Published in final edited form as:

Med Decis Making. 2018 July ; 38(5): 584–592. doi:10.1177/0272989X18773718.

The Effect of Total Cost Information on Consumer Treatment Decisions: An Experimental Survey

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Abstract

Background—Unrestrained use of expensive, high-risk interventions runs counter to the idea of a limited medical commons.

Objective—To examine the effect of displaying the total first-year cost of implanting a left ventricular assist device (LVAD) on a hypothetical treatment decision and whether this effect differs when choosing for oneself versus for another person.

Design—We conducted an online survey in February 2016. The survey described the clinical course of end-stage heart failure and the risks and benefits of an LVAD. Participants were randomized to one of four scenarios, which varied by patient identity (oneself versus another person) and description of total cost.

Measurements—Acceptance of LVAD implantation. Reasoning and attitudes were secondarily explored.

Results—We received 1,211 valid responses. The mean age was 38.3 years (± 12.8); 53.5% were female and 84.4% white. Participants were more likely to accept an LVAD when shown the total cost (66.2% v. 58.0%, $p=0.003$) or when choosing for another (68.0 % vs. 56.4%, $p<0.001$). Open-

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Conflict of Interests

Kwon: None reported.

Allen: Dr. Allen receives consultancy fees from Novartis and Janssen.

Scherer: None reported.

Thompson: None reported.

Abdel-Maksoud: None reported.

McIlvennan: None reported.

Matlock: None reported.

ended responses indicated that acceptors wanted to extend survival while decliners feared poor quality of life with LVAD therapy. Acceptors and decliners agreed that consumers can help lower the cost of health care, but decliners were more likely to consider cost when making health care decisions ($p < 0.001$).

Limitations—Limitations include the use of a hypothetical scenario; the use of paid participants; and differences between the respondents and the typical patient facing an LVAD decision.

Conclusions—In this sample, being shown the total cost increased the likelihood of accepting an expensive, high-risk treatment. The results question how well consumers understand the relationship between expensive treatments and the commons.

Introduction

In 1968, biology professor Garrett Hardin popularized the idea that societal resources (“the commons”) are finite and are inevitably ruined by the rational short-term decisions of individuals.¹ A few years later, physician and researcher Howard H. Hiatt applied this idea to health care. Holding up the recently introduced coronary artery bypass graft (CABG), Hiatt warned that “...we risk reaching a point where marginal gains to individuals threaten the welfare of the whole.”²

Whether or not we have reached that point is a critical question in health care today. A CABG in Hiatt’s time cost approximately \$11,000, or \$57,000 in 2016 dollars—a large figure, but one that is hardly noteworthy in this current era of tyrosine kinase inhibitors (more than \$100,000 per year), kidney transplants (about \$330,000), and, most recent, left-ventricular assist devices (\$200,000 to \$550,000 in the first year).^{3–17} While these interventions provide large benefits, their costs produce significant concern, since higher costs are ultimately passed on to society.^{18–19}

Whether consumers understand this connection or modify their decisions based on it is often questioned. Some studies have found that at least a sizeable minority do consider how their choices impact the nation’s health care costs. In a poll of 1,974 consumers, 53% of respondents agreed that consumers “could help make health care more affordable if they tried,” and 20% felt consumers/patients had the best chance of reducing the cost of health care—on a par with insurance companies.²⁰ Patients facing treatment decisions respond similarly: One study of 256 oncology patients found that 26% agreed that doctors should consider the country’s health care costs in their treatment recommendations.²¹

To better characterize the attitudes of consumers toward the commons, we designed a study to investigate how total cost information affects consumers’ hypothetical health-care decision-making. We used the diagnosis of heart failure and the decision to implant a left-ventricular assist device (LVAD) as the scenario because it represents an intervention with tremendous benefit but at high cost and significant risk. Since total costs represent a societal burden, we also sought information on whether consumers believe unrelated strangers should accept an LVAD. Finally, because of the lack of research in this area, we explored whether sociodemographic factors and attitudes affect treatment choice.

Methods

Design

We designed a survey, using LVAD implantation as the hypothetical scenario, to test the hypotheses: 1) showing consumers the total cost of an expensive, high-intensity treatment would decrease the likelihood of choosing the treatment, and 2) one would be less likely to choose the treatment for another person than for oneself. This project was approved by the Colorado Institutional Review Board (protocol#15-2172).

