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Health Message Framing Effects on Attitudes, Intentions, and Behavior: A Meta-Analytic Review

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Abstract

Background: Message framing has been an important focus in health communication research, yet prior meta-analyses found limited support for using message framing to increase the impact of health intervention messages.

Purpose: The present meta-analysis focused on the specific outcomes used to assess the persuasive impact of framed health messages (attitudes, intentions, or actual behavior).

Methods: Literature searches and prior meta-analyses identified 189 effect sizes from 94 studies which compared the persuasive impact of gain- and loss-framed messages. All effect sizes were obtained from peer-reviewed, published studies.

Results: Gain-framed messages were significantly more likely than loss-framed messages to encourage illness prevention behaviors overall (r = .083, p =.002). This effect was most apparent in the domains of skin cancer prevention (r = .237, p<.001), smoking cessation (r = .198, p<.001), and physical activity (r = .160, p<.001). No significant effect of framing was found when persuasion was assessed by attitudes or intentions, or among studies encouraging detection behaviors (all p's > .05).

Conclusions: Gain-framed messages appear to be more effective than loss-framed messages in promoting illness prevention behaviors on the whole, and skin cancer prevention, smoking cessation, and physical activity behavior in particular. Future research should continue to examine the contexts in which loss-framed messages are most likely to promote illness detection behaviors, as well as the factors that mediate the effect of framing on prevention behavior.

Keywords: message framing, persuasive communication, attitudes, intention, behavior, health

Health Message Framing Effects on Attitudes, Intentions, and Behavior: A Meta-Analytic Review

Public health advocates often use persuasive messages as one strategy to motivate people to adopt healthy behaviors or modify unhealthy ones. Accordingly, the most recent report published by the United States Office of the Surgeon General, *Healthy People 2020*, details the importance of research and evaluation as an aid in the development of these health communication programs (1). In accordance with this objective, researchers have sought to take advantage of the important interplay between theory and practice in designing effective health communication strategies. One consideration in the communication of health information is how the behavior recommendations and health outcomes in a message are framed.

Health Message Framing

Health messages can be framed to highlight either the benefits of engaging in a particular behavior (a gain-frame) or the consequences of failing to engage in a particular behavior (a loss-frame). For example, a gain-framed message aimed at increasing exercise might be “Exercising regularly can help you lose weight”. On the other hand, a loss-framed message might be “Not exercising regularly can make you gain weight”. This simple variation in how health information can be framed is important because research has shown that although often conveying essentially identical information, one type of message frame may be more effective than another at promoting health behavior change (2).

The apparent phenomenon, whereby essentially identical information can have differential effects on people’s choices depending on how it is framed, originated out of work on Prospect Theory (3). The framing postulate of Prospect Theory proposes that when faced with two choices – one posing little risk and one posing some higher degree of risk – a person’s preference for one option over the other will be influenced by the manner in which the choices are framed. If the choices emphasize potential losses, individuals are often willing to choose a risky option to prevent those losses. However, if the choices emphasize potential gains, individuals are generally less willing to choose options involving risk to secure those gains.

Rothman and Salovey (2) applied this reasoning to how people might respond to framed health messages. In particular, they suggested that gain-framed messages should be more effective than loss-framed messages for promoting health behaviors perceived to be only minimally risky to carry out. For health behaviors perceived to have some higher degree of risk associated with performing them, loss-framed messages should be more effective. Specifically, Rothman and Salovey (2) proposed that the function of a behavior can suggest how risky people are likely to view performing the behavior to be. Behaviors that serve an illness *prevention* function (i.e., physical activity) should often be viewed as involving very little risk, because as Rothman and Salovey suggest, the only thing risky about them is not engaging in them. On the other hand, behaviors that serve an illness *detection* function (i.e., mammography) should be more likely to be viewed as involving a higher degree of risk because of the possibility that a serious illness could be discovered. In this respect, Rothman and Salovey (2) proposed that the underlying function of a health behavior should serve as a useful heuristic for the perceived riskiness of a health behavior, and should moderate people's responses to framed messages. Specifically, they proposed that gain-framed messages should be more persuasive for illness prevention behaviors, and loss-framed messages should be more persuasive for illness detection behaviors.

Previous Reviews

To date, Rothman and Salovey's (2) hypotheses have been the dominant predictions in health message framing research. A number of reviews of the health message framing literature have recently appeared (4-7), two of these being the first meta-analyses specifically examining the role of framing in promoting preventive health behaviors (6) and detection health behaviors (7). These reviews (6,7) report finding limited support for Rothman and Salovey's (2) predictions regarding the role of health behavior function. For preventive health behaviors, there was a significant but weak advantage of gain-framed messages over loss-framed messages (effect size $r = .032$, $p = .015$). In particular, the strongest effects were found for studies that promoted preventive dental hygiene behaviors ($r = .154$), while other effect sizes ranged from $r = .018$ (safe sex behaviors) to $r = .110$ (exercise). Excluding dental hygiene behaviors from the analysis, no significant advantage of either a gain- or loss-framed message was observed for the preventive health behaviors examined.

Similar conclusions were drawn in a review of detection health behaviors (7). Loss-framed messages showed a significant but also weak advantage over gain-framed messages ($r = -.039$, $p = .020$). Again, one type of behavior (breast cancer detection, $r = -.056$) appeared to anchor the loss-frame advantage. Excluding breast cancer studies from the analysis, no significant advantage of either a loss- or gain-framed message was observed from the remaining subset of studies.

As has been noted elsewhere (8), an important limitation of these prior reviews is that they failed to distinguish among the various outcomes with which researchers have operationalized the "persuasiveness" of framed health messages. Many studies have used immediate measures of attitudes towards a health behavior or intentions to engage in a behavior as the primary outcome of interest. Far fewer studies have attempted to assess actual behavior change as a measure of persuasiveness. It is well-known that there is often a disconnect between people's attitudes, intentions and their behavior (9), and eliciting a change in one's immediate intentions may reflect different psychological processes than eliciting a change in a person's behavior. For an interventionist, influencing behavior is the primary aim. Yet in prior reviews (6,7), when studies included multiple outcomes, the analyses focused on measures of immediate attitudes and intentions rather than behavior as their outcomes. Thus, an important gap in the health message framing literature is a review of the influence of gain- and loss-framed messages on health behavior, not simply attitudes and intentions (8).

Present Review

The aim of the present review is to provide an updated review of health message framing research, with a focus on studies that assess health behavior as an outcome. We examined the persuasiveness of framed health messages in a manner that recognizes the gap often noted between intentions and behavior (9). We ran separate analyses for measures of persuasion that are most often indicative of immediate cognitive responses to framed messages (i.e., attitudes and intentions) and those that are indicative of more meaningful behavioral responses. Consistent with Rothman and Salovey (2), we predicted that gain-framed messages would be most likely to promote the adoption of preventive health behaviors, whereas loss-framed messages would be most likely to promote the adoption of detection health behaviors.

