

Comparing the Standard Rating Scale and the Magnifier Scale for Assessing Risk Perceptions

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Objective. A new risk perception rating scale ("magnifier scale") was recently developed to reduce elevated perceptions of low-probability health events, but little is known about its performance. The authors tested whether the magnifier scale lowers risk perceptions for low-probability (in 0%–1% magnifying glass section of scale) but not high-probability (>1%) events compared to a standard rating scale (SRS). **Method.** In studies 1 (n = 463) and 2 (n = 105), undergraduates completed a survey assessing risk perceptions of high- and low-probability events in a randomized 2 × 2 design: in study 1 using the magnifier scale or SRS, numeric risk information provided or not, and in study 2 using the magnifier scale or SRS, high- or low-probability event. In study 3, hypertension patients at the Philadelphia Veterans Affairs hospital completed a similar survey (n = 222) assessing risk perceptions of 2 self-relevant high-probability events—heart

attack and stroke—with the magnifier scale or the SRS. **Results.** In study 1, when no risk information was provided, risk perceptions for both high- and low-probability events were significantly lower (P < 0.0001) when using the magnifier scale compared to the SRS, but risk perceptions were no different by scale when risk information was provided (interaction term: P = 0.003). In studies 2 and 3, risk perceptions for the high-probability events were significantly lower using the magnifier scale than the SRS (P = 0.015 and P = 0.014, respectively). **Conclusions.** The magnifier scale lowered risk perceptions but did so for low- and high-probability events, suggesting that the magnifier scale should not be used for assessments of risk perceptions for high-probability events. **Key words:** magnifier scale; standard rating scale; risk perceptions (*Med Decis Making* 2005;25:560–570)

Research in fields as varied as medicine, psychology, and marketing involves assessment of risk perceptions: beliefs about the likelihood of experiencing various outcomes. For instance, many studies have

assessed risk perception to test models of health behavior that posit an association between risk perception and health behavior.^{1–14} Other research measures risk perception to detect errors and biases in risk judgments,^{15–18} to assess the association between risk judgments and emotion,^{19–25} and to increase the accuracy of people's risk perceptions.^{11,26–28} Thus, several important and large bodies of research depend on obtaining assessments of people's risk perception that accurately reflect their beliefs.

However, 1 common problem in risk perception research is that people tend to overestimate the likelihood of the risks that they face.^{26,29–37} For instance, several studies have found that the vast majority of women overestimate their risk of breast cancer: they provide a numeric estimate that exceeds their predicted risk from

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the Gail model.^{26,29,36} This tendency may be attributable to difficulty with the concept of probability or numbers more broadly,³⁸ a lack of experience with generating probabilities, a lack of awareness of the low probability of facing the outcome in question, or high levels of media attention (increasing risk perception through the availability heuristic).^{31,39} Another potential explanation is that little has been done to examine the psychometric properties of risk perception measures,⁴⁰ and the measures themselves may contribute to inappropriate estimation of risk.

Specifically, the tendency to overestimate one's risk compared to one's actual risk may be attributable to the use of risk perception measures that bias people against the use of low probabilities (i.e., <1%). The standard rating scale (Appendix A), used in many studies to elicit risk perception,^{26,27} includes the same distance on the scale between 0% and 10% as it does between 90% and 100%. This structure could make it unlikely for participants to report very low subjective probabilities in contexts in which reporting a probability below 1% as one's risk perception would be appropriate (e.g., an assessment of risk perception of the probability of having a child with cystic fibrosis, which is 1 in 3200 live births).⁴¹

In an effort to address the concern that the standard rating scale leads to inaccurate assessments of risk perceptions for very low-probability events, Woloshin and others, like others before them,⁴² developed a "magnifier scale" (Appendix A) that magnifies the probabilities between 0% and 1% on a logarithmic scale.⁴³ In their comparison of the magnifier scale to the standard rating scale among samples as varied as veteran hospital patients to university faculty and students, no differences were seen between the scales in test-retest reliability, as well as on their measures of validity and usability.

