How Much Are Patients Willing to Pay to Avoid Postoperative Nausea and Vomiting?

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Postoperative nausea and vomiting (PONV) are unpleasant experiences. However, there is no drug that is completely effective in preventing PONV. Whereas cost effectiveness analyses rely on specific health outcomes (e.g., years of life saved), cost-benefit analyses assess the cost and benefit of medical therapy in terms of dollars. We hypothesized that patients were willing to pay for a hypothetical new drug that would eliminate PONV. Eighty elective day surgical patients using general anesthesia participated in the study. After their recovery in the postanesthetic care unit, they were asked to complete an interactive computer questionnaire on demographics, the value of avoiding PONV, and their willingness to pay for an antiemetic. Patients were willing to pay US$56 (US$26–US$97; median, 25%–75%) for an antiemetic that would completely prevent PONV.

Patients who developed nausea (n = 21; 26%) and vomiting (n = 9; 11%) were willing to pay US$73 (US$44–US$110) and US$100 (US$61–US$200; median, 25%–75%), respectively (P < 0.05). Seventy-six percent of patients considered avoiding postoperative nausea and 78% of patients considered avoiding vomiting as important (≥50 mm on a 0–100-mm visual analog scale). Nausea or vomiting in the postanesthetic care unit, greater patient income, previous history of PONV, more importance placed on avoiding nausea and vomiting, increasing age, and being married are independent covariates that increase the willingness to pay estimates. Patients associated a value with the avoidance of PONV and were willing to pay between US$56 and US$100 for a completely effective antiemetic.

Cost-effectiveness and cost-benefit analyses are analytical techniques that can help physicians and policy makers by comparing health care practices and technologies in terms of their relative economic efficiencies in providing health benefits (1). Cost-effectiveness analysis compares the net monetary costs of a health care intervention with some measures of clinical outcome or effectiveness, such as increased longevity, expressed most often as life-years saved. Whereas other health care outcomes, e.g., dollar per episode of postoperative nausea and vomiting (PONV) avoided, can be calculated with a cost-effectiveness analysis, there is no standard against which to measure the value obtained. Cost-effectiveness analysis is also paternalistic, i.e., someone who manages the delivery of health care (neither patients nor their doctors) will decide what is worthwhile. In a cost-benefit analysis, the costs of a health care intervention are assessed the same way as in cost-effectiveness analysis, but measures of clinical outcomes or effectiveness are typically converted into monetary units (2). The patients will determine what monetary value they place on their therapy and what they want to fund from their own resources, their insurance, or tax dollars.

Many new drugs have been introduced in anesthesia, often replacing older and less expensive drugs. Much has been written on the benefits of these newer drugs in terms of physiological and pharmacological responses of patients. Little is known of the value patients put on the benefits of these new drugs. PONV is an unpleasant experience that occurs often after surgery. The results of several studies suggest that patients not only rank the absence of PONV as being important (3) but also rank it as more important than an earlier discharge from an ambulatory surgical unit (4).

We hypothesized that patients were willing to pay (WTP) for an antiemetic that would eliminate PONV and that the WTP amount was related to the patient’s demographic characteristics.
Methods

After obtaining IRB approval and signed informed patient consent before anesthesia, we recruited 80 consecutive patients presenting for elective day surgery using general anesthesia. Patients were asked to complete an interactive computer questionnaire on WTP (see Appendix 1) in the postanesthetic care unit (PACU) after they met institutional PACU discharge criteria. Potential participants were not told in advance that a computer would be used to administer the questionnaire to avoid bias against those who might have an aversion to the use of computers. Those who did not understand the English language were excluded from participation. A research nurse familiarized the patients with the interactive questionnaire in the preoperative holding area before surgery.

A working group of a statistician, a computer programmer, and a staff member from the Departments of Anesthesia and Economics and Health Policy formulated the questionnaire, which was tested for ease of use on departmental volunteers before deployment. The interviews consisted of three parts. The first set of questions introduced the participants to the format of the questionnaire and ensured that the participants understood the concept of WTP. A hypothetical scenario was presented to assess whether each patient understood the WTP concept. The “chance of nausea and vomiting” numbers were randomly generated by the computer. If their answers were appropriate, (i.e., they rejected the new drug because it had both an increased incidence of PONV and a larger cost compared with the routine drug), then they were deemed to have understood the concept and were allowed to proceed to the next part of the questionnaire. If they did not get this right, the concept was explained to them, and they had to correctly answer that question before continuing.