Method

Identification of Studies

Literature search. Studies were identified using one of two search methods. A bulk of the studies in the current review were identified through an examination of the reference lists from previous reviews (4-7). In addition, we conducted our own literature search in order to identify studies that succeeded the previous reviews. Specifically, we mirrored the previous literature searches performed by O'Keefe and Jensen (6, 7) using identical key terms (*framing, framed, frame, appeal, message, persuasion, persuasive, gain, positive, positively, benefit, loss, negative, negatively, threat*, and *valence*) in an interdisciplinary set of computerized databases (Academic Search Premier, Alt Health Watch, CINAHL Plus, EBSCO, ERIC, Health Source, MEDLINE, PsycINFO, Psychology and Behavioral Sciences Collection, and PUBMED) current through at least February 2011. If available, we also examined the 'online first' table of contents for the most commonly referenced journals in the previous reviews (*British Journal of Health Psychology*, *European Journal of Communication*, *Health Psychology*, *Journal of Applied Social Psychology*, *Journal of Communication*, *Journal of Experimental Social Psychology*, *Journal of Health Communication*, *Journal of Health Psychology*, and *Psychology & Health*). The initial search yielded close to 300 citations. After excluding duplicate search results, studies already identified from previous reviews, and those that did not meet our inclusion criteria (see next section), 27 of these were relevant to our current review and included in the main analyses alongside studies from the previous reviews (an asterisk [*] in Table 1 denotes studies not included in previous reviews).

Inclusion criteria. Studies had to meet a total of five criteria to be included in the present analysis. First, studies had to be published in English and in a scholarly, peer-reviewed journal. Unlike some prior reviews (5-7), dissertations, theses, and presentations were excluded. We chose only to include published, peer-reviewed papers to enhance the quality of the studies included in our analyses, and to allow for replication of our search methods. To address potential publication bias that might arise as a result of this, we performed a diverse set of publication bias analyses, reported alongside any relevant results.

Second, similar to previous reviews of health message framing (6,7), studies needed to compare gain-framed messages (emphasizing the positive outcomes of engaging in a health behavior) with loss-framed messages (emphasizing the negative outcomes of failing to engage in a health behavior)[1]. Studies not examining a health prevention or illness detection behavior (i.e., sleep-related car crashes [10]; oocyte donation [11]) were excluded. Third, messages included in the analyses had to be representative of health promotion information that would be suitable for integration into actual health communication interventions. For example, messages that were manipulated to be intentionally weak or to be from intentionally non-credible sources were excluded (i.e., low credibility conditions; 12-14). Fourth, studies had to report primary data analysis. For studies that published several papers from one set of data, only the primary data analyses were included (i.e., 15). Reports of secondary data analysis where we had already included the primary analyses (i.e., 16, 17) were excluded.

Finally, measures of persuasion had to be in the form of attitudes, intentions, or behavior (self-reported or objective) with sufficient quantitative data available to estimate an effect size. Studies in which persuasion was measured in a proxy manner (i.e., making health decisions for a parent [18]; making health decisions for other students [19]) were excluded. Studies in which persuasion was measured in a form other than attitudes, intentions, or behavior (i.e., interest in a health behavior [20]) were also excluded. In situations where the appropriate quantitative data was not available from a published report, but a study met all other inclusion criteria, contact with the primary author of the report was attempted and the study was excluded if no response was given (i.e., 21, 22)

Outcome Variables and Effect Size Measures

Outcome variables. Persuasion was assessed through measures of attitude towards the behavior, behavioral intention, or actual behavior. Typically, health message framing studies employ a single type of outcome measure. However, unlike previous reviews by O'Keefe and Jensen (6-7), studies that reported multiple measures of persuasion (i.e., both intentions and behavior) were not averaged together into a single summary effect size. Rather, an effect size was calculated for each measure of persuasion reported (attitudes, intentions, and behavior) and a separate analyses was performed for each type of outcome.

Effect size measure. The effect size *r* was used to summarize the comparison between each gain-framed message and its loss-framed equivalent. When the calculated difference between the messages favored the gain-framed message, the effect size was given a positive sign (+). When the difference favored the loss-framed message, a negative sign (-) was used.

Coded Factors

Coding of all studies was completed independently by the authors, with any discrepancies resolved through discussion. Each study was coded for the following characteristics: (a) the *function* of the advocated health behavior (prevention or detection) (b) the *domain* of the advocated health behavior (breast cancer, skin cancer, oral health, diet, physical activity, general obesity prevention, safe sex, heart disease, smoking, virus/vaccines, or other), (c) the combined *sample size* of the gain- and loss-framed message conditions (with a range from 16 to 6,552), (d) the effect size of the gain- versus loss-framed comparison on all relevant outcomes, (e) the timeframe of the outcome assessment (immediate vs. at a follow-up), (f) the average age of the population, and (g) the message modality (print, audio, or video). Only characteristics (a) through (e) are reported herein, as no meaningful moderation was found for characteristics (f) and (g).

Meta-Analytic Procedures

Effect sizes were analyzed using a random effects model. A random effects model assumes that between-study differences in effect sizes arise due to between-study differences in populations and methods rather than due solely to sampling error. While more prone to producing a Type II error than a fixed effects model, a random effects model is considered a more conservative approach (23) and appropriate when a large number of studies are available.

Using the Comprehensive Meta-Analysis software program (24), separate analyses were completed for each type of persuasion outcome. In each of these analyses, the independence of effect sizes was preserved by allowing each study (or each independent sample) to only contribute one effect size to each type of outcome. For instance, if a study reported two attitude measures, the mean of those attitude measures was used as the effect size for that particular study in the attitude analysis. These cases, where multiple measures of the same outcome have been combined, are noted in Table 1 with a dagger symbol (†) . Thus, each study (or each sample) could contribute a maximum of three effect sizes. For analytic purposes, each effect size correlation was transformed to a Fisher's *z.* However, for purposes of presentation and interpretation, the results were then transformed back to the effect size correlation, *r* (25).

We assessed for the potential influence of publication bias by taking a number of approaches that ask different questions about the data. We first used a rank correlation test (26) to obtain the Kendall's tau rank correlation coefficient, the statistical equivalent of the funnel plot (which plots effect size against variance), in order to assess the presence of *any* relationship between an effect size and its associated variance, which could suggest that studies reporting stronger effect sizes with a smaller sample were more likely to be published. As the rank correlation test is generally uninformative when the number of effect sizes are small, we only pursue publication bias analyses when more than 10 effects size are available for a given analysis (27). When a summary effect size was found to be significant and the rank correlation suggested the presence of possible bias, we further examined the extent to which publication bias could be *exclusively* responsible for our findings by performing a number of additional tests. First, we conducted Rosenthal's (28) "file drawer analysis". This analysis yields the "fail-safe N", which provides an estimate of the number of non-significant unpublished studies needed to nullify a significant meta-analytic effect size. Next, we used the nonparametric iterative "trim and fill" procedure suggested by Duval and Tweedie (29) to determine *how much* impact publication bias may have had on our significant findings and to provide an estimate of the effect size in question had there been no publication bias. Last, we examined whether there was any relationship between the year of publication and the magnitude of an effect size, to test whether there was a temporal trend in stronger effect sizes being published as the message framing literature evolved.