The authors concluded that the magnifier scale was easy to use, performed just as well on important psychometric properties, and led participants to appropriately report lower risk perceptions for events with true probabilities below 1%. In addition, the authors examined another important attribute of the scale: it decreases respondents' risk perceptions for low-probability events but not for high-probability events. To lower risk perceptions for events with a probability of greater than 1% would represent a measurement bias⁴³—an alteration of responses as a result of the instrument used, not people's true perceptions of their risk. On this criterion, the magnifier scale appeared to perform well. Participants' median risk perceptions were orders of magnitude lower when using the magnifier scale than when using the standard rat-

ing scale for low-probability events, such as becoming a parent of sextuplets, and were no different in the 2 scales for high-probability events, such as catching a cold in the next year. However, no statistical tests were reported to support these findings.

The importance of accurate elicitation of risk perceptions for numerous bodies of research highlights the need for further examination of this new scale to affirm its dominance over the standard rating scale. The magnifier scale is more complex, is more difficult to score, requires more instructions for participants (Figure 1 in Woloshin and others⁴³), and consumes more space on a questionnaire than the standard rating scale. To warrant use over the standard rating scale, the magnifier scale must be truly superior in its ability to elicit accurate risk perceptions.

Thus, the purpose of this research is to further examine the performance of the magnifier scale relative to the standard rating scale (SRS). We compare the magnifier scale to the SRS on its ability to overcome the tendency for participants to overestimate risks by increasing participants' use of low probabilities for low-probability events but not for high-probability events. In addition, we extend the previous work by comparing the 2 scales on this attribute in the typical condition in which risk perception is assessed—when participants are not given numeric probability information about the risks in question—as well as when they are provided with this information.

To examine these questions, we conducted 2 studies to assess undergraduates' risk perceptions about various health events, including high- and low-probability events, using an experimental design in which participants were randomized to report their risk perceptions using either the magnifier scale or the SRS (studies 1 and 2). We then conducted a nearly identical survey using the high-probability events among hypertensive patients at a veterans hospital so that the risks in question (heart attack and stroke) would be more personally relevant to the study participants (study 3). We examined whether, compared to the SRS, the magnifier scale lowered risk perceptions for low-probability events (those in the magnifying glass section of the magnifier scale: 0%–1%) but not for high-probability events. We also examined (in study 1) how the 2 scales performed when risk information was and was not provided.

STUDY 1

Method

With approval from the Institutional Review Board of the University of Pennsylvania, an anonymous ques-

Table 1 Percentage of College Students' with Risk Perception $\leq 1\%$ Using Magnifier vs. Standard Rating Scale (Study 1)

Health Event (Probability High or Low)	No Risk Information Provided			Risk Information Provided		
	Standard Rating Scale (%) (n = 63)	Magnifier Scale (%) (n = 61)	P Value ^a	Standard Rating Scale (%) (n = 65)	Magnifier Scale (%) (n = 54)	P Value ^a
Stroke (high)	0	20	0.002	16	9	0.067
Heart attack (high)	0	14	0.002	16	19	0.931
Stomach cancer (low)	8	45	<0.0001	34	48	0.135
Food poisoning (low)	0	5	0.084	28	63	0.0002

a. By chi-square test.

tionnaire was administered to undergraduates in 3 psychology courses. Participants were recruited through an announcement in their class asking them to complete a short survey about health risks. All students were eligible to participate.

After completing practice questions to familiarize themselves with the response scale (as in Woloshin and others⁴³), participants were randomized to complete 1 of 4 surveys in a 2×2 design: response scale type (standard rating scale or magnifier scale) (Appendix A) and risk information provided (none v. population averages given*) (Appendix B).

