Framing of health information messages (Review)

Akl EA, Oxman AD, Herrin J, Vist GE, Terrenato I, Sperati F, Costiniuk C, Blank D, Schünemann H

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[Intervention Review]

Framing of health information messages

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ABSTRACT

Background

The same information about the evidence on health effects can be framed either in positive words or in negative words. Some research suggests that positive versus negative framing can lead to different decisions, a phenomenon described as the framing effect. Attribute framing is the positive versus negative description of a specific attribute of a single item or a state, for example, "the chance of survival with cancer is 2/3" versus "the chance of mortality with cancer is 1/3". Goal framing is the description of the consequences of performing or not performing an act as a gain versus a loss, for example, "if you undergo a screening test for cancer, your survival will be prolonged" versus "if you don't undergo screening test for cancer, your survival will be shortened".

Objectives

To evaluate the effects of attribute (positive versus negative) framing and of goal (gain versus loss) framing of the same health information, on understanding, perception of effectiveness, persuasiveness, and behavior of health professionals, policy makers, and consumers.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library,* issue 3 2007), MEDLINE (Ovid) (1966 to October 2007), EMBASE (Ovid) (1980 to October 2007), PsycINFO (Ovid) (1887 to October 2007). There were no language restrictions. We reviewed the reference lists of related systematic reviews, included studies and of excluded but closely related studies. We also contacted experts in the field.

Selection criteria

We included randomized controlled trials, quasi-randomised controlled trials, and cross-over studies with health professionals, policy makers, and consumers evaluating one of the two types of framing.

Data collection and analysis

Two review authors extracted data in duplicate and independently. We graded the quality of evidence for each outcome using the GRADE approach. We standardized the outcome effects using standardized mean difference (SMD). We stratified the analysis by the type of framing (attribute, goal) and conducted pre-planned subgroup analyses based on the type of message (screening, prevention, and treatment). The primary outcome was behaviour. We did not assess any adverse outcomes.

Main results

We included 35 studies involving 16,342 participants (all health consumers) and reporting 51 comparisons.

In the context of attribute framing, participants in one included study understood the message better when it was framed negatively than when it was framed positively (1 study; SMD -0.58 (95% confidence interval (CI) -0.94 to -0.22); moderate effect size; low quality evidence). Although positively-framed messages may have led to more positive perception of effectiveness than negatively-framed messages (2 studies; SMD 0.36 (95% CI -0.13 to 0.85); small effect size; low quality evidence), there was little or no difference in persuasiveness (11 studies; SMD 0.07 (95% CI -0.23 to 0.37); low quality evidence) and behavior (1 study; SMD 0.09 (95% CI -0.14 to 0.31); moderate quality evidence).

In the context of goal framing, loss messages led to a more positive perception of effectiveness compared to gain messages for screening messages (5 studies; SMD -0.30 (95% CI -0.49 to -0.10); small effect size; moderate quality evidence) and may have been more persuasive for treatment messages (3 studies; SMD -0.50 (95% CI -1.04 to 0.04); moderate effect size; very low quality evidence). There was little or no difference in behavior (16 studies; SMD -0.06 (95% CI -0.15 to 0.03); low quality evidence). No study assessed the effect on understanding.

Authors' conclusions

Contrary to commonly held beliefs, the available low to moderate quality evidence suggests that both attribute and goal framing may have little if any consistent effect on health consumers' behaviour. The unexplained heterogeneity between studies suggests the possibility of a framing effect under specific conditions. Future research needs to investigate these conditions.

PLAIN LANGUAGE SUMMARY

Framing of the health information message in either negative or positive words

Examples illustrating different types of framing

The same information about health effects can be framed either in positive words or in negative words. Attribute framing refers to the positive versus negative description of a specific attribute of a single item or a state, for example, "the chance of survival with cancer is 2/3" versus "the chance of mortality with cancer is 1/3". Goal framing is the description of the consequences of performing or not performing an act as a gain or a loss, for example, "if you undergo a screening test for cancer, your survival will be prolonged" versus "if you don't undergo screening test for cancer, your survival will be shortened".

Summary

There is a widely held belief that framing of health information messages can lead to different decisions and different health behaviours; this is described as the 'framing effect'.

This systematic review identified 35 studies of 16,342 people testing this hypothesis. It found that both attribute and goal framing may have little if any effect on health consumers' behavior.

In one study of attribute framing, participants understood the message better when it was framed negatively than when it was framed positively. Positively-framed messages may have led to more positive perception of effectiveness than negatively-framed messages. There was little or no difference in persuasiveness in the context of attribute framing.

In the context of goal framing, loss messages led to a more positive perception of effectiveness compared to gain messages for screening messages, and may have been more persuasive for treatment messages.

The unexplained differences in the results of the included studies suggests the framing effect may exist under specific but yet undetermined conditions. Future research needs to investigate these conditions.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Attribute framing

Patient or population: consumers
Intervention: negatively-framed health messages
Comparison: positively-framed health messages

Outcomes	Average effect with positive message *	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
Understanding	**0.58 SDs lower** (0.94 to 0.22 lower)	124 (1 study)	⊕⊕⊕◯ **low**[1,2]	1.2 point difference on a 10 point Likert scale. (moderate effect size
Perception (measured as rating on a scale of perceived effectiveness)	**0.36 SDs higher** (0.13 lower to 0.85 higher)	226 (2 studies)	⊕⊕◯◯ **low**[1,3]	0.7 point difference on a 10 point Likert scale. (small effect size)
Persuasiveness (measured as a hypothetical decision or intention or willingness to adopt an intervention)	**0.07 SDs higher** (0.23 lower to 0.37 higher))	1068 (8 studies)	⊕⊕◯◯ **low**[1,4,5]	0.2 point difference on a 10 point Likert scale (no difference)
Behavior	**0.09 SDs higher** (0.14 lower to 0.31 higher)	282 (1 study)	⊕⊕⊕◯ **moderate**[5,6]	0.2 point difference on a 10 point Likert scale (no difference)

* SD: standard deviation
We interpreted SMDs using the following rules suggested by the Cochrane Handbook:
<0.40 represents a small effect size
0.40 to 0.70 represents a moderate effect size
>0.70 represents a large effect size
We back translated the point estimates of the results by multiplying SMD by the standard deviation from a representative study (SD of 2 on a 10 point Likert-type scale)

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Indirectness: outcome is a surrogate for health behavior.
[2] Imprecision: relatively small number of participants.
[3] Imprecision: the CI includes both values in favour of negative framing and values in favour of positive framing.

[4] Inconsistency: out of the 7 studies, 1 was in favour of negative framing, 4 were in favour of positive framing, and 3 were in favour of neither. I^2=85%. Subgroup analysis based on the type of message found that I^2 was low (0%) in only one subgroup including 2 studies (harm messages).
[5] Did not downgrade for imprecision because CI included mostly values reflecting no to small effects.
[6] Risk of bias: for the one included study, it was not reported whether allocation was concealed nor whether there were losses to follow-up.

BACKGROUND

Description of the condition

The clear and effective communication of research evidence is important for ensuring the success of evidence based practice and the participation of health consumers in healthcare decisions. Such communication should lead to decisions that are consistent with the values and preferences of the health consumer. The same information about health effects can be framed either in positive words or in negative words. The way information is framed can lead to different decisions, a phenomenon described as the framing effect.

Description of the intervention

Schneider 1995 proposed a taxonomy classifying the framing effect into three types :

- 'Risky choice framing' (see Appendix 1). We did not consider this type of framing in our review as it is not applicable to health messages communicated in public health or clinical settings.
- 'Attribute framing', also called 'statistical framing' and 'different consequences framing' (see Appendix 2 and the table below). Attribute framing is the positive versus negative description of a specific attribute of a single item or a state. For example, "the chance of survival with cancer is 2/3" versus "the chance of mortality with cancer is 1/3".
- 'Goal framing', also called 'action framing', 'behavior framing' and 'same consequences framing' (see Appendix 2 and the table below). Goal framing is the depiction of the consequences of performing or not performing an act as a gain versus a loss. For example, "if you undergo screening for cancer, your survival will be prolonged" versus " if you don't undergo screening for cancer, your survival will be shortened".

Type of framing	**Attribute Framing**		**Goal framing**			
Type of message	**Positive**	**Negative**	**Gain**		**Loss**	
			Gain: attain a desirable outcome	Non-loss: not attain an undesirable outcome	Loss: attain an undesirable outcome	Non-gain: not attain a desirable outcome
Example	The chance of survival with cancer is 2/3	The chance of mortality with cancer is 1/3	If you undergo screening for cancer, your survival will be prolonged	If you undergo screening for cancer, your survival won't be shortened	If you don't undergo screening for cancer, your survival will be shortened	If you don't undergo screening for cancer, your survival won't be prolonged

The Characteristics of included studies provides examples of these two types of framing by reproducing the framing messages used in each study.

How the intervention might work

According to the Prospect theory (Kahneman 1979; Tversky 1981), people make decisions by using a reference point to judge whether a particular outcome is a gain or a loss. Positively-framed messages and negatively-framed messages induce different shifts

in the location of the reference point, leading to different effects on risk seeking.

Specifically, in goal framing, a negatively-framed message emphasizing losses ("if you do this, you will suffer this negative consequence") may have a greater impact on a given behavior than a comparable positively-framed message emphasizing gains ('if you do this, you will have this positive outcome"). Various theories (see Appendix 1) suggest that certain healthcare messages (for example, prevention, screening and therapeutic messages) are more or less prone to framing effects (Kahneman 1979; Tversky 1981; Rothman 1997).

The framing effect might vary in relation to screening, prevention and therapy due to the baseline risk of the condition. With screening decisions, the baseline risk of the condition that is being screened for is relatively low. With therapeutic decisions, the baseline risk is considered to be nearly 100%. Screening focuses on detecting disease with assumed consequences of later management, while therapeutic messages focus on change of the disease (that is, they deal with altering the course of a disease). These factors may influence health behavior (whether or not to undergo screening or therapy) and this behavior may be influenced by differentially framed messages.

Why it is important to do this review

Levin 1998 published a systematic review on the framing effect based on their proposed taxonomy, which is summarized above (Schneider 1995). They showed that within each type of framing, results show substantial consistency. In attribute framing, attributes are judged more favourably when labelled positively rather than negatively. In goal framing, a negatively-framed message emphasizing losses tends to have a greater impact on a given behavior than a comparable positively-framed message emphasizing gains. However, Levin's systematic review was not restricted to health messages. It also did not explore the Rothman and Salovey hypothesis that the framing effect varies by the type of health question (such as screening, prevention or therapy).

OBJECTIVES

To evaluate the effects of attribute (positive versus negative) framing and of goal (gain versus loss) framing of the same health information, on understanding, perception of effectiveness, persuasiveness and behaviour of health professionals, policy makers, and consumers.

METHODS

Criteria for considering studies for this review

Types of studies

Randomized controlled trials, quasi-randomised controlled trials, and cross-over studies.

Types of participants

Health professionals, policy makers, and consumers.

Types of interventions

Interventions of interest consisted of positively versus negatively-framed messages (attribute framing) or gain-framed versus loss-framed messages (goal framing). The two messages being compared should describe the same health information. As mentioned above, we excluded studies of risky choice framing.

We excluded interventions that compared different statistical presentations of the same heath information (Akl 2011), alternative graphical or verbal presentations of the same evidence, alternative orders of comparing risks or comparisons, or alternative media to present the same information.

We also excluded studies in which participants chose between different interventions with different benefits and harms using alternative presentation formats, since any effects of the presentation formats would be completely confounded with any effects of the differences in benefits and harms.

Types of outcome measures

The primary outcome was actual decisions or behaviours. We were also interested in the surrogates of that outcome including: understanding, perception of effectiveness, and persuasiveness. An additional outcome of interest was the consistency of the decision with values and preferences. We did not assess any adverse outcomes.

We only considered objective understanding (for example, correctly stating which treatment is more effective after being presented with statistical data) and not self-reported understanding. Perception of effectiveness refers to how effective an intervention is perceived to be (for example, rating of the perceived effectiveness of vaccination). Persuasiveness refers to how likely participants are to make a hypothetical decision in favour of an intervention (for instance, a hypothetical decision to treat cholesterol). Appendix 3 provides examples of outcomes assessed in the studies classified according to this review typology of outcomes. Also, the outcome had to relate to the health behavior of interest (that is, in an experiment of the framing of the use of sunscreen for preventing skin cancer, an eligible perception of effectiveness outcome should relate to the perception of the efficacy of using sunscreen and not understanding how large the risk of getting skin cancer is in relation to sun exposure).

Search methods for identification of studies

Electronic searches

The search was part of a larger search for studies assessing alternative presentations of the same empirical evidence about health. We conducted the initial search in June 2002, and updated it in September 2004 and October 2007.

We first used OVID to search MEDLINE (1966 to 2007), EMBASE (1980 to 2007), and PsycINFO (1887 to 2007). We searched the Cochrane Central Register of Controlled Trials (CENTRAL, *The Cochrane Library* Issue 3 2007) using FRAM* and PRESENT* as text words. We searched MEDLINE, EMBASE, and PsycINFO by ANDing a search for study type with a search for intervention type. We used no language or date restriction (see Appendix 4).

Searching other resources

We used the 'Related Articles' feature of PubMed MEDLINE to find additional articles. We searched MEDLINE and PsycINFO databases for articles published by the first authors of included studies and of excluded but closely related studies. We reviewed the reference lists of related systematic reviews, included studies and excluded but closely related studies. Finally, we contacted experts in the field.

Data collection and analysis

Selection of studies

Two review authors independently screened the title and abstract of identified articles for relevance. We retrieved the full text of those articles judged potentially relevant by at least one review author. Two review authors then independently screened the full text article for inclusion or exclusion. The review authors resolved their disagreements by discussion or by consulting a third review author. Studies excluded after examination of the full text are listed in the table Characteristics of Excluded Studies, with the reason for exclusion given.

Data extraction and management

We developed a standardized data extraction form. Two review authors extracted data from each included study in duplicate and independently. They resolved their disagreements by discussion or by consulting a third review author. We extracted data that related to study methods, participants, intervention, assessed outcome, and study results. We extracted data for the longer follow-up time when the authors reported more than one. We attempted to contact authors for incompletely reported data.

We noted the type of message (prevention, screening, treatment, other), the type of framing (attribute, goal), and the attainment and valence of the message.

Assessment of risk of bias in included studies

Two review authors independently assessed the methodological quality of each included study and resolved their disagreements by discussion or by consulting a third review author. Methodological data included:

1. Allocation concealment. We considered the following methods of concealment of allocation as adequate: (1) central randomization; (2) sequentially numbered drug containers; and (3) sequentially numbered, opaque, sealed envelopes. For cross-over studies we assessed the randomization of the order of interventions.
2. Randomization. We considered the following methods of sequence generation as adequate: (1) repeated coin-tossing; (2) throwing dice; (3) dealing previously shuffled cards; (4) using a published list of random numbers; and (5) using a list of random numbers generated by a computer. For cross-over studies we assessed the randomization of the order of interventions.
3. Objectivity and directness of outcomes: yes (e.g., real understanding, behavior); no (e.g., hypothetical outcome, such as hypothetical decisions).

We then graded the quality of the underlying evidence for each outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (Guyatt 2008; Higgins 2011). As our main outcome of interest was behavior, we considered understanding, perception of effectiveness, and persuasiveness as surrogates for behavior.

Measures of treatment effect

We analyzed the results of included studies for each eligible comparison. Because outcomes in these studies are typically scaled responses to survey questions, we standardized the effects using Hedges adjusted standardized mean difference (SMD). We also calculated the adjusted standard error for the resulting SMD. The SMD ensures that the differences across the scales are standardized to a uniform scale before they are combined.

For comparisons with binary measures (with proportions p1 and p2) we calculated z value using the following formula: $z = (p1 - p2) / (p * (1 - p) * [(1/n1) + (1/n2)])^{1/2}$ where $p = (p1*n1 + p2*n2) / (n1 + n2)$. For comparisons with continuous measures where we were not able to calculate the SMD directly, we calculated t-values using the means and standard errors: $t = (m1-m2)/(se2^2/n1 + se2^2/n2)^{1/2.}$ In both cases, we calculated the corresponding SMD using SMD = 2t/sqrt(N) (Cooper 1994) and adjusted it using the same adjustment factor.

We analyzed data as they related to the intended health behavior, for example, we transformed data reported for "willingness to

have unprotected sex“ into data relating to ”willingness to have protected sex.

Assessment of heterogeneity

We tested results for homogeneity across studies using the I^2 test (Higgins 2003) and used the following interpretation of the value of I^2: 0 to 50 = low; 50 to 80 = moderate and worthy of investigation; 80 to 100 = severe and worthy of understanding; 95 to100 = aggregate with major caution (Julian Higgins, personal communication).

Assessment of reporting biases

We created inverted funnel plots of individual study results plotted against inverse of the variance in order to check for possible publication bias.

Data synthesis

We stratified the analysis by the type of framing (attribute or goal). We pooled multiple outcome measures for a single trial - for example, three different questions about perception of effectiveness or responses to three different scenarios by the same participants - using fixed-effect models into a single SMD for that comparison. We pooled data from different studies when appropriate using random-effects models with the inverse variance approach. We interpreted SMDs using the following rules (Higgins 2011):

- < 0.41 represents a small effect size
- 0.40 to 0.70 represents a moderate effect size
- > 0.70 represents a large effect size.

In addition, we back-translated the results by multiplying SMD by the standard deviation from a representative study (e.g., SD of 2 on a 10 point Likert-type scale).
If a paper reported the results of two or more separate comparisons enrolling different participants, we treated these as separate comparisons. If a study used a between-subjects factorial design to compare an intervention of interest across another factor, we treated these as separate comparisons if there was no evidence of interaction.

Subgroup analysis and investigation of heterogeneity

We conducted pre-planned subgroup analyses based on type of message, which we divided into screening, prevention, treatment, and other (including diagnostic, harm and public health messages). When the test for interaction was statistically significant, we reported the SMD for each subgroup.

