

Assessment of the Sunk Cost Effect in Clinical Decision Making

Abstract

Despite the current push toward the practice of evidence-based medicine and comparative effectiveness research, clinicians' decisions may be influenced not only by evidence, but also by cognitive biases. A cognitive bias describes a tendency to make systematic errors in certain circumstances based on cognitive factors rather than evidence. Though health care providers have been shown in several studies to be susceptible to a variety of types of cognitive biases, research on the role of the sunk-cost bias in clinical decision-making is extremely limited. The sunk-cost bias is the tendency to pursue a course of action, even after it has proved to be suboptimal, because resources have been invested in that course of action. This study explores whether health care providers' medical treatment recommendations are affected by prior investments in a course of treatment. Specifically, we surveyed 389 health care providers in a large urban medical center in the United States during August 2009. We asked participants to make a treatment recommendation based on one of four hypothetical clinical scenarios that varied in the source and type of prior investment described. By comparing recommendations across scenarios, we found that providers did not demonstrate a sunk-cost effect; rather, they demonstrated a significant tendency to over-compensate for the effect. In addition, we found that more than one in ten health care providers recommended continuation of an ineffective treatment.

Introduction

When patients are faced with making decisions regarding their health, most rely on health care providers for information and recommendations (Fox & Jones, 2009). In return, health care providers have a fiduciary duty to their patients to make recommendations that serve to protect and promote the patient's health. Research has shown, however, that the recommendations of physicians and other health care providers often do not reflect the best available evidence (Lenfant, 2003). This represents not only a missed opportunity to provide high-quality health care, but also a waste of the resources invested in carrying out clinical research (Lenfant, 2003). To remedy this, significant initiatives have been undertaken to reach evidence-based conclusions on the value of medical interventions based on data from multiple sources. These initiatives include a \$1.1 billion investment provided by the American Recovery and Reinvestment Act (Marshall, 2009) and a Patient-Centered Outcomes Research Institute provided by the Patient Protection and Affordable Care Act (Kaiser, 2010). Yet, these initiatives operate under the assumption that the reason why physicians sometimes make recommendations that fail to reflect best available evidence is lack of information. While lack of information is perhaps one reason, another reason why recommendations are not reflective of evidence is that physicians, like all of us, often make decisions based on decisional shortcuts known as "heuristics" that produce "cognitive biases."

The heuristics and biases literature exposes the many "predictably irrational" tendencies in judgment and decision-making (Ariely, 2010; Gilovich et al., 2002; Kahneman et al., 1982; Sunstein & Thaler, 2008), which are found across cultures and populations (Gilovich et al., 2002). Many of these tendencies have been shown to occur in medical decision-making both by

patients and physicians (Klein & Stefanek, 2007). For example, loss aversion bias (e.g. Banks et al., 1995; McNeil et al., 1982) numeracy bias towards frequencies (e.g. Slovic et al., 2000), omission bias (e.g. Aberegg et al., 2005; DiBonaventura & Chapman, 2008; Elstein et al., 1986), confirmation bias (e.g. Klein, 2005), and availability bias (e.g. Dale et al., 2006; Poses & Anthony, 1991; Ubel et al., 2001) have all been shown to influence clinical decisions.

The cognitive bias that we focus on in this study is the “sunk-cost effect.” We chose to study this bias because it has received comparatively little attention in the literature, yet it has significant implications for wasted resources and patient care. The sunk-cost effect, sometimes referred to as “irrational escalation,” is a tendency for people to pursue a course of action even after it has proved to be suboptimal, because resources have been invested in that course of action. A classic example of the sunk-cost effect resulting from the sunk-cost bias was given by Thaler (1980): “A family pays \$40 for tickets to a basketball game to be played 60 miles from their home. On the day of the game there is a snowstorm. They decide to go anyway, but note in passing that had the tickets been given to them, they would have stayed home.”

According to classical models of rationality, a rational person makes choices by assessing the probability of possible outcomes, the utility derived from each possible outcome, and pursuing the outcome that offers an optimal combination of probability and utility (Gilovich et al., 2002). Normative standards of rationality are formal rules and principles that describe how people should behave to achieve this optimization, and they are often used as a standard against which individual behavior is compared (Keys & Schwartz, 2007). The sunk-cost effect violates a standard of normative rationality that states that our choices should be future-oriented and past investments should be irrelevant given that our decisions impact the future and not the past (Keys & Schwartz, 2007).