The second set of questions established the value patients placed on the avoidance of PONV and the amount they were WTP for a hypothetical antiemetic that would completely prevent it. The third set of questions established demographic characteristics, health functional status, income, education levels, and other factors that might affect the response.

Patients were not compensated financially for participation to avoid a disproportionate share of patients with smaller income who might be more willing to participate on that basis. A “play money” bias was eliminated by noting that the drug would be an out-of-pocket expense. This intentional deception was IRB approved and noted in the informed consent (without noting which part of the interview might include some “minor false statements”). We evaluated the play money effect by also evaluating how much this therapy would be valued if someone else (insurance companies) were paying. Starting point bias was eliminated by randomly varying the cost of a new antiemetic between US$5 and US$50 (an a priori reasonable range and consistent with IV drug acquisition costs for antiemetics and other anesthetics).

Patients were first acquainted with the type of questions asked. The computer then asked the patients whether they would choose a new antiemetic that would completely abolish the incidence of PONV or the routine antiemetic, which would still allow a chance of PONV. If the respondent chose the routine antiemetic, the random price of the new drug was decreased by $x/8 (minimal cost was set at US$2) and the question reiterated up to eight times, with the cost reduced proportionally after each question. If the respondent chose the new antiemetic, the price of the new antiemetic was increased by $x/8 and the question reiterated, again up to eight times. The process continued until the price of the new antiemetic was enough to make the respondent reverse the preference. After eight iterations, patients were asked the amount they would be WTP for the new antiemetic. A maximum ceiling on the value of the antiemetic was set at US$500, with no minimum.

Power calculation revealed that 80 patients would be adequate to detect a significant (P < 0.05) relationship between WTP value and the presence or absence of nausea with α = 0.9 and β = 0.2. Descriptive statistics were calculated and reported. Univariate and multivariate linear regressions were fitted to relate WTP to possible predictors. The confidence intervals and P values of the various covariates were presented. The distribution of WTP was nonnormal (P value for the Shapiro-Wilk test of normality was 0.0001). Hence, the rank analysis of variance was adopted. Kendal’s τ b correlation was used to assess redundancy in the explanatory variables. A P value <0.05 was considered statistically significant.

Results

Eighty patients (32 men, 48 women) completed the questionnaire. The median age was 46 years, with a median (25%–75%) household income of US$52,500 (US$24,725–US$96,750). Patients were WTP US$56 (US$26–US$97; median, 25%–75%) for an antiemetic that would reduce the incidence of PONV to zero. Patients who did not develop PONV were WTP US$40 (US$20–US$95; median, 25%–75%; P < 0.05). Patients who developed nausea (n = 21, 26%) were WTP US$73 (US$44–US$110), and those who actually experienced emesis (n = 9, 11%) were WTP the larger sum of US$100 (US$61–US$200; median, 25%–70%). P < 0.05 among the groups. When the cost of the antiemetic was to be borne by an insurance payment, the WTP amount allotted by the patients increased by an average of 68%. One patient, who did not develop PONV, had a WTP borne by insurance value above the $500 cutoff and was hence capped at $500.
Seventy-six percent of patients considered avoiding postoperative nausea and 78% considered avoiding postoperative vomiting important (patient response ≥50 mm on a 0–100-mm visual analog scale). A number of covariates significantly increased the patients’ WTP amount and the patients’ WTP amount to be borne by insurance. These included nausea or vomiting in the PACU, larger patient’s income, previous history of PONV, the importance the patient placed on avoiding PONV, and increasing age (Table 1).

Discussion

This study elucidated the value that patients place on eliminating PONV. Patients having surgery under general anesthesia value avoidance of PONV and are WTP US$56–US$100 to avoid experiencing these unpleasant side effects.

Health care costs consume more than 13% of the American gross domestic product. Although direct anesthesia costs are a very small component of this US$1 trillion annual cost in the United States, pressure by hospital administrators and payers to cut anesthesia-related costs has intensified (5). However, there is a paucity of data establishing the monetary value associated with the avoidance of common undesirable postoperative side effects from the patient’s perspective. Because traditional cost-effectiveness is defined as dollars per year of life saved, therapies (including most of what an anesthesiologist does) that do not prolong life but ameliorate pain, suffering, anxiety, and other intangibles have not been considered by traditional cost-effectiveness analyses. Short-term amelioration of pain and suffering does not save years of life. Although quality of life adjustments are possible via cost-utility analysis (by using some sort of survey methodology), these are appropriate for long-term disease effects, not the short-term quality of life issues, such as acute pain or recovery from anesthetic effects, that anesthesiologists routinely address. There are no benchmarks to judge whether the cost of a therapy that affects this short-term quality of life is worthwhile. We sought to define a benchmark for the most common anesthetic side effect—PONV.

