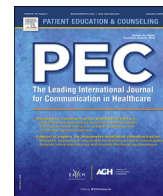




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Effects of a leaflet on breast cancer screening knowledge, explicit attitudes, and implicit associations

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ABSTRACT

Objective: To assess the effect of an information leaflet on knowledge, explicit attitudes, implicit associations, and attendance for breast cancer screening.

Methods: Dutch women (aged 49–75 years) were approached three months before their breast cancer screening invitation. After providing informed consent, participants were randomised to receiving the information leaflet (intervention condition) or not (control condition). Screening knowledge, explicit attitudes, and implicit associations were assessed through web-based questionnaires, at baseline and two weeks later. Actual screening attendance data were collected.

Results: In total, 988 women completed both questionnaires. Participants in the leaflet condition scored higher on knowledge (9.9 versus 9.6, $p < 0.001$, scale 0–11), and more often had positive explicit attitudes (97% versus 95%, $p = 0.03$), than those in the control condition. This contrast was bigger among first-time invitees. Implicit associations were not correlated with explicit attitudes or attendance. Explicit attitudes were moderately correlated with attendance ($r = .30$, $p < 0.001$).

Conclusion: The information leaflet led to more knowledge and more positive explicit attitudes. Implicit associations towards breast cancer screening were not correlated with attendance.

Practice Implications: Encouragement to learn about the screening programme can increase levels of knowledge of invitees and therefore support their decision-making about participation. This might be especially relevant for first-time invitees.

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1. Introduction

Individual behaviour is shaped by attitudes [1]. Two different types of attitudes can be distinguished: explicit attitudes and implicit associations [2]. Explicit attitudes are deliberate and are present at the conscious level [1,2]. People are conscious of their explicit attitudes and are able to self-report them. In contrast to explicit attitudes, implicit associations can influence and guide behaviour without people's conscious awareness, they can result in spontaneous or automatic behaviour [1,2]. Explicit attitudes and implicit associations can be contradictory [2]. It has been shown that implicit associations can affect consumer behaviour and decision-making [3–5], but little is known to what extent they affect medical decision-making about, for instance, cancer screening.

Participation in population-based breast cancer screening programmes is voluntary and usually free-of-charge. In the Netherlands, eligible women (ages 50–75) receive a personal invitation each screening round accompanied by an information leaflet about the procedure, and harms and benefits of breast cancer screening. The information is aimed at enabling women to make an informed choice about whether or not to participate in the screening [6,7]. However, it is unclear to what extent the current information leaflet (2018) contributes to the knowledge of women, and whether it affects explicit attitudes, implicit associations, and attendance.

Attendance rates of breast cancer screening programmes in the Netherlands, England, Finland, and the USA slightly decreased over the past years (e.g. the Netherlands: from 82.4% in 2007 to 76.6% in 2018) [8–12]. To better understand this decrease and the way women decide to participate in breast cancer screening or not, more insight into knowledge, explicit attitudes, and implicit associations is useful. It is currently unknown if and to what extent attendance to the breast cancer screening programme is associated with explicit attitudes or implicit association.

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The aim of this study was to examine the influence of an information leaflet on the level of decision-relevant knowledge about breast cancer screening, explicit attitudes and screening attendance among women invited for breast cancer screening. This study also aimed to investigate the association between explicit attitudes as well as implicit associations towards the Dutch breast cancer screening programme and attendance.

2. Methods

2.1. Population

Women, aged 49–75, living in the South West screening region of the Netherlands, who were due to be invited for breast cancer screening were approached to participate in this study by a joint letter from the local screening organisation 'Bevolkingsonderzoek Zuid-West' and Erasmus MC. The letters were sent in November and December 2018 and included study information, an invitation to participate, and an informed consent form. Women who were registered at the screening organisation as 'not willing to participate in research' were not approached to participate in this study. During five to 10 years following a breast cancer diagnosis women are not invited for the regular screening program, and therefore this group of women was not included in our study. Having no email address or internet access was an exclusion criterion.

2.2. Sample size calculation

Sample size calculation indicated that 834 women needed to participate to be able to show an effect in response time with 80 % power and statistical significance of 0.05. Based on the participation rate in a previous study evaluating the screening programme, we expected a participation rate of about 30 % among screening attenders and about 10 % among non-attenders [6].

Potential participants were selected by the regional screening organisation (Bevolkingsonderzoek Zuid-West) based on postal code. To reach a representable population of participating and non-participating women, women who had declined participation in previous screening rounds were oversampled. In total, 5568 women were invited, of which 1211 (22 %) women had not participated in previous screening rounds, 3817 (68 %) women had participated in previous screening rounds, and 540 (10 %) women were to receive their first screening invitation [12].

