Threatening communication: diffusing the scientific evidence on fear appeal effectiveness among intervention developers, policy makers, politicians, scientists and advertising professionals

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Threatening communication: diffusing the scientific evidence on fear appeal effectiveness among intervention developers, policy makers, politicians, scientists and advertising professionals

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Abstract:

BACKGROUND: Threat-based interventions are ineffective yet popular. The current paper reports the evaluation of an intervention that was designed to discourage using threatening communication and that targeted those responsible for this popularity.

METHODS: Of the 153 participants who started, 102 completed both the first phase and the six-week follow-up measurement of the within-subject experiment. In the first phase, participants rated hypothetical behavior change interventions in six health domains (e.g., smoking, alcohol), after which they were presented with an intervention targeting themselves, which provided evidence on the ineffectiveness of threatening communication as persuasive instrument. Participants then rated more hypothetical interventions immediately and after six weeks.

RESULTS: The intervention decreased the effectiveness ratings of threat-based interventions, but to a lower degree than expected, with the mean effectiveness grades immediately post-manipulation still exceeding four on a ten-point scale.

CONCLUSIONS: The tested intervention is a promising attempt to directly influence the key populations responsible for the continuous use of threat communications in persuasion.

Keywords:

Fear appeals, intervention development, intervention developers, policy makers, politicians, scientists, advertising professionals

Introduction

Behavior change interventions frequently emphasize the severity of negative consequences of undesired behavior, often in a threatening fashion (E. L. Cohen, Shumate, & Gold, 2007), and usually without efficacy (or coping) components (Smith, 1997). The warning labels on cigarette packs are a well-known example. For a long time, the effectiveness of such threatening communications was a controversial issue, with some papers actively promoting their use (Hammond, Fong, McDonald, Brown, & Cameron, 2006) and others discouraging it (Ruiter & Kok, 2005, 2006). The wide implementation of and interest in warning labels (Goodall & Appiah, 2008; Silpasuwan et al., 2008; Vardavas, Connolly, Karamanolis, & Kafatos, 2009) evidences the tendency of intervention developers to follow the former argument.

This lack of consensus regarding the persuasive effectiveness of threatening health communications follows from inconsistency between theory and outcomes of empirical research. Fear appeal theories (Witte, 1992; de Hoog, Stroebe, & de Wit, 2007; also see Goldenberg & Arndt, 2008) hold that threatening information only leads to the desired action if it convinces receivers that they are susceptible to a severe threat, to which the desired behavior is an effective solution (response efficacy) that they can efficaciously perform (self-efficacy). When threat (severity or susceptibility) is low, no threat is perceived. When efficacy (response efficacy or self-efficacy) is low, the resulting knowledge (one is threatened but unable to resolve this threat) triggers defensive responses, that often result in minimizing the threat (e.g. by lowering perceived susceptibility) and prohibit protective action. In other words, theory predicts that empirical studies should find interactions between threat and efficacy, such that threat only has an effect when efficacy is high.

Nonetheless, reviews of the effects of fear appeals have not supported these predictions, often only finding evidence for main effects of threat and efficacy (Witte & Allen, 2000; de

Hoog et al., 2007). Simultaneously, controlled studies of the processing of threatening information found evidence for defensive processing (Kessels, Ruiter, & Jansma, 2010; Nielsen & Shapiro, 2009; Ruiter, Kessels, Smerecnik, Wouters, & Jansma, 2012), negative effects on beliefs (Brown & Locker, 2009; Brown & Smith, 2007), and even on behavior (Ben-Ari, Florian, & Mikulincer, 2000). These inconsistencies, together with the intuitive appeal of threatening communications as a behavior change method (see, for example Goodall & Appiah, 2008; Gorn, Lavack, Pollack, & Weinberg, 1996), and the equally intuitive assumption that target population members know which behavior change methods are effective in influencing them (Vardavas et al., 2009), have probably contributed to the enduring popularity of threatening communications (Soames Job, 1988).

A recent meta-analysis, designed to resolve the controversy between theory and evidence, found that the theoretical predictions did hold when studies with inferior methodology were excluded (i.e., only including studies manipulating both threat and efficacy, and measuring behavior as an outcome measure; G.-J. Y. Peters, Ruiter, & Kok, n.d.-a). The average effect sizes clearly showed a significant interaction between threat and efficacy, such that threat only had an effect under high efficacy ($d = 0.31$), and efficacy only had an effect under high threat ($d = 0.71$). In fact, the effect of threat under low efficacy was negative ($d = -0.31$) and almost significant ($p = .061$). Given that most interventions using threatening elements do not provide coping information or otherwise influence efficacy (E. L. Cohen et al., 2007; Smith, 1997), this is a worrying outcome. However, when looking at evidence from other meta-analyses, the picture becomes even bleaker. Insofar as threatening communications do have an effect, this is very weak compared to the effect of other behavior change methods. A meta-analysis comparing different behavior change methods concluded that “no threat-inducing argument had any positive behavioral effect whatsoever” (Albarracín et al., 2005, p. 882). Similarly, as another meta-analysis into condom use where long-term

effects of fear appeals were studied "[…] clearly shows, inducing fear is not an effective way to promote HIV-relevant learning or condom use either immediately following the intervention or later on." (Earl & Albarracín, 2007, p.504).

In all, it appears that one of the most popular behavior change methods is an unfortunate weapon of choice at best. This means that there is a need to change these practices, establishing more evidence- and theory-based health promotion practice. Doing so would, interestingly, require the development of a behavior change intervention. However, this intervention would not target a population defined by a health problem, but instead a relatively small population of behavior change professionals and key decision makers. The intervention would need to address those beliefs of behavior change professionals that underlie their choices to utilize threatening information (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011).

