

Changes of Heart: The Switch-Value Method for Assessing Value Uncertainty

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Background. Medical choices often evoke great value uncertainty, as patients face difficult, unfamiliar tradeoffs. Those seeking to aid such choices must be able to assess patients' ability to reduce that uncertainty, to reach stable, informed choices. **Objective.** The authors demonstrate a new method for evaluating how well people have articulated their preferences for difficult health decisions. The method uses 2 evaluative criteria. One is internal consistency, across formally equivalent ways of posing a choice. The 2nd is compliance with principles of prospect theory, indicating sufficient task mastery to respond in predictable ways. **Method.** Subjects considered a hypothetical choice between noncurative surgery and palliative care, posed by a brain tumor. The choice options were characterized on 6 outcomes (e.g., pain, life expectancy, treatment risk), using a drug facts box display. After making an initial choice,

subjects indicated their willingness to switch, given plausible changes in the outcomes. These changes involved either gains (improvements) in the unchosen option or losses (worsening) in the chosen one. A 2×2 mixed design manipulated focal change (gains v. losses) within subjects and change order between subjects. **Results.** In this demonstration, subjects' preferences were generally consistent 1) with one another: with similar percentages willing to switch for gains and losses, and 2) with prospect theory, requiring larger gains than losses, to make those switches. **Conclusion.** Informed consent requires understanding decisions well enough to articulate coherent references. The authors' method allows assessing individuals' success in doing so. **Key words:** end of life care; patient decision making; health preference elicitation; prospect theory; decision aids. (*Med Decis Making* XXXX;XX:xx-xx)

Decision making begins by understanding one's options, then proceeds to understanding oneself—and the tradeoffs one wishes to make. With many medical choices, both tasks can be challenging. The situation can be unfamiliar, uncertain, and complex, forcing one to identify, then master the relevant facts. The tradeoffs can be wrenching, forcing one to identify, then integrate relevant personal values. Those tradeoffs might be between certain pain now and possibly reduced pain later, between

money and the relief obtained with costly antiemetics, or between burdens borne by oneself and one's family.¹

Considerable progress has been made in developing analytical approaches to identifying decision-critical facts, theoretical approaches to communicating them, and empirical methods for evaluating how well they have been understood.^{2,3} Woloshin and others¹ offer a state-of-the-art approach, informed by decision analysis, communication science, and evaluation research. It uses a tabular, drug facts box format like that in Table 1 (whose contents are explained below) to facilitate comparisons between outcomes, which are described as quantitatively as possible, with supplementary verbal explanations.

Rather less progress has been made in addressing value uncertainty—individuals' need to articulate the implications of their basic values in the specific, demanding contexts posed by medical choices. Most research on value uncertainty focuses on context effects, in which seemingly equivalent ways of presenting the same information lead to different

Received XX Month 20XX from Department of Social and Decision Sciences, Carnegie Mellon University, Pittsburgh, Pennsylvania (LKJ, BF). The research was supported by a doctoral fellowship from the Social Sciences and Humanities Research Council of Canada to John and a grant from the US National Science Foundation SES-0433152 to Fischhoff. Revision accepted for publication XX Month 20XX.

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DOI: 10.1177/0272989X09344750

