Preferences for cervical cancer screening: the role of implicit associations

Authors
Ida J. Korfage [1]
Erik W. de Kwaadsteniet [2]
Arno van Voorst [3]
Anne M. Stiggelbout [4]
Marieke de Vries [4,5]
Arwen H. Pieterse [4]

[1] Erasmus University Medical Center, Department of Public Health, Rotterdam, the Netherlands
[2] Leiden University, Faculty of Social Sciences, Social and Organizational Psychology, Leiden, the Netherlands
[3] GGZ Central Psychiatric Center, Amersfoort, the Netherlands
[4] Leiden University Medical Center, Department of Medical Decision Making, Leiden, the Netherlands
[5] Radboud University, Behavioural Science Institute, Institute for Computing and Information Sciences (iCIS) & Social and Cultural Psychology, Nijmegen, the Netherlands

Abstract

Objectives: Implicit associations influence behaviour, but their impact on cancer screening intentions is unknown. We aimed to fill this gap.

Methods: We assessed implicit associations with cervical cancer screening using an evaluative priming task. Participants were shown primes ('Pap test', neutral or non-word) followed by positive or negative target words. The test assumes that response times are shorter if primes and targets are strongly associated in the participant's mind. The Dutch cervical cancer screening program targets women aged 30-60, 226 of them completed online assessments twice. Prior to the second assessment participants were randomized to reading versus not reading the leaflet about the cervical screening program.

Results: After controlling for knowledge and screen history, response times for 'Pap test' no longer differed between positive and negative targets. Implicit associations were not correlated with explicit attitudes or screening intentions. Reading the leaflet of the national screening program resulted in improved knowledge levels ($p<0.001$), but implicit associations, explicit attitudes, and screening intentions remained similar.

Conclusion: Cervical cancer screening intentions were related to explicit attitudes, but not to implicit associations.

Practice implications: Knowledge improved after reading the leaflet about cervical cancer screening, but attitudes towards screening and screening intentions were not affected.

Key-words:

explicit attitudes; automatic associations; implicit preferences; screening; preventive behaviour; informed decisions

1. Introduction

Implicit associations have been shown to affect consumer behaviour[1-3]. So far, however, it is largely unknown if and how such Implicit associations also impact medical decision-making such as participating in cancer screening. In Western countries the decision to accept or decline participation in cancer screening programs is considered a matter of individual choice[4,5]. In this view, people are entitled to weigh the positive and negative aspects of a screening program and then make an autonomous, informed choice about their participation[6]. Following Marteau et al., an informed choice is defined as a choice that is based on relevant knowledge with the individuals' attitudes being consistent with actual behaviour[7]. From this perspective, non-participation in a screening program is a perfectly acceptable outcome of a decision process, if based on sufficient decision-relevant knowledge and in line with the individual's attitude towards participating in the specific program [7]. However, the uptake of screening is below average among women with low socio-economic status, whose cervical cancer risk is above average[8], which leads one to believe that non-participation may not always be the result of an informed choice[8].

Attitudes can be implicit and explicit. Implicit attitudes, which we will refer to as implicit associations, are defined as highly accessible, evaluative representations[9] that are automatically activated even in the absence of an intention to evaluate the object[10]. Implicit associations are based on automatic associations[3,11-14] and can guide people's behaviour without their conscious awareness[15]. They may help explain why women at higher risk of cervical cancer do not participate in screening. Explicit attitudes are more or less deliberate and conscious, and are not necessarily correlated with implicit associations[16-19]. In practice, people will often react based on their first associations, i.e. on their implicit associations, rather than on deliberate decision strategies, i.e. their explicit attitudes[1,20,21].
Possibly actual screening behaviour is not always driven by explicit intentions, but sometimes depends more strongly on automatically activated associations, which can be tapped by implicit associations measurements. If we wish to better understand non-participation in screening, then it may be relevant to address implicit associations with cancer screening in addition to explicit attitudes. Such implicit associations have not been assessed so far.

We aimed to measure women's intentions to have or to decline the cervical cancer screening test, and the associations of these intentions with women's implicit associations with and explicit attitudes towards this test. Additionally, we wanted to know if and how knowledge about cervical screening programs was related to women's implicit associations and explicit attitudes. Finally, we assessed the associations between educational level, screening history, implicit associations, explicit attitudes, and intentions to participate. With these aims we developed the necessary methodologies.