A recent qualitative study aimed to identify these beliefs (G.-J. Y. Peters, Ruiter, & Kok, n.d.-b). Intervention developers, policy makers, politicians, scientists and professionals from advertising agencies were interviewed about threatening communication. The main reasons for using threatening communication were to confront people with the consequences of a behavior and to evoke emotions. Emotions were assumed to evoke two goals. The first perceived goal of emotions was to draw attention to the intervention and prompt self-reflection, which would then lead to the desirable behavior, because target population members were assumed to act rationally on hypothesized (successful) increments in risk perceptions. This assumption of rationality also explained the presupposition that achieving awareness or raising risk perception would cause behavior change. This enhanced awareness was the second perceived goal emotions could serve: explicitly emotionally defined risk was often assumed to directly enhance awareness (G.-J. Y. Peters, Ruiter, & Kok, n.d.-b).

Use of threatening communication was further exacerbated by incomplete theoretical knowledge (G.-J. Y. Peters, Ruiter, & Kok, n.d.-b). This resulted in, for example, threatening interventions to not be considered fear inducing; underestimation of what is required to enhance self-efficacy; and overestimation of efficacy levels in the target population. Most participants did not know many behavior change methods, threatening communication sometimes being the only known solution. Participants often believed the target population could help in identifying useful methods, and some relied on advertising agencies, who mainly advocated originality, confrontation, and humor. The complexity of evaluating behavior change interventions often led participants to adopt proxies for effectiveness such as how well-known an intervention was. Finally, working with external organizations sometimes facilitated the choice for threatening communications: funders or intermediary organizations such as schools sometimes preferred threatening communication, and politicians often desired quick and salient, rather than thoroughly researched, interventions (G.-J. Y. Peters, Ruiter, & Kok, n.d.-b).

On the basis of these beliefs, we developed an intervention that aimed to change beliefs regarding the effectiveness of threat communications among of intervention developers, policy makers, politicians, scientists and professionals from advertising agencies. The current paper reports the outcomes of the experimental evaluation of this intervention. We hypothesized that the intervention will cause threat-based persuasive interventions to be evaluated more negatively. In addition, we measured a number of beliefs about threatening communication to verify the conclusions from our qualitative study ("interventions should increase risk perception", "threatening interventions should enhance efficacy", "interventions should use emotion and confrontation", "common sense is reliable in intervention development", and "increasing perceived severity also increases perceived susceptibility"; G.-J. Y. Peters, Ruiter, & Kok, n.d.-b). We hypothesized that participants whose professions are

proximal to the field of behavior change science (i.e., intervention developers and scientists) will hold beliefs that are more in line with the scientific evidence than participants whose professions are further removed from behavior change science (e.g. politicians, managers).

Methods

Design and ethics

This study used a within-subjects design, where we measured participants' initial effectiveness ratings before our manipulation (at t_0), immediately afterwards (at t_1), and after six weeks (at t_2). We chose to employ a within-participants design because we anticipated recruitment to prove challenging (see below). The study was approved by the ethical committee of the faculty of psychology and neuroscience of Maastricht University.

Recruitment

We aimed to recruit participants from five populations of key actors: intervention developers, policy makers, politicians, scientists and professionals from advertising agencies. Because these populations are small but relatively interconnected, we used a snowballing method to recruit participants. We first approached interviewees from the qualitative study we described earlier as well as relevant contacts from our networks, whom we asked whether they would like to participate and/or invite people they knew from one of the key populations. During the data collection phase, we monitored the number of participants from each key population, and we tried to specifically approach more participants from key populations where sample sizes remained low.

Participants

In total, 153 participants started the first phase of the study, 117 completed it (114 of whom provided their e-mail address for follow-up), and 102 completed the second phase (see

Table 1: Sample sizes and characteristics, and associations of self-identified role with dropout during phase 1 (t_0 and t_1), between phase 1 and 2 (t_2), and gender and age at t_0.

	N_{t0}	N_{t1}	N_{t2}	% female	Mean age (SD)
Intervention developer	40	34	31	85%	40.33 (10.95)
Campaign leader	31	24	21	87%	41.39 (9.17)
Advertising professional	5	5	3	60%	40.20 (9.83)
Scientist	27	21	19	74%	38.33 (8.25)
Policy maker	30	21	18	67%	44.00 (10.89)
Manager	15	8	7	53%	50.20 (11.26)
Politician	5	4	3	40%	52.20 (7.40)
Total	153	117	102	75%	42.28 (10.55)
Effect size of association		V = .23	V = .20	V = .29	η^2 = .13
Test statistic for association		χ^2 = 8.39	χ^2 = 5.80	χ^2 = 13.11	F = 3.48
Degrees of freedom		6	6	6	6, 146
Asymptotic p-value		.211	.447	.041	.003
Percentage of cells with count < 5		36%	29%	36%	
Exact p-value		.011	.004	.001	

Note: N_{t0} = nr of participants who started phase 1; N_{t1} = nr of participants who completed phase 1 and association of dropout at t_1 with role; N_{t2} = nr of participants who completed phase 2 and association of dropout at t_2 with role

Figure 1 and the Procedure section). Participants' characteristics, separate per self-identified role, are shown in Table 1. The proportion of participants that dropped out before completing the first and second phase differed significantly between self-identified roles, but only with small effect sizes (Cramèr's Vs of .23 and .20, respectively). Managers, politicians, policy-makers and advertising professionals were slightly more likely to drop out. Three quarter of the entire sample at t_0 was female (75% at t_0, 73% at t_2), and the average age was 42 years (both at t_0 and t_2). At t_0, Thirty-two percent of the participants worked at a national health promoting organization, thirty percent for a regional health promoting organization, eight percent for a company, ten percent for a university, and twenty percent for the government (6% municipal, 2% provincial, and 12% national).

Procedure

Before starting the study, participants arrived at an introductory webpage that explained the background of the study using a mildly misleading coverstory. The coverstory was misleading in that it did not explain that the study focused on threatening communication, instead simply explaining that the study addressed effective behavior change methods, and explained the

procedure. This introduction also explained that starting the study (i.e. clicking the link at the bottom of the page) implied agreement to the informed consent.