Participants were asked to rate their likelihood of experiencing 4 health events, which were selected because they have a range of likelihoods of occurring: lifetime risk of having a stroke, heart attack, stomach cancer, or food poisoning (Appendix B). Heart attack and stroke were considered "high-probability events," and stomach cancer and food poisoning were considered "low-probability events." Participants also responded to questions about the following demographic characteristics: gender, age, race/ethnicity, and year in college.

Statistical Analyses

Descriptive statistics were used to examine the characteristics of the study sample. Chi-square tests were used to compare the percentage of participants reporting a risk perception in the magnifying glass section of the magnifier scale (0%–1%) when using the magnifier scale compared to the SRS. Two-sample *t* tests were used to compare participants' mean risk perceptions when using the magnifier scale compared to the SRS. These analyses were conducted on each of the 4 health

events, and responses were compared when risk information was and was not provided.

To assess the overall effect of scale type on high- v. low-probability events in the condition when no risk information was provided, we conducted a 2×2 ANOVA, including scale type (magnifier scale v. SRS), high- or low-probability event, and the interaction term. We assessed the main effects and whether there was an interaction between scale type and probability event type.

To examine whether the magnifier scale had a different effect when risk information was and was not provided, we conducted a $2 \times 2 \times 2$ ANOVA, including scale type, risk information provided or not, high- or low-probability event, and all interaction terms.

Results

Participants

Participants ($n = 463$) were mostly female (58%) and white (69%) and had a mean age of 19 years ($SD = 4$). As expected by randomization, there were no differences in participants' demographic characteristics in the 4 survey conditions ($P > 0.35$ for all 3 demographic characteristics).

Magnifier Glass Scale v. Visual Analog Scale When No Risk Information Given

As shown in Table 1 (columns 2–4), when no risk information was given, the percentage of participants who reported a risk perception of 1% or less was greater when using the magnifier scale than the SRS for both the low-probability events (food poisoning: $\chi^2 = 2.98$, $P = 0.084$; stomach cancer: $\chi^2 = 22.06$, $P < 0.0001$) and the high-probability events (stroke: $\chi^2 = 14.02$, $P = 0.0002$; heart attack: $\chi^2 = 9.38$, $P = 0.002$).

In addition, as shown in Table 2 (columns 2–4), when no risk information was given, 2-sample *t* tests

*Gender-specific risk estimates were provided for stroke and heart attack risks.

Table 2 College Students' Mean Risk Judgments Using Magnifier v. Standard Rating Scale (Study 1)

Health Event (Probability High or Low)	No Risk Information Provided			Risk Information Provided		
	Standard Rating Scale (%) (n = 63)	Magnifier Scale (%) (n = 61)	P Value ^a	Standard Rating Scale (%) (n = 65)	Magnifier Scale (%) (n = 54)	P Value ^a
Stroke (high)	26	17	0.004	17	16	0.672
Heart attack (high)	34	24	0.0105	38	35	0.381
Stomach cancer (low)	16	11	0.1236	5	5	0.244
Food poisoning (low)	70	50	0.0002	25	27	0.770

a. By 2-sample *t* test.

showed that participants' risk perceptions were lower when using the magnifier scale than when using the SRS for food poisoning and stomach cancer, the 2 low-probability events, although only food poisoning reached statistical significance (food poisoning: $t_{128} = 3.86, P = 0.0002$; stomach cancer: $t_{126} = 1.55, P = 0.124$). Risk perceptions were also significantly lower with the magnifier scale for stroke and heart attack despite the high probability of these outcomes (as determined by population averages reported in the literature)⁴⁴ (stroke: $t_{126} = 2.91, P = 0.004$; heart attack: $t_{126} = 2.60, P = 0.011$).

The 2 × 2 ANOVA in the no-risk-information-provided condition predicting risk perceptions from scale type and probability event type (high or low) showed that there was a main effect of scale type ($F = 20.01, P < 0.0001$) and probability event type ($F = 21.59, P < 0.0001$) and no interaction between scale type and probability event type ($P = 0.54$), indicating that risk perceptions are lower using the magnifier scale than the SRS for both high- and low-probability events.