Table 1 Information on the Outcomes for the 2 Options

	Surgery	Palliative Care
Life expectancy	Because of the tumor's position, size, and physiology, the surgery will not cure you. The surgery is expected to extend your life by 2 months beyond the 6 months expected with this kind of cancer. With surgery, your life expectancy is therefore about 8 months.	About 6 months.
Pain	Initially: For the 3 weeks following surgery during which you will be hospitalized, you are likely to experience intense pain from the brain incision, even with pain killers. On a 1–10 scale, your pain level will be a 9. Later: One month after your surgery, your pain will be somewhat higher than what you are experiencing now. On a 1–10 scale, your pain level will be a 4.	You will experience pain symptoms similar to those you are currently experiencing. Your pain medication will be managed to keep you as comfortable as possible. For example, the medication will help to relieve nausea, vomiting, and severe headaches. Although the tumor will continue to grow, your pain will be managed such that you will experience pain symptoms similar to those you are currently experiencing. On a 1–10 scale, your pain level will continue to be a 3.
Functionality	The surgery may reduce some of your symptoms including the headache, nausea, and poor memory. Eventually, though, the cancer will take its course and your functionality will gradually worsen. Your speech production will deteriorate, followed by vision impairment and comprehension problems.	Your functionality will gradually worsen. Your speech production will deteriorate, followed by vision impairment and comprehension problems.
Location	The surgery will take place at a hospital located 2 miles from your home.	The palliative care facility is located 2 miles from your home.
Risks	The surgery bears a 2% chance of death.	There is a 1% chance of death due to medication side effects.
Side effects	May include increased fatigue, cognitive problems, headaches, and seizures. There is also a small chance of losing some or all vision.	May include fatigue from the medications, cognitive problems, headaches and seizures. There is also a small chance of losing some or all vision.

choices.^{4–7} Context effects can reflect value uncertainty, when people look to context for cues regarding what they should want.² Reliance on contextual cues can, however, also reflect incompletely specified choices, which force people to seek hints regarding missing details.³ As a result, evaluating preference consistency requires well-specified choices.

The present study introduces a new method for evaluating how well people have articulated their preferences—and how much residual uncertainty remains. We demonstrate the method with a medical choice designed to evoke the difficult tradeoffs that sudden, life-threatening illnesses can pose, while still being hypothetical, so that subjects could not

bring outside knowledge. We provided a detailed description, with a drug facts box format, so that inconsistent preferences could be attributed to poorly articulated values, rather than to poorly specified options. We compare our method to a conventional strength-of-preference rating scale.

Our approach, which we call the switch-value method, evaluates how well preferences have been articulated in terms of their internal and external validity. We assess internal validity by the consistency of preferences elicited by logically related questions. We assess external validity by the consistency of preferences with 2 principles of prospect theory⁸: 1) losses matter more than quantitatively equivalent gains and 2) certain outcomes receive

added weight. Prospect theory is, of course, not a normative guide to decision making. However, the descriptive validity of these predictions has been so well established that people should follow them, if they have mastered a decision well enough to articulate their preferences.

Our approach reflects the growing awareness that preference formation is often a constructive process, whereby individuals infer the implications of their basic values for novel choices.^{4–6} If they are successful, then the resulting preferences should show construct validity, in the sense of being sensitive to relevant changes in the options and insensitive to irrelevant ones. Like other tests of construct validity, ours posits the relevance of changes prior to measuring sensitivity.

METHOD

Task

We created a choice that would evoke a difficult, plausible medical decision, although a hypothetical one, so as to minimize reliance on outside medical knowledge. Subjects were asked to imagine that they had just been diagnosed with a brain tumor, then to choose between palliative care and noncurative surgery to excise the tumor, with each option described in comparable detail (Appendix 1). The descriptions used a drug facts box format to characterize the options in terms of 6 outcomes that might affect choices: life expectancy, pain, functionality, distance from home, risk of death from treatment, and other side effects.^{1,7}

We pretested the specific outcome values (e.g., months of life expectancy) so that they would produce divided choices across subjects—suggesting that the choice was difficult and evoked value uncertainty.

After subjects made their choices (palliative care or noncurative surgery), we assessed their value uncertainty in 2 ways. One elicited their strength of preference on a conventional 7-point scale, anchored at 1 = “not at all strongly” and 7 = “very strongly.” The 2nd, the switch-value method asked them how much each outcome (e.g., months of life expectancy) would have to change, for their choice to switch. There were 2 versions of the switch-value question, designed to capture sensitivity to prospect theory’s prediction. The gain version asked how much better the unchosen option would have to be, for the subject to prefer it (Figure 1a). The loss

version asked how much worse the chosen option would have to be, for the subject to abandon it (Figure 1b).