PONV is one of the most common complications after anesthesia, with an incidence of between 20% and 80% (6–8). Patients consider PONV one of the most undesirable postoperative symptoms, and it is one of the most common reasons for poor patient satisfaction rating in the postoperative period (9). Macario et al. (3) quantified patients’ preferences for postoperative outcomes before surgery. PONV was among the 10 most undesirable outcomes after surgery. Indeed, patients allocated the largest amount (US$30) to avoid PONV out of a total of US$100 they were allowed to spend to avoid all complications.

WTP is based on simple supply-demand theory in economics. A consumer will pay up to a certain amount for the benefits of consuming a particular good or service, but above maximum WTP no longer feels that the benefits obtained outweigh the opportunity cost of purchasing the item (10). WTP has been extensively used as a tool in economic evaluation of alternative land use, but it has only recently been applied to the economic evaluation of health care (11). The WTP technique has been used to value interventions in screening, prevention, treatment, and service provision. This method gives valid and consistent results when valuing health care interventions (12).

Tang et al. (13), in an efficacy and cost-benefit analysis of administering prophylactic antiemetic to women having gynecological laparoscopy, asked patients how much they would be WTP out of their own pocket to prevent PONV if they were to undergo the same laparoscopic operation in the future. They provided a choice of US$0, US$50, US$100, US$250, or another dollar amount. They found that patients were WTP an average of US$117 ± US$82 (mean ± sd). The authors, however, did not examine the factors that could affect the WTP value, e.g., income, education, insurance payer, etc. It is conceivable that the larger WTP value compared with our results may reflect the higher socioeconomic status of that population. Also, their results may have been affected by providing ceiling values, anchor ranges, and starting point biases that were all addressed in this study through initial value randomization and value iteration. Our initial values were limited to US$5–US$50, so the fact that patients were never presented with a value as high as US$250 because of the iterative value generation (x + x/8, maximum iterative value of US$129) may have predisposed this patient group to a lower value compared with the results of Tang et al. In addition, there was no cap on their maximum values. Because the data in our study were right skewed, we placed a cap on a maximum amount of $500 and reported the median and interquartile ranges. Diez (14) used a structured questionnaire to evaluate parents’ WTP for a reduction in postoperative emesis in their children. The median value was found to be £50 (US$75; 95% CI, £20–£80), which was very similar to this study.

Previous studies have established the validity and reliability of WTP estimates in other health care applications (15). However, cost-benefit analysis is not often performed in anesthesiology. When severe morbidity and mortality outcomes are extremely rare, it is important to assess the economics of treating less tangible but more common outcomes, such as pain, sore throat, PONV, and anxiety. Who in this world can be a better judge of the value of those interventions than those who have experienced the problem? We have
demonstrated that a majority of patients associated the absence of PONV as desirable and equated that with a monetary value, as we might predict. Those who developed nausea, vomiting, or both on the day of surgery had a more vivid realization of how unpleasant these symptoms were and hence, as would be expected, attached a larger sum to avoiding PONV in the future. In addition, we have shown that the WTP amount correlated significantly with a number of covariates, such as income levels (a surrogate for marginal utility of income, which is expected to affect WTP), the importance of avoiding PONV, and a history of PONV. In this study, we addressed only the issue of WTP for an effective antiemetic. It would be interesting to ask patients their WTP to avoid other unpleasant symptoms related to anesthesia and surgery.

WTP is difficult to ascertain by simply asking a single question (16). Asking closed-end questions (suggesting one value to respondents, who can either accept or decline it) involves larger costs and resources, takes more time, and may limit responses around the initial starting value (starting point bias). Our questionnaire addressed these issues by providing a varied starting point, in the reasonable range of US$5–US$50. This was designed to reduce starting point bias (i.e., if you suggest an initial value of $5, it is less likely that $50 will be seen as reasonable, and vice versa.). However, after patients in our survey went through the eight iterations, they were asked to state the amount they were WTP, allowing an open-ended question to supplement the closed-ended questions previously iterated. We also found no correlation between the final WTP value and the initial suggested dollar amount. An interactive computer program has several advantages over a paper questionnaire. The problem of interviewer bias is avoided, and it may promote more honest revelation of preferences. Subjects are better able to recall information provided in a multimedia format compared with receiving the same information in written format alone (17).