Magnifier Glass Scale v. Visual Analog Scale When Risk Information Provided

The impact of the magnifier scale on judgments was different, however, when participants were given information about the average person's risk of each of the 4 health events.

As shown in Table 1 (columns 5–7), the percentage of participants who reported a risk perception of 1% or less was no different when using the magnifier scale than the standard rating scale for stroke, heart attack, and stomach cancer ($\chi^2 < 3.36, P > 0.067$ for all 3) and significantly greater with the magnifier scale only for food poisoning ($\chi^2 = 14.29, P = 0.0002$).

For all 4 health events, participants' risk perceptions were no different when using the SRS than when using the magnifier scale ($t < 0.88, P > 0.244$ for all comparisons) (Table 2, columns 5–7).

The ANOVA predicting risk perceptions from scale type, risk information provided or not, and high- or low-probability event and all interaction terms showed significant main effects of scale type ($F = 11.69, P = 0.0007$) and risk information provided ($F = 35.39, P < 0.0001$), no main effect of probability event type ($P = 0.98$), and a significant interaction between scale type and provision of numeric risk information ($F = 9.12, P = 0.003$). Thus, the responses to the magnifier scale are only lower than the SRS in the absence of risk information.

Discussion

The results of study 1 reveal that in the absence of risk information about the health event in question, participants report lower risk perceptions when using the magnifier response scale than when using the SRS. Unlike Woloshin and others,⁴³ however, our results show that the magnifier scale lowered risk perceptions for both high-probability events that are well beyond the 0% to 1% section of the magnifying glass (stroke: 11%–15%, heart attack: 44%–51%) and low-probability events that are within (food poisoning: 0.12%) or just beyond (stomach cancer: 1.3%) the 0% to 1% section. When participants were given information about the average likelihood of each risk, however, their risk perceptions were less likely to be affected by the response scale that they used. Thus, these results suggest that when participants do not have information about the risks they are being asked about, the use of the magnifier scale may inappropriately influence participants to report lower risk perceptions for both low- and high-probability events and may thereby lead to inaccurate assessments.

However, we considered the possibility that the interpretation of our results is limited by our partly within-subject design. Subjects in study 1 who were randomized to use the magnifier scale reported their risk perceptions of both high- and low-probability events. This

raises the possibility that the lower risk perceptions for high probability when using the magnifier scale were due not to the magnifier scale itself but rather to the influence of responding to a low-probability event in the magnifier section of the scale. That is, when magnifier scale participants responded to the high-probability event items, the magnifier section of the magnifier scale may have been more salient to them because they responded to a low-probability event item, possibly in the magnifying glass section of the scale, on the same survey.

Although this explanation is rendered less plausible by the order of the items in the survey (the high-probability events preceded the low-probability events), it is nevertheless important to attempt to rule out. Thus, in study 2, we conducted a between-subjects design in which participants responded to only high- or low-probability events on either the magnifier scale or SRS. Using this design, if risk perceptions for high-probability events are lower using the magnifier scale than the SRS, this cannot be attributed to the experience of having responded to a low-probability event on the magnifier scale.

STUDY 2

Methods

With approval from the Institutional Review Board of Dickinson College, an anonymous questionnaire was administered to undergraduates in 4 psychology courses. Participants were recruited through an announcement in their class asking them to complete a short survey about health risks. All students were eligible to participate.

After completing practice questions to familiarize themselves with the response scale (as in Woloshin and others⁴³), participants were randomized to complete 1 of 4 surveys in a between-subjects 2×2 design: high- or low-probability health events and magnifier scale or SRS. Thus, subjects either reported their risk perceptions of the 2 high-probability events using the magnifier scale or the SRS, or they reported their risk perceptions of the 2 low-probability events using the magnifier scale or SRS. The 2 high-probability events were again lifetime risk of heart attack and stroke, and the 2 low-probability events were lifetime risk of brain cancer (population average risk: 0.50%)⁴⁵ and multiple sclerosis (population average risk: 0.2%).⁴⁶ These 2 new low-probability events were used because the discrepancy between participants' risk perception for food poisoning in study 1 and the estimate obtained in the literature suggested that they interpreted this

health event differently than we intended. None of the participants was given risk information. The format and wording of the items were identical to that used in the no-risk-information condition of study 1. Following the risk perception items, participants reported their demographic characteristics: gender, age, race/ethnicity, and year in college.

