The Influence of Base Rate and Case Information on Health-Risk Perceptions: A Unified Model of Self-Positivity and Self-Negativity

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This research examines how consumers use base rate (e.g., disease prevalence in a population) and case information (e.g., an individual's disease symptoms) to estimate health risks. Drawing on construal level theory, we propose that consumers' reliance on base rate (case information) will be enhanced (weakened) by psychological distance. A corollary of this premise is that self-positivity (i.e., underestimating self-risk vs. other-risk) is likely when the disease base rate is high but the case information suggests low risk. In contrast, self-negativity (i.e., overestimating self-risk vs. other-risk) is likely when the disease base rate is low, but case information implies high risk. Six experiments provide convergent support for this thesis, using different operationalizations of construal level, base rate, and case risk across multiple health domains. Our findings inform the extant literature on health-risk perception and also provide theoretical implications for research on social comparisons, as well as that on the use of base rate versus case information.

Anecdotal evidence suggests that people sometimes suffer from a self-negativity bias when it comes to forming health-risk assessments, such that we fear the worst possible outcomes when it comes to our own health, while maintaining a calm objectivity (sometimes infuriatingly so!) with regard to others. For example, when someone else suffers from indigestion, we accurately perceive it as being merely indigestion, but the same symptom in ourselves can lead to worries about a possible heart attack (Leahy 2006); likewise, a lump can induce worries about breast cancer in the same person who may downplay a friend's similar concern by pointing out that eight out of ten such lumps are benign. Taken to an extreme, such self-negativity manifests as hypochondria (which reports suggest may afflict up to 8.5% of the US adult population; Medical News Today, 2009) and can have substantial adverse consequences, including undue anxiety as well as needless expenditure on medical treatments.

Interestingly, however, the extant literature on health-risk perceptions has not obtained evidence of this sort of self-negativity bias. Rather, a wealth of evidence testifies to the existence of the opposite effect—a self-positivity bias wherein individuals typically *underestimate* their vulnerability (compared with that of others) to a variety of health risks such as gum problems, heart attack, venereal disease, and cancer (Perloff and Fetzer 1986; Taylor and Brown 1988; Weinstein 1980). Consumer researchers have added important insights into this body of work by identifying ways of reducing the magnitude of the self-positivity bias (e.g., Chandran and Menon 2004; Raghubir and Menon 1998); again, however, a self-negativity effect has typically not been documented, except for chronic pessimists (Lin, Lin, and Raghubir 2003).

The current investigation addresses the issue of self-pos-

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itivity versus self-negativity effects as part of a broader inquiry into the relative influence of base-rate information (relating to the ubiquity of the risk in the target population) and case-risk information (i.e., idiosyncratic details about the target individual) on assessments of health risk. Drawing upon construal level theory (CLT; Trope and Liberman 2010), we propose a unified model of health-risk perceptions, positing that base-rate information has greater impact on health-risk judgments that are psychologically distant (vs. near), with the reverse being true for the impact of case risk. As discussed later, this premise also enables us to delineate conditions in which self-positivity versus self-negativity will manifest in health assessments.

Six studies provide empirical support for our framework, which informs three major areas. Of primary importance, it contributes to an important substantive domain in the consumer literature: health-risk perceptions. As one of the world's largest and fastest-growing industries, the healthcare industry consumes over 10% of gross domestic product in most developed countries. For the United States, this number is expected to reach 19.6% by 2016 (Poisal et al. 2007). Because of economic and public policy implications, the issue of how consumers judge health risks has assumed increasing importance, and scholars have highlighted the need for further research in this area (Dunning, Heath, and Suls 2004). In responding to this call, the current research provides fresh insights into the mechanisms that underlie the formation of health-risk assessments. It also provides a systematic documentation of self-negativity effects in these assessments, to set alongside the self-positivity effects documented thus far in the health perception literature.

Second, and relatedly, our research contributes to the relatively small body of work on social comparisons that has documented *both* self-negativity versus self-positivity effects in the same domain (Kruger 1999; Menon, Kyung, and Agrawal 2009) by identifying a new moderator of these opposing effects. Finally, this inquiry offers a new theoretical perspective as to the relative influence of case versus base information on judgments of a target (Bar-Hillel and Fischhoff 1981).

THEORETICAL BACKGROUND

Assessing Health Risk: Base Rate and Case Risk

Previous literature (Keller, Lipkus, and Rimer 2002; Lin et al. 2003) suggests that consumers' health-risk perceptions may be influenced by two types of information. One of these is *base rate*, which reflects the ubiquity of disease in the target population (Lin et al. 2003; Raghubir 2008). For example, some health risks such as flu have a higher base rate, whereas the base rates of other risks like cancer are relatively low; correspondingly, people will typically believe it is more likely that an individual is suffering from the former rather than the latter type of health risk. Alternately, people may form health-risk assessments on the basis of idiosyncratic *case-risk information*, which reflects specific characteristics of the target person such as their likelihood of engaging in risky behaviors (e.g., Raghubir and Menon 1998) or possessing certain symptoms of an illness (e.g., Dunning et al. 2004; Menon, Block, and Ramanathan 2002). Thus, a person who has undergone blood transfusion several times will likely be judged as more vulnerable to diseases like human immunodeficiency virus (HIV) or hepatitis C than someone who has not had any blood transfusions; similarly, the likelihood of flu will typically be rated higher for an individual exhibiting several flu symptoms (fever, runny nose, tiredness) as compared to just one (e.g., runny nose).

This article examines how and why overall health-risk judgments are differentially influenced by base and case information when both types of information are provided. We note that this issue has received some attention in other (health-unrelated) contexts. In particular, research relating to the base-rate fallacy (Kahneman and Tversky 1973; Nisbett and Ross 1980) finds that participants given both base-rate information (i.e., the prevalence of a characteristic within a population) and case information (e.g., concrete personality sketches of the target person) base their judgments of the target almost solely on the sketches. Thus, when told that a target person was "short, slim and likes to read poetry," respondents were more likely to guess that the person was a professor of classics than a truck driver, ignoring the far higher base rate of truck drivers than classics professors in the population (Nisbett and Ross 1980). This tendency to neglect base-rate information has been reliably replicated (Bar-Hillel 1980; Lyon and Slovic 1976), although some exceptions have also been identified. For example, base rate is relied on more when it is consistent with the implications of case information (Lynch and Ofir 1989), when it is causally relevant (Ajzen 1977), or when case information is relatively impoverished (Bar-Hillel and Fischhoff 1981).

In sum, while there is much evidence for the base-rate fallacy, there do appear to be conditions under which base rate has more of an influence (and conversely, case risk is used less). In seeking to understand health-risk assessments, the current inquiry adds to this broader body of work by offering a new theoretical perspective as to the relative influence of these two types of information. By delineating conditions that facilitate or hamper the influence of base and case information on health-risk judgments, we are also able to obtain insights into self-positivity versus self-negativity effects.

Base Rate versus Case-Risk Information: The Abstract/Concrete Distinction

As the first step of our conceptualization, we posit a fundamental qualitative distinction between base-rate and case-risk information. Base rates, by definition, consist of abstracted information about a target category (e.g., "seasonal flu in the United States results in approximately 36,000 deaths each year") rather than feature-specific information about a particular exemplar of that category. On the other hand, case-risk information provides idiosyncratic, vivid details at

a much greater level of specificity—and is therefore more concrete than base-rate information. In fact, case-risk information typically involves two forms of specificity: the information refers to a particular individual and provides details about a particular dimension—such as a particular risky behavior (e.g., having unprotected sex) or a particular disease symptom (e.g., having a fever). Such specific information is likely to be easier to visualize (a key property of concreteness; Chandran and Menon 2004) as compared to the category level information that a base rate provides. Consistent with this view, scholars have referred to base-rate information as being "remote, pallid, and abstract," while case information, on the other hand, has been viewed as "vivid, salient, and concrete" (Nisbett et al. 1982, 111; see also Lynch and Ofir 1989, 170). Reinforcing these conceptual arguments, we subsequently also provide empirical support for the notion that base (case) information is relatively abstract (concrete).

In light of this postulated distinction between base and case information, research on construal level theory (Trope and Liberman 2010) provides a relevant theoretical platform for our inquiry into the relative impact of these two types of information on health perceptions. CLT states that objects, events, or individuals can be perceived as being either psychologically close or distant; psychological distance itself varies along different dimensions such as spatial, temporal, or social. The central premise of the theory is that distant objects are represented as abstract, high-level construals that rely on generalized category-level information rather than specific details. In contrast, psychologically close objects are represented as concrete, low-level construals that contain specific details rather than generalized abstractions.