Sensitivity analysis

We conducted pre-planned sensitivity analyses excluding studies of lower methodological quality (i.e., did not meet at least two of the three methodological criteria. When the test for interaction was statistically significant, we planned to conduct the sensitivity analysis for each subgroup separately.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

Results of the search

Our electronic searches identified a total of 23,493 unique citations (10,732 unique citations in June 2002, 2,637 additional unique citations in September 2004, and 10,124 additional unique citations in October 2007). The title and abstract screening identified 99 citations as potentially eligible for this review, and we retrieved these studies in full text. Screening of these 99 full text studies identified 35 eligible studies.

Included studies

The 35 included studies recruited a total of 16,342 participants. All studies were conducted with health consumers. The response rate was high (> 50%) in 13 studies (26%), low (≤ 50%) in 2 studies (4%), and not reported in 35 (70%) studies.
The 35 studies reported a total of 51 comparisons: 13 comparisons related to attribute framing and 38 comparisons of goal framing. The messages used in these comparisons were about:

- screening (n = 19),
- prevention (n = 19),
- treatment (n = 8), and
- other (n = 5: 2 harm, 1 diagnosis, 1 public health, 1 on abortion); 1 study (Wilson 1987) used 2 types of messages.

Some of the 51 comparisons included more than 1 outcome; there was a total of 69 outcome measurements: 1 for understanding, 16 for perception of effectiveness, 34 for persuasiveness, 17 for behavior, and 1 for consistency of decision with people's values.

Excluded studies

We excluded 64 studies for the following reasons: not a comparison of interest (n = 11); not an original study (n = 11); not an appropriate study design (n = 3); use of different information in the comparison groups (n = 18); no outcome of interest evaluated

(n = 8); and data for the comparison of interest not reported and not available from author (n = 13). These are reported in the table Characteristics of excluded studies,

Risk of bias in included studies

Figure 1 and Figure 2 respectively show the methodological quality graph and summary of included studies. Of the 51 comparisons, 42 were randomized controlled trials (82%), 8 were quasi-randomised controlled trials (16%), and 1 was a cross-over study (2%). Of the 51 comparisons, allocation was concealed in 8 (16%), not concealed in 5 (10%), and unclear whether concealed or not in 38 (75%). The design was randomized in 42 (82%), not randomized in 1 (2%), and unclear whether randomized or not in 8 (16%) studies. Of the 51 comparisons, 17 (33%) evaluated an objective outcome.

Figure 1. Methodological quality graph: review authors' judgements about each methodological quality item presented as percentages across all included studies.

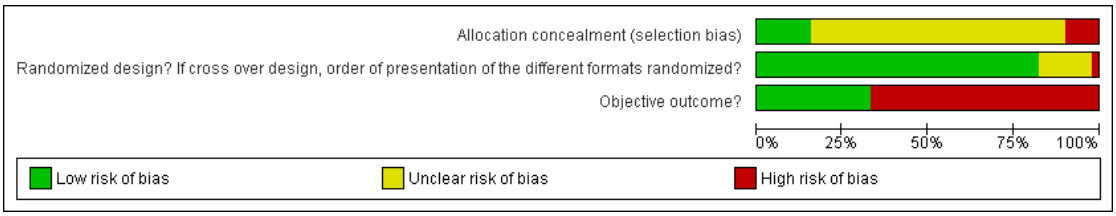
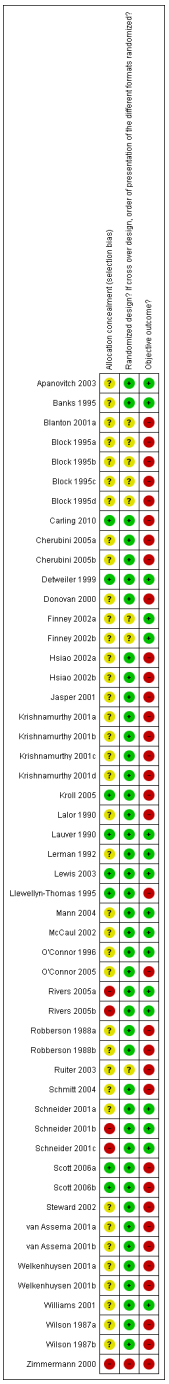


Figure 2. Methodological quality summary: review authors' judgements about each methodological quality item for each included study.



Effects of interventions

See: **Summary of findings for the main comparison** Summary of findings table 1: Attribute framing; **Summary of findings 2** Summary of findings table 2: Goal framing

Attribute framing

Understanding

One study reported one comparison using a screening message (Lewis 2003). Negative framing led to better understanding than positive framing; the SMD was -0.58 (95% confidence interval (CI) -0.94 to -0.22), a moderate effect size corresponding to a 1.2 point difference on a 10 point Likert-type scale (Analysis 1.1). The quality of the evidence was low (Summary of findings for the main comparison).

Perception of effectiveness

Two studies reported two comparisons using one screening (Lewis 2003) and one other (harm) (Donovan 2000) message. Positively-framed messages led to more positive perception of effectiveness than negatively-framed messages; the pooled SMD was 0.36 (95% CI -0.13 to 0.85) (I^2 = 70%), a small effect size corresponding to a 0.7 point difference on a 10 point Likert-type scale. The quality of the evidence was low (Summary of findings for the main comparison).

In subgroup analysis, the test for interaction was not statistically significant (P = 0.18).

Persuasiveness

Eight studies reported 11 comparisons using 2 screening messages (Welkenhuysen 2001a; Welkenhuysen 2001b), 1 prevention message (Blanton 2001a), 5 treatment messages (Krishnamurthy 2001a; Krishnamurthy 2001c; Llewellyn-Thomas 1995; Wilson 1987a; Zimmermann 2000) and 3 other types of messages (2 harm (Donovan 2000; Jasper 2001) messages and 1 message about abortion (Wilson 1987b)). The inverted funnel plot did not suggest publication bias. Positive and negative framing did not lead to different persuasiveness; the pooled SMD was 0.07 (95% CI -0.23 to 0.37) (I^2 = 83%) (Analysis 1.3), corresponding to a 0.1 point difference on a 10 point Likert-type scale. The quality of the evidence was low (Summary of findings for the main comparison).

In subgroup analyses, the test for interaction was statistically significant (P < 0.0001). The pooled SMD was -0.20 (95% CI -0.93 to 0.53) (I^2 = 90%) for the screening messages; -0.61 (95% CI -0.98 to -0.25) for the prevention message; 0.33 (95% CI -0.14 to 0.80) (I^2 = 79%) for the treatment messages; and 0.10 (95% CI -0.30 to 0.51) (I^2 = 69%) for the other type messages. None of the screening or prevention messages' comparisons was of high quality to conduct sensitivity analysis. Only one treatment message comparison was of high quality (Llewellyn-Thomas 1995) and the associated SMD was -0.14 (95% CI -0.64 to 0.37). Two of the other type messages (the two using harm messages (Donovan 2000; Jasper 2001)) were of high quality and the associated SMD was 0.31 (95% CI 0.04 to 0.58) (I^2 = 0%).

Behavior

One study reported one comparison using a prevention message (O'Connor 1996). Positive and negative framing did not lead to different behavior; the SMD was 0.09 (95% CI -0.14 to 0.31) (Analysis 1.4), corresponding to a 0.2 point difference on a 10 point Likert-type scale. The quality of the evidence was moderate (Summary of findings for the main comparison).

Goal framing

Understanding

None of the included studies assessed this outcome in the context of goal framing.

Perception of effectiveness

Eight studies reported 14 comparisons using 5 screening messages (Cherubini 2005a; Cherubini 2005b; Hsiao 2002b; Ruiter 2003; Schmitt 2004) and 9 prevention messages (Block 1995a ; Block 1995b; Block 1995c; Block 1995d; Detweiler 1999; Hsiao 2002b; Kroll 2005; van Assema 2001a; van Assema 2001b). The inverted funnel plot did not suggest publication bias. Gain and loss framing did not lead to different perception of effectiveness; the pooled SMD was -0.03 (95% CI -0.22 to 0.16) (I^2 = 61%) (Analysis 2.1), corresponding to no difference on a 10 point Likert-type scale.

In subgroup analysis, the test for interaction was statistically significant (P = 0.0003). For screening messages, loss framing led to more positive perception of effectiveness compared to gain framing; the pooled SMD was -0.30 (95% CI -0.49 to -0.10) (I^2 = 0%) , a small effect size corresponding to a 0.6 point difference on a 10 point Likert-type scale. The quality of the evidence was moderate (Summary of findings 2). For prevention messages, gain and loss framing did not lead to different perception of effectiveness; the pooled SMD was 0.11 (95% CI -0.12 to 0.33) (I^2 = 57%) corresponding to a 0.2 point difference on a 10 point Likert-type scale. The quality of the evidence was low (Summary of findings 2).

The sensitivity analysis included three high quality comparisons for the screening messages (Cherubini 2005a; Cherubini 2005b;

Schmitt 2004) and the pooled SMD was -0.37 (95% CI -0.61 to -0.12) (I^2 = 0%). The sensitivity analysis included one high quality comparison for the prevention message (Detweiler 1999) and the SMD was 0.08 (95% CI -0.18 to 0.35).

Persuasiveness

Fourteen studies reported 23 comparisons using 6 screening messages (Banks 1995; Cherubini 2005a; Cherubini 2005b; Hsiao 2002b; Schmitt 2004; Scott 2006b), 13 prevention messages (Block 1995a; Block 1995b; Block 1995c; Block 1995d; Detweiler 1999; Hsiao 2002a; Kroll 2005; O'Connor 2005; Robberson 1988a; Robberson 1988b; Scott 2006a; van Assema 2001a; van Assema 2001b), 3 treatment messages (Carling 2010; Krishnamurthy 2001b; Krishnamurthy 2001d), and 1 other type (public health) message (Steward 2002). The inverted funnel plot did not suggest publication bias. Gain and loss framing did not lead to different persuasiveness; the pooled SMD was -0.06 (95% CI -0.18 to 0.06) (I^2 = 73%) (Analysis 2.2), corresponding to a 0.1 point difference on a 10 point Likert-type scale.

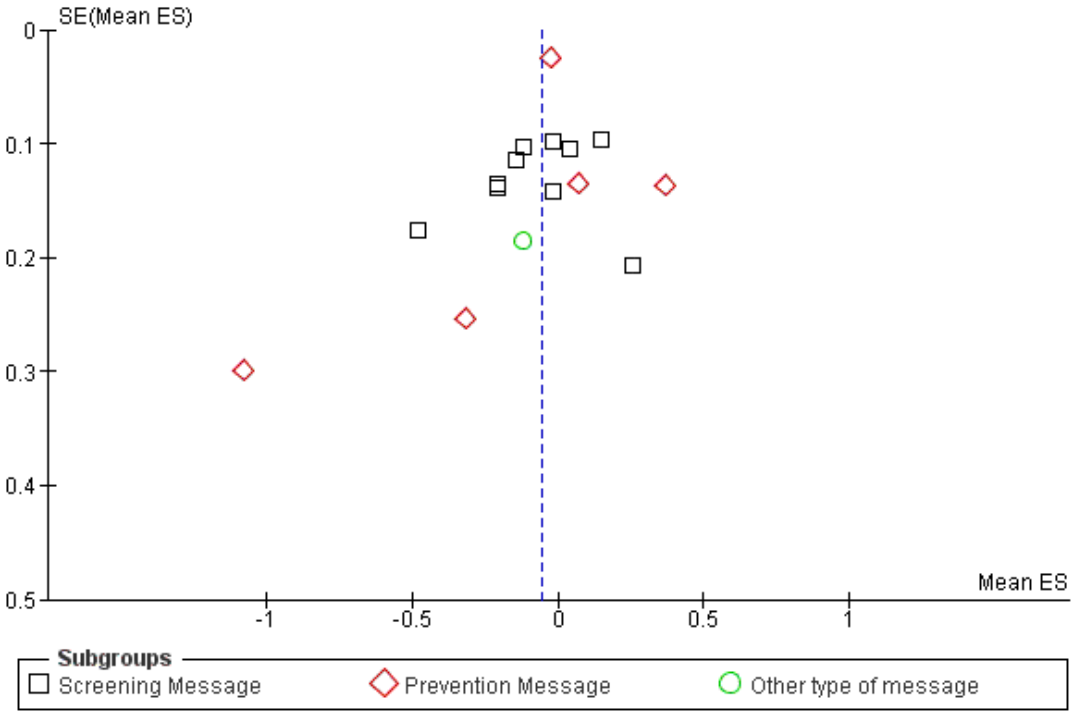
In subgroup analysis, the test for interaction was statistically significant (P = 0.0006). For screening messages, gain and loss framing did not lead to different persuasiveness; the pooled SMD was 0.06 (95% CI -0.23 to 0.35) (I^2 = 75%) corresponding to a 0.1 point difference on a 10 point Likert-type scale The quality of the evidence was low (Summary of findings 2). For prevention messages, gain and loss framing did not lead to different persuasiveness; the pooled SMD was 0.02 (95% CI -0.11 to 0.16) (I^2 = 53%) corresponding to no difference on a 10 point Likert-type scale The quality of the evidence was low (Summary of findings 2). For treatment messages, loss messages may have been more persuasive than gain messages; the pooled SMD was -0.50 (95% CI -1.04 to 0.04) (I^2 = 89%) a moderate effect size corresponding to a 1 point difference on a 10 point Likert-type scale. The quality of the evidence was very low (Summary of findings 2).

The sensitivity analysis included five high quality comparisons for the screening messages (Banks 1995; Cherubini 2005a; Cherubini 2005b; Schmitt 2004; Scott 2006b) and the pooled SMD was -0.03 (95% CI -0.15 to 0.08) (I^2 = 0%). The sensitivity analysis included three high quality comparisons for the prevention messages (Scott 2006a; Detweiler 1999; O'Connor 2005) and the pooled SMD was -0.04 (95% CI -0.20 to 0.13) (I^2 = 56%). Only one treatment message comparison was of high quality (Carling 2010) and the associated SMD was -0.21 (95% CI -0.36 to -0.07).

Behavior

Thirteen studies reported 16 comparisons using 10 screening messages (Apanovitch 2003 ; Banks 1995; Finney 2002a; Finney 2002b; Lalor 1990; Lerman 1992; Rivers 2005b; Schneider 2001b; Schneider 2001c; Williams 2001), 5 prevention messages (Detweiler 1999; Mann 2004; McCaul 2002; Rivers 2005a; Schneider 2001a), and 1 other type (diagnostic) message (Lauver 1990). The inverted funnel plot suggested a possible publication bias in favour of loss messages (Figure 3). Gain and loss framing did not lead to different behavior; the pooled SMD was -0.06 (95% CI -0.15 to 0.03) (I^2 = 63%) (Analysis 2.3), corresponding to a 0.1 point difference on a 10 point Likert-type scale. The quality of the evidence was low (Summary of findings 2).

Figure 3. Funnel plot of comparison: 2 Goal Framing, outcome: 2.3 Behavior.



In subgroup analysis, the test for interaction was not statistically significant (P = 0.62). The sensitivity analysis included 13 high quality comparisons (Apanovitch 2003 ; Banks 1995; Detweiler 1999; Lauver 1990; Lerman 1992; Mann 2004; McCaul 2002; Rivers 2005a; Rivers 2005b; Schneider 2001a Schneider 2001b; Schneider 2001c; Williams 2001) and the SMD was -0.07 (95% CI -0.18 to 0.04) (I^2 = 67%).

Consistency of decision with values

Only one study (Carling 2010) assessed the effects of alternative framing of message on the consistency of decision (to take antihypertensive medication) with values. The group that was presented gain-framed information appeared to make decisions that were most consistent with a second, more fully informed decision. However, the results did not clearly support gain framing as the "best" in terms of ensuring consistency.

Additional results

Detweiler 1999 compared the two forms of gain-framed messages (gain and non-loss) and the two forms of loss-framed messages (loss and non-gain) (see Appendix 2). They found no differences between the two gain-framed messages or between the two loss-framed messages. Although Apanovitch 2003 compared the two forms for gain and loss messages, they did not report analyses on differences.

Appendix 5 summarizes the results of comparisons and studies for which data are not reported but which are otherwise eligible. The results were not consistent with a discernable pattern.

Appendix 6 presents the results for the effect modification of the framing effects by 18 different factors. The results of the most studied factor (that is, level of involvement) were inconsistent.

ADDITIONAL SUMMARY OF FINDINGS *[Explanation]*

Goal framing

Patient or population: consumers
Intervention: loss-framed health messages
Comparison: gain-framed health messages

Outcomes	Average effect with gain message *	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
Perception - screening message (measured as rating on a scale of perceived effectiveness)	**0.30 SDs lower** (0.49 to 0.10 lower)	513 (5 studies)	⊕⊕⊕◯ **moderate**[1]	0.6 point difference on a 10 point Likert scale (small effect size)
Perception - prevention message (measured as rating on a scale of perceived effectiveness)	**0.11 SDs higher** (0.12 lower to 0.33 higher)	815 (9 studies)	⊕⊕◯◯ **low**[1,2,3]	0.2 point difference on a 10 point Likert scale (no difference)
Persuasiveness - screening message (measured as a hypothetical decision or intention or willingness to adopt an intervention)	**0.06 SDs higher** (0.23 lower to 0.35 higher)	931 (6 studies)	⊕⊕◯◯ **low**[1,2,3]	0.1 point difference on a 10 point Likert scale (no difference)
Persuasiveness - prevention message (measured as a hypothetical decision or intention or willingness to adopt an intervention)	**0.02 SDs higher** (0.11 lower to 0.16 higher)	1496 (13 studies)	⊕⊕◯◯ **low**[1,2]	0 point difference on a 10 point Likert scale (no difference)
Persuasiveness - treatment message (measured as a hypothetical decision or intention or willingness to adopt an intervention)	**0.50 SDs lower** (1.04 lower to 0.04 higher)	1788 (3 studies)	⊕◯◯◯ **very low**[1,2,4]	1 point difference on a 10 point Likert scale (moderate effect size)
Behavior	**0.06 SDs lower** (0.15 lower to 0.03 higher)	11629 (16 studies)	⊕⊕◯◯ **low**[2,5,6]	0.1 point difference on a 10 point Likert scale (no difference)

* SD: standard deviation
We interpreted SMDs using the following rules suggested by the Cochrane Handbook:
<0.40 represents a small effect size
0.40 to 0.70 represents a moderate effect size
> 0.70 represents a large effect size
We back translated the point estimates of the results by multiplying SMD by the standard deviation from a representative study (SD of 2 on a 10 point Likert-type scale)

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Indirectness: outcome is a surrogate for health behavior.
[2] Inconsistency: Statistical test for heterogeneity shows a significant P value; large $I^{2.}$
[3] Did not downgrade for imprecision because confidence interval (CI) included mostly values reflecting no to small effects.
[4] Imprecision: the CI includes both values in favour of loss framing and values in favour of gain framing.
[5] Sensitivity analysis included 13 high quality comparisons and found the SMG at -0.07 (95% CI -0.18 to 0.04), consistent with the main analysis.
[6] Risk of bias: the inverted funnel suggested a possible publication bias in favour of loss framing.