As an example of a gain question, subjects who had chosen palliative care were asked, “How long would the life expectancy with surgery have to be, in order for you to switch to preferring it?” The corresponding loss question was, “How short would the life expectancy with palliative care have to be, in order for you to switch to preferring surgery?” Both questions offered the option of saying that no change was big enough for them to switch, for example, “I would choose palliative care no matter how long the life expectancy with surgery is” or “I would choose palliative care no matter how short its life expectancy is.” Switch-value questions were posed for the 4 outcomes with quantitative values (Table 1). Willingness to switch suggests that the options are close enough for the details to matter.

Given the importance of task comprehension, for putting individuals in a position to assess their values, we also examine respondents’ sensitivity to task details.

Procedure

A total of 172 Carnegie Mellon University students participated for course credit. First, they read the scenario. After choosing their preferred option, they rated the strength of that preference and then indicated how much each of 4 outcomes had to change, for them to switch their choice. By random assignment, half of the subjects first considered gains (improvements) in the unchosen option, then losses (worsening) in the chosen option. The other half had the order reversed. The survey concluded with demographic questions. It was administered online. The University’s Institutional Review Board for Protection of Human Subjects approved the study.

Data Analysis

We tested whether the demographic characteristics (age, year of study, and race) differed for subjects in the between-subject condition (considering gain or loss changes first), using independent samples *t* tests (for continuous variables) and χ^2 tests (for categorical variables). To test for differences in switch values, we used nonparametric tests (Wilcoxon signed ranks) because switch values were not normally distributed. We also focus on medians, rather than means.

a Your life expectancy with surgery is about 8 months. How *long* would the life expectancy with surgery have to be, in order for you to switch to preferring it? Assume that everything else stayed the same.

I would choose palliative care no matter how long the life expectancy with surgery is.

I would prefer surgery if its life expectancy was increased to: **(in months)**

b Your life expectancy with palliative care is about 6 months. How *short* would the life expectancy with palliative care have to be, in order for you to switch to preferring surgery? Assume that everything else stayed the same.

I would choose palliative care no matter how short its life expectancy is.

I would prefer surgery if the life expectancy with palliative care was decreased to: **(in months)**

Figure 1 (a) Sample switch question: Life expectancy from the gain perspective, for a subject who chose palliative care. (b) Sample switch question: Life expectancy from the loss perspective, for a subject who chose palliative care.

RESULTS

Subjects

Subjects' ages ranged from 18 to 23 years ($M = 20.1$); 53% were male. They included sophomores (27%), juniors (49%), and seniors (24%). They described themselves as Asian (56%), Caucasian (35%), African American (3%), and Hispanic (2%). There were no significant differences in the demographics of subjects receiving gain and loss questions in the 2 orders.

Order Effects

There were no significant differences in strength-of-preference ratings or switch values for any question, whether a question came 1st or 2nd. Therefore, we collapsed across orders.

Overall Choices

Most subjects (131 of 172 = 76%) chose palliative care, resulting in a less even split than we had sought. However, almost all subjects making either

choice identified a change in at least 1 outcome that would prompt switching their choice (palliative care, 95%; surgery, 90%; NS). With a decision having closely matched options, consistent choices are not a given, but a reflection of success in articulating stable preferences.

Willingness to Switch with Losses and Gains—External Validity

We assessed external validity by the extent to which switch values were consistent with prospect theory,⁹ assuming that people who have mastered a decision well enough to articulate their preferences should behave according to its well-established principles. Tables 2 and 3 show differences between subjects' initial values (in Table 1) and their switch values*. According to prospect theory, subjects

*We excluded switch values that clearly represented confusion (e.g., switching from palliative care when its life expectancy increased). The percentage of confused switches ranged from 1% to 4%, across the 8 outcome and frame combinations, with 20% of subjects having at least 1 switch value excluded. All conclusions hold when these seemingly confused responses are included.