Drawing on this premise, a substantial body of work has demonstrated that abstract information exerts more impact on representations and judgments of psychologically distant events, while the reverse holds true of concrete information (Förster, Friedman, and Liberman 2004; Kim, Rao, and Lee 2009; Liberman and Trope 1998). In one illustrative study, participants were asked to estimate the likelihood of a target person attending a guest lecture (Liviatan, Trope, and Liberman 2008). The target purportedly had either the same initials as the participant (and was therefore perceived as socially proximal) or had different initials (socially distant). The guest lecture was described either as being high in feasibility (e.g., scheduled at a convenient time) and low in desirability (e.g., uninteresting topic) or the other way around (i.e., interesting topic but scheduled at an inconvenient time). Note that, in general, feasibility factors tend to relatively concrete, whereas desirability considerations are relatively abstract (Liberman and Trope 1998). Of interest, participants' estimates of the target person's likely behavior were more influenced by feasibility considerations such as scheduling convenience when the target was proximal rather than distant, while relatively abstract desirability considerations such as topic interest exerted an increased influence as the target became more distant. These results thus support the thesis that the reliance on concrete (abstract) inputs increases as the target becomes psychologically closer (distant). A host of other findings converge on the same conclusion (see Trope and Liberman [2010] for a review).

Combining this well-established effect of psychological distance with the aforementioned distinction between base (abstract) and case (concrete) information, it follows that

> **H1**: Consumers' reliance on base-rate information for assessing health risk will be enhanced when the judgment is psychologically distant (vs. relatively close). Case-risk information (e.g., pathogenic behaviors or syndromes), on the contrary, will exert a greater influence when the judgment is psychologically close (vs. distant).

Self-Positivity versus Self-Negativity

We test this focal hypothesis by examining the effects of psychological distance and construal level on health-risk assessments in several different ways. These include a manipulation using temporal distance (experiment 5), as well as a direct induction of construal level (experiment 6). The psychological distance dimension that we focus on most, however, is social distance—that is, we examine how health-risk assessments that are made on the basis of case-risk plus base-rate information differ for socially close versus distant target (experiments 1–4). Doing so allows us to provide insights into the dilemma referred to earlier: when are people likely to display a self-positivity (lower risk assessments for themselves than others) versus a self-negativity effect (higher risk assessments for themselves than others)? CLT holds that judgments regarding the self are psychologically closer (and therefore involve low-level construals) as compared to judgments about others, which involve relatively high-level construals (Kim, Zhang, and Li 2008; Liviatan et al. 2008; Yan 2012; Yan and Sengupta 2011). This insight, in conjunction with our proposition above, enables us to delineate specific conditions regarding self-positivity versus self-negativity effects. Because base-rate (case-risk) information has a greater influence on judgments regarding others (the self), self-positivity should likely manifest when the base rate of a health risk is relatively high, while the case information signals low risk. In such instances, individuals will be prone to judging others more at risk than themselves. In contrast, self-negativity is particularly likely to manifest when the base rate is relatively low, but the case information signals high risk—in such instances, individuals should be more prone to judging themselves at risk than others. More formally, we hypothesize that

> **H2**: Self-positivity is more likely when the disease base rate is high, but case information signals low risk. Self-negativity, on the contrary, is more likely when disease base rate is low but case information signals high risk.

Note that this construal-based framework is not the only approach to understanding health-risk assessments. Rather,

the current conceptualization, which is based on a cognitive perspective, supplements earlier work in the area that has taken more of a motivational approach—for instance, one reason commonly cited for the self-positivity bias observed in health-risk perceptions has to do with a self-enhancement motive (Raghubir and Menon 1998; Taylor and Brown 1988), which makes people want to believe that they are at less at risk than others. We fully acknowledge the validity of such motivational perspectives; at the same time, we suggest that a construal-based viewpoint can offer fresh insights into this domain, adding to extant findings without in any way contradicting them.

Results from six studies provide convergent support for our theses. All studies tested our basic proposition (hypothesis 1), by examining respondents' reliance on base rate versus case risk to form health-risk assessments, as a function of psychological distance. In order to document self-negativity versus self-positivity effects (hypothesis 2), experiments 1–4 focused on the social dimension of psychological distance. Subsequent studies increased confidence in our conceptualization by generalizing the obtained effects to other dimensions of psychological distance and directly manipulating construal level in order to illuminate the underlying process. All studies reported in this article were conducted with undergraduate participants at a university in Hong Kong; participants' age range varied from 18 to 25 years.

EXPERIMENT 1: HIV

Method

Experiment 1 provided an initial test of our proposition in the context of assessing vulnerability to HIV, a frequently studied health risk (e.g., Raghubir and Menon 1998). Two hundred forty-three student participants (140 female) were randomly assigned to either the "self" or the "other" condition. Participants in the former condition were asked to estimate their own likelihood of contracting HIV. In the latter, they were asked to estimate the likelihood that an average person in Hong Kong would contract HIV. Note that in all the social distance studies reported in this article (experiments 1–4), this factor was manipulated between subjects. Using a within-subjects measurement technique would heighten the temporary salience of motivational forces such as self-enhancement (Klar and Giladi 1997; Moore 2007). Such motivational forces, as noted earlier, are orthogonal to our treatment, which draws on CLT to offer a cognitive account of health-risk assessments (the possible integration of motivational and cognitive mechanisms is addressed in the General Discussion).

All participants in the study estimated risk likelihood (for "self" or "other") on two scales, one a 7-point scale and the other a 101-point scale; each scale was anchored by "very unlikely" and "very likely." These two items were highly correlated ($r = .81$) and thus were standardized and averaged into an index of estimated risk likelihood. Participants then responded to two further questions. The first, which measured perceived base rate, asked them: "how ubiquitous is HIV in Hong Kong?" (1 = very rare; 7 = very ubiquitous). The second question assessed perceived risky behavior likelihood, which is a form of case risk (see Menon et al. 2002). Depending on whether participants were in the "self" ("other") condition, this question was phrased as: "how likely are you (an average Hong Kong person) to engage in risky behaviors by which HIV is transmitted?" (1 = very unlikely; 7 = very likely).

Our conceptualization predicts that the effects of both base-rate and behavior likelihood on risk assessments should be moderated by social distance (self vs. other judgments). Base-rate perceptions should exert a greater influence on risk assessments of another (vs. the self), while the reverse should manifest for risky behaviors.

Results

The risk likelihood index was regressed on the following independent variables: (1) a dummy variable for the target (self = 0, other = 1), (2) perceptions of base rate, (3) risky behavior likelihood, (4) three 2-way interactions, and (5) a 3-way interaction. As would be expected, the main effect of risky behavior perceptions was significant ($\beta = .50$, $t = 4.60$, $p < .001$), which indicated that a greater perceived likelihood of engaging in HIV-inducing behaviors led to a higher assessment of contracting the disease. The main effects of base rate and social distance did not reach significance, nor did the 3-way interaction (all $p > .50$).

In support of our first hypothesis, we found that the effects of both base rate and case risk (as assessed by risky behavior likelihood) were moderated by predicted two-way interactions with social distance. First, a significant interaction between base rate and social distance ($\beta = .44$, $p < .01$) revealed that the influence of base-rate perceptions on health-risk judgments—as indicated by the slope of base rate—was greater when health risk was assessed for others ($\beta = .45$, $t = 8.22$, $p < .001$) rather than the self ($\beta = .12$, $t = 1.68$, $p = .10$). Second, a significant interaction between social distance and risky behavior likelihood ($\beta = -.29$, $p < .05$) revealed that the latter's influence was significantly larger when health risk was assessed for the self ($\beta = .54$, $t = 13.11$, $p < .001$) rather than for others ($\beta = .13$, $t = 2.01$, $p = .05$). Thus, as we expected, respondents relied more on base rate (case risk) when forming risk assessments for others (themselves).

Self-Positivity versus Self-Negativity. Our second hypothesis predicts that self-positivity (lower risk estimates for self vs. others) is most likely when the base rate signals high risk, but case information signals low risk. In contrast, self-negativity (greater risk estimates for self vs. others) is likely to be observed when base rate signals low risk, but case information signals high risk. Spotlight analyses were conducted to test these predictions. Specifically, both base rate and risky behavior likelihood were plotted at one standard deviation above and below the mean, which enabled us to observe the simple effect of social distance (self vs. other). Note that for the behavior likelihood item, partici-

pants had responded to separate questions in the "self" (risky behavior likelihood of self) versus the "other" condition (risky behavior likelihood of average person in Hong Kong). However, no significant difference was observed for this item across the two conditions in terms of either means ($M_{self} = 2.45$, $M_{other} = 2.47$, $F < 1$, $p > .90$) or variances ($SD_{self} = 1.33$, $SD_{other} = 1.41$, Levene statistic $= .46$, $p > .50$). It was thus possible to perform a single spotlight analysis on risky behavior likelihood by pooling the two conditions.