The link opened an instance of LimeSurvey (LimeSurvey Project Team / Carsten Schmitz, 2012). On the first page, participants provided their age, gender, employer category, and self-identified role (see Measurements section for details). The next six pages contained hypothetical problem scenarios and intervention descriptions, which participants graded (see JARS/CONSORT flowchart in Figure 1; American Psychological Association, 2008). On the next page, participants' beliefs were measured, and the following page presented the manipulation (i.e. our intervention to influence their beliefs), measured the time participants spent on that page, and assessed whether participants thought the information was clear. Participants were then prompted to assess whether they had understood the information, and were asked whether they were convinced, and if not, why not. The following six pages again contained ratings of (different) hypothetical interventions. Finally, participants were thanked for their participation and their e-mail address was requested so that they could be emailed about the second phase. On this page, participants also had the option of sending 'tell-a-friend' emails to up to five other potential participants.

After six weeks, participants who provided their e-mail address started receiving automated e-mails inviting (reminding) them to participate in the follow-up (Cook, Heath, & Thompson, 2000). Participants received an e-mail every four days (96 hours) until they completed the follow-up or until 10 e-mails had been sent. The e-mail contained a link that participants could press (or copy-paste in their browser) to start the second phase, which consisted of twelve pages where the same interventions were rated as during the first phase of the study. Finally, participants could select a charity to which Maastricht University would transfer € 25,00 as an incentive for participation. When all data were collected, participants were e-mailed a debriefing.

Measurements

Because we anticipated that recruiting participants would be challenging, we invested a lot of effort in keeping the study as brief as possible, while also keeping it interesting. These goals had two consequences: we severely limited the number of variables we measured, and we measured our dependent variable by letting participants rate hypothetical interventions.

First, participants typed in their age and then selected their gender (male or female). They then indicated at what kind of organization they worked (national health promoting organisation, regional health promoting organisation, company, municipal government, provincial government, national government, university, or 'other, please specify'). Finally, participants indicated their role in their organisation (intervention developer, campaign leader [often senior intervention developers], policy maker, manager, politician, scientist, or advertising professional). Then, participants rated six interventions (see Intervention rating section), and then a number of beliefs about different behavior change methods were measured. These beliefs were each measured with one to four statements, each of which was judged as true or false on a five-point scale (save some loss in translation, the five points corresponded to "Absolutely not true", "Mostly not true", "I don't know", "Mostly true" and "Absolutely true"). The statements were averaged into indices for the five beliefs ("interventions should increase risk perception", 4 items, $\alpha = .46$; "threatening interventions should enhance efficacy", 2 items, $\alpha = .80$; "interventions should use emotion and confrontation", 3 items, $\alpha = .51$, "common sense is reliable in intervention development", 2 items, $\alpha = .05$; and "increasing perceived severity also increases perceived susceptibility", 1 item). These statements were not intended to be repeated measures of the same construct, but quite contrarily to tap different aspects to enhance validity. This means that Cronbach's α does not reflect index reliability. A complete list of the statements is provided in Table 3 in the Appendix.

Participants were then shown the page with the manipulation. The server stored the time participants spent on this page. In addition, participants indicated whether they thought the information was clear (1 = "very unclear" to 5 = "very clear"). They were then asked to indicate to what degree they were convinced by the information (1 = "absolutely not" to 5 = "completely"). If their answer was not "completely", they were asked to type in what they did not found convincing. Finally, participants rated interventions for six more scenario's. In the follow-up, participants rated interventions for twelve scenario's.

Intervention rating

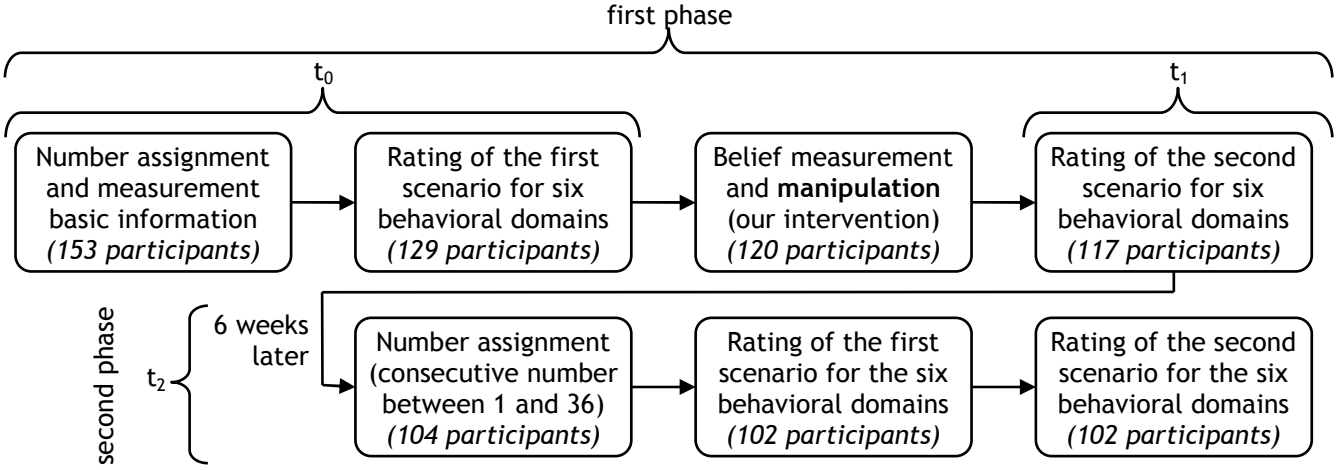
To measure participants' preference for threatening communications, we developed hypothetical problem scenarios, and for each scenario, descriptions of three possible interventions. We developed two scenarios for each of six behavioral domains: smoking, alcohol, exercise & diet, traffic, condom use, and 'bluepox', a hypothetical disease that would necessitate consumption of large quantities of water. The proposed interventions differed in the main determinant they targeted (and therefore, in the behavior change method they employed). The first intervention targeted perceived threat using threatening communication (without addressing efficacy); the second intervention targeted knowledge (often using principles from the elaboration likelihood model or active learning); and the third intervention targeted social cognitive determinants (e.g. subjective norm, self-efficacy or skills, using modeling or another method for these determinants; see Bartholomew et al., 2011). At t_0, participants rated interventions for six scenarios (one for each health problem); at t_1, participants rated interventions for the six remaining scenarios; and at t_2, participants rated interventions for all twelve scenarios (see Figure 1).