2.3. Design

Women who provided consent and their e-mail address were randomised to the intervention condition (leaflet) or the control condition (no leaflet) by computer-generated random numbers. Subsequently, a link to a web-based questionnaire was sent to the participants by e-mail. The questionnaire started with a short introduction to the Dutch national breast cancer screening programme and contained questions regarding intention to participate, explicit attitudes, knowledge about the screening programme, reasons to participate or not, and demographics. A priming task was included to assess implicit associations. Two weeks after completing their first questionnaire, participants in the intervention group were asked to read an online information leaflet (see below). Participants in the control condition did not receive this leaflet. Then, all participants were asked to complete the second questionnaire (see Fig. 1). Subsequently, following the regular invitation schedule, all respondents received an invitation to participate in the breast cancer screening programme and the information leaflet.

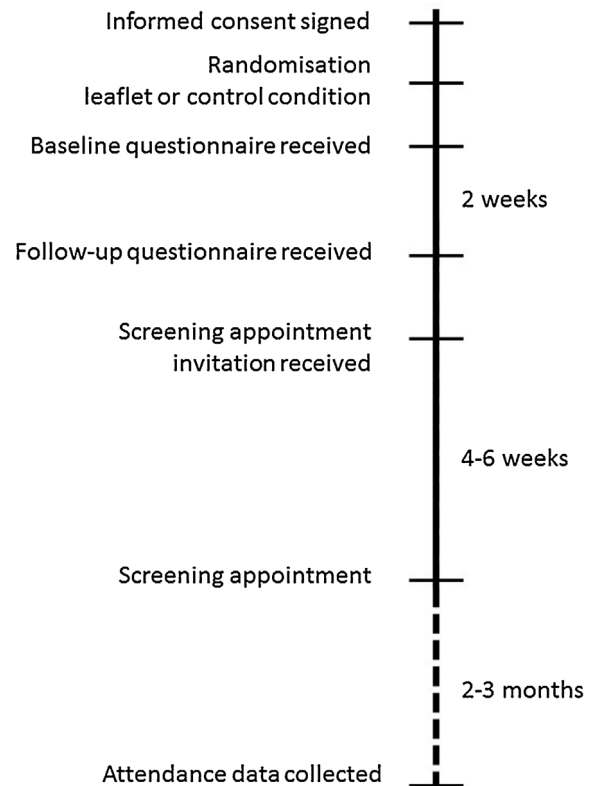


Fig. 1. Data collection timeline.

Since it is not always feasible to assess actual participation, previous studies concerning informed choice, often assessed intention to participate as a proxy for actual participation. Although strongly correlated, intention to participate in screening is not necessarily similar to actual screening attendance and can be considered to be more influenced by explicit attitudes [13,14]. Therefore, this study will study the effects of both intention and actual attendance. Conditional on provided consent, attendance data for this screening round were provided by the screening organisation. Collection of attendance data took place two to three months after the planned screening appointment.

2.3.1. Intervention

Women in the intervention group were provided the official breast cancer screening information leaflet from the Dutch National Institute for Public Health and the Environment (RIVM). The leaflet was developed based on the opinion of experts who recommended “[using] simple texts without numerical values to present information on difficult topics as false positives and overdiagnosis”(6). Therefore, the leaflet was designed to increase the level of gist knowledge, i.e. “the ability to identify the essential points of the information presented”, rather than verbatim knowledge, i.e. “the ability to correctly read numbers from graphs” [15].

The January 2018 version (appendix Fig. 1) contains information about the screening invitation, the screening process, possible screening outcomes, and the benefits and harms of screening. Unlike most official information leaflets, potential harms such as overdiagnosis, overtreatment, false-negatives, and interval cancers were described explicitly [16].

2.3.2. Content of the questionnaires

The baseline questionnaire included demographic questions about screening history, living situation, educational level, employment status, and home language of the respondent.

Gist knowledge about the breast cancer screening programme was determined using 11 statements (based on expert consultations); response options were ‘true’, ‘false’, or ‘I don’t know’ [6]. In the absence of an agreed external criterion to define ‘sufficient’ knowledge, it was operationalised as a minimum of eight correct answers [6,17–19]. Participants’ explicit attitudes towards breast cancer screening were measured through an attitudes scale derived from the multidimensional informed choice measure of Marteau et al. [20]. It contained six cognitive items regarding the breast cancer screening programme, such as ‘I think participation in the breast cancer screening programme within three months for me would be useless/useful’. Participants responded on 7-point-likert scales. In accordance with guidelines, missing items on the attitudes scale were imputed by individuals’ mean score, if at least 50% of the items had been completed [21]. The results were transformed to a 0–100 scale and categorised as negative (<50) or positive (≥50) attitudes.