For participants exposed to information comprising high base rate and low risky behavior likelihood, a significant positive influence of social distance on health-risk assessment was obtained ($\beta = .80$, $t = 2.02$, $p < .05$)—that is, risk assessments were higher for others versus self, illustrating self-positivity. In contrast, given a low base rate but high risky behavior likelihood, social distance had a significant negative effect on risk assessments ($\beta = -1.09$, $t = -2.85$, $p < .01$), illustrating self-negativity (see fig. 1).

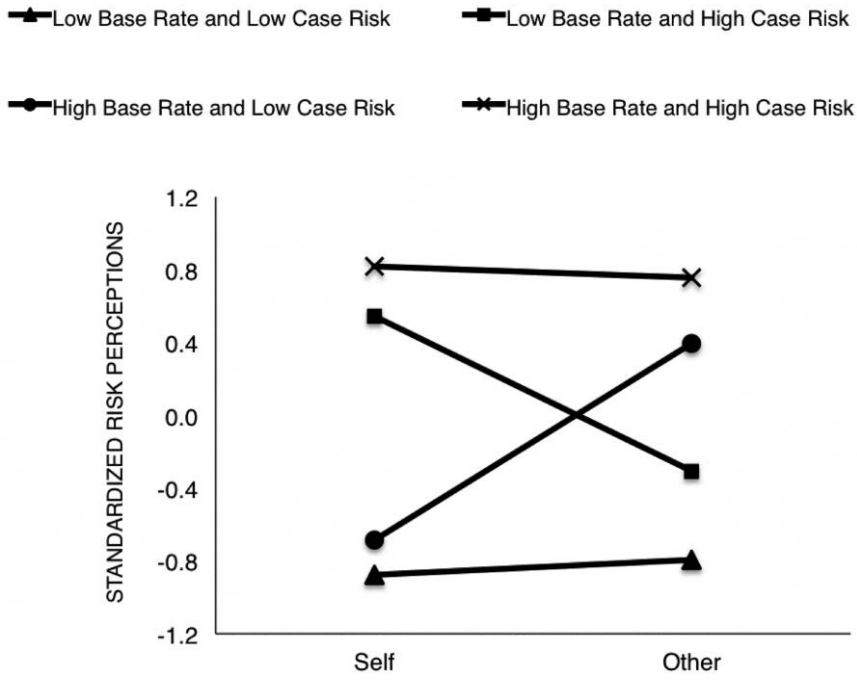
Note that we do not offer any a priori predictions regarding self-other differences in the remaining two cells where base-rate and case-risk perceptions are aligned (low base rate–low case risk; high base rate–high case risk). Our conceptualization posits a greater influence of case risk on self-judgments and of base rate on other-judgments; thus, one possibility is that self-other differences simply get "canceled out" when base-rate and case-risk perceptions offer similar instead of opposing implications. Other possibilities also exist, however—for instance, given the robust documentation of a self-positivity bias in the health literature, a self-positivity effect may be a default or baseline finding that emerges in these two conditions. In the current study, however, spotlight analyses for these two scenarios (high-high and low-low) revealed no significant effect of social distance (all $t < 1$, all $p > .50$).

Discussion

Experiment 1 provided an initial test of our construal-based conceptualization of health-risk assessments. Consistent with predictions, base rate, as assessed by perceptions of disease ubiquity, exerted a greater influence when participants judged how much others (as compared to they themselves) were at risk of contracting the disease. On the other hand, idiosyncratic case risk, as assessed by participants' perceptions of the likelihood of pathogenic behaviors, exerted a greater influence on risk assessments for self versus others. As a corollary, experiment 1 also documented self-positivity and self-negativity biases as predicted. When disease base rate was high while risky behavior likelihood was low, participants judged themselves less vulnerable to risk than others (self-positivity). However, when base rate was low and risky behavior likelihood was high, participants judged themselves more vulnerable than others (self-negativity).

FIGURE 1

EXPERIMENT 1: SPOTLIGHT ANALYSIS DOCUMENTING SELF-POSITIVITY AND SELF-NEGATIVITY IN HEALTH-RISK PERCEPTIONS



Although these results provide initial support for our predictions, base-rate and case-risk perceptions in experiment 1 were measured rather than being manipulated, thus making it difficult to establish causality. Experiment 2 addressed this concern.

EXPERIMENT 2: SWINE FLU VERSUS REGULAR FLU

Experiment 2 sought to provide further insights into the relative influence of base rate and case risk on health-risk assessments by observing the effects of manipulating both of these antecedent factors. In addition, this study generalized our previous findings in several different ways. First, instead of requiring respondents to assess the possibility of contracting illnesses in the future, the dependent variable asked them to diagnose the likelihood that they (or others) were currently suffering from a particular infection given a set of symptoms. Lay people commonly engage in such diagnoses, both on behalf of themselves and others; further, arriving at these diagnoses is conceptually similar to forming assessments of future health risk. Both involve a form of likelihood estimation on the basis of base and case information, and we argue, therefore, that both should follow a similar underlying process. Second, we manipulated base rate by varying the illness regarding which participants were asked to form a diagnosis: either swine flu (H1N1; low rate of occurrence) or regular flu (high rate of occurrence). Third, we manipulated case risk by giving respondents information as to the symptoms that the target of diagnosis was suffering from (e.g., cough, headache, etc.). Symptoms, much like specific risky behaviors, provide concrete, idiosyncratic detail about the particular individual and are therefore a form of case information. The level of risk conveyed by the symptoms was manipulated by varying the number of symptoms (1 vs. 4), analogous to manipulating the number of risky behaviors made salient while judging health risks (Raghubir and Menon 1998). Fourth, in the "other" condition, instead of asking participants to assess health risks for an "average person," we asked them to assess the risk for "someone" suffering from the symptoms. The latter induction should encourage thoughts of a specific person, thus increasing the equivalence between "self" and "other" conditions along the specificity dimension.

Method

Student participants ($N = 250$; 146 female) were randomly assigned across a 2 (self vs. other) × 2 (number of syndromes: 1 vs. 4) × 2 (disease type: swine flu vs. regular flu) between-subjects design. All participants were first informed that the purpose of the study was to assess students' knowledge about various types of illnesses. They were instructed to imagine that "you are (someone is) suffering from the following symptom(s): cough (cough, fever, running nose, and headache)." This statement thus manipulated both social distance ("you" vs. "someone") and number of symptoms (one vs. four). Next, all participants were asked to assess their (the person's) likelihood of contracting either H1N1 or a regular flu (disease type manipulation), along a 101-point scale anchored by 0 (very unlikely) and 100 (very likely). As a manipulation check, all respondents then rated the ubiquity of H1N1 and regular flu in Hong Kong on 10-point scales ranging from 1 (very rare) to 10 (very common).

Results

Manipulation Check. As expected, participants perceived H1N1 ($M = 4.97$) as being less common than regular flu ($M = 8.34$; $F(1, 242) = 549.29$, $p < .001$), supporting the efficacy of our base-rate manipulation. No other effects were significant.

Hypothesis Testing. A 2 × 2 × 2 ANOVA on the key dependent variable, illness likelihood, revealed significant main effects of flu type, as well as number of symptoms. Participants in the regular flu condition judged illness likelihood as being greater than those in the H1N1 condition ($M_{flu} = 51.80$ vs. $M_{H1N1} = 20.72$; $F(1, 242) = 103.43$, $p < .001$). Similarly, participants in the four symptoms condition ($M_{four} = 44.93$) judged illness likelihood as being greater than those in the single-symptom condition ($M_{one} = 27.58$; $F(1, 242) = 32.24$, $p < .001$).

Of more importance, and in line with our hypotheses, these two main effects were qualified by significant 2-way interactions with the self-other manipulation of social distance. First, a 2-way interaction between base rate and social distance ($F(1, 242) = 3.98$, $p < .05$) showed that, as predicted, the impact of base rate was greater for the "other" ($M_{flu} = 54.05$ vs. $M_{H1N1} = 16.87$; $M_{diff} = 37.18$) versus the "self" condition ($M_{flu} = 49.54$ vs. $M_{H1N1} = 24.56$; $M_{diff} = 24.98$). Second, a significant interaction between number of symptoms and social distance ($F(1, 242) = 7.77$, $p < .01$) confirmed the prediction that number of symptoms would have a greater impact on estimated illness likelihood in the "self" ($M_{one} = 24.12$ vs. $M_{four} = 49.99$; $M_{diff} = 25.87$) versus the "other" condition ($M_{one} = 31.05$ vs. $M_{four} = 39.88$; $M_{diff} = 8.83$). No other effects were significant.