Table 2 Required Changes from Base-Case Values Such that Subjects Who Initially Chose Palliative Care ($N=131$) Would Switch to Preferring Surgery

Outcome	Gain Question	Loss Question	Difference
	Gain Question (How Much Better Would the Outcome Have To Be with Surgery, in Order To Switch to Preferring It?)	Loss Question (How Much Worse Would the Outcome Have To Be with Palliative Care, in Order To Switch to Preferring Surgery?)	(Wilcoxon Signed-Rank Test)
Required Change from Base-Case Value (See Table 1)			
Life expectancy	Med = 4.0 mo M = 9.67 mo ($n = 115$; 87.8%)	Med = 3.0 mo M = 3.32 mo ($n = 105$; 80.2%)	$Z = -7.07$, $P < 0.0005$
Pain	Med = 4.0 M = 4.51 ($n = 111$; 84.7%)	Med = 3.5 M = 3.79 ($n = 122$; 93.1%)	$Z = -3.70$, $P < 0.0005$
Location	Med = 1.0 M = 1.0 ($n = 14$; 10.7%)	Med = 48.0 M = 309.0 mi ($n = 55$; 42.0%)	N/A
Risk of death	Med = 1.80 M = 1.56 ($n = 39$; 29.8%)	Med = 24.00 M = 26.93 ($n = 103$; 78.6%)	N/A

Note: Cell sample sizes represent the number of subjects willing to specify a switch value; cell percentages represent the percentage of subjects willing to specify a switch value, of all subjects who chose palliative care. "N/A" is listed in the "Difference" column for the comparisons that do not offer tests of prospect theory due to asymmetrical outcomes (as explained in the text). Med, median ; M, mean.

should require larger positive changes (gains) in the unchosen option than negative changes (losses) in the chosen one, before switching. Creating medically plausible decisions led to outcomes that varied in the sizes of the possible gains and losses. For example, the location for both treatments was 2 miles from the patient’s home, meaning that the distance could get much worse, but not much better. Such outcomes do not allow comparing the relative weight given to gains and losses. As seen in Tables 2 and 3, there were 3 clear comparisons: life expectancy and pain for subjects choosing palliative care and life expectancy for subjects choosing surgery. The other choices provided a rich, realistic context, with enough distracting detail to limit subjects’ ability to produce artifactually consistent choices.

Subjects Who Initially Chose Palliative Care (Table 2)

Life expectancy. As seen in Table 1, subjects were told that they could expect to live 6 months with palliative care and 8 months with surgery. Among those who initially chose palliative care, most identified switch values, for shifting to surgery, both if surgery life expectancy improved (the

gain question) and if palliative care life expectancy worsened (the loss question): 87.8% (115 of 131), 80.2% (105 of 131); NS. Consistent with prospect theory, switching required greater gain with surgery (med = 4 months; M = 9.68 months) than loss with palliative care (med = 3 months; M = 3.32 months), Wilcoxon signed-ranks test, $Z = -7.07$, $P < 0.0005$.

Pain. Subjects were initially told that they could expect pain of 3 (on a 0–10 scale) with palliative care and pain of 9 with surgery for the 1st 3 weeks, then pain of 4. Among subjects choosing palliative care, most identified switch values, for shifting to surgery, both if surgery pain improved and if palliative care pain worsened (84.7% = 111 of 131 v. 93.1% = 122/131; NS). Consistent with prospect theory, switching required greater gain with surgery, in units of reduced pain (med = 4; M = 4.51) than loss with palliative care (med = 3.5; M = 3.79), Wilcoxon signed-ranks test, $Z = -3.70$, $P < 0.0005$.