Outside the medical realm, the sunk-cost bias has been found to exert a significant influence on decisions about travel (Arkes & Blumer, 1985), entertainment (Arkes & Blumer, 1985), investments (Staw, 1976), and even whether to continue a war (Schwartz, 2005). Despite this body of literature, there has been very limited study of whether sunk-cost bias plays a role in health care providers' decision-making processes. In the only peer-reviewed study to look at this issue that we could find, Bornstein et al. (1999) attempted to determine the presence of a sunk-cost effect in medical treatment decisions through a survey of 36 internal medicine and family practice residents. Their findings indicated that medical residents did not demonstrate a sunk-cost effect in making medical decisions, but did exhibit a sunk-cost effect when making decisions about non-medical topics (e.g., continuation of music lessons that are paid for but no longer enjoyable). The authors concluded that medical residents had a “domain-specific advantage” in decision-making that enabled them to avoid the sunk-cost effect, but only in their area of expertise.

In the current study, we expand on the work of Bornstein et al. (1999) by examining this issue with a large sample of health care providers across a range of experience levels and specialties, to gauge the extent to which they exhibit a sunk-cost effect in their medical treatment decisions. We also attempted to identify the reasoning behind their decision to recommend or not recommend continuation of a treatment that appears to be ineffective. Identification of reasoning behind the decision to recommend continuation of treatment or not helped to assess the impact of the sunk-cost effect.

Methods

In this study, we assessed the sunk-cost effect using original data collected from health care providers affiliated with a medical school located in a large, urban medical center in the southern United States. Ethics approval for the study was obtained from approved the Baylor College of Medicine Internal Review Board. An invitation to take part in the current study was e-mailed through a list serve to all members of the medical school's faculty practice plan ($n=1347$). The initial invitation, combined with a single reminder e-mail generated a total of 389 responses (response rate=29%) during the study period in August 2009. We tested the respondents for their propensity to demonstrate the sunk-cost effect in relation to the type and source of investment made (i.e., provider time or patient money). In addition, we assessed the reasoning behind their decision by asking each participant to state their level of agreement with several possible explanations. These included an explanation about the importance of either taking past investments into account or avoiding doing so (*sunk-cost/sunk-cost avoidance* explanation), an explanation about predictions regarding future efficacy of treatment (*optimism/pessimism* explanation), and an explanation about the importance of being consistent with original recommendations (*consistency* explanation).

Procedure

Participants were surveyed using a ten to eleven item online questionnaire conducted with Zoomerang. First, respondents were divided into four groups (Table 1), using their birth month as a proxy for random assignment. Each group was presented with a different variation of a hypothetical clinical scenario. The scenario was adapted from the sample medical scenario used by Bornstein et al. (1999), to describe an unsuccessful course of medical treatment that had been previously prescribed by the respondent. Multiple physicians and researchers in the field of medical decision-making reviewed the scenario versions for clarity, accuracy and plausibility

before the launching of the survey. The four versions of the scenario varied based on the type of prior investment made into the treatment (see appendix for complete scenario text). The first version involved an investment of the provider's time in the treatment plan (respondents born in January, May, or September). In the second version, the patient had invested money into the treatment plan (March, July, and November birthdates). The third version included both the provider time and patient money investment (February, June, and October birthdates). In the final scenario, no prior investment was described (April, August and December birthdates).

After reading the scenario, participants were asked three sets of questions within the online questionnaire. First, respondents were asked to make a decision about whether they would recommend continuation of the treatment. Responses were based on a 5-point Likert scale (1=definitely no, 2=probably no, 3=maybe, 4=probably yes, 5=definitely yes).

Respondents were then stratified into two groups based on their responses to the first question. Participants who selected the response of would definitely not or would probably not recommend treatment continuation were grouped as *normative* respondents, since we considered treatment discontinuation to be the normative, optimal response to the scenario in keeping with the sunk-cost principle. Those who did not choose a normative response, and instead were either undecided or recommended treatment continuation, were grouped as *non-normative* respondents. These groupings were not revealed to the participants. Each group was then asked about the reasons for their recommendation. *Normative* respondents were asked to rate their level of agreement with the following two reasons to recommend discontinuation: (1) *pessimism* – “The treatment is not working and is not going to work if given more time,” and (2) *sunk-cost avoidance* – “The time and money invested in this treatment plan are not relevant to my clinical recommendation.” *Non-normative* respondents were asked to rate their level of agreement with

three possible reasons to recommend continuation: (1) *optimism* – “The treatment might still work if given more time,” (2) *sunk-cost* – “There has already been time and money invested in this treatment plan,” and (3) *consistency* – “It is important to be consistent in my recommendations.” Responses to both these questions were rated on a 5-point Likert scale (1=strongly disagree, 2=slightly disagree, 3=neither agree nor disagree, 4=slightly agree, 5=strongly agree). The follow up questions in this section were presented in random order.