2. Methods

In the Dutch national cervical cancer screening program, women aged 30-60 are invited once every five years to attend cytological cervical cancer screening (using a so-called Pap test), with the aim of early detection and treatment of (pre)cancerous stages, and improving survival. Participating in this program does not entail financial costs for the individual participant. Nationally, the 5-years coverage is 77% [22]. Many women usually participate but occasionally skip a screening round, for instance due to pregnancy.

Female participants in an online Dutch panel aged 30-60 were asked to complete two online assessments with a two-week interval. The participants were representative for the Dutch population in terms of age (in the specific 30-60 group), education level, and regional spread.

At baseline, all participants were given a short description of the Dutch national program for cervical cancer screening (see Appendix). They were then asked to imagine they had been

invited to have cervical screening and to indicate their intention to accept this invitation. Next, they completed an evaluative priming task to assess their implicit associations with the cervical cancer screening test, followed by a questionnaire containing a measure to assess their explicit attitudes towards this test as well as questions to assess knowledge about the cervical cancer screening program. The order of assessments was chosen such that neither the measurement of explicit attitudes nor the measurement of knowledge could affect participants' implicit associations.

At the follow-up assessment, participants were randomly assigned to one of two conditions. Participants in the Leaflet condition were asked to read the information leaflet that is sent to all women who are eligible for a screening round in the national cervical cancer screening program (available from http://www.rivm.nl/dsresource?objectid=rivmp:58256&type=org&disposition=inline&ns_nc=1). Participants in the Control condition did not receive additional introductions or materials, they were just asked to imagine they had received an invitation to participate in cervical screening. Participants in both conditions were subsequently asked to complete the same assessments as at baseline.

Participants were asked to indicate their age. Information about educational level was provided by the host of the panel. We asked participants whether they ever had been invited to participate in the cervical cancer screening program, whether they ever participated, and whether they ever had an unfavourable screening test result. We hypothesized that educational level and a history of screening tests may be associated with higher levels of knowledge about the screening program and potentially impact implicit associations with and/or explicit attitudes towards screening.

Implicit associations: evaluative priming task

Validated measures to assess implicit associations with screening programs or other preventive health behaviour were not available at the time of the study. Therefore, we adapted an evaluative priming task, a widely used task in social cognition research that was originally developed to assess attitudes towards social groups or activities. We programmed the task into Qualtrics software (version 4.2015) using the QRTEngine program[23]. In this task a participant is first shown a prime on a computer screen. The prime can be a word like 'holidays'. Then a target is shown, for instance the word 'good' or the word 'bad'. Next, the participant is asked to indicate if the target is negative or positive by pressing a key. Participants were asked to perform this task while trying to maximize both speed and accuracy of their responses. The task relies on the assumption that if primes and target words are strongly associated in the participant's mind, the participant will react more quickly [24]. Response times to the target words are therefore considered to indicate implicit positive or implicit negative associations with the

prime. For instance, if a participant has a positive association with a primed word such as 'holidays', she will respond more quickly to a target word that is positive (e.g., 'good'), but more slowly to a target word that is negative (e.g., 'bad').

The evaluative priming task[3,25] that we developed contained three primes: 1) a screening prime ('Pap test'), 2) a neutral prime ('bookshelf), and 3) a non-word (a collection of letters in random order; Tipajvnaui). Each prime was followed on the screen by a positive (good, beautiful, smart, or pretty) or negative (false, stupid, bad, or nasty) target word. All target words were monosyllabic in Dutch. The same sets of primes and target words were used at both assessments and in both conditions. Participants were asked to indicate the target's connotation by pressing the key 'a' in case of a negative target and key 'l' in case of a positive target, left and right on the qwerty keyboard used in the Netherlands.

Each trial started with the presentation on the computer screen of a so-called fixation cross that participants were asked to look at, with a random duration ranging from 1000 to 2000 milliseconds (ms). Then a prime was presented for 200ms, followed by a 100-ms interval before onset of the target word. The target word remained on the screen until the participant responded. The participant's response was recorded, along with the response latency (from the word onset to response), to the nearest millisecond. A 1000 ms interval passed before presentation of the next trial.

To familiarize participants with the procedure, a block of 24 practice trials preceded the actual priming task. The actual task consisted of 24 trials, in which all combinations of each of the three primes and each of the eight target words were presented once, in random order. We conducted a pilot study with 74 female students who conducted the practice trials and the actual task as described, and found that the task was well understood.

