, having experienced limitations of cervical screening in the past and knowing someone who experienced limitations of screening in the past. We ran these models for attributions of blame to the screening system and attribution of blame to the vignette character.

Results

Trust

The level of trust in the Irish control group was significantly lower than in the Scottish sample and the Irish treatment group (Figure 2a, Table 1a). The difference in trust between the Irish control group and the Scottish sample was quite large – about half a standard deviation. Based on the supposition that the CervicalCheck negatively affected trust in Ireland, this

finding was as we predicted. At the same time, the difference between the Irish control and treatment groups – even though it was smaller (about one-fourth of a standard deviation) – suggests that exposure to the new information materials created following the controversy restores some trust in the screening service.

When looking at individual components of trust, the largest differences between the Irish control group and Scotland were in trust towards laboratories that test the screening samples and perceived credibility of the results of cervical screening, suggesting that those elements of trust were impacted the most. Descriptive statistics for all individual components of trust across the three groups can be found in Table C1.

Age was positively associated with trust. Older participants had higher levels of trust compared to the youngest group. Neither having a degree nor belonging to a minority group was important to the levels of trust, nor was there an interaction between educational attainment and exposure to the information materials. Knowing someone who had experienced limitations of cervical screening was negatively associated with trust. Finally, the participants with higher comprehension of cervical screening had higher trust and, somewhat surprisingly, lower belief that cervical screening programme would be open with the participants in case something went wrong.

The pattern of results was similar for our other dependent variable – a belief that the screening service will be open if something goes wrong – but the effects were larger. Participants in the Irish control group were less likely to believe that the screening service would be open if something went wrong than participants in Scotland and the Irish treatment group (Figure 2b, Table 1b). Among background variables, members of the ethnic majority were less likely to believe in the openness of the screening service, as were those who knew someone who had experienced cervical screening limitations in the past.

*** Figure 2 about here ***
*** Table 1 about here ***

Attributions of Blame

To the screening system

Consistent with our predictions, the Irish control group attributed more blame to the screening system than the Scottish sample and the Irish treatment group (Figure 3a). That the Irish treatment group attributed less blame to the screening system suggests that the new information materials are partly successful at explaining limitations inherent in the testing process. However, the Irish treatment group still attributed more blame than the Scottish sample. Across all three groups, the participants attributed more blame to the system when the vignette contained information about the past attendance at the screening of the vignette character, the results of the cytology review and the cancer stage. All three vignette factors influenced attributions of blame – participants attributed less blame to the system when past attendance was inconsistent, and more blame when the cytology review showed abnormal cells were present but not detected and when the cancer was at an advanced stage (Table 2). The effect of finding abnormalities on review was the largest among the vignette factors. The group moderated it: participants in the Irish control group attributed more blame for a positive review than in the Irish treatment group and Scotland (Figure 4). As for the effects of the covariates, having a degree was associated with higher attributions of blame, while having higher levels of comprehension was associated with lower attributions of blame to the screening system.

*** Figure 3 about here ***
*** Table 2 about here ***
*** Figure 4 about here ***

To the vignette character

Attribution of blame to the vignette character was generally low and did not differ across the three groups (Figure 3b). As we predicted, when the past attendance at screening of the vignette character was inconsistent, participants attributed more blame to her (Table 3). However, this effect was somewhat smaller in Scotland (Figure 5). Among the covariates, higher comprehension reduced blame assigned to the vignette character, while the older group of participants (55-64 yo) tended to attribute more blame to the vignette character.

*** Table 3 about here ***
*** Figure 5 about here ***

Perceptions of the CervicalCheck Controversy

Figure 6 presents frequencies of coded responses to the open question about the CervicalCheck controversy. These responses give us an idea of how the CervicalCheck controversy was perceived and why it affected trust and attributions of blame for cervical screening limitations in Ireland. The most popular response was "incorrect result/mistake", with more than 300 mentions, while 66 more cited "missed abnormal cells", and another 54 referred to "false negative results". "Coverup/hiding mistake" was the third most popular response, with more than 200 mentions. Notably, 184 participants said that the controversy emerged because CervicalCheck did not inform women that abnormal cells were found in their earlier samples, and this lack of disclosure delayed their cancer diagnosis and treatment.. These responses signal a profound misunderstanding among many women of the post-cancer audit controversy. In addition, there were many mentions of incompetence and negligence of those involved in the screening process: the labs (169 mentions), the National Screening Service and broader healthcare services in Ireland (63). Only 49 people said that the issues emerged because the results of the retrospective review were not disclosed to women diagnosed with interval cancer – the least popular response.

Initially, we hoped to create a variable that would allow us to categorise our participants into those with apparent misperceptions about the controversy and those without to use as a covariate. In practice, this distinction was impossible to make.