Participants were asked how likely they were to participate in the breast cancer screening programme if they would receive an invitation within the coming three months. The answers were given on a 7-point-likert scale. Scores 1 and 2 were classified as a negative intention, 3–5 as a neutral intention, and 6 and 7 as a positive intention.

Following the model of Marteau et al., a woman was considered to have made an informed choice when she had sufficient knowledge about the breast cancer screening program, a positive attitude towards participating in this program, and participated in the programme, or when she had sufficient knowledge, a negative attitude and did not participate in the programme [20].

To assess participants’ implicit associations, a priming task was used. Priming tasks are widely used in social cognition research, and were originally developed to assess implicit associations towards social groups or activities [3–5,22]. During priming tasks, people are shown primes (pictures or words) of a topic of interest

followed by target words. The target words used are distinctively positive or negative. The participants are asked to respond to the target word and indicate if it was positive or negative. The task relies on the assumption that the prime automatically activates an evaluation, and that if primes and target words are strongly associated in the participant’s mind, the participant will react more quickly [23]. Therefore, the response time to the task was assumed to be shortest when the participant strongly associated the prime with the presented target [22].

In the priming task, a screening, neutral and non-word prime were used. The prime words chosen had to be short, simple and representative. For the screening prime, “Röntgenfoto” (X-ray) was found to be too long and difficult for quick reading and less typical for breast cancer screening. Therefore, we opted for “Borstfoto’s” (breast X-rays/pictures) which was a more simple and clear referral to breast cancer screening. Since this prime was crucial, we checked with healthcare providers, a patient organisation and the collaborating local screening organisation (BOZW) whether they agreed. The neutral prime, “Brievensbus” (mailbox), was chosen because of its neutral meaning and because it had the same amount of syllables as the screening prime. The non-word prime was a random order of consonants at about the same length as the other primes (“Fjnmplkzv”).

Each of the primes was shown on the computer screen, followed after a 100 ms interval by a target word. The target words could be positive or negative (for example ‘good’ or ‘bad’). The respondents were asked to state as quickly and accurately as possible whether the shown target was positive or negative by pressing a specific key on their keyboard (i.e. the keys “L” and “A”, respectively). The complete priming task consisted of 24 combinations of primes and targets, in which all combinations of the three primes and eight targets were presented once, in a random order. Due to misconceptions regarding one of the targets (double meaning in Dutch) the response times for this target were excluded for analyses.

Response times considered to be too fast (quicker than 300 milliseconds (ms)) or too slow (slower than 3000 ms) were

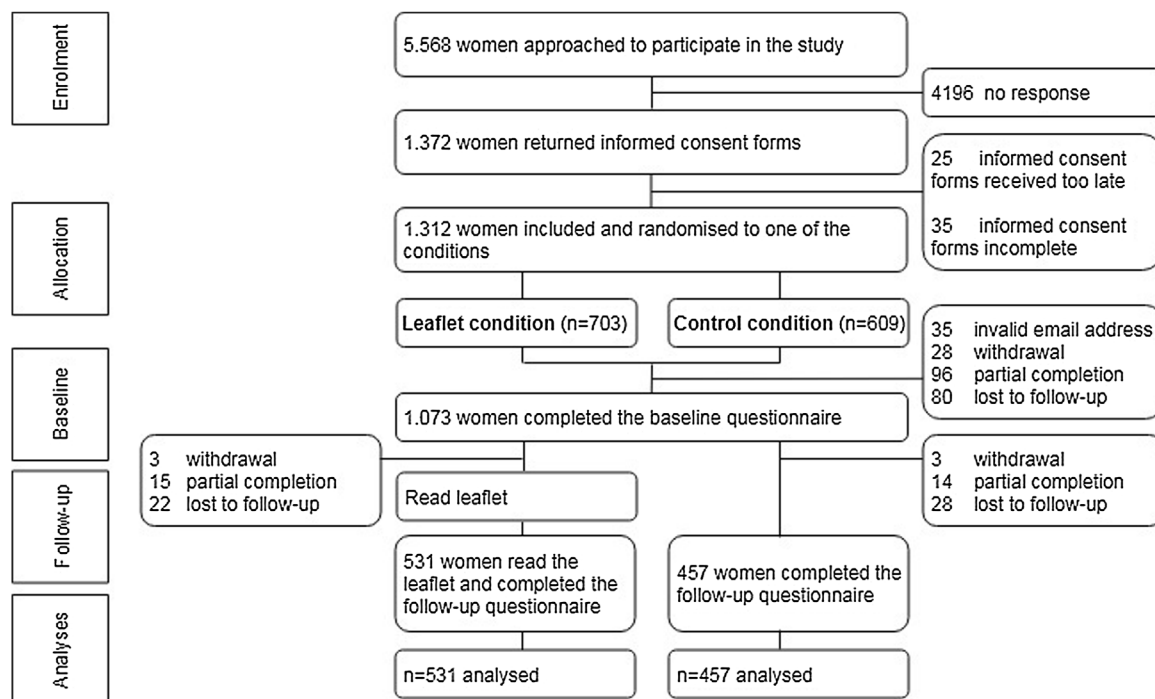


Fig. 2. Flowchart.