The average grade of the threatening intervention was the dependent variable. There were four reasons we included the interventions based on knowledge and social cognitive determinants. First, they allowed us to examine whether judgments would be influenced by

the presence of alternatives. Second, they supported our cover story. Third, we hoped that this comparison of different hypothetical interventions would render the experience more fun, thereby decreasing drop-out. Fourth, they allowed us to examine specificity of the effects of our manipulation. By including the knowledge-based interventions, we could examine whether our manipulation caused participants to also devaluate a non-threatening, but nonetheless probably ineffective intervention (L. W. H. Peters, Kok, Ten Dam, Buijs, & Paulussen, 2009). By including the interventions based on social cognitive determinants, we could examine whether our manipulation also caused participants to rate such theory-based interventions higher (as theory-based interventions have been shown to be more effective than non-theory based interventions; L. W. H. Peters, Kok, Ten Dam, Buijs, & Paulussen, 2009; Webb, Joseph, Yardley, & Michie, 2010). We first showed the threatening intervention in isolation so that participants' grades would not be affected by comparison with the other intervention types. Because we expected that most participants would recognize the intervention based on social cognitive determinants as the most effective, we added this last. Thus, the study was set up to collect intervention grades for interventions in six behavioral domains, for three intervention types, and when no, one or two other interventions were presented (for threat-based interventions; but one or two for knowledge-based interventions, and always two for interventions based on social cognitive determinants).

To minimize order effects, we used a counterbalanced design to present the 12 scenarios. We generated a 6x6 Latin square using the *williams* package (Sailer, 2008) in R (R Development Core Team, 2012; Williams, 1949; see Pezzullo, 1999 for more information). This Latin square is shown in Figure 1. Because we wanted to vary the order differently for the first six scenarios (at t_0) and the last six scenarios (at t_1), we assigned every participant a number between 1 and 36 (consecutively; i.e. the 1st and 37th participants had number 1; the 2nd and 38th participants had number 2, etc). This number determined the order of the

JARS (CONSORT) flowchart illustrating the flow of the participants through the study



All generated hypothetical scenarios (second row) and interventions (third row)

First scenario																		Second scenario																	
A			B			C			D			E			F			A			B			C			D			E			F		
T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S	T	K	S

Behavioral domains: A = diet & exercise, B = bluepox, C = alcohol, D = smoking, E = traffic, F = adherence
Interventions: T = threat-based, K = knowledge-based, S = based on social cognitive determinants

Latin square

1	A	B	F	C	E	D
2	B	C	A	D	F	E
3	C	D	B	E	A	F
4	D	E	C	F	B	A
5	E	F	D	A	C	B
6	F	A	E	B	D	C

Assignment square

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	7	8	9	10	11	12
3	13	14	15	16	17	18
4	19	20	21	22	23	24
5	25	26	27	28	29	30
6	31	32	33	34	35	36

The six routes participants could take

1:	A		B		F			C		E		D											
	T		T	K	T	K	S	T		T	K	T	K	S									
2:	B		C		A			D		F		E											
	T		T	K	T	K	S	T		T	K	T	K	S									
3:	C		D		B			E		A		F											
	T		T	K	T	K	S	T		T	K	T	K	S									
4:	D		E		C			F		B		A											
	T		T	K	T	K	S	T		T	K	T	K	S									
5:	E		F		D			A		C		B											
	T		T	K	T	K	S	T		T	K	T	K	S									
6:	F		A		E			B		D		C											
	T		T	K	T	K	S	T		T	K	T	K	S									

Figure 1: the JARS (CONSORT) flowchart; the overview of all generated interventions; the Latin square that was used to determine the order of the scenarios; the assignment square that was used to assign participants to a row of the Latin square; and the six routes a participant could take (for each row of the Latin square, the behavioral domain order combined with the interventions that were presented to and rated by the participants).

scenarios at t_0 and t_1 based on an assignment square we constructed (see Figure 1). The column in which a participants' number occurred determined which Latin square row was used at t_0, and the row in which the number occurred determined which Latin square row was used at t_1. For example, for the 23rd participant (and the 59th participant, etc), row 5 of the Latin square determined the order in which the behavioral domains were presented at t_0, and row 4 determined the order at t_1 (therefore, at t_0, this participant saw and rated all three interventions for smoking, but only the threatening intervention for diet and exercise). At t_2, for every participant that started the follow-up a new number was generated (again, consecutively), and this number's coordinated in the assignment square in Figure 1 again determined the order of the scenarios. The order of the first six scenarios (which had been presented at t_0 in the first phase of the study) was determined by the column of this participants' number, and the order of the seventh to the twelfth scenario (which had been presented at t_1 in the first phase) was determined by the row of this number. Within each single scenario, we varied the order of the two or three interventions randomly. Ideally, we would have counterbalanced this as well, but we decided against this as we expected that we would not be able to recruit sufficient participants.

The intervention

We attempted to keep the intervention as brief as possible. It consisted of roughly one page of information. This text did three things. First, to target relevant beliefs, it summarized the scientific evidence: threatening communication is ineffective, even potentially counter-effective, unless efficacy is high (mainly based on the outcomes of our meta-analysis, see G.-J. Y. Peters, Ruiter, & Kok, n.d.-a). Second, to explain what should be done instead in an intervention, the text explained that the choice of behavior change method should be based on the relevant determinants, population and context, as well as practical considerations that may prohibit choosing certain methods if the parameters for effectiveness could not be satisfied

(Bartholomew et al., 2011). Finally, the text recommended one method that could generally be applied without danger (modeling).

We decided to include this last recommendation because whereas utilizing threatening communication is often used as some sort of "one-size-fits-all" behavior change method, adequate theory- and evidence based intervention development is generally (and, in fact, correctly) considered a very complicated business. In other words, we expected the self-efficacy of many participants regarding developing true theory- and evidence based interventions to be low. As sufficient self-efficacy is generally regarded as a necessary precondition for behavior (and therefore behavior change; Fishbein & Ajzen, 2010; Fishbein et al., 2001), we deemed it important to offer an easy desirable behavior. Therefore, we included this recommendation to provide participants with a new "one-size-fits-all" solution they could use.