The final set of questions pertained to the participant’s demographic information including age, gender, years since completion of training, and profession. Physician respondents were asked to indicate whether they were predominantly primary care providers or specialists. Data from respondents who did not answer a demographic question were excluded only from analysis that utilized responses to that question.

The primary outcome of interest was how respondents’ recommendations varied across groups and therefore across investment types. Additional outcomes of interest included how respondents’ recommendation and reason ratings differed depending on demographic characteristics. All statistical analysis was conducted with $\alpha = 0.5$.

Results

Participants

The sample included 177 males (45.5%), 205 females (52.7%), and 7 respondents who did not indicate a sex (1.8%). Respondents ranged in age from 25 to 82 years old ($M = 45.7$, $SD = 11.1$); 14 respondents (3.6%) did not indicate their age. There were 348 allopathic or osteopathic physicians (266 specialists, 73 primary care providers, 7 positions that did not fit

either category, and 2 who failed to indicate specialty), 18 nurse practitioners, 14 Ph.D.s, 10 physician assistants, 2 licensed clinical social workers, one nurse anesthetist, and one certified nurse midwife (respondents could select more than one profession). Six respondents (1.5%) did not list a profession. The length of time participants had been in their profession ranged from less than one year to 53 years ($M = 14$, $SD = 11$); 14 respondents (3.6%) did not indicate how long it had been since completion of their training.

The characteristics of respondents who provided demographic information were similar to the characteristics of all members of the faculty practice plan (Table 1). Respondents included a slightly higher proportion of physicians compared to the composition of the faculty practice plan ($\chi^2=6.063$, $p= .014$). Among physicians, a lower proportion of respondents were specialists compared to the proportion of specialists in the faculty practice plan overall ($\chi^2=6.063$, $p= .014$). There was no significant difference in mean age ($t(1720) = 0.462$, $p= .64$) or the frequencies of males and females ($\chi^2=1.975$, $p= .16$) in the sample compared to the members of the faculty practice plan. Data for the number of years since completion of training were not available for all members of the faculty practice plan.

<<Table 1 about here>>

Recommendations for Continuation or Discontinuation

Across all scenario groups, the mean response to the question of whether to recommend continuation of treatment fell between 1, “definitely no” and 3, “maybe” (Figure 1). The mean recommendation response varied across the scenario groups ($F(3,385)=5.916$, $p=.001$). Specifically, the mean recommendation response was higher (i.e., more favorable towards

continuation) when respondents received the *no investment* scenario ($M=2.42$) than when the scenario involved investment of patient money ($M=1.98$, $t(186)=2.839$, $p=.005$), provider time ($M=1.88$, $t(198)=3.623$, $p<.001$), or both ($M=1.88$, $t(177)=3.527$, $p=.001$).

<<Figure 1 about here>>

Relationship Between Recommendation and Demographics

Both within each scenario group, and in the sample as a whole, recommendation responses were not significantly associated with respondents' gender, age, professional grouping (physician vs. non-physician), or physicians' specialty (specialist vs. primary care). In addition, there were no significant interaction effects between scenario group and gender, age, professional grouping, or years in practice, or treatment recommendation. However, for respondents who received the *provider time investment* scenario, there was a significant negative correlation between the number of years of practice and the treatment recommendation ($r(102)=-.209$, $p = .033$) demonstrating that when there had been investment of the provider's time, providers in practice longer recommended treatment discontinuation more strongly than providers with fewer years since completion of training. This finding, based on a post-hoc subset analysis, should be interpreted with caution.

Reported Reasons for Recommendations

Respondents in each scenario group who chose the normative response (would not recommend treatment continuation) demonstrated higher levels of agreement with *pessimism* reasoning than *sunk-cost avoidance* ($p<.001$) (Table 2). These high levels of agreement with *pessimism* reasoning did not vary significantly among scenario groups, while agreement with *sunk-cost avoidance* reasoning, in contrast, did vary ($F(294)=20.376$, $p<.001$). Notably, the

provider time investment group tended to agree with *sunk-cost avoidance*, while the other groups tended to disagree, a statistically significant difference ($p<.05$).

