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Presenting Risk Information—A Review of the Effects of "Framing" and other Manipulations on Patient Outcomes

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Discussing risks and benefits of treatments or care options is becoming an increasingly important part of modern health care. This paper reviews the literature about manipulations of risk and benefit information in the clinical setting. There is a paucity of evidence in this field, particularly when examining specific manipulations.

Only three categories of manipulation had three or more studies. The available evidence shows that the way information is presented can have significant effects on decisions made. The largest effects are evident when relative risk information is presented, as compared with absolute risk data. In addition, "loss framing" is more effective in influencing screening uptake behaviors than "gain framing" (odds ratio 1.18 [95% confidence interval 1.01–1.38]). There is also a pattern of evidence from studies comparing simpler with more complex information, more data with less, and those comparing numerical with verbal descriptions of risks. These studies suggest that providing more information, and which is more understandable to the patient, is

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associated with improved patient knowledge and a greater wariness to take treatments or participate in trials. These findings can contribute to efforts to improve communication between professionals and patients.

There are many areas of health care in which professionals provide risk information to patients to enhance "informed choices" (Elwyn, Edwards, & Kinnersley, 1999) or to try to bring about reductions in risk behavior. Examples of this include attempts to increase uptake of screening, such as mammography, or modify behavior, such as smoking cessation. In all such situations the discussions frequently include weighing up of the risks and benefits of different options. Communication of this information to patients is central to this process. In this paper we focus on how different approaches to portraying risks may affect the degree of success in achieving certain goals. This covers a range of ways of manipulating the information being provided. It includes narrow manipulations of information such as, for example, expressing the risks associated with treatment options in either negative (e.g., chances of failure) or positive (e.g., chances of success) terms. These manipulations fall within the conventional understanding of "framing," which is defined as the description of logically equivalent choice situations in different ways (Wilson, Purdon, & Wallston, 1988). Other manipulations, which are not necessarily "logically equivalent," include presenting patients with a greater or lesser level of detail about the effects of interventions or presenting risk factor information in a personalized vignette instead of a general population description.

There is an extensive literature addressing the effects of "framing of information" on attitudes, perceptions, and choices. Reviews have been conducted (Wilson et al., 1988; Rothman & Salovey, 1997; Kuhberger, 1998), but most of this literature comprises studies conducted in laboratory (mostly undergraduate study samples) and not clinical settings. However, there is evidence that framing variations have different effects in clinical versus laboratory settings (Kuhberger 1998; Rothman & Salovey, 1997; Siminoff & Fetting, 1989), largely because of the influence of contextual factors such as stresses, previous personal experiences, and different ways that the risk information may be used or shared (Edwards, Pill, and Stott, 1996).

In view of the important influence of setting, we undertook a review of the evidence about the effects of manipulating information, restricted to the context of discussing risks in a clinical setting. The review sought to identify how different manipulations of information affect key patient outcomes such as knowledge, anxiety, risk perception, and intentions and actual behavior.

Review Method

We undertook a systematic literature search of MEDLINE, EMBASE, CINAHL, PsycLit, SCI, SSCI, Assia, and CancerLit databases up to 1999. The principal search topics related to communication about risks in one-to-one health care encounters. The search strategy used "layers" of subject headings for risk (health behavior or lifestyle or risk or risk taking or risk factors), and communication (communication or counseling or genetic counseling or health education or health promotion or patient compliance or patient education or persuasive communication). In addition to electronic searches, key review articles and reference lists of included studies were examined (Jou, Shanteau, & Harris, 1996; Kuhberger, 1998; Rothman & Salovey, 1997; Wilson et al., 1988). Full details of the search and its output are given elsewhere (Matthews et al., 1996).

From the many articles addressing risk and communication issues, those meeting the definition of risk communication were selected. This definition was derived from references (Ahl et al., 1993; Ng & Hamby, 1997) for the health care setting as was the following: "one-to-one communication in which the intervention includes a stimulus to subjects to assess or weigh up the risks/chance and benefits of a treatment choice or behavioral (risk reducing) change." Within these risk communication studies the literature on manipulation of information was then identified. This included "framing" studies addressing logically equivalent choices (see categories 1–3 below) (Wilson et al., 1998) and other manipulations examining different ways of conveying the same information, but in which the alternatives were not logically equivalent (see categories 4–9 below). They were restricted to the "clinical setting," which was defined as incorporating

- interventions with patients in the health care setting, including real or hypothetical choices about treatment or behavior or
- studies using samples of subjects not obtained from a health care setting but where the choices are of current personal medical relevance (e.g., sexual health behavior risks or skin cancer risks in students).

Studies not fulfilling these criteria were excluded from this review. Examples of such studies included assessing cognitive processing of information but not in the health care context (Klein, 1997); those reporting the use of "fear" messages (Rhodes & Wolitski, 1990; Sutton & Hallett, 1988) (i.e., raising the subjects' levels of fear about a topic or condition but not weighing up risks and benefits); and students considering a situation of being a patient in the future (Marteau, 1989). Other exclusions included papers where data for the relevant group of subjects could not be distinguished from a total group that included subjects addressing irrelevant topic matter (Halpern, Blackman, & Salzman, 1989).

Data were extracted from the identified papers by two reviewers for content, nature, and models of interventions; setting; personnel; methodological quality and bias (converted into a composite "method score" from 11 variables); and effect sizes of key outcomes (i.e., knowledge, perception of risk, anxiety, intended and actual behavioral changes if available) (Deeks, Glanville, & Sheldon, 1996).

The method score was intended to guide the weight that could be attached to the results of individual papers. The 11 items were derived from existing methodological checklists (Moher et al., 1995; Verhagen et al., 1998) and allow an assessment to be made of the primary research quality (across a range of study designs) and its description in the published paper. The component items were as follows: definition of aims; sample formation; description of inclusion and exclusion criteria; description of subject characteristics; power calculation; objectivity of outcome measures used; adequacy of follow-up; adequacy of analysis (intention to treat); adjustment for baseline differences between groups; appropriate unit of allocation to groups; and randomization method. Each variable was marked 0, 1, or 2 for adequacy and a total method score was then constructed (out of 22 for experimental studies and out of 16 for observational studies).