Location. Both treatments were initially described as being 2 miles from the patient’s home. Given the asymmetrical opportunities for gain (in surgery proximity) and loss (in palliative care proximity), this outcome offers no test of conformity with

Table 3 Required Changes from Base-Case Values Such that Subjects Who Initially Chose Surgery ($N = 41$) Would Switch to Preferring Palliative Care

Outcome	Gain Question	Loss Question	Difference
	(How Much Better Would the Outcome Have To Be with Palliative Care, in Order To Switch to Preferring It?)	(How Much Worse Would the Outcome Have To Be with Surgery, in Order To Switch to Preferring Palliative Care?)	(Wilcoxon Signed-Rank Test)
Required Change from Base-Case Value (See Table 1)			
Life expectancy	Med = 2.0 mo M = 4.66 ($n = 28$; 68.3%)	Med = 2.0 M = 2.45 ($n = 26$; 63.4%)	$Z = -4.13$ $P < 0.0005$
Pain	Med = 2.0 M = 1.97 ($n = 27$; 65.9%)	Med = 1.0 M = 1.0 ($n = 15$; 36.6%)	N/A
Location	Med = 1.9 M = 1.90 ($n = 14$; 34.1%)	Med = 48.0 M = 47.12 ($n = 15$; 36.6%)	N/A
Risk of death	Med = 0.99 M = 0.85 ($n = 14$; 34.1%)	Med = 28.00 M = 30.46 ($n = 30$; 73.2%)	N/A

Note: Cell sample sizes represent the number of subjects willing to specify a switch value; cell percentages represent the percentage of subjects willing to specify a switch value, of all subjects who chose surgery. "N/A" is listed in the "Difference" column for the comparisons that do not offer tests of prospect theory due to asymmetrical outcomes (as explained in the text). Med, median; M, mean.

prospect theory. It does, however, provide a measure of subjects' attention to detail: very few (10.7%; 14 of 131) identified a distance to surgery so small (< 2 mi) that they would switch to it. However, 42.0% (55 of 131) identified a distance to palliative care so large that they would switch to surgery (med = 48 mi).

Risk of death. For the sake of medical realism, both options had low probabilities of death from treatment (2% for surgery, 1% for palliative care). As with location, the asymmetrical opportunities for gain (with reduced surgery risk) and loss (with increased palliative care risk) left no opportunity to assess conformity with prospect theory. As a measure of the importance of including details about this outcome, 29.8% (39 of 131) of subjects identified a surgery risk so low that they would shift to it (med = 1.8%), whereas 78.6% (103 of 131) identified a palliative care risk so large that they would shift from it (med = 24.0%).

Surgery (Table 3)

Life expectancy. Among subjects who chose surgery, about two-thirds identified improvements in palliative care's life expectancy and reductions in

surgery's life expectancy that were large enough for them to shift (68.3% = 28 of 41 v. 63.4% = 26 of 41; NS). Subjects required greater gain with palliative care (med = 2 months; M = 2.45 months) than loss with surgery (M = 4.66 months), before switching, consistent with prospect theory—although the difference was not statistically significant (Wilcoxon signed-ranks test, $Z = -1.75$, $P = 0.08$).

Pain. The initial pain level with surgery was so high (9) that there was little opportunity for it to worsen, preventing a test of consistency with prospect theory. As a measure of the importance of specifying this feature, 65.9% (27 of 41) of subjects identified reductions in palliative care pain and 36.6% (15 of 41) identified increases in surgery pain that would prompt switching to palliative care.

Location. As mentioned, the initial distance to both treatments was too short to allow a test of consistency with prospect theory. About one-third of subjects identified decreases in the distance to palliative care (34.1% = 14 of 41) and increases in the distance to surgery (36.6% = 15 of 41) that would prompt switching to palliative care.

Risk of death. Consistent with the low initial death rates, many more subjects identified increases

in surgery risk (73.2% = 30 of 41) than decreases in palliative care risk (34.1% = 14 of 41) that would prompt switching to palliative care.