Statistical Analyses

Descriptive statistics were used to examine the characteristics of the study sample, and linear or logistic regressions, as appropriate, were used to compare the characteristics of the 4 groups.

To assess an overall effect of scale type across the 2 health events and whether scale type interacted with probability event type (high or low), a 2×2 mixed-effects ANOVA was run predicting risk perceptions from scale type, probability event type, and the interaction of these 2 variables.

Results

Participants

Participants ($n = 105$) were mostly female (68%) and white (88%) and had a mean age of 20 years ($SD = 1.3$). As expected by randomization, there were no differences in participants' demographic characteristics in the 4 survey conditions ($P > 0.70$ for all 3 demographic variables).

Magnifier Glass Scale v. Visual Analog Scale for High- v. Low-Probability Events

Subjects' mean risk perceptions for the high events were 24.9 using the magnifier scale and 39.3 using the SRS, and for low events, they were 16.7 using the magnifier scale and 20.3 using the SRS. The 2×2 mixed-effects ANOVA revealed significant main effects of scale type ($F = 6.19$, $P = 0.015$) on risk perceptions and probability event type ($F = 14.12$, $P < 0.0001$) and no interaction ($F = 2.19$, $P = 0.142$). Thus, risk perceptions were lower when using the magnifier scale than when using the SRS, regardless of whether the health event was high or low probability.

Discussion

The results of study 2 replicate those of study 1: risk perceptions were lower when using the magnifier scale compared to the SRS, and this effect was true for both high- and low-probability events. In this between-subjects design, this effect could not be attributed to the effect of responding to low-probability events on high-

probability event risk perceptions. In addition, in study 2, both low-probability events performed as expected and thereby support the conclusion that the unusual pattern of results seen in study 1 with food poisoning was attributable to misinterpretation of the food poisoning items.

However, an important limitation of studies 1 and 2 is that the college students in these studies are not likely to face the health events addressed in this study for decades (with the possible exception of food poisoning). Thus, although risk perception research frequently uses undergraduate students,^{24,47-50} the participants in our study may not have felt that the health events were personally relevant to them, and this may have altered the impact of the scales on their responses.

To address this concern, in study 3, we conducted a similar survey with hypertensive patients at a veterans hospital assessing their risk perceptions of heart attack and stroke. Because these participants have hypertension, stroke and heart attack are 2 high-probability, self-relevant health events. As in studies 1 and 2, we examined whether the magnifier scale lowers reported risk perceptions compared to the SRS, even for these health outcomes that are well outside of the 0% to 1% magnifying glass section of the magnifier scale in probability of occurrence for the study participants.

STUDY 3

Methods

With approval from the Institutional Review Board of the Philadelphia Veterans Affairs Medical Center (VA), VA patients were asked to complete a survey assessing their risk perceptions of heart attack and stroke using either the SRS or the magnifier scale. Items were identical to the stroke and heart attack items used in studies 1 and 2, except that in study 3, we asked about 10-year risk instead of lifetime risk. As in study 2, no participants were given risk information.

Only those patients who had been diagnosed with hypertension and were taking at least 1 antihypertensive medication were included in the study. This ensured that each participant's risk of heart attack and stroke was greater than 1% and, therefore, outside of the magnifying glass section of the magnifier scale. To confirm that participants were at >1% risk of a stroke and heart attack, medical chart abstractions were conducted to extract participants' stroke and heart attack risk factors, which were then used to calculate their risk of each health event from risk calculators derived from the Framingham Heart Study.^{*51,52}

Two stages of data collection were conducted. In stage 1, patients were invited to complete a survey in exchange for a small gift (e.g., a VA logo cap) while waiting for a primary care appointment at the VA. Patients who were confirmed to have hypertension were included in the study ($n = 45$). These participants reported their risk perceptions using the standard rating scale.

