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Low health literacy and health information avoidance but not satisficing help explain don't know responses to questions assessing perceived risk

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Abstract

Background: People who say they don't know (DK) their disease risk are less likely to engage in protective behavior.

Purpose: This study examined possible mechanisms underlying not knowing one's risk for common diseases.

Methods: Participants were a nationally representative sample of 1005 members of a standing probability-based survey panel who answered questions about their comparative and absolute perceived risk for diabetes and colon cancer; health literacy; risk factor knowledge, health information avoidance; and beliefs about illness unpredictability. Survey satisficing was a composite assessment of not following survey instructions, non-differentiation of responses, haphazard responding, and speeding. The primary outcomes were whether a person selected DK when asked absolute and comparative risk perception questions about diabetes or colon cancer. Base SEM path models with pathways from information avoidance and health literacy/knowledge to DK responding for each DK outcome were compared to models that also included pathways from satisficing or unpredictability beliefs.

Results: Base models contained significant indirect effects of health literacy (ORs=0.94 to 0.97, all $p < .02$) and avoidance (ORs=1.05 to 1.15, all $p < .01$) on DK responding through risk factor knowledge, and a direct effect of avoidance (ORs=1.21 to 1.28, all $p < .02$). Adding the direct effect for satisficing to models resulted in poor fit (for all outcomes RMSEA estimates > 0.17 , all WRMR > 3.2 , all CFI < 0.47 , all TLI < 0.49), indicating that satisficing was not associated with DK responding. Unpredictability was associated with not knowing one's diabetes risk (OR=1.01, $p < .01$).

Limitations: The data were cross-sectional, therefore directionality of the pathways cannot be assumed.

Conclusions: DK responders may need more health information, however it needs to be delivered differently. Interventions might include targeting messages for lower health literacy audiences and disrupting defensive avoidance of threatening health information.

Keywords

don't know responding; perceived risk; health literacy; avoidance; satisficing

When people are offered the opportunity to respond “don't know” (DK) to survey questions, DK is a common response.^{1–3} DK responding has been studied and debated in research related to attitudes, opinions, and knowledge assessment across multiple disciplines including political science, sociology, marketing, and psychology,^{2, 4–6} but only recently in the domain of risk perception.^{7–10} As in other research domains, DK responding to risk perception questions may be due to lack of knowledge. People who say they DK their disease risk may lack knowledge of risk factors and their relevance to themselves. In contrast, DK responding to survey questions may also be due to being unwilling to engage in required cognitive processes (satisficing). This might also be the case for perceived risk questions.^{11, 12} Knowing which process is more likely to underlie DK responding has significant implications for whether to elicit DK responses in surveys, how to treat DK responses in statistical analyses, and whether DK responders might require targeted interventions.

Don't Know Responding Prevalence and Proposed Mechanisms

When a DK response option is provided for perceived risk questions, people often select it. For example, one third of underserved Appalachian women attending a mobile mammography program indicated that they did not know their 5-year risk of breast cancer when a DK option was provided.¹³ In a sample recruited at a health clinic serving a diverse urban population, rates of DK for perceived colon cancer risk were high: 49% to 69%.⁷ Even when a DK option is not provided, write-in DK responses may reach 9% of responses to risk perception questions about colon and breast cancer.^{7–10} People also seem to use the mid-point in probability response options to indicate uncertainty. Use of the “50” midpoint is lower if an “absolutely no idea” response option is offered.¹⁴ By one estimate, approximately 63.4% of 50% probability responses to a question about their probability of dying in the next 10 years were explained as “don't know” responses.^{15, 16} Given the prevalence of DK responding to risk perception questions, it is important to understand whether DK responding is a survey design artifact that we ought to try to minimize, or whether it is theoretically and practically meaningful, providing insight into cognitive states and behavioral tendencies of DK responders.