*** Figure 6 about here ***

Discussion

This paper presents a study on public perceptions of cervical screening, focusing on the impact of the national cervical screening controversy in Ireland in 2018. We aimed to assess the effect of the controversy on trust and blame attribution for screening limitations, together with the effectiveness of new information materials. Although our study focused on one country with its specific history, institutions and practices, the limitations of screening are universal. Consequently, screening programmes worldwide may be susceptible to similar controversies to some extent. We hope that the findings from this paper are valuable for

other countries seeking to enhance their information materials, improve understanding of screening, make public controversies less likely, and assist in restoring trust where necessary.
Our results supported the pre-registered hypotheses. Trust levels were lower in the Irish control group (not exposed to information materials) than in Scotland. These results align with previous qualitative research (O'Donovan et al., 2022; Lynch et al., 2021) on the impact of Ireland's cervical screening controversy.
The differences in trust were particularly pronounced for trust in laboratories analysing screening samples and the perceived credibility of screening results. Responses to the open text question about the CervicalCheck controversy echoed this strong impact. Irish participants were less likely to believe that CervicalCheck would be open, in line with the issues raised by the scoping inquiry (Scally, 2018), which observed insufficient oversight of planning the interval cancers audit and disclosure. Even though the supplementary report by Scally (2019) found no issue with laboratory standards, and the inquiry's recommendations were met (HSE, 2022); and an independent review by the UK's Royal College of Obstetricians and Gynaecologists (2019) confirmed that programme clinical outcomes were as expected, these trust aspects suffered the most.
Our study demonstrates a positive impact of the new information materials, which went some way to counter the effects of the controversy on trust and blame attributions. These materials, updated to correct misperceptions that had become apparent during the controversy, successfully improved trust and reduced blame for interval cancers. While trust levels in Ireland remained lower than in Scotland, and blame levels were higher in Ireland, our findings highlight the invaluable role of open and transparent communication in mitigating the adverse effects of the controversy.
Additionally, we found a significant relationship between comprehension and blame, indicating that a better understanding of screening creates less blame on the programme, for any interval cancers that develop. This underscores the importance of improving public comprehension of screening.
Our findings also confirm that people are sensitive to contextual information when forming attributions of blame. Specifically, participants tended to attribute more blame to screening participants who missed past appointments, and attributions of blame were lower when abnormal cells were not detectable in the previous screening sample and higher when cancers were at an advanced stage. The latter finding is consistent with existing literature, where severe outcomes are often associated with higher blame in various contexts, such as large-scale crises involving companies and governments (Gilbert, 2022). These results suggest that communication strategies should consider such contextual cues as they can affect how people process and interpret information about screening.
Our study has limitations. The comparison between the two countries to assess the controversy's impact might introduce confounding factors beyond our control. Despite this, we considered Scotland the most suitable comparison due to its similarities to Ireland's population, screening programme, and attitudes towards healthcare services. We aimed to minimise potential biases in the comparison process. Another limitation arises from using branded materials, revealing the CervicalCheck source to the participants. This may have influenced trust and credibility perceptions (Kassin, 2016), independently of the content of the materials. However, this approach enhances the external validity of our experiment, as CervicalCheck typically sends information materials about screening to eligible women.
Despite limitations, our study offers insights into how controversies related to public health activities impact perceptions and whether damaged trust can be restored. We demonstrate

that such controversies can strongly affect trust and attributions of blame for limitations of the screening process. However, mitigation efforts based on open communication and transparency can be successful.

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Figure 1. Experimental design