The effect size (e.s.) was calculated (where possible from the statistical data in the paper) by dividing the mean difference or difference in proportions by the sample standard deviation (SD) (Russell et al., 1998). This measure allows valid comparisons between outcomes measured on different scales (Slavin, 1995). E.s. data will be presented alongside tests of statistically significant differences. This is to enable readers to gauge the size of expected effects (and the uncertainty around

them), rather than just whether the null hypothesis can be rejected or not, as generally required of a review of health care interventions.

Last, a categorization of the different types of framing studies was made. These categories were identified inductively from the retrieved literature (Jensen & Allen, 1996; Murphy et al. 1999) by separate researchers (AE, EM), and then agreed to by discussion and defined. All papers were then classified independently by the authors into one of these categories. Again agreement over classification was achieved by discussion. The nine categories identified were as follows:

Category number (and number of studies):

1. Negative versus positive framing of risk information (i.e., information about the different consequences of a specified single action, for example, the chances of mortality or survival from surgery; another example is the chances of side-effects or remaining free of side-effects when taking a drug), $n = 4$.
2. Loss framing versus gain framing (i.e., information about the different outcomes of different actions, for example, the risks or disadvantages of not undertaking a screening behavior versus emphasis on the benefits or advantages of undertaking the screening behavior, $n = 7$.
3. Numerical and graphical presentation of information versus numerical information only, $n = 1$.
4. More data points versus less (presenting a greater number of factual statements about a certain choice compared with fewer), $n = 3$, two by the same authors.
5. Numerical presentation of risk information versus verbal ("qualitative"—e.g., "frequently," "commonly," "rarely," etc.) descriptions of the same risks, $n = 2$.
6. Relative risk data versus absolute risk or numbers needed to treat information, $n = 3$.
7. Vivid portrayal of risk information (by detailed or personalized vignettes) versus abstract (or general) risk information, $n = 2$ by the same author.
8. Lay terminology to present risk information versus usual medical terminology, $n = 1$.
9. Manipulating base rate (absolute risk) and "anchoring" points (denominators) for frequencies, $n = 1$.

Only "loss framing versus gain framing" and "negative versus positive framing" contained more than three papers. The paucity of data in most categories made metanalysis unlikely to be meaningful and this was not undertaken. We will, however, attempt to synthesise the available evidence to derive important messages from the literature (Slavin, 1995). We therefore present first a summary of the studies within each category and then a "synthesis" of the principal findings and issues arising.

In the second category (gain versus loss framing) there was sufficient homogeneity of topics and intervention and outcome measures to summarize the effects of loss framing in a metanalysis (a further requirement for homogeneity of study design excludes two of these studies from this process) (Greenhalgh, 1997; Russell et al., 1998). In category 1, metanalysis was considered inappropriate as most studies addressed treatment choices in which no clear "right" answer is evident and hence the direction of effects is arbitrary.

Results and Discussion

Framing effects had been examined in 24 of the retrieved publications. A range of clinical topics was addressed, including prevention (e.g., influenza immunization),

detection (e.g., mammography screening) and treatment (e.g., cancer treatment choices). Individual papers are summarized in Table 1.

1. *Negative versus Positive Framing of Risk Information*

Four studies examined the effects of presenting the risks associated with alternative treatment choices in negative (i.e., chances of mortality, morbidity, or side-effects) or positive (i.e., chances of survival, being free of disease, or side-effects) terms (Jacoby, Baker, Chadwick, & Johnson, 1993; Llewellyn-Thomas, McGreal, & Thiel, 1995; McNeil, Pauker, Sox, & Tversky, 1982; O'Connor, Pennie, & Dales, 1996). Method scores varied from 8 to 17 out of 22.

According to prospect theory, framing probabilistically equivalent information either positively or negatively will shift the reference point from which the outcomes of alternative options are judged (i.e., whether they are perceived as benefits or harms) (Kahneman & Tversky, 1979). More specifically, the impact would be expected to be greater on the comparison between two treatments if outcomes were framed as a difference between mortality rates of 0% and 10% than if they were framed as a difference between survival rates of 100% and 90%. That is, a treatment option would be judged as relatively more attractive in the positive frame (e.g., 90% chance of survival) than the negative frame (e.g., 10% chance of mortality).

Although this prediction has been consistently supported by studies outside the clinical setting (Marteau, 1989), only one of the four studies showed a statistically significant effect in favor of positive framing (McNeil et al., 1982). In this one study McNeil et al. (1982) found that patients' intended choices for radiation (the safer option with no risk of perioperative mortality) rather than surgery (the option associated with some risk of perioperative mortality) reduced from 42% in the mortality frame to 25% in the survival frame (17% change; SE of change 2.7; e.s. = 0.45; $p < 0.0001$) (McNeil et al., 1982). In other words, subjects were more likely to choose the surgical option (riskier in the short term) when the outcomes of treatments were positively framed. However, the method score in this study was low, at 8 out of 22.

The effects of framing in the other three studies were not statistically significant (Jacoby et al., 1993; Llewellyn-Thomas et al., 1995; O'Connor et al., 1996). Method scores in these papers were 8, 14, and 17 out of 22. These studies were inconsistent in which frame was found to affect decisions most. The trends were toward negative framing being most persuasive in two studies (Jacoby et al., 1993; Llewellyn-Thomas et al., 1995) and positive framing in the other (O'Connor et al., 1996).

Overall no clear pattern of effects was evident from the studies in this category.

2. *Loss Framing versus Gain Framing*

According to prospect theory perceived losses in not acting are proposed to motivate action in risky situations more than perceived gains in action (Kahneman & Tversky, 1979). For example, loss-framed messages (e.g., emphasising the risks of not obtaining a mammography) are expected to be more effective than gain-framed messages (e.g., emphasising the benefits of obtaining a mammography) in persuading individuals to perform a health behavior that is perceived to be risky (e.g., the chance of detecting an abnormality in the breast).