Explicit attitudes

The participants' explicit attitudes towards cervical cancer screening were measured through an attitudes scale that was adapted from the multidimensional measure for informed choice of Marteau et al.[7] that addressed how women perceived their uptake of prenatal screening. Our attitudes scale consisted of six cognitive items, e.g. did women consider their participation in cervical cancer screening important vs. unimportant, and of three affective items, e.g., did women consider their participation in cervical cancer screening as reassuring vs. frightening. Participants responded on five-point Likert-type scales, ranging from e.g., 'important' to 'unimportant' or 'reassuring' to 'frightening'. 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[26]. To facilitate interpretation, the results were transformed to 0–100 scores.

In agreement with Van den Berg et al.[27], mid-point scale responses (45-55) were taken to indicate neither positive nor negative attitudes and were classified as 'neutral'. Scores below 45 were classified as 'negative', scores above 55 as 'positive'. The Cronbach alpha score was 0.91 both at baseline and at follow-up, indicating good internal consistency of the scale according to quality criteria[28].

Intention to undergo cervical cancer screening

To assess the participants' intention to undergo cervical cancer screening, we asked them the following: "Imagine that you receive an invitation to be screened within the following weeks. Please indicate how likely it is that you will accept this invitation and will be screened" (Likert-type scale ranging from 1, 'Definitely not' to 7, 'Definitely yes').

Gist knowledge

Gist knowledge reflects "the ability to identify the essential points of the information presented"[29]. To assess to what extent participants understood essential points about cervical screening and whether the leaflet improved knowledge, we assessed gist knowledge in both conditions and at both assessments. To this end, we addressed seven key characteristics of screening programs as identified in the literature[30,31]. These relate to e.g., the aim and the procedure of the screening program, the a priori possibility of false positive and false negative screen results, and overtreatment. The number of correct answers was summed per participant (score range 0-7).

Informed decisions

We defined an informed choice as a choice based on relevant knowledge while attitudes and actual screen behaviour aligned[7]. Actual screening behaviour of study participants was unknown to us. Because intention is strongly correlated with infrequent behaviour and has shown to be a proper predictor of screening behaviour[32], we used screening intentions instead.. We operationalized relevant knowledge as having answered at least 5 of 7 knowledge questions correctly.

In accordance with current guidelines[25], responses that were too fast (i.e., quicker than 300 ms) or too slow (i.e., slower than 3,000 ms), as well as incorrect responses, were considered errors and were excluded from the analyses of implicit associations.

Inferential statistics included t-tests to assess differences between Leaflet and Control conditions in continuous variables and Pearson chi-square analyses for categorical ones (two-tailed significance).

Differences in gist knowledge levels between assessments were assessed per group with paired t-tests. Differences in gist knowledge levels between conditions were calculated using t-tests.

To assess implicit associations, we compared per prime the response times to negative versus

positive targets[33]. We also compared these differences in response times between conditions using t-tests.

We calculated associations between women's educational level, women's history of having received an invitation to have a Pap test taken, having had a previous Pap test, and having had an adverse Pap test result with knowledge about the screening program, implicit associations with and explicit attitudes towards it, and intended participation using Pearson product-moment correlations. Differences in response time between primes (screening, neutral word, and non-word) and between targets (positive or negative) in the evaluation task were tested using a repeated measures ANOVA. An interaction term (prime*target) was included. Subsequently, variables that were significant in the Pearson correlations were included as covariates (repeated measures ANCOVA). Conform Strick et al[3] the above repeated measures analyses were repeated with log-transformed reaction times to control for their non-normal distribution.

All analyses were performed in SPSS, version 21 and significance was set at $\alpha=0.05$.

3. Results

Four hundred and five women started the baseline assessment, and 278 of them completed it. Of these, 226 (82%) also participated at follow-up and they were randomized into the Leaflet (n=113) or Control (n=113) condition (Figure 1).

The average age, educational levels, and screening history did not significantly differ between the two conditions (Table 1). The majority of women who reported to have never had a Pap test were 30-34 years old (Table 1); potentially they had not yet received invitations to have a Pap test.

The average error rate in making judgments about the connotation of the target adjectives was 13% at baseline in the entire group. At follow-up, this rate was 10% in both conditions (n.s.). We found at all assessments and for each prime that processing targets in combination with a negative target required more time than the combination with a positive target (Table 2). The difference in response time per negative versus positive target regarding the non-word prime was significantly larger in the Leaflet condition than in the Control condition.