Recruitment

Participants were recruited through Amazon Mechanical Turk (MTurk), an online platform through which registered workers complete tasks in return for small payments. We limited our population to MTurk workers 18 years or older, located within the United States, and with a work approval rating of 98% or higher. Based on author experience and the results of a 70-person pilot survey, we targeted an effect size of 10%. A power calculation demonstrated that we would need a sample of 1,211 people to achieve 80.1% power to detect a difference of 10% between any two scenarios (two-tailed $\alpha = 0.05$). We estimated that the survey would take three to five minutes to complete, and therefore paid each participant \$0.70 to match an hourly wage at or above the 2016 Colorado minimum of \$8.31.²²

Survey instrument

Experimental conditions

Using text that had previously been shown to differentiate between participants,²³ we developed a hypothetical scenario that described end-stage heart failure and the option to have an LVAD implanted. The scenario varied by patient identity—oneself (“Self”) or another person (“Other”)—and display of total cost. We provided the probabilities of one-year survival with and without the LVAD, described the surgery, and explained the risks and benefits. Participants randomized to the cost scenarios also saw this text: “The cost of this treatment for the first year is about \$300,000. Assume you have insurance that will cover almost all the cost.” To test the clarity and performance of the scenarios prior to the study, we performed cognitive interviewing with two volunteers not associated with the health-care industry and conducted a 70-person pilot through MTurk. See Supplement 1 for the full survey instrument.

The survey software randomized participants to one of four scenarios: 1) participant offered an LVAD without cost information (Self); 2) participant offered an LVAD with cost information (Self-Cost); 3) participant deciding on LVAD therapy for another person without cost information (Other); and 4) participant deciding on LVAD therapy for another person with cost information (Other-Cost). After reading the scenario, participants were asked either “Should you get the treatment?” (Self) or “Should this person get the treatment?” (Other). They responded using a six-point Likert-type anchor ranging from “Definitely not” to “Definitely,” then explained their decision in free text. Subsequently, participants were shown a series of statements about health care and asked to what extent they agreed or

disagreed, and completed the Subjective Numeracy Scale-3 (SNS-3), a validated estimate of a person's facility with numerical data.²⁴ Respondents answered demographic questions and rated their health status using a validated single-item question taken from the Behavioral Risk Factor Surveillance System.²⁵

Two attention checks were used during the survey (Supplement 1). Participants were required to acknowledge a warning that the survey used attention checks; such warnings have been shown to increase attention by 12%.²⁶ Those who failed either attention check or completed the survey in less than 90 seconds were excluded.

Outcome measures and covariates

The primary outcome was treatment decision. The primary explanatory variables were Cost (Cost vs. No Cost) and Identity (Self or Other). Covariates were chosen *a priori*, based on the authors' experience, cognitive interviewing, and a review of the literature on health-care decision-making. They included age, sex, race, ethnicity, marital status, children, self-reported health status, and markers of socioeconomic status (insurance status, education, and home ownership).²⁷ SNS-3 was included due to concerns that respondents who did not understand the risk information in the scenario would choose differently.

Analysis

Characteristics of the sample were described using means and standard deviations for continuous variables and frequencies for categorical variables. Associations between characteristics and treatment choice were first assessed using *t*-tests, chi-square tests, and the Wilcoxon rank-sum test. We used logistic regression to test the effects of our primary explanatory variables (Cost and Identity) and possible interaction between them. The result of these tests became our base model. Because of the lack of literature addressing our research question, we then used the purposeful selection strategy described by Bursac et al²⁸ to fit an exploratory multiple logistic regression model. Covariates achieving a significance of $p \leq 0.15$ using chi-square or *t*-tests were retained and tested within the regression model.

The free-text response to the question "Why did you make the choice you did?" was coded inductively. Two authors (DDM and RK), blinded to the outcome, each reviewed the same random sample of 20 comments and identified themes. Themes were compared until a consensus was reached. Eight major themes were created, and one major theme was recorded for each participant. RK coded the remaining participant comments. DDM reviewed all coding and DDM and RK discussed and reached a consensus for comments. Frequencies were calculated by outcome.

Except where noted, significance was set to an α of 0.05. All analyses were performed using SAS University Edition 3.4 (SAS Institute Inc., Cary, NC).

Results

Sample

We conducted the survey in February 2016 and received 1,449 responses. Because MTurk workers choose which tasks to pursue (in contrast to receiving an invitation), response rate

was not calculable. We removed 238 responses for non-completion, missing either attention check, or completing the survey in less than 90 seconds, leaving 1,211 usable responses (Figure 1). The mean time to completion was approximately six minutes. The attrition rate was 16.4%.