excluded [24]. Also, response times were excluded in case of incorrect responses, e.g. in case the positive key “L” was pressed after the negative word “bad”. Implicit associations were then calculated per prime by subtracting the average response times for the negative targets from the average response times for the positive targets.

2.4. Statistical analyses

T-tests and chi-square tests were performed to test for differences between the two randomised groups in attendance, explicit attitudes, implicit associations, knowledge, and informed choice. Subsequently, Pearson’s, Phi, and Cramer’s V correlations were measured between implicit associations, explicit attitudes, intention to participate, attendance, knowledge about breast cancer screening, level of education, previous invitation for breast cancer screening, previous attendance in breast cancer screening, and previous referrals based on breast cancer screening results.

Subgroup analyses were performed for participants who were invited for the national breast cancer screening programme for the first time. These first-time invitees were identified based on self-reporting to not have had a previous invitation. Differences in response times between left and right handed respondents were also tested.

Repeated measures ANOVAs were performed to test for differences in response time between the primes and targets in the priming task. The interaction term (“prime*target”) was also included. Subsequently, a repeated measures ANCOVA was

performed taking into account the covariates that were significant in the correlations analyses.

All analyses were performed in IBM SPSS Statistics, version 24 and statistical significance was set at $\alpha = 0.05$.

3. Results

3.1. Background characteristics

In total, 5568 study invitations were sent out and 1372 informed consent forms were received (response rate 25 %) (Fig. 2). Of these, 25 were received too late and 35 were invalid. The 1312 included participants were randomised to the leaflet ($n = 703$, 54 %) and the control condition ($n = 609$, 46 %).

Thirty-five women (2.7 %) were excluded due to unknown or invalid email addresses, and 28 (2.1 %) women withdrew from participation after being sent the first questionnaire due to lack of time or technical issues. In total, 1073 participants (83 %) completed the first questionnaire. After being sent the second questionnaire, another six participants (<1%) withdrew from participation. In total, 988 participants (92 %) completed the second questionnaire.

Data-analyses included 988 participants; 531 in the leaflet condition and 457 in the control condition. Of these, 904 (92 %) also gave consent to collect attendance data from the screening organisation. Baseline characteristics of the two randomised groups were similar (Table 1). Participants were on average 60 years of age ranging from 49 to 75 in both conditions.

Table 1
Participant characteristics ($n = 988$).

	Leaflet condition ($n = 531$)	Control condition ($n = 457$)	p-value
Age			
Mean (SD)	60.1 (6.7)	59.9 (6.9)	0.15
Range	48.5 - 75.0	49.0 - 74.9	
Missing	0	0	
Educational level (n,%)			
High	146 (28)	123 (27)	0.44
Middle	287 (55)	239 (53)	
Low	87 (17)	90 (20)	
Missing	11	5	
Language spoken at home (n,%)			
Dutch	454 (96)	407 (98)	0.13
Dutch and other	8 (2)	2 (1)	
Other	10 (2)	5 (1)	
Missing	59	43	
Living situation (n,%)			
With partner	441 (84)	366 (80)	0.21
Not with partner	87 (17)	89 (20)	
Missing	3	2	
Working status (n,%)			
Paid work	293 (60)	250 (59)	0.85
No paid work	64 (13)	53 (13)	
Retired	129 (27)	119 (28)	
Missing	45	35	
Previously invited to participate in breast cancer screening (n, %)			
Yes	464 (88)	397 (87)	0.77
Do not remember	6 (1)	4 (1)	
No	58 (11)	56 (12)	
Missing	3	0	
Previously participated in breast cancer screening (n,% of invited)			
Yes	427 (93)	374 (94)	0.40
No	32 (7)	22 (6)	
Missing	5	1	
Previously referred for further diagnostics (n,% of participated)			
Yes	62 (15)	46 (12)	0.36
No	365 (86)	328 (88)	
Missing	0	0	

3.2. Informed choice

At baseline, the average knowledge score was 9.3 (on a scale of 0–11). At follow-up, a difference was seen between the leaflet and control condition (9.9 versus 9.6, respectively, $p < 0.001$). This resulted in 94 % and 91 % of participants having sufficient knowledge in the two respective groups ($p = 0.09$). At baseline, 96 % had positive explicit attitudes, at follow-up these percentages were 97 % in the leaflet condition and 95 % in the control condition ($p = 0.03$). No differences in screening attendance were found between the leaflet and control condition (90 % versus 88 %, respectively, $p = 0.46$).