<<Table 2 about here>>

Among providers who did not choose the normative response, and instead were either undecided or recommended continued treatment, *optimism* reasoning received the highest level of agreement (Table 3). In all scenario groups, there was significantly higher agreement with *optimism* than with *consistency* ($p<.05$). *Optimism* was also rated more highly than *sunk-cost* in all scenario groups, though this difference was significant ($p<.01$) only in the *provider time investment* and *no investment* groups. Across scenario groups, levels of agreement with *sunk-cost* reasoning varied ($F(88)=4.227, p=.008$). The *provider time investment* group disagreed with *sunk-cost* reasoning, while the two groups that read scenarios involving investment of patient money (with or without investment of provider time) agreed with *sunk-cost* reasoning, a difference which was statistically significant ($p<.05$).

<<Table 3 about here>>

Discussion

In this study, health care providers were asked to make recommendations for or against the continuation of a treatment plan that was not demonstrating efficacy despite being given adequate time to work. Across all scenario groups, providers overwhelmingly tended toward the normative response of not recommending treatment continuation. This encouraging finding suggests that health care providers, in general, are not likely to recommend that patients continue a treatment that is not providing benefit. This is consistent with the findings of Bornstein et al. (1999), who demonstrated that medical residents asked to choose a course of action in a

hypothetical clinical scenario consistently rated switching to a more effective treatment as a more attractive option than continuing an ineffective treatment.

The four scenarios used in this study varied in one way: the description of the previous investment in the treatment plan. If previous investment was irrelevant to a provider's treatment recommendation, we would anticipate no significant difference in recommendations between groups. If, instead, providers were falling prey to the sunk-cost effect, those who read a scenario that described previous investment by the provider, the patient, or both, would be more likely to recommend treatment continuation. In this study, however, it was the providers who read a scenario that did not describe any such previous investment who were most likely to recommend treatment continuation. Therefore, it is apparent that providers in this study failed to exhibit a sunk-cost effect, and in fact displayed a trend in the opposite direction from what would be predicted by the sunk-cost effect. Although this study cannot determine precisely why participants displayed this pattern of responses, the results may represent overcompensation for the sunk-cost effect.

Overcompensation for Sunk-Cost Effect

One possibility is that respondents had either a formal or abstract awareness of the sunk-cost effect and once alerted to the past investment of resources, they consciously or subconsciously attempted to circumvent this bias and make a treatment decision based only on the available clinical evidence. This explanation is consistent with past research that has demonstrated that people who are aware of the sunk-cost effect, whether through formal training in economics or following a brief instruction on the effect, are less likely to make judgments that are consistent with sunk-cost bias (Larrick et al., 1990).

In attempting to avoid irrationality in their decision, however, respondents may have overestimated the impact of the effect on their thinking, and thus overcompensated. This would explain why providers who read the scenario without investment of resources were actually the most likely to recommend the patient continue the treatment: these respondents were not trying to avoid taking past investments into account, as they did not view costs expended solely by the insurer as a prior investment. Studies on correction for cognitive biases have shown that this over-estimation of the magnitude of the bias is not an unlikely possibility. While many people are concerned about the potential for bias in their judgments, people are not accurate at assessing the direction and magnitude of a particular cognitive bias (Wilson & Brekke, 1994).

In addition, evidence of an attempt to avoid the sunk-cost effect is apparent when comparing the responses of providers who read the scenario that included only an investment of their own time with those of respondents whose scenario did not describe a past investment. Among respondents who endorsed the normative response of not recommending treatment continuation, those in the *provider time investment* group reported significantly higher levels of *sunk-cost avoidance* reasoning than members of the *no investment* group. In other words those whose scenario included the investment of their own time agreed that the previous investment was irrelevant to their recommendation. In contrast, those whose scenario described no investment other than a cost to the insurance company were nearly neutral about the relevance of any previous investment, likely because providers do not view the cost to the insurance company as a previous investment in the treatment plan.

Respondents whose scenarios included the investment of patient money (with or without the investment of provider time) likewise appear to have tried to avoid taking prior investments into account, as their recommendations do not differ significantly from the recommendations of

the *provider time investment* group. However, in contrast to the *provider time* group, the respondents in these groups tended to express disagreement that this investment was irrelevant. This data seems, on its face, to be contradictory, as these respondents' hypothetical actions suggest they are trying to avoid taking past investments into account, while their reported reasoning suggests that they found past investments relevant to the decision.