Participants were mostly white (84.4%), and 53.5% were female (Table 1). The mean age was 38.3 years (± 12.8). Most participants had health insurance (84.3%) and rated their health as good, very good, or excellent (84.4%). Of the 1,211 participants, 607 (50.1%) were in the Cost scenario and 614 (50.7%) were in the Self scenario. Excluded participants were more likely to be of Hispanic ethnicity (27.9% versus 13.2%; $p=0.000$) or multiracial (30.0% versus 13.7%; $p=0.014$) but were otherwise not different from analyzed participants.

Primary outcomes

Overall, 62% chose the treatment. Of all those exposed to Cost (whether in the Self or Other scenarios), 66.2% chose LVAD therapy, versus 58.0% of those not exposed to Cost (OR 1.42, $p=0.003$). Of all those asked to choose for another person, 68.0% chose LVAD therapy, versus 56.4% of those choosing for themselves (OR 1.65, $p<0.001$). We found no evidence of interaction between the Cost/No Cost scenario and Self/Other scenario using graphical or logistic regression tests (OR 1.02, $p=0.925$).

The probability of responding “Yes” to LVAD therapy varied significantly across the four scenarios ($p<0.001$), ranging from 52.6% in the Self scenario to 71.5% in the Other-Cost scenario (Figure 2). Compared with those in the Self scenario, participants in the Self-Cost scenario had 1.38 times higher odds of agreeing to the treatment, although this was of borderline significance (95% CI 1.00, 1.90). As compared with those in the Self scenario, those in the Other scenario had 1.60 times higher odds of choosing the treatment than those in the Self scenario (95% CI 1.16, 2.23), and those in the Other-Cost scenario had 2.26 times higher odds of choosing the treatment (95% CI 1.63, 3.14); these were significant (Table 2).

Predictors of accepting the treatment

Of the covariates tested through multiple logistic regression, only female sex made a significant difference in choice. Being female increased the odds of choosing an LVAD by 1.28 versus being male (95% CI 1.02, 1.62; $p=0.037$). Age over 35 years and poor self-rated health status did not predict acceptance of an LVAD (Supplement 2).

Reasons why people chose or rejected an LVAD

The reasons participants gave for their treatment choice differed depending on whether or not they accepted an LVAD (Table 3). Of those accepting an LVAD, 51.6% felt that life should be prolonged as much as possible. By contrast, of those declining the treatment, 56.9% were concerned about quality of life after the surgery. Acceptors were less sure of their choice than decliners, with 16.9% of acceptors indicating they needed more time or information versus 3.7% of decliners. Both groups described weighing the risks and benefits; this process was a major theme for 25.2% of acceptors versus 31.6% of decliners.

Attitudes of people who accepted or declined an LVAD

For five of the seven health-care attitude statements tested, participants who chose the treatment differed significantly from those who rejected the treatment (Table 4). Acceptors were more likely to agree with statements indicating a disregard for cost, such as “I don’t consider cost when I make a decision about my health” (acceptors, 30.1%; decliners, 18.8%; $p<0.001$) and “As long as I have insurance, it doesn’t matter how much a treatment costs” (acceptors, 42.8%; decliners, 30.9%; $p<0.001$). The two groups did not differ with respect to “The cost of health care is one of the biggest problems facing this country,” ($p=0.640$) or “Consumers can help lower the cost of health care” ($p=0.483$).

Discussion

We hypothesized that consumers would be less likely to choose an expensive, high-risk intervention when they are shown the total cost to the commons. Instead, we found that exposure to cost increased the odds of choosing the treatment. We also hypothesized that consumers would, as Hardin’s essay predicted, be less likely to choose such an intervention for strangers than for themselves. Instead, we found that the odds of choosing the treatment were higher when choosing for another than when choosing for oneself. The two effects were additive, and the likelihood of choosing the treatment for someone else when the cost was known was higher than choosing the treatment for oneself when the cost was hidden.

The result that participants were more likely to accept the treatment when seeing the total cost of the LVAD for one year (\$300,000) could have several possible explanations. One possibility is that when participants did not know the cost, they may have feared their out-of-pocket expense would be high, since we did not tell those in the No Cost scenario that insurance would pay for almost all the cost. This is not supported by the free-text comments, however, as only 3.3% (15 participants) of those in the No Cost scenario mentioned concerns about a high financial burden. (See Supplement 3 for an additional analysis of the data excluding these participants.) Moreover, we found no statistical interaction between exposure to cost and insurance status.

Another possibility is that participants in the Cost scenario were in fact deliberately raiding the commons, since the direct cost in this experiment was to be borne by the insurer. This explanation is not without support. For example, in their interviews with 211 focus group participants, Sommers et al found that many consumers felt that their payment of premiums obviated the need to consider health-care costs. One person stated that “...we’re all against [our insurance]. So there, I’d go with the most expensive [treatment], without hesitation.” Interestingly, the participants also understood the communal nature of costs and acknowledged that choosing less expensive care was an ethical duty—albeit one they would not fulfill.²⁹ By contrast, we found no evidence of a vindictive attitude in the free-text comments in our study, making this explanation less likely.