Analyses

Consistent with the notion that "the primary product of any research inquiry is one or more measures of effect size, not *p* values" (J. Cohen, 1990), we calculated Cohen's d to express the strength of associations between means and dichotomous variables (e.g. the difference between means at two time-points). In addition, we tested whether such associations deviated from independence using paired-samples t-tests (i.e. the minimally sufficient analyses; Wilkinson et al., 1999). We report the p-values found in these analyses with a precision of four decimals, as we frequently adjusted the alpha to maintain a family-wise Type 1 error rate of 5%.

Results

Before examining the effects of the manipulation, we examined the beliefs of our target population. We included these beliefs to be able to compare the degree to which these beliefs were held among the target populations. However, only very few politicians (4), managers (9)

and advertising professionals (5) participated in the study. Therefore, we dichotomized the data into two groups: those with jobs closely related to behavior change science (intervention developers, campaign leaders, and scientists) and those with jobs further removed (politicians, policy makers managers, and advertising professionals). We conducted a MANOVA, which yielded a significant omnibus effect ($\eta^2 = .11$, $p = .0133$, $F[5, 121] = 3.02$). We therefore conducted independent samples t-tests to examine differences in beliefs (see Figure 2). Because we conducted five t-tests, we consider an outcome significant when the p-value is lower than .01 to maintain a family-wise error rate of five percent. Participants whose professions were farther removed from the field of behavior change science more frequently believed that increasing severity causes increased susceptibility ($d = 0.56$, $p = .0030$, $t[125] = 3.02$). The direction of the other differences (interventions should increase risk perception, $d = 0.44$, $p = .0187$, $t[125] = 2.38$; threatening interventions should enhance efficacy, $d = 0.31$, $p = .1003$, $t[125] = 1.66$; interventions should use emotion and confrontation, $d = 0.10$, $p = .5852$, $t[125] = 0.55$; and common sense is reliable in intervention development, $d = 0.33$, $p = .0760$, $t[125] = 1.79$) was according to our hypotheses, but these differences did not achieve

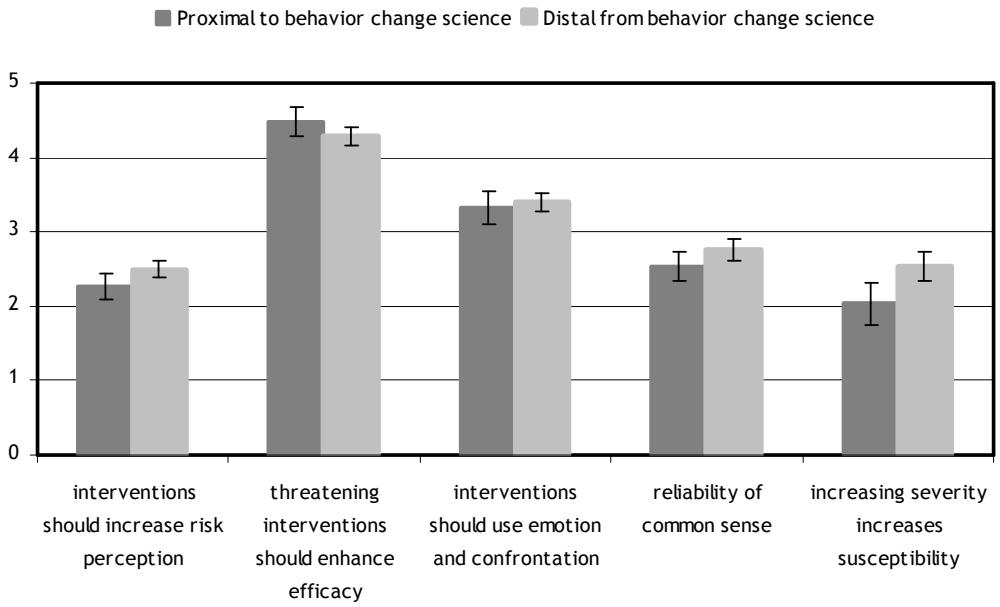


Figure 2: Means and confidence intervals for beliefs regarding threatening communication.

significance.

We then turned to the main research question: was the manipulation effective? Participants stayed on the manipulation page on average for 8:00 minutes, and indicated that they found the information clear (mean = 4.34, SD = 0.73) and convincing (mean = 4.18, SD = 0.87). Before collapsing the grades over behavioral domains, we attempted to establish whether threatening interventions were consistently rated higher or lower within some behavioral domains. However, the fact that all 36 hypothetical interventions we developed were different (three interventions for each of the six behavioral domains for each of the two scenarios, see Figure 1) already causes variation in grades between the interventions. Therefore, a test for variation between behavioral domains would only be meaningful if the variation in grades between behavioral domains was larger than the variation in the difference of grades for the two different interventions within each behavioral domain (i.e. in the first versus second scenario, see Figure 1). The data from t_2 could be used to examine these variations (in the first phase of the study, the manipulation took place between t_0 and t_1, so comparison of the scenario versions would be confounded by the effects of the manipulation).