Results

Does the Function of a Health Behavior Moderate Framing Effects?

Rothman and Salovey's (2) underlying prediction was that the prevention vs. detection function of a health behavior should moderate the influence of gain- and loss-framing on the persuasiveness of health messages. Contrary to this prediction, we observed no significant moderating effect of function on the persuasiveness of health messages when persuasiveness was assessed as either attitudes towards the behavior ($Q(1) = 1.209$, $p = .272$) or intentions to perform the behavior ($Q(1) = 1.588$, $p = .208$).

However, a significant moderating effect of function was found when persuasive impact was assessed as behavior ($Q(1) = 11.635$, $p = .001$). Thus, the effect of gain- vs. loss-framing on health *behavior* was dependent on the function of the advocated behavior. Next, we detail the effects of framing within prevention and detection behaviors.

Illness Prevention Behaviors

Effects on attitudes and intentions. There was no significant effect of framing on attitudes among studies that examined a prevention behavior ($k = 45$; $r = .039$, $p = .149$) (see Table 2). Similarly, there was no significant effect of framing on intentions among studies that examined a prevention behavior ($k = 46$; $r = .028$, $p = .171$). Thus, when examining both attitudes and intentions as outcomes, our results largely replicate those reported by O'Keefe and Jensen (6,7).

Effects on behavior.[2] The size of the persuasive effect of gain- versus loss-framed messages *did* differ significantly among studies that employed measures of actual behavior. Among prevention behaviors, the persuasive effect of gain-framed messages was significantly different than that of loss-framed messages ($k = 32$; $r = .083$, $p = .002$), consistent with the predictions of Rothman and Salovey (2). Furthermore, the method of behavioral assessment (self-reported; $k = 19$; $r = .092$, $p = .003$ vs. objective; $k = 13$; $r = .073$, $p = .110$) did not significantly moderate this effect ($Q = .120$, $p = .729$).

As Table 3 shows, a further breakdown within the prevention behavior category revealed that the difference in persuasive effects between the gain- and loss-framed messages was most apparent in the domains of smoking ($k = 3$; $r = .198$, $p < .001$), skin cancer prevention ($k = 2$; $r = .237$, $p < .001$), and physical activity ($k = 6$, $r = .160$, $p <.001$). A safe sex study ($k = 1$, $r = .081$, p = .11) also contributed to the notable framing effects. In contrast, studies of diet ($k = 7$, $r =$ -

.014, p = .81) and a study of vaccination showed the weakest effect of framing (k = 1, r = -.015, p = .226). However, as Table 3 shows, in no case was there a significant loss-frame advantage within any specific domain of prevention behavior.

Publication bias. We assessed the possible influence of publication bias on the summary effect size for each outcome in the illness prevention category. As indicated by the non-significant Kendall's tau rank correlation coefficients in Table 2 (p's >.05), there appeared to be no evidence of publication bias for the studies that examined the effect of framing on prevention attitudes or intentions. For studies that examined the effect of framing on prevention behaviors, the rank correlation coefficient approached significance (Kendall's tau b = -.171, one tailed p = .084), suggesting that some bias may be present (26).

When examining the *extent* to which publication bias may have been responsible for this significant effect, however, both the file drawer analysis (27) and the trim and fill analysis (28) suggested a negligible influence of publication bias. The fail-safe N, or the number of missing studies needed to nullify these significant findings, was 208, which exceeds the recommended cutoff of 5k+10, or 170 (27). Further, no values were imputed using the trim and fill procedure, yielding identical values for the summary effect size as in our original analyses. We also examined whether the magnitude of the effect of framing on prevention behavior was related to year of publication. One might expect, for example, that more recent studies would require stronger effect sizes in order to be published, compared to earlier studies. A meta-regression found no significant influence of publication year on the magnitude of the effect of framing on prevention behavior (p = .69). Taken together the results of these analyses suggest that, as a class of behaviors, the findings for prevention behaviors were not likely the result of publication bias.

Within-study comparisons of effect sizes. Seventeen studies assessed prevention behavior as well as attitudes and intentions, enabling a direct comparison of differences in effect sizes among outcome measures while eliminating between-study differences inherent in the prior analyses. For each of the 17 studies, a contrast effect size was calculated that represented the difference between the behavioral effect size and the effect size on attitudes and/or intentions. For studies reporting both attitudes and intentions, a combined attitudes/intentions effect size was used to simplify analysis and presentation. Based on prior meta-analytic findings (30), we estimated the correlation between intentions and behavior to be .50 and attitudes and behavior to be .25, and followed procedures detailed by Rosenthal and Rubin (31) to estimate the contrast effect size while accounting for these correlations among multiple outcomes. Given the relatively small number of studies and our interest in determining whether the contrast effect size was significant within the pool of 17 selected studies, a fixed effect procedure was used to test the significance of the summary contrast effect size.

This analysis showed a slightly greater magnitude of framing effect for behavioral outcomes compared to attitudes/intentions (summary contrast effect size, $r = .026$; 95% CI = -.013, -.064), although this contrast was not statistically significant ($p = .19$). While this non-significant contrast suggests similar magnitude of framing effects on behavioral compared to attitudinal/intentional outcomes, we also note that in more than half of these studies, the behavioral outcome was assessed a week or even a month or more later than the attitudinal/intentional measures (32, 33, 34, 35, 36, 37, 38, 39, 40, 41). Thus, the statistically similar effect size is noteworthy, given that the passage of time may have been more likely to attenuate the effect of framing on behavioral outcomes compared to the immediate attitudinal/intentional outcomes.[3] It is important to note that even among these 17 studies that assessed both attitudes/intentions and behavior, there appeared to be a notable disconnect between attitudes/intentions and behavior, as only one study (42) reported that the effects of gain vs. loss framing was mediated by attitudes/intentions, and this mediation was only marginally significant.

Illness Detection Behaviors

Effects on attitudes and intentions. The size of the persuasive effect of gain- versus loss-framed messages did not differ significantly in studies that measured either attitudes towards a health behavior (k = 16; r = -.034, p = .572) or intentions to perform a health behavior (k = 32; r = -.025, p = .496) (see Table 2). Again, when examining both attitudes and intentions as outcomes, our results largely replicate those reported by O'Keefe and Jensen (6,7).

Effects on behavior. For studies that advocated detection behavior, there was also no significant difference between the persuasive effect of gain-framed versus loss-framed messages in promoting behavior (k = 18; r = -.040, p = .101). This effect was not moderated by how behavior was assessed (Q = .036, p = .850), as self-reported behavior showed a similar effect size (k = 12; r = -.036, p = .300) as objective behavior (k = 6; r = -.046, p = .246). Breaking down the detection category by behavior domain revealed one notable domain, breast cancer detection, in which there was a trend towards a significant difference in the persuasive effect of the gain- versus the loss-framed message (k = 10; r = -.052, p = .077).