In total, 718 women (80 %) made an informed choice. Of them, 701 made the decision to participate in screening and 17 not to participate, see Fig. 3A. About half of the uninformed choices were due to insufficient knowledge. Differences in informed choice between the two conditions were not significant (i.e. in the leaflet condition 84 % made the informed choice to participate and 2% not to participate compared to 78 % and 3% in the control condition, $p = 0.07$).

3.2.1. Subgroup analyses of first-time invitees

At baseline, 80 % of first-time invitees had sufficient decision-relevant knowledge versus 89 % of women in the total population (Appendix table A1). After reading the leaflet, 93 % of first-time invitees reported sufficient knowledge versus 77 % of first-time invitees in the control condition. The attendance rate was 83 % among the first-time invitees versus 89 % in the total population. The rate of women with positive explicit attitudes was similar for first-time invitees and the total population (97 % versus 96 %).

The lower level of knowledge and the lower attendance resulted in a lower proportion of first-time invitees who made an informed choice (66 %). Again about half of the uninformed choices were due to insufficient knowledge (Fig. 3B).

3.3. Implicit associations

At baseline, 505 women completed the priming task. However, 26 of them withdrew, only partially completed the second questionnaire, or were lost to follow-up. Therefore, baseline priming task data of 479 (48 % of 988) women were analysed. At follow-up, priming task data of 522 (53 %) women were analysed (Table 2). Participants pressed the correct key (i.e. the key corresponding to the target) 87–89 % of the time. No significant difference in accurate responses was seen between the conditions.

On average, responses were a little quicker (i.e. response times were shorter) when positive or neutral targets followed the screening prime versus negative targets, resulting in a positive mean difference in response times (17.9 ms and 34.2 ms, respectively) at baseline. For the non-word prime, responses were on average slower for positive targets than for negative targets, resulting in a negative mean difference in response times (-26.7 ms). This trend was also seen for the leaflet condition at follow-up. In the control condition, average responses were slower for positive targets for all three primes. However, the standard deviations were large for all mean differences. No differences were seen between the two conditions. No differences were found in response times between left and right handed participants (results not shown).

No correlations were found between implicit associations and explicit attitudes or between implicit associations and intention to participate (Table 3). Also, no correlation was found between implicit associations and attendance ($r = .05$, $p = 0.33$).

Explicit attitudes were found to be strongly correlated with intention to participate, and moderately with attendance (Table 3). Intention to participate was found to be moderately correlated with attendance. A moderate correlation was also found between attendance and previous participation. Intention and attendance were found not to be correlated with implicit associations.

Repeated measures ANOVA did not show any significant prime effects, target effects or interaction effects for prime*target (Table 4). Thus there were no differences in average response times between the different primes, between the different targets, and between certain combinations of primes and targets. No significant difference was found for the interaction term prime*condition meaning that there were no differences in response times for the different primes between the leaflet and control condition.

4. Discussion

4.1. Discussion

The results of our study show that women who were provided with the information leaflet reported better knowledge, and more often positive explicit attitudes. This contrast was larger among first-time invitees. Implicit associations were not associated with explicit attitudes towards breast cancer screening. Explicit attitude was found to be associated with attendance, while implicit associations were not.