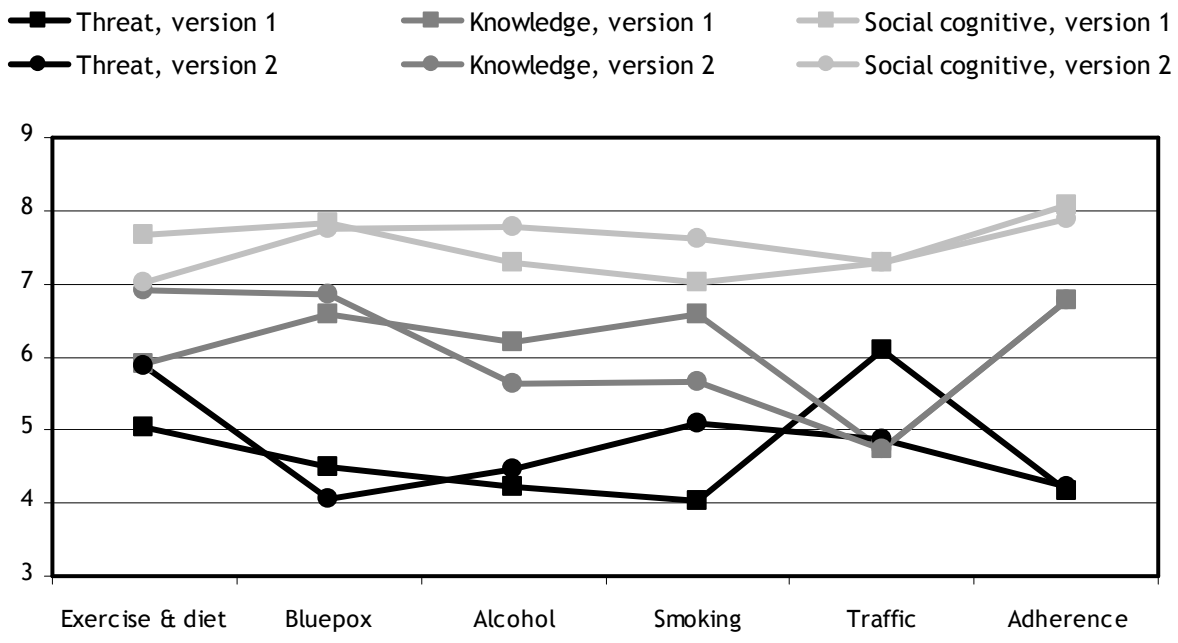


Figure 3: Mean intervention grades for each scenario version in each behavioral domain at t_2.

Figure 3 shows the mean intervention grades for each scenario version for each behavioral domain. None of the analyses of variance comparing the variance between behavioral domains to the variance between scenario versions achieved significance, indicating that interventions were not graded differently across behavioral domains. Therefore, intervention grades were collapsed over behavioral domain and scenario version.

Subsequently, we examined whether it mattered how many other interventions were rated simultaneously. The mean intervention ratings are shown in Table 4 in the Appendix, as are effect sizes and significance tests of the difference between rating in isolation, or simultaneously with one or two other interventions. Because we conducted 12 t-tests, we consider an outcome significant when the p-value is lower than .0043 to maintain a family-wise error rate of five percent. When looking at the rating of threatening interventions, at t_0, participants tend to rate threat-based interventions slightly higher when rated simultaneously with knowledge-based interventions ($d = 0.27$, $p = .0020$, $t[139] = 3.15$), an effect that disappears when all three interventions are rated simultaneously. At t_1, just after the manipulation, this effect reverses ($d = -0.42$, $p < .0001$, $t[119] = 5.76$), and at t_2, threatening interventions are rated the same regardless of whether they are rated in isolation or together with other interventions. When looking at knowledge-based interventions, these are rated higher when only rated simultaneously with threatening interventions than when also rated

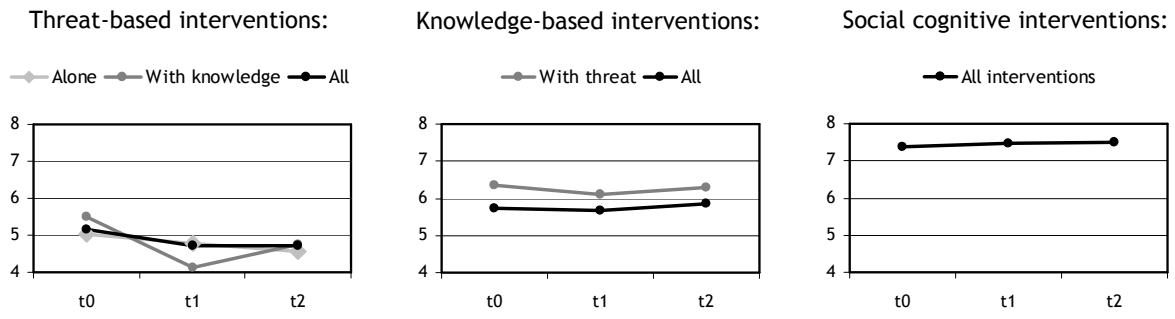


Figure 4: Mean intervention ratings when interventions were rated in isolation, simultaneously with one other intervention, or simultaneously with two other interventions, at each time-point.

simultaneously with interventions based on social cognitive determinants (d = 0.51, p < .0001, t[135] = 5.14).

Because of these differences, we tested the effect of our manipulation separate for all three situations: when the threatening interventions were rated in isolation, together with the knowledge-based intervention, and together with both other interventions (see Figure 4 for a visual representation of these means; we did also conduct a repeated measures ANOVA on the three means obtained when disregarding the number of simultaneously rated interventions: $\eta^2 = .14$, $p < .0001$, $F_{lower\text{-}bound}[1, 102] = 16.88$). Table 2 shows the means, standard deviations, and differences between intervention ratings at the three time-points. The difference between ratings at t_0 and t_1 reflects the effect of the manipulation and the difference between ratings at t_0 and t_2 reflects the degree to which this effect is sustained after six weeks. Because we conducted 16 t-tests, we consider an outcome significant when the p-value is lower than .0032 to maintain a family-wise error rate of five percent. At t_0, all intervention types were rated differently, with the largest differences between the interventions based on knowledge and social cognitive determinants (d = 1.77, p < .0001, t[102] = 11.92) and between the interventions based on threat and social cognitive determinants (d = 1.72, p < .0001, t[135] = 13.13), and smaller differences between the interventions based on threat and knowledge when only these two were rated (d = 0.65, p < .0001, t[139] = 5.18) and when all three were rated simultaneously (d = 0.42, p = .0003, t[135] = 3.76).