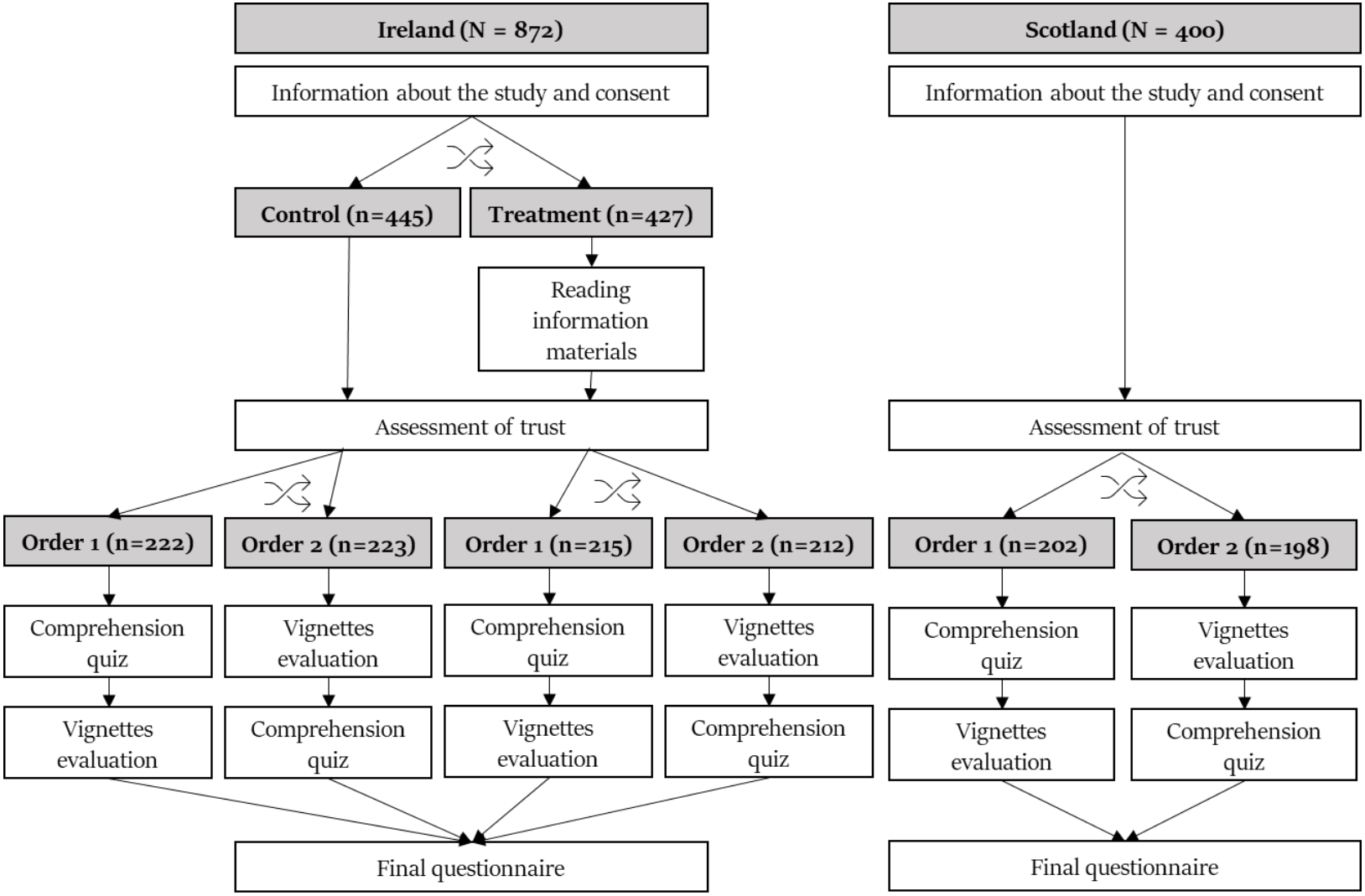
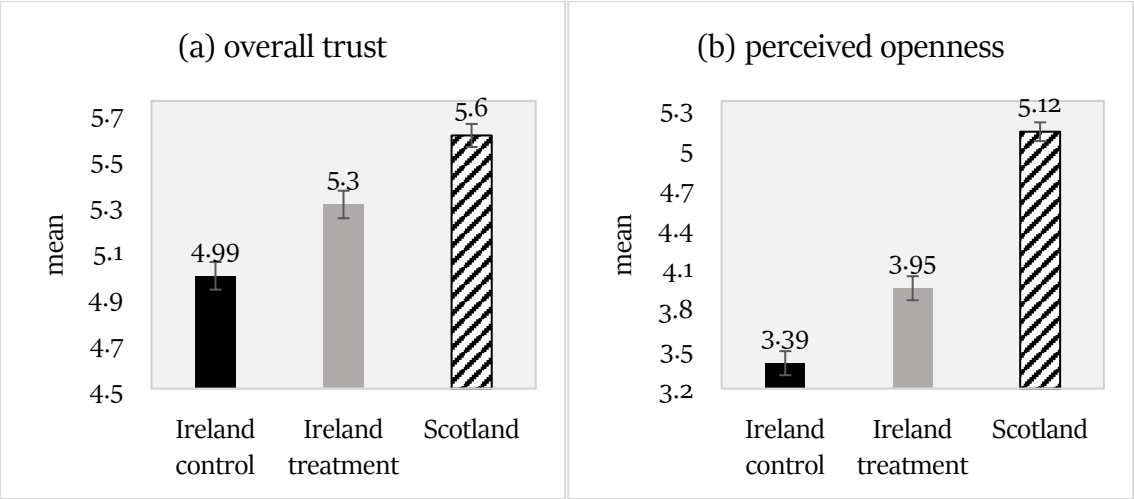


Figure 2 Mean levels of (a) trust and (b) perceived openness of the screening service in the control and treatment groups in Ireland and in Scotland.