A majority of at least 80% per condition reported positive explicit attitudes towards screening. Explicit attitudes did not statistically differ between conditions ($p=0.64$, Table 2).

At baseline, an average of 4.5 out of seven knowledge items were answered correctly (Table 2). At follow-up, mean knowledge levels in the Leaflet condition increased significantly ($p <0.001$) to 5.8 and were significantly higher than those in the Control condition (4.5, t-test -7.06; $p<0.001$).

At baseline and at follow-up around 80% of the participants intended to be screened, 9 to 14% were undecided, and the remaining women intended not to be screened (Table 2). Neither at baseline nor at follow-up did intentions significantly differ between conditions, nor were associations between intentions to participate in cervical screening and implicit associations significant (Table 3). There was a significant, positive association between positive explicit attitudes and intentions to participate in cervical screening at baseline ($R=0.79$; $p<0.001$) and at follow-up (Leaflet condition: $R=0.89$, $p<0.001$; Control condition: $R=0.68$, $p=<0.001$; Table 3).

At baseline, 56% of participants did not make an informed decision about intention to screen. This was mainly due to insufficient knowledge scores. The majority of informed decisions were to have the cervical screening test. At follow-up, 77% of women in the Leaflet group made an informed decision about screening. A majority of these decisions were to have the screening test. In the Control condition, 47% of the decisions about screening could be labelled as informed, also most often to have the screening test.

At baseline, gist knowledge was significantly associated with positive explicit attitudes towards the Pap test (R=0.15, p=0.03) and positive intentions for future participation (R=0.16, p=0.02).These associations were insignificant at follow-up. A history of participating in cervical cancer screening was consistently significantly associated with positive explicit attitudes (R=0.42 -0.51, p<0.001) and with positive intentions for future participation (R=0.42-0.58, p<0.001). At baseline, earlier participation in screening was borderline significantly associated with positive implicit associations (baseline: R=0.13, p=0.07).

The ANOVAs yielded significant prime effects at baseline (F(2, 187)=19.4, p<0.001) and at follow-up (F(2, 200)=4.9, p=0.008), with response times almost always being longer for 'Pap test' versus other primes, see Table 4. The target effect was also significant at baseline (F(1, 188)=10.4, p=0.002) and at follow-up (F(1, 201)=22.2, p<0.001). Additionally, at follow-up an interaction effect was found for prime*condition (F(2, 200)=4.7, p= 0.01). That is, in the Leaflet condition, the participants responded consistently slower to the screening prime than in the Control condition, while the participants in the Leaflet condition responded faster to the other primes. The participants in the Leaflet condition thus needed more time to respond to the screening prime. The prime*target interaction effect was statistically insignificant at both assessments.
We then included baseline gist knowledge and a history of screening as covariates (repeated measures ANCOVAs). The ANCOVAs yielded significant prime effects at baseline (F(2, 177)=3.6, p=0.03) and at follow-up (F(2, 187)=5.3, p=0.006), the target effects were no longer significant. The interaction effect at follow-up for prime*condition remained significant (F(2, 187)=6.9, p=0.001). Conducting the above repeated measures analyses with log-transformed reaction times (cf. Strick et al., 2009[3]) yielded similar results.

4. Discussion and conclusion

4.1 Discussion

In this study we developed methodology to assess implicit associations with participating in cervical screening using a priming task. Following a brief description of the national program for cervical cancer screening, participants indicated their knowledge levels, implicit associations with and explicit attitudes towards the Pap test, and their intentions towards having a Pap test. At follow-up, the average response times in the priming task were shorter and fewer mistakes were made than at baseline, potentially due to a learning effect. Irrespective of primes, response times to positive targets were consistently shorter than those to negative targets. This might be explained by the attention grabbing effect of negative stimuli[34]. Following the inclusion of baseline gist knowledge and a history of screening in the analyses, target effects became insignificant.

Explicit attitudes towards cervical cancer screening were mostly positive, but implicit associations did not seem to be positive or negative. As hypothesized, having a history of participating in screening was significantly associated with positive explicit attitudes towards the Pap test and with positive intentions for future participation, but contrary to our hypothesis we found no association of screening history with gist knowledge or implicit associations.