Seven papers compared the effectiveness of loss-framed versus gain-framed messages to persuade people to undertake different types of health behaviors. Most of

TABLE 1 Principal Results and Design Characteristics of Included Studies, by Manipulation Category

Author, year, & country	Clinical topic	Subjects	[a]Study design, sample size recruited	Intervention—content	Intervention: delivery	Control input	Method score (out of 22 unless stated)	Outcomes with [b]effect size (e.s.) and adjusted effect size (a.e.s.) & statistical significance	Comment
1. Negative versus positive framing of risk information									
Jacoby et al., 1993 (UK)	Epilepsy treatment compliance	Patients with epilepsy	RCT $N = 72$	Negatively framed risk information (chances of recurrence of seizure)	One-to-one + written	Positively framed risk information (chances of remaining seizure-free)	8	2.7% increase in reported change in preference (59.4% vs. 56.7%; e.s. = 0.16; a.e.s. = 0; $p = 0.83$)	
Llewellyn-Thomas et al., 1995 (USA)	Cancer treatment choices	Colorectal cancer patients	RCT $N = 90$	Negatively framed risk information (chances of side-effects)	Written	Positively framed risk information (chances of remaining free of side-effects)	17	6.7% more patients agreed to participate in treatment trial (e.s. = 0.27; a.e.s. = 0.11; $p = 0.592$)	Effect of context may be great. Raises ethical issues about manipulation of decisions by presenting data in different formats
McNeil et al., 1982 (USA)	Treatment choices: lung cancer	General medical patients, physicians, and students	Quasi-expt. $N = 1153$	Negatively framed risk information (chances of mortality)	Written	Positively framed risk information (chances of survival)	8	17% increase in intentions to choose radiation option (associated with lower risk of perioperative mortality) (e.s. = 0.45; a.e.s. = 0.17; $p < 0.0001$)	Framing of information modifies treatment choices made
O'Connor et al., 1996 (Canada)	Treatment choice: influenza immunization	Eligible patients at respiratory and cardiology clinics	RCT $N = 292$	Negatively framed risk information (chances of acquiring influenza/ side-effects with and without vaccine)	One-to-one + written + visual illustration	Positively framed risk information (chances of remaining influenza-free/free of side-effects with and without vaccine)	14	1% increase in uptake (e.s. = 0.1; a.e.s. = − 0.06; $p = 0.86$) 7.4% less expected to remain free of side-effects (e.s. = − 0.23; a.e.s. = − 0.23; $p = 0.045$) 4.2% more work absenteeism (e.s. = − 0.21; a.e.s. = − 0.37; $p = 0.04$)	
2. Loss framing versus gain framing									
Banks et al., 1995 (USA)	Mammography	Women workers aged > 40 with history of poor utilization of screening	RCT $N = 133$	Loss-framed message (emphasizing risks of not being screened)	Video	Gain-framed message (emphasizing benefits of being screened)	15	14.7% increase in uptake of mammography (e.s. = 0.42; a.e.s. = 0.27; $p < 0.05$) Knowledge scores worse (mean change 0.21; e.s. = − 0.08; a.e.s. = − 0.08) Risk perceptions higher (mean change 0.25; e.s. = 0.15; a.e.s. = 0.15; $p > 0.05$)	Negative impact on knowledge and risk perception represent "costs" of improving uptake

Detweiler et al., 1999 (USA)	Skin cancer risks	Beach visitors	RCT $N = 217$	Gain-framed messages (including value of skin protection)	Brochure	Loss-framed messages (including risks of sun exposure)	11	18% increase in collection of sunscreens (e.s. 0.47; a.e.s = 0.32; $p < 0.01$) Intentions to use sunscreen more frequently also increased (no e.s. data; $p < 0.01$)	Other intentions not significantly increased and anxiety ratings not reported.
Lauver & Rubin, 1990 (USA)	Cervical smears	Women with abnormal smears and no previous colposcopy	RCT $N = 116$	Loss-framed messages (emphasizing risks of not being screened)	Telephone contact + written	Gain-framed messages (emphasizing risks of being screened)	17	5.2% increase in uptake of colposcopy (e.s. = 0.24; a.e.s. = 0.09; $p = 0.76$)	High uptake in both groups (> 70%).
Lerman et al., 1992 (USA)	Mammography	Female HMO members aged 50–74 with an abnormal mammogram	RCT $N = 446$	Loss-framed messages (emphasizing risks of not being screened)	Written	Gain-framed messages (emphasizing risks of being screened)	14	1% increase in uptake (e.s. = 0.1; a.e.s. = − 0.06; $p = 0.88$)	Loss-framed package heightens perceived vulnerability but balanced with reassurance.
Meyerowitz & Chaiken, 1987 (USA)	Breast screening	Female undergraduates	RCT $N = 90$	Loss-framed messages (emphasizing risks of not doing breast self-examination [BSE])	Written	Gain-framed messages (emphasizing benefits of doing BSE)	8	Increased practice of BSE (mean change 0.68; e.s. = 0.6; a.e.s. = 0.6; $p = 0.046$) More positive attitudes toward BSE (mean change 1.56; e.s. = 0.61; a.e.s. = 0.61; $p = 0.04$) Greater intentions to perform BSE (mean change 1.53, e.s. = 0.61; a.e.s. = 0.61; $p = 0.044$)	Large effect sizes demonstrated for a screening behavior now no longer recommended
Myers et al., 1991 (USA)	Colorectal screening	Men aged 50–74, members of HMO	RCT $N = 2201$	Loss-framed messages (emphasizing risks of not doing screening)	Telephone contact + written	Gain-framed messages (emphasizing benefits of screening)	14	3.4% increase in adherence to screening (e.s. = 0.19; a.e.s. = 0.04; $p = 0.1$)	< 50% completed trial. Neither gain- nor loss-framed package appears very effective.
Rothman et al., 1993 (USA)	Skin cancer risks	Yale students	Quasi-expt. $N = 397$	Loss-framed messages (emphasizing risks of not detecting skin cancer early)	Written	Gain-framed message (emphasizing benefits of detecting skin cancer early)	13	Increased perceived risk to self (mean change 0.17; e.s. = 0.09; a.e.s. = − 0.04; $p = 0.037$) Increased concern about skin cancer (mean change 0.45; e.s. = 0.2; a.e.s. = 0.07; $p = 0.052$)	No evidence of effectiveness of message framing variable with context: gender, disease settings, etc.