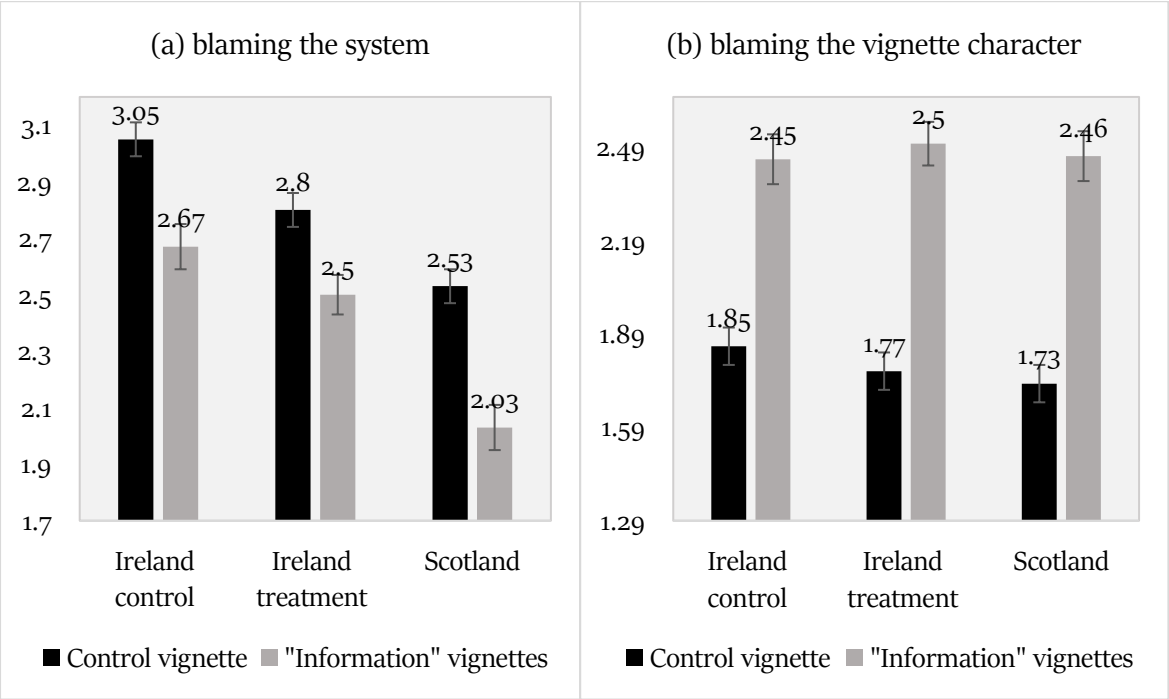
Note. The difference between the maximum and minimum bounds on the y-scale equals 1SD. Error bars are standard errors.

Table 1. Ordinal logistic regression predicting trust in the screening service and belief that the screening service will be open if something goes wrong.

	(a) Trust						**(b) Belief that Cervical Check will be open**					
	Model 1			Model 2			Model 1			Model 2		
	Estimate (SE)	95% CI		Estimate (SE)	95% CI		Estimate (SE)	95% CI		Estimate (SE)	95% CI	
		2.5%	97.5%		2.5%	97.5%		2.5%	97.5%		2.5%	97.5%
Scotland (ref. control)	0.883*** (0.131)	0.626	1.140	0.979*** (0.179)	0.629	1.329	1.673***(0.131)	1.417	1.932	1.563*** (0.174)	1.222	1.904
Treatment (ref. control)	0.453*** (0.123)	0.212	0.695	0.484** (0.152)	0.186	0.782	0.567***(0.122)	0.328	0.807	0.623*** (0.149)	0.331	0.914
Having a degree	0.094 (0.107)	-0.116	0.304	0.169 (0.186)	-0.196	0.533	0.038 (0.104)	-0.235	0.283	0.034 (0.184)	-0.326	0.394
Age (ref. 23-34)												
35-44 yo	0.287* (0.136)	0.022	0.553	0.196 (0.139)	-0.076	0.468	0.032 (0.132)	-0.226	0.289	0.060 (0.134)	-0.203	0.324
45-54 yo	0.479** (0.147)	0.191	0.766	0.335* (0.165)	0.039	0.632	0.352 (0.142)	0.073	0.631	0.383** (0.147)	0.095	0.671
55-64 yo	0.489** (0.159)	0.177	0.801	0.349* (0.164)	0.027	0.672	0.214 (0.153)	-0.09	0.514	0.229 (0.158)	-0.08	0.538
Socgrade: ABC1				-0.119 (0.111)	-0.335	0.0968				0.104 (0.107)	-0.314	0.105
Majority				-0.029 (0.134)	-0.291	0.234				0.451** (0.130)	-0.706	-0.196
Limitations – personal				0.177 (0.129)	-0.077	0.431				0.018 (0.124)	-0.224	0.261
Limitations - others				-0.264* (0.110)	-0.479	-0.049				0.281** (0.106)	-0.489	-0.074
Comprehension				0.085*** (0.020)	0.045	0.125				0.056** (0.020)	-0.095	-0.018
Scotland*degree				-0.019 (0.266)	-0.54	0.501				0.025 (0.255)	-0.525	0.475
Treatment*degree				-0.298 (0.263)	-0.812	0.217				0.007 (0.261)	-0.503	0.518
Log-likelihood	-1793.851			-1762.491			-2326.654			-2289.872		
N	1269			1258			1269			1258		

Note. *** p < .001; ** p < .01; * p < .05

Figure 3. Mean levels of attributions of blame (a) to the vignette character and (b) to the screening system in the control and treatment groups in Ireland and in Scotland.



Note. The difference between the maximum and minimum bounds on the y-scale equals 1SD. Error bars are standard errors.