We could not assess how participants' attitudes related to their real screening behaviour. However, screening intentions, which have shown to be good predictors of screening behaviour, were consistently related to explicit attitudes but not to implicit associations. Also, screening history, which is an indication of past behaviour, was consistently associated with explicit attitudes while the associations with implicit associations were insignificant or borderline significant (p=0.07). The latter could mean that implicit associations are not related to screening behaviour or that we did not detect it. A potential explanation for the fact that we did not detect a relation between intentions and implicit associations is that we had to assess intentions in an explicit way while relations between implicit and explicit measures tend to be weak, as shown in a meta-analysis of 126 studies on implicit association tests and explicit self-report measures [35].

Having at least such a minimum of information can help people to decide whether they want to enter the screening program or not. In that sense we agree with Irwig and colleagues that potential participants 'should be aware of the screening program and have received and understood an agreed minimum of information about benefits and harms of the procedure' before making a decision about uptake [36]. We found that providing such information using the screening leaflet improved screen-specific knowledge, but did not affect intentions.

A strength of our study is that we thoroughly pre-tested our methodology to assess implicit associations. Also, the study participants represented the actual age range of the target

population of the national screening program. For future studies we recommend to assess actual rather than intended uptake of screening. Also, we recommend further research into explicit attitudes and implicit associations targeted at at-risk groups for cervical cancer and into the associations of these with actual screening behaviours.

4.2 Conclusion

In conclusion, women do not seem to have strong positive or negative implicit associations with cervical screening. We also found that screening intentions in participating women were related to explicit attitudes but not to implicit associations. Receiving information about the cervical screening program resulted in higher levels of knowledge, but did not affect implicit associations, explicit attitudes or screening intentions.

4.3 Practice implications

The women in our study, all belonging to the target age group of the national screening program, showed positive explicit attitudes towards cervical cancer screening. The majority reported positive intentions to participate in cervical cancer screening, but did not seem to have strong implicit associations with it. The leaflet about the cervical screening program resulted in improved gist knowledge, but did not impact explicit attitudes, implicit associations, or screening intentions. We recommend to target further research at at-risk groups for cervical cancer, potentially through a tailored telephone follow-up approach[37]. Improved insight into how explicit attitudes and implicit associations are related with actual screening behaviour may help better design information procedures for the target population of the screening program.

Funding sources

I.J. Korfage and A.H. Pieterse were funded through a postdoctoral research fellowship of the Dutch Cancer Society, reference EMCR 2008-4339 and UL 2011-5222 respectively.

References

1. Dijksterhuis A, Smith PK, Van Baaren RB, Wigboldus DHJ. The Unconscious Consumer: Effects of Environment on Consumer Behavior. *J Consum Psychol.* 2005;15:193-202.
2. Holland RW, Vries Md, Hermsen B, Knippenberg Av. Mood and the Attitude–Behavior Link: The Happy Act on Impulse, the Sad Think Twice. *Soc Psychol Pers Sci.* 2012;3:356-64.
3. Strick M, van Baaren RB, Holland RW, van Knippenberg A. Humor in advertisements enhances product liking by mere association. *J Exp Psychol Appl.* 2009;15:35-45.
4. General Medical Council. *Seeking Patients' Consent: the Ethical Considerations.* London1998.
5. Minister of Health. *Letter about screening [Kaderbrief screening], PG/ZP 2.848.440.* The Hague2008.

