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VALUE IN HEALTH

The Bias Against New Innovations in Health Care: Value Uncertainty and Willingness to Pay

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ABSTRACT

This paper offers a model for the bias found in willingness-to-pay valuations against new treatments. For example, this bias provides an explanation for patient preferences that make it difficult for formularies to take treatments off their lists, even when newer treatments would appear to be clearly preferable. The appeal of the model, which is based on imperfect information, is that it is consistent with rational preferences and rational behavior by patients, which are necessary for standard models and methods related to decision theory, cost-effectiveness, and efficiency.

Keywords: health, information, innovation, valuation, willingness to pay.

Introduction

Economic evaluation, typically using patient valuations for health services, is widely used by both industry and government during the process of planning and introducing new treatments. Willingness-to-pay (WTP) valuations are advocated as a means of helping decide about new investments because they lend themselves to standard cost-benefit calculations. A perceived problem with WTP methodology in the health context is a bias against new treatments, which was recently described in terms of WTP for a new form of colon cancer screening in a study by Salkeld et al. [1], who found that holding everything else constant, patients significantly preferred the existing screen to a new type of screen. Strong preferences for the status quo screen imply high marginal valuations of that screen relative to the valuations of the new type of screen. This finding has far-reaching implications for the valuation of health-services innovations.

The bias described by Salkeld et al. [1] is directly related to patients' stating far higher willingness-to-accept (WTA) valuations (i.e., how much they would have to be paid to give up an existing screen or other treatment) than WTP valuations (how much they would pay for a new screen or treatment). Under the usual assumption of declining marginal utility, one would expect WTA to exceed WTP by a modest amount, because giving up a small amount of something would be expected to lower utility by more, relative to some initial quantity, than utility would rise by adding that same small amount. Hence, differences between WTA and WTP could be interpreted in terms of income effects on the individual's preference structure. The theory underlying the measurement of WTA and WTP, as well as practical issues in designing measurement schemes, viewed in terms of the standard theory, is discussed thoroughly by Mitchell and Carson [2]. However, the discrepancy between WTA and WTP has been seen to be very large (often WTA is four times larger than WTP) in many experimental economics and valuation studies in various contexts [3]. In the health context, this suggests that patients would be very unlikely to accept new procedures vis-à-vis established procedures. Also, Hanemann [4] has pointed out that where the good in question has no good substitutes, income effects could be magnified, causing WTP and WTA valuations to differ dramatically even under conventional assumptions. Our concern here focuses on cases where alternative treatments are good substitutes, in which context Hanemann's explanation does not apply. Experiments show that subjects can exhibit large disparities between WTP and WTA even in such cases.

Various behavioral hypotheses have been advanced to explain the general discrepancy

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between WTA and WTP [1,3], including the endowment effect [5], models of regret [6], and models of loss aversion [7]. The endowment model posits that when people own something they automatically place an additional value on the item, so that once something is owned people value it higher than they would be willing to pay to buy it. It is as if individuals are not able to foresee the value of ownership at the time of the purchase decision but experience the value once they own the item. The regret model is built on the notion that people do not want to make decisions that could cause them to experience regret. Hence, people tend to stick to the status quo to avoid a chance of feeling regret. The important point is that staying with the status quo is not viewed as an active decision, and therefore, even a bad outcome associated with the status quo does not produce regret. Loss aversion is the notion that people value losses more than gains, where losses and gains are defined in terms of a particular reference point. Since the status quo defines the reference point, the potential gains offered by an alternative treatment are valued relatively little, whereas potential losses are heavily valued.

All of these models are consistent with the observed bias; however, they are not based on rational expected-utility decision making and are inconsistent with even the most basic properties of preferences: completeness, transitivity, and independence of irrelevant alternatives. An easy way to see this is to note that in all these models the end result is valued differently depending on the process or the order of decisions that are made. For example, if an individual is initially presented with object A and then later given the option of trading it for object B, many more individuals will choose to keep object A than would choose to trade for object A if they had been given object B originally. Insofar as decisions are governed by these rules, it is impossible to relate them to underlying stable preferences. Individuals do not make decisions that focus on obtaining preferred outcomes, so choices cannot be used to infer which outcomes would make them "better off." The purpose of this paper is to draw attention to a simple but general model of behavior that is consistent with rational preferences and that accounts for the large differences in magnitude of WTA values relative to WTP values. The model illustrates how informational uncertainty and signals, combined with rational preferences, affect WTP versus WTA valuations. In the context of health valuation involving WTP measures, this model predicts a bias against new treatments such as the one documented by Salkeld et al. [1]. In the model, patients create this bias by responding rationally to informational signals from their environments. Note that our model is consistent with Bayesian decision making, although we have not focused on the formal derivations of that model. For applications of Bayesian tools to health decisions, see the recent special issue of the *International Journal of Technology and Assessment in Health Care* [8]. Nevertheless, our approach differs from these in that we are applying these tools to understanding observed decisions rather than as a proscriptive specification.

Model

The model relies on the idea of incomplete knowledge, which we refer to here as value uncertainty. There are a number of sources of value uncertainty. Within health services, the uncertainty typically derives from an inability to judge how valuable the object will be in actual use. Uncertainty is a particularly important feature for goods that incorporate stochastic elements, which is often the case in health services, and where consumption does not imply direct knowledge of all relevant outcomes. Judgment of outcomes in health care is often made even more difficult by the fact that benefits may accrue over an extended period in an uncertain future and may themselves be highly abstract.

Even in the case of more concrete goods in health services such as crutches or bandages, an important source of uncertainty is the lack of knowledge about the cost of an acceptable substitute—including the difficulty of locating it. For such goods, we need not assume that the underlying preferences are unknown, but merely that the rational valuation at a particular point in time is tied to unknown market prices.