There a number of possible explanations for DK responding. People who respond DK may lack the necessary knowledge or beliefs for expressing the opinion, belief, or knowledge required to answer the question.^{6, 17} In support of this position, DK responding has been found to be more common among people with lower knowledge or familiarity with the topic,

^{2, 3} including for perceived risk questions.^{7, 13} In addition, DK responses are not distributed at random, and appear to be more common among those who, as Francis and Busch describe, have been excluded to a greater extent “from information, influence, and decision-making processes”.¹⁸ Rates of DK responding, including to risk perception questions, are more common among those who are disadvantaged, including those with low education, those who are born outside the U.S., and racial and ethnic minorities, with education typically being the strongest correlate.^{3, 9, 10, 13, 15, 18} The relationships between DK responding to risk perception questions and demographic characteristics may indicate that DK responders have barriers to accessing public health messages such as lower health literacy or English literacy. Indeed, lower health numeracy has been associated with greater likelihood of responding DK to colon cancer risk perception questions.⁷

Low health literacy or lack of access to health information due to other causes may not be the only reason people lack knowledge about disease risk factors. A second explanation for DK responding is that the opportunity to learn about disease risk information can trigger motivated avoidance of the information. Wanting to avoid disease risk information is common: 39% of a nationally representative sample agreed that, “I would rather not know my chances of getting cancer”.¹⁹ People may avoid disease risk information because it can elicit unpleasant emotions, compel difficult or unwanted behavior change, or force changes in prized beliefs such as positive views of their own self-worth or competence.²⁰ Avoidance may be particularly common if people believe they are unable to manage the source of the threat - in this case as many as half of people will choose to remain uninformed about health risks.^{21, 22} If people avoid health information about a particular topic, they may be uninformed about disease risk factors and may be more likely to not know or be uncertain about their disease risk.

A third explanation for DK responding is what Krosnick has referred to as satisficing on surveys, adapting the term first coined by Herbert Simon.^{12, 23} Krosnick argues that many survey respondents will lose the motivation to go through all the necessary cognitive steps of interpreting the question, retrieving information from memory and integrating this information to thoughtfully answer each question. Thus, many respondents will likely start to “compromise their standards and expend less energy instead” (p. 215).¹¹ According to this view, some survey respondents try to minimize the cognitive effort they spend answering survey questions and take advantage of DK response options, which can appear to be a reasonable answer but requires little cognitive effort.^{11, 12} Krosnick argues that including a no-opinion response option such as DK does not improve scale reliability and, if people are encouraged to provide a directional response, their responses are meaningful and predictive.^{12, 23} Using a similar logic, it has been argued that there are reasons people disingenuously respond DK in addition to satisficing, such as being unwilling to share one’s beliefs.²⁴

A final explanation is that some people may hold beliefs that are logically inconsistent with making risk judgments. One such possible belief shown to be highly prevalent in the general population^{25–28} is that risk for disease is unknowable or random, and thus cannot be predicted. While not yet linked to DK responding, this belief could provide an additional explanation for why some people say they DK their risk for disease.

Study Objective and Hypotheses

We sought to understand the extent to which each of the four proposed mechanisms for DK responding (lack of risk knowledge stemming from low health literacy, information avoidance, satisficing, and/or unpredictability beliefs) account for DK responding to perceived risk questions for common illnesses. We examined this question using perceived risk for type 2 diabetes and colorectal cancer as both are relatively common (life time risks are 40% for diabetes and 4.3% for colorectal cancer^{29, 30}) and people can take behavioral measures to reduce their risk of developing the diseases. Our overarching hypothesis was that DK responding to perceived risk questions is mediated through lack of knowledge of disease risk factors stemming from either low health literacy, defensive information avoidance, or both. As low health literacy is a barrier to understanding and applying standard health messages,³¹ we reasoned that low health literacy could be a barrier to accumulating adequate risk factor knowledge for appraising one's risk of common illnesses. As risk factor knowledge likely does not encompass all the information people need to appraise their risk, we reasoned there would also be direct effects of health literacy and avoidance on DK responding. We also examined the most common alternative hypotheses for DK responding. As described previously, the prevailing alternative explanation of DK responding is satisficing. Consequently, we tested whether people who tend to engage in behaviors identified as indicators of satisficing are also more likely to say they DK their risk for disease. Finally, we tested the second alternative hypothesis that the extent to which people believe that getting diabetes or colon cancer is unpredictable is associated with DK responding.