Certainty Effects—External Validity

According to prospect theory, people assign extra weight to certain outcomes. In our example, death risk is an uncertain outcome, with a 1% or 2% chance (depending on the treatment). Reducing its risk to 0% should be especially valuable to subjects who behave according to prospect theory when deciding whether to switch choices.

Subjects choosing palliative care. As seen in Table 2, 29.8% (39 of 131) of these subjects identified a reduction in surgery's death risk that was large enough to switch to it. All of these subjects (33 of 33[†]) required reducing surgery's death risk to 0% from 2%. In contrast, a 2% increase in palliative care's death risk (from 1% to 3%) prompted switches by only 4 of the 96 (= 3.1%) subjects who identified any value for switching to surgery. Thus, a 2% gain (reduced risk) that produced zero risk had much greater impact than a 2% loss (increased risk) that did not. Note that this result violates prospect theory's prediction that losses loom larger than gains, indicating that the certainty effect was stronger than the gain-loss contrast.

Subjects choosing surgery. Overall, 8 subjects identified a reduction in palliative care risk that would switch them to surgery. All 8 required eliminating the risk, representing a 1% gain, from 1% to 0%. In contrast, a 1% worsening in surgery's death risk (from 2% to 3%) would lead only 2 subjects to switch to palliative care. Here, too, a gain that produced a certain outcome had more impact than a loss of the same size.

Consistency of Switching with Gains and Losses—Internal Validity

If subjects have understood the choices and articulated their values, then they should reveal consistent switching policies, when asked gain and loss questions—providing there are similar opportunities to change in each direction. Thus, consistent switching indicates clarity, whereas inconsistent switching indicates value uncertainty. Thus, if subjects have understood the task and themselves, those

willing to switch when considering losses should also be willing to switch when considering gains.

As mentioned, 3 cases offer such tests of internal consistency. All 3 showed it: 1) Among subjects choosing palliative care, those who would switch for some loss in its life expectancy were more likely to switch for some gain in surgery's life expectancy ($r = 0.40$, $P < 0.0005$). Among subjects who would switch, those requiring relatively larger losses with palliative care also required relatively larger gains with surgery ($r = 0.53$, $P < 0.0005$). 2) Among subjects choosing palliative care, those who would switch for some increase in its pain were more likely to switch for some decrease in surgery's pain ($r = 0.47$, $P < 0.0005$). Among subjects who would switch, those requiring larger losses with palliative care also required larger gains with surgery ($r = 0.24$, $P = 0.017$). 3) Among subjects choosing surgery, those who would switch for some loss in its life expectancy were more likely to switch for some gain in palliative care's life expectancy ($r = 0.48$, $P = 0.002$). Among subjects who would switch, those requiring larger losses with surgery also required larger gains with palliative care ($r = 0.45$, $P = 0.063$).

Across all outcomes, among subjects initially choosing palliative care, 87.1% of willingness-to-switch patterns were consistent, in the sense that, if subjects would switch for some gain in an outcome, they would also switch for some loss. Among those initially choosing surgery, 72.0% of willingness-to-switch patterns were consistent. For the 3 cases allowing tests of prospect theory, 84.5% were consistent.

Rating-Scale and Switch-Value Measures of Value Uncertainty

On average, subjects stated that they felt fairly strongly about their choices ($M = 5.01$, on the 1–7 rating scale). Ratings were stronger for palliative care than for surgery ($M = 5.24$ v. 4.29 , $t(55.69) = -2.96$, $P < 0.01$, adjusted for heteroscedasticity).

Consistent with their weaker preferences ratings, subjects choosing surgery made more switches than did subjects choosing palliative care ($M = 4.05$ v. 3.01 ; $t(46.9) = 2.34$, $P = 0.02$, adjusted for heteroscedasticity). Also consistent is the finding that choices for the gain and loss questions were less consistent among subjects choosing surgery than among those choosing palliative care (72.0% v. 87.1%; $\chi^2(1) = 3.44$, $P = 0.06$).