Publication bias. We assessed the possible influence of publication bias on the summary effect size for each outcome in the illness detection category. As indicated by the non-significant Kendall's tau statistics in Table 2 (p's >.05), there appeared to be no evidence of publication bias for studies that examined the effect of framing on detection attitudes, intentions, or behaviors.

Discussion

The goal of the present review was to clarify the conclusions made in prior meta-analytic reviews (6,7) with regards to the effect of gain- and loss-framing on the persuasiveness of health messages. In this review, we distinguish between the various common outcomes used in framing studies (attitudes, intentions, behavior), and find that although loss-framed messages were not significantly more likely than gain-framed messages to promote detection *behavior*, gain-framed messages were significantly more likely than loss-framed messages to promote prevention *behavior*.

Making Sense of the Findings: Prevention Behaviors

In line with O'Keefe and Jensen (6), we found a weak advantage for gain-framed messages over loss-framed messages on attitudes (r = .04) and intentions (r = .03), both of which were not significantly different from zero. However, contrary to O'Keefe and Jensen, gain-framed messages were significantly more persuasive than loss-framed messages in promoting actual preventive health *behavior* (r = .08, p = .002), and this summary effect did not appear to be due to publication bias. Although several domains of prevention behavior – smoking cessation, skin cancer prevention, and physical activity – seemed to drive this overall effect, insufficient number of published studies were available within particular domains to make firm conclusions. Despite this, in no case was there a significant loss-frame advantage within any specific domain of prevention behavior.

In the prevention domain, our findings give rise to a central question that has potentially important theoretical and practical implications. That is, why were gain-framed messages more effective than loss-framed messages in promoting the adoption of illness prevention behavior, but gain-framed messages were no more effective than loss-framed messages in promoting favorable attitudes and intentions to adopt those behaviors?

This pattern suggests that framing effects on the adoption of prevention behaviors may not be completely mediated by the most commonly-assessed beliefs used in health message framing studies (attitudes, intentions). Further, we note that historically, it has been difficult to identify the specific beliefs that mediate the effects of message framing on health behavior (see 43, for review). For these reasons, using attitudes and intentions as proxy measures for the effect of health message framing on behavior may be misguided, and conclusions about the effect of message framing based primarily on studies that employ only measures of attitudes and intentions may either underestimate its effect or provide an incomplete picture of the effect of message framing on behavior. These findings underscore one important point of our review: the *practical* benefit of health message framing can only be realized by examining behavior as an outcome.

What, then, are the factors that might mediate the influence of message framing on prevention behavior? It may be that gain-framed messages communicate other types information that may more directly influence behavior, such as self-efficacy, social norms, outcome expectancies, or positive emotion. For example, the prevention behaviors for which gain-framed messages had the strongest advantage were skin cancer prevention, smoking cessation, physical activity and safe sex, with the weakest advantage found for diet and vaccination. Self-efficacy is known to be an important determinant of smoking cessation, physical activity, and safe sex (44), and a belief that may exert a direct influence on behavior. In contrast, self-efficacy may play a far lesser role in the prediction of relatively easier, one-time-only behaviors such as vaccination (that is unless the vaccination behavior is more extensive and necessitates adherence to a regimen to be effective, in which case self-efficacy does play an important role [45]). Indeed, we know that when it comes to making healthy lifestyle changes that are perceived to be challenging or complex, “self-efficacy considerations are probably paramount” (46, pp. 87). Similarly, the framing of a message may also convey other implicit information such as the prevalence of the advocated behavior (47), which may also exert a direct effect on behavior. Lastly, gain-framed messages promoting prevention behavior appear to stimulate greater levels of information processing and better subsequent memory than loss-framed messages (48). This enhanced level of information processing and memory for gain-framed messages over loss-framed messages may also explain why behavioral effects emerge over time in the absence of comparable effects on immediate self-reported attitudes and intentions. Thus, the findings from this meta-analysis underscore the importance of using behavior as an outcome in health message framing research, and for research to better identify the processes that mediate the effects of framed messages on behavior (43).

Making Sense of the Findings: Detection Behaviors

O’Keefe and Jensen (7) reported finding a weak, but significant advantage of loss-framed messages (r = -.039) for the combined promotion of attitudes, intentions, and behaviors related to illness detection. The present findings largely replicate these prior findings when examining attitudes, intentions, and behavior separately, and do not lend support to Rothman and Salovey’s (2) prediction of an overall advantage of loss-framed over gain-framed messages in the promotion of illness detection behaviors.

We speculate that this lack of support for Rothman and Salovey’s (2) prediction may have to do with the degree of variability in how individuals think about the riskiness of detection behaviors. Rothman and Salovey’s (2) Prospect Theory-based prediction rests on the assumption that detection behaviors are typically perceived as risky. However, within any behavioral domain, there can be important variability in how people think about the risks associated with the behavior, and this variability may lead to differences in how framed messages work.

In fact, it may not necessarily be the detection or prevention function of a behavior that regulates people's responses to framed messages, but rather people's unique construals of the risks associated with the behavior (49). In the case of prevention behaviors, people may generally view such behaviors to be relatively safe and certain to engage in, and hence a reliable advantage of gain-framed messages may result. Detection behaviors, on the other hand, may represent a class of behaviors for which people have more variable beliefs about their susceptibility to the relevant health condition.

To illustrate, Apanovitch and colleagues (50) showed that when promoting HIV tests, loss-framed messages were only more effective than gain-framed messages for people who were uncertain about what the outcome of the test would be. For people who were certain that the test would not find the presence of HIV, gain-framed messages were more effective in promoting testing than loss-framed messages. A similar pattern emerged in a study that manipulated college students' perception of risk for developing heart disease as an attempt to encourage cholesterol screening (51), where loss-framed messages were more effective only when students were led to believe they were at a high risk for developing heart disease. In promoting screening mammography, Gallagher and colleagues (52) reported a loss-frame advantage only for women who considered themselves to be at high risk for breast cancer. No advantage of either frame was reported for women who felt little or no risk. Thus, people's unique perceptions of risk reflect one individual difference variable that may moderate the extent to which loss-framed messages motivate people to take up detection behaviors, and may help explain the minor, but not statistically significant, overall advantage of loss-framed messages over gain-framed messages for the promotion of detection behaviors.

Limitations

Our conclusions are necessarily limited by the body of research we reviewed, including issues such as the inconsistency of statistical reporting across studies and the restricted scope of studies available to analyze. For instance, there were nearly three times as many effect sizes for measures of attitudes and intentions (k = 139) as there were effect sizes for behavioral measures (k = 50). Despite this apparent imbalance in number of studies reporting behavioral outcomes, our findings regarding the advantage of gain-framed messages over loss-framed messages in promoting prevention behaviors was statistically significant. Furthermore, very few studies provide the complete text of the framed messages, preventing us from examining how factors such as the proportion of framed information might have influenced the magnitude of the framing effects.