In stage 2, a survey was mailed to 500 eligible VA patients along with a \$5 bill as a token of appreciation for completing and returning the survey. The mailed survey was identical to the survey distributed in the VA in stage 1 except that the SRS was replaced in all items with the magnifier scale. Six surveys were undeliverable, and 177 participants returned their completed survey, for a response rate of 36% (177/494).

Statistical Analyses

Descriptive statistics were used to examine the characteristics of the study sample, and t tests and chi-square tests were used, as appropriate, to compare the characteristics of the 2 groups (stage 1 and stage 2).

Pearson correlations, t tests, and chi-square tests were used, as indicated, to assess whether socio-demographic characteristics that differed between the 2 groups were associated with risk perceptions.

An overall assessment of the difference in risk perceptions using the 2 scales across the 2 health outcomes was conducted with a 2×2 ANOVA with scale type (magnifier or SRS), health event (stroke or heart attack), and the interaction included in the model.

Results

Participants

Overall, participants had a mean age of 65 years ($SD = 10$), 52% were black, 39% completed some college education or more, and 24% earned \$40,000 or more (Table 3). Magnifier scale participants (stage 2; $n = 180$) were no different from visual analog scale participants (stage 1; $n = 45$) in educational attainment, income, or gender ($P = 0.585$, $P = 0.698$, and $P = 0.311$, respectively) but were older ($t = 4.06$, $P = 0.0001$) and less likely to be black ($\chi^2 = 8.3$, $P = 0.004$). However, in bivariate analyses, neither race nor age was associated with risk perceptions: mean risk perceptions (race:

*The heart attack risk calculator provided an estimate of >30% for those participants whose risk was over 30%. When calculating the sample average heart attack risk, these participants were assigned a risk of 30%, leading to an underestimate of the sample average.

Table 3 Characteristics of Participants in Study of Veterans (Study 3)

	All Participants (<i>n</i> = 243)	Stage 1 (Standard Rating Scale) (<i>n</i> = 45)	Stage 2 (Magnifier Scale) (<i>n</i> = 177)	Comparison of 2 Samples ^a
Gender (% male)	97	95	98	0.311
Age (mean)	65.3	59.6	66.6	0.0001
Education (% some college or more)	39	36	40	0.585
Race (% black)	52	67	43	0.004
Income (% >\$40,000)	24	22	25	0.698

a. *P* value from 2-sample *t* test or chi-square test as appropriate.

stroke: $P = 0.34$ /heart attack: $P = 0.68$; age: stroke: $P = 0.76$ /heart attack: $P = 0.63$).

As expected, participants' actual stroke and heart attack risks were well above the 0% to 1% magnifying glass section of the magnifier scale. According to models that calculate heart attack and stroke risks from risk factors extracted from participants' medical charts, participants' average calculated stroke risk was 13% ($SD = 10$), and average calculated heart attack risk was 19% ($SD = 8$); both were no different in the 2 samples (stroke: $P = 0.505$; heart attack: $P = 0.266$).

Magnifier Glass Scale v. Visual Analog Scale for High-Probability Events

Subjects' mean risk perception for heart attack was 33.7 using the magnifier scale and 41.8 using the SRS; for stroke, it was 33.5 using the magnifier scale and 40.7 using the SRS. The effect of scale type on risk perceptions was significant in the 2 (scale type) \times 2 (health event) ANOVA ($F = 6.14, P = 0.014$), demonstrating that across the 2 high-probability events (stroke and heart attack), risk perceptions were lower when using the magnifier scale than when using the SRS.