If the recommendations of providers whose scenario included a prior investment reflect a conscious or subconscious attempt to avoid taking prior investments into account, why did respondents in the *provider time investment* group agree that prior investments are irrelevant to the decision at hand, while those who read scenarios involving investment of patient money disagreed? One potential explanation is that participants changed their behavior as a result of being studied. The social desirability bias is a well-studied phenomenon in which participant answers reflect a tendency to respond in ways that the participant views as socially correct or desirable (Fisher, 1993). It is possible that respondents' willingness to agree that prior investments are irrelevant varied across investment types because of a perception that it is socially acceptable, or even desirable, to be unmoved by some types of investments (e.g. their own (provider) time), but not others (e.g. patient money). In particular, past research has demonstrated that health care providers are reluctant to accept that monetary or material incentives affect their behavior and clinical decisions due to their social undesirability in the medical context, yet empirical research consistently demonstrates that they do (Lichter, 2008; Orłowski & Wateska, 1992; Wazana, 2000). Respondents in this study may have been may have reacted with an emotional insistence that they are “above” taking their own investments into account.

Regardless of whether or not providers endorsed sunk-cost avoidance reasoning when asked directly, their recommendations appear to reflect recognition and avoidance of this bias, with resulting overcompensation for its effect. Despite our finding that providers' tendency to recommend continuation of treatment varies based on whether or not resources have been invested in the current plan, within each scenario group, respondents tended to select the normative response of recommending that treatment not be continued, as noted above. However, a surprising proportion of respondents in each group stated that they would probably or definitely recommend that the patient continue the treatment even though the scenario clearly indicated that the treatment was not working. We now turn our attention to a discussion of this finding.

Unrealistic Optimism

When respondents were asked about the reasons for their hypothetical treatment recommendation, across all scenarios, respondents displayed the highest levels of agreement with statements about whether the treatment would or would not be effective if given more time. This indicates that, unsurprisingly, most health care providers in our sample made their recommendation primarily based on their prediction of the treatment's future efficacy (or lack thereof). Overall, 11% of respondents said that they would probably or definitely continue treatment. Of these, more than 88% slightly or strongly agreed that the treatment might still work if given more time. This was an unexpected finding, considering that the scenario was designed to indicate that the treatment was not working and was unlikely to work in the future. Each scenario included the following statement: "*After six weeks, your patient returns to you and tells you that there has been no difference in the symptoms despite taking the drug (which generally takes 2-3 weeks to work).*" Although it is surely the case that different patients respond differently to treatments, and that some patients may take longer to respond to therapy than

others, the patient in the scenario has been using the treatment well past the expected time when results would be seen, with no signs of improvement. This raises two questions: first, why would providers believe that the treatment might start working if given more time? And second, what are the implications of their optimism?

Although our study data cannot provide the answers to the first question, we can speculate on some potential causes. Prior research has shown that health care providers struggle to make accurate clinical predictions. Providers have been demonstrated to inaccurately predict length of survival, patient adherence to treatment plans, and treatment efficacy (e.g. Christakis & Lamont, 2000; Graz et al., 2005; Lee et al., 2001; Phillips et al., 2011). In some cases, providers have been found to be overly optimistic in their clinical predictions. For instance, Christakis & Lamont (2000) found that on average, physicians overestimated length of survival in terminally ill patients by a factor of 5.3. Graz et al. (2005) found that physicians significantly overestimated the efficacy of surgery for back pain, with 59% of patients for whom physicians had predicted “a great deal of improvement” reporting no improvement in their symptoms one year post-operatively. Clearly health care providers are not always successful at making accurate clinical predictions and some may simply have an innate tendency to be optimistic, both of which are reflected in the current study by the belief among some respondents that the treatment would become effective in the future.

In addition, for some respondents, an overall tendency towards optimism may have been reinforced by application of the availability heuristic, when decision-makers subconsciously equate the ease of remembrance of an outcome with its likelihood of occurrence. This heuristic has been shown to influence real and hypothetical treatment decisions of patients and providers (e.g. Dale et al., 2006; Ubel et al., 2001; Xu et al., 2011). It is possible that the providers in this

study who chose to recommend treatment continuation may have had a recent or memorable experience in which a patient responded to treatment long after a response would have been anticipated to occur, and this experience may have affected their assessment of the likelihood that this treatment would become effective.