Table 2: Means and standard deviations for the intervention ratings separated by intervention type and number of interventions rated simultaneously, as well as differences between ratings at each time-point.

		t_0		t_1		t_2		t_0-t_1			t_0-t_2		
Type	S	mean	(sd)	mean	(sd)	mean	(sd)	d	p	t^*	d	p	$t^\dagger$
Threat	0	4.97	(1.82)	4.78	(1.51)	4.58	(1.46)	0.12	.1981	1.29	0.20	.0399	2.08
	1	5.43	(1.47)	4.12	(1.66)	4.75	(1.49)	0.83	.0000	8.91	0.38	.0011	3.37
	2	5.12	(1.62)	4.71	(1.40)	4.71	(1.47)	0.28	.0023	3.12	0.22	.0460	2.02
Knowldg.	1	6.41	(1.20)	6.09	(1.26)	6.31	(0.99)	0.25	.0237	2.29	0.10	.3382	0.96
	2	5.69	(1.19)	5.69	(1.19)	5.86	(0.96)	0.09	.4164	0.82	-0.10	.3800	-0.88
SCD	2	7.43	(0.95)	7.46	(1.10)	7.51	(0.83)	-0.03	.7381	-0.34	-0.11	.3140	-1.01

Type = intervention type (based on threat, knowledge, of social cognitive determinants); S = number of other interventions presented simultaneously; * Df = 118; † Df = 102

Interestingly, the effect of the manipulation depended on which interventions were rated simultaneously (see Table 2). Ratings of threat-based interventions did not decrease over time when they were rated in isolation ($d_{t_0\text{-}t_1} = 0.12$, $d_{t_0\text{-}t_2} = 0.20$) or simultaneously with both other intervention types ($d_{t_0\text{-}t_1} = 0.28$, $d_{t_0\text{-}t_2} = 0.22$). However, when the threat-based and knowledge-based interventions were rated simultaneously, there was a large drop in ratings for threat-based interventions ($d_{t_0\text{-}t_1} = 0.83$) that had not yet completely disappeared after six week ($d_{t_0\text{-}t_2} = 0.38$). The manipulation did not influence participants' ratings of interventions based on knowledge or social cognitive determinants (ds < .25). We computed correlation coefficients for the association between the difference in intervention ratings between t_0 and t_1 and between t_0 and t_2 (12 ratings) and how long participants stayed on the page where the manipulation was presented, whether participants indicated that they thought the information was clear, and whether they indicated that they were convinced. Of these 36 correlation coefficients, only one correlation was significant: whether participants indicated that they were convinced was correlated to the short-term effect when the threat-based intervention was rated simultaneously with the knowledge-based intervention (the largest effect, see Table 2; r = -.227, p = .0130; note that alpha is .0014 when correcting for the 36 significance tests).

Discussion

The current paper reported the evaluation of a minimal intervention that targeted intervention developers, policy makers, politicians, scientists and advertising professionals. The intervention effectively decreased participants' ratings of threat-based interventions, but only when participants simultaneously rated a knowledge-based intervention. The effect weakened over time but had not yet completely dissipated at the six weeks follow-up.

Perhaps the most curious finding was that the rating of threat-based interventions depended on the available alternatives, especially because this effect disappeared when threat-based intervention were rated simultaneously with both an intervention based on knowledge and on social cognitive determinants. Lower ratings for threat-based interventions when rated simultaneously with other interventions would be consistent with previous findings (G.-J. Y. Peters, Ruiter, & Kok, n.d.-b), and would confirm that one of the reasons that threat-based interventions are still popular is the lack of alternatives. The finding that our intervention had no effect on the rating of threat-based interventions when they were rated in isolation supports this theory. However, this theory is inconsistent with two other findings. First, the threat-based interventions were rated similar when two alternatives were available as when rated in isolation. Second, at t_0, the threat-based intervention was rated *higher* when rated alongside the knowledge-based intervention. Given the low effect size and the relatively high p-value, it is possible that the higher rating at t_0 was a Type 1 error. Even then, though, there is no explanation for the fact that when the intervention based on social cognitive determinants is introduced, the threat-based intervention is rated higher again. This clearly warrants further investigation.

In addition to the evaluation of our intervention, we examined a number of beliefs that were identified in an earlier study (G.-J. Y. Peters, Ruiter, & Kok, n.d.-b). We expected that these beliefs would be held to a stronger degree among participants whose professions were less proximal to the field of behavior change science (e.g. politicians). We only found partial support for this association: although all associations were in the expected direction, with small to medium effect sizes, only one achieved significance. It is possible that this reflects a power problem, especially since we corrected alpha downward to maintain a family-wise Type 1 error rate of five percent, but only new studies can confirm this.

This low statistical power, and more specifically, the low number of participants, is among the main limitations of this study. Although recruitment of intervention developers, campaign leaders, policy makers en scientists was quite successful, the recruitment of politicians, managers and advertising professionals failed. This considerably limited both the analyses we could conduct and the power we had in those analyses. A second limitation is strongly related to these recruitment problems: because we depended in part on snowballing for our recruitment, we prioritized survey brevity quite highly. Because of this, our measures were few and relatively unreliable (i.e. we did not include items to measure constructs repeatedly to decrease measurement error). This decreased our power for the belief analyses further. Finally, a limitation was that our outcome measure (intervention rating) may not resemble actual behavior change intervention decision-making. On the other hand, the fact that the threat-based intervention was consistently rated low, and the intervention based on social cognitive determinants was consistently rated high, does suggest a certain validity of this measure.

Although we found a large effect of our intervention, participants still gave threat-based interventions a rating over four on a ten-point scale, seconds and minutes after having read the information constituting our intervention. This information contained sentences such as "avoid threatening communication; avoid confrontation, avoid emotional messages, and try not to shock" and "other studies showed that other methods for behavior change are considerably more effective than threatening communication (in fact, the use of threatening communication often had a counteractive effect, decreasing the effectiveness of an intervention)". We had expected, especially immediately post-intervention, that the ratings of threat-based interventions would be much lower. This resistance to scientific evidence is somewhat worrying, but not inconsistent with evidence from other domains: medical professionals have also been shown resistant to influence by empirical evidence (Keijsers,

Meertens, Bouter, Kessels, & Knipschild, 1992; Rovers et al., 2012). At the same time, there is some evidence that more elaborate interventions can have an effect (Boonacker, Hoes, Dikhoff, Schilder, & Rovers, 2010); perhaps there is a need for a more powerful intervention than one that only informs professionals of the evidence and provides an alternative.