TABLE 1—*Continued*

Author, year, & country	Clinical topic	Subjects	[a]Study design, sample size recruited	Intervention—content	Intervention: delivery	Control input	Method score (out of 22 unless stated)	Outcomes with [b]effect size (e.s.) and adjusted effect size (a.e.s.) & statistical significance	Comment
3. Numerical and graphical versus numerical information only									
Greenwood et al. 1992 (USA)	General health	Family practice patients	RCT $N = 83$	Health risk appraisal—with numerical and graphical feedback	Written	Health risk appraisal—with numerical feedback	9	No significant differences in intention to change behavior (no e.s. data)	Little data reported. Possible confounding factor—in the intervention the HRA reported deaths per 1,000, in the control input deaths per 1,000 were reported.
4. More data points versus fewer									
Mazur & Hickam, 1990 (USA)	Treatment choices (condition unspecified)	General medical clinic attenders	Quasi-expt. $N = 144$	Treatment choice based on outcome data at 6 time stages	One-to-one + written	Treatment choice based on outcome data at 3 time stages	12	35.0% more people chose treatment option with more data points being presented (e.s. = 0.73; a.e.s. = 0.45; $p < 0.0001$)	After controlling for framing influences, amount of data also appears important.
Mazur & Hickam, 1994 (USA)	Treatment choices (condition unspecified)	General medical clinic attenders	Quasi-expt. $N = 136$	Extensive explanation of graphs of treatment outcomes (6 datapoints)	One-to-one + visual illustration	Limited explanation of graphs of treatment outcomes (3 datapoints)	15	30.9% patients report intending to change treatment choice when presented with more data (e.s. = 0.67; a.e.s. = 0.38; $p < 0.0001$)	Effects perhaps restricted to those initially preferring long-term survival.
Quaid et al., 1990 (USA)	Anticonvulsant drug information and compliance	Adults or parents of children about to start therapy	RCT $N = 43$	"Reasonable person standard"—disclosure of all risks that patients think a reasonable person should know to make decision	One-to-One	Medical practice standard—Disclosure of risks that doctors currently discuss	16	No change in compliance levels (no e.s. data) Increased no. of side-effects recalled (mean change 1.28; e.s. = 0.4; a.e.s. = 0.4; $p = 0.1$) Lower anxiety levels (mean change 0.93; e.s. = 0.14; a.e.s. = 0.14; $p = 0.2$)	Pilot study—insufficient power to detect differences in compliance.
5. Numerical versus verbal risk information									
Fetting et al., 1990 (USA)	Chemotherapy treatment choices	Female cancer patients attending outpatients	RCT $N = 282$	Chances of disease-free survival expressed numerically	Written	Chances of disease-free survival expressed verbally	16	17% reduction in intention to choose treatment trial (e.s. = 0.46; a.e.s. = 0.31; $p = 0.01$) 6.4% increase in correct knowledge responses (e.s. = 0.26; a.e.s. = 0.11; $p = 0.35$)	Numerical information appears to result in greater reluctance to participate.

Inglis & Farnill, 1993 (Australia)	Anaesthetic risk information	Inpatients awaiting operation	RCT $N = 40$	More detailed information + numerical incidences of complications	Audio-taped message + written	Usual written informed consent materials	19	Reduction in anxiety (mean change 0.85; e.s. = 0.05; a.e.s. = 0.05; $p = 0.77$) 40% increase in knowledge of death rates (e.s. = 0.82; a.e.s. = 0.66; $p = 0.008$) & 5% increase in knowledge of nausea rates (e.s. = 0.23; a.e.s. = 0.07; $p = 0.74$)	Different effects on knowledge variables that differ in severity of outcomes.
6. Relative versus absolute risk/numbers needed to treat information									
Hux & Naylor, 1995 (USA)	Cardiovascular medication risks & benefits	General medical clinic attenders	Quasi-expt. $N = 100$	Relative risk (RR) information	One-to-one and written	Absolute risk information (AR) or (NNT) data	14	46% more patients chose therapy RR than AR (e.s. = 0.92; a.e.s. = 0.64; $p < 0.0001$) 57% more patients chose therapy with RR than NNT (e.s. = 1.15; a.e.s. = 0.87; $p < 0.0001$)	RR information highly persuasive; both RR and AR information may be necessary for fully informed consent.
Malenka et al., 1993 (USA)	Treatment choices	General medical outpatient attenders	Obs. $N = 492$	Relative risk information	Written	Absolute risk information	11 out of 16	29.5% increase in choice of treatment when presented in relative risk terms above expected 50% (e.s. = 0.65; a.e.s. = 0.36; $p < 0.0001$)	Substantial reanalysis of figures reported. Also raises ethical issues about altering treatment decisions by presentation of different data formats.
Sarfati et al., 1998 (NZ)	Cancer screening	Community sample	Obs. $N = 414$	Relative risk information format	Telephone	Absolute risk or numbers needed to screen data (NNS)	10 out of 16	80% chose screening with relative risk, 53% with absolute risk (e.s. = 0.61; a.e.s. = 0.45; $p < 0.001$), and 43% with NNS (e.s. = 0.77; a.e.s. 0.52; $p < 0.001$)	
7. Vivid versus abstract risk information									
Rook, 1986 (USA)	Risk reduction for osteoporosis	Women workers aged 35–45 or > 55	Quasi-expt. $N = 80$	Case history version—giving information on prevalence and risk factors illustrated by a real case	Written	Abstract version—giving information on prevalence and risk factors in statistical/population terms	14	Reduced calcium intake (mean change − 0.06), worse accuracy of recall of information (mean change − 0.2), risk perception (personal vulnerability mean change − 0.18) (no e.s. data—but all changes non-stat sig.)	Relative effectiveness of interventions compared, with little attention on whether interventions may be clinically effective in absolute terms.

TABLE 1—*Continued*

Author, year, & country	Clinical topic	Subjects	[a]Study design, sample size recruited	Intervention—content	Intervention: delivery	Control input	Method score (out of 22 unless stated)	Outcomes with [b]effect size (e.s.) and adjusted effect size (a.e.s.) & statistical significance	Comment
Rook, 1987 (USA)	Osteoporosis	Community volunteers	2 RCTs $N = 20$ & 40	Case history version—giving information on prevalence and risk factors illustrated by a real case	Written	Abstract version—giving information on prevalence and risk factors in statistical/population terms	13	Persuasiveness of info. Increased (change 0.94; $p < 0.02$); no significant differences in concern, information value, recall of risk factors, or adoption of health recommendations	As above
8. Lay versus medical terminology									
Van haecht et al. 1991 (Belgium)	Pain relief drug information and compliance	Patients with acute musculoskeletal injuries	RCT $N = 366$	Patient package insert (describing side-effect risks in simpler syntax and lay terminology)	Written	Traditional package insert (from pharmaceutical industry describing side-effect risks in medical jargon)	14	9.4% more patients reporting side-effects as reason for non-compliance (e.s. = 0.32; a.e.s. = 0.17; $p = 0.08$) Higher ratings of risks exceeding benefits (mean change 1.0; e.s. = 0.29; a.e.s. = 0.29; $p = 0.02$) Lower anxiety levels (mean change 1.0; e.s. = 0.17; a.e.s. 0.17; $p = 0.11$).	Appraisal of the actual benefit of the treatment reduced by intervention package.
9. Manipulating base-rate and anchoring points									
Yamagishi, 1997 (USA)	11 causes of death	Undergraduates (Washington University)	Obs $N = 52$	Different probabilities of death, expressed as percentage or out of 10,000	Written		7 out of 16	Rates of "1,286 out of 10,000" were rated more risky than rates of "24.14 out of 100." (Statistically significant [$p < 0.05$] for 7 of 11 causes.)	