Methods

Procedure and Participants

Participants were members of a nationally representative standing GfK KnowledgePanel who complete web-based surveys. The panel is comprised of 55,000 individuals selected with addressed-based probability sampling based on the most recent Delivery Sequence File of the United States Postal Service, which avoids non-coverage issues associated with telephone-based sampling. Participants are provided with free Internet access and a web-enabled device if they do not already have this. This survey sample was selected from the panel using an equal probability selection method. Data were collected between May and June of 2016. Of the 1,818 panel members invited to complete the survey, 1,033 did so (completion rate of 56.8%). Those without initial access received Internet access and/or a web-enabled device as compensation for completing surveys. Those who already had access received points for completing surveys which they could be redeemed. Typical earnings are \$4-\$6 per month. To maintain data quality, GfK excluded 26 cases because they met two or more criteria for extreme low quality responding: 1) completed the survey in 5.5 min or less (1/4 median time of 22 min), 2) answering compliance checks incorrectly (e.g., "Survey validation item, please select 'Somewhat agree'"), 3) straight-lined or selected the same response for at least half of the 8 question grids, and 4) inconsistently answered a repeated question about their insurance status.³² The modal proportion of responders who are careless enough to impact study findings is reported to be 8–12%.³² We were especially

conservative in dropping participants ($n=26$, 2.5%) because we planned to use less stringent versions of these indicators as our satisficing index. The goal was to drop participants who were likely responding in such extreme nonsensical ways that their responses could obscure real patterns in the data. Rates of DK responding were not different between those who were removed compared to the rest of the sample (31% vs. 26% for diabetes absolute risk, 30% vs 19% for diabetes comparative risk, 35% vs 47% for colon absolute, and 38% vs. 31% for colon comparative risk ($p = .09$ to $.61$) in pre-weighted data).

Participants were not asked questions about an illness with which they had been diagnosed; participants with diabetes only answered questions pertaining to colon cancer and vice versa. Two participants were excluded because they had been diagnosed with both diabetes and colon cancer; 893 participants answered questions about diabetes and 998 answered questions about colon cancer, for a total of 1,005 participants in either or both analyses. Study procedures were approved by the University at Buffalo Institutional Review Board and participants were consented as part of GfK's umbrella IRB-approved consent process.

Measures

Outcome Measures.—We assessed DK responding for each of four different risk questions: absolute and comparative risk for diabetes and colon cancer. Each type of risk was assessed with items adapted from the Health Information National Trends Survey (HINTS): “How likely are you to get diabetes/colon cancer in your lifetime? (not at all likely/somewhat likely/fairly likely/very likely/DK)” and “Compared to the average (man/woman) your age, would you say that you are less like to get diabetes/colon cancer, about as likely, or more likely?/DK.”³³ For each question, we counterbalanced the order the response options were presented so that half of respondents saw the DK option first and half saw it last, as in our pilot work we found that people are more likely to select DK if it is presented first rather than last. A DK responding variable was created for each of the four risk questions by dichotomizing responses into either any valid response or a DK response.

Hypothesized Mechanisms.—Health literacy was assessed with the Newest Vital Sign (NVS)³⁴ a commonly used objective measure of health literacy with good validity.^{34, 35} Participants answered a series of questions about a nutrition label using print literacy, document literacy, and numeracy skills. Answers to each question were coded as correct = 1 and incorrect 0 (missing coded as incorrect) and the number of correct answers summed (range 0–6). When used for screening, health literacy is often dichotomized; however, given that our goal was to identify mechanisms potentially underlying DK responding we treated health literacy as a continuous variable, in order to investigate whether there is a linear relation between the two.

Information avoidance was separately assessed for each disease (diabetes and colon cancer) with 7 items from Howell and Shepperd's information avoidance scale³⁶ [$\alpha = .84$ (diabetes) and $.86$ (colon cancer)] adapted to specifically enquire about avoiding information about colon cancer or type 2 diabetes. Participants rated the extent to which they agreed with items such as, “I would rather not know about colon cancer/diabetes.” (1 = strongly disagree to 4 = strongly agree). Mean scores were calculated for each participant.