It may also be that because the cost of the surgery was high, participants had a different perception of the value of the treatment. Previous studies have shown that consumers frequently equate high cost with high quality.³⁰ One study, which showed total costs, safety grades, and out-of-pocket cost information for fictional hospitals, found that if out-of-pocket

costs were held equal, 96% of consumers were more likely to choose a hospital with a better safety grade despite higher total costs.³¹

The results of this study run contrary to experiments involving self-other decision-making, which generally find that people are more risk-averse when choosing for themselves than for abstract others— e.g., strangers.^{32, 33} Researchers hypothesize that whether or not someone uses his own level of risk-aversion to frame a choice for another depends, at least in part, on the emotional distance (or closeness) he feels toward that other. In other words, for those whom they know, people will make choices similar to the choices they would make for themselves. This naturally leads to a question about the meaning of risk: Did respondents consider the worse outcome to be loss of life or the prospect of surgery and its attendant effects on quality of life? This variability in perception was highlighted in Ubel et al's experiments evaluating how physicians make recommendations. This study found that for themselves, physicians preferred a higher risk of death than a higher risk of a complication, such as a permanent colostomy or paraplegia, but made the opposite recommendation for a hypothetical patient.³⁴

Limitations

Our study has several limitations. First, this study used a hypothetical scenario to elicit treatment decisions. Although data from patients actually facing the decision described in the scenario would be preferable, several researchers have found that hypothetical scenarios can approximate real-world choices.^{35–37} We also based our text on a scenario already shown to discriminate among participants in this population,²³ and further refined it with cognitive interviewing and pilot-testing. Furthermore, a sample of comparable size comprising patients facing an actual LVAD decision would be difficult to obtain.

Second, an MTurk sample is not representative of the population at large. However, at least one study has found that the demographics of MTurk workers are more similar to those of the U.S. population than are in-person convenience samples.³⁸ A study demonstrated that samples from MTurk and from the National Science Foundation's Time-sharing Experiments for the Social Sciences program (a more robust and representative sample) produced similar results in 80% of studies.³⁹ More important, our sample is not representative of the typical patient facing an LVAD decision. The mean age of U.S. patients receiving an LVAD from 2005 to 2009 was 53.¹⁰ By contrast, the mean age of respondents in our study was 38, and only 16% considered themselves to have fair or poor health. It should be noted that our analysis found no effect on choice from either age or health status.

Third, MTurk participants could be finishing surveys quickly to get the reimbursement. To preempt this, we set the approval rating at 98%, higher than the recommended "high reputation" standard of 95%;⁴⁰ offered payment equivalent to the Colorado minimum hourly wage; rejected any response failing at least one of two attention checks; and rejected any survey completed in less than 90 seconds.

Fourth, the results of this study are not generalizable to situations in which the decision is not one of life or death. We hypothesize that the outcomes in non-critical scenarios would be

more likely to correspond to the self-other decision-making research that focuses on relatively inconsequential items, such as small sums of money.

Finally, some relationships between the covariates and the outcome may not have been uncovered in this study. Age was found to violate the assumption of linearity in the logit and was therefore dichotomized. The sample sizes for some values of race/ethnicity and self-rated health status were small, and these covariates were also dichotomized. It is likely, given the results in the early portion of the stepwise selection process, that meaningful associations could be identified with a larger data set.

Conclusion

This study demonstrated that total cost information affects treatment decision-making in a manner counter to our *a priori* hypotheses. Although the concept of a limited medical commons is fundamental to the national discourse on health care costs, consumers may not understand the relationship between expensive, high-risk treatments and their own ultimate out-of-pocket costs. The results also question whether the argument that resources are limited is notwithstanding in the face of life or death decisions and whether the nation is ready to accept curbs to its use of medical resources. Additional research is needed to better interpret these results, including the effect of framing and different levels of cost detail (for example, out of pocket versus societal) on decisions, and differences in consumers' definitions of risk.

Acknowledgments

None.

The work was performed at the Adult and Child Consortium for Health Outcomes Research and Delivery Science at the University of Colorado School of Medicine and at the Colorado School of Public Health, both in Aurora, Colorado.

A portion of this work was presented at student forums for the Colorado School of Public Health and the University of Colorado School of Medicine.