[a] Study design: RCT = Randomized controlled trial; Quasi-expt. = quasi-experimental; Obs = observational.

[b] Effect sizes are based on relevant subsamples of this group, according to the comparison in question. Adjusted effect size (a.e.s.) refers to an adjustment made in the light of regression analysis of principal outcomes, which found that RCTs and continuous outcome measures are associated with smaller effect sizes than non-RCTs or binary outcome measures, respectively. They are therefore adjusted to be comparable from the same baseline/zero.

[c] Statistical significance values are given to exact figures where these can be extracted or calculated from data in the original publication; all p-values < 0.0001 are presented as such and not given exactly (data available from authors if required); larger p-values that are not given exactly reflect insufficient data in the original publication to enable calculation.

these papers focused on detection rather than preventive behaviors (Banks et al., 1995; Lauver & Rubin, 1990; Lerman et al., 1992; Meyerowitz & Chaiken, 1987; Myers et al., 1991; Rothman et al., 1993). Method scores for these papers ranged from 8 to 17 out of 22, with four of the six papers scoring on or above the median of 14 out of 22 (Banks et al., 1995; Lauver & Rubin, 1990; Lerman et al., 1992; Myers et al., 1991).

The prediction that loss-framed messages would be most effective, because of the assumption that detection behaviors are perceived as risky in the short term because of their ability to detect disease (Rothman & Salovey, 1997), was generally borne out by all six studies, although e.s.s were small (range 0.09 to 0.42) and statistically significant in only two (Banks et al., 1995; Meyerowitz & Chaiken, 1987). For example, Banks et al. examined the uptake of mammography screening in women presented with either loss-framed (emphasizing risks of not being screened) or gain-framed (emphasising benefits of being screened) messages (1995). The loss-framed information was significantly more effective in increasing uptake (66.2% vs. 51.5%; 14.7% change; $p < 0.05$; SE of change 8.4; e.s. = 0.42).

In general greater e.s.s were noted for knowledge, anxiety, and attitudinal variables (e.g., intentions to take treatments, tests, etc.) than for behavioral outcomes, although differences also were small. The summary of effects on uptake of screening is given in Figure 1. The metanalysis in this figure includes only four of the six papers, because one is not a randomized controlled trial (Rothman et al., 1993) and therefore would be expected to show a larger effect simply by design (Edwards et al., 1998), and the other uses a continuous outcome measure (Meyerowitz & Chaiken, 1987). The odds ratio from the four included studies is weighted heavily by one large study (Myers et al., 1991) but demonstrates a statistically significant effect in favor of loss framing (odds ratio 1.18, 95% confidence interval 1.01–1.38).

The seventh paper examining the effects of gain and loss framing concerned preventive rather than detection behaviors (Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999). Detweiler et al. found that gain-framed brochure messages were associated with an increased collection of sunscreens for use at the beach (e.s. 0.47; adjusted e.s. (a.e.s.) 0.32; $p < 0.01$). However, results concerning subjects' intentions to use the sunscreens were less clear-cut with only the "intended frequency to apply" showing statistically significant differences. Anxiety measures also were assessed but were not reported, suggesting that these also did not show differences.

In summary, there is a clear pattern among the six studies of detection behavior that supports the greater effects of loss framing. The study of prevention behavior found some evidence of the greater effects of loss framing in this context.

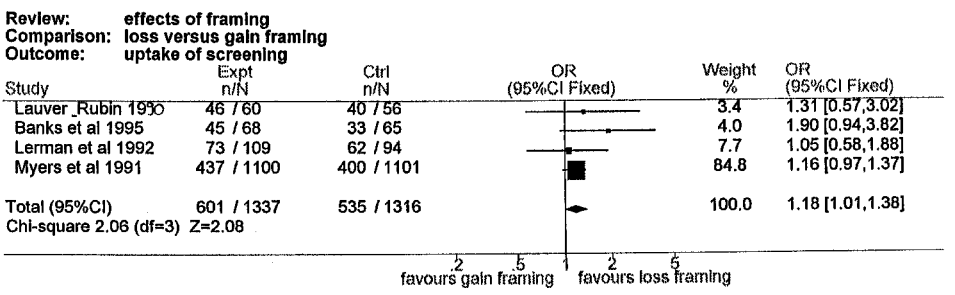

FIGURE 1 Review: effects of framing; comparison: loss versus gain framing; outcome: uptake of screening.

3. *Numerical and Graphical versus Numerical Information Only*

One paper was identified in this category (Greenwood, Ellis, & Grass, 1992). The method score in this paper was low (9 out of 22). Greenwood et al. compared two forms of health risk appraisal feedback, one with numerical feedback of information, and the other with numerical and graphical illustration of the individual's data (Greenwood et al., 1992). Results from "accuracy of risk perception" were not reported but are assumed to show no change as the groups were combined for further analysis. No significant differences in intention to change behavior were identified (no e.s. data available).

4. *More Data Points versus Fewer*

Three papers were identified in this group (Mazur & Hickam, 1990, 1994; Quaid, Faden, Vining, Freeman, 1990). Method scores were below the median for two (Mazur & Hickam, 1990, 1994) and above the median for the other (Quaid et al., 1990).

Some caution in interpreting their results is necessary as the studies may not have been able to control for other influences on the decision-making process. These could include the consultation duration (i.e., longer time to discuss more data) and the influence of body language and cues, which may affect the interaction between professional and patient. Indeed the influence of time is likely to be greatest in this category of framing studies. A further variable feature in these papers lies in two (Mazur & Hickam, 1990, 1994) being "framing neutral" (i.e., both mortality and survival data presented), whereas one (Quaid et al., 1990) was in a negative-framing context (i.e., side-effect profiles presented); this influence may override potential differences from varying amounts of information.