DISCUSSION

Summary of main results

In the context of attribute framing, participants in one included study understood the message better when it was framed negatively compared to positively (moderate effect size; low quality evidence). Although positively-framed messages led to a more positive perception of effectiveness (small effect size; low quality evidence), there was little if any difference in persuasiveness (low quality evidence) and attribute framing had no effect on health consumers' behavior (moderate quality evidence).

In the context of goal framing, and compared to gain messages, loss messages led to more positive perception of effectiveness for screening messages (small effect size; moderate quality evidence) and tended to be more persuasive for treatment messages (moderate effect size; very low quality evidence). However, they had little or no effect on health consumers' behavior (low quality evidence). These results do not unequivocally support framing effect theories or frameworks (Kahneman 1979; Tversky 1981; Schneider 1995; Rothman 1997) in relation to health messages. Indeed, these theories and frameworks were based on observations in laboratory settings as opposed to natural settings. They were also based on effects on surrogate outcomes as opposed to behavior. Understanding of information may not necessarily lead to a positive perception or persuade individuals to do or not to do something. Also, persuasion might not last long enough or might be so hampered by barriers (such as those related to the healthcare system) that it might not translate into actual behavior.

Overall completeness and applicability of evidence

The effectiveness of communication of health messages is directly linked to its effects on clinicians' evidence-based practice and consumers' informed medical decision making. However, none of the included studies targeted health professionals or policy makers. The vast majority of included studies did not directly assess the effects on consumers' behavior. Indeed, most of the evidence is based on hypothetical scenarios and relates to surrogate outcomes of understanding, perception of effectiveness and persuasiveness. Another valuable outcome is the consistency between the consumer's behavior and his or her values (that is, the relative impor-

tance of the desirable and undesirable effects of the intervention) (Carling 2008). No study assessed this outcome; only one study (Carling 2010) assessed the effects of goal framing on the consistency of decisions with values. The results did not clearly support the superiority of gain or loss framing in terms of ensuring consistency, although gain framing led to decisions most consistent with more fully-informed decisions.

Quality of the evidence

The vast majority of the comparisons were randomized controlled trials. However, 74% of studies did not report on the adequacy of concealment of allocation. The sensitivity analysis excluding studies at a higher risk of bias did not substantially alter the results for the outcomes of perception of effectiveness, persuasiveness and behavior for goal framing.

The assessment of quality by outcome using the GRADE approach showed that the quality of evidence varied from low to moderate for attribute framing, and from very low to moderate for goal framing. The quality of evidence was mainly affected by the use of surrogate outcomes and inconsistency. In spite of this inconsistency, in general, there does not seem to be a framing effect (particularly because the I^2 test is very powerful for standardised mean difference (SMD)). While there may be specific conditions under which an effect might exist, we were not able to determine such attributes.

Potential biases in the review process

Our electronic search strategy was designed for the effects of alternative presentations of risk information and not specifically for message framing. We plan to design a specific strategy for our next update of this review. In addition to using more specific and more adequate search terms, the updated strategy would benefit from widening the scope of searching (to include, for instance, CINAHL, ERIC, some trial registers and some grey literature). Although our electronic search may not have captured all eligible studies, our additional search strategies were apparently effective. Still, the date of search for this systematic review will be three years old by the time of its publication.

Because the included studies reported their outcomes using different scales, we had to use SMD to analyze and present our results. We tried to make our results more interpretable by back translating the SMD into a scaled value. However, simulation studies have found SMD to be biased towards no effect, especially with smaller studies (Van Den Noortgate 2003).

As noted above, our statistical approach for dealing with binary data in cross-over trials is limited. Since we designed our initial plan of analysis, new statistical methods have been developed, and we intend to use them with our next update (Curtin 2002; Elbourne 2002).

Agreements and disagreements with other studies or reviews

Earlier reviews of framing effects have tended to be narrative, did not conduct meta-analyses or did not distinguish different types of framing (Edwards 2001; Rothman 1997; Wilson 1988; Moxey 2003). We discuss here the results of three systematic reviews that included meta-analyses (Kuhberger 1998; O'Keefe 2007; O'Keefe 2009).

Kuhberger 1998 did not restrict their systematic review to health messages and the main analysis included all types of framing (including risky choice framing). The review found small to moderate differences between framing conditions (about a third of a standard deviation). However, the effect was mainly driven by studies of risky choice framing. The analysis found that both attribute framing (referred to as "framing by outcome salience") and goal framing (referred to as "message compliance design") were "ineffective".

O'Keefe 2007 conducted a systematic review assessing the persuasiveness of gain-framed and loss-framed messages for prevention behaviours. They found that gain-framed appeals are statistically significantly more persuasive than loss-framed appeals. However this superiority was driven by studies of dental hygiene behaviours and absent in studies of other preventive behaviours. Also, although statistically significant, the superiority was "quite small", corresponding to a correlation of 0.03. The authors concluded that the effect is so small that it should be considered negligible.

O'Keefe 2009 conducted another systematic review assessing the persuasiveness of gain-framed and loss-framed messages for screening behaviours. They found that loss-framed appeals were more persuasive than gain-framed appeals. However this superiority was driven by studies of breast cancer screening and absent in studies of other screening behaviours. Also, although statistically significant, the superiority was "quite small", corresponding to a correlation of -0.039. They concluded that loss-framed messages are unlikely to substantially improve persuasiveness.

In both their reviews, O'Keefe 2007 and O'Keefe 2009 considered attitude change, post-communication agreement, behavioral intention, and behavior as measures of persuasion, and averaged their measures to yield a single summary when more than one was reported.

AUTHORS' CONCLUSIONS

Implications for practice

The main finding of this study is that attribute and goal framing has little if any consistent effect on behavior (low to moderate quality evidence). This finding is strengthened by its consistency with findings of other well-conducted systematic reviews. Any effect (for example, in breast cancer screening) would possibly be

further attenuated by the multiple complex factors (such as access to care and adequacy of follow-up) that affect heath behavior, and eventually health outcomes. Moreover, there is evidence that the framing effects for both prevention and detection messages weaken with time (Rivers 2005a).

In the absence of evidence for the superiority of one frame over the other, a balanced presentation when producing patient information or decision aids is likely to be the safest approach.

Implications for research

Future research in the field of health communication should use high quality randomised controlled trial design, be conducted in real life settings, and assess outcomes such as actual behavior and the consistency of choices and behaviours with preferences and values. Future updates of this systematic review should aim to explain the unexplained heterogeneity between studies; that is, through meta-regression analyses exploring potential effect modifiers such as different perceived consequences (avoiding a bad health state as opposed to attaining a good health state) (See Appendix 2), type of heath message, level of baseline risk, level of involvement, and perceived susceptibility. Currently, such exploration is limited by the number of available studies, their quality, the large number of potential effect modifiers and potential confounding.

This review illustrates the danger of generalizing theory and laboratory research into clinical settings. Also, in the business field, a message framing intervention in a laboratory setting led to very different results in natural settings (Ganzach 1997). These facts highlight the need to test communication interventions empirically. While these studies would ideally take place in real life settings, they are complex and possibly not worth the cost. Carefully designed studies (with low risk of bias) using hypothetical scenarios may provide further evidence as to whether or not real life experiments are worth conducting.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Apanovitch 2003

Methods	Randomized controlled trial; 2x2 factorial design: action framing (attain versus not attain) x valence (desirable versus undesirable)
Participants	531 women from low income neighbourhoods recruited from public housing developments or a community health center 90% of recruited subjects included in the analysis.
Interventions	Videos with information about HIV screening framed either as gain or loss
Outcomes	Intention to get a screening test for HIV (persuasiveness) (data not available) Getting an HIV test within 6 months of intervention (behavior)
Notes	Screening message; goal framing; varying attainment and valence in a 2x2 factorial design **Examples of Messages:** Gain frame (attain, desirable): There are many benefits, or good things, you may experience if you get tested for HIV. If you decide to get HIV tested you may feel the peace of mind that comes with knowing about health. (Accompanied by a photo of a couple embracing on a couch) Loss frame (not attain, desirable): There are many benefits, or good things, you may not experience if you don't get tested for HIV. If you decide not to get HIV tested you won't feel the peace of mind that comes with knowing about your health. (Accompanied by a photo of a couple sitting at opposite ends of a couch) Loss frame (attain, undesirable): There are many problems, or bad things, you may experience if you don't get tested for HIV. If you decide not to get HIV tested, you may feel more anxious because you may wonder if you're ill. (Accompanied by a photo of a couple sitting at opposite ends of a couch) Gain frame (not attain, undesirable): There are many problems, or bad things, you may not experience if you get tested for HIV. If you decide to get HIV tested, you may feel less anxious because you won't wonder if you're ill. (Accompanied by a photo of a couple embracing on a couch)

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	

Banks 1995

Methods	Randomized controlled trial.
Participants	133 female utility employees who had never been diagnosed with breast cancer and were not adherent to national guidelines for obtaining mammography screening No details provided regarding response rate.
Interventions	Educational video presentation about benefits of mammography screening using gain-framed versus loss-framed formats
Outcomes	Intention to get a mammogram (persuasiveness). Mammography screening (at 6 and 12 months) (behavior).
Notes	Screening message; goal framing; varying attainment; using a desirable valence **Examples of Messages:** Gain frame: We will show you that detecting breast cancer early will save your life. Loss frame: We will show that failing to detect breast cancer early can cost you your life

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Mammography screening at 6 and 12 months.

Blanton 2001a

Methods	Quasi-randomised controlled trial. Blanton 2001a relates to study 4.
Participants	120 undergraduate students. No details provided regarding response rate.
Interventions	Message comparing those who use to those who don't use condoms framed either positively or negatively
Outcomes	Willingness to have unprotected sex (transformed into willingness to have protected sex) (persuasiveness)
Notes	Prevention message; attribute framing. **Messages:** Positive frame: People who have sex with condoms are more responsible and less selfish than people who have sex without condoms Negative frame: People who have sex without condoms are less responsible and more

Blanton 2001a (*Continued*)

	selfish than people who have sex with condoms	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	High risk	

Block 1995a

Methods	Quasi-randomised controlled trial; 2 x 2 factorial design (framing) x (low versus high efficacy interventions by varying the certainty with which adherence to the recommendations will lead to the desired outcome) Block 1995a relates to study 1, low efficacy group.
Participants	44 undergraduate students. No details provided regarding response rate.
Interventions	Messages about the effect of the adherence to precautions on contracting HPV and controlling the development of lesions using positive versus negative framing
Outcomes	Attitude towards the recommendation (perception of effectiveness) Intention to comply with recommendations (persuasiveness).
Notes	Prevention (and treatment) message, goal framing; varying attainment; using undesirable valence **Examples of Messages:** Gain frame: If you use the following precautions, you will be able to avoid contracting HPV. If you do have HPV, using these same precautions may help control the development of lesions Loss frame: If you don't use the following precautions, you will not be able to avoid contracting HPV. If you do have HPV, not using these same precautions may help speed the development of lesions

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.

Block 1995a (*Continued*)

Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	High risk	

Block 1995b

Methods	Quasi-randomised controlled trial; 2 x 2 factorial design (framing) x (low versus high efficacy interventions by varying the certainty with which adherence to the recommendations will lead to the desired outcome) Block 1995b relates to study 1, high efficacy group.
Participants	50 undergraduate students. No details provided regarding response rate.
Interventions	Messages about the effect of the adherence to precautions on contracting HPV and controlling the development of lesions using positive versus negative framing
Outcomes	Attitude towards the recommendation (perception of effectiveness) Intention to comply with recommendations (persuasiveness).
Notes	Prevention (and treatment) message, goal framing; varying attainment; using undesirable valence **Examples of Messages**: Gain frame: If you use the following precautions, you will be able to avoid contracting HPV. If you do have HPV, using these same precautions may help control the development of lesions Loss frame: If you don't use the following precautions, you will not be able to avoid contracting HPV. If you do have HPV, not using these same precautions may help speed the development of lesions

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	High risk	

Block 1995c

Methods	Quasi-randomised controlled trial; 2 x 2 factorial design (framing) x (low versus high efficacy interventions by varying the certainty with which adherence to the recommendations will lead to the desired outcome) Block 1995c relates to study 2, low efficacy group.
Participants	57 undergraduate students. No details provided regarding response rate.
Interventions	Messages about the effect of prevention behavior (sunscreen use and use of wide-brimmed hats) on skin cancer
Outcomes	Attitude towards the recommendation (perception of effectiveness) Intention to comply with recommendations (persuasiveness).
Notes	Prevention message, goal framing; varying attainment; using undesirable valence **Examples of Messages:** Gain frame: By using a sunscreen with a Sun Protection Factor (SPF) of 15 or greater, and wearing a wide-brimmed hat...you will avoid UV rays. Loss frame: By not using a sunscreen with a Sun Protection Factor (SPF) of 15 or greater, and not wearing a wide-brimmed hat...you will not avoid UV rays

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	High risk	

Block 1995d

Methods	Quasi-randomised controlled trial; 2 x 2 factorial design (framing) x (low versus high efficacy interventions by varying the certainty with which adherence to the recommendations will lead to the desired outcome) Block 1995d relates to study 2, high efficacy group.
Participants	58 undergraduate students. No details provided regarding response rate.
Interventions	Messages about the effect of prevention behavior (sunscreen use and use of wide-brimmed hats) on skin cancer
Outcomes	Attitude towards the recommendation (perception of effectiveness) Intention to comply with recommendations (persuasiveness).

Block 1995d (*Continued*)

Notes	Prevention message, goal framing; varying attainment; using undesirable valence **Examples of Messages:** Gain frame: By using a sunscreen with a Sun Protection Factor (SPF) of 15 or greater, and wearing a wide-brimmed hat...you will avoid UV rays. Loss frame: By not using a sunscreen with a Sun Protection Factor (SPF) of 15 or greater, and not wearing a wide-brimmed hat...you will not avoid UV rays

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	High risk	

Carling 2010

Methods	Internet-based randomized controlled trial.
Participants	1528 adult volunteers in Norway recruited through a nationally televised weekly health program No details provided regarding response rate.
Interventions	Information about the effects of antihypertensive medication displayed on a website framed either positively or negatively
Outcomes	Decision whether to take antihypertensive medication (persuasiveness)
Notes	Treatment message, goal framing; varying attainment; using undesirable valence **Examples of messages:** Gain frame: Of 1000 people who do not take medication to lower their blood pressure, 930 will escape having cardiovascular disease over the next 10 years. Of 1000 people who take medication to lower their blood pressure, 944 will escape having cardiovascular disease over the next 10 years Loss frame: Of 1000 people who do not take medication to lower their blood pressure, 70 will have cardiovascular disease over the next 10 years. Of 1000 people who take medication to lower their blood pressure, 56 will have cardiovascular disease over the next 10 years

Risk of bias

Bias	Authors' judgement	Support for judgement

Allocation concealment (selection bias)	Low risk	Randomization part of the automatic process of logging on to the survey website
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	Hypothetical outcome.

Cherubini 2005a

Methods	Randomized controlled trial; 2x2 factorial design: framing (positive versus negative) x emotional vividness (reassuring versus fear evoking) Cherubini 2005a relates to "reassuring" group.
Participants	180 men from North Italy. 82% response rate.
Interventions	Six page pamphlet reporting information about prostate cancer, screening methodologies, and medical care recommendations framed either positively or negatively
Outcomes	Perceived utility of a prostate examination (perception of effectiveness) Motivation to perform a prostate examination (persuasiveness) Some of the data supplied by authors.
Notes	Screening message; goal framing; varying attainment; using desirable valence **Examples of Messages:** Gain frame: Only by having a prostate examination can you be sure that you do not have prostate cancer. Research shows that men who regularly undergo prostate examinations have an increased chance of finding a tumour in the early, more treatable stage of the disease. You can gain several potential health benefits by having an examination that's not at all distressful and requires just a little of your time. Take advantage of this opportunity Loss frame: Not having a prostate examination, you cannot be sure that you do not have prostate cancer. Research shows that men who do not undergo prostate examinations have a decreased chance of finding a tumour in the early, more treatable stage of the disease. You can lose several potential health benefits by failing to have an examination that's not at all distressful and requires just a little of your time. Do not fail to take advantage of this opportunity

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different for-	Low risk	

Cherubini 2005a (*Continued*)

mats randomized?		
Objective outcome?	High risk	

Cherubini 2005b

Methods	Randomized controlled trial; 2x2 factorial design: framing (positive versus negative) x emotional vividness (reassuring versus fear evoking) Cherubini 2005b relates to "evoking" group.
Participants	180 men from North Italy. 82% response rate.
Interventions	Six page pamphlet reporting information about prostate cancer, screening methodologies, and medical care recommendations framed either positively or negatively
Outcomes	Perceived utility of a prostate examination (perception of effectiveness) Motivation to perform a prostate examination (persuasiveness) Some of the data supplied by authors.
Notes	Screening message, goal framing. **Examples of Messages:** Gain frame: "If you are over 40, you should request a prostate examination from your physician. Only by having a prostate examination can you be sure that you do not have prostate cancer. Research shows that men who regularly undergo prostate examinations have an increased chance of finding a tumour in the early, more treatable stage of the disease. You can gain several potential health benefits by having an examination that's not at all distressful and requires just a little of your time. Take advantage of this opportunity. " Loss frame: "Not having a prostate examination, you cannot be sure that you do not have prostate cancer. Research shows that men who do not undergo prostate examinations have a decreased chance of finding a tumour in the early, more treatable stage of the disease. You can lose several potential health benefits by failing to have an examination that's not at all distressful and requires just a little of your time. Do not fail to take advantage of the opportunity."