We assessed risk factor knowledge by asking participants to indicate whether 5 risk factors increased/lowered/makes no difference to risk for colon cancer or diabetes; knowledge was scored as the total number of correct responses for test items (possible range = 0–5). Risk factors for colon cancer were smoking, family history, older age, lack of regular exercise, eating a high fat diet.³⁷ Risk factors for diabetes were smoking, family history, not being a healthy weight, older age, not eating a healthy diet.³⁸

Alternative Mechanisms.—We created a composite measure of satisficing with our four indicators of poor quality responding (possible range 0–4). These were chosen to assess behaviors other than DK responding identified by Krosnick as possible indicators of satisficing on surveys (not being thoughtful about question meaning, choosing responses haphazardly or randomly, choosing the first reasonable response, choosing the status quo response, acquiescence, failing to differentiate ratings or answering the same way for all items in a set).¹¹ We included two items in which the reader needed to read instructions to select a specific response option. Embedded instructions have been used elsewhere to measure satisficing³⁹ and was used in this study to detect choosing responses haphazardly or randomly. We counted the number of grids containing reverse-coded questions that were straightlined by a given participant to assess failing to differentiate ratings. We also asked an insurance status question twice; not answering the same question consistently would indicate choosing responses haphazardly or randomly. Finally we identified people who completed the survey in 8 minutes or less as an omnibus assessment of the satisficing behaviors discussed by Krosnick,¹² as each of these behaviors will help the respondent dispense with the difficult task of completing the survey task.

The satisficing composite differed from the criteria for dropping participants from the study in two important ways: 1) the speeding criterion was more liberal in the case of the satisficing composite than the criteria for dropping participants and, 2) the satisficing composite was a count variable, on which people varied as a function of the number of indicators of inattentive responding they had demonstrated.

We assessed unpredictability beliefs (beliefs that getting either colon cancer or diabetes cannot be predicted) with three items for each disease: “Anybody can get diabetes/colon cancer, no matter what they do;” “Diabetes/Colon cancer can strike anyone at any time;” and “You never know who is going to get diabetes/colon cancer.” Each item had a four-level Likert response for level of agreement. Unpredictability scores were calculated as a mean of the three items and, for ease of interpretation, scaled from 0 to 100 (alpha = 0.87 for both scales).

Potential Covariates.—We used demographic characteristics assessed annually by GfK. These included gender, age, race/ethnicity (non-Hispanic White/non-Hispanic Black/Hispanic/other), employment status (employed/not employed/retired), marital status (married or partnered/divorced or separated/never married/widowed), education which we dichotomized to simplify models (high school education or less/greater than high school education).

Analyses

Data were weighted to be representative of the U.S. population of non-institutionalized adults by GfK based on benchmarks from the March 2015 Supplement survey for the Current Population Survey (CPS) for adults, 18 years and older.⁴⁰ Using structural equation modeling (SEM), we assessed the fit of base models for all four DK risk perception outcomes (absolute colon, comparative colon, absolute diabetes, comparative diabetes). The base models included direct effects of health literacy and avoidance on DK responding and indirect effects of health literacy and avoidance on DK responding through knowledge (see Figure 1). We then tested alternative SEM models in which we added either a direct effect of satisficing on the DK outcomes or a direct effect of unpredictability on DK outcomes. Among demographic variables, only education was associated with both health literacy and DK responding. It was included as a covariate in the pathway through health literacy in all models.

Model fit was assessed using residual mean square error (RMSEA; acceptable if lower bound of confidence interval includes 0.05),⁴¹ Comparative Fit Index (CFI; acceptable if at least 0.9),⁴² and Tucker Lewis Index (TLI; acceptable if at least 0.9),⁴³ and weighted root mean square residuals (WRMR; values much greater than 1 indicate unacceptable fit) index.⁴⁴ For the dichotomous DK responding outcomes, odds ratios are calculated. Bootstrap estimates of standard error were used to assess indirect effects. Analyses were conducted in MPlus (version 8). To verify that results did not vary depending on placement of the DK option, we stratified by order and tested all models separately for the two groups.