Mazur and Hickam (1990) compared the presentation of six datapoints about the survival and mortality rates for a treatment choice, versus only three of these datapoints. Data were presented in written format, to general medical patients, to be read through and discussed with the investigators as required. Of the patients receiving three datapoints, 49% intended to choose the long-term survival option, compared with 84% in those receiving more data (35% change; $p = 0.00002$; SE of change 8.0; e.s. = 0.73).

In another paper these authors (Mazur & Hickam, 1994) presented graphical presentations of survival data from a possible treatment option, again to general medical patients. A comparison of "limited explanation" (discussion of three key points) of the data with "extensive explanation" (five key points) of the graph was made. Of patients receiving extensive explanation, 44% changed their previously specified intended treatment choice, compared with 13% of those given limited explanation (30.9% change; $p = 0.00006$; SE of change = 7.8; e.s. = 0.67). As in the first paper by these authors the method score was below the median, but the paper showed a substantial change in intended treatment choices associated with presenting more data.

The third paper in this section by Quaid et al. compared two styles of written drug side-effect information for carbamazepine (1990). A "reasonable person's standard" (more information listed) was compared with the "medical practice standard" (current practice). Both included numerical data for some side-effects listed. No significant differences in knowledge, anxiety, or actual compliance were demonstrated (knowledge improved, e.s. = 0.14, $p = 0.2$; anxiety greater, e.s. = 0.4, $p = 0.1$; com-

pliance unchanged) with the reasonable persons standard compared with the medical practice standard.

In sum, two of the three papers showed changes in outcomes associated with altering the amount of information presented to the patient. Where differences were observed in these studies patients appeared to become more cautious when presented with more data (Mazur & Hickam, 1990).

5. *Numerical versus Verbal Risk Information*

Two papers were identified in this section (Fetting et al., 1990; Inglis & Farnill, 1993), both of which had method scores above the median (19 and 16 out of 22). Both studies asked subjects given either verbal descriptions of risks or numerical data to mark on visual analog scales the likely frequency of adverse events.

Fetting et al. presented female cancer patients with vignettes containing numerical or verbal descriptions of the risks of treatment being offered in a chemotherapeutic trial and then examined their treatment choices (1990). Knowledge (accuracy of (immediate) recall) was greater in the group given numerical information (61.3% vs. 54.9%; 6.4% change; SE of change 6.76; e.s. = 0.26), although the difference was not statistically significant ($p = 0.349$). Intention to choose the treatment trial was, however, significantly lower in the numerical group than the verbal group (34.7% vs. 52.4%; 17.7% change; SE of change 6.74; e.s. = 0.46; $p = 0.01$).

Second, Inglis and Farnill (1993) compared the provision of numerical risk information about anaesthetics with verbal descriptions of the risks ("frequently," "rarely," etc.). Knowledge of the risk of nausea showed little difference between groups ($p = 0.744$), but knowledge of risk of death was different (55% correct after numerical information, 15% after verbal description; 40% change; $p = 0.008$; SE of change 0.14; e.s. = 0.82). Anxiety (Spielberger) scores were greater in the group given verbal information (35.2 [SD 12.3] vs. 32.6 [SD 14.0]), but the difference was not statistically significant (e.s. = 0.23; $p = 0.744$).

In sum, patients appeared to become more wary of the treatment choice available when (negatively framed) risk information was presented numerically. Furthermore, among the findings of one of these papers, changes in knowledge appeared greatest for serious risks (mortality) than for less serious risks (nausea) (Fetting et al., 1990).

6. *Relative versus Absolute Risk/Numbers Needed to Treat Information*

Three papers were identified in this section (Hux & Naylor, 1995; Malenka, Baron, Johansen, Wahrenberger, & Ross, 1993; Sarfati, Howden-Chapman, & Woodward, 1998), all of which had high method scores (14 out of 22, 11 out of 16, and 10 out of 16).

Hux and Naylor (1995) assessed how the format of efficacy data determines patient acceptance of treatment. Advised of the relative risk reduction with lipid-lowering therapy, 88% of patients assented to treatment, compared with 42% with absolute risk reduction information (46% change; $p < 0.0001$; SE of change 5.91; e.s. = 0.92) or 31% with "numbers needed to treat" (NNT) information (57% change; $p < 0.0001$; SE of change 5.65; e.s. = 1.15). Similar findings were reported by Sarfati et al. (1998), this time in the context of screening test choices. Eighty percent of subjects indicated that they would accept the test when the relative risk

reduction was presented, compared with 53% with absolute risk and 43% with NNT data (e.s. 0.61 and 0.77, respectively; $p < 0.001$).

Malenka et al. (1993) examined whether patients' perceptions of the benefits of a (hypothetical) medication are influenced by whether the benefit is presented in relative or absolute risk terms. Of those expressing a treatment preference, 79% chose the medication presented with relative risk benefits and 21% chose the absolute risk option. These figures may be compared with the 50% that would be expected by chance (29% change; $p < 0.0001$; SE of change 3.5; e.s. = 0.65).

In sum, relative risk reduction information regarding treatments or tests appears much more "persuasive" than the corresponding absolute risk or NNT data.

7. *Vivid versus Abstract Risk Information*

Two papers by the same author were identified in this category (Rook, 1986, 1987). In the earlier and larger study (Rook, 1986), the method score was above the median (14 out of 22). Rook (1986) examined the effects of vivid versus abstract information in encouraging preventive behavior for osteoporosis. The "vivid" portrayal comprised case vignettes of individuals to whom the individual may be able to relate more closely than an average or nonpersonalized report. In this study of 80 subjects no statistically significant changes were identified for accuracy of recall of information about osteoporosis, perceived personal vulnerability, or actual calcium intake. In the second paper (Rook, 1987), two samples of 20 and 40 were used to explore similar outcomes of a similar intervention (method score 13 out of 22). A small difference suggested that the "vivid" case history was more "persuasive" (mean change 0.94; $p < 0.02$). No statistically significant differences in "concern" or "value of the information" to the subjects were found. At follow-up recall of risk factors and adoption of the health recommendations were similar in the groups given vivid or abstract information. Thus this study provided very marginal support for the predictions of social psychological theory, which predicts that vivid information will be more persuasive than abstract information (Hamill, Wilson, & Nisbett, 1980; Nisbett & Ross, 1980), but the first paper (Rook, 1986) gave no such support (and if anything deviated from social psychological theory). It may be that although these papers involved presenting information "roughly equivalent in content and credibility," it is not clear whether further differences were introduced by the constraints of language, hence clouding the difference between interventions.