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Detweiler 1999

Methods	Randomized controlled trial; 2x2 factorial design: action framing (attain versus not attain) x valence (desirable versus undesirable)
Participants	217 beach goers, 18 or older. "Approximately 90% of those asked to participate agreed to do so, and of the brochures that were distributed, over 95% were completed and returned."
Interventions	Brochure with information about skin cancer and the use of sunscreen framed as gain versus loss
Outcomes	Perceived efficacy of sun-protective behavior (perception of effectiveness) Self-reported intention to use sunscreen at beach (persuasiveness) Redemption of a sunscreen coupon (behavior).
Notes	Prevention message; goal framing; varying attainment and valence in a 2x2 factorial design **Examples of Messages:** Gain frame (attain, desirable): Protect yourself from the sun and you will help yourself stay healthy Loss frame (not attain, desirable): Don't expose yourself to the sun and you won't risk becoming sick Loss frame (attain, undesirable): Expose yourself to the sun and you will risk becoming sick Gain frame (not attain, undesirable): Don't protect yourself from the sun and you won't help yourself stay healthy

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	

Donovan 2000

Methods	Randomized controlled trial.
Participants	102 adult females (18-45 years) in a shopping mall. 74% response rate.
Interventions	Participants were presented with information about a hypothetical new infant immunization with side effect information framed either positively or negatively

Donovan 2000 (*Continued*)

Outcomes	Attitude toward the immunization shot (perception of effectiveness) Intention to immunize (persuasiveness).
Notes	Harm message (in the context of a prevention message), attribute framing **Messages:** 90% of children do not develop the side effect (negative frame; author categorized it as positive) 10% of children do develop a side effect (positive frame; author categorized it as negative)

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Finney 2002a

Methods	Quasi-randomised controlled trial.
Participants	313 women, at least 40 years of age with a positive family history of breast cancer, and due for their annual mammogram No details provided regarding response rate.
Interventions	Mammogram screening reminder letters framed either positively or negatively. Messages based on those used by Banks 1995.
Outcomes	Compliance with mammogram screening (at 1 and 2 months) (behavior)
Notes	Screening message; goal framing; varying attainment; using a desirable valence **Examples of messages:** Gain frame: We will show you that detecting breast cancer early will save your life. Loss frame: We will show that failing to detect breast cancer early can cost you your life

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.

Finney 2002a (*Continued*)

Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	Low risk	Compliance with mammogram screening.

Finney 2002b

Methods	Quasi-randomised controlled trial.
Participants	616 women, at least 40 years of age without a positive family history of breast cancer, and due for their annual mammogram No details provided regarding response rate.
Interventions	Mammogram screening reminder letters framed either positively or negatively. Messages based on those used by Banks 1995.
Outcomes	Compliance with mammogram screening (at 1 and 2 months) (behavior)
Notes	Screening message; goal framing; varying attainment; using a desirable valence **Examples of messages:** Gain frame: We will show you that detecting breast cancer early will save your life. Loss frame: We will show that failing to detect breast cancer early can cost you your life

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	Low risk	Compliance with mammogram screening.

Hsiao 2002a

Methods	Randomized controlled trial; 2x2x2 factorial design: frame (positive versus negative) x type of exercise (regular exercise versus exercise testing) x emphasis (prevention versus detection) Hsiao 2002a relates to regular exercise with prevention focus and vary by frame
Participants	49 college students with "lack of regular physical activity and previous participation in exercise testing" No details provided regarding response rate.

Hsiao 2002a (*Continued*)

Interventions	Pamphlet promoting regular exercise framed either positively or negatively
Outcomes	Attitude (perception of effectiveness). Behavioral intention (persuasiveness).
Notes	Prevention message; goal framing; varying attainment; using desirable valence Data not available for self-reported activity level (behavior) **Messages:** Gain frame: There are important health benefits to be gained from engaging in regular exercise. By engaging in regular exercise, you can effectively lower your LDL (the bad cholesterol that sticks to your artery walls) and increase your HDL (the good cholesterol that removes LDL from your artery walls). Additionally, by engaging in regular exercise, you can effectively lower your fat content and increase your muscle mass. Ultimately, when you engage in regular exercise, you are taking advantage of a safe and effective way to reduce your risk of heart disease and improve your cardiovascular fitness. With early prevention, you can avoid expensive medical treatment and unnecessary suffering caused by heart problems later on Loss frame: There are important health benefits that can be lost from failure to engage in regular exercise. By not engaging in regular exercise, you cannot effectively lower your LDL (the bad cholesterol that sticks to your artery walls) and increase your HDL (the good cholesterol that removes LDL from your artery walls). Additionally, by not engaging in regular exercise, you cannot effectively lower you fat content and increase your muscle mass. Ultimately, when you do not engage in regular exercise, you fail to take advantage of a safe and effective way to reduce your risk of heart disease and improve your cardiovascular fitness. Without early prevention, you miss opportunities to avoid expensive medical treatment and unnecessary suffering caused by heart problems later on

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	Self-reported activity level.

Hsiao 2002b

Methods	Randomized controlled trial; 2x2x2 factorial design: frame (positive versus negative) x type of exercise (regular exercise versus exercise testing) x emphasis (prevention versus detection) Hsiao 2002b relates to exercise testing with detection focus and vary by frame No details provided regarding response rate.
Participants	46 college students with "lack of regular physical activity or previous participation in exercise testing."
Interventions	Pamphlet promoting exercise testing framed either positively or negatively
Outcomes	Attitude (perception of effectiveness). Behavioral intention (persuasiveness).
Notes	Screening message; goal framing; varying attainment; using desirable valence **Messages:** Gain frame: There are important health benefits to be gained from participating in an exercise test. By participating in an exercise test, you can effectively assess how your heart and blood vessels respond to physical exertion. As the body works harder during exercise, it requires more oxygen and the heart has to pump more blood. Thus by participating in an exercise test, you can effectively find out early if there is a lack of blood supply through the arteries that go to the heart. Ultimately, when you participate in an exercise test, you are taking advantage of a safe and effective way to detect your risk of heart disease and improve your cardiovascular fitness. With early detection, you can avoid expensive medical treatment and unnecessary suffering caused by heart problems later on Loss frame: There are important health benefits that can be lost from failure to participate in an exercise test. By not participating in an exercise test, you cannot effectively assess how your heart and blood vessels respond to physical exertion. As the body works harder during exercise, it requires more oxygen and the heart has to pump more blood. Thus, by not participating in an exercise test, you cannot effectively find out early if there is a lack of blood supply through the arteries that go to the heart. Ultimately, when you do not participate in an exercise test, you fail to take advantage of a safe and effective way to detect your risk of heart disease and improve your cardiovascular fitness. Without early detection, you miss opportunities to avoid expensive medical treatment and unnecessary suffering caused by heart problems later on

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Jasper 2001

Methods	Randomized controlled trial, 84% response rate
Participants	105 female callers to a counselling service for pregnant women in Toronto 84% response rate.
Interventions	Teratogenic-risk information presented in either a positive frame or a negative frame
Outcomes	Willingness to take the drug (persuasiveness).
Notes	Harm message (in the context of a treatment message), attribute framing **The Messages:** Negative-frame: In every pregnancy, there is a 1 to 3% chance that a woman will give birth to a child who has a major birth defect. This/these drug(s) [insert applicable drug name] has/have not been shown to change that Positive-frame: "In every pregnancy, there is a 97 to 99% chance that a woman will give birth to a child who does not have a major birth defect. This/these drug(s) [insert applicable drug name] has/have not been shown to change that

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Krishnamurthy 2001a

Methods	Randomized controlled trial; 2x2 factorial design: (goal versus attribute framing) x (positive versus negative framing). Each participant received 5 messages with 5 different levels of effectiveness (10%, 30%, 50%, 70%, 90%) Krishnamurthy 2001a relates to students who received attribute framing. No details provided regarding response rate.
Participants	143 undergraduate college students (considered to have low intrinsic self relevance) participated in studies A and B
Interventions	Participants were presented with information about 5 possible new treatments for a health condition they chose ("that had most recently warranted a visit to a physician")
Outcomes	Likelihood of talking to the physician about the treatment (persuasiveness)

Krishnamurthy 2001a (*Continued*)

Notes	Treatment message, attribute framing. **The Messages:** Positive attribute framing condition: Treatment A (B, C, D, E) provides better results for 50% (10%, 90%, 70% or 30%) of the patients with your health condition Negative attribute framing condition: Treatment A (B, C, D, E) fails to provide better results for 50% (90%, 10%, 30% or 70%) of the patients with your health condition.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Krishnamurthy 2001b

Methods	Randomized controlled trial; 2x2 factorial design: (goal versus attribute framing) x (positive versus negative framing). Each participant received 5 messages with 5 different levels of effectiveness (10%, 30%, 50%, 70%, 90%) Krishnamurthy 2001b relates to students who received goal framing. No details provided regarding response rate.
Participants	143 undergraduate college students (considered to have low intrinsic self relevance) participated in studies A and B
Interventions	Participants were presented with information about 5 possible new treatments for a health condition they chose ("that had most recently warranted a visit to a physician")
Outcomes	Likelihood of talking to the physician about the treatment (persuasiveness)
Notes	Treatment message, goal framing; varying attainment; using desirable valence **The Messages:** Positive goal framing condition: By taking Treatment A (B, C, D, E) you get a 50% (10%, 90%, 70% or 30%) chance of getting better results Negative goal framing condition: By not taking Treatment A (B, C, D, E) you give up a 50% (10%, 90%, 70% or 30%) chance of getting better results

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.

Krishnamurthy 2001b (*Continued*)

Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Krishnamurthy 2001c

Methods	Randomized controlled trial; 2x2 factorial design: (goal versus attribute framing) x (positive versus negative framing). Each participant received 5 messages with 5 different levels of effectiveness (10%, 30%, 50%, 70%, 90%) Krishnamurthy 2001c relates to patients who received attribute framing. No details provided regarding response rate.
Participants	117 patients of a health clinic (considered to have high intrinsic self relevance) participated in studies C and D
Interventions	Participants were presented with information about 5 possible new treatments for a health condition they chose ("that had most recently warranted a visit to a physician")
Outcomes	Likelihood of talking to the physician about the treatment (persuasiveness)
Notes	Treatment message, attribute framing. **The Messages:** Positive attribute framing condition: Treatment A (B, C, D, E) provides better results for 50% (10%, 90%, 70% or 30%) of the patients with your health condition Negative attribute framing condition: Treatment A (B, C, D, E) fails to provide better results for 50% (90%, 10%, 30% or 70%) of the patients with your health condition.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Krishnamurthy 2001d

Methods	Randomized controlled trial; 2x2 factorial design: (goal versus attribute framing) x (positive versus negative framing). Each participant received 5 messages with 5 different levels of effectiveness (10%, 30%, 50%, 70%, 90%) Krishnamurthy 2001d relates to patients who received goal framing. No details provided regarding response rate.
Participants	117 patients of a health clinic (considered to have high intrinsic self relevance) participated in studies C and D
Interventions	Participants were presented with information about 5 possible new treatments for a health condition they chose ("that had most recently warranted a visit to a physician")
Outcomes	Likelihood of talking to the physician about the treatment (persuasiveness)
Notes	Treatment message, goal framing; varying attainment; using desirable valence **The Messages:** Positive goal framing condition: By taking Treatment A (B, C, D, E) you get a 50% (10%, 90%, 70% or 30%) chance of getting better results Negative goal framing condition: By not taking Treatment A (B, C, D, E) you give up a 50% (10%, 90%, 70% or 30%) chance of getting better results

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Kroll 2005

Methods	Randomized controlled trial.
Participants	192 students from a metropolitan area private parochial high school "who met the criteria for the lowest two stages of exercise change" No details provided regarding response rate.
Interventions	Multimedia PowerPoint presentation about exercising with messages framed either positively or negatively
Outcomes	Perceived persuasiveness of the message (perception of effectiveness) Intention to exercise (on days 1, 7, 30) (persuasiveness).

Kroll 2005 (*Continued*)

Notes	Prevention message; goal framing; varying valence. **Examples of messages:** Gain frame: You'll be more healthy if you exercise. Loss framed: If you don't exercise, you'll get sick.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Lalor 1990

Methods	Randomized controlled trial.
Participants	55 undergraduate women, ages 19 to 42 who reported practicing breast self-examination (BSE) less than 4 times per year No details provided regarding response rate.
Interventions	Pamphlet on breast cancer examination framed either positively or negatively
Outcomes	Actual breast self-examination (behavior). (Although study assessed perception of effectiveness and persuasiveness, it did not report the related raw data.)
Notes	Screening message, goal framing, varying attainment; using desirable valence **Examples of messages:** Gain frame: By doing BSE now, you can learn what your normal, healthy breasts feel like so that you will be better prepared to notice any small, abnormal changes that might occur as you get older Loss frame: By not doing BSE now, you will not learn what your normal, healthy breasts feel like so that you will be ill prepared to notice any small, abnormal changes that might occur as you get older

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.

Lalor 1990 (*Continued*)

Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	Cluster randomizations; "only one type of pamphlet was distributed at each training session so that subjects were unaware that there were two different pamphlets."
Objective outcome?	High risk	

Lauver 1990

Methods	Randomized controlled trial.
Participants	116 women with abnormal Papanicolaou (pap) test. 85% response rate.
Interventions	When informed about the positive pap test, women were told about the gains with follow-up (positive frame) or the losses without follow-up (negative frame)
Outcomes	Return to the clinic for a follow-up colposcopy test within six weeks of contact (behavior)
Notes	Mixed diagnostic and treatment message; goal framing; varying attainment; using desirable valence **Examples of Messages:** Gain Message: By going for colposcopy, you can have further tests to learn what the abnormal cells mean.... If (necessary), you would be in a good position to get early treatment. With early treatment you could raise your chances for living cancer-free and symptom-free Loss Message: By not going for colposcopy, you cannot have further test to learn what the abnormal cells mean....If (necessary), you would not be in a good position to get early treatment. Without early treatment, you could lower your chances for living cancer-free and symptom-free

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Low risk	Sealed envelopes.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Return to the clinic for a follow-up colposcopy test.

Lerman 1992

Methods	Randomized controlled trial.
Participants	446 women with abnormal mammograms during the previous year and eligible to receive an annual screening mammogram during the study period (data for about half included in meta-analysis) 47% of eligible women included in the study. The response rate to telephone intervention was 71%. The response rate for checking the outcome 3 months later was 89%
Interventions	Psychoeducational booklet, with information about abnormal mammograms and the necessity of continued screening, written in a positive frame or negative frame were mailed to the women followed one week later by a free mammogram referral
Outcomes	Participant self-reported adherence to mammography screening three months after the intervention (behavior)
Notes	Screening message, goal framing. **Messages:** not provided.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Adherence to mammography screening.

Lewis 2003

Methods	Randomized controlled trial.
Participants	179 women aged 35 to 49, with no history of breast cancer, able to read and write in English, attending a General Internal Medicine practice 67% response rate.
Interventions	Video presentations in which a female narrator conveys positively versus negatively-framed messages about the benefits and harms of screening mammography. The verbal presentations were reinforced with diagrams
Outcomes	Change in the accuracy of the response to questions about the potential benefits and harms of mammography (understanding) Change in the perception of effectiveness of the importance of the benefits of mammography relative to its downsides (perception of effectiveness)

Notes	Screening message; attribute framing. **Examples of Messages:** Positive frame: Of 1000 women getting mammograms every year for 10 years, 1 woman's life is extended because she got yearly mammograms Negative frame: Of 1000 women getting mammograms every year for 10 years, 999 women's lives are not extended because they got yearly mammograms

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	Opaque, sealed and sequentially numbered envelopes.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	1 out of 2: understanding.

Llewellyn-Thomas 1995

Methods	Randomized controlled trial.
Participants	60 patients with colorectal cancer. Of 264 eligible patients, 96 invited, 90 participated (60 included in the meta-analysis)
Interventions	Booklets with information about a chemotherapeutic treatment presented in a positive or negative frame
Outcomes	Hypothetical decision to participate in a clinical trial incorporating the chemotherapeutic treatment (persuasiveness)
Notes	Treatment (including benefit and harm) message; attribute framing **The Messages:** Positive frame: 20 out of 100 patients will be free of these side effects, and will retain their ability to carry out their usual daily work and recreational activities. 5 years after treatment, 55 out of 100 patients will have survived Negative frame: 80 out of 100 patients will have these side effects, which will interfere with their ability to carry out their usual daily work and recreational activities. 45 out of 100 patients will have died

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	Sealed envelope.

Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Mann 2004

Methods	Randomized controlled trial.
Participants	70 undergraduate students enrolled in a research methods course (7 of them excluded from analysis) No details provided regarding response rate.
Interventions	Articles adapted from the American Medical Association Website presenting facts about gum disease and proper flossing technique, presented either in a gain frame or in a loss frame
Outcomes	Self-reported use of flosses (behavior).
Notes	Prevention message, goal framing; varying valence; using "attain" type of terms **Examples of Messages:** Gain frame: Flossing your teeth daily removes particles of food in the mouth, avoiding bacteria, which promotes great breath Loss frame: If you don't floss your teeth daily, particles of food remain in the mouth, collecting bacteria, which causes bad breath

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	

McCaul 2002

Methods	Randomized controlled trial.
Participants	6522 men and women who lived in 29 North Dakota counties and had not submitted reimbursement requests to cover flu shots the previous year "Subject loss was approximately 6%."