We used a hypothetical antiemetic that would totally prevent PONV in the questionnaire. Such a drug admittedly does not exist. However, we wanted to present a relatively straightforward scenario that patients could easily comprehend. Patients have difficulty in understanding various hypothetical efficacy rates (10). It is probable that the WTP amounts we have demonstrated may be more than might occur in real life, when the efficacy of the drug would not be 100% (certainty equivalent factor). However, the results from this study can still be used in future cost-benefit analysis of any particular antiemetic therapy.

Determination of WTP may be sought from different samples of populations. The issue of whether WTP estimates differ among those with and without the symptoms is critically important. It is known that particular patients’ preferences tend to overvalue a particular health state or health benefit if it is a personal feature of their lives. However, a previous study of preferences for health states (cancer) found a high degree of correspondence between ratings provided by patients and by the general public (18). By using the “greatest good” argument to justify a society perspective for an economic analysis, it is suggested that a representative community sample be used to value a disease state or value of a drug. However, in this scenario, patients who are undergoing surgery have the risk of developing PONV and hence have a stake in avoiding these unpleasant symptoms, so societal value may not be relevant. Hence, we interviewed patients who were having surgery rather than a sample of community at large, in which immediate postoperative considerations would not have received the thought and attention necessary to make value judgments.

To put this into concrete terms, imagine that you plan to go to a major league sporting event. Suppose one year before you have ever considered buying tickets to the game, and without reference to any particular situation, you are asked by someone on the street if you would pay $5 for a beer and $3 for a soft drink. Most rational people would say no. Flash forward to a hot, crowded sports stadium. You and your little boy are quite thirsty, and he wants a soft drink. That causes you to assess your marginal utility of income at that time for that purpose, and you end up WTP eight times what you would pay in the grocery

Table 1. Covariates that Correlated Positively with WTP Amount

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Confidence intervals</th>
<th>P value</th>
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<tbody>
<tr>
<td>Nausea in the PACU</td>
<td>−0.955 to 0.011</td>
<td>0.05</td>
</tr>
<tr>
<td>Vomiting in the PACU</td>
<td>−1.461 to −0.13</td>
<td>0.02</td>
</tr>
<tr>
<td>Previous history of PONV</td>
<td>−1.798 to −1.034</td>
<td>0.00001</td>
</tr>
<tr>
<td>Importance of avoiding nausea</td>
<td>0.002 to 0.015</td>
<td>0.01</td>
</tr>
<tr>
<td>Importance of avoiding vomiting</td>
<td>0.002 to 0.015</td>
<td>0.01</td>
</tr>
<tr>
<td>Patient’s income</td>
<td>0.000004 to −0.00001</td>
<td>0.0002</td>
</tr>
<tr>
<td>Increasing age</td>
<td>0.029 to 0.347</td>
<td>0.02</td>
</tr>
</tbody>
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WTP = willingness to pay; PACU = postanesthetic care unit; PONV = postoperative nausea and vomiting.
store. You choose to spend your money that way, at that time, in that context. That is the real world. That is the essence of all rational economic transactions, and that is the essence of this study’s valuation method.

In summary, this study demonstrates that it is possible to establish patients’ value for a particular therapy. WTP estimates relates to income, previous history of PONV, PONV in the PACU, and importance of avoiding PONV in the expected direction. Patients value not having PONV and are willing to pay US$56–US$100 out of their own pocket for a totally effective antiemetic.

We appreciate the assistance of Rhonda Dear, RN, and Lee McClurkin, RN, with data collection and Angela Rogers for manuscript preparation.

Appendix 1
WILLING TO PAY FOR AVOIDANCE OF POSTOPERATIVE NAUSEA AND VOMITING

Thank you for being a part of our study. Anesthesia and surgery can sometimes cause nausea and vomiting. We are going to ask you how you feel about postoperative nausea and vomiting. To answer the questions, please enter the number that corresponds to your answer.

First we are going to ask you about your experience with nausea. How often do you have nausea?