Together, these papers do not support the theoretical predictions that vivid information is more persuasive or effective.

8. *Lay versus Medical Terminology*

One paper was identified in this category (Van haecht, Vanderstichele, Debacker, & Bogaert, 1991) with a method score of 14 out of 22. Van haecht et al. (1991) assessed the effects of replacing medical jargon in a traditional drug insert about the potential adverse reactions associated with Non-steroidal Anti-inflammatory Drugs (NSAID) therapy with simpler terminology (e.g., terms like anorexia/nausea were replaced by loss of appetite/tendency to vomit). Findings of greater knowledge of risks and benefits with the simpler insert (mean change 1.0; $p = 0.163$; SE of change 0.467; e.s. = 0.29) but greater anxiety ($p = 0.107$; e.s. = 0.17) were reported, but these were not statistically significant differences. More people cited an adverse drug

reaction as a reason for discontinuing their therapy with the new insert than the traditional one (20.5% vs. 11.1%; $p = 0.082$; SE of change 4.8; e.s. = 0.32).

In sum, now there is insufficient evidence upon which to judge the effects of simpler drug package inserts; what current evidence there is does not suggest substantial beneficial effects on people's knowledge of the risks and benefits or adherence to treatment from such an intervention.

9. *Manipulating Base-Rate (Absolute Risk) and Anchoring Points (Denominators)*

One paper was identified in this category that assessed the effects of manipulating information in relation to 11 common causes of death, most of which were of potential relevance to the subjects involved (Yamagishi, 1997). Yamagishi analyzed the rankings of causes of death given by undergraduates (method score 7 out of 16) and found that mortality rates of "1,286 out of 10,000" were rated more risky than rates of "24.14 out of 100." This appeared to be a robust phenomenon across mortality causes ($p < 0.05$ for 7 of 11 causes).

These results suggest that "base-rate neglect" occurs and that individuals' judgments have been influenced more by altering the anchoring points (i.e., the actual numbers of deaths, irrespective of the actual rates).

Synthesis

Framing variations and other manipulations of information have important influences on perceptions of risk and decisions made by patients. This review identified 24 studies assessing the effects of manipulating information in the context of clinical risk communication. Within this heterogeneous group of studies, relative risk information formats appeared much more persuasive than absolute risk or NNT formats. There were indications from the studies in general support of the theoretical predictions that loss framing is more effective on the uptake of screening practices and there was some limited evidence that positive framing may be more effective in terms of individuals being prepared to choose an apparently more risky option. However, there were insufficient data for these findings to be really conclusive. Other studies demonstrated that when the format of information is altered by presenting more information, and which is more understandable by the patient, this is associated with a greater wariness of the treatments available.

This review addresses a broader range of information manipulations than others (Jou et al., 1996; Kuhberger, 1998; Rothman & Salovey, 1997; Wilson et al., 1988) that assess "framing" as operationalised in line with the conceptualization of Kahneman and Tversky (1979). As this review addressed information manipulations in the context of risk communication it offers different lessons than the other reviews of framing alone (Jou et al., 1996; Kuhberger, 1998; Rothman & Salovey, 1997; Wilson et al., 1988). Because of the inclusion criteria for the clinical setting and because the clinical topics covered by these papers include the commonest preventive, screening, and treatment decision-making scenarios in health care, the results of this review also have immediate relevance and potential applicability to clinical practice.

Other reviews that include a range of studies in the "laboratory" setting or with subjects for whom the clinical topic is not immediately relevant cannot make this step so easily. Such findings outside the clinical setting may not be generalizable to

the clinical setting (Rothman & Salovey, 1997; Siminoff & Fetting, 1989). However, as noted above, there are limitations in the volume of research available for this review. This renders the conclusions and lessons for clinical practice to be tempered with caution until further research has been undertaken to increase the "weight of evidence" (Edwards, Russell, & Stott, 1998). Areas for further research will be identified below. When such research becomes available and is reviewed, the conclusions are likely to be clearer and obligations on professionals to take heed of the lessons for their clinical practice will be greater.

Only the first two framing categories (loss framing versus gain framing and negative versus positive framing) had more than three papers identified. In general, the findings in both categories were consistent with earlier work by cognitive psychologists in the nonclinical arena (Kahneman & Tversky, 1979). All six loss-framing versus gain-framing studies showed greater effect sizes on uptake of screening practices if messages emphasized the risks or disadvantages of not being screened rather than the benefits or advantages of being screened (Banks et al., 1995; Lauver & Rubin, 1990; Lerman et al., 1992; Meyerowitz & Chaiken, 1987; Myers et al., 1991; Rothman et al., 1993). The small but consistent effect identified for loss framing (although statistically significant in only two of the six studies) may have only modest clinical importance for individual health care encounters, but when viewed in public health terms and when used in dealing with large populations of patients, the effects may be substantial (Edwards et al., 1998).

The pattern of findings in the four papers examining negative versus positive framing was less conclusive. Only one of the studies indicated that the characterization of outcomes in terms of chances of survival rather than the chances of death could have a significant effect on people's preferences for treatment options: as predicted, subjects were more likely to choose an apparently riskier option if the outcomes of the treatments were positively framed (McNeil et al., 1982). One other study supported this result (O'Connor et al., 1996), but two did not (Jacoby et al., 1993; Llewellyn-Thomas et al., 1995), slightly "favoring" negative framing.

These studies suggest that patients' preferences for treatment options cannot be so easily manipulated by the way in which risk information is presented as may be suggested from "laboratory" studies. If one wants to move toward more patient-centered approaches to the medical consultation and the promotion of patient choice for a range of health care options (McWhinney, 1996; Richards, 1998), it is important to establish whether treatment decisions made by patients are in fact largely independent of the positive or negative framing of outcomes. In view of the body of evidence from laboratory-based studies indicating otherwise, however, it may be advisable for both formats to be presented in usual practice if clinicians wish to avoid the risk of manipulating patient choices even by small degrees. There may also be an onus on clinicians and researchers to show that they have avoided manipulation of patient choices, particularly in view of the effects demonstrated by Yamagishi (1997). This may be achieved by focusing on a range of affective outcomes in addition to the cognitive and behavioral outcomes commonly reported now (Llewellyn-Thomas, 1995; Edwards & Elwyn, 1999). These include satisfaction with the communication and decision-making processes, understanding (in distinction to knowledge) of the risks and benefits of different options, and certainty that the best choices have been made (Edwards & Elwyn, 1999).