Study expenses were funded by Daniel Matlock's career development award from the National Institute on Aging (K23AG040696).¹

¹Funding for this study and for Dr. Matlock's time was provided by a career development award from the National Institute on Aging (K23AG040696). Dr. Allen's time was supported by grant K23HL105896 from the National Heart, Lung, and Blood Institute of the National Institutes of Health and grants from the Patient-Centered Outcomes Research Institute and the American Heart Association. The funding agreements ensured the authors' independence in designing the study, interpreting the data, writing, and publishing the report.

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Figure 1.

Analyzed sample.

Self, choosing the treatment for oneself. Other, choosing the treatment for another. Cost, cost is displayed.

Figure 2.
Percent of participants accepting the treatment, by scenario.

Table 1

Characteristics of the sample (n=1,211).

Characteristic	Patients, No. (%)
Mean age, y (SD)	38.3 ($\pm$ 12.8)
< 40	758 (62.6%)
> 40	453 (37.4%)
Sex	
Male	563 (46.5%)
Female	648 (53.5%)
Race	
White	1022 (84.4%)
Non-white	189 (15.6%)
Asian or Pacific Islander	87 (7.2%)
Black	74 (6.1%)
American Indian or Alaska Native	7 (0.6%)
Multiracial/other	21 (1.7%)
Ethnicity	
Hispanic	62 (5.1%)
Non-Hispanic	1149 (94.9%)
Own/rent home	
Own	567 (46.8%)
Rent	532 (43.9%)
Neither own nor rent	112 (9.3%)
Education	
Less than high school	7 (0.6%)
High school or GED	125 (10.3%)
Some college	378 (31.2%)
College graduate	493 (40.7%)
Any post-graduate work	208 (17.2%)
Marital status	
Now married	486 (40.1%)
Widowed	18 (1.5%)
Divorced or separated	135 (11.2%)
Never married	572 (47.2%)
Has children	502 (41.5%)
Self-reported health status	
Poor	33 (2.7%)
Fair	156 (12.9%)
Good	435 (35.9%)
Very good	465 (38.4%)

Characteristic	Patients, No. (%)
Excellent	122 (10.1%)
Has health insurance	1021 (84.3%)
Mean numeracy* (SD)	4.67 ($\pm$ 1.09)

* Short Numeracy Scale-3 (SNS-3); 6 is best

GED, General Educational Development; SD, standard deviation

Table 2

Treatment decisions, by scenario (reference = Self). Bonferroni $\alpha = 0.0167$.

		% yes	OR (95% CI)	χ^2 p
Scenario	Other-Cost	71.5%	2.26 (1.63, 3.14)	<0.0001
	Other	64.1%	1.60 (1.16, 2.23)	0.0047
	Self-Cost	60.5%	1.38 (1.00, 1.90)	0.0505
	Self	52.6%	reference	

Table 3

Major themes of reasons for treatment choice (n=1,211).

Major theme	Treatment choice		Exemplar
	Acceptors (n=752)	Decliners (n=459)	
One should prolong life	51.6%	0.4%	"A life is priceless. No matter the odds of success or failure, it is always best to save a life."
benefits outweigh risks	20.9%	0.0%	"Well you have to swing for the fence... You have to try."
need more time or information	16.9%	3.7%	"It all depends how old the person is and what their quality of life is like."
quality of life	4.4%	56.9%	"Even if you do survive it doesn't sound like much of a life."
risks outweigh benefits	4.3%	31.6%	"I'd rather be dead than deal with open-heart surgery."
other	1.6%	1.7%	"Religion reasons."
cost	0.4%	0.2%	"The cost is a burden on society."
one should accept death	0.0%	5.5%	"If my heart can't pump on it's own, it's time to die."

Totals do not sum to 100% due to rounding.

Table 4

Attitude agreement, by treatment choice.

Statement	Agreed with statement n (%)		n	p
	Acceptors	Decliners		
Health care is a human right.	682 (90.8%)	393 (86.2%)	1,207	0.013
The cost of health care is one of the biggest problems facing this country.	707 (94.5%)	429 (93.9%)	1,205	0.640
Physicians should not consider costs when making recommendations about health care.	515 (68.5%)	274 (59.8%)	1,210	0.002
Consumers can help lower the cost of health care.	543 (72.4%)	323 (70.5%)	1,208	0.483
Doctors should do everything possible to save someone's life.	687 (91.8%)	358 (34.3%)	1,205	<0.001
I don't consider cost when I make a decision about my health.	226 (30.1%)	86 (18.8%)	1,207	<0.001
As long as I have insurance, it doesn't matter how much a treatment costs.	322 (42.8%)	142 (30.9%)	1,211	<0.001