Results

Descriptive findings

Rates of DK responding to perceived diabetes risk questions were 30% for absolute likelihood and 21% for comparative likelihood. For colon cancer, they were 47% for absolute likelihood and 31% for comparative likelihood. As shown in Table 1, mean avoidance for both diseases was just below 2.0 (mean colon cancer avoidance = 1.96; mean diabetes avoidance = 1.95) out of 4.0, and median health literacy was 5 out of 6, with 21% scoring 3 or lower, indicating they likely have limited health literacy.³⁴ Most (80%) had no satisficing flags, another 16% had one, and the remaining 4% had 2 or 3. Mean unpredictability was 73.02 (SD = 22.2) for colon cancer and 62.23 (SD = 24.9) for diabetes.

Model fit

The base path models met acceptable fit criteria for both diabetes and colon cancer risk outcomes. Model fit statistics for the final models are presented in Table 2. Fit for the base models was acceptable according to RMSEA and CFI (all tests of RMSEA = 0.05 rejected, all CFI > 0.90). A few were slightly under the generally accepted thresholds for TLI and WRMR of 0.9 and 1.0, respectively (all TLI > 0.80, all WRMR < 1.12). Model fit interpretations were consistent regardless of DK placement. When we added a direct effect of satisficing the models these had an unacceptable fit (all CFI < 0.5, all TFI < 0), indicating that satisficing did not explain additional variance over the effects of health literacy, avoidance, and knowledge. Adding unpredictability to the models resulted in acceptable

model fit (all TLI > 0.80, all TFI > 0.91), indicating these models are appropriate for estimation of path effects. Model fit was similar regardless of whether participants viewed the DK option first versus last.

Path analyses for diabetes

Figure 2 depicts the base path models by outcome. People with higher health literacy were more knowledgeable about diabetes ($b_{\text{absolute}} = 0.38$, $p < .001$; $b_{\text{comparative}} = 0.37$, $p < .001$), as were those less likely to avoid information about diabetes ($b_{\text{absolute}} = -0.65$, $p < .001$; $b_{\text{comparative}} = -0.65$, $p < .001$). Being more knowledgeable about diabetes was associated with less DK responding ($OR_{\text{absolute}} = 0.90$, 95% CI = 0.84–0.96; $OR_{\text{comparative}} = 0.85$, 95% CI = 0.79–0.91) and there were indirect effects of both health literacy ($OR_{\text{absolute}} = 0.96$, 95% CI = 0.93–0.98; $OR_{\text{comparative}} = 0.93$, 95% CI = 0.88–0.99) and avoidance ($OR_{\text{absolute}} = 1.08$, 95% CI = 1.02–1.13; $OR_{\text{comparative}} = 1.11$, 95% CI = 1.05–1.17) on DK responding through knowledge (Table 3). Higher diabetes information avoidance was also directly associated with more DK responding, over and above its indirect effects through knowledge ($OR_{\text{absolute}} = 1.28$, 95% CI = 1.09–1.50; $OR_{\text{comparative}} = 1.27$, 95% CI = 1.07–1.51). For comparative diabetes risk only, higher health literacy had a direct association with less DK responding ($OR = 0.93$, 95% CI = 0.88–0.99). Unpredictability was associated with DK responding such that higher unpredictability was associated with slightly more DK responding ($OR_{\text{absolute}} = 1.01$, 95% CI = 1.00–1.01; $OR_{\text{comparative}} = 1.01$, 95% CI = 1.00–1.01).

Path analyses for colon cancer

The path analyses for colon cancer yielded nearly identical results as for diabetes as is shown in Figure 2. As for diabetes, people with higher health literacy were more knowledgeable about colon cancer ($b_{\text{absolute}} = 0.31$, $p < .001$; $b_{\text{comparative}} = 0.31$, $p < .001$) as were people who were less likely to avoid colon cancer ($b_{\text{absolute}} = -0.47$, $p < .001$; $b_{\text{comparative}} = -0.47$, $p < .001$). There were indirect effects of health literacy ($OR_{\text{absolute}} = 0.97$, 95% CI = 0.95–0.99; $OR_{\text{comparative}} = 0.95$, 95% CI = 0.93–0.97) and avoidance ($OR_{\text{absolute}} = 1.05$, 95% CI = 1.01–1.08; $OR_{\text{comparative}} = 1.09$, 95% CI = 1.05–1.13) on DK responding through knowledge. Over and above this indirect effect, avoidance was directly associated with more DK responding ($OR_{\text{absolute}} = 1.21$, 95% CI = 1.06–1.39; $OR_{\text{comparative}} = 1.22$, 95% CI = 1.06–1.40). Unlike for diabetes, there were no direct effects of health literacy on DK responding and while the models that included unpredictability had acceptable fit, there were no statistically significant associations between unpredictability and DK responding for colon cancer perceived risk questions.