McCaul 2002 (*Continued*)

Interventions	A reminder letter from the state peer review organization about the consequences of the flu vaccine framed either positively or negatively
Outcomes	Vaccination rate (behavior).
Notes	Prevention message; goal framing; varying attainment; undesirable valence **Examples of Messages:** Gain frame: The gain insert featured the picture and testimonial of a North Dakota woman who had received a flu shot the previous year and had not gotten the flu. The testimonial stated, "I got a flu shot last year, and stayed healthy. I'm convinced that the flu shot protected me. I like to stay as healthy and active as I can, so I'm getting a flu shot again this year." In addition, the insert displayed information about three benefits of getting "your flu shot soon" ("You will be less likely to get the flu this fall"; "If you do get the flu, you will probably not be as sick" and "You will be less likely to enter the hospital because of the flu") Loss frame: The loss insert featured the picture and testimonial of another North Dakota woman who had not received a flu shot last year and had spent several days in bed, sick with the flu. The testimonial stated, "I didn't get a flu shot last year, and caught the flu. I was sick and in bed for nine days. I want to avoid catching the flu again this year, so I'm getting a flu shot." In addition, the insert displayed information about three costs "if you don't get your flu shot soon" ("You will be more likely to get the flu this fall"; "If you do get the flu, you will probably be more sick" and "You will be more likely to enter the hospital because of the flu")

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Vaccination.

O'Connor 1996

Methods	Randomized control trial.
Participants	292 participants from outpatient respiratory and cardiac clinics and eligible for Influenza immunization No details provided regarding response rate.
Interventions	Messages about the benefits and risks of influenza vaccine presented using positive or negative frames

O'Connor 1996 (*Continued*)

Outcomes	Immunization rate (behavior).	
Notes	Prevention message, attribute framing. **Examples of messages**: The positive frame described the percentage of individuals who remain influenza-free and free of vaccine side effects. The negative frame used the percentage who acquires influenza and vaccine side effects with and without immunization	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	

O'Connor 2005

Methods	Randomized controlled trial.	
Participants	304 undergraduate students who had previously used some form of contraception No details provided regarding response rate.	
Interventions	Material with information about an imaginary male hormonal contraception framed either positively or negatively	
Outcomes	Intention to use the male contraception (persuasiveness).	
Notes	Prevention message; goal framing; varying attainment; using a desirable valence **The Messages:** Gain-frame: "If you use the male contraceptive pill or injection, you will be able to take advantage of an alternative, convenient method, which would provide reliable contraception, does not carry a significant risk of side effects and would allow for a more equal sharing of the responsibility for contraception." Loss frame: "If you do not use the male contraceptive pill or injection, you will not be able to take advantage of an alternative, convenient method, which would provide reliable contraception, does not carry a significant risk of side effects and would allow for a more equal sharing of the responsibility for contraception."	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Rivers 2005a

Methods	Randomized controlled trial; 2x2 factorial design (gain versus loss) x (prevention versus detection) Rivers 2005a relates to the prevention comparison.
Participants	441 women attending an urban community health clinic serving predominantly minority and lower-income populations 71% follow up rate at 6 months; 78% follow up rate at 12 months
Interventions	10 min video presentation about cervical cancer and Pap smear using either positive or negative framing. The video emphasized the prevention function of the test
Outcomes	Self-reported Pap test utilization at 6 months (behavior).
Notes	Prevention message; goal framing; varying attainment; using negative valence **Examples of Messages:** Gain-frame: If you get regular Pap smears, you can prevent cervical cancer from developing...and preventing cervical cancer can save your life Loss frame: If you don't get regular Pap smears, you can't prevent cervical cancer from developing...and not preventing cervical cancer can cost your life

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	High risk	Computer-generated table of randomly sorted combinations of conditions
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Self-reported behavior.

Rivers 2005b

Methods	Randomized controlled trial; 2x2 factorial design (gain versus loss) x (prevention versus detection) Rivers 2005b relates to the detection comparison.
Participants	441 women attending an urban community health clinic serving predominantly minority and lower-income populations 71% follow up rate at 6 months; 78% follow up rate at 12 months
Interventions	10 min video presentation about cervical cancer and Pap smear using either positive or negative framing. The video emphasized the detection function of the test
Outcomes	Self-reported Pap test utilization at 6 months (behavior).
Notes	Screening message; goal framing; varying attainment. **Examples of Messages:** Gained-framed: If you get regular Pap test, you can detect cervical cancer early...and detecting cervical cancer early can save your life Loss framed: If you don't get regular Pap test, you can't detect cervical cancer early...and not detecting cervical cancer early can cost your life

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	High risk	Computer-generated table of randomly sorted combinations of conditions
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Self-reported behavior.

Robberson 1988a

Methods	Randomized controlled trial; 3x2 factorial design: message framing (positive versus negative versus both) x type of appeal (health versus self esteem) Robberson 1988a refers to groups with "health" as type of appeal.
Participants	84 non exercising females students enrolled in introductory psychology courses No details provided regarding response rate.
Interventions	Information about the effects of exercise on bodily functioning and mental functioning using positive versus negative framing
Outcomes	Intention to exercise (persuasiveness).

Robberson 1988a (*Continued*)

Notes	Prevention message; goal framing; varying attainment; using desirable valence **Examples of Messages:** Gain frame: One of the greatest advantages of becoming involved in a regular exercise program is the resulting increase in physical stamina and endurance Loss frame: One of the greatest disadvantages of not being involved in a regular exercise program is the resulting decrease in physical stamina and endurance

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Robberson 1988b

Methods	Randomized controlled trial; 3x2 factorial design: message framing (positive versus negative versus both) x type of appeal (health versus self esteem) Robberson 1988b refers to groups with "esteem" as type of appeal.
Participants	84 non exercising females students enrolled in introductory psychology courses No details provided regarding response rate.
Interventions	Information about the effects of exercise on bodily functioning and mental functioning using positive versus negative framing
Outcomes	Intention to exercise (persuasiveness).
Notes	Prevention message, goal framing. **Examples of Messages:** Gain frame: And what better results of exercise and fitness can there be than that general 'feeling good about yourself' that goes along with the improved appearance, personal style, confidence and control. There's a boost to self-esteem that gives you greater comfort with yourself so that your pride and self-acceptance grow Loss frame: And then there's that general 'feeling bad about yourself' that often goes along with a poor appearance, lack of personal style. lowered confidence, and lessened control. Feeling of worthlessness and self-degradation commonly increase

Risk of bias

Bias	Authors' judgement	Support for judgement

Robberson 1988b (*Continued*)

Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Ruiter 2003

Methods	Quasi-randomised controlled trial.
Participants	110 female Dutch undergraduate students. No details provided regarding response rate.
Interventions	Information about performing breast self-examination in either gain frame or loss frame
Outcomes	Evaluation of the importance of breast self-examination relative to five other health behaviours (perception of effectiveness)
Notes	Screening behavior; goal framing; varying attainment; using desirable valence **Examples of Messages:** Gain frame: By performing breast self-examination, your chances to detect breast cancer in an early and better treatable stage will be high Loss frame: By not performing breast self-examination, your chances to detect breast cancer in an early and better treatable stage will be low

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Unclear risk	No details provided.
Objective outcome?	High risk	

Schmitt 2004

Methods	Randomized controlled trial; 2x2 factorial design: message framing (positive verus negative versus both) x screening function (illness-detecting versus health affirming)
Participants	177 female community volunteers. 85% response rate.

Schmitt 2004 (*Continued*)

Interventions	Pamphlets with information about cholesterol, heart disease and blood cholesterol screening framed either positively or negatively
Outcomes	Implementation Intention to obtain a blood cholesterol screening test (persuasiveness)
Notes	Screening test; goal framing; varying attainment, using desirable valence **Examples of messages:** Gain frame: If you obtain a blood cholesterol test, you will gain important information about your cardiovascular health Loss frame: If you do not obtain a blood cholesterol test, you will not gain important information about your cardiovascular health

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Schneider 2001a

Methods	Randomized controlled trial; 2x2 factorial design (gain versus loss visual) x (gain versus loss auditory) Schneider 2001a is a separate publication from Schneider 2001b and Schneider 2001c.
Participants	437 undergraduates attending a public university in New England No details provided regarding response rate.
Interventions	Multimedia presentation using visual and auditory modalities randomizing patients in 2x2 (gain versus loss visual and gain versus loss auditory)
Outcomes	Self-reported smoking behavior after 6 weeks (behavior).
Notes	Prevention behavior, goal framing. The factorial design (gain versus loss visual and gain versus loss auditory) weakness the validity of the results as half the participants received mixed framing. We used only data from groups receiving consistent messages (i.e. gain visual and gain auditory; and loss visual and loss auditory) **Examples of Messages:** Gain frame: "If you quit you'll look and feel better right away." Loss frame: "If you don't quit you won't look and smell better...."

Schneider 2001a (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	

Schneider 2001b

Methods	Randomized controlled trial. Schneider 2001b refers to multicultural video intervention.
Participants	379 women (mostly minorities) over 40 recruited from inner-city community health clinics or from public housing developments Not clear what the response rate to the initial invitation is. Contact rates at 6 and 12 months follow up were 70 and 71%
Interventions	10 minutes multicultural video about breast cancer and screening mammography framed either positively or negatively
Outcomes	Actual mammography screening (at 6 and 12 months) (behavior)
Notes	Screening behavior; goal framing; varying attainment; using desirable valence **Examples of Messages:** Gain frame: ...detecting breast cancer early can save a woman's life. When a woman gets regular mammograms, she is doing her best to detect breast cancer early Loss frame: ...failing to detect breast cancer early can cost a woman her life. When a woman does not get regular mammograms, she is not doing her best to detect breast cancer early

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	High risk	Coin flip.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Actual mammography screening.

Schneider 2001c

Methods	Randomized controlled trial. Schneider 2001c refers to targeted video intervention.
Participants	373 women (mostly minorities) over 40 recruited from inner-city community health clinics or from public housing developments Not clear what the response rate to the initial invitation was. Contact rates at 6 and 12 months follow up were 70 and 71%
Interventions	10 minute long targeted video about breast cancer and screening mammography framed either positively or negatively
Outcomes	Actual mammography screening (at 6 and 12 months) (behavior)
Notes	Screening behavior; goal framing; varying attainment; using desirable valence **Examples of Messages:** Gain frame: ...detecting breast cancer early can save a woman's life. When a woman gets regular mammograms, she is doing her best to detect breast cancer early Loss frame: ...failing to detect breast cancer early can cost a woman her life. When a woman does not get regular mammograms, she is not doing her best to detect breast cancer early

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	High risk	Coin flip.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Actual mammography screening.

Scott 2006a

Methods	Randomized controlled trial; 2x2 factorial design (gain versus loss visual) x (present versus future time orientation) Scott 2006a refers to gain versus loss; prevention messages.
Participants	395 college women. No details provided regarding response rate.
Interventions	Print messages about women and heart disease, main behavioral risk factors associated with heart disease, likely benefits of healthy activities and suggested actions
Outcomes	Likelihood of engaging in specific prevention behaviours within the next 30 days (persuasiveness). Data supplied by authors. Our analyses combine the variables 'reduce salt', 'lower dietary cholesterol', 'increase physical activity', and 'reduced body fat'

Scott 2006a (*Continued*)

Notes	Prevention messages; goal framing; varying attainment; using both desirable and undesirable valences Prevention message analysis combined reduce salt, lower dietary cholesterol, increase physical activity, reduce body fat; smoking cessation not included per author recommendation because of data quality issues **Examples of Messages:** Gain-frame: The likely future benefits of healthy activities: achieve your goals for yourself as an active older adult; have the strength to go for long walks, garden, or play with future children or grandchildren; maintain a healthy weight; be less dependent on others to do things Loss frame: The likely future consequences of unhealthy activities: fail to achieve your goals for yourself as an active older adult; lack the strength to go for long walks, garden, or play with future children or grandchildren; have difficulty maintaining a healthy weight; be more dependent on other to do things

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	Participants pulled a folded piece of paper from a bag that had up to 400 pieces, each with a number that ranged from 1 to 400 and the number corresponded with message conditions to determine message assignment
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Scott 2006b

Methods	Randomized controlled trial; 2x2 factorial design (gain versus loss visual) x (present versus future time orientation) Scott 2006b refers to gain versus loss; screening messages.
Participants	395 college women. No details provided regarding response rate.
Interventions	Print messages about women and heart disease, main behavioral risk factors associated with heart disease, likely benefits of healthy activities and suggested actions
Outcomes	Likelihood of engaging in specific detection behaviours within the next 30 days (persuasiveness). Data supplied by authors. Our analyses combine the variables 'check BP' and 'check cholesterol'

Scott 2006b (*Continued*)

Notes	Screening messages; goal framing. Screening message analysis combined check BP and check cholesterol **Examples of Messages:** No examples provided for screening messages.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Low risk	Participants pulled a folded piece of paper from a bag that had up to 400 pieces, each with a number that ranged from 1 to 400 and the number corresponded with message conditions to determine message assignment
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Steward 2002

Methods	Randomized controlled trial (study 1).
Participants	183 University undergraduate and graduate students. No details provided regarding response rate.
Interventions	Messages advocating an HIV prevention program emphasizing the benefits of funding (gain-framed) or the costs of not funding (loss-framed) the program
Outcomes	Support for the program (persuasiveness).
Notes	Public health message; goal framing; varying attainment; using a desirable valence **Examples of Messages**: Gain frame: By increasing their current budget, needle exchange programs could operate full time in neighbourhoods with high drug use Loss frame: With their current budget, needle exchange programs cannot operate full-time in neighbourhoods with high drug use"

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.

Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

van Assema 2001a

Methods	Randomized controlled trial; 2x2 factorial design: Frame (positive versus negative) x Dietary behavior (fat versus fruits and vegetables) van Assema 2001a relates to fat as dietary behavior. This study is also reported in Brug 2003 (study 1). No details provided regarding response rate.
Participants	78 adults recruited via schools for adult education in three cities in the southern part of the Netherlands
Interventions	Booklet presenting a list of arguments for dietary behavioral change using positive versus negative frames
Outcomes	Cognitive attitude (perception of effectiveness). Intention to change the dietary behavior (persuasiveness).
Notes	Prevention message; goal framing; variation of both attainment and valence **Examples of Messages:** Gain frame: People that eat a low fat diet: have more chance of staying healthy; probably have less chance of getting cancer; have less chance of getting a cardiovascular disease; etc Loss frame: People that eat too much fat: have more chance of becoming ill; probably have more chance of getting cancer; have more chance of getting a cardiovascular disease; etc

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

van Assema 2001b

Methods	Randomized controlled trial; 2x2 factorial design: Frame (positive versus negative) x Dietary behavior (fat versus fruits and vegetables) van Assema 2001b relates to fruits and vegetables as dietary behavior. This study is also reported in Brug 2003 (study 1).
Participants	70 adults recruited via schools for adult education in three cities in the southern part of the Netherlands No details provided regarding response rate.
Interventions	Booklet presenting a list of arguments for dietary behavioral change using positive versus negative frames
Outcomes	Cognitive attitude (perception of effectiveness). Intention to change the dietary behavior (persuasiveness).
Notes	Prevention message; goal framing; variation of both attainment and valence **Examples of Messages:** Gain frame: People that do eat enough F&V: have more resistance against diseases, such as flu and cold; have less chance of getting cancer; often have an adequate intake of dietary fibres and therefore more chance of healthy bowels Loss frame: People that do not eat enough F&V: have less resistance against disease, such as flu and cold; have more chance of getting cancer; often have an inadequate intake of dietary fibres and therefore more chance of bowel problems

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Welkenhuysen 2001a

Methods	Randomized controlled trial; 2x2 factorial design (positive versus negative framing) x (numerical versus verbal presentation) Welkenhuysen 2001a relates to the numerical presentation.
Participants	147 first year students in medical sciences. No details provided regarding response rate.
Interventions	Informative text describing the cystic fibrosis, in the context of a decision regarding prenatal diagnosis, using positive versus negative framing of the numerical probabilities of the disease

Welkenhuysen 2001a (*Continued*)

Outcomes	Decision whether to ask for a prenatal test (persuasiveness)	
Notes	Screening message, attribute framing. **Examples of messages:** Negative frame: 25% change of having a cystic fibrosis child Positive frame: 75% chance of having a child without cystic fibrosis	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Welkenhuysen 2001b

Methods	Randomized controlled trial; 2x2 factorial design (positive versus negative framing) x (numerical versus verbal presentation) Welkenhuysen 2001b relates to the verbal presentation.	
Participants	153 first year students in medical sciences. No details provided regarding response rate.	
Interventions	Informative text describing the cystic fibrosis, in the context of a decision regarding prenatal diagnosis, using positive versus negative framing of the verbal probabilities of the disease	
Outcomes	Decision whether to ask for a prenatal test (persuasiveness)	
Notes	Screening message, attribute framing. "Moderate chance" and "high chance" were the translation of 25% and 75% probabilities **Examples of messages:** Negative fame: moderate chance of having a cystic fibrosis child Positive frame: high chance of having a child without cystic fibrosis	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.

Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	

Williams 2001

Methods	Randomized controlled trial; 2x3 factorial design: statistical frame (positive versus negative) x behavior frame (positive versus negative versus no framing)
Participants	539 women aged 30 to 70. No details provided regarding response rate.
Interventions	Brochure with information regarding risk factors for breast cancer and the role of family history as a risk factor. Statistics conveying the percentage of women who are likely to get breast cancer was framed positively or negatively (statistical framing) and the message providing behavioral recommendation was framed positively, negatively or not framed (behavior framing)
Outcomes	Breast self-examination behavior (behavior).
Notes	Screening message; goal framing. **Examples of messages:** "Three levels of framing were applied to the section in the brochure that provides behavioral recommendations: gain framing, loss framing, and no framing." No further details provided

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	Low risk	Breast self-examination behavior.

Wilson 1987a

Methods	Randomized controlled trial. Wilson 1987a is experiment 1.
Participants	91 undergraduate students enrolled in Introductory Psychology at San Diego State University No details provided regarding response rate.
Interventions	Subjects were presented with a hypothetical situation relating to a terminal liver disease and the probability of dying versus survival of a surgery that would improve long term survival
Outcomes	Choosing the alternative of surgery (persuasiveness).
Notes	Treatment message; attribute framing. **Examples of messages:** Positive frame: the probability of surviving the operation was 20 per cent Negative frame: while the probability of dying during the operation was 80 per cent

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	Hypothetical outcome.