Our review was also limited to peer-reviewed, published studies. While this may increase the methodological quality of the studies in our review, it may also exclude studies that did not find significant effects of framing on behavior, and this may be of greatest concern in interpreting the effect of framing for the promotion of prevention behavior. However, we note that a diverse set of publication bias analyses suggested minimal, if any, influence of publication bias. Furthermore, a number of prevention behavior studies included in this analysis reported no significant overall effect of framing on behavior (e.g., 33, 34, 37, 53, 54, 55), while others included experimental manipulations that attenuated the gain-frame advantage on behavior (e.g., 41, 56, 57). Thus, while there is clearly heterogeneity in the magnitude of the gain-frame advantage for prevention behavior, our results suggest that framing matters. When a persuasive message is intended to convey the consequences of prevention, gain-framed messages should lead to greater chances of success than loss-framed messages.

Lastly, our review is guided by the predominant perspective that has guided health message framing research over the last 15 years, namely, Rothman and Salovey's application of Prospect Theory to health communication (2). Indeed, Rothman and Salovey's perspective has been influential insofar as Prospect Theory is one of the few behavioral theories to explicitly suggest that gain- vs. loss-framed information can have substantially different effects on people's choices and behaviors. Indeed, we found support for Rothman and Salovey's underlying prediction for the moderating role of prevention vs. detection function on health behavior. However, we acknowledge that Prospect Theory alone cannot explain the entire pattern of results we found, such as the lack of framing effects observed on attitudinal/intentional outcomes. More recently, researchers have investigated health message framing effects within the context of other motivational theories such as Protection Motivation Theory (58, 41) or Regulatory Focus Theory (59, 60). To date, however, no single theory can account for the heterogeneity of health message framing effects observed across outcome measures and domains of health behavior (8).

Practical Implications

Given the large disconnect between people's intentions to change their behavior and their actual likelihood of change (9), the most meaningful outcome one can hope for in an intervention is a change in actual behavior. The findings of the present review provide evidence that *how* you frame a health message is an important consideration in the design of messages promoting prevention behavior.

Although the effect of message framing on prevention behavior might seem relatively small in magnitude, it is important to keep in mind that health behaviors are complex in nature, and health message framing is but one aspect of an intervention that can contribute to its success. Indeed, Latimer and colleagues offer that “the small changes induced by framed messages may contribute to the additive effects of multiple intervention components” (61; p. 648). Other aspects of message-based health interventions include message tailoring, for example. Interestingly, a recent meta-analysis of tailored health behavior change interventions reported an effect of using tailored health messages over generic “one-size-fits-all” messages of $r = .07$ (62). In our study, the advantage of gain-framed over loss-framed messages for promoting prevention behaviors was of similar magnitude ($r = .083$), suggesting that framing alone, at least for prevention behaviors, can have as much of an effect on the adoption of health behaviors as other more specific and comprehensive methods of message tailoring.

Although we found no overall main effect of framing for the promotion of detection behaviors, other studies suggest that framing may still be a useful part of an intervention strategy for detection behaviors, especially for interventions that have an opportunity to target people with high perceptions of risk for a relevant health condition (i.e., 50-52). Whereas reviews have concluded that “One cannot expect that using a gain-framed appeal rather than a loss-framed appeal will make much difference to the success of such messages” (6; p. 634), the present review suggests that such a conclusion may not be warranted, particularly for several domains of prevention behaviors. Our findings also underscore the importance of assessing behavior in health communication research, as well as the potential usefulness of message framing in future behavior change interventions, such as mass media, large scale public interventions, as well as smaller-scale tailored health behavior interventions.

Conflict of Interest Statement

The authors have no conflict of interest to disclose.

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Footnotes

[1]The present review focuses on a particular type of framing effect defined by Levin and colleagues [63] as ‘goal framing’. As opposed to ‘attribute framing’, which involves manipulating the health behavior as either a good thing to engage in (positive frame) or bad thing (negative frame) to engage in, ‘goal framing’ works under the assumption that the health behavior is a good thing to do and instead uses the positive frame to describe the gains associated with performing the behavior and the negative frame to describe the losses associated with not performing the behavior.

[2]Unless otherwise specified, we report ‘behavior’ as a combined outcome of self-reported and objective behavioral measures. We note the appropriateness of this approach as the relationship between self-reported and objective measures of behavior for the most commonly cited domains in the present analysis are typically greater than the typical attitude/intention and behavior correlation of .50 (9). Indeed, we see this in the domains of smoking (64, 65), mammography (66-70) diet (71), oral health (72-75), and physical activity (76-78) (all r’s > .50, sensitivities > .90).

[3]The strongest evidence for moderation by timeframe was found among studies that assessed prevention behavior. Although not significant using the more conservative random-effects analyses $Q(1) = 1.810$, $p = .178$), this moderation was significant in a fixed effects analysis ($Q(1) = 6.802$, $p = .009$), with behaviors assessed immediately after message presentation showing stronger effects of framing ($k = 6$, $r = .150$, $p = .001$) than behaviors assessed at a follow-up ($k = 26$, $r = .077$, $p = .007$). Moderation by timeframe could not be tested for attitudes/intentions as not enough studies assess these outcomes at a delayed follow-up. Furthermore, no moderation by timeframe was found for studies assessing detection behavior.

Table 1

Cases Analyzed (Organized by Author)