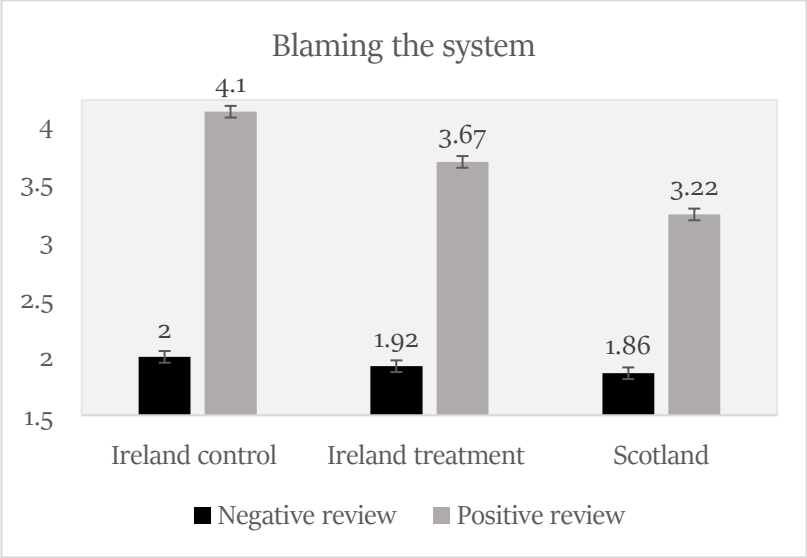
Table 2. Ordinal mixed-effects models predicting attribution of blame to the screening system.

	Model 1			Model 2			Model 3			Model 4		
	Estimate (SE)	95% CI		Estimate (SE)	95% CI		Estimate (SE)	95% CI		Estimate (SE)	95% CI	
		2.5%	97.5%		2.5%	97.5%		2.5%	97.5%		2.5%	97.5%
Main predictors												
Scotland (vs. control)	-0.749***(.115)	-0.975	-0.523	-1.191***(0.169)	-1.521	0.859	-1.054***(.168)	-1.384	-0.724	-0.634**(.221)	-1.071	-0.204
Treatment (vs. control)	-0.264* (.110)	-0.480	-0.048	0.039 (0.160)	-0.275	0.353	-0.488** (.160)	-0.803	-0.173	-0.087 (.216)	-0.51	0.335
Vignette contains information	0.603***(.062)	0.481	0.725	0.529*** (.105)	0.323	0.735						
Vignette factors												
Past attendance – noncompliant							-0.229***(.065)	-0.357	-0.101	-0.362***(.115)	-0.59	-0.136
Cytology review – positive							3.451***(.089)	3.277	3.624	4.113***(.114)	3.839	4.387
Cancer stage - advanced							0.264***(.065)	0.136	0.393	0.216 (.115)	-0.01	0.442
Interactions												
Scotland*vignette contains info				0.335* (.154)	0.042	0.645						
Treatment*vignette contains info				-0.142 (.149)	-0.434	0.149						
Scotland*noncompliant attendance										0.125 (.161)	-0.191	0.441
Treatment*noncompliant attendance										0.234 (.161)	-0.08	0.548
Scotland*positive review										-1.183***(0.171)	-1.517	-0.849
Treatment*positive review										-0.753***(.168)	-1.083	-0.423
Scotland*advanced stage										-0.162 (.162)	-0.48	0.155
Treatment*advanced stage										0.237 (.161)	-0.08	0.552
Other explanatory variables												
Total comprehension score				-0.177***(.017)	-0.211	-0.143				-0.254***(0.03)	-0.30	-0.203
Having a degree	0.191* (.041)	0.048	0.421	0.243**(.094)	0.059	0.427	0.348* (.139)	0.076	0.620	0.376** (.138)	0.106	0.647
Age												
35-44 yo	-0.280* (.120)	-0.508	-0.031	-0.168 (.119)	-0.401	0.066	-0.374* (.177)	-0.722	-0.026	-0.222 (.176)	-0.57	0.122
45-54 yo	-0.340*(.129)	-0.617	-0.103	-0.225 (.129)	-0.478	0.029	-0.516**(.191)	-0.892	-0.141	-0.329 (.191)	-0.70	0.045
55-64 yo	-0.244 (.140)	-0.540	-0.019	-0.113 (.141)	-0.389	0.163	-0.471* (.208)	-0.878	-0.063	-0.249 (.208)	-0.66	0.158
Socgrade: ABC1				0.227* (.094)	0.042	0.411				0.295* (.139)	0.02	0.567
Majority				-0.221 (.113)	-0.444	0.001				-0.232 (.168)	-0.56	0.097
Limitations – personal				0.080 (.108)	-0.133	0.292				0.083 (.160)	-0.23	0.397
Limitations - others				0.154 (.094)	-0.031	0.338				0.272 (.139)	-0.01	0.544
Log-likelihood	-7872.40			-7741.13			-5318.66			-5196.07		
N (observations)	6295			6241			5033			4990		
N (participants)	1260			1249			1260			1249		

Table 3. Ordinal mixed-effects models predicting attribution of blame to the vignette character.