Discussion

In this study we examined potential explanations for responding DK to disease risk perception questions. For all risk perception questions, health literacy was indirectly associated with DK responding through risk factor knowledge, and information avoidance was both directly and indirectly (through risk factor knowledge) associated with DK responding. Unpredictability was also directly associated with DK responding for diabetes likelihood questions, although the effect was very small and did not improve model fit. The

model fit statistics indicate that, in combination, these pathways adequately, although not entirely, accounted for variation in DK responding. Importantly, satisficing did not contribute to explaining DK responding. Our results, as well as previous research, makes a compelling case that DK responses to risk perception questions are not attributable to satisficing or an inattentive response style, but rather that people respond DK to risk perception questions partly because they lack knowledge they could use as a basis for an disease risk judgment.

Confirmation that knowledge gaps underlie DK responding provides insight into the state of health messaging. Despite years of risk messaging about diabetes and colon cancer, a surprising number of people appear to be unable to appraise their level of risk for either disease, and, in particular, colon cancer. The pathway from health literacy to low risk factor knowledge and not knowing one's disease risk is likely part of a broader set of health communication disparities. It has been hypothesized that we often fail to reach our most vulnerable populations (e.g., those with low SES) with health messaging,^{45, 46} and this contributes to comparatively worse health behaviors, delayed care seeking, and worse health outcomes.^{47, 48} It might be possible to reduce disparities by improving people's health literacy or, conversely, redesigning health messaging to be more accessible to those with lower health literacy by including plain language graphics such as icon arrays, videos, simple text.⁴⁷⁻⁴⁹ Continued transformation of preventive care with the goals of making it more accessible and patient centered should also improve the reach of provider messaging to patients with low health literacy (and others).⁵⁰⁻⁵² Expanding services by community health workers may help us better bridge linguistic and cultural gaps.⁵³ Finally, it is in public health's purview to advocate for system change that will increase educational opportunity for vulnerable populations, including the poor and racial/ethnic minorities.

Our results also revealed pathways to DK responding that have not been previously considered. While defensive avoidance is a known deterrent of effortful processing of health risk information,^{20, 50, 54} it was not previously linked to uncertainty about risk perception or DK responding to risk perception questions. This finding confirms that risk information avoidance may be associated with whether people engage in risk appraisals. This may partially account for the underwhelming success of risk messaging interventions including mass media campaigns and even provision of tailored risk information at both increasing knowledge and changing behavior. We also found a significant direct association between risk information avoidance and DK responding even after accounting for the indirect path through risk factor knowledge. We can only speculate on the reason for this association, but it may be that some people who avoid risk information about a given disease also tend to avoid speculating on their risk for the disease as well. It could be important to integrate strategies for reducing defensive processing both when presenting risk information and in situations where people are challenged to appraise their risk as a step toward taking preventive measures.

Believing that getting diabetes is unpredictable was associated with slightly higher DK responding. The belief that diabetes risk is unpredictable runs counter to prevailing medical and public health conceptualizations of diseases, which emphasize clear causes and preventive actions. Our findings for unpredictability were not significant for colon cancer,

perhaps because of a ceiling effect; beliefs about unpredictability were high for colon cancer (mean = 73.02, 0–100 scale). It is not incorrect for people to believe that diabetes and colorectal cancer are to some degree unpredictable²⁸ – after all, it is impossible to identify precisely which individual person will develop either disease.