One final reason why some providers felt that the treatment might start working could be due to a lack of information or clarity provided in the brief scenarios. Perhaps fewer providers would have expressed optimism about the future efficacy of the treatment if it were stated more directly that the treatment was not likely to work in the future, perhaps with a statement such as, “In clinical trials, fewer than one percent of patients began to show a response after six weeks of treatment.” Yet in reality, this level of information is often unavailable to providers, and in many cases providers have to make decisions about whether to continue treatment based on an average response time or the average improvement seen at a single time point. For example, the prescribing information for Lipitor, one of the most prescribed medications in the United States (IMS, 2011), gives physicians the following guidance about how long it usually takes for improvements in cholesterol to become apparent: “Therapeutic response is seen within 2 weeks, and maximum response is usually achieved within 4 weeks and maintained during chronic therapy” (Pfizer, 2009, p. 18). Unfortunately, as in our scenario, no information is provided about how often it takes substantially longer than this for results to be seen. While this lack of specific guidance may allow room for optimism about the potential for response to occur well after this time period, this optimism is not evidence-based.

The implications of this unrealistic optimism are far-reaching. Providers who have a tendency to believe that a treatment will be efficacious despite evidence to the contrary, and act on this belief when making decisions about particular treatment recommendations, have the

potential to cause harm to patients. In particular, continuation of a treatment that is not effective exposes the patient to several risks, including direct short-term and long-term adverse effects of treatment, emotional distress, delayed initiation of potentially more effective treatment, and possibly delayed correction of an incorrect diagnosis. In addition to these concerns, patients will likely have to expend time, effort, and possibly financial resources to adhere to a treatment regimen that is not providing benefit.

In addition to the risks posed to the individual patient, the finding that a small but significant number of providers in this study would continue treatment that has not been effective has ramifications for the health care system as a whole. The costs of providing this treatment may be small on an individual basis, but quite substantial in aggregate. There may also be costs associated with treatment of side effects or an increased number of follow-up visits as patients spend a longer period of time determining the appropriate treatment. In a time when health care spending is increasingly under scrutiny, it is imperative that we look for ways to address instances of unrealistic optimism affecting treatment recommendations.

Limitations

While the current study provides insight into the role of the sunk-cost effect in medical treatment decisions and raises questions about unrealistic optimism among some health care providers, it is important to note several limitations of this study. First, this study only tested respondents on a single version of one specific scenario. In contrast, a previous study of the sunk-cost effect in medical decisions (Bornstein et al., 1999) provided each participant with multiple versions of a scenario to determine how responses varied based on the level of investment described in the scenario. While this method does have the advantage of showing how a single individual's responses to a scenario can vary from investment to investment, it has

the disadvantage of making the aim of the study highly apparent to the participant, which is likely to affect the results. When it is clear to a participant that the survey is trying to determine whether one's medical recommendation is affected by previous investment in a treatment plan, the recognition of that fact might reduce the impact of sunk-cost bias, or further increase the overcompensation for the effect that was seen in this study. As a result, it is possible that if we had provided all participants with all four versions of the scenario, our results may have been different.

Further, although physicians reviewed our scenario for authenticity and clarity, it is possible that this scenario was not representative of a common clinical decision facing some or many of the survey respondents. In particular, five respondents held clinical positions that do not have prescribing privileges (3 with Ph.D. degrees only, and 2 clinical social workers), however results on our main outcome measure did not change when these providers were excluded (analysis not shown). This study was unable to assess whether providers' avoidance of the sunk-cost effect extends to decisions outside of medication recommendations. Future research could include a variety of scenarios to determine if the results found in this study are consistent across several examples of clinical and non-clinical decisions. A second limitation of this study is that participants' response to the scenario given in the survey may not be reflective of their behavior when faced with a similar situation in practice. Although it is difficult to construct an experimental model to measure the sunk-cost effect in medical treatment decisions, observational studies could be a useful adjunct to future research in this area.

Our evaluation of providers' reasoning is limited by the close-ended nature of the available responses. It is likely that reasons for any particular clinical decision are more complex than the information captured in our study. For example, providers may have felt more

responsibility to “make things right” and change from a failed course when an investment had been made. Alternately, respondents whose scenarios included details about prior investments and were therefore slightly longer, may have been more or less engaged and this may have affected their responses. There is limited data to suggest that the length of survey questions may affect results (Kalton & Schuman, 1982). Further research using in-depth, open-ended questioning may provide additional insight. The sample used for this study also comes with limitations. The providers surveyed are all affiliated with a single academic institution in the United States. It is possible that results obtained from this population are not generalizable to providers in other practice types or in other countries. While studies have found evidence of the sunk-cost effect influencing non-medical decision-making in many countries (Keil et al., 1994; Keil et al., 2000), there is also evidence that the strength of the effect might vary across cultures (Chow et al., 1997; Keil et al., 1994). In order to better understand the effect of culture on the sunk-cost effect in the context of clinical decision-making, more research is needed.