Discussion

The results of this research demonstrate that within 2 very different sample populations, the use of the magnifier scale reduces people's risk perceptions, not only for low-probability events but also for high-probability events, such as stroke and heart attack, that fall well outside of the magnifying glass section (0%–1%) of the magnifier scale. These results were found both in 2 samples of college students as well as in a sample of patients who, because of a diagnosis of hypertension, are at high risk for heart attack and stroke. These results were also replicated in a between-subjects design in which participants' risk perceptions of high-probability events could not have been influenced by the experience of reporting their risk perception for a low-probability

event. Thus, this research failed to replicate Woloshin and others' finding⁴³ that the magnifier scale leads participants to report lower risk perceptions but only for events that fall within the magnifying glass section of the scale.

The tendency of the magnifier scale to lower reported risk perceptions appears to be limited to cases in which people are not given information about the actual likelihood of the risk being assessed. When participants in study 1 were told the average person's actual likelihood of facing each outcome, the magnifier scale did not affect their reported risk perceptions. This question was not examined in studies 2 or 3. Perhaps when participants are very uncertain about their risk perception answer, they are more influenced by changes in the item wording or response scale, but when they are more confident in their response (e.g., because probability information about the event in question is provided), such format changes have less influence on their responses.

Because the magnifier scale requires more extensive training and preparation of participants as well as longer questionnaires than the SRS, we feel that to warrant use, the magnifier scale must be clearly superior to the SRS. Criteria for superiority should include the magnifier scale leading to more accurate risk perceptions for events that have an estimated actual probability of less than 1% without affecting risk perceptions for events with an estimated actual probability of greater than 1%. To lower risk perceptions for these higher probability events would constitute a measurement bias. Our findings suggest that the magnifier scale incorrectly alters reported risk perceptions for higher probability events.

It is important to note that Woloshin and others⁴³ found that a linear verbal response scale (e.g., 7-point scale labeled from *not at all likely* to *extremely likely*) performed better than both the SRS and the magnifier scale on their measures of validity, reliability, and usability. Thus, when a numeric estimate of participants'

risk perception is not needed, Woloshin and others' results suggest that the verbal scale ought to be employed. However, in many studies, such as those that compare people's risk perceptions to numeric estimates of their actual risks,^{27,53-55} researchers require an assessment of participants' risk perception on a 0% to 100% numeric scale. In such situations, our results suggest that when participants are unaware of the likelihood of the risk in question and the probability is above 1%, the use of the magnifier scale may lead to inappropriately altered risk perceptions.

However, there are limitations to this research. First, as previously noted, studies 1 and 2 used university undergraduates, for whom the health risks examined may not be salient. Furthermore, undergraduates represent a homogeneous population who are likely to be more highly educated than the general population and, therefore, may be more comfortable with low probabilities than the general population.^{38,43} However, the replication of the results of studies 1 and 2 in study 3 lends credence to the generalizability of the results to older, less educated populations for whom these risks are more immediate and who may have greater difficulty with the use of low probabilities. Second, as with any survey research, response bias is a concern. It is possible that nonresponders in all studies differed from responders, but there is no obvious reason why this would be the case on the dimension of risk perceptions. Finally, participants in study 3 were not randomized to condition, and demographic differences were seen between the 2 groups. However, concerns about group differences are alleviated by the fact that the variables on which the groups differed (age and race) were not associated with the key variables.

The results of this research demonstrate that the magnifier scale reduces reported risk perceptions regardless of the probability of the health event in question. Thus, when researchers or health care providers require a numeric risk perception from their subjects or patients, the magnifier scale may be a useful response scale for obtaining more accurate risk perceptions about low-probability events but may lead to inappropriate reductions in reported risk perceptions about high-probability events. This suggests that use of the magnifier scale should be limited to assessments of subjective probabilities of very low-probability events.