6. Osterlie W, Solbjor M, Skolbekken JA, Hofvind S, Saetnan AR, Forsmo S. Challenges of informed choice in organised screening. *J Med Ethics.* 2008;34:e5.
7. Marteau TM, Dormandy E, Michie S. A measure of informed choice. *Health Expect.* 2001;4:99-108.
8. Koopmanschap MA, van Oortmarssen GJ, van Agt HM, van Ballegooijen M, Habbema JD, Lubbe KT. Cervical-cancer screening: attendance and cost-effectiveness. *Int J Cancer.* 1990;45:410-5.
9. Fazio RH. On the automatic activation of associated evaluations: An overview. *Cognition Emotion.* 2001;15:115-41.
10. Cunningham WA, Raye CL, Johnson MK. Implicit and explicit evaluation: FMRI correlates of valence, emotional intensity, and control in the processing of attitudes. *J Cogn Neurosci.* 2004;16:1717-29.
11. Gawronski B, Bodenhausen GV. Associative and propositional processes in evaluation: an integrative review of implicit and explicit attitude change. *Psychol Bull.* 2006;132:692-731.
12. Strack F, Deutsch R. Reflective and impulsive determinants of social behavior. *Pers Soc Psychol Rev.* 2004;8:220-47.
13. Smith ER, DeCoster J. Dual-Process Models in Social and Cognitive Psychology: Conceptual Integration and Links to. *Pers Soc Psychol Rev.* 2000;4:108.
14. Wilson TD, Lindsey S, Schooler TY. A model of dual attitudes. *Psychol Rev.* 2000;107:101-26.
15. Fazio RH, Olson MA. Implicit Measures in Social Cognition Research: Their Meaning and Use. *Annu Rev Psychol.* 2003;54:297-327.
16. Baccus JR, Baldwin MW, Packer DJ. Increasing implicit self-esteem through classical conditioning. *Psychol Sci.* 2004;15:498-502.
17. Gregg AP, Seibt B, Banaji MR. Easier done than undone: Asymmetry in the malleability of implicit preferences. *J Pers Sol Psychol.* 2006;.90:1-20.
18. Gawronski B, Strack F. On the propositional nature of cognitive consistency: Dissonance changes explicit, but not implicit attitudes. *J Exp Soc Psychol.* 2004;40:535-42.
19. Olson MA, Fazio RH. Reducing Automatically Activated Racial Prejudice Through Implicit Evaluative Conditioning. *Pers Soc Psychol Bull.* 2006;32:421-33.
20. Bargh JA. Losing Consciousness: Automatic Influences on Consumer Judgment, Behavior, and Motivation. *J Cons Res.* 2002;29:280-5.
21. Chartrand TL. The Role of Conscious Awareness in Consumer Behavior. *J Consum Psychol.* 2005;15:203-10.
22. Erasmus MC. Cervical cancer screening program [Bevolkingsonderzoek baarmoederhalskanker]. 2016:8. http://www.rivm.nl/dsresource?objectid=5590fcef-0cd6-4f62-8a8f-3d49da2415e3&type=org&disposition=inline.
23. Barnhoorn JS, Haasnoot E, Bocanegra BR, van Steenbergen H. QRTEngine: An easy solution for running online reaction time experiments using Qualtrics. *Behav res methods.* 2015;47:918-29.
24. van Agt H, Fracheboud J, van der Steen A, de Koning H. Do women make an informed choice about participating in breast cancer screening? A survey among women invited for a first mammography screening examination. *Patient Educ Couns.* 2012;89:353-9.

25. Fazio RH, Sanbonmatsu DM, Powell MC, Kardes FR. On the automatic activation of attitudes. *J Pers Soc Psychol.* 1986;50:229-38.
26. Ware JEJ, Snow KK, Kosinski M, Gandek BG. *SF-36 health survey: manual and interpretation guide.* Boston, MA : The Health Institute, New England Medical Center; 1993.
27. van den Berg M, Timmermans DR, Ten Kate LP, van Vugt JM, van der Wal G. Are pregnant women making informed choices about prenatal screening? *Genet Med.* 2005;7:332-8.
28. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol.* 2007;60:34-42.
29. Hawley ST, Zikmund-Fisher B, Ubel P, Jancovic A, Lucas T, Fagerlin A. The impact of the format of graphical presentation on health-related knowledge and treatment choices. *Patient Educ Couns.* 2008;73:448-55.
30. Zapka JG, Geller BM, Bulliard JL, et al. Print information to inform decisions about mammography screening participation in 16 countries with population-based programs. *Patient Educ Couns.* 2006;63:126-37.
31. Wald N. Information leaflets in medical screening. *J Med Screen.* 2006;13:109.
32. Power E, Van Jaarsveld CHM, McCaffery K, Miles A, Atkin W, Wardle J. Understanding intentions and action in colorectal cancer screening. *Ann Behav Med.* 2008;35:285-94.
33. Holland RW, de Vries M. Implicit evaluation as a basis for intuition. *Foundations for tracing intuition: Challenges and methods*2010:123-38.
34. Baumeister RF, Bratslavsky E, Finkenauer C, Vohs KD. Bad is stronger than good. *Rev gen psychol.* 2001;5:323.
35. Hofmann W, Gawronski B, Gschwendner T, Le H, Schmitt M. A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures. *Pers Soc Psychol Bull.* 2005;31:1369-85.
36. Irwig L, McCaffery K, Salkeld G, Bossuyt P. Informed choice for screening: implications for evaluation. *Brit Med J.* 2006;332:1148-50.
37. Groenenberg I, Crone MR, van Dijk S, et al. Response and participation of underserved populations after a three-step invitation strategy for a cardiometabolic health check. *BMC public health.* 2015;15:1.