A further limitation of our study is that the response rate to our survey was 29% and it is unknown whether the responses of non-participants would have differed from those of participants. In addition, respondents included a slightly higher proportion of physicians, particularly specialists, compared to the population we invited to participate. It seems unlikely that these demographic differences affected our results, as in our analysis respondent profession (physician vs. non-physician) and specialty (primary care vs. specialist) were not correlated with treatment recommendation.

Conclusions

Overall, the study found that regardless of the investment described in the scenario, providers overwhelmingly chose the rational, normative response of recommending discontinuation of the ineffective treatment. In addition, respondents did not demonstrate a sunk-cost effect when making this clinical decision across a wide variety of investments including provider time, patient money, or both. This reassuring finding is consistent with the only previous study of this topic (Bornstein et al., 1999). Our study provides further insight in demonstrating that not only do providers not display a tendency to continue a course of treatment due to previous investment in that plan, they in fact actively try to avoid doing so. Further research is necessary both to confirm this finding, and to further delineate the extent and implications of this overcompensation.

In addition, this research highlights the substantial levels of unrealistic optimism found among health care providers. Although optimism may be a desirable characteristic among health care providers, and is likely beneficial to many aspects of patient care, unrealistic or misplaced optimism has the potential to result in harm to patients and costs to society. As comparative effectiveness research continues to play an increasing part in guiding medical practice, developing methods to quell unrealistic optimism may become increasingly necessary.

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Appendix: Sample scenario text

Your patient has osteoarthritis and as a result suffers from mild but persistent daily knee pain. You have tried several drugs to control the pain, but they have not been effective. There is a new drug that was recently approved that you think would help your patient, but it is not on the list of drugs covered by your patient's formulary. You decide to call the insurance company to get approval. After you spend two hours on the phone with the pharmacy benefits manager, you are informed that your patient will have to cover the total costs of the drug. You tell your patient this and she decides to purchase the drug anyway. She purchases a 90 day supply for \$600. After six weeks, your patient returns to you and tells you that she has not had any side effects, but can't tell any difference in her symptoms despite taking the drug. The drug generally takes 2 to 3 weeks to work.

The above is the scenario read by the *both investments* group. In the *provider time investment* scenario, the insurance company agrees to cover the full cost of the drug and the patient receives the same 90-day supply with no out-of-pocket cost. In the *patient money investment* scenario, the patient purchases the medication for the same \$600 without a phone call from the provider to the insurer. In the *no investment* scenario, the medication is fully covered by the insurer and there is no provider phone call or cost to the patient.

Table 1
Demographic characteristics of sample and scenario groups

	All Faculty Practice Plan	All Respondents	Scenario Investment Type			
			No investment	Provider time	Patient money	B inves
Physicians, %	84.5	89.5	84.6	92.7	92.8	8
Primary care, %	15.6	21.0	20.8	20.8	17.8	2
Specialists, %	84.4	76.4	74.0	77.2	81.8	7
Non-Physicians, %	15.5	10.5	15.4	7.3	7.2	1
Female, %	49.6	52.7	44.0	48.6	51.5	6
Male, %	50.4	45.5	52.7	50.5	47.4	3
Age, M (SD)	46.0 (11.6)	45.7 (11.1)	45.5 (11.4)	45.2 (10.8)	47.3 (11.5)	45.0
Years since training, M (SD)	--	14.4 (11.0)	13.7 (11.5)	14.7 (10.6)	15.5 (11.6)	13.5
Total <i>n</i>	1347	389	91	109	97	

Table 2

Mean levels of agreement with reasons for treatment discontinuation, normative respondents

Scenario Investment Type	<i>Pessimism</i>	<i>Sunk-Cost Avoidance</i>	<i>p</i>
	<i>1 = strongly disagree, 5 = strongly agree</i>		
<i>No investment, n = 57</i>	4.23	2.93	<.001
<i>Provider time, n = 89</i>	4.44	3.58	<.001
<i>Patient money, n = 73</i>	3.99	2.07	<.001
<i>Both investments, n = 76</i>	4.17	2.26	<.001
	<i>p = .082</i>	<i>p = <.001</i>	