Self-Positivity versus Self-Negativity. Also in line with predictions, planned contrasts then revealed that given a high base rate (regular flu) and low case risk (only one symptom), participants *underestimated* their own infection likelihood compared to that of others ($M_{self} = 33.70$ vs. $M_{other} = 49.91$; $t(242) = 2.73$, $p < .01$). In contrast, and also as predicted, a self-negativity effect obtained given a low base rate (swine flu) and high case risk (four symptoms), with participants now *overestimating* their illness likelihood in relation to others ($M_{self} = 34.59$, $M_{other} = 21.56$; $t(242) = 2.11$, $p < .05$). Finally, as in experiment 1, there was no significant difference in the low-low ($t < 1$) or high-high conditions ($t = 1.17$, $p > .20$; table 1).

Discussion

Using manipulated (rather than measured) base rate and case risk, experiment 2 replicated our previous findings re-

TABLE 1

EXPERIMENT 2: PARTICIPANTS' DIAGNOSIS AS A FUNCTION OF BASE RATE, NUMBER OF SYMPTOMS, AND SOCIAL DISTANCE

Base rate	Number of symptom(s)	Social distance	Mean (SD)
H1N1 (low)	One	Low (self)	14.54 (15.80)
		High (other)	12.18 (10.44)
	Four	Low (self)	34.59 (23.18)
		High (other)	21.56 (16.89)
Regular flu (high)	One	Low (self)	33.70 (24.17)
		High (other)	49.91 (27.27)
	Four	Low (self)	65.39 (32.96)
		High (other)	58.19 (32.45)

garding the relative influence of these two types of information on health-risk assessments. It is noteworthy also that the current study obtained findings convergent with experiment 1 while using different inductions of base rate and case risk, and also a different (but conceptually similar) dependent measure of health-risk judgments—that is, current diagnosis rather than future risk assessment. Apart from enhancing the credibility of the basic pattern of results, these extensions add to the health-risk literature by providing conceptual links between seemingly different variables. For instance, they testify to the underlying conceptual similarity between risky behaviors and disease symptoms: both provide concrete, idiosyncratic case-risk information and thus exert a greater influence under low psychological distance.

These results also contain interesting applied implications. Many illnesses share similar symptoms such as fever and headache. However, the base rates of these illnesses can vary a lot. The findings of experiment 2 imply that consumers may overestimate their likelihood of getting a rare (often more serious) disease based on a few symptoms that may actually be indicative of a more common (but less serious) illness. Our results further suggest that in such cases, seeking others' advice, rather than engaging in self-diagnosis, may be helpful since an observer is more likely to give due weight to the disease base rate instead of being disproportionately influenced by the case symptoms.

We note that a key assumption underlying the results thus far is that base-rate information is more abstract than the case-risk information provided to respondents. As mentioned earlier, theoretical insights from prior research (Lynch and Ofir 1989; Nisbett et al. 1982) are consistent with this assumption; however, given its centrality to the current investigation, we also ran a post-test to provide empirical validation. Participants ($N = 37$) were provided with definitions of base rate ("refers to the general frequency of a disease") and case information ("specific characteristics related to the disease, such as symptoms or disease-producing behaviors") in the context of health risks. Subsequently, they were asked to rate how abstract or concrete they found each of these two forms of information—that is, base rate and case risk (1 = very concrete; 7 = very abstract) and also how easy it was to form a visual image based on each type of information (1 = very easy; 7 = very difficult). The latter scale, which has been used in prior research (Chandran and Menon 2004) to assess concreteness-abstractness, is based on the notion that more concrete information is easier to visualize.

Results on both items supported the assumption that base rate is a more abstract cue than specific case information. On the first, direct measure, base rate was perceived as being more abstract ($M = 3.68$) than case risk ($M = 2.81$; $F(1, 36) = 5.24$, $p < .05$). Consistent with this, the second measure found that base rate was more difficult to visualize ($M = 4.32$) than case-risk information ($M = 3.11$; $F(1, 36) = 12.94$, $p < .01$).

EXPERIMENT 3: BREAST CANCER

Experiment 3 sought to provide convergent evidence for a key part of our conceptualization—namely, that people rely more on base-rate information when forming health-risk assessments regarding others (vs. themselves), but rely more on case-risk information when assessing their own health risk (vs. that of others). To examine this issue of differential reliance, we used an information search paradigm: respondents were asked to identify which type of externally provided information (base rate vs. case risk) they would prefer to access in order to form judgments of health risk. The domain of study was breast cancer, another widely studied health risk (Keller et al. 2002).

Method and Results

Forty-six female students were randomly assigned to each of two cells: "best friend" versus "unknown woman." Specifically, participants were instructed to imagine being asked to estimate the vulnerability of their best female friend, or of an unknown woman in Hong Kong, to breast cancer—a "best friend" is typically closer on the social distance dimension than an "unknown person" (Kim et al. 2008). They were further told that in order to improve their estimation accuracy, they could get access to one of two types of information: (1) the percentage of women in Hong Kong with breast cancer or (2) information pertaining to the judgment target's personal case history, such as dietary and fitness habits. Participants were asked to choose which of these two types of information they would prefer to view. Neither of these two forms of information was actually provided; rather, respondents were asked to indicate which type of information they would prefer to access if they could. Note that because the study examined participants' choice of different forms of externally provided information, it made sense to induce psychological proximity via the "best friend" induction rather than a "self" induction—use of the latter would have prompted a general reliance on internal (memory) search and dampened differences in preferential access to different types of external information.

Consistent with expectations, participants in the psychologically close "best friend" condition were more likely to seek case-risk information ($M = 15/22$) than those in the

relatively distant "unknown female" condition ($M = 8/24$), who preferred to view base-rate information in order to make their judgments ($\chi^2(1) = 5.58$, $p < .05$). These results provide further support for the process underlying our key proposition: in estimating a psychologically proximal (distant) health risk, participants are more likely to rely on information pertaining to case risk (base rate).

EXPERIMENT 4: DISEASE "X"

While results across experiments 1–3 are reassuringly convergent, a criticism might be leveled against the different inductions of the socially distant ("other") condition used in these studies. This condition was operationalized either in terms of "an average Hong Kong person" (experiment 1); "someone" (experiment 2); or "an unknown woman" (experiment 3). Although these inductions have been utilized in past research on self-positivity effects in health perceptions (e.g., Raghubir and Menon 1998), it may be argued that all of them make participants think in terms of a generalized abstraction (rather than any specific person), thus artificially inflating the influence of base-rate information. Although the "someone" frame (experiment 2) was used specifically to address this concern—that induction is more likely to encourage thoughts of a specific person—experiment 4 was run to provide a cleaner rebuttal of the potential criticism. As explained below, this study created a greater degree of equivalence between the socially proximal and distal conditions by referring to a specific person in both conditions.

Method

Undergraduate participants ($N = 241$; 141 females) were randomly assigned to conditions according to a 2 (social distance) × 2 (base rate) × 2 (case information) between-subjects design. The procedure used was very similar to that of experiment 2, with two major differences. First, while experiment 2 had featured two different diseases in order to manipulate base rate (swine flu vs. regular flu), a hypothetical disease (disease X) was used in this study in order to control for possible confounds, such as knowledge about the disease, severity of the disease, and so forth. Base rate was now manipulated by explicitly telling participants that the disease was either rare or quite common.

Second, to address the concern described above, we manipulated social distance without changing specificity by following a method used by Zhang et al. (2008). This manipulation simply involved varying the name of the judgment target: respondents assessed health risk for either "Chris Chan" or "Chris Smith." Given that our participants were all of Chinese ethnicity (and living in Hong Kong), the former target is likely to be perceived as being socially closer than the latter (Zhang et al. 2008). Finally, following experiment 2, case information was manipulated by describing the target person as having developed one versus four symptoms associated with the disease. To illustrate, participants in the high base rate/high case risk/socially distant condition were told to imagine that a person named Chris Smith had developed four symptoms associated with disease X, which is "quite a common disease." All participants were then asked to assess the target's likelihood of incurring the disease on a 7-point scale (1 = very unlikely; 7 = very likely). As manipulation checks, they also indicated the ubiquity of the disease (1 = very rare; 7 = very ubiquitous), how close they felt to the target (1 = very close; 7 = very distant), and the number of symptoms the target had (1 = very few; 7 = many).