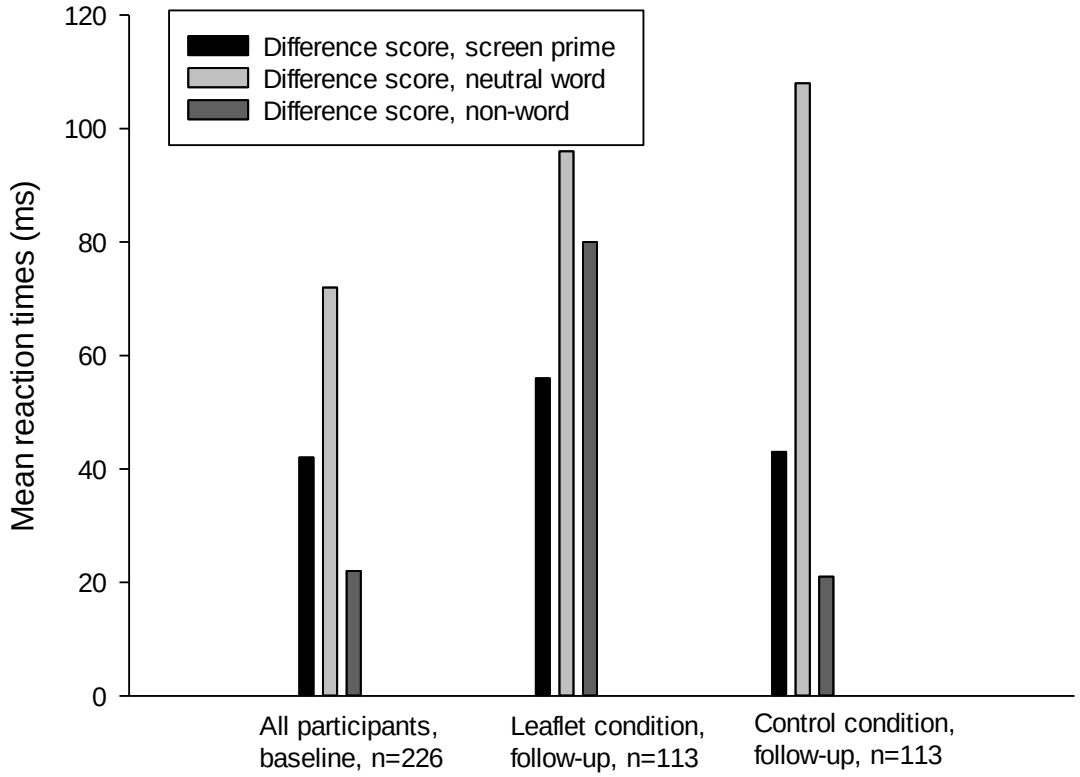

Figure 1. Per prime, the average differences in response times to negative versus positive targets.

Table 1. Participant characteristics (n= 226)

	Leaflet condition (n= 113)	Control condition (n= 113)	p-value
Age			
Mean (SD)	46.1 (8.5)	46.4 (9.5)	0.88
Range	30-60	30-60	
Missing	*1*	-	
Educational level (n, %)			0.82
High	38 (34)	35 (31)	
Middle	49 (43)	53 (47)	
Low	26 (23)	25 (22)	
Ever invited to participate in cervical screening (n, %)			0.60
Yes	110 (97)	108 (96)	
Do not remember	2 (2)	2 (2)	
No	1 (1)	3 (3)	
Ever participated in cervical screening (n, %)			0.21
Yes	97 (90)	102 (94)	
No	11 (10)	6 (6)	
Missing	*5*	*5*	
Ever had an unfavourable Pap test result (n, %)			
Yes	24 (22)	21 (19)	0.11
Do not remember	-	4 (4)	
No	85 (78)	83 (77)	
Missing	*4*	*5*	

Table 2. Knowledge, explicit attitudes, implicit associations, and intentions regarding participation in cervical cancer screening at baseline and follow-up, ordered by Leaflet versus Control condition.