Subjects with stronger preference ratings were not, however, less likely to switch their preferences

[†]Numbers in the table and the text differ slightly, due to elimination of subjects with incoherent switching patterns (see previous footnote).

($r = -0.04$; NS), nor did they require larger changes to switch ($r = 0.13$; NS), nor were they more likely to make switches consistent with prospect theory: palliative care–life expectancy ($r = -0.05$; NS), palliative care–pain ($r = -0.06$; NS), surgery–life expectancy ($r = -0.03$; NS).

DISCUSSION

The decision studied here poses a choice between noncurative surgery and palliative care, for a suddenly discovered brain tumor. It was designed to have features found in many difficult medical choices: The condition, treatment, and outcomes are all unfamiliar. The tradeoffs are harsh. The choice is fateful. The details matter. The options are characterized on 6 potentially relevant outcomes: life expectancy, pain, functionality, distance from home, risk of death from treatment, and other side effects. Each outcome has medically plausible values, selected to produce divided preferences, across subjects, and willingness to switch, within subjects, if the outcomes change. Such a close decision should challenge individuals' ability to master the details and articulate their preferences.

Using this decision as an example, the study demonstrates a new method for assessing individuals' success in achieving informed choices. It considers their preferences' internal validity, as measured by consistency when elicited in different ways, and their external validity, as measured by consistency with 2 predictions of prospect theory—taken as a descriptively valid account of how people make choices, when they understand their options and themselves.

The method uses a display found to make choice options clear, allowing subjects to focus on articulating their preferences among them.¹ If subjects understand their task, inconsistent switch values can be more confidently attributed to uncertainty about what they want, rather than to confusion about what they are being offered.

Using a convenience sample of students, we found good external validity, reflected in consistency with the 2 prospect theory principles: 1) Losses affected choices more than did similarly sized gains, as seen in subjects' greater willingness to switch choices when the chosen option got worse than when the unchosen option improved. 2) Subjects were particularly likely to switch when death risk became zero.

We also found good internal validity: 1) Subjects who would switch with gains were more likely to switch with losses. 2) Subjects who switched more

times with gain questions also switched more times with loss questions. 3) Among subjects who would switch, those who required larger changes with gains also required larger changes with losses.

We sought a naturalistic task, with features needed to ensure informed decisions: a full, involving scenario, clear communication of medically plausible information, quantitative outcome estimates (where relevant), and a format that facilitates comparing options. We specified values for all outcomes so that subjects would not need to guess them. For example, without location information, some subjects might have assumed that brain surgery was conducted at a distant medical center. The low rate of confused responses indicates successful communication of these details and the evaluation tasks.

Subjects' preferences show the hallmarks of construct validity: greater sensitivity to changes in seemingly important outcomes, such as pain, than to changes in seemingly less relevant ones, such as location; greater sensitivity to large changes than to small ones (e.g., moving treatment to further than 2 mi away as opposed to moving it closer). Thus, these subjects had reasonably well-articulated preferences for a difficult, novel decision with many potentially relevant details. Less mastery might be found with individuals who are less analytical than Carnegie Mellon students and with materials that did not use the drug facts box format and undergo extensive pretesting.

We also assessed value uncertainty with a conventional strength-of-preference rating scale. On average, the ratings showed greater value uncertainty among subjects choosing surgery, consistent with their greater willingness to switch from it and their somewhat less consistent preferences. At the individual level, though, the ratings were not correlated with whether subjects had any switch value, with how often they switched, or with how large a change they needed before switching. Thus, the switch value captured aspects of value uncertainty that the rating scale did not. Switch values are also more directly related to decision making, by virtue of describing specific choices, not general feelings about choices.