Study	N	*r*	95% CI		Codings[a]		
*Abhyankar, O'Connor, & Lawton [79]	142	-0.13	-0.29,	0.04	1/	8/	1
*Abhyankar, O'Connor, & Lawton [79]	142	-0.24	-0.39,	-0.08	1/	8/	2
Apanovitch, McCarthy, & Salovey [50] certain	281	0.15	0.03,	0.26	2/	5/	3
Apanovitch, McCarthy, & Salovey [50] uncertain	144	-0.07	-0.23,	0.09	2/	5/	3
Arora [12] high credibility	105	0.00	-0.17,	0.17	2/	1/	3
Arora [12] high credibility	105	0.00	-0.17,	0.17	2/	2/	3
Arora & Arora [13] high credibility	133	-0.13	-0.31,	0.06	1/	4b/	1
Arora & Arora [13] high credibility	134	-0.18	-0.36,	0.01	1/	4b/	2
*Arora, Stoner, & Arora [14] high credibility	68	0.00	-0.24,	0.24	1/	4a/	1
*Arora, Stoner, & Arora [14] high credibility	68	0.00	-0.24,	0.24	1/	4a/	2
Banks, et al. [80]	133	-0.02	-0.19,	0.15	2/	1/	1
Banks, et al. [80]	133	-0.15	-0.31,	0.02	2/	1/	2
†Banks, et al. [80]	132	0.00	-0.17,	0.17	2/	1/	3
Bannon & Schwartz [53]	50	0.02	-0.26,	0.29	1/	4b/	3
*Bartels, et al. [49] study 1 90% efficacy	35	0.33	-0.01,	0.60	1/	8/	1
*Bartels, et al. [49] study 1 60% efficacy	35	-0.21	-0.51,	0.13	1/	8/	1
*†Bartels, et al. [49] study 2 health benefit	81	0.23	0.02,	0.43	2/	9/	2
*†Bartels, et al. [49] study 2 health problem	82	-0.22	-0.42,	0.00	2/	9/	2
Benz Scott & Curbow [81]	395	0.04	-0.06,	0.13	2/	6/	2
*Berry & Carson [82]	87	0.07	-0.15,	0.27	1/	4a/	1
Block & Keller [83] study 1 high efficacy	50	-0.01	-0.29,	0.27	2/	5/	1
Block & Keller [83] study 1 high efficacy	50	0.05	-0.23,	0.33	2/	5/	2
Block & Keller [83] study 1 low efficacy	44	-0.29	-0.54,	0.01	2/	5/	1
Block & Keller [83] study 1 low efficacy	44	-0.21	-0.48,	0.09	2/	5/	2
Block & Keller [83] study 2 high efficacy	58	0.17	-0.10,	0.41	2/	2/	1
Block & Keller [83] study 2 high efficacy	58	0.16	-0.10,	0.40	2/	2/	2
Block & Keller [83] study 2 low efficacy	57	-0.21	-0.45,	0.05	2/	2/	1
Block & Keller [83] study 2 low efficacy	57	-0.25	-0.48,	0.01	2/	2/	2
Broemer [84] study 1	80	-0.10	-0.31,	0.12	1/	4/	2
Broemer [85] study 1 easy to imagine	30	-0.48	-0.72,	-0.15	1/	4/	1
Broemer [85] study 1 hard to imagine	30	0.29	-0.08,	0.59	1/	4/	1
Broemer [85] study 2 easy to imagine	30	-0.25	-0.56,	0.12	2/	1/	1
Broemer [85] study 2 hard to imagine	30	0.56	0.25,	0.77	2/	1/	1
Broemer [85] study 3 easy to imagine, serious	36	0.48	0.18,	0.70	1/	8/	1
Broemer [85] study 3 easy to imagine, trivial	36	-0.27	-0.55,	0.07	1/	8/	1
Broemer [85] study 3 hard to imagine, serious	36	0.18	-0.16,	0.48	1/	8/	1
Broemer [85] study 3 hard to imagine, trivial	36	0.38	0.06,	0.63	1/	8/	1
†Brug, Ruiter, & van Assema [86] study 1	74	0.08	-0.15,	0.30	1/	4b/	1
†Brug, Ruiter, & van Assema [86] study 1	74	0.04	-0.19,	0.27	1/	4b/	2
Brug, Ruiter, & van Assema [86] study 2	149	0.09	-0.07,	0.25	1/	4b/	1
Brug, Ruiter, & van Assema [86] study 2	149	0.01	-0.15,	0.17	1/	4b/	2
Brug, Ruiter, & van Assema [86] study 3	92	0.01	-0.20,	0.21	1/	4b/	1

Brug, Ruiter, & van Assema [86] study 3	92	0.11	-0.09,	0.31	1/	4b/	2
Chang [87] study 2	410	0.06	-0.04,	0.16	1/	7/	1
Chang [88] study 2 high risk	142	-0.17	-0.33,	-0.01	1/	9/	2
Chang [88] study 2 low risk	141	0.47	0.33,	0.59	1/	9/	2
*†Cho & Boster [89]	246	-0.17	-0.29,	-0.04	1/	9/	1
*†Cho & Boster [89]	246	-0.21	-0.33,	-0.09	1/	9/	2
*†Cosedine, et al. [90]	132	0.08	-0.09,	0.25	2/	1/	3
Cox, Cox, & Zimet [91] study 2	213	-0.06	-0.19,	0.08	1/	5/	2
Cox & Cox [92] anectodal	108	-0.31	-0.47,	-0.12	2/	1/	1
Cox & Cox [92] anectodal	103	-0.27	-0.44,	-0.08	2/	1/	2
Cox & Cox [92] statistical	108	0.05	-0.15,	0.23	2/	1/	1
Cox & Cox [92] statistical	103	0.19	0.00,	0.37	2/	1/	2
Detweiller, et al. [93]	217	0.21	0.08,	0.33	1/	2/	2
Detweiller, et al. [93]	217	0.17	0.04,	0.30	1/	2/	3
†Finney & Iannotti [94]	628	-0.04	-0.12,	0.04	2/	1/	3
*Gallagher & Updegraff [32]	176	0.06	-0.08,	0.20	1/	4a/	1
*Gallagher & Upegraff [32]	176	0.11	-0.04,	0.25	1/	4a/	3
*Gallagher, et al. [52]	355	-0.17	-0.29,	-0.05	2/	1/	3
*Gerend & Cullen [56] short term	181	-0.08	-0.22,	0.07	1/	9/	3
*Gerend & Cullen [56] long term	181	0.26	0.12,	0.39	1/	9/	3
Gintner, et al. [95]	96	0.16	-0.06,	0.36	2/	6/	2
Gintner, et al. [95]	81	0.00	-0.20,	0.20	2/	6/	3
*Goodall & Appiah [96] breathing label	210	0.08	-0.06,	0.21	1/	7/	1
*Goodall & Appiah [96] breathing label	210	0.05	-0.08,	0.18	1/	7/	2
*Goodall & Appiah [96] teeth label	210	0.10	-0.03,	0.24	1/	7/	1
*Goodall & Appiah [96] teeth label	210	0.09	-0.05,	0.22	1/	7/	2
*Hevey, et al. [97]	390	0.00	-0.10,	0.10	1/	2/	2
*Hoffner & Ye [98]	190	-0.02	-0.16,	0.12	1/	2/	2
Jones, Sinclar, & Courneya [33] credible source	96	0.00	-0.20,	0.20	1/	4a/	1
Jones, Sinclar, & Courneya [33] credible source	96	0.10	-0.10,	0.30	1/	4a/	2
Jones, Sinclar, & Courneya [33] credible source	96	0.11	-0.09,	0.30	1/	4a/	3
†Jones, et al. [34] credible	68	0.09	-0.15,	0.32	1/	4a/	1
Jones, et al. [34] credible	68	0.00	-0.24,	0.24	1/	4a/	2
†Jones, et al. [34] credible	68	0.09	-0.15,	0.32	1/	4a/	3
Keller, Lipkus, & Rimer [99] study 1 negative affect	43	0.31	0.01,	0.56	2/	1/	2
Keller, Lipkus, & Rimer [99] study 1 positive affect	42	-0.34	-0.58,	-0.04	2/	1/	2
Keller, Lipkus, & Rimer [99] study 2 negative affect	62	0.32	0.07,	0.53	2/	1/	2
Keller, Lipkus, & Rimer [99] study 2 positive affect	62	-0.33	-0.54,	-0.09	2/	1/	2
Knapp [57] health values	98	0.05	-0.15,	0.25	1/	3/	2
†Knapp [57] health values	98	-0.09	-0.28,	0.12	1/	3/	3
Knapp [57] social values	98	-0.14	-0.33,	0.06	1/	3/	2
†Knapp [57] social values	98	0.31	0.12,	0.48	1/	3/	3
Lalor & Hailey [100]	55	0.14	-0.13,	0.39	2/	1/	2
Lalor & Hailey [100]	55	0.09	-0.18,	0.35	2/	1/	3
*Latimer, et al. [35]	322	0.31	0.21,	0.41	1/	4a/	2
*†Latimer, et al. [35]	322	0.01	-0.10,	0.12	1/	4a/	3
Lauver & Rubin [101]	116	-0.08	-0.25,	0.11	2/	9/	3
†Lawatsch [54]	103	0.12	-0.08,	0.31	1/	4b/	3