Wilson 1987b

Methods	Randomized controlled trial. Wilson 1987b is experiment 2.
Participants	91 undergraduate students enrolled in Introductory Psychology at San Diego State University No details provided regarding response rate.
Interventions	Scenario in which a genetic counsellor counsels an expectant woman who is a haemophilia carrier about the chances of having a problem birth. She is presented with the probability of having a "normal" versus an "affected" child
Outcomes	Opinion whether or not the woman should abort (persuasiveness)
Notes	"Other" type of message; attribute framing. **Examples of messages:** Positive frame: the probability of having a 'normal' child was 50 per cent

Wilson 1987b (*Continued*)

	Negative frame: the probability of having an 'affected' child was 50 per cent	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	Unclear risk	No details provided.
Randomized design? If cross over design, order of presentation of the different formats randomized?	Low risk	
Objective outcome?	High risk	Hypothetical outcome.

Zimmermann 2000

Methods	Non-randomized cross-over study.	
Participants	40 breast cancer patients, 25 to 70 years old, with history of breast surgery and past adjuvant chemotherapy experience without recurrence of cancer at the time of the study; residing in Verona, Italy No details provided regarding response rate.	
Interventions	Cancer treatment information presented in a positive (probability that the cancer is cured) or a negative (probability that the cancer will return) frame. For each frame 3 messages were presented each with different level of risk of recurrence (10%, 20% and 30%)	
Outcomes	Hypothetical treatment decision about adjuvant chemotherapy (yes, no) (persuasiveness)	
Notes	Treatment message, attribute framing. **Examples of Messages:** Mrs. A (B) (high probability of cure) (low risk of recurrence) In case Mrs. A (B) chooses chemotherapy, the probability of cure (recurrence) in the next five years increases from 85% to 90% (decreases from 15% to 10%) No chemotherapy probability of cure 85% (probability of recurrence 15%) Chemotherapy probability of cure 90% (probability of recurrence 10%)	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment (selection bias)	High risk	
Randomized design? If cross over design, order of presentation of the different formats randomized?	High risk	Patients presented first with 3 negatively-framed scenarios and 2 months later with 3 positively-framed scenarios (fixed order)

Objective outcome?	High risk	

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Aarts 2007	Not a comparison of interest (examined the role of negative affect in moderating goal priming effects)
Abood 2005	Not a comparison of interest (compared loss-framed message to "usual communication")
Armstrong 2002	Not a comparison of interest (compared two types of graphs and not verbal health messages)
Arora 2000	Not an appropriate study design (study design not clear)
Blanton 2001b	Not a comparison of interest (framing is not of the health information itself)
Blumenschein 1998	Not a comparison of interest (not a health message; part of utility elicitation tool and outcome is the utility of an outcome)
Brug 2003	Data for the comparison of interest not reported and not available from author (study 1 reported in van Assema 2001a; studies 2 and 3 not reported elsewhere)
Brunton 2007	Not an appropriate study design (not RCT; all patients received the same information)
Carlson 2005	Not an original study (review)
Christensen 1995	No outcome of interest evaluated (study outcome was the preference for treatment A versus treatment B (or test versus no test))
Collins 2005	Use of different information in the comparison groups (differences in the presentation besides framing)
Collins 2006	Data for the comparison of interest not reported and not available from author
Cox 2001	Use of different information in the comparison groups
Cunningham 2006	Use of different information in the comparison groups
Diamond 1992	No outcome of interest evaluated (study outcome was the preference for treatment A versus treatment B)
Druckman 2001	Use of different information in the comparison groups (the risky choice problem)
Fagley 1987	Use of different information in the comparison groups (the risky choice problem)
Gallagher 2007	Not a comparison of interest

(*Continued*)

Gurm 2000	Use of different information in the comparison groups (different presentation format besides framing: percentage for positive frame and frequency for negative frame)
Hein 1997	Not an original study
Kahneman 1979	Use of different information in the comparison groups (the risky choice problem)
Kahneman 2007	Not an original study
Kalichman 1995	Use of different information in the comparison groups (different amount of information)
Kiene 2005	Use of different information in the comparison groups
King 2005	Not an original study (review)
Kuhberger 1998	Not an original study (review)
Lalor 1989	Data for the comparison of interest not reported and not available from author
Levin 1988	Data for the comparison of interest not reported and not available from author
Levin 1990	Use of different information in the comparison groups (the risky choice problem)
Levin 1993	Use of different information in the comparison groups (the risky choice problem)
Levin 1998	Not an original study (review)
Linville 2001	Data for the comparison of interest not reported and not available from author
Maheswaran 1990	Data for the comparison of interest not reported and not available from author
Marteau 1989	Data for the comparison of interest not reported and not available from author
Mayhorn 2002	Use of different information in the comparison groups (the risky choice problem)
McKee 2001	No outcome of interest evaluated (study outcome was the preference for treatment A versus treatment B)
McNeil 1982	No outcome of interest evaluated (study outcome was the preference for treatment A versus treatment B)
Meyerowitz 1987	Data for the comparison of interest not reported and not available from author
Millar 2000	Data for the comparison of interest not reported and not available from author
Miller 1999	Data for the comparison of interest not reported and not available from author
O'Connor 1985	No outcome of interest evaluated (study outcome was the preference for treatment A versus treatment B)

(*Continued*)

O'Connor 1989	No outcome of interest evaluated (study outcome was the preference for treatment A versus treatment B)
Oliver 2004	No outcome of interest evaluated (standard gamble)
Orbell 2006	Not a comparison of interest
Ortendahl 2006	Not an original study
Percy 1995	Not a comparison of interest (framing is not of the health information itself but of the shifting frame in a probability trade off task)
Plank 1994	Not an original study
Rettig MckKee 2001	No outcome of interest evaluated (study outcome was the preference for surgery versus radiation therapy)
Ronnlund 2005	Use of different information in the comparison groups (the risky choice problem)
Rothman 1993	Data for the comparison of interest not reported and not available from author
Rothman 1997	Not an original study (review)
Rybash 1989	Not a comparison of interest (messages delivered as positively framed are in fact partly negatively-framed and vice versa)
Salovey 2004	Not an original study (review)
Schneider 1992	Use of different information in the comparison groups
Schneider 1995	Not an original study
Shiloh 2001	Use of different information in the comparison groups
Stalmeier 1999	Not a comparison of interest (about health utilities)
Steffen 1994	Data for the comparison of interest not reported and not available from author
Stuart 2003	Use of different information in the comparison groups
Trotto 2001	Data for the comparison of interest not reported and not available from author
Tversky 1981	Use of different information in the comparison groups (the risky choice problem)
Wang 2001	Use of different information in the comparison groups (the risky choice problem)
Wilson 1990	Not a comparison of interest (framing is not of health information itself)

(*Continued*)

Wong 2002	Not an appropriate study design ("Inappropriate number of subjects at follow-up" for the outcome of interest)

DATA AND ANALYSES

Comparison 1. Attribute Framing

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Understanding	1		Mean ES (Random, 95% CI)	-0.58 [-0.94, -0.22]
1.1 Screening Message	1		Mean ES (Random, 95% CI)	-0.58 [-0.94, -0.22]
2 Perception of effectiveness	2		Mean ES (Random, 95% CI)	0.36 [-0.13, 0.85]
2.1 Screening Message	1		Mean ES (Random, 95% CI)	0.12 [-0.23, 0.47]
2.2 Other type of Message	1		Mean ES (Random, 95% CI)	0.62 [0.22, 1.02]
3 Persuasiveness	11		Mean ES (Random, 95% CI)	0.07 [-0.23, 0.37]
3.1 Screening message	2		Mean ES (Random, 95% CI)	-0.20 [-0.93, 0.53]
3.2 Prevention Message	1		Mean ES (Random, 95% CI)	-0.61 [-0.98, -0.25]
3.3 Treatment Message	5		Mean ES (Random, 95% CI)	0.33 [-0.14, 0.80]
3.4 Other type of message	3		Mean ES (Random, 95% CI)	0.10 [-0.30, 0.51]
4 Behavior	1		Mean ES (Random, 95% CI)	0.09 [-0.14, 0.31]
4.1 Prevention message	1		Mean ES (Random, 95% CI)	0.09 [-0.14, 0.31]

Comparison 2. Goal Framing

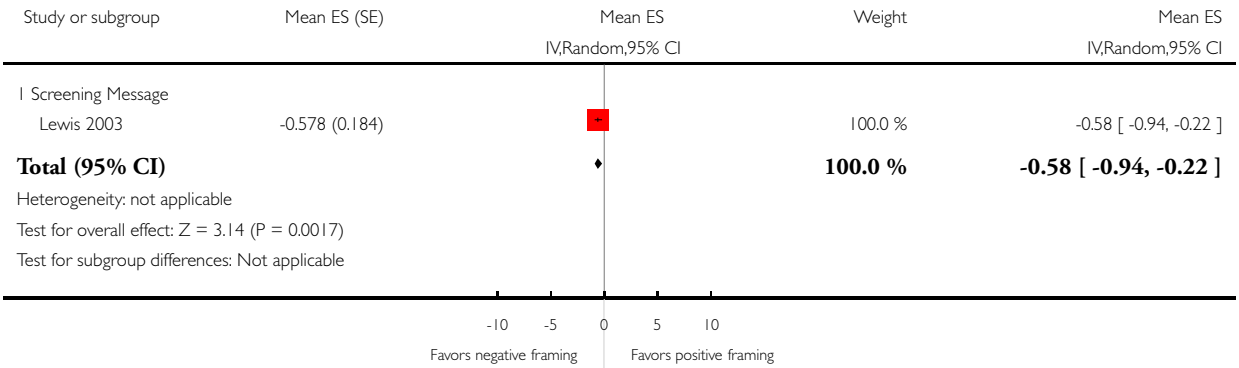
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Perception of effectiveness	14		Mean ES (Random, 95% CI)	-0.03 [-0.22, 0.16]
1.1 Screening Message	5		Mean ES (Random, 95% CI)	-0.30 [-0.49, -0.10]
1.2 Prevention Message	9		Mean ES (Random, 95% CI)	0.11 [-0.12, 0.33]
2 Persuasiveness	23		Mean ES (Random, 95% CI)	-0.06 [-0.18, 0.06]
2.1 Screening Message	6		Mean ES (Random, 95% CI)	0.06 [-0.23, 0.35]
2.2 Prevention Message	13		Mean ES (Random, 95% CI)	0.02 [-0.11, 0.16]
2.3 Treatment Message	3		Mean ES (Random, 95% CI)	-0.50 [-1.04, 0.04]
2.4 Other type of message	1		Mean ES (Random, 95% CI)	-0.36 [-0.65, -0.07]
3 Behavior	16		Mean ES (Random, 95% CI)	-0.06 [-0.15, 0.03]
3.1 Screening Message	10		Mean ES (Random, 95% CI)	-0.07 [-0.17, 0.04]
3.2 Prevention Message	5		Mean ES (Random, 95% CI)	-0.09 [-0.37, 0.19]
3.3 Other type of message	1		Mean ES (Random, 95% CI)	-0.12 [-0.48, 0.25]

Analysis 1.1. Comparison 1 Attribute Framing, Outcome 1 Understanding.

Review: Framing of health information messages

Comparison: 1 Attribute Framing

Outcome: 1 Understanding

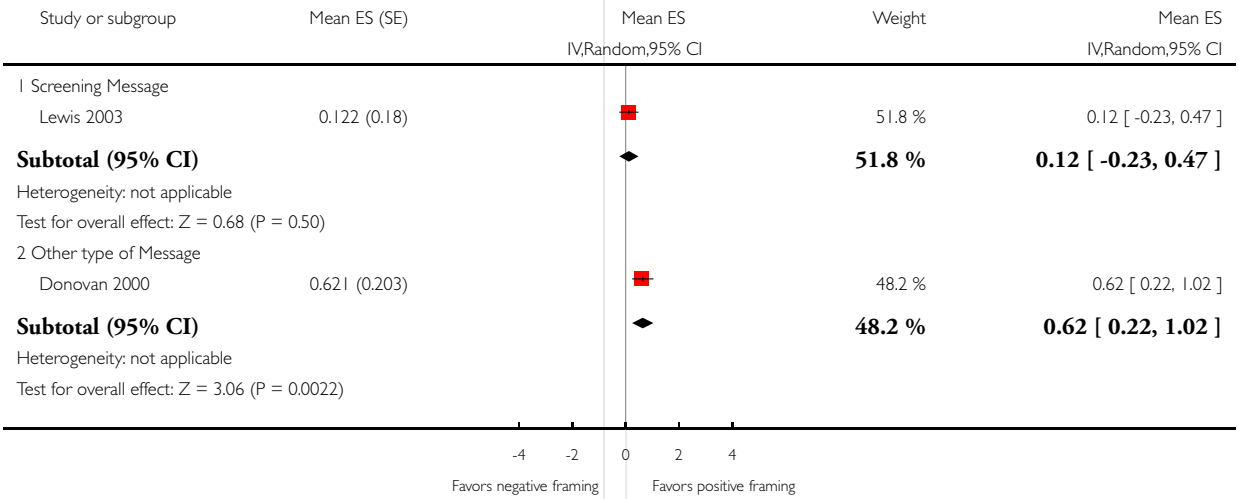


Analysis 1.2. Comparison 1 Attribute Framing, Outcome 2 Perception of effectiveness.

Review: Framing of health information messages

Comparison: 1 Attribute Framing

Outcome: 2 Perception of effectiveness



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Study or subgroup	Mean ES (SE)	Mean ES IV,Random,95% CI	Weight	Mean ES IV,Random,95% CI
Total (95% CI)			**100.0 %**	**0.36 [-0.13, 0.85]**
Heterogeneity: Tau² = 0.09; Chi² = 3.38, df = 1 (P = 0.07); I² =70%				
Test for overall effect: Z = 1.45 (P = 0.15)				
Test for subgroup differences: Chi² = 3.38, df = 1 (P = 0.07), I² =70%				

Analysis 1.3. Comparison 1 Attribute Framing, Outcome 3 Persuasiveness.

Review: Framing of health information messages

Comparison: 1 Attribute Framing

Outcome: 3 Persuasiveness

Study or subgroup	Mean ES (SE)	Mean ES IV,Random,95% CI	Weight	Mean ES IV,Random,95% CI
1 Screening message				
Welkenhuysen 2001a	0.172 (0.165)		9.8 %	0.17 [-0.15, 0.50]
Welkenhuysen 2001b	-0.574 (0.164)		9.8 %	-0.57 [-0.90, -0.25]
Subtotal (95% CI)			**19.7 %**	**-0.20 [-0.93, 0.53]**
Heterogeneity: Tau² = 0.25; Chi² = 10.28, df = 1 (P = 0.001); I² =90%				
Test for overall effect: Z = 0.54 (P = 0.59)				
2 Prevention Message				
Blanton 2001a	-0.613 (0.187)		9.5 %	-0.61 [-0.98, -0.25]
Subtotal (95% CI)			**9.5 %**	**-0.61 [-0.98, -0.25]**
Heterogeneity: not applicable				
Test for overall effect: Z = 3.28 (P = 0.0010)				
3 Treatment Message				
Krishnamurthy 2001a	1.073 (0.253)		8.5 %	1.07 [0.58, 1.57]
Krishnamurthy 2001c	0.609 (0.269)		8.2 %	0.61 [0.08, 1.14]
Llewellyn-Thomas 1995	-0.137 (0.259)		8.4 %	-0.14 [-0.64, 0.37]
Wilson 1987a	0.37 (0.213)		9.1 %	0.37 [-0.05, 0.79]

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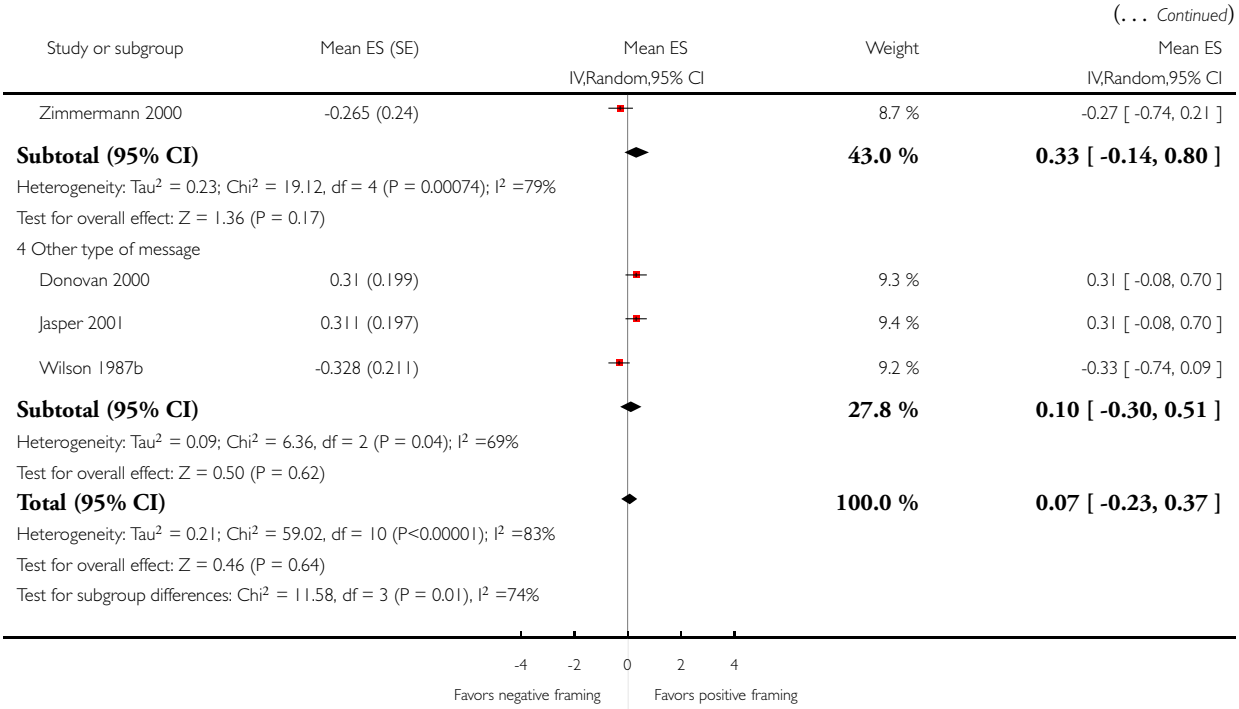
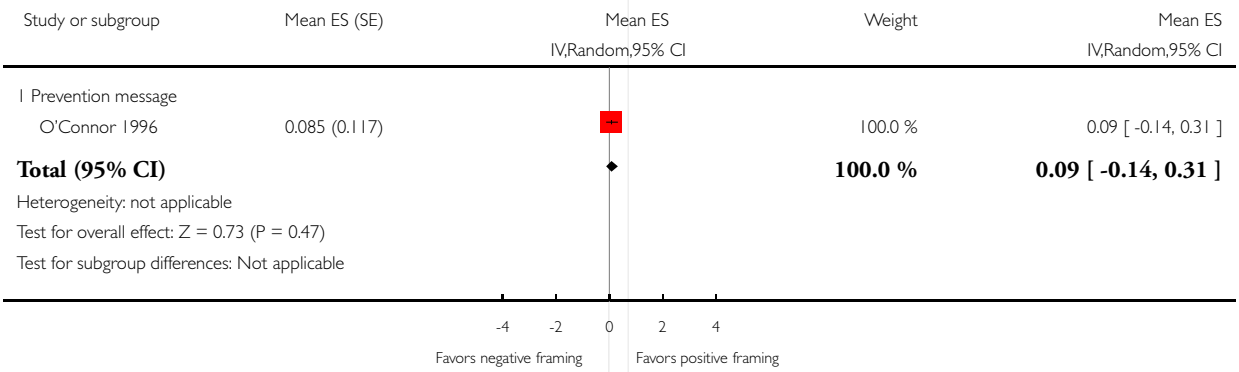


Analysis 1.4. Comparison 1 Attribute Framing, Outcome 4 Behavior.