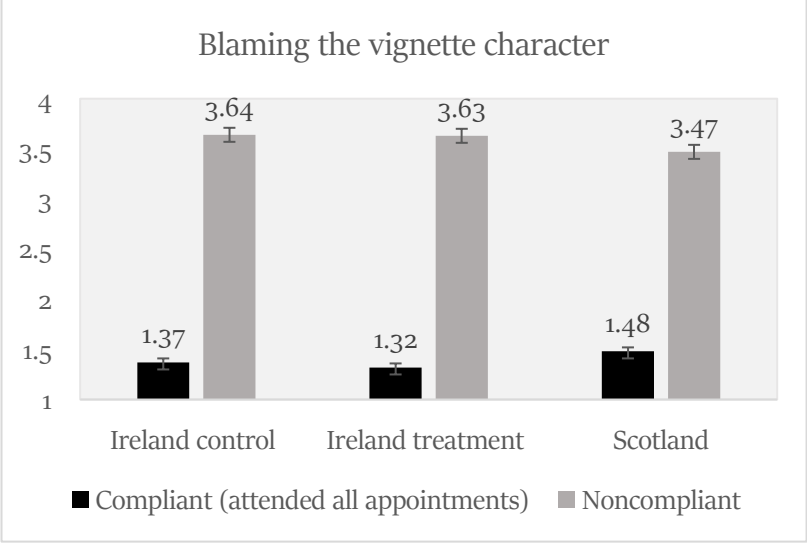
	Model 1			Model 2			Model 3			Model 4		
	Estimate (SE)	95% CI		Estimate (SE)	95% CI		Estimate (SE)	95% CI		Estimate (SE)	95% CI	
		2.5%	97.5%		2.5%	97.5%		2.5%	97.5%		2.5%	97.5%
Main predictors												
Scotland (vs. control)	-0.003 (.108)	-0.215	0.210	-0.367* (.180)	-0.719	-0.04	-0.09 (.169)	-0.424	0.241	0.158 (.191)	-0.217	0.453
Treatment (vs. control)	0.053 (.104)	-0.151	0.257	-0.009 (.175)	-0.352	-0.333	-0.065 (.162)	-0.382	0.252	-0.227***(.002)	0.274	0.283
Vignette contains information	0.997***(.07)	0.857	1.137	0.846*** (.119)	0.613	1.079						
Vignette factors												
Past attendance – noncompliant							4.408*** (.111)	4.190	4.625	4.635*** (.123)	4.390	4.879
Cytology review – positive							-0.094 (.069)	-0.229	0.042	-0.236***(.002)	-0.266	-0.257
Cancer stage - advanced							-0.129 (.069)	-0.266	0.007	-0.261***(.002)	-0.266	0.231
Interactions												
Scotland*vignette contains info				0.223 (.173)	-0.115	0.561						
Treatment*vignette contains info				0.217 (.170)	-0.116	0.561						
Scotland*noncompliant attendance										-0.886***(.179)	-1.237	-0.535
Treatment*noncompliant attendance										0.148 (.146)	-0.138	0.434
Scotland*positive review										0.221 (.118)	-0.011	0.453
Treatment*positive review										0.278*** (.002)	0.274	0.283
Scotland*advanced stage										0.081 (.118)	-0.152	0.313
Treatment*advanced stage										0.227*** (.002)	0.223	0.232
Other explanatory variables												
Total comprehension score				-0.107***(.016)	-0.139	-0.075				-0.161***(.002)	-0.165	-0.158
Having a degree	0.022 (.090)	-0.155	0.199	0.044 (.088)	-0.129	0.218	-0.04 (.141)	-0.316	0.236	-0.012*** (.002)	0.007	0.016
Age												
35-44 yo	0.060 (.115)	-0.165	-0.285	0.114 (.112)	-0.106	0.334	0.064 (.180)	-0.289	0.417	0.140 (.159)	-0.173	0.452
45-54 yo	-0.013 (.124)	-0.257	0.229	0.064 (.123)	-0.176	0.304	0.159 (.194)	-0.221	0.539	0.240 (.180)	-0.113	0.592
55-64 yo	0.352** (.134)	0.089	0.614	0.413** (.132)	0.154	0.671	0.689** (.209)	0.279	1.098	0.753***(.194)	0.372	1.134
Socgrade: ABC1				-0.154 (.089)	-0.311	0.035				-0.216*** (.002)	-0.221	-.212
Majority				-0.443*** (.105)	-0.650	0.237				-0.698***(.149)	-0.978	-0.418
Limitations – personal				0.102 (.102)	-0.110	0.302				0.216 (.150)	-0.078	0.510
Limitations - others				-0.057.090)	-0.232	0.117				-0.134 (.136)	-0.401	0.132
Log-likelihood	-8761.33			-8648.73			-6084.65			--5982.52		
N (observations)	6295			6241			5033			4990		
N (participants)	1260			1249			1260			1249		

Figure 4. The effect of review on attributions of blame to the screening system in the control and treatment groups in Ireland and in Scotland.