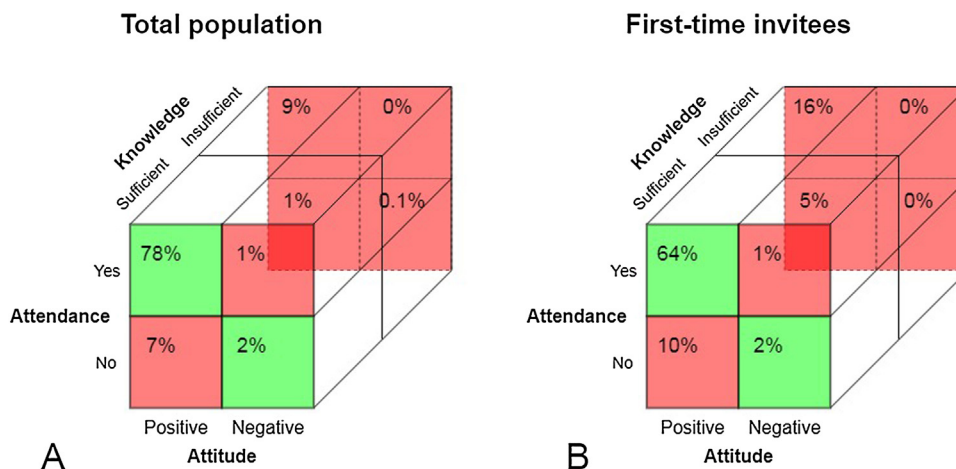


Fig. 3. Classification of informed choice according to Marteau et al. [18]. A) total baseline population B) subgroup baseline analyses of first-time invitees. Gray: informed choice, Blanc: no informed choice * Percentages are rounded off, so they may not add to 100%. To view this figure in colour, please access the online version.

Table 2
Implicit associations, explicit attitudes, knowledge, intention to participate, attendance, and informed choice of breast cancer screening at baseline and follow-up, split for leaflet and control group.

	Baseline	Follow-up		P-value
	n = 988	Leaflet n = 531	Control n = 457	
Implicit associations	n (%)			
Participants completing the priming task	479 (48)	300 (57)	222 (49)	<0.01
	Mean difference in response time in milliseconds (SD)			
Screening prime & negative target minus screening prime & positive target	17.9 (431)	3.6 (432)	-2.7 (436)	0.99
Neutral prime & negative target minus neutral prime & positive target	34.2 (377)	24.9 (401)	-38.6 (367)	0.35
Non word prime & negative target minus non word prime & positive target	-26.7 (415)	-13.7 (434)	-28.8 (419)	0.59
	Mean % (SD)			
Accurate responses to target words	87 (18)	89 (17)	87 (18)	0.14
Explicit attitudes	n (%)			
Positive	945 (96)	516 (97)	432 (95)	0.03
Negative	41 (4)	14 (3)	24 (5)	
Missing	2	1	1	
Levels of knowledge (0–11)				
Mean (range)	9.3 (2–11)	9.9 (4–11)	9.6 (2–11)	<0.001
Sufficient knowledge (≥ 8) n (%)	869 (89)	486 (94)	409 (91)	0.09
Intention to participate	n (%)			
Positive	929 (94)	507 (96)	423 (93)	0.15
Neutral	33 (3)	15 (3)	21 (5)	
Negative	25 (3)	9 (2)	13 (3)	
Missing	1	0	0	
Participation	n (%)			
Participated	803 (89)	437 (90)	366 (88)	0.46
Did not participate	101 (11)	51 (11)	50 (12)	
Missing	84	43	41	
Informed choice	n (%)			
Yes, informed choice to participate in screening	701 (78)	403 (84)	321 (78)	0.07
Yes, informed choice not to participate in screening	17 (2)	8 (2)	11 (3)	
No, not an informed choice	186 (21)	71 (15)	82 (20)	
Missing	84	49	43	

In an earlier study on informed choice in the Dutch breast cancer screening programme a rate of 88 % informed choices among first-time invitees was reported [6]. This finding was based on intention to participate rather than actual attendance, which may explain the difference with the 66 % as found in the current study. The positive effect of the leaflet on knowledge and informed choice confirms the findings of two studies in Australia [17,25]. One study found that women who received a decision aid leaflet for breast cancer screening with evidence-based information about breast cancer mortality reduction, over-detection, and false positives in screening had more knowledge and more often made an informed choice than women who received a similar leaflet without information about over-detection [25]. The other study found that 40-year-old women who received an online decision aid regarding breast cancer screening were more knowledgeable and less likely to be uncertain about their intention to participate than women who did not receive the aid, although this study found no difference in informed choice between the two groups [17]. Both studies found a reduction in intention to participate in the screening when women received an extensive decision aid, however this was not the case in our study [17,25]. Our results showed that asking women explicitly to read the leaflet increased their level of knowledge, but did not deter them from participating in screening. The use of the official information leaflet as designed by the Dutch National Institute for Public health and the Environment (RIVM) is a strength of this study. This leaflet is already routinely provided to every woman invited for breast cancer screening in the Netherlands. No further implementation is needed to see the effects found, whereas, in other studies, new leaflets or decision-aids were developed within the study that may not be implemented by policy makers [25–27]. Further research should be aimed at motivating women to read the leaflet, to increase its potential effect.

A meta-analysis of 126 studies found that correlations between implicit associations and explicit attitudes tended to be small and were even more reduced when they considered socially sensitive topics [28]. This study did not find a correlation between implicit associations and explicit attitude towards breast cancer screening. Possibly participants may have felt a pressure to give socially desired answers, which made the topic partly socially sensitive therefore the meta-analysis is in line with our findings. No correlation was found between implicit associations and intention to participate or attendance in breast cancer screening. This is similar to the results of Korfage et al., who found no correlation between implicit associations and intention to participate in cervical cancer screening [14].