Results did not support the satisficing hypothesis, suggesting that eliminating DK response options from surveys is not a satisfactory solution for dealing with respondents who might select DK. Researchers have often opted to discourage DK responses on surveys by either not offering “DK” response options or further probing DK responses. Often, remaining DK responses are treated as missing data. Our findings support the inclusion of DK response options for risk perception questions. The potential risks of misunderstanding the nature of DK responses have been articulated elsewhere.^{3, 5, 58} If DK responses are not drawn from the sample at random, forcing people to choose a valid response option introduces bias, reduces measurement validity,⁵ and could undermine the ability to model the relationship between risk perception and behavior.⁵⁹

This work highlights gaps in health behavior theories and suggests ways they might be expanded to include uncertainty about risk perception. For example, expectancy-value models such as the health belief model and theory of planned behavior predict whether people view protective action as worth their while -- the assumption is made that people are aware of the threat.^{60, 61} Exceptions include models that describe phase behavior change such as the transtheoretical model or precaution adoption process model, typically include a phase in which people may not be aware of the threat. The authors of the precaution adoption process model advise that, “if people have never heard of a hazard or a potential precaution, they cannot have formed opinions about it” and, “(to) say “I don’t know” indicates something important and is real data that should not be discarded.”⁶⁵ Don’t know responding and uncertainty more generally has been associated with lower engagement in health protective behavior.^{8, 64} This is consistent with decision-making research demonstrating that having relative certainty regarding one’s personal risk for disease increases the likelihood of engaging in protective behavior.⁶⁶ Given this evidence, theoretical consideration of how uncertainty about perceived risk influences merits additional attention. The present work advances the field of health behavior change theory by beginning to specify why people may be uncertain about a threat and identifying specific ways we might engage with these individuals.

Limitations and future directions

Our assessment of knowledge was relatively narrow and brief. By assessing knowledge more broadly we might have found it accounted for more variance in DK responding. We have reported a high degree of variability in people’s level of uncertainty about their perceived risk, even among those who choose a valid response rather than DK.⁶⁴ People might have different standards for what constitutes adequate evidence for being informed enough to provide an answer.^{24, 67} In order to achieve maximum sensitivity and specificity, surveys might be designed to help all respondents feel as confident as possible, but also encourage true DK responding. Question formulation that specifies or clarifies what is being asked of the respondent may reduce spurious DK responding while maximizing assessment of true

uncertainty among responders. DK responding was less common for comparative versus absolute risk perception questions.

For surveys in which participants may have little intrinsic investment in thoughtful responding, addressing issues of inattentiveness is important because responses from inattentive responders can obscure true relationships in the data.³² We aimed to balance the need to eliminate data from the most egregious inattentive responders from our final weighted dataset (to maintain minimal data quality) and the need to maintain variability in our operational definition of satisficing. Our cutoff for removing participants accomplished the goal of retaining variability on our satisficing composite as 20% of the sample demonstrated some form of inattentive responding.

Conclusions

We tested competing hypotheses for DK responding to perceived risk questions in a nationally representative sample. Many people who say they don't know their risk probably lack the basis for making a risk judgment. However, there are multiple paths to this point, including difficulty understanding and accessing health messaging due to low health literacy and defensive avoidance of health information. Given that DK responses, to a large extent, reflect cognitive-affective states that may not only influence the risk appraisal process, but ultimately whether people engage in health protective behavior,⁸ it seems advisable to routinely assess DK responses and to develop ways of reaching individuals who respond DK with health messaging. Risk messaging is a mainstay of health communication, yet large numbers of people appear unable to appraise their risk for common serious diseases. Accordingly, a novel approach to health communication is required.

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Figure 1.
Hypothesized base model and alternative models.

Figure 2.

Base SEM path models. All effects shown are statistically significant at $\alpha = 0.05$ and model fit criteria were met for all four models. Estimates are unstandardized b estimates unless otherwise noted.