Results

Manipulation Checks. All three factors were manipulated successfully. First, participants perceived the disease as being less common in the low versus high base-rate condition ($M_{low} = 2.56$ vs. $M_{high} = 4.94$; $F(1, 233) = 400.95$, $p < .001$). Second, participants believed themselves closer to the target (Chris) when the latter's surname was Chan than when it was Smith ($M_{Chan} = 3.03$ vs. $M_{Smith} = 4.43$; $F(1, 233) = 73.92$, $p < .001$). Finally, participants believed that the target had more disease symptoms in the high versus low case-risk conditions ($M_{low} = 2.39$ vs. $M_{high} = 4.87$; $F(1, 233) = 402.77$, $p < .001$). No other effects were significant on any of these measures.

Relative Influence of Base Rate and Case Information. Results of a 3-way ANOVA revealed that, as would be expected, both base rate and case information exerted main effects on the dependent variable, likelihood of contracting the disease. Participants in the high base-rate condition judged disease likelihood as being greater than those in the low base-rate condition ($M_{low} = 2.80$ vs. $M_{high} = 3.52$; $F(1, 233) = 25.61$, $p < .001$). Similarly, participants in the four symptoms condition ($M_{four} = 3.61$) judged disease likelihood as being greater than those in the single-symptom condition ($M_{one} = 2.70$; $F(1, 233) = 43.92$, $p < .001$).

As in experiment 2, these main effects of base rate and case risk were qualified by 2-way interactions with social distance. First, as anticipated, a significant interaction between base rate and social distance ($F(1, 233) = 4.21$, $p < .05$) showed that base rate had a greater impact on estimated disease likelihood for the socially distant (Smith: $M_{low} = 2.67$ vs. $M_{high} = 3.66$; $M_{diff} = .99$) versus proximal target (Chan: $M_{low} = 2.96$ vs. $M_{high} = 3.38$; $M_{diff} = .42$). Second, we predicted that this pattern would reverse for case-risk information (number of symptoms). Indeed, a significant interaction between case risk and social distance ($F(1, 233) = 8.87$, $p < .01$) confirmed that the number of symptoms had a greater impact on estimated disease likelihood for the proximal (Chan: $M_{one} = 2.50$ vs. $M_{four} = 3.84$; $M_{diff} = 1.34$) versus the distant target (Smith: $M_{one} = 2.91$ vs. $M_{four} = 3.42$; $M_{diff} = .51$). None of the other effects reached significance (all $F < 1$).

Self-Positivity versus Self-Negativity. Although the social distance manipulation in this study did not involve the "self" versus "other" frames, exactly the same patterns of

underestimating and overestimating risk should hold when comparing estimated disease likelihood for a socially proximal versus distant target. Consistent with this logic, planned contrasts revealed that given a high base rate and low case risk, participants underestimated disease likelihood for the socially proximal versus distant target ($M_{Chan} = 2.69$ vs. $M_{Smith} = 3.42$; $t(233) = 2.62$, $p < .01$)—akin to the self-positivity effect. In contrast, and also as predicted, an effect akin to self-negativity obtained given a low base rate and high case risk, with participants overestimating disease likelihood for the proximal vs. distant target ($M_{Chan} = 3.61$ vs. $M_{Smith} = 2.94$; $t(233) = 2.40$, $p < .05$). As before, no significant differences were found in the high-high and low-low conditions (all $t < 1$; table 2).

TABLE 2

EXPERIMENT 4: LIKELIHOOD OF GETTING DISEASE "X" AS A FUNCTION OF BASE RATE, CASE INFORMATION, AND SOCIAL DISTANCE

Base rate	Number of symptom(s)	Social distance	Mean (SD)
Low	One	Low (Chan)	2.31 (.93)
		High (Smith)	2.40 (.93)
	Four	Low (Chan)	3.61 (1.07)
		High (Smith)	2.94 (.76)
High	One	Low (Chan)	2.69 (.81)
		High (Smith)	3.42 (1.18)
	Four	Low (Chan)	4.07 (1.46)
		High (Smith)	3.90 (1.32)

Discussion

Experiment 4 replicated our earlier findings using a social distance manipulation that did not involve changes in target specificity, and keeping disease severity constant across conditions. This study thus helps to further counter the argument that the observed effects may be driven by stimulus artifacts.

Taken together, experiments 1–4 provide convergent support for our basic thesis that the effect of base-rate (case-risk) information on health-risk assessment is enhanced (weakened) by psychological distance. Further, as predicted by this perspective, a self-positivity effect was obtained in the high base rate/low case-risk condition, whereas self-negativity was observed in the low base rate/high case-risk condition. It is useful to reiterate that these findings supplement rather than contradict earlier research on health-risk perceptions, which has drawn on a motivational perspective (and within-subjects measurement of the self-other difference, as appropriate in that perspective) to find robust evidence for a self-positivity bias in health-risk perceptions (Perloff and Fetzer 1986; Taylor and Brown 1988; Weinstein 1980). The current inquiry, in contrast, adopts a cognitive viewpoint (and a between-subjects measurement approach) to identify both self-positivity and self-negativity effects.

Despite the difference in measurement methods, the current findings are reassuringly consistent with some extant research that has examined ways of attenuating the self-positivity effect (e.g., Chandran and Menon 2004; Menon et al. 2002; Raghubir 2008). These scholars have found that increasing the concreteness of risk-related information—for example, by exposing respondents to risky behaviors that are easy to visualize (such as not bandaging a cut)—enhances respondents' self-risk assessments, and thereby reduces the magnitude of the self-positivity effect. The framework presented here, in arguing that concrete risk information will influence self-judgments more than other-judgments, is in complete accord with these findings. Further, it extends them in important ways. First, while these investigations have examined how self-risk assessments are enhanced by making risk information more concrete (which is an important conclusion in itself), we also investigate the other half of our proposition: namely, that abstract information, such as that contained in base rates, influences other-judgments more than self-judgments of risk. Second, in doing so, we are able to demonstrate and explain both self-positivity effects and self-negativity effects. While earlier work in this area has identified ways of attenuating self-positivity effects, it has not predicted or delineated a reversal.

EXPERIMENT 5: OSTEOPOROSIS

Experiment 5 investigated the moderating impact of temporal distance (i.e., risk assessments made in the immediate vs. distant future) on the relative influence of base rate and case risk on health-risk perceptions. If the results observed for social distance in experiments 1–4 are driven by construal differences (as our conceptualization argues), then the same moderating influence should be observed for other forms of psychological distance, such as the temporal one. Thus, a major goal of this study was to build further support for our construal-based conceptualization of health-risk assessments. In addition, examining the influence of temporal distance is important in its own right because consumers need to estimate their vulnerability to health risks not only at the present moment in time, but also, very often, with regard to the future. For instance, a student might be more interesting in judging his/her vulnerability to osteoporosis at a much older age than s/he currently is—how does this temporal distinction moderate the relative influence of base versus case information? Understanding this question is important because for many health risks, preventive actions need to be taken much before the illness actually has a chance of occurring.

Experiment 5 also sought to generalize our findings by studying a health risk (osteoporosis) that has not received much attention in consumer literature. The National Osteoporosis Foundation (NOF) in the United States reports that osteoporosis is a major public health threat for an estimated 44 million Americans, or 55% of the people 50 years of age and older. In addition, while the likelihood of getting osteoporosis is much higher for older than younger people, future risk can be significantly decreased by taking preventive actions at a younger age. However, young people's intentions of taking such preventive actions (e.g., drinking milk; exercising regularly) may partly depend on their per-

ceived vulnerability to osteoporosis. Consequently, from a public policy standpoint, it is important to understand how young people estimate their vulnerability to such health risks that may only arise in the distant future, and the current conceptualization can help in this regard.

Finally, another property of osteoporosis is that vulnerability to it varies across gender, with 80% of those affected by osteoporosis being women. This property allows us to use a naturally occurring induction of base rate, increasing the external validity of our results.

Method

A 2 (base rate: high vs. low) × 2 (case risk: high vs. low) × 2 (temporal distance: near vs. far) between-subjects design was used ($N = 254$; 117 females). The base-rate manipulation was based on gender. To begin the study, each participant read a short paragraph about osteoporosis. Across conditions, the first sentence of the paragraph stated that women are four times more vulnerable to osteoporosis than are men. This created a gender-based induction of base rate, by encouraging men and women to hold the (valid) belief that the illness rate differs systematically across the two groups.