Lee & Aaker [59] study 1 prevent reg focus	56	-0.22	-0.45,	0.05	1/	4b/	1
Lee & Aaker [59] study 1 promotion reg focus	56	0.25	-0.02,	0.48	1/	4b/	1
Lee & Aaker [59] study 2 prevent reg focus	81	-0.22	-0.42,	-0.01	1/	2/	1
Lee & Aaker [59] study 2 promotion reg focus	82	0.27	0.06,	0.46	1/	2/	1
Lee & Aaker [59] study 3 high risk	40	-0.33	-0.58,	-0.02	1/	9/	1
Lee & Aaker [59] study 3 low risk	41	0.38	0.09,	0.62	1/	9/	1
Lee & Aaker [59] study 4a prevent reg focus	59	-0.21	-0.44,	0.05	1/	4b/	1
Lee & Aaker [59] study 4a promotion reg focus	60	0.19	-0.07,	0.42	1/	4b/	1
Lee & Aaker [59] study 5 prevent reg focus	71	-0.20	-0.41,	0.03	1/	4b/	1
Lee & Aaker [59] study 5 promotion reg focus	71	0.15	-0.08,	0.37	1/	4b/	1
Lee, Brown & Blood [102] high efficacy	135	0.08	-0.09,	0.24	2/	2/	1
Lee, Brown & Blood [102] high efficacy	135	0.16	-0.01,	0.32	2/	2/	2
Lee, Brown & Blood [102] low efficacy	134	-0.19	-0.35,	-0.02	2/	2/	1
Lee, Brown & Blood [102] low efficacy	134	-0.02	-0.19,	0.15	2/	2/	2
Lerman, et al. [103] high suspicion	223	-0.12	-0.25,	0.01	2/	1/	3
Lerman, et al. [103] low suspicion	223	0.08	-0.06,	0.21	2/	1/	3
*Levin, et al. [104] United States sample	127	-0.25	-0.41,	-0.08	1/	4b/	2
*Levin, et al. [104] Australian sample	97	-0.03	-0.23,	0.17	1/	4b/	2
Looker & Shannon [36]	235	0.26	0.14,	0.38	1/	4b/	1
Looker & Shannon [36]	235	-0.18	-0.30,	-0.05	1/	4b/	2
Looker & Shannon [36]	235	0.18	0.05,	0.30	1/	4b/	3
*Maguire, et al. [105]	103	0.08	-0.12,	0.27	2/	9/	2
Maheswaran & Myers-Levy [51] high involved	49	-0.37	-0.59,	-0.10	2/	6/	1
Maheswaran & Myers-Levy [51] high involved	49	-0.43	-0.63,	-0.16	2/	6/	2
Maheswaran & Myers-Levy [51] low involved	49	0.45	0.19,	0.65	2/	6/	1
Maheswaran & Myers-Levy [51] low involved	49	0.43	0.17,	0.63	2/	6/	2
*Mann, Sherman, & Updegraff [37]	59	-0.16	-0.40,	0.10	1/	3/	2
*Mann, Sherman, & Updegraff [37]	59	0.02	-0.24,	0.27	1/	3/	3
McCall & Ginis [106]	60	0.31	0.06,	0.52	1/	4a/	3
McCaul, Johnson, & Rothman [55]	6522	-0.02	-0.04,	0.01	1/	8/	3
McKee, et al. [107]	271	0.20	0.08,	0.31	1/	7/	3
Meyers-Levy & Maheswaran [108] high risk/involve	37	-0.50	-0.71,	-0.22	1/	6/	1
Meyers-Levy & Maheswaran [108] high risk/no involve	37	0.50	0.22,	0.71	1/	6/	1
Meyers-Levy & Maheswaran [108] low risk/involve	37	0.10	-0.23,	0.41	1/	6/	1
Meyers-Levy & Maheswaran [108] low risk/no involve	36	0.34	0.01,	0.60	1/	6/	1
Millar & Millar [109] high involved	261	0.15	0.03,	0.27	1/	9/	2
*Moorman & van den Putte [110]	151	0.08	-0.08,	0.24	1/	7/	1
*Moorman & van den Putte [110]	151	0.14	-0.02,	0.29	1/	7/	2
Myers, et al. [111]	2201	-0.04	-0.08,	0.00	2/	9/	3
Nan [112] study 1	155	0.00	-0.16,	0.16	1/	4a/	1
Nan [112] study 1	155	0.00	-0.16,	0.16	1/	4a/	2
Nan [112] study 2	155	0.22	0.05,	0.37	2/	8/	1
Nan [112]study 2 desirable, high involved	34	0.00	-0.34,	0.34	2/	8/	2
Nan [112] study 2 desirable, low involved	34	0.00	-0.34,	0.34	2/	8/	2
Nan [112] study 2 undesirable high involved	34	-0.23	-0.53,	0.11	2/	8/	2
Nan [112] study 2 undesirable low involved	34	0.31	-0.04,	0.59	2/	8/	2
*O'Connor, Ferguson, & O'Connor [113] study 2	304	-0.08	-0.19,	0.04	1/	5/	1
*O'Connor, Ferguson, & O'Connor [113] study 2	304	-0.03	-0.14,	0.09	1/	5/	2