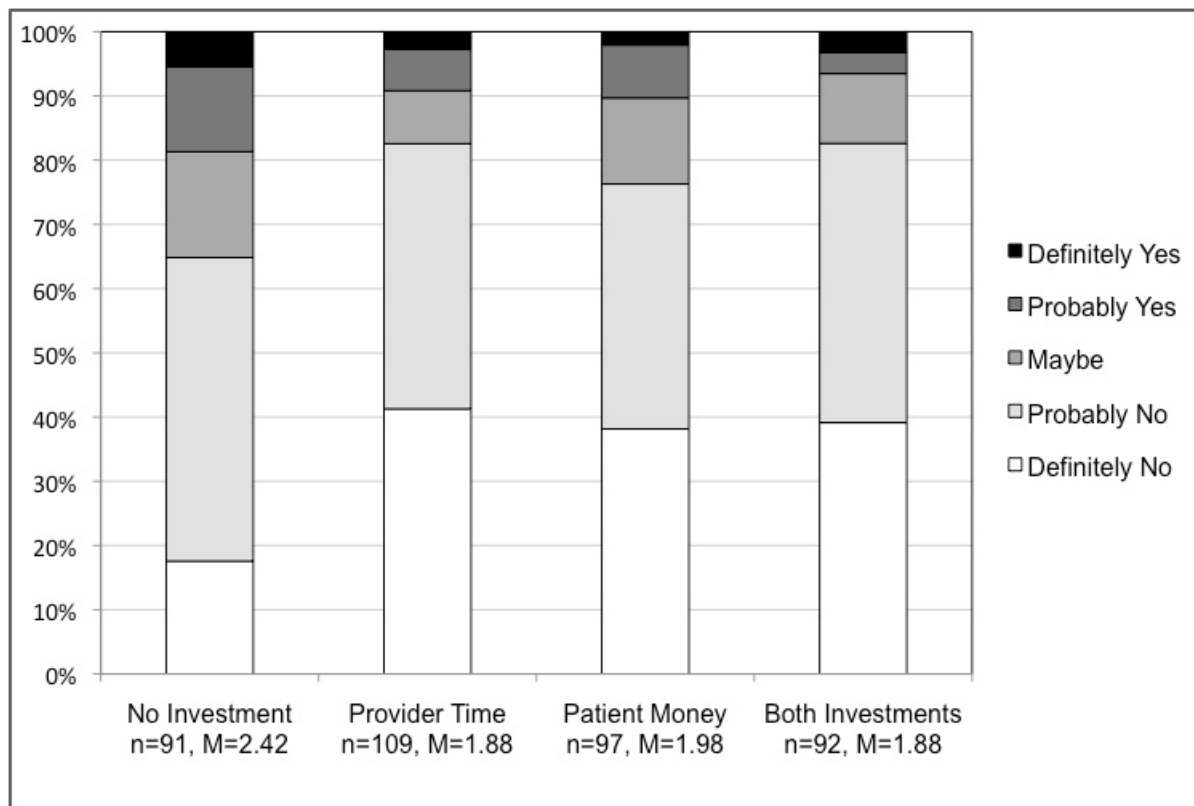
Table 3

Mean levels of agreement with reasons for treatment continuation, non-normative respondents

Scenario Investment Type	Optimism (a)	Sunk-Cost (b)	Consistency (c)	p
	<i>1 = strongly disagree, 5 = strongly agree</i>			
<i>No investment, n = 32</i>	3.88	3.00	2.94	<i>a-b: < .01 a-c: < .01 b-c: .823</i>
<i>Provider time, n = 19</i>	4.16	2.63	2.42	<i>a-b: < .01 a-c: < .001 b-c: .429</i>
<i>Patient money, n = 23</i>	3.87	3.57	2.61	<i>a-b: .110 a-c: < .001 b-c: < .01</i>
<i>Both investments, n = 15</i>	4.00	3.80	3.20	<i>a-b: .486 a-c: < .01 b-c: .156</i>
	<i>p = .593</i>	<i>p < .01</i>	<i>p = .183</i>	

Figure 1

Distribution of recommendations to continue treatment, by scenario group



ACCEPTED

- U.S. Clinicians did not demonstrate a sunk-cost effect when making a hypothetical clinical decision.
- Instead, clinicians demonstrated active avoidance and overcorrection for sunk-cost effects.
- Absence of sunk-cost effect held regardless of type of prior investment or provider demographic characteristics.
- A surprising number of clinicians would recommend a patient continue treatment that is ineffective.
- Recommendation for continuation of ineffective treatment reflected unrealistic optimism about future treatment efficacy.