	Baseline	Follow-up		
		Leaflet condition	**Control condition**	
	n= 226	n=113	n=113	**p-value**
Implicit associations	Difference in response time in milliseconds (SD)	Mean response time in milliseconds (SD)	Mean response time in milliseconds (SD)	
Screening prime & negative target minus screening prime & positive target	42 (433)	72 (355)	22 (273)	0.25
Neutral prime & negative target minus neutral prime & positive target	56 (334)	96 (274)	80 (348)	0.71
Non word & negative target minus non word & positive target	43 (288)	108 (271)	21 (328)	0.04
Accurate responses to target words	% (SD) 87 (20)	% (SD) 90 (18)	% (SD) 89 (21)	0.73
Explicit attitudes (Marteau)*	n (%)	n (%)	n (%)	0.64
Positive	182 (81%)	90 (80)	94 (83)	
Neutral	19 (8%)	12 (11)	8 (7)	
Negative	25 (11%)	11 (10)	11 (10)	
Levels of Gist Knowledge (0-7)	Mean 4.5 (SD 1.3) Range: 0-7	Mean 5.8 (SD 1.3) Range 0-7	Mean 4.5 (SD 1.4) Range 0-7	<0.001
Intention	n (%)	n (%)	n (%)	0.34
Positive	180 (80)	92 (81)	92 (82)	
Undecided	30 (13)	10 (9)	14 (13)	
Negative	16 (7)	11 (10)	6 (5)	
Missing	-		*1*	
Informed decisions	n (%)	n (%)	n (%)	
Yes, informed decision	98 (44)	86 (77)	58 (47)	<0.001
No, not an informed decision	125 (56)	25 (23)	51 (53)	

Table 3. Correlations between intention, implicit associations and explicit attitudes regarding participation in cervical cancer screening and educational level, screening history, knowledge about the screening program.

		Baseline		
		Intention	Implicit associations	Explicit attitudes
Entire group	Implicit associations, i.e. the difference in response time to [screening prime & negative target] versus [screening prime & positive target]	0.11 (p=0.11)		
	Explicit attitudes	0.79 (p<0.001)	0.04 (p=0.54)	
	Gist knowledge	0.16 (p=0.02)	-0.07(p=0.60)	0.15 (p=0.03)
	Educational level	0.03 (p=0.66)	-0.04 (p=0.60)	-0.001 (p=0.99)
	Having been invited for cervical cancer screening	0.26 (p<0.001)	0.02 (p=0.82)	0.08 (p=0.25)
	Participation in cervical cancer screening	0.53 (p<0.001)	0.13 (p=0.07)	0.42 (p<0.001)
	Having had an unfavourable screening test result	0.15 (p=0.03)	0.002 (p=0.97)	0.09 (p=0.20)
		Follow-up		
		Intention	Implicit associations	Explicit attitudes
Leaflet group	Implicit associations, i.e. the difference in response time to [screening prime & negative target] versus [screening prime & positive target]	-0.04 (p=0.72)		
	Explicit attitudes	0.89 (p<0.001)	0.01 (p=0.93)	
	Gist knowledge	0.05 (p=0.61)	0.10 (p=0.29)	0.08 (p=0.39)
	Educational level	0.08 (p=0.39)	-0.08 (p=0.40)	0.03 (p=0.72)
	Having been invited for cervical cancer screening	0.22 (p=0.02)	0.09 (p=0.36)	0.23 (p=0.01)
	Participation in cervical cancer screening	0.58 (p<0.001)	0.04 (p=0.69)	0.51 (p<0.001)
	Having had an unfavourable screening test result	0.14 (p=0.16)	-0.002 (p=0.99)	0.14 (p=0.16)
		Intention	Implicit associations	Explicit attitudes
Control group	Implicit associations, i.e. the difference in response time to [screening prime & negative target] versus [screening prime & positive target]	-0.07 (p=0.50)		
	Explicit attitudes	0.86 (p<0.001)	-0.10 (p=0.33)	
	Gist knowledge	0.03 (p=0.76)	-0.10 (p=0.34)	-0.03 (p=0.77)
	Educational level	-0.10 (p=0.30)	0.01 (p=0.94)	0.02 (p=0.85)
	Having been invited for cervical cancer screening	0.19 (p=0.05)	-0.01 (p=0.92)	0.12 (p=0.21)
	Participation in cervical cancer screening	0.42 (p<0.001)	-0.02 (p=0.85)	0.43 (p<0.001)
	Having had an unfavourable screening test result	0.13 (p=0.19)	-0.03 (p=0.76)	0.09 (p=0.38)