Review: Framing of health information messages

Comparison: 1 Attribute Framing

Outcome: 4 Behavior

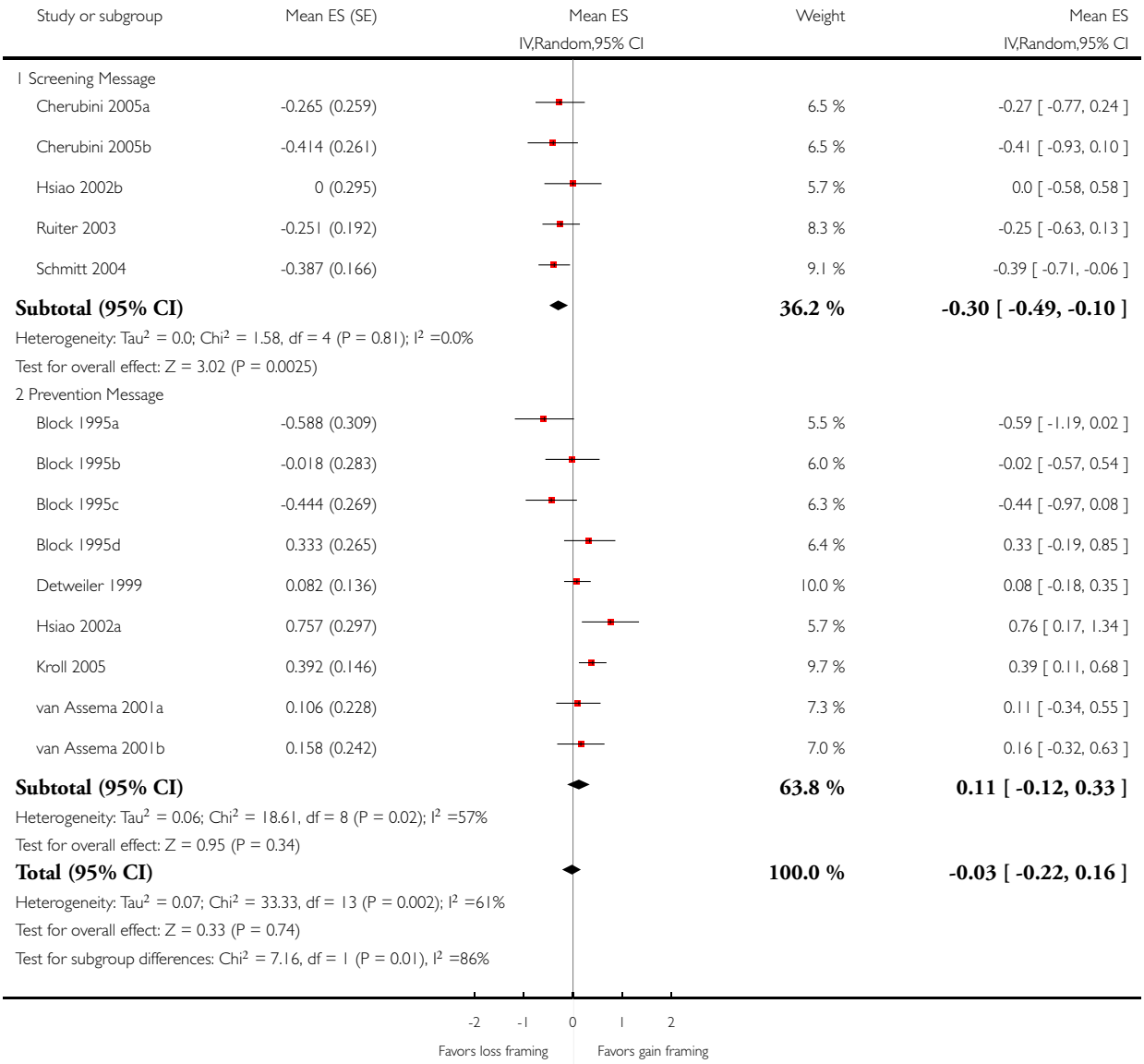


Analysis 2.1. Comparison 2 Goal Framing, Outcome 1 Perception of effectiveness.

Review: Framing of health information messages

Comparison: 2 Goal Framing

Outcome: 1 Perception of effectiveness



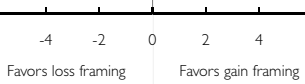
Analysis 2.2. Comparison 2 Goal Framing, Outcome 2 Persuasiveness.

Review: Framing of health information messages

Comparison: 2 Goal Framing

Outcome: 2 Persuasiveness

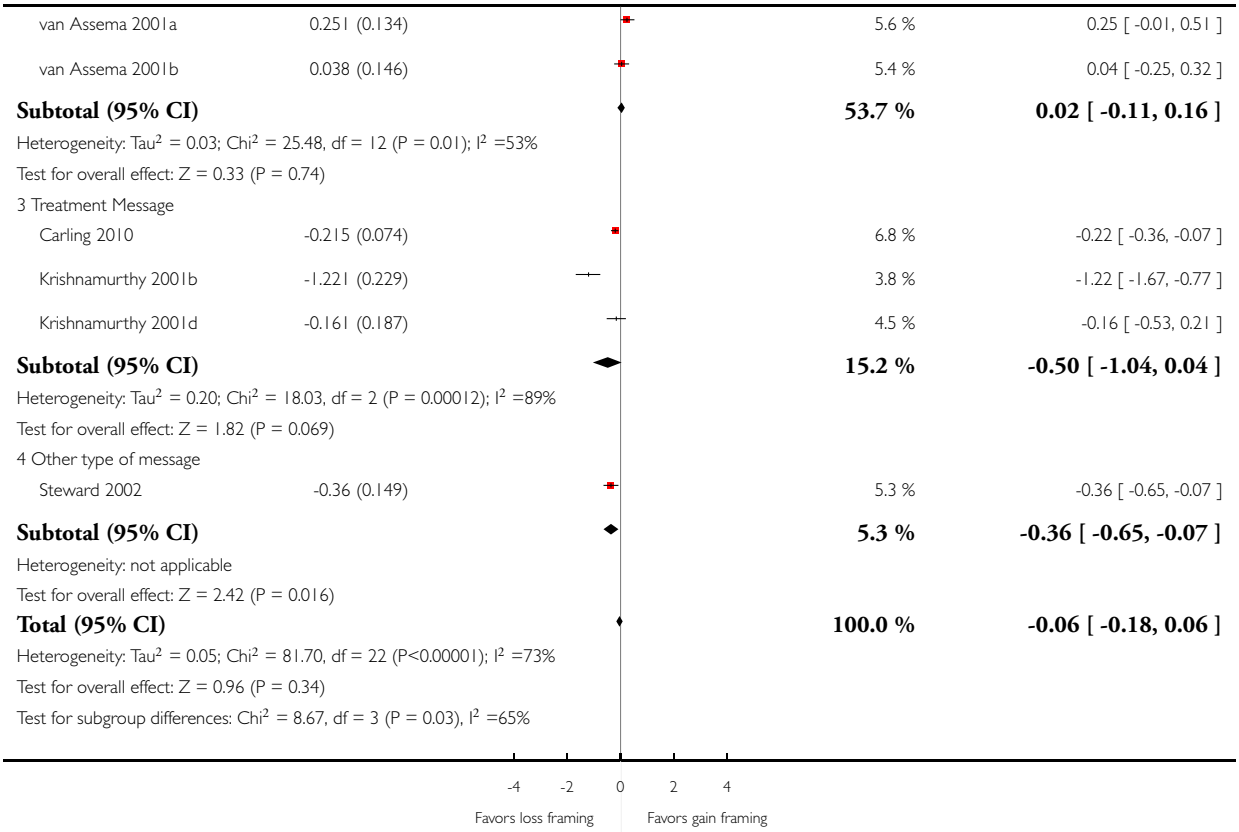
Study or subgroup	Mean ES (SE)	Mean ES IV,Random,95% CI	Weight	Mean ES IV,Random,95% CI
1 Screening Message				
Banks 1995	0 (0.173)		4.8 %	0.0 [-0.34, 0.34]
Cherubini 2005a	-0.398 (0.261)		3.3 %	-0.40 [-0.91, 0.11]
Cherubini 2005b	-0.251 (0.259)		3.3 %	-0.25 [-0.76, 0.26]
Hsiao 2002b	1.333 (0.329)		2.5 %	1.33 [0.69, 1.98]
Schmitt 2004	0.021 (0.165)		5.0 %	0.02 [-0.30, 0.34]
Scott 2006b	-0.001 (0.072)		6.9 %	0.00 [-0.14, 0.14]
Subtotal (95% CI)			**25.8 %**	**0.06 [-0.23, 0.35]**
Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 19.66$, df = 5 (P = 0.001); $I^2 = 75\%$				
Test for overall effect: Z = 0.41 (P = 0.68)				
2 Prevention Message				
Block 1995a	-0.421 (0.305)		2.7 %	-0.42 [-1.02, 0.18]
Block 1995b	0.103 (0.283)		3.0 %	0.10 [-0.45, 0.66]
Block 1995c	-0.511 (0.271)		3.2 %	-0.51 [-1.04, 0.02]
Block 1995d	0.319 (0.264)		3.3 %	0.32 [-0.20, 0.84]
Detweiler 1999	0.203 (0.136)		5.6 %	0.20 [-0.06, 0.47]
Hsiao 2002a	0 (0.286)		3.0 %	0.0 [-0.56, 0.56]
Kroll 2005	0.057 (0.144)		5.4 %	0.06 [-0.23, 0.34]
O'Connor 2005	-0.129 (0.115)		6.0 %	-0.13 [-0.35, 0.10]
Robberson 1988a	-0.375 (0.413)		1.8 %	-0.38 [-1.18, 0.43]
Robberson 1988b	1.228 (0.452)		1.5 %	1.23 [0.34, 2.11]
Scott 2006a	-0.095 (0.051)		7.2 %	-0.10 [-0.19, 0.00]



(*Continued . . .*)

(. . . *Continued*)

Study or subgroup	Mean ES (SE)	Mean ES IV,Random,95% CI	Weight	Mean ES IV,Random,95% CI
van Assema 2001a	0.251 (0.134)		5.6 %	0.25 [-0.01, 0.51]
van Assema 2001b	0.038 (0.146)		5.4 %	0.04 [-0.25, 0.32]
Subtotal (95% CI)			**53.7 %**	**0.02 [-0.11, 0.16]**
Heterogeneity: Tau^2 = 0.03; Chi^2 = 25.48, df = 12 (P = 0.01); I^2 =53%				
Test for overall effect: Z = 0.33 (P = 0.74)				
3 Treatment Message				
Carling 2010	-0.215 (0.074)		6.8 %	-0.22 [-0.36, -0.07]
Krishnamurthy 2001b	-1.221 (0.229)		3.8 %	-1.22 [-1.67, -0.77]
Krishnamurthy 2001d	-0.161 (0.187)		4.5 %	-0.16 [-0.53, 0.21]
Subtotal (95% CI)			**15.2 %**	**-0.50 [-1.04, 0.04]**
Heterogeneity: Tau^2 = 0.20; Chi^2 = 18.03, df = 2 (P = 0.00012); I^2 =89%				
Test for overall effect: Z = 1.82 (P = 0.069)				
4 Other type of message				
Steward 2002	-0.36 (0.149)		5.3 %	-0.36 [-0.65, -0.07]
Subtotal (95% CI)			**5.3 %**	**-0.36 [-0.65, -0.07]**
Heterogeneity: not applicable				
Test for overall effect: Z = 2.42 (P = 0.016)				
Total (95% CI)			**100.0 %**	**-0.06 [-0.18, 0.06]**
Heterogeneity: Tau^2 = 0.05; Chi^2 = 81.70, df = 22 (P<0.00001); I^2 =73%				
Test for overall effect: Z = 0.96 (P = 0.34)				
Test for subgroup differences: Chi^2 = 8.67, df = 3 (P = 0.03), I^2 =65%				

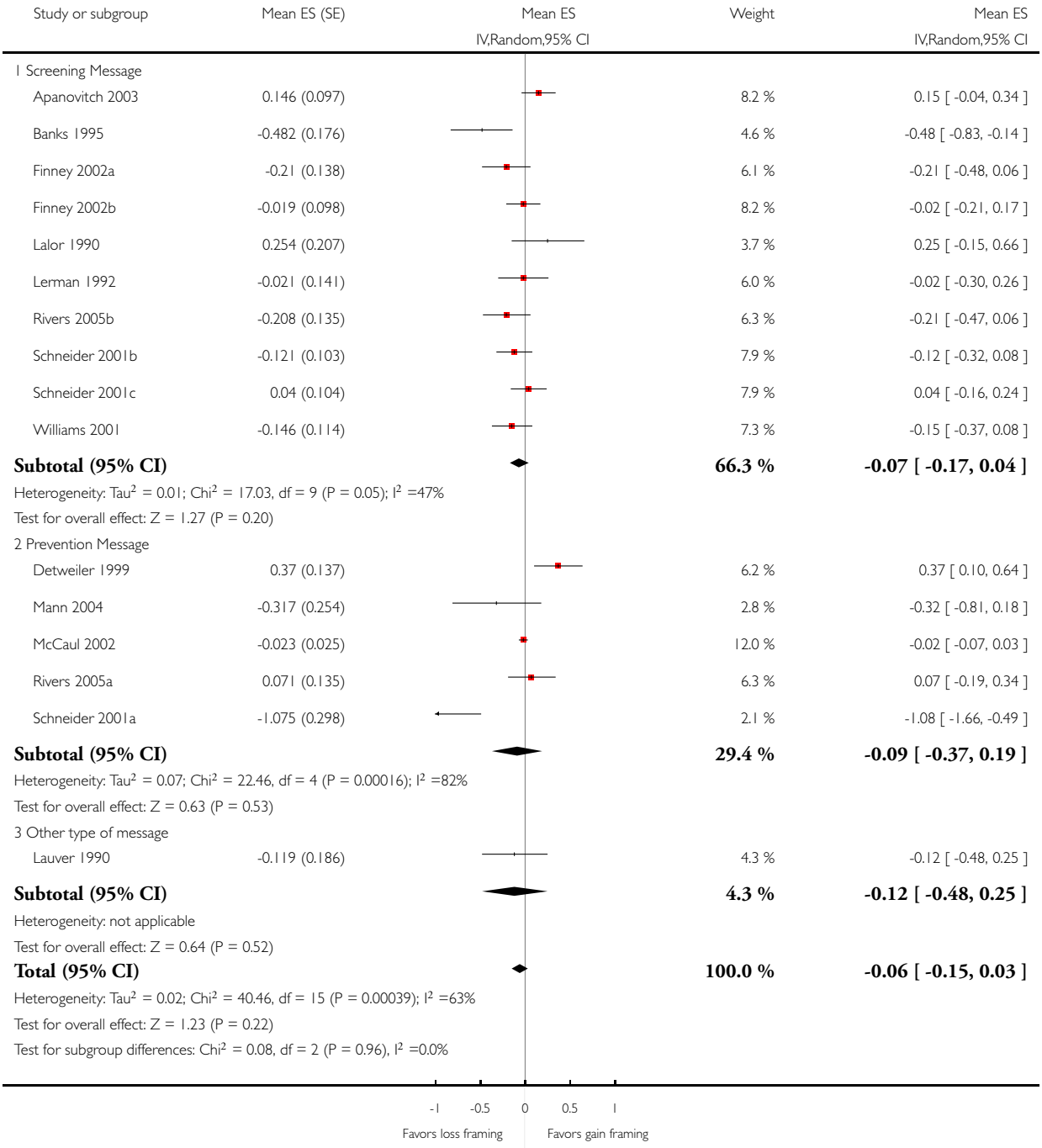


Analysis 2.3. Comparison 2 Goal Framing, Outcome 3 Behavior.