This study is unique in analysing informed choice in screening using actual attendance data. So far, studies used intention to participate as a proxy for actual attendance. The correlation found between intention to participate and attendance was only $r=0.42$ ($p < 0.001$). This means that there was an association between intention to participate and attendance, but that a number of participants had an intention that was deviating from their actual attendance. Therefore, we think it is a strength of this study that actual attendance data was used. A weakness of this study was that only about half of the participants completed the priming task. This reduced the power of the analyses and could have led to selection bias. Comparing demographics, the participants who completed the priming task were more often higher educated, less often retired, and more often first-time invitees than the participants who did not complete the priming task. No differences were seen in age, living conditions, and previous participation in the screening programme. Reasons why participants completed the questionnaire, but did not complete the priming task were not fully known, although some participants reported medical or technical difficulties. A limitation of this study is that it

Table 3

Correlations between intention, attendance, implicit associations and explicit attitudes regarding breast cancer screening and educational level, screening history, knowledge about the screening programme.

	Baseline, entire group (n = 988)			
	Implicit associations	Explicit attitude	Intention	Attendance
Implicit associations, i.e. the difference in response time to [screening prime & negative target] versus [screening prime & positive target]	–	–.03 (p = 0.83)	–.05 (p = 0.31)	.05 (p = 0.33)
Explicit attitude		–	.64 (p < 0.001)	.30 (p < 0.001)
Intention to participate	–.05 (p = 0.31)	.64 (p < 0.001)	–	.42 (p < 0.001)
Attendance	.05 (p = 0.33)	.30 (p < 0.001)	.42 (p < 0.001)	–
Knowledge	.08 (p = 0.08)	–.03 (p = 0.40)	.03 (p = 0.35)	.03 (p = 0.32)
Educational level	.01 (p = 0.80)	–.18 (p < 0.001)	–.09 (p < 0.01)	.01 (p = 0.95)
Previously invited to participate in breast cancer screening	.05 (p = 0.30)	.00 (p = 0.92)	–.02 (p = 0.45)	.07 (p = 0.03)
Previous participation in breast cancer screening	–.04 (p = 0.43)	.37 (p < 0.001)	.59 (p < 0.001)	.44 (p < 0.001)
Previously referred for further diagnostics	–.05 (p = 0.39)	.00 (p = 0.95)	–.01 (p = 0.83)	–.09 (p = 0.02)
	Follow-up, leaflet condition (n = 531)			
	Implicit associations	Explicit attitude	Intention	Attendance
Implicit associations, i.e. the difference in response time to [screening prime & negative target] versus [screening prime & positive target]	–	.01 (p = 0.90)	.01 (p = 0.86)	–.05 (p = 0.45)
Explicit attitude	.01 (p = 0.90)	–	.67 (p < 0.001)	.30 (p < 0.001)
Intention to participate	.01 (p = 0.86)	.67 (p < 0.001)	–	.40 (p < 0.001)
Attendance	–.05 (p = 0.45)	.30 (p < 0.001)	.40 (p < 0.001)	–
Knowledge	.01 (p = 0.94)	.06 (p = 0.19)	.07 (p = 0.10)	.07 (p = 0.15)
Educational level	.10 (p = 0.09)	–.22 (p < 0.001)	–.10 (p = 0.02)	.08 (p = 0.20)
Previously invited to participate in breast cancer screening	–.01 (p = 0.92)	–.02 (p = 0.68)	–.07 (p = 0.13)	.02 (p = 0.62)
Previous participation in breast cancer screening	.05 (p = 0.45)	.39 (p < 0.001)	.52 (p < 0.001)	.47 (p < 0.001)
Previously referred for further diagnostics	.04 (p = 0.60)	.03 (p = 0.56)	.01 (p = 0.82)	–.10 (p = 0.05)
	Follow-up, control condition (n = 457)			
	Implicit associations	Explicit attitude	Intention	Attendance
Implicit associations, i.e. the difference in response time to [screening prime & negative target] versus [screening prime & positive target]	–	–.01 (p = 0.92)	.09 (p = 0.20)	.04 (p = 0.61)
Explicit attitude	–.01 (p = 0.92)	–	.69 (p < 0.001)	.33 (p < 0.01)
Intention to participate	.09 (p = 0.20)	.69 (p < 0.001)	–	.47 (p < 0.001)
Attendance	.04 (p = 0.61)	.33 (p < 0.001)	.47 (p < 0.001)	–
Knowledge	.04 (p = 0.54)	.01 (p = 0.83)	.07 (p = 0.12)	.04 (p = 0.46)
Educational level	–.08 (p = 0.24)	–.15 (p < 0.001)	–.09 (p = 0.05)	.07 (p = 0.41)
Previously invited to participate in breast cancer screening	.06 (p = 0.42)	.05 (p = 0.29)	.07 (p = 0.17)	.12 (p = 0.02)
Previous participation in breast cancer screening	.06 (p = 0.47)	.39 (p < 0.001)	.56 (p < 0.001)	.40 (p < 0.001)
Previously referred for further diagnostics	–.05 (p = 0.57)	–.03 (p = 0.61)	–.03 (p = 0.64)	–.08 (p = 0.16)