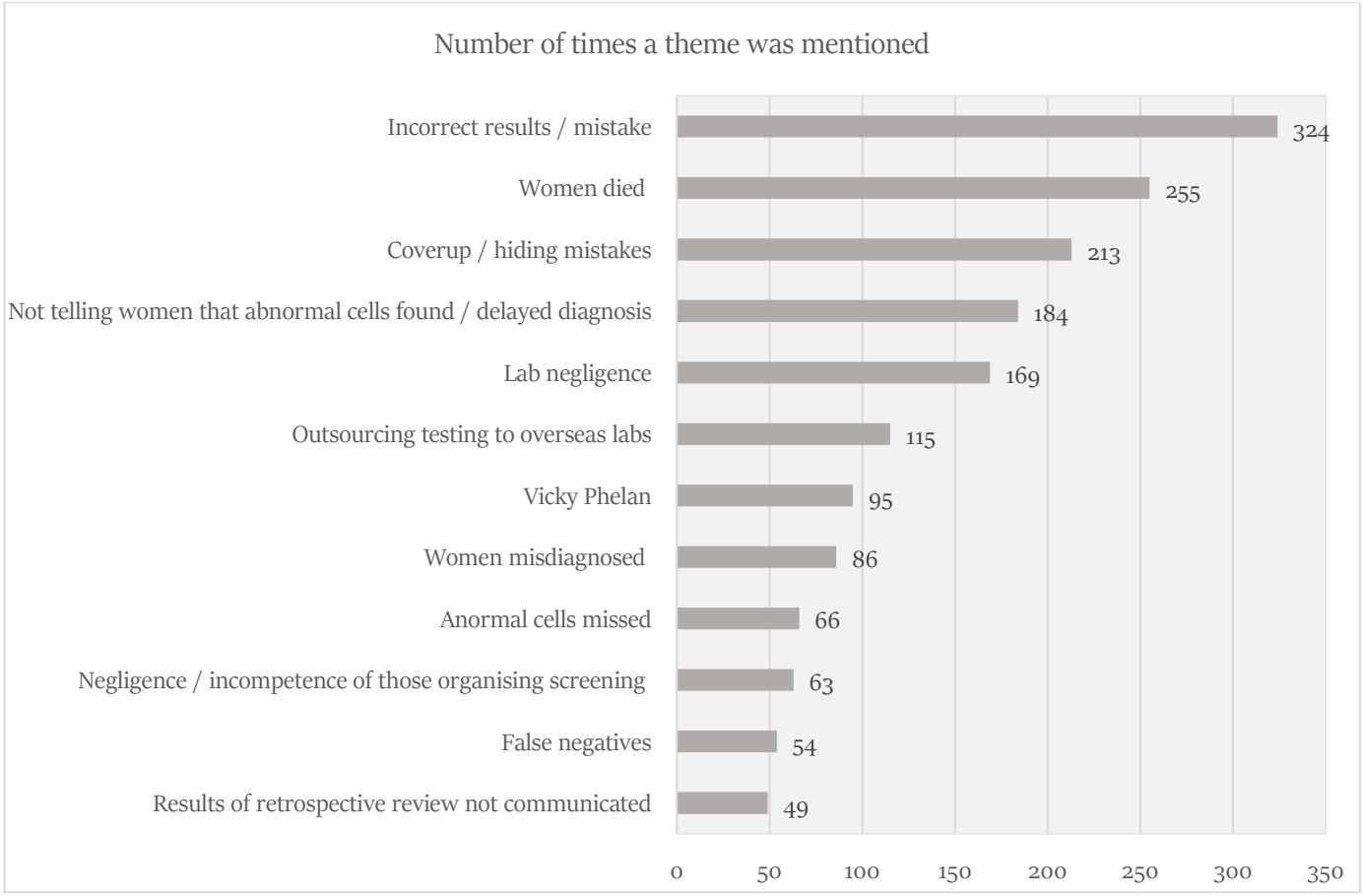
Note. The difference between the maximum and minimum bounds on the y-scale equals 1SD. Error bars are standard errors.

Figure 5. The effect of past attendance at screening of the vignette character on the attributions of blame to them in the control and treatment groups in Ireland and in Scotland.



Note. The difference between the maximum and minimum bounds on the y-scale equals 2SD. Error bars are standard errors.

Figure 6. Participants' understanding of CervicalCheck controversy.



APPENDIX A

Table A1. Socio-demographic variables and other covariates across treatment and control groups in Ireland and in Scotland

	Ireland: Control (N=445)	**Scotland (N=400)**	**Ireland: Treatment (N=427)**
Age			
23-34 yo	24%	27%	22%
35-44 yo	40%	24%	37%
45-54 yo	20%	28%	25%
55-64 yo	16%	22%	16%
Education			
No degree	68%	46%	67%
Has a degree	32%	53%	33%
Social grade			
ABC1	64%	54%	64%
C2DE + F	36%	46%	36%
Ethnicity			
Belongs to majority	83%	79%	85%
Belongs to minority	17%	21%	15%
*Having experienced limitations of cervical screening in the past**			
Had a positive result than was later found negative	12%	12%	12%
Experienced stress and anxiety	32%	24%	27%
Experienced issues related to poor communication of the results	9%	7%	7%
Did not experience limitations	59%	67%	64%
Knowing someone who experienced limitations in the past			
Had a positive result than was later found negative	29%	21%	24%
Experienced stress and anxiety	25%	21%	27%
Experienced issues related to poor communication of the results	8%	6%	8%
Does not know anyone who experienced limitations	57%	64%	59%

**Calculated on the sample of those who participated in cervical screening in the past (87% of the Irish control group, 80% of the Scottish sample and 86% of the Irish treatment group.*