Incorporating the notion of value uncertainty, a basic illustrative form of a rational model that explains the WTA-WTP discrepancy is as follows. Patients are taken to be utility maximizers, where utility for patient i has the form $Y_i + v_i^* \delta_i$, where $\delta = 1$ if the subject keeps or obtains a treatment or service, $\delta = 0$ otherwise. Y_i is the dollar expenditure on other goods; and v_i^* is the true value of the treatment/service for subject i. If patient i were a price taker in a free market for the treatment/service with knowledge of the true value v_i^*, he or she would choose to purchase or retain the treatment/service so long as $v_i^* > p$, where p is the treatment's price or opportunity cost, and would choose not to purchase it if $v_i^* < p$.

Value uncertainty enters specifically as the assumption that the individual does not observe v_i^* but does observe an error-prone signal of the object's value, $v_i = v_i^* + e_i$, where e_i is the realization of a random variable, e, with mean zero. We may interpret v_i as an index capturing directly observable object characteristics that are associated with its value, albeit imperfectly. Intuitively, the variance (e) can be taken as an indicator of value uncertainty in the sense that if var(e) = 0, there is no value uncertainty, and $v_i = v_i^*$. As var(e) grows, value uncertainty increases, and the observed signal is a progressively poorer measure of the object's actual value. Note that with value certainty, there will be no WTA-WTP gap predicted by the model.

Given whatever information gave rise to an initial v_i, the patient's estimate of value v_i^* can be written $E(v_i^* \mid v_i)$. When an individual has experience within the health-care arena, additional information becomes available. In the context of a WTP valuation of a new treatment, the new treatment has not been incorporated in the patient's setting, which informs the patient that others in the same setting (e.g., physicians or other patients) currently value it less than the current treatment. Conversely, treatments currently in use imply that others value them above alternative treatments. The model in this situation is similar to the notion of "what is must be best," echoing the findings and discussion in Porter and Macintyre [9]. Note, however, that the model is not couched in terms of patients experiencing something and then automatically valuing it more highly than something they have not experienced. Rather, patients incorporate "signals" based on observed choices of their physician and/or other patients into their expected valuations. After incorporating these signals they behave according to standard rational preference theory.

Returning to the formal model, if the individual has knowledge only of v_i, the expected value of the object is $E(v_i^* \mid v_i)$. Designate U as an indicator that the treatment is already in use by others and NU is an indicator that it is not currently in use. We can write the expected value for the treatment in use that has characteristics indexed by v_i as $E(v_i^* \mid v_i, U)$ and the value of a new treatment with the same observable characteristics as $E(v_i^* \mid v_i, NU)$. It follows that

$$(1) \quad E(v_i^* \mid v_i, NU) \leq E(v_i^* \mid v_i) \leq E(v_i^* \mid v_i, U)$$

with strict inequality holding when var(e) > 0, and with the difference increasing with var(e). Again, the basic intuition is that patients gain information from observed choices by others. Equation 1 says that a treatment's expected value is higher (relative to a baseline of no knowledge) if one knows that many other people use, or have used, the treatment and lower if one knows that others do not use the treatment. Of course, the magnitude of the impact of value uncertainty on WTP-WTA discrepancies in general will depend on various factors, including the particular institutional structure in which an individual is acting. However, an important prediction from the model in any setting is that greater uncertainty regarding the new treatment will lead to a greater bias against the new treatment versus a known status quo. This prediction is not found in previous theories regarding discrepancies in WTA and WTP. Also, this prediction is consistent with results found in Salkeld et al. [1], given that the proposed new cancer screen involved considerable uncertainty to the patient.

The model provides several testable predictions. Patients respond to information signals in forming valuations, and we posit that current use of the treatment is an important source of information. The theory implies that as other information becomes more available, patients will rely less on this source, so the gap between WTP and WTA will decline. Such a result could be confirmed by random assignment of subjects to groups receiving various levels of information about existing and new treatments. Randomized treatment descriptions would allow analysis of the extent to which valuations of new and current treatments depend on information. Similarly, riskier treatments will display greater levels of value uncertainty, and so the gap between WTP and WTA will be greater. Again, the pattern of choices between treatments described as new and current, where uncertainty for both treatments is varied, provides a test of the model.

Supportive evidence from tests of a general form of this model using ordinary goods in an experimental WTP study can be found in Mueser [10]. It was found that as experimental subjects received more information about an object, the variation in their valuations decline—implying lower value uncertainty—as does the gap between WTP and WTA for the objects.

Discussion

There are two important issues to note. First, our model does not offer different predictions in terms of the direction of WTP bias as compared to the competing explanations discussed above (the endowment effect, regret, and loss aversion). Those explanations may still be helpful and appropriate in specific contexts. Nevertheless, the model presented here helps to explain the discrepancy between WTA and WTP using a framework derived from conventional individual optimization. This means that the assumption of rational decision making, in conjunction with a recognition of the informational structures that individuals face, can be useful in predicting these kinds of behaviors. Equally important, the framework here may help in the design of methods to elicit underlying patient preferences regarding treatment options.

Second, understanding the impact of information and signals in general, as well as the decision to invest in information by patients and provide information by physicians and companies promoting treatments, are important areas for research. Although beyond the scope of this discussion, the rational framework presented here can be incorporated and expanded to address these broader concerns. It is clear that issues surrounding information and uncertainty will continue to play a key role in understanding health-care markets and in making decisions about care. It is imperative that we continue to improve our understanding of behavior and valuation in the context of uncertainty as the health-care arena continues to strive for optimal care at a reasonable cost.

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