Moving on to discuss the papers in the other categories, interpretation of results clearly has to be cautious in light of the limited number of papers in each category (and the highly variable and often poor methodological quality of some). None of

the studies that examined the effect of other types of manipulation found significant effects on what might be considered desired behavioral outcomes (i.e. risk-reducing or compliance behaviors). Presenting more data rather than less in written side-effect information for carbamazepine (an anticonvulsant drug) did not improve compliance (Fetting et al., 1990); graphical illustration of risks in addition to numerical information presented in a health risk appraisal did not have any impact on intentions to change behavior (Greenwood et al., 1992); and presenting vivid case history information instead of abstract information had no effect in encouraging preventive behaviors for osteoporosis (Rook, 1986).

Treatment choice decisions were, however, apparently more easily manipulated. First, patients appeared to make different decisions when presented with more data-points than fewer (Mazur & Hickam, 1990, 1994). In particular, presenting more information appeared to make them more likely to choose more cautiously (Mazur & Hickam, 1990) or change their previously specified intended treatment choice (Mazur & Hickam, 1994). As discussed, however, altering the amount of information presented to patients may have altered other factors such as the length of time taken for the consultation.

Similar findings to those comparing "more information with less" were observed in the papers that compared numerical with verbal risk communication (Fetting et al., 1990; Inglis & Farnill, 1993). Knowledge levels appeared to improve and patients become more wary of the treatment choice available. Among the findings of one of these papers, changes in knowledge appeared greatest for serious risks (mortality) than for less serious risks (nausea) (Inglis & Farnill, 1993).

Further changes in (intended) decisions were identified by the papers comparing relative risk with absolute risk, or NNT data, both set in a context of gain framing (Hux & Naylor, 1995; Malenka et al., 1993). In particular, treatments were perceived as more beneficial if their risk-reducing properties were presented in relative risk form. These large effect sizes mirror those identified from presenting information to professionals and policy makers (Bucher, Weinbacher, & Gyr, 1994; Cranney & Walley, 1996; Forrow, Taylor, & Arnold, 1992).

It should be noted, however, that these findings raise clinical and ethical issues about the goal of risk communication. Is the goal to achieve a desired change in patient behavior (from the practitioner's or population health perspective)? Or is it to facilitate informed choice by the patient? Only the latter approach, seeking to enable patients to make informed choices, is fully consistent with ethical principles of autonomy. The former restricts this, although possibly with the intention of beneficence for the individual or justice in distribution of resources amongst the population. It is not for this discussion to seek to provide the solution to this tension but to identify that manipulations have potentially powerful effects and these must be taken into consideration in the delivery of risk communication to individuals or groups.

We note also that although the components of the most persuasive message will be of great interest to those involved in individual- or population-based health care, current trends are now moving toward more patient-centered medical approaches to the consultation and the promotion of patient choice for a range of health care options (McWhinney, 1996; Richards, 1998). In these, patient autonomy is frequently afforded greater weight than other ethical principles. However, other authors have attempted to strike a balance. Hux and Naylor suggested that "multiple complementary formats may be most appropriate" (1995), enabling patients to make an informed choice based on the "whole truth" rather than a version of the "truth."

This has certain theoretical justifications, one of which is ethical. Such developments accord with the newly proposed principle of "relationality" (Bottorff et al., 1996). It promotes the provision of accurate honest information in the context of the individual situation. Using multiple complementary formats of the same information (Hux & Naylor, 1995; Liao et al., 1996) is also supported by psychological research into (the biases of) human information processing (Klein, 1997; Yamagishi, 1997).

From a practical perspective, also we have identified from other focus group work with primary care professionals that a range of information available for discussion in the consultation is also more likely to meet the needs of professionals (Edwards, Matthews, Pill, & Bloor, 1998). Primary care professionals appear to want a range of data types available and in different formats. They envisage themselves then being flexible as to which information they actually use in the consultation, tailoring it to the individual concerned. How professionals conduct this tailoring process still remains to be clarified. The potential trade-offs with information overload for a patient also require attention. Treatment choice decisions appeared more easily manipulated than prevention or screening decisions (Howards et al., 1998).

Further Research

This review has identified a paucity of framing and related studies in clinical settings. The findings reported must therefore be interpreted with caution until further empirical research is conducted.

- More research is required in all the manipulation categories identified, and it must be well designed.
- Once sufficient data accrues, formal metanalyses in the different framing categories will be feasible and should be performed. These will have greater power to estimate the effects of manipulations than is currently possible.

The lessons for risk communication may then be clearer and there will be an onus on clinicians to take heed of such lessons in their clinical practice.

Most papers in this review (20 out of 24) were conducted in North America.

- There is a need to examine whether the findings documented are generalizable to other countries or health care systems.
- With so few papers identified in most manipulation categories, research also must examine the effects of these manipulations across a variety of clinical topics.
- Framing effects must be examined in real practice rather than the many hypothetical situations (with patients) studied to date.

There are ethical constraints on undertaking research with patients actually needing treatment, but real treatment choices have been studied by observing current practice (Simihoff & Fetting, 1989), and this should be emulated.

- Further research also should examine the effects of professionals having multiple complementary data formats available to aid discussions with individual patients. Such research could be pragmatic, in terms of examining what professionals choose to use with individuals patients.

This would have less ethical constraints than for "pure" framing variations. When there is more evidence on the effects of framing and other manipulations, and the ways information is used in practice, it will be possible to produce materials to

support treatment and other decisions in wider practice, with greater confidence that they can avoid the risks of manipulating patient decisions unfairly.

- More research into the types of information formats preferred by different groups of patients is required to support the production of such materials.

In all future research of manipulations, investigators also should address a broader range of outcomes than those currently reported in the literature.

- In addition to the current focus on cognitive and behavioral outcomes, it is important to assess affective outcomes (Llewellyn-Thomas, 1995). These should include satisfaction with the communication and decision-making processes, understanding (in distinction to knowledge) of the risks and benefits of different options, and certainty that the best choices have been made (Edwards & Elwyn, 1999). These offer greater understanding of whether patients have truly made "informed choices" and not decisions manipulated by the information format.

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