APPENDIX B

Education. The question about educational attainment had the following response categories in Ireland: (1) less than junior certificate, (2) junior certificate or equivalent, (3) leaving certificate, (4) technical or vocational certificate, (5) diploma, (6) degree, (7) masters, (8) doctorate. In Scotland, we used the following categories: (1) School Leaving Certificate, National Qualification Access Unit, (2) O Grade, Standard Grade, GCSE, GCE, GCE O Level, CSE, National Qualification Access 3 Cluster, Intermediate 1 or 2, National 4 or 5, Senior Certificate or equivalent, (3) GNVQ/GSVQ Foundation or Intermediate, SVQ Level 1 or 2, SCOTVEC/National Certificate Module, City and Guilds Craft, RSA Diploma or equivalent, (4) Higher Grade, Advanced Higher, CSYS, A Level, AS Level, Advanced Senior Certificate or equivalent, (5) GNVQ/GSVQ Advanced, SVQ Level 3, ONC, OND, SCOTVEC National Diploma, City and Guilds Advanced Craft, RSA Advanced Diploma or equivalent, (6) HNC, HND, SVQ Level 4, RSA Higher Diploma or equivalent, (7) First Degree, Higher Degree, SVQ Level 5 or equivalent, (8) Professional qualifications e.g., teaching, accountancy, (9) Other school examinations no already mentioned, (10) Other post-school but pre-Higher education examinations not already mentioned.

Social grade. We used the occupational group of the chief income earner in a household to define participants' social grade. The categories were the following: (1) higher managerial/professional/administrative (e.g., doctor/board director), (2) intermediate manager/professional/administrative (e.g., newly qualified solicitor/middle manager), (3) supervisory or clerical/junior managerial/professional/administrative (e.g., office worker or salesperson) or student, (4) skilled manual worker (e.g., bricklayer or bus/ambulance driver or pub/bar worker, etc.), (5) semi or unskilled manual work (e.g., manual workers or apprentice or shop assistant), (6) casual worker – not in permanent employment or retired or unemployed or full-time carer, (7) farmer/agricultural worker, (8) unsure.

Ethnicity. In Ireland, we used classification of the Irish Statistics Office: (1) white Irish, (2) white Irish Traveller, (3) any other white background, (4) black or black Irish - African, (5) black or black Irish – any other black background, (5) Asian or Asian Irish – Chinese, (6) Asian or Asian Irish – any other Asian background, (7) other, including mixed background. In Scotland, we used the classification used in Scotland's Census: (1) Scottish, (2) Other British, (3) Irish, (4) Gypsy/Traveller, (5) Polish, (6) Pakistani, (7) Indian, (8) Bangladeshi, (9) Chinese, (10) African, (11) Caribbean, (12) Arab, (13) other.

APPENDIX C

Table C1. Individual components of trust: Descriptive statistics

	Ireland: Control			Scotland			Ireland: Treatment		
	Mean	*SD*	*SE*	*Mean*	*SD*	*SE*	*Mean*	*SD*	*SE*
Trust towards Cervical Check	4.54	1.66	0.08	5.62	1.41	0.07	4.89	1.54	0.07
Trust towards GPs and nurses	5.64	1.34	0.06	5.58	1.47	0.07	5.68	1.21	0.06
Trust towards labs	4.15	1.72	0.08	5.61	1.33	0.07	4.44	1.62	0.08
Trust towards NSS*	4.65	1.56	0.07	-	-	-	4.97	1.48	0.07
Trust towards HSE/NHS Scotland	3.91	1.78	0.08	5.52	1.51	0.08	3.98	1.74	0.08
Trust in results of screening	3.98	1.68	0.08	5.43	1.31	0.07	4.41	1.57	0.08
Beliefs that information provided when one is invited to participate is sufficient									
Information about purpose	5.5	1.48	0.07	5.74	1.32	0.07	5.82	1.34	0.07
Information about benefits	5.64	1.43	0.07	5.81	1.35	0.07	5.87	1.26	0.07
Information about limitations	4.73	1.8	0.09	5.04	1.58	0.08	5.23	1.59	0.08
Belief that information about screening is credible									
Information about purpose	5.35	1.48	0.07	5.82	1.31	0.07	5.61	1.44	0.07
Information about benefits	5.47	1.47	0.07	5.84	1.33	0.07	5.72	1.35	0.07
Information about limitations	4.88	1.65	0.08	5.39	1.49	0.07	5.32	1.52	0.07

*Asked only in Ireland

Table C2. Individual components of attributions of blame: Descriptive statistics

	Ireland: Control			Scotland			Ireland: Treatment		
	Mean	*SD*	*SE*	*Mean*	*SD*	*SE*	*Mean*	*SD*	*SE*
Blaming the sample taker (nurse/GP) – no info	2.18	1.62	0.08	1.97	1.46	0.07	2.09	1.52	0.07
Blaming the sample taker (nurse/GP) – with info	2.1	1.5	0.07	2.01	1.38	0.07	1.95	1.26	0.06
Blaming the lab – no info	2.98	2.09	0.10	2.05	1.56	0.08	2.75	1.95	0.09
Blaming the lab (the lab) – with info	3.64	1.49	0.07	3.04	1.39	0.07	3.46	1.42	0.07
Blaming the screening service – no info	2.87	2.00	0.10	2.06	1.51	0.08	2.66	1.9	0.09
Blaming the screening service – with info	3.05	1.29	0.06	2.53	1.24	0.06	2.8	1.19	0.06