Table 1.**Participant Characteristics (N=1005)**

Characteristic	n (%)	Characteristic	n (%)
Gender		Education	
Female	521 (52%)	High school	372 (37%)
Male	484 (48%)	> High school	633 (63%)
Age		Prevalent Diabetes	
18 – 24	86 (9%)	Yes	112 (11%)
25 – 34	153 (15%)	No	893 (89%)
35 – 44	135 (13%)	Prevalent Colon Cancer	
45 – 54	175 (17%)	Yes	9 (1%)
55 – 64	218 (22%)	No	998 (99%)
65+	238 (24%)	DK Response: Absolute Diabetes (N = 893)	
Race/ Ethnicity		Yes	265 (30%)
White, not Hispanic	741 (74%)	No	628 (70%)
Black, not Hispanic	98 (10%)	DK Response: Comparative Diabetes (N = 893)	
Hispanic	97 (10%)	Yes	190 (21%)
Other	67 (7%)	No	703 (79%)
Employment		DK Response: Absolute Colon (N = 998)	
Employed	576 (57%)	Yes	471 (47%)
Unemployed	207 (21%)	No	527 (53%)
Retired	222 (22%)	DK Response: Comparative Colon (N = 998)	
Marital Status		Yes	308 (31%)
Married/ Partnered	611 (61%)	No	690 (69%)
Divorced/ Separated	122 (12%)		
Never married	228 (23%)		
Widowed	44 (4%)		
Measure	N	Mean (SD)	Possible Range
Avoidance – Diabetes	888	1.95 (0.6)	1 – 4
Avoidance – Colon	994	1.96 (0.6)	1 – 4
Knowledge – Diabetes	893	3.80 (1.3)	0 – 5
Knowledge – Colon	998	3.39 (1.6)	0 – 5
Health Literacy	1005	4.73 (1.6)	0 – 6
Satisficing	1005	0.23 (0.5)	0 – 4
Unpredictability – Diabetes	885	62.23 (24.9)	0 – 100
Unpredictability – Colon	993	73.02 (22.2)	0 – 100

Table 2.

SEM Path Model Fit Indices and Measures for Base and Alternative Models

Outcome	Model	RMSEA (90% CI)	WRMR	CFI	TLI
Diabetes	Base	0.051 (0.02, 0.08)	0.891	0.958	0.906
Absolute	Base + Satisficing	0.245 (0.22, 0.27)	3.985	0.380	-0.489
Risk	Base +	0.045 (0.02, 0.07)	0.889	0.959	0.902
	Unpredictability				
Diabetes	Base	0.061 (0.03, 0.10)	0.879	0.961	0.884
Comparative	Base + Satisficing	0.246 (0.22, 0.27)	3.987	0.409	-0.418
Risk	Base +	0.052 (0.03, 0.08)	0.967	0.953	0.887
	Unpredictability				
Colon	Base	0.063 (0.04, 0.09)	1.114	0.916	0.811
Absolute	Base + Satisficing	0.191 (0.17, 0.22)	3.279	0.429	-0.369
Risk	Base +	0.055 (0.03, 0.33)	1.071	0.917	0.801
	Unpredictability				
Colon	Base	0.055 (0.03, 0.09)	1.007	0.943	0.871
Comparative	Base + Satisficing	0.174 (0.15, 0.20)	3.251	0.471	-0.059
Risk	Base +	0.050 (0.03, 0.08)	1.002	0.939	0.853
	Unpredictability				

Note: Outcomes are dichotomized based on DK responding of the perceived risk item. Base models include effects of health literacy and disease-specific avoidance, both directly and indirectly via disease-specific knowledge.

Table 3.

Odds ratios and p-values for total, indirect, and direct effects of avoidance and health literacy on DK responding

	Diabetes		Diabetes		Colon Cancer		Colon Cancer	
	Absolute Risk	Comparative Risk	Absolute Risk	Comparative Risk	Absolute Risk	Comparative Risk	Absolute Risk	Comparative Risk
	DK Responding	DK Responding	DK Responding	DK Responding	DK Responding	DK Responding	DK Responding	DK Responding
Avoidance								
Total Effect	1.38 ***	1.42 ***	1.27 **	1.32 ***				
Indirect Effect	1.07 **	1.15 ***	1.05 **	1.08 ***				
Direct Effect	1.28 **	1.23 *	1.21 **	1.22 **				
Health Literacy								
Total Effect	0.94 *	0.88 ***	0.98	0.94 *				
Indirect Effect	0.97 *	0.94 ***	0.97 **	0.95 ***				
Direct Effect	0.97	0.93 *	1.01	0.99				

Note: Effects of avoidance and health literacy on each perceived risk DK outcome are estimated using SEM path models, with bootstrapped estimates for indirect effects. Indirect effects of both variables are via knowledge.

*** p<.001
 ** p<.01
 * p<.05.