*Park, et al. [114]	116	0.02	-0.16,	0.20	2/	9/	3
Ramirez [115]	116	0.04	-0.14,	0.22	1/	3/	3
Richardson, et al. [116]	389	0.08	-0.02,	0.18	1/	5/	3
Rivers [117] detect	156	-0.12	-0.27,	0.04	2/	9/	3
Rivers [117] prevent	156	0.04	-0.12,	0.19	1/	9/	3
Robberson & Rogers [118] health	42	-0.19	-0.47,	0.12	1/	4a/	2
Robberson & Rogers [118] self esteem	42	0.54	0.28,	0.72	1/	4a/	2
Rothman, Martino, et al. [42] experiment 1 detect	88	-0.33	-0.50,	-0.13	2/	8/	2
Rothman, Martino, et al. [42] experiment 1 prevent	99	0.00	-0.20,	0.20	1/	8/	2
Rothman, Martino, et al. [42] experiment 2	60	-0.26	-0.48,	0.00	2/	3/	1
Rothman, Martino, et al. [42] experiment 2	60	-0.26	-0.48,	0.00	2/	3/	2
Rothman, Martino, et al. [42] experiment 2	60	-0.39	-0.58,	-0.15	2/	3/	3
Rothman, Martino, et al. [42] experiment 2	60	-0.26	-0.48,	0.00	1/	3/	1
Rothman, Martino, et al. [42] experiment 2	60	0.22	-0.03,	0.45	1/	3/	2
Rothman, Martino, et al. [42] experiment 2	60	0.22	-0.03,	0.45	1/	3/	3
*Rothman, Salovey, et al. [119] study 1	199	0.00	-0.14,	0.14	1/	2/	2
*Rothman, Salovey, et al. [119] study 2	143	0.28	0.12,	0.42	1/	2/	3
†Schneider, Salovey, Apanovitch, et al. [120] multi	132	-0.11	-0.28,	0.06	2/	1/	3
†Schneider, Salovey, Apanovitch, et al. [120] targeted	132	0.05	-0.13,	0.22	2/	1/	3
†Schneider, Salovey, Pallonen, et al. [121]	109	0.24	0.06,	0.41	1/	7/	3
Shannon & Rowan [122]	138	0.04	-0.13,	0.20	1/	4/	3
Sherman, Mann, & Updegraff [38]	67	-0.01	-0.25,	0.23	1/	3/	2
Sherman, Mann, & Updegraff [38]	67	0.13	-0.11,	0.36	1/	3/	3
Steward, et al. [123]	863	0.03	-0.04,	0.10	1/	7/	2
*Toll, et al. [15]	170	0.17	0.02,	0.31	1/	7/	3
*Trupp, et al. [124]	70	-0.29	-0.51,	-0.03	1/	9/	3
*Tykocinkski, et al. [125] actual ideal	23	-0.49	-0.75,	-0.09	1/	4b/	2
*†Tykocinkski, et al. [125] actual ideal	23	-0.12	-0.51,	0.30	1/	4b/	3
*Tykocinkski, et al. [125] actual ought	16	0.39	-0.14,	0.74	1/	4b/	2
*†Tykocinkski, et al. [125] actual ought	16	-0.02	-0.51,	0.48	1/	4b/	3
Umphrey [126]	128	0.09	-0.09,	0.26	2/	9/	2
*Updegraff, et al. [39] strong	136	0.06	-0.11,	0.22	1/	3/	1
*Updegraff, et al. [39] strong	136	0.01	-0.16,	0.18	1/	3/	2
*Updegraff, et al. [39] strong	136	-0.01	-0.18,	0.16	1/	3/	3
Urban, et al. [127]	100	-0.08	-0.27,	0.12	2/	5/	2
*Uskul, Sherman, & Fitzgibbon [60]	100	0.02	-0.18,	0.22	1/	3/	2
†van Assema, et al. [128]	146	0.00	-0.16,	0.16	1/	4b/	1
†van Assema, et al. [128]	148	0.05	-0.12,	0.21	1/	4b/	2
*van't Riet, Ruiter, Werrij, Candel, et al. [129] study 2	129	0.15	-0.02,	0.32	1/	4a/	1
*van't Riet, Ruiter, Werrij, Candel, et al. [129] study 2	129	0.02	-0.16,	0.19	1/	4a/	2
*van 't Riet, Ruiter, Werrij, et al. [40]	466	0.06	-0.03,	0.15	1/	4a/	1
*van 't Riet, Ruiter, Werrij, et al. [40]	466	0.09	-0.02,	0.20	1/	4a/	2
*van 't Riet, Ruiter, Werrij, et al. [40]	299	0.09	0.00,	0.18	1/	4a/	3
van 't Riet, Ruiter, Werrij, et al. [58] high efficacy	62	-0.24	-0.46,	0.01	2/	2/	2
van 't Riet, Ruiter, Werrij, et al. [58] low efficacy	62	0.13	-0.12,	0.37	2/	2/	2
*van 't Riet, Ruiter, et al. [41] high efficacy	575	0.12	0.00,	0.24	1/	4b/	2
*van 't Riet, Ruiter, et al. [41] high efficacy	512	-0.08	-0.19,	0.05	1/	4b/	3
*van 't Riet, Ruiter, et al. [41] low efficacy	575	-0.07	-0.18,	0.05	1/	4b/	2

*van 't Riet, Ruiter, et al. [41] low efficacy	512	0.06	-0.05,	0.17	1/	4b/	3
Williams, Clarke, & Borland [130]	539	-0.10	-0.18,	-0.01	2/	1/	3
*Yu, et al. [131]	213	0.12	-0.02,	0.25	1/	9/	2

[a]The coding judgments, in order, are: behavior function category (1 = disease prevention, 2 = disease detection); specific behavior (1 = breast cancer, 2 = skin cancer, 3 = oral health, 4 = general obesity-related, 4a = physical activity, 4b = diet, 5 = safe sex, 6 = heart disease, 7 = smoking, 8 = virus/vaccines, 9 = other); and specific measure of persuasion (1 = attitudes, 2 = intentions, 3 = behavior).

* Denotes cases not included in previous reviews (6, 7).
† Denotes cases where multiple measures of the *same* outcome have been combined.

Table 2

Summary of Results

	k	Mean *r*	*95% CI*	Kendall's tau (τ)[a]
Detection				
Attitudes	16	-.034	-.153, .085	.000
Intentions	32	-.025	-.098, .047	-.046
Behavior	18	-.040	-.088, .008	.072
Prevention				
Attitudes	45	.039	-.014, .091	.068
Intentions	46	.028	-.012, .068	.000
Behavior	32	.083*	.031, .134	-.171[†]

[a]A statistical representation of the possible influence of publication bias determined by performing a rank correlation test between individual standardized effect sizes and their variances.

[†]$p < .10$. *$p < .01$.

Table 3

Summary of Effects on Behavioral Outcomes by Domain

	k	Mean *r*	95% *CI*	
Detection Behaviors				
Breast Cancer	10	-.052	-.109	.006
Heart	1	.159	-.061	.365
Oral Health	1	-.387**	-.584	-.148
Safe Sex	2	.049	-.167	.260
Other	4	-.043*	-.082	-.005
Prevention Behaviors				
Diet	7	-.014	-.128	.099
Obesity	1	.037	-.131	.203
Oral Health	7	.052	-.068	.169
Physical Activity	6	.160**	.052	.264
Safe Sex	1	.081	-.018	.179
Skin Cancer	2	.237**	.137	.333
Smoking	3	.198**	.116	.277
Virus/Vaccine	1	-.015	-.039	.009
Other	4	-.001	-.208	.206

*$p < .05$. ** $p < .01$.