The remainder of the paragraph manipulated case-risk information. This was done by making salient risk-related behaviors that are either quite common or relatively uncommon, a procedure that has been used previously to manipulate perceptions of risky behavior likelihood (Menon et al. 2002). Specifically, to convey a low (high) likelihood of risky behavior, participants were posed the following question: "Do you know that smoking and heavy drinking (not drinking milk every day) is one of the major causes of osteoporosis?" We expected that the latter behavior—not drinking milk every day—would be believed to be more common, and thus produce a higher perception of case risk.

After reading the paragraph, participants in the temporally proximal condition were asked to estimate their *current* vulnerability to osteoporosis whereas those in the distant condition were asked to estimate their likely vulnerability when they were *in their sixties*. The specific measures of perceived risk were as follows. Participants in the proximal condition were asked to rate (1) their current likelihood of getting osteoporosis (1 = very unlikely; 7 = very likely), (2) their current vulnerability to osteoporosis (1 = very low; 7 = very high), (3) how concerned they were about osteoporosis (1 = not at all; 7 = very much), and (4) their intentions of getting a bone density test for osteoporosis (1 = will definitely not; 7 = will definitely). Those in the temporally distant condition were asked to respond to the same set of scales, with the only difference being that each scale was reworded to reflect perceived vulnerability when participants reached their sixties (e.g., "rate the likelihood of your getting osteoporosis in your sixties," etc.). These four dependent measures were averaged to form a single index of risk assessment for each of the two temporal conditions ($\alpha_{near} = .79$; $\alpha_{distant} = .85$).

Finally, to check the manipulations of base-rate and case-risk information, all participants were asked to assess (1) men and women's vulnerability to osteoporosis (1 = very low; 7 = very high), and (2) their own likelihood of (*a*) smoking and drinking heavily, and (*b*) of not drinking milk everyday (1 = very unlikely; 7 = very likely).

Results

Manipulation Checks. Results of a 2 × 2 × 2 repeated-measures ANOVA yielded a significant gender effect on vulnerability ratings. Participants perceived women as being more vulnerable to osteoporosis than men ($M_{women} = 4.69$ vs. $M_{men} = 2.67$; $F(1, 224) = 533.13$, $p < .001$), suggesting that our gender-related manipulation of base rate was successful. Similarly, a repeated-measures ANOVA on risky behavior likelihood yielded the expected main effect of behavior type—participants reported that they were more likely to not drink milk everyday ($M = 3.43$) than to drink and smoke heavily ($M = 1.89$; $F(1, 224) = 100.01$, $p < .001$). Thus, the former behavior is associated with greater case risk than the latter. No other effects reached significance on either measure.

Hypothesis Testing. Results of a three-way ANOVA on the risk assessment index revealed significant main effects of base rate (operationalized by gender) and case risk (operationalized by risky behavior likelihood). Women, who formed the high base-rate group, perceived a greater risk of contracting osteoporosis than did men, who formed the low base-rate group ($M_{female} = 3.96$ vs. $M_{male} = 2.89$; $F(1, 220) = 52.62$, $p < .001$). Similarly, risk estimates were higher in the high case-risk ($M_{high\text{-}risk} = 3.72$) versus the low case-risk condition ($M_{low\text{-}risk} = 3.13$; $F(1, 220) = 15.98$, $p < .001$). Finally, we also found a marginally significant effect of temporal distance: not surprisingly, participants judged their likelihood of getting osteoporosis to be higher in the distant future than at the present moment ($M_{future} = 3.59$ vs. $M_{current} = 3.29$; $F(1, 220) = 3.49$, $p = .06$).

Of more importance, the main effects of base and case risk were qualified by the predicted two-way interactions with the temporal distance manipulation. A two-way interaction between base rate and temporal distance ($F(1, 220) = 13.03$, $p < .001$) confirmed our prediction regarding the weaker impact of base rate, as assessed by the gender difference in estimates, in the temporally close ($M_{female} = 3.83$ vs. $M_{male} = 3.30$; $M_{diff} = 0.53$) versus distant condition ($M_{female} = 4.09$ vs. $M_{male} = 2.49$; $M_{diff} = 1.60$). In contrast, but also as predicted, a significant interaction between temporal distance and case risk ($F(1, 220) = 6.15$, $p < .05$) confirmed that case-risk information had a greater impact on risk assessments in the temporally close ($M_{high\text{-}risk} = 4.04$ vs. $M_{low\text{-}risk} = 3.09$; $M_{diff} = 0.95$) versus distant condition ($M_{high\text{-}risk} = 3.40$ vs. $M_{low\text{-}risk} = 3.18$; $M_{diff} = 0.22$). None of the other effects, including the three-way interaction, reached significance.

Additional Analyses. The self-other dimension was not manipulated in this study; however, we still wished to investigate whether a conceptual convergence was obtained

with our earlier findings regarding self-positivity and self-negativity. The temporally proximal (distal) condition in this study is akin to the self (other) condition in the previous studies. Thus, self-positivity in the current context would involve a lower estimation of risk at the current time as compared to the future, whereas an effect analogous to self-negativity would be reflected in the reverse pattern. Again, based on our construal-level conceptualization, we predicted a self-positivity pattern in the high base-rate/low case-risk condition, whereas a self-negativity pattern was expected in the low base-rate/high case-risk condition.

Consistent with our theorizing and previous results, we found that female participants (high base rate) for whom low-risk case risk was made salient underestimated their vulnerability to osteoporosis at the current time ($M = 3.19$) as compared to the distant future ($M = 4.03$; $t(220) = 2.81$, $p < .01$). Conversely, male participants (low base rate) exposed to high case-risk information estimated that they were more vulnerable to osteoporosis now ($M = 3.61$) than in the future ($M = 2.65$; $t(220) = 3.14$, $p < .001$; table 3).

TABLE 3

EXPERIMENT 5: PERCEIVED OSTEOPOROSIS RISK AS A FUNCTION OF GENDER, CASE RISK, AND TEMPORAL DISTANCE

Gender	Case risk	Temporal distance	Mean (SD)
Male	Low	Close	2.98 (1.27)
		Distant	2.32 (1.08)
	High	Close	3.61 (1.36)
		Distant	2.65 (1.04)
Female	Low	Close	3.19 (1.10)
		Distant	4.03 (.94)
	High	Close	4.48 (.90)
		Distant	4.15 (1.15)

Discussion

By obtaining exactly the same pattern of results as before while using a different operationalization of psychological distance (temporal rather than social), experiment 5 offered reassuring support for our overall theorizing. Base rate had a greater impact on temporally distant (vs. proximal) risk assessments, while the reverse pattern obtained with regard to the influence of case risk.

Via its focus on temporal distance, this study also offers policy implications by indicating when and why individuals may be more (and less) likely to engage in preventive behaviors now for risks that may only affect them later. Specifically, even those for whom the base rate of illness occurrence is low—men, in this instance—may be persuaded to increase their current assessments of risk (and therefore their willingness to engage in preventive behaviors) by messages that highlight common risky behaviors. Highlighting relatively infrequent behaviors is unlikely to be as effective. In fact, messages that focus on such uncommon behaviors (e.g., smoking and heavy drinking) may actually produce a counterproductive effect for another group—those for whom the base rate of the disease is high (women, in this instance). For these individuals, thinking about infrequent risky behaviors is likely to induce a self-positivity effect, causing them to downplay the current risk and attenuate their likelihood of engaging in preventive behaviors at the present time. In sum, it makes sense to expose both groups to messages that highlight common risky behaviors, because it is such concrete case information that most influences proximal estimates of health risk.

We note that a previous article has also invoked the temporal aspect of CLT to examine health-risk perceptions (Chandran and Menon 2004). However, their approach was different from ours. Specifically, these scholars manipulated temporal frame, by presenting risk factors in terms of per-day (proximal frame) or per-year (distal frame) occurrence. They argued that a proximal frame should increase the concreteness of the risk information and thereby increase self-risk assessments. Different from the temporal frame manipulation, our induction of temporal distance does not in itself influence the concreteness/abstractness of risk-related manipulation. Rather, if predicts the variation in influence of concrete (case information) and abstract (base information) on risk perceptions. That said, our conceptualization is also broadly in accord with Chandran and Menon's (2004) insights; as noted earlier, we agree that making risk information more concrete should enhance self-risk assessments.