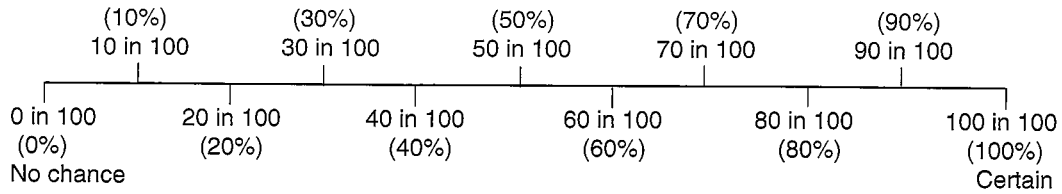
The need for accurate measurement of risk perceptions for many areas of research highlights the importance of fully understanding the psychometric properties of the magnifier scale and other risk perception measures in diverse populations and under a variety of circumstances (e.g., when participants do and do not have a sense of the probability of the risks in question). Further work is needed to examine whether these measures truly capture how people think about their risks and whether other approaches to risk perception measurement are needed.

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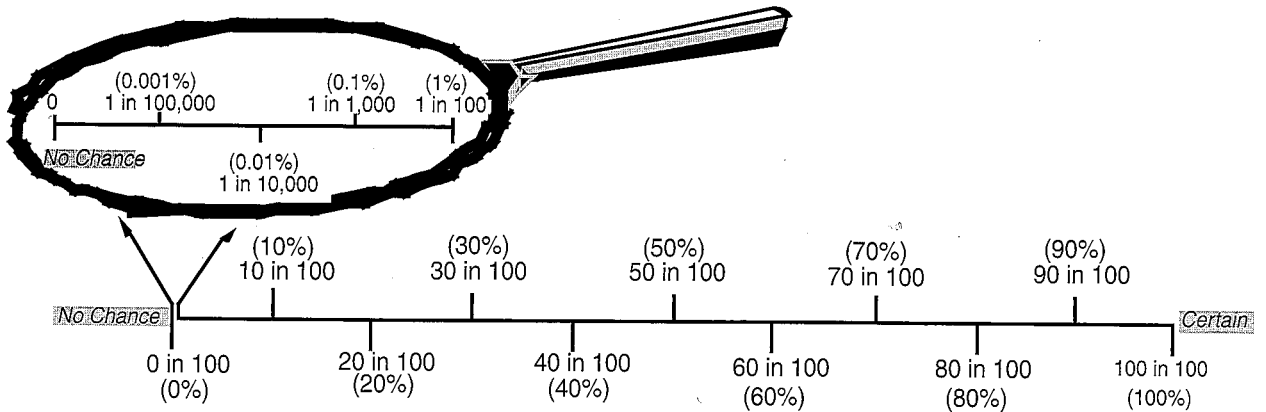
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APPENDIX A
Response Scales

(1) Standard rating scale



(2) Magnifier scale



APPENDIX B

Items in Study 1 and Risk Information Conditions

1. No risk information provided (shaded sections below omitted)
2. Average likelihood of risk being assessed at respective item

The chance that the average college male will have a stroke in his lifetime is 15%. The chance that the average college female will have a stroke in her lifetime is 11%.

What is the chance that YOU will have a STROKE *in your lifetime*? Place an X anywhere on the scale below [either inside or outside the magnifying glass].

The chance that the average college male will have a heart attack in his lifetime is 51%. The chance that the average college female will have a heart attack in her lifetime is 44%.

What is the chance that YOU will have a HEART ATTACK *in your lifetime*? Place an X anywhere on the scale below [either inside or outside the magnifying glass].

The chance that the average person will get stomach cancer in his or her lifetime is 1.3%.

What is the chance that YOU will get STOMACH CANCER *in your lifetime*? Place an X anywhere on the scale below [either inside or outside the magnifying glass].

The chance that the average person will get food poisoning in his or her lifetime is 0.12%.

What is the chance that YOU will get FOOD POISONING *in your lifetime*? Place an X anywhere on the scale below [either inside or outside the magnifying glass].

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