was not possible to address women who opted out from the breast cancer screening programme. Also the fact that 89 % of the participants in this study attended the screening programme versus 76 % in this specific region in the previous screening round, 96 % reported a positive explicit attitude, 96 %

had a positive intention to participate, and 89 % had sufficient knowledge at baseline indicates that study participants were probably more positive about breast cancer screening than the average population [29]. Still, the two randomised groups were comparable.

Table 4
Repeated measures analyses (ANOVA).

	F-test	Degrees of freedom	p-value	Effect size
Baseline				
Prime	0.420	2; 402	0.66	0.002
Target	0.327	1; 403	0.57	0.001
Prime * target	2.078	2; 402	0.13	0.010
ANCOVA¹				
Prime	0.469	2; 324	0.63	0.003
Target	1.982	1; 325	0.16	0.006
Prime * target	1.571	2; 324	0.21	0.010
Follow-up				
Prime	0.086	2; 431	0.92	0.000
Target	0.761	1; 432	0.38	0.002
Prime * target	0.216	2; 431	0.81	0.001
Prime * condition	2.402	2; 431	0.09	0.011
ANCOVA¹				
Prime	2.255	2; 358	0.11	0.012
Target	0.278	1; 359	0.60	0.001
Prime * target	1.080	2; 358	0.34	0.006
Prime * condition	2.835	2; 358	0.06	0.016

¹corrected for the variables educational level and previous participation in breast cancer screening.

It is important that women have sufficient decision-relevant knowledge about the advantages and disadvantages of participating in breast cancer screening and are enabled to make an informed choice [7]. It could be argued that this is especially important when they make this decision for the first time, since future attendance had been shown to be strongly related to attendance at the first screening round [30]. Our results indicate that the information leaflet increases the knowledge of women about the breast cancer screening programme. This effect was the largest in the subgroup of first-time invitees. Although most participants in this study had been invited for the screening programme multiple times before and therefore had received this (or a similar) information leaflet previously, this study still found an increase in knowledge after receiving the leaflet. Possibly not all women read the leaflet when they receive it with the invitation or they may have forgotten details over time. We expected that in the context of the study, participants were more likely to read the leaflet more intensively than when they received it with the screening appointment invitation. Therefore, the found effects on knowledge and explicit attitudes may be smaller in practice.

4.2. Practice implications

The information leaflet can help increase knowledge about the screening programme and thereby increase the number of women making an informed choice. This is especially important for women who are invited for the first time, because their level of knowledge is lower.

We recommend to raise attention towards and interest in reading the official leaflet. This is important to keep women up-to-date about changes and insights concerning the screening programme. Next to that, new research can explore how information can best be provided. Different modes of delivering information to women can be studied, such as infographics or movies, as well as exploring the use of different distribution channels such as email, publishing in local newspapers, via social media, or via community groups. A barrier might be that women are invited for breast cancer screening biennially over a period of 24 years and are therefore potentially not interested in gathering information every time they are invited. Possibly, more personalised information can be offered to first-time invitees and previously invited participants.

4.3. Conclusion

In conclusion, providing an information leaflet to women invited for breast cancer screening led to slightly higher levels of knowledge, and more women with positive explicit attitudes, in particular amongst women who were invited for the first time. In first-time invitees baseline knowledge was less often sufficient, but the leaflet increased this. Intention to participate and attendance seem to be associated with explicit attitude, however, not with implicit associations.

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CRediT authorship contribution statement

Lindy M. Kregting: Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing - original draft, Writing - review & editing. **Nicolien T. van Ravesteyn:** Conceptualization, Methodology, Supervision, Writing - review & editing. **Wolferth Spijker:** Conceptualization, Writing - review & editing. **Tessa Dierks:** Conceptualization, Writing - original draft, Writing - review & editing. **Clare A. Aitken:** Conceptualization, Writing - review & editing. **H. Amarens Geuzinge:** Conceptualization, Writing - review & editing. **Ida J. Korfage:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

None.

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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.2020.06.032>.

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