EXPERIMENT 6: HEPATITIS C

The last study sought to provide direct support for a crucial aspect of our conceptualization: namely, the role of construal level. We have argued that psychological distance (whether social or temporal) has the observed effect on health-risk perceptions because it changes the level of construal. Specifically, greater distance yields a superordinate, ends-related, abstract construal (increasing the effect of base rate), whereas lower distance yields a subordinate, means-related concrete construal (increasing the impact of case information). The literature on CLT already provides substantial evidence for the first link of this chain of reasoning—namely, that psychological distance influences construal levels (Trope, Liberman, and Wakslak 2007). However, for our posited mechanism to be supported, we need to show evidence for the second link—that is, that construal level itself directly influences the relative impact of base and case information on health-risk perceptions. To test this logic, experiment 6 directly manipulated construal level by priming participants with either an "abstract" or "concrete" mind-set; we reasoned that this manipulation should influence health-risk perceptions in the same way as psychological distance does.

Method

A 2 (base rate: high vs. low) × 2 (case risk: high-risk vs. low-risk) × 2 (construal level: high vs. low) between-subjects design was used ($N = 254$; 143 females). The procedure comprised two phases. Phase 1 manipulated con-

strual level by asking participants to think about and write either "why" they should do exercises or "how" to exercise (Freitas, Gollwitzer, and Trope 2004). Existing literature has found that repeatedly thinking in terms of "why" ("how") activates superordinate, abstract thought (as opposed to subordinate, concrete thinking); thus, this manipulation has frequently been used to directly influence construal levels (Agrawal and Wan 2009; Freitas et al. 2004). Following the why/how manipulation, we assessed level of action construal via the Behavior Identification Form (Vallacher and Wegner 1989). This form consists of 25 items, each of which asks respondents to select between two descriptions of the same behavior (e.g., ringing a doorbell): one that comprises higher level construals related to goals or "why" considerations (e.g., "seeing if someone is home"; coded as "1" here) and another that comprises lower level construals related to means or "how" considerations (e.g., "moving your finger"; coded as "0").

This ended phase 1. In phase 2, participants were asked to complete an ostensibly unrelated task that sought to assess consumers' health knowledge. For greater generalizability, we examined a different health risk in this study—hepatitis C (Agrawal and Wan 2009; Menon et al. 2002). Participants were asked to read a short paragraph about hepatitis C in which both base rate and case risk were manipulated. Those in the high (low) base-rate condition were informed that hepatitis C was a very common (rare) disease in Hong Kong. Case risk was then manipulated via risky behavior likelihood, as in experiment 5. Participants in the high case-risk (low case-risk) condition read the following question: "Do you know that hepatitis C is often contracted simply by leaving a cut unbandaged (getting a tattoo)"? Both conditions thus highlighted a concrete risky behavior, which is a form of case risk. However, the likelihood of the risky behavior (and thus the level of health risk it implied) differed for the two conditions, since leaving a cut unbandaged is a relatively common behavior compared to getting a tattoo (see Menon et al. 2002).

After reading the paragraph, all participants were asked to rate their likelihood of getting hepatitis C (1 = very unlikely; 7 = very likely), their vulnerability to hepatitis C (1 = extremely low; 7 = extremely high), how concerned they were about hepatitis C (1 = not at all; 7 = very much), and intention to get tested for hepatitis C (1 = will definitely not; 7 = will definitely). An index based on these four items ($\alpha = 0.75$) served as a measure of risk perceptions. Finally, to check the manipulations of base rate and case risk, participants were also asked to assess (1) the ubiquity of hepatitis C in Hong Kong (1 = very rare; 7 = very common), and (2) their likelihood of engaging in the behavior mentioned in the paragraph (getting a tattoo, or leaving a cut bandaged; 1 = very unlikely; 7 = very likely).

Results and Discussion

Manipulation Checks. First, results of a 2 × 2 × 2 ANOVA on the composite BIF score, which was obtained by summing up responses to all 25 items in the BIF form, revealed only a significant effect of construal level priming ($F(1, 246) = 11.94$, $p < .01$). Participants primed with the superordinate "why" mind-set scored higher than those primed with the subordinate "how" mind-set ($M_{why} = 16.13$ vs. $M_{how} = 14.41$); a higher score indicates a relatively high-level construal. Second, the ANOVA on perceived ubiquity showed that participants in the high base-rate condition judged hepatitis C as being more common in Hong King than those in the low base-rate condition ($M_{high\text{-}base} = 3.75$ vs. $M_{low\text{-}base} = 2.34$; $F(1, 246) = 243.51$, $p < .001$). Finally, regarding perceptions of case risk, participants indicated that they would be more likely to engage in the frequent behavior (i.e., leaving a cut unbandaged; $M_{high\text{-}risk} = 4.29$) than the infrequent one (i.e., getting a tattoo; $M_{low\text{-}risk} = 2.28$; $F(1, 246) = 504.18$, $p < .001$). No other effects were significant on any of these measures.

Risk Perception. A 2 × 2 × 2 ANOVA on the risk perception index revealed significant main effects of base rate and case risk. As expected, participants in the high base-rate condition perceived that they were more at risk of contracting Hepatitis C than those in the low base-rate condition ($M_{high\text{-}base} = 3.48$ vs. $M_{low\text{-}base} = 2.91$; $F(1, 246) = 25.77$, $p < .001$). Similarly, high case-risk led to greater health-risk perceptions than low case-risk ($M_{high\text{-}risk} = 3.44$, $M_{low\text{-}risk} = 2.96$; $F(1, 246) = 17.59$, $p < .001$).

Of importance, these two main effects were qualified by the predicted two-way interactions with the construal manipulation. A significant interaction between base rate and construal level ($F(1, 246) = 15.88$, $p < .001$) confirmed that the impact of base rate was higher in the "why" condition ($M_{low\text{-}base} = 2.71$ vs. $M_{high\text{-}base} = 3.75$; $M_{diff} = 1.04$) compared to the "how" condition ($M_{low\text{-}base} = 3.10$ vs. $M_{high\text{-}base} = 3.22$; $M_{diff} = 0.12$). Further, we predicted that the influence of case risk would follow the opposite pattern. In support, a significant interaction between construal level and case risk ($F(1, 246) = 11.51$, $p < .01$) confirmed that case risk had a greater impact on overall health-risk perceptions in the "how" ($M_{high\text{-}risk} = 3.60$ vs. $M_{low\text{-}risk} = 2.72$; $M_{diff} = 0.88$) versus "why" condition ($M_{high\text{-}risk} = 3.28$ vs. $M_{low\text{-}risk} = 3.20$; $M_{diff} = 0.08$). No other effects were significant (table 4).

Discussion. Findings from this study provided direct evidence regarding the predicted impact of construal levels on

TABLE 4

EXPERIMENT 6: PERCEIVED RISK OF HEPATITIS C INFECTION AS A FUNCTION OF BASE RATE, CASE RISK, AND WHY/HOW MIND-SET

Base rate	Case risk	Mind-set	Mean (SD)
Low	Low	How	2.73 (.80)
		Why	2.76 (1.11)
	High	How	3.46 (1.00)
		Why	2.66 (.88)
High	Low	How	2.71 (.96)
		Why	3.61 (.93)
	High	How	3.73 (.86)
		Why	3.90 (.74)

the relative impact of base rate and case risk on health assessments. Consistent with the logic underlying this research, we found that base rate had a greater impact on health perceptions when high-level, abstract thinking was activated, whereas case risk (as operationalized by risky behavior likelihood) had a greater influence given more concrete, low-level thought. The convergence between the findings obtained in this study with those from our previous studies increases confidence as to the mechanism underlying the earlier results.

GENERAL DISCUSSION

Consumers typically rely on two types of information —population base-rate information and idiosyncratic case risk details—to form their assessments of health risk. While previous research has largely focused on the influence of either base rate or case risk, we draw on construal level theory to provide an integrated framework, arguing that the effect of base-rate information is enhanced by psychological distance, with the reverse being true for the impact of case risk details (e.g., pathogenic behavior likelihood, disease symptoms, etc.). Apart from delineating conditions that increase or decrease the influence of these two forms of information, this conceptualization also provides insights into how and why health-risk assessments may manifest self-negativity versus self-positivity biases. The former bias is likely to be observed given a low base rate and high case risk, whereas the latter bias will likely be observed given a high base rate and low case risk.

Six studies provide triangulating support for our theorizing by using multiple operationalizations of construal levels (social distance in experiment 1–4, temporal distance in experiment 5, and mind-set priming in experiment 6), multiple dependent measures (perceived risk likelihood, disease diagnosis), different health risks (HIV, breast cancer, hepatitis C, osteoporosis, and swine flu), diverse operationalizations of base rate (direct manipulation, gender-based induction, and disease type), and of case risk information (likelihood of engaging in risky behaviors, number of symptoms).