Review: Framing of health information messages

Comparison: 2 Goal Framing

Outcome: 3 Behavior



APPENDICES

Appendix 1. Theories of message framing

In their classic 'Asian disease' problem, Kahneman and Tversky asked study participants to choose between two alternative programs to combat an outbreak of an unusual Asian disease (Tversky 1981). With the first program, 200 people out of 600 will be saved, while with the second program there is a 1/3 probability that 600 people will be saved and a 2/3 probability that no people will be saved. Although the two alternatives have equivalent outcomes, the first is certain while the second is risky. When the outcomes of the scenario were framed positively (e.g. 200 will be saved) people were risk averse (i.e. selected the certain alternative over the risky alternative). When the outcomes of the scenario were framed negatively (e.g. 400 will die) people were risk seeking (i.e. selected the risky alternative over the certain alternative). Although the two alternatives have equivalent outcomes the first is certain while the second is risky in each of these two differently framed messages.

Kahneman and Tversky developed the prospect theory to explain the framing effect observed in their Asian disease experiment (Kahneman 1979; Tversky 1981). The theory argues that people make decisions by using a reference point to judge whether a particular outcome is a gain or a loss. Positively-framed messages and negatively-framed messages induce different shifts in the location of the reference point leading to different effects on risk seeking. This leads to the observed tendency of risk aversion with positively-framed problems, and risk seeking with negatively-framed problems.

Rothman and Salovey built on Kahneman and Tversky's work to extend these concepts to the health domain. They hypothesized that gain frames would be more effective for disease prevention and recuperative (therapeutic) behaviors and that loss-frames would be more effective for disease detection (screening) behaviors (Rothman 1997).

Indeed, prevention behaviors, such as the use of sunscreen or vaccination, are performed to prevent the onset of a health problem and are thus perceived as not risky. Similarly recuperative behaviors, such as chemotherapy or radiotherapy, may be performed to halt the progression of a health problem and/or to prevent its complications and are thus perceived as not risky. Based to the prospect theory, Rothman and colleagues suggested that gain frames should be more persuasive for these types of risk averse behaviors.

On the other hand, detection behaviors, such as colorectal endoscopy and mammography, are performed to discover early signs of a health problem. Although they are supposed to minimize long terms risks, they are perceived as risky in the short term. Based on the prospect theory, Rothman and colleagues suggested that loss frames should be more persuasive for these types of risk seeking behaviors.

Appendix 2. Definitions of attribute and goal framing

1. Attribute framing/ Statistical framing/ Different consequences framing

Framing relates to the description of a specific attribute of a single item or a state either positively or negatively: "Among women who get cancer *two thirds/one third* will *survive/die* from the disease"

2. Goal framing/ Behavior framing/ Same consequences framing

Framing highlights performing or not performing a behavior and the subsequent presence or absence of an outcome: "When you *get/do not get a screening test*, you *will detect/will not detect* cancer in early stages". The framing of the outcome part of the message is constructed along the 2 dimensions of attainment (attain versus not attain) and valence (desirable versus undesirable) (Brendl 1995; Detweiler 1999):

Gain message:

- attain a desirable outcome (gain)
- not attain an undesirable outcome (non-loss)

Loss message:

- attain an undesirable outcome (loss)
- not attain a desirable outcome (non-gain)

This differentiation has been referred to as the "kernel state of the consequence under discussion". The kernel state is the basic, root state mentioned in the message's description of the consequence.

Type of framing	**Attribute Framing**		**Goal framing**			
Type of message	Positive	Negative	Gain		Loss	
			Gain: attain a desirable outcome	Non-loss: not attain an undesirable outcome	Loss: attain an undesirable outcome	Non-gain: not attain a desirable outcome
Example	The chance of survival with cancer is 2/3	The chance of mortality with cancer is 1/3	If you undergo screening for cancer, your survival will be prolonged	If you undergo screening for cancer, your survival won't be shortened	If you don't undergo screening for cancer, your survival will be shortened	If you don't undergo screening for cancer, your survival won't be prolonged

Appendix 3. Examples of study outcomes classified according to the systematic review typology of outcomes

Understanding

- Accuracy of responses to questions about the potential benefits and harms of mammography

Perception of effectiveness

- Attitude towards the recommendation
- Perceived utility of a prostate examination
- Perceived efficacy of sun-protective behavior
- Attitude toward the immunization shot

Persuasiveness

- Intention to get a screening test for HIV
- Intention to get a mammogram
- Likelihood of engaging in specific prevention behaviors within the next 30 days
- Willingness to have protected sex
- Intention to comply with recommendations
- Decision whether to take antihypertensive medication
- Motivation to perform a prostate examination
- Self-reported intention to use sunscreen at beach
- Intention to immunize

Behavior

- Getting an HIV test within 6 months of intervention
- Mammography screening at 6 months
- Redemption of a sunscreen coupon

Appendix 4. Electronic search strategies

The search used in MEDLINE (starting January 1966) and EMBASE (starting January 1980) were:
1-randomized controlled trial.pt.
2-controlled clinical trial.pt.
3-((random$ or control$) adj5 trial$).mp.
4-((random$ or control$) adj5 (trial$ or stud$)).mp.
5-cross?section$.mp.
6-(cross$ adj section$ adj3 (trial$ or stud$)).mp.
7-(random$ adj allocat$).mp.
8-randomized controlled trials/
9-controlled clinical trials/
10-cross-sectional studies/
11-random$.ti,ab.
12-1 or 2 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13-*Risk/
14-exp communication barriers/
15-exp probability learning/
16-(fram$ adj4 effect$).mp.
17-(communicat$ adj5 risk$).mp.
18-((quantit$ or amount) adj2 information).mp.
19-((way$ or method$ or manner) adj2 (present$ or interpret$ or report$) adj3 (evidence or information or data or results)).mp.
20-health education.mp.
21-patient education.mp.
22-graphic$.mp.
23-(information$ adj5 display).mp.
24-(risk adj5 presentation).mp.
25-13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21or 22.mp. or 23 or 24
26-12 and 25
In PsycLIT (starting January 1887), we used the same search for intervention type as in Medline and the following search for study type:
1-randomi#ed controlled trial$.tw.
2-((singl$ or doubl$ or trebl$ or tripl$) adj3 (blind$ or mask$)).tw.
3-placebo/
4-placebo$.tw.
5-random$.tw.
6-comparative studies$.tw.
7-(clin$ adj3 trial$).tw.
8-1 or 2 or 3 or 4 or 5 or 6 or 7
In addition, we searched MEDLINE, EMBASE and PscyINFO using “framing” as title word (framing.ti).

Appendix 5. Results of comparisons and studies for which data is not reported but otherwise eligible

Attribute framing

Levin 1988 assessed the framing of a treatment message (new cancer treatment). They found higher ratings of effectiveness, a higher likelihood of recommending the treatment to another person, and a higher likelihood of recommending the treatment to a family member when the message was framed positively.

Linville 2001 assessed the framing of a prevention message describing the effectiveness of condom use. They found that with a positive frame, participants were more likely to agree on advertising the condom as "effective" and to be willing to use the condom.

Marteau 1989 studied the framing of the risk of dying with a surgery for a terminal liver cancer (willingness to undergo surgery), risk of a fetus having spina bifida (willingness to undergo amniocentesis), and risk of a child of a haemophilia carrier mother of being affected (willingness to consider abortion). They found that patients were more likely to choose surgery when the message about perioperative survival was framed positively rather than negatively. There was a tendency for a framing effect with the spina bifida scenario (negative frame more persuasive in terms of performing an amniocentesis) but not with the haemophilia scenario.

Williams 2001 studied the framing of the percentage of women in different risk categories who are likely to get breast cancer. They found no effect of attribute framing.

Goal framing

Brug 2003 assessed the framing of a dietary prevention messages. They found no significant differences in attitudes or intentions between the gain-frame and loss-frame messages.

Collins 2006 assessed the framing of a prevention message relating to sexually transmitted diseases. There were no significant main effects of message framing on attitudes toward having sex or on intentions to have sex.

Steffen 1994 assessed the framing of a testicle self-examination screening message. They found no framing effect on attitude, intention and behavior.

Lalor 1990 studied the framing of a breast self-examination screening message. They found no significant effects of message type.

Trotto 2001 studied the framing the message about breast self-examination in a group of female college students. The authors found no impact of framing on participants' perceived risk of breast cancer or intention to conduct a breast self-examination as well.

Meyerowitz 1987 assessed the framing of a breast self-examination screening message. Subjects presented with loss-framed messages had more positive attitudes, intentions and behaviors related to screening.

Rothman 1993 found that exposure to loss-framed information made women more likely but men less likely to intend adopting a screening behavior. No such effect was found for the prevention behavior (Rothman 1993). In another experiment, women exposed to gain-framed messages were more likely than those who read loss-framed messages to request sunscreen with an appropriate sun protection factor (prevention behavior) (Rothman 1993).

Maheswaran 1990 studied the framing of a cholesterol screening message. Millar 2000 studied goal framing of a safe driving behavior message. Miller 1999 assessed the goal framing of a message on the value of a diagnostic follow-up colposcopy for precancerous cervical lesions in women. The three studies reported on interaction effects but not on main effects of framing.

Appendix 6. Results for the effect modification of the framing effects

Level of involvement

Levin 1988 studying the attribute framing of a treatment message found that the framing effect was independent of the level of involvement (recommending the treatment to others or to a family member).

Maheswaran 1990 studied goal framing of a cholesterol screening message in undergraduate students. They found that loss-framed messages were more persuasive under high involvement (message describing risk of coronary heart disease in youth) while gain-framed messages were more persuasive under low involvement (message describing risk of coronary heart disease in elderly).

Millar 2000 studying the goal framing of a safe driving behavior message found that when issue involvement was high, subjects receiving gain messages were more likely to agree with the message and to be willing to adopt the behavior. When issue involvement was low, there was no significant difference between the gain and loss messages in agreement or willingness.

Rothman 1993 found that exposure to loss-framed information made women more likely but men less likely to intend adopting a screening behavior. No such effect was found for the prevention behavior (Rothman 1993). In another experiment, women exposed

to gain-framed messages were more likely than those who read loss-framed messages to request sunscreen with an appropriate sun protection factor (prevention behavior) (Rothman 1993). The authors explained these findings by an interaction between framing and involvement based on their assumption that women are more "involved" in the issues of skin cancer and sun tanning compared with men.

Donovan 2000 evaluated the interaction between framing effect and level of involvement. There was no interaction for the outcomes of this review.

Krishnamurthy 2001a investigated both attribute framing and goal framing using the same treatment message. They found that positive framing was superior to negative framing in the context of attribute framing while negative framing was superior to positive framing in the context of goal framing when studying a population with low intrinsic self relevance (ie. students). They also found that the framing effect in the context of goal framing disappeared in a population with high levels of intrinsic self relevance (ie. patients).

Williams 2001 studied framing the message about breast cancer self-examination. A loss frame led to greater positive behavioral change relative to the gain-frame among women without a family history of breast cancer (low involvement), but not among women with family history of breast cancer (high involvement).

Finney 2002a found that a loss-framed message increased compliance with mammography screening in women with a family history of breast cancer (considered to have a high level of issue involvement) at one month but not at 2 months. The investigators found no framing effect in women with no family history of breast cancer (considered to have a low level of issue involvement).

Scott 2006a found that the effects of goal framing of screening messages varied in women with or without parental history of high blood pressure or cholesterol: those with such a history were more likely to intend to 'check blood pressure or cholesterol in the next 30 days' when presented with a loss-framed message; those without a history were more likely to express such an intention when presented with a gain-framed message.

Wilson 1987a studied the effect of framing on a message relating to a hypothetical terminal liver disease and the probability of dying versus surviving of a surgery that would improve long term survival. The authors found that, when the choice of a medical option involved another individual's health outcome, subjects were still more likely to endorse riskier treatments when the outcomes were presented in a positive rather than negative context. However, when the medical decision involved a stranger's health outcomes, the contest effect did not occur.

Perceived susceptibility

Collins 2006 assessing the effect of goal framing of a prevention message relating to sexually transmitted diseases found that with a gain-framed message, intentions to adopt the prevention behavior were marginally lower when the perceived risk of abstinence was high. With a loss-framed message, intentions to adopt the prevention behavior were significantly higher when the perceived risk of abstinence was low. The authors measured sexual involvement and contextual risk as proxies for perceived risk of abstinence.

Lalor 1990 studying the goal framing of breast self-examination screening message found no interaction between framing effect and high or low levels of feeling of susceptibility in terms of attitude about, intention to perform, and actually performing breast self-examination.

Meyerowitz 1987 assessing goal framing of a breast self-examination screening message found that framing effect did not interact with fear arousal, memory for the message content, perceived susceptibility to breast cancer or stronger beliefs in efficacy of screening.

Perceived efficacy/self-efficacy

Meyerowitz 1987 assessing goal framing of a breast self-examination screening message found that framing effect interacted with perceived self efficacy.

Block 1995a found that in the context of goal framing of prevention messages, a low efficacy condition (i.e., when it is uncertain that following the recommendations will lead to the desired outcome) motivates more in-depth processing, in the context of which loss frames are more persuasive than gain ones. in contrast, a high efficacy condition generates less effortful message processing in which gain and loss frames are equally persuasive.

Dispositional Motivations

Mann 2004 tested the framing effect in the context of a message promoting flossing. They found that loss-framed message was associated with self-reporting of flossing in avoidance-oriented people while a gain-framed message was associated with self-reporting of flossing in approach-oriented people. The congruency hypothesis states that individuals who are approach-oriented are highly responsive to reward or incentive cues and those who are avoidance-oriented are highly responsive to punishment or threat cues (Carver 2000).

Attitude toward affected group

Steward 2002 evaluated the framing effect in the context of advocating an HIV prevention program. He found that participants with more negative attitudes viewed the outcomes as more uncertain and, consequently, were more influenced by loss-framed than gain-framed messages, whereas those with more positive attitudes saw the outcomes as less uncertain and were unaffected by frame.

Prior intention

Detweiler 1999 found a gain-frame advantage in promoting a prevention behavior (sunscreen use) among those who had not prior intention to use sunscreen but not among those who had a prior intention.

Emotional vividness

Cherubini 2005a found no interaction between framing and emotional vividness.

Motivation

Schmitt 2004 found that in individuals who are highly motivated to comply with a recommended health behavior, message framing may influence attitude towards the behavior but not have a direct effect on behavioral intentions or overt behavior.

Optimism

Lauver 1990 assessed the effect of goal framing of diagnostic message related to an abnormal Papanicolaou test and found no interaction between framing and optimism.

Fear

Ruiter 2003 assessed the impact of goal framing of a screening message on the perceived importance of breast self-examination. They found loss framing to be more persuasive, particularly in the context of high fear arousal.

Need for cognition

Schmitt 2004 found no interaction between the effect of framing on persuasiveness and the "need for cognition".

Amount of information

In the study by Diamond 1992, the framing effects varied with the amount of information presented.

Certainty of the test outcome

Apanovitch 2003 tested the framing effect in the context of a message to motivate HIV testing among low-income, ethnic minority women. Among participants who reported being certain of the test outcome, a gain-framed message was associated with a higher rate of self-reported testing compared with a loss-framed message. Among women who perceived the outcome of HIV testing as relatively uncertain, the two types of framing led to similar rates of self-reported testing and the trend was in the direction of greater effectiveness for the loss-framed message.

Level of risk

Marteau 1989 studying attribute framing of a treatment message found that the framing effect varied with the level of risk presented in these messages. It was evident when the risk of survival from operation was 40% or less. They also found that only patients presented with the higher risk of being abnormal (spina bifida scenario) were more likely to consider amniocentesis when presented with the negative frame.

Time effect

Rivers 2005a showed that the framing effects for both prevention and detection messages weakened with time.

Culturally adapted message

Schneider 2001b; Schneider 2001c found a framing effect in detection message (mammography), with loss-framed messages being more persuasive, when the message was multi-cultural but not when it was targeted to a specific ethnic group.

Numerical versus verbal probabilities

Welkenhuysen 2001a; Welkenhuysen 2001b studied the effect of framing a message describing cystic fibrosis, in the context of a decision regarding prenatal diagnosis. They found no framing effect when using numerical probabilities but found that when using verbal probabilities, students exposed to negatively-framed messages were more willing to decide on prenatal diagnosis. The verbal probabilities "moderate chance" and "high chance" were the translation of 25% and 75% numerical probabilities.

Other

Brug 2003 and van Assema 2001a; van Assema 2001b found no interaction with factors such as perceived personal relevance, credibility or novelty of the information or the perceived importance of the topic addressed.

HISTORY

Protocol first published: Issue 4, 2007

Review first published: Issue 12, 2011

CONTRIBUTIONS OF AUTHORS

EAA: study conception and design, screening, data extraction, data analysis and interpretation.

ADO: study conception and design, data analysis and interpretation.

JH: study conception and design, data extraction data analysis and interpretation.

GV: screening, data extraction, data analysis and interpretation.

CC: screening, data extraction.

DB: screening, data extraction.

HJS: study conception and design, screening, data extraction, data analysis and interpretation.

DECLARATIONS OF INTEREST

Some of the review authors were also authors of one included study: Carling 2010. A review author who was not a study author (IT), as well as EA, were involved in data abstraction and analysis for these studies.

SOURCES OF SUPPORT

Internal sources

- State University of New York at Buffalo, NY, USA.

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Salary support to HJS

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- Norwegian Research Council, Norway.

Funding to AO.

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Funding to HJS.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The protocol title was: 'Negative versus positive framing of health information'.

The protocol inclusion criteria for type of studies include RCTS, quasi-RCTs and controlled before and after studies (CBAs). We omitted CBAs from the review because its categorization reflects mainly the outcome assessment method which could apply to different types of study designs.

The protocol inclusion criteria for type of outcome included any measure (including self-reported) of the different outcomes. In the review, and for the outcome of understanding, we considered only objective measurements after carefully considering the nature of that outcome.

INDEX TERMS

Medical Subject Headings (MeSH)

*Health Behavior; *Persuasive Communication; Comprehension; Consumer Health Information [*methods]; Health Communication [*methods]; Perception; Randomized Controlled Trials as Topic

MeSH check words

Humans