In all, this study uncovered a lot of venues for future research that are not only interesting but also urgent. This urgency stems mainly from the fact that, given the risks of threat-based interventions, many lives and resources can be saved when politicians, policy makers, managers, campaign leaders and intervention developers resort to alternative behavior change methods. The fact that the current study is the first to examine these key populations' evaluations of behavior change interventions means that there remains a lot to discover before more effective interventions can be developed that target these populations. Ultimately, however, as the science of behavior change accumulates an evidence base that enabled the development of ever more effective behavior change interventions, attention will have to shift towards ways to disseminate this evidence.

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Appendix

Table 3: Raw means and standard deviations for the belief measures within each role.

Belief	Statement	Intervention developers (n = 35) Mean (SD)	Campaign leaders (n = 26) Mean (SD)	Policy makers (n = 27) Mean (SD)	Managers (n = 9) Mean (SD)	Politicians (n = 4) Mean (SD)	Scientists (n = 21) Mean (SD)	Advertising professional (n = 5) Mean (SD)	Mean Mean (SD)
Threatening interventions should enhance efficacy	If you present confronting information, you also have to tell people what the desired behavior is	4.54 (0.74)	4.46 (0.51)	4.26 (0.86)	4.33 (0.50)	3.75 (1.26)	4.38 (0.59)	4.80 (0.45)	4.41 (0.71)
Interventions should increase risk perception (reversed)	One of the most important reasons why people exhibit unhealthy or risky behavior is that they have a hard time exhibiting the right behavior, not that they do not see the risks	4.23 (0.55)	4.19 (0.85)	4.04 (0.85)	4.22 (0.44)	3.50 (1.00)	3.95 (0.80)	4.00 (0.00)	4.10 (0.73)
Interventions should use emotion and confrontation	Confronting communications draws attention	3.37 (1.11)	3.81 (0.90)	3.48 (0.98)	3.00 (1.00)	4.00 (0.82)	3.57 (1.03)	4.20 (0.45)	3.54 (1.01)
Interventions should use emotion and confrontation	People remember emotional communications better	3.40 (0.77)	3.88 (0.65)	3.70 (0.91)	3.33 (1.00)	4.00 (0.82)	3.71 (0.85)	4.20 (0.45)	3.66 (0.82)
Interventions should use emotion and confrontation	Communication that evokes emotions leads to self-reflection regarding the relevant behavior	2.63 (0.88)	3.12 (0.95)	3.07 (1.00)	2.89 (1.17)	3.00 (0.82)	2.71 (0.90)	2.60 (0.89)	2.87 (0.95)
Reliability of common sense	Regarding behavior change interventions, you have to assume that people think and act logically on the basis of new information	1.83 (0.71)	2.00 (0.94)	2.19 (0.92)	1.67 (0.71)	2.50 (1.00)	1.43 (0.75)	1.60 (0.55)	1.87 (0.85)
Reliability of common sense	When thinking about health promotion interventions it's often useful to stop to think how something would affect you yourself	3.29 (1.07)	3.27 (1.15)	3.41 (1.12)	3.67 (1.00)	4.00 (0.00)	3.29 (0.96)	3.00 (1.00)	3.35 (1.05)
Interventions should increase risk perception	One of the most important aspects of intervention is increasing risk perception	2.77 (1.11)	3.12 (0.95)	3.11 (0.89)	3.22 (1.20)	3.75 (0.96)	3.10 (1.04)	3.00 (1.41)	3.04 (1.03)
Interventions should increase risk perception	People who behave unhealthily or riskily are usually not sufficiently aware of the potential negative consequences	2.34 (0.97)	2.35 (0.98)	2.48 (0.94)	3.00 (1.22)	2.75 (0.96)	2.19 (0.87)	2.20 (0.45)	2.40 (0.95)
Increasing severity increases susceptibility	If you sufficiently emphasize the severity of potential negative consequences of behavior, people become aware that it can happen to them too	1.89 (0.83)	2.15 (1.01)	2.41 (0.93)	2.67 (1.00)	3.00 (0.82)	2.14 (0.73)	2.60 (0.89)	2.21 (0.91)
Interventions should increase risk perception	People who exhibit unhealthy behavior are usually quite able to behave differently; they just don't understand the risks	2.03 (0.82)	2.15 (0.67)	2.22 (0.75)	2.22 (0.67)	2.75 (0.96)	1.57 (0.51)	2.20 (0.45)	2.06 (0.74)
Threatening interventions should enhance efficacy	If you present threatening information about a behavior, you also have to tell people how they can address that behavior	4.51 (0.74)	4.38 (0.50)	4.33 (0.55)	4.33 (0.50)	3.50 (1.00)	4.52 (0.60)	4.60 (0.55)	4.41 (0.63)

Table 4: Mean interventions ratings and effect sizes and significance levels of the difference between rating in isolation and simultaneously with one or two other interventions.

	Intervention based on threat			Intervention based on knowledge			Intervention based on social cognitive determinants		
	t0	t1	t2	t0	t1	t2	t0	t1	t2
1. Rated in isolation	5.02	4.78	4.58						
2. Rated with one other intervention	5.50	4.12	4.75	6.37	6.09	6.31			
3. Rated with all other interventions	5.15	4.71	4.71	5.73	5.69	5.86	7.36	7.46	7.51
Difference between 1 and 2									
d	-0.27	0.42	-0.12						
p	.0020	.0000	.0636						
t	-3.15	5.76	-1.88						
Df	139	118	102						
Difference between 1 and 3									
d	-0.08	0.05	-0.09						
p	.3833	.5936	.1779						
t	-0.87	0.54	-1.36						
Df	135	118	102						
Difference between 2 and 3									
d	0.22	-0.38	0.03	0.51	0.33	0.62			
p	.0057	.0000	.6787	.0000	.0006	.0000			
t	2.81	-5.70	0.42	5.14	3.54	5.14			
Df	135	118	102	135	118	135			