The current conceptualization and findings contribute to three fields of inquiry. Of primary importance, they illuminate the domain of health-risk perceptions in multiple ways. At a secondary level, they inform two broad theoretical areas: one relating to social comparison research on self-positivity versus self-negativity effects (also sometimes termed unrealistic optimism vs. unrealistic pessimism; e.g., Menon et al. 2009), and the other dealing with the use of base versus case information in judgment formation.

Health-Risk Assessments

This article adds to the health-risk literature in several different directions. First, our conceptualization presents a new perspective on how people arrive at health-risk assessments, delineating conditions under which the underlying process is more likely to be top-down (enhanced influence of base rate) versus bottom-up (enhanced influence of case details). Second, while past consumer research on health-risk perceptions has reliably documented a self-positivity bias (Perloff and Fetzer 1986; Taylor and Brown 1988) and also demonstrated ways of attenuating such a bias (Chandran and Menon 2004; Raghubir and Menon 1998), our investigation complements these findings by documenting conditions under which a reversal (i.e., a self-negativity effect) is manifested. By predicting and demonstrating the symmetric nature of self-positivity and self-negativity in health-risk assessments, the current inquiry is thus able to extend current knowledge in this area.

Third, in addition to documenting the self-negativity effect, the key moderator proposed in our work (construal level) has the potential to integrate several past findings relating to the self-positivity bias in health perceptions. For example, in a seminal article, Raghubir and Menon (1998) found that asking participants to recall three (vs. five) risky behaviors significantly increased participants' own vulnerability to HIV. However, perception of others' vulnerability was unaffected by this ease of retrieval manipulation. This finding is consistent with the current framework—the perceived likelihood of engaging in risky behaviors is a form of case-specific information and therefore should be utilized more in the psychologically proximal (i.e., self) condition, as was found in that study. Similarly, while our conceptualization draws on the premise that base-rate information is typically more abstract than case details, it is certainly conceivable that the relative degree of abstractness of each type of information can be varied through appropriate framing techniques—and corresponding effects should then be observed on health-risk assessments. For instance, if the base-rate information is framed to be more concrete, its influence on self-risk assessments should increase—as indeed past research in this area has found (Chandran and Menon 2004; Raghubir 2008).

Implications for Other Literatures

The current research also informs the literature in other areas. One of these is the field of social comparisons, which examines how judgments regarding the self differ from judgments regarding others across a variety of domains, such as predicted task performance (Kruger 1999), likelihood of being lucky in major life issues (Weinstein 1980), estimates of succeeding in a game of chance (Lin, Lin, and Raghubir 2004), and so forth. Of interest, unlike research on health-risk perceptions (which has thus far largely documented self-positivity biases), social comparison research in other areas has found evidence for both self-positivity (Taylor and Brown 1988; Weinstein 1980) and self-negativity biases (Higgins 1987; Lin et al. 2004). As scholars have pointed out however (Dunning et al. 2004; Menon et al. 2009), these investigations typically demonstrate either a self-positivity effect or a self-negativity effect; rarely has the same inquiry provided evidence for both biases in the same domain. There are just a few exceptions to this rule; for example, in a recent article, Menon et al. (2009) showed that self-positivity

is likely to manifest for outcomes that are perceived to be controllable, whereas self-negativity manifests for uncontrollable outcomes. There is clearly a need for more research along these lines, which succeeds in documenting both opposing effects while providing a theoretical rationale for when each bias is likely to occur. The current inquiry takes a step in that direction by using a construal-based argument to outline such contingencies in the domain of health perceptions.

In a similar vein, we provide contingency-based insights into another literature: that on the use of base versus case information in judgment formation (Kardes 1988; Nisbett and Ross 1980). Following the initial demonstration of people's tendency to neglect base-rate information (Tversky and Kahneman 1973), scholars have both replicated this finding (Bar-Hillel 1980; Lyon and Slovic 1976) and also indicated ways in which it can be attenuated—for instance, by increasing the salience and diagnosticity of base-rate information (Bar-Hillel and Fischhoff 1981; Lynch and Ofir 1989). The current work suggests another such moderator—specifically, we find that the influence of base-rate information is enhanced with greater psychological distance from the target of judgment. While the current research focuses on the health perceptions domain, the convergence of our findings across two different forms of psychological distance (social and temporal) suggests that the distance factor should moderate the relative influence of base versus case information in other domains as well, although further work will be required to verify this speculation.

Finally, it is worth considering the current findings in relation to recent work in the construal level domain that has examined how activating low versus high-level construals can directly influence probability judgments of subsequent unrelated events—as manifested in responses to questions such as "Tom is waiting for the subway. How likely is the train to be late?" (Wakslak and Trope 2009). These authors propose that because lower likelihood events are more distant and therefore construed at a relatively abstract level, a bidirectional learned association causes the reverse as well: a more abstract mind-set produces lower probability judgments. While the current research also uses CLT to examine probability judgments (in the form of health-risk estimates), it adopts a different perspective and thus generates new insights. The Wakslak and Trope (2009) research examines probability assessments of events for which people have little prior information; in such situations, people are likely to rely on learned associations—and thus, construal level can exert a *direct* effect on probability judgments. The present work, in contrast, examines situations for which people are given a substantial amount of information (consisting of both base and case data) about the target. Our results suggest that in such conditions, construal level influences probability judgments through an *indirect* mechanism, namely, by influencing the relative impact of base versus case information on the final judgment.

Practical Implications

By documenting both a self-positivity and a self-negativity bias, our work provides straightforward applied implications for consumers, health practitioners, and public policy experts in the health domain. We concur with prior research as to the likely adverse consequences of a self-positivity bias, such as an unwillingness to take necessary preventive action and a consequently higher risk of infection (Raghubir and Menon 1998). At the same time, it needs to be borne in mind that the reverse bias of self-negativity may have significant downsides as well. Such self-negativity can lead, for example, to mistakenly diagnosing oneself as possessing a serious disease, causing both unnecessary anxiety and wasteful medical expenditure (Leahy 2006). Mistaken self-diagnoses of this sort are particularly likely given the ease of information access on the internet, which frequently leads consumers to engage in "symptom matching" exercises.

Reassuringly, the current research, while documenting both positivity and negativity biases, also contains implications as to how such biases might be attenuated. Indeed, given that the biases themselves manifest under a symmetric set of conditions—with self-positivity (self-negativity) more likely given a high base-rate and low case-rate (low base-rate and high case-rate)—the solutions are of a symmetric nature as well. Thus, our findings are in agreement with prior research that shows that self-positivity can be attenuated by increasing perceptions of case risk—such as emphasizing frequently occurring risky behaviors (Menon et al. 2002; Raghubir and Menon 1998). Conversely, the current results imply that self-negativity may be attenuated by increasing perceptions of disease base rate—for example, by highlighting that symptoms in question are likely to be a manifestation of a commonly occurring disease (such as common flu) rather than a rare one (swine flu; experiment 2). In addition, our findings suggest that seeing a doctor, rather than engaging in self-diagnosis, makes sense not just for the obvious reason (the doctor is an expert)—but also because, in diagnosing a patient (i.e., an "other"), a doctor is more likely to take into account the base rate of the disease rather than being solely influenced by the case symptoms. Again, this is likely to attenuate the negativity bias for relatively uncommon diseases.

Future Research

The current work takes a purely cognitive approach to understanding health-risk perceptions. However, it bears repeating that affective (Agrawal, Menon, and Aaker 2007) and motivational accounts are also highly relevant. As noted earlier, self-positivity could arise from self-enhancement motives (Lin et al. 2003; see Dunning et al. 2004 for a review), not just due to the differential influence of base and case risk. A particularly interesting avenue for future research would be to investigate the possible interaction between the motivational forces that underlie health assessments and the cognitive contingencies outlined here. For instance, the self-negativity biases documented in our stud-

ies tend to be smaller in magnitude than the self-positivity biases. One reason for this could be that although purely cognitive factors exert symmetric effects on the two biases, motivational factors operate toward self-positivity and against self-negativity, a speculation worth exploring in future work. Further, even though people have a motivational propensity to think positively about themselves, their ability to do so may vary as a function of information diagnosticity. Thus, when case information (which we argue is particularly diagnostic for self-judgments) implies low risk and is therefore consistent with the self-enhancement motive, an assimilation effect may occur, reinforcing the self-positivity bias. However, if case information clearly implies high risk, a contrast effect may result, leading to even greater self-negativity than might be observed absent a self-enhancement motive. Research along these lines, which integrates multiple perspectives on health assessments, has the potential to offer rich theoretical insights and further illuminate our understanding of an important substantive domain.

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