A study by Mendelsohn and others¹⁰ found that trained survey interviewers could use the switch-value method in a clinical setting. Patients who had received prolonged mechanical ventilation were asked to evaluate, in retrospect, how sensitive their choice would have been to changes in 5 outcomes (e.g., pain, financial burden).¹⁰ The method had good test–retest reliability and patient acceptance (with

anecdotal accounts of it helping them to sort out the issues). A suggestive result was that younger and healthier patients expressed stronger preferences for receiving mechanical ventilation, as revealed in their switch values.

We believe that the switch-value method could be applied in other clinical settings, providing a vital perspective on whether patients have resolved the value uncertainty that can accompany difficult medical decisions. Although the method could be used with decisions presented in any way, we believe that the best results will be found with a drug facts box format, affording clear comparisons between alternative treatments. The switch-value method could help to evaluate decision aids,^{2,3} complementing research that assesses users' understanding of the facts.¹¹

Any ethical health decision aid should be evaluated empirically, starting with individuals for whom the decision is hypothetical, as was done here. In extending the present results, 1 possible complication is adding some of the emotion present in actual choices.^{12,13} Although the direction of emotion effects is often predictable, their size depends on the context. As a result, direct assessment is needed, to see how much emotion matters. For example, Lerner and others¹⁴ found that probability judgments for terror-related events were 6-8 percentage points higher after a fear-inducing manipulation than after an anger-inducing one. Effects of that size might tip close decisions, like the present one.

Our subjects were all college students considering a stimulus designed to pose a health emergency that they could imagine. It went through multiple rounds of pretesting, partly because few pretest subjects chose surgery, contrary to our expectation that students would like the "fighting chance" that it offers. Despite incrementally improving the surgery prognosis, we found that most subjects still chose palliative care. Possibly, the drug facts box display made palliative care seem like a form of treatment, rather than a form of "giving up." The display may also have made it clearer that the surgery was noncurative. Both results would be successes for the display, in facilitating informed choices.

The switch-value method assesses the quality of preferences in terms of their internal consistency, across questions, and their external consistency, with prospect theory. Of course, neither criterion guarantees sound choices. Internally consistent choices can be consistently misguided, if people predict their own desires poorly.^{15,16} Prospect theory is not normative. However, articulating preferences well enough to act according to its principles could be a step

toward more normative choices. The measures offered here provide ways to assess individuals' success at reducing value uncertainty, complementing measures of their success at understanding decision facts. Together, such measures can inform judgments of whether people understand their options and themselves well enough to provide informed consent for medical decisions.

ACKNOWLEDGMENT

We thank Gabriel Silverman for help in creating our stimuli as well as 2 anonymous reviewers whose comments greatly improved the manuscript.

APPENDIX 1 Scenario

Please imagine the following:

Recently, you have been experiencing severe headaches and nausea. The symptoms usually appear when you wake up, then dissipate through the day. Twice in the last month, your symptoms were so bad that you woke up vomiting. You've also been feeling very sluggish.

You decide to consult your doctor. He is quite concerned and conducts a neurological examination, including a variety of memory, reflex, balance, and coordination tests. After this examination, he tells you that he is recommending further tests to rule out the possibility that you may have a brain tumor.

A week later, you report to the hospital for an MRI in order to look for any abnormal tissue growth in the brain, such as a tumor.

The following week, you return to your doctor's office to get the results of the MRI. Visibly worried, your doctor sits you down and tells you that the MRI test has revealed a malignant brain tumor. This type of brain tumor, at this stage, is incurable. He tells you that most patients in your condition live about 6 months.

You ask what your options are. The doctor says you have 2 options, surgery and palliative care. He says that patients with your condition choose each of these options about equally often.

The doctor gives you more detailed information about the options, to consider before deciding. It is summarized on the next page. Please read it now, then answer the questions that follow.

Please consider this decision solely from your perspective. That is, for now, please don't consider the wishes of your family and loved ones about the decision. Assume that you have insurance to cover whatever you choose.

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