0 1 2 3 4 5 6 7 8 9 10
Never Sometimes Often

Based on your experience as a passenger in a car, how often do you have motion sickness (carsick)?

0 1 2 3 4 5 6 7 8 9 10
Never Sometimes Often

Before today, have you ever had surgery? 1. Yes 2. No

Did you have nausea after your surgery today? 1. Yes 2. No

Second, we are going to ask you about your experience with vomiting. How often do you have vomiting?

0 1 2 3 4 5 6 7 8 9 10
Never Sometimes Often

Did you have vomiting after surgery today? 1. Yes 2. No

Now we are going to ask you how you feel about nausea. To do this, we will use a scale that measures how important it is for you to avoid nausea.

How important was it to you to avoid nausea after your surgery?

0 1 2 3 4 5 6 7 8 9 10
Not at all important Somewhat important Very important

Now we are going to ask you how you feel about vomiting.

How important was it to you to avoid vomiting after your surgery?

0 1 2 3 4 5 6 7 8 9 10
Not at all important Somewhat important Very important

Good. The next thing we want to do is ask you about your health. To do this, we will use another scale from 0 to 10. Notice that a 10 on the scale means that you are in perfect health. Notice that a 0 on the scale means that your health is as bad as death.

How would you rank your current health?

0 1 2 3 4 5 6 7 8 9 10
Death Perfect health
Good. Now we are going to ask you a different type of question about anesthesia.

With the drug you ordinarily receive during surgery, the average risk of nausea and vomiting is ___ out of 100. This means that for every 100 people having the ordinary anesthesia, ___ would be expected to have nausea and vomiting after receiving the drug.

Good. Now we are going to ask you about the value of a new drug to prevent nausea and vomiting postoperatively. To receive a new experimental anti-nausea drug, you would have to pay $___ before your next surgery. Now you are going to have to choose if you want the new anti-nausea drug. The ordinary treatment and the new drug are exactly the same except for:

—The price you have to pay for the anti-nausea drug and
—The chance of nausea and vomiting after surgery.

First, let’s talk about the PRICE for the anti-nausea drug

<table>
<thead>
<tr>
<th>Routine anti-nausea drug</th>
<th>New drug</th>
</tr>
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<tbody>
<tr>
<td>No charge</td>
<td>$___</td>
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If you use the NEW DRUG, it will cost you $___ out of your pocket during your next surgery (It is not covered by insurance). Now let’s look at the chance of nausea and vomiting after surgery if the ROUTINE DRUG or the NEW DRUG is used.

<table>
<thead>
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<th>New drug</th>
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<tr>
<td>No charge</td>
<td>$___</td>
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On average the chance of nausea and vomiting after surgery is ___ out of 100 if the routine drug is used. This means that for every 100 people treated, would be expected to get nausea and vomiting. The chance of nausea and vomiting is ___ out of 100 if the NEW DRUG is used.

Choose which drug you would prefer: 1. routine drug 2. new drug

If you choose the routine drug, good! The routine drug had a lower price and lower risk of nausea and vomiting than the new drug. If you choose the new drug, notice that the NEW DRUG is more expensive the ordinary drug. Also, the risk of nausea and vomiting is higher if the new drug is used.

The question you just answered was presented to make sure you understood this type of question. The next question will not be as easy. Now we will ask you about a real drug, that can be used in your treatment during your next surgery. If you use this drug, you will have no risk of nausea and vomiting. However, there is a cost for this new drug. It is not covered by insurance and you would have to purchase it with your own money.

<table>
<thead>
<tr>
<th>Routine anti-nausea drug</th>
<th>New drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chance of nausea and vomiting</td>
<td>__ out of 100</td>
</tr>
<tr>
<td>Price</td>
<td>__ no charge</td>
</tr>
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</table>

This time there is no right or wrong answer, since there is NO DRUG that is better and cheaper. We just want to find out which drug you prefer. So the price is lower if you use the routine anti-nausea drug, but the CHANCE OF NAUSEA AND VOMITING is lower if you use the new drug.

Which drug would you prefer if you had you have another surgery?

1. The routine anti-nausea drug—no charge
2. The new drug

AT THIS TIME, PLEASE LET THE INTERVIEWER KNOW YOU HAVE REACHED THIS POINT IN THE QUESTIONNAIRE.

How much do you think the new drug would be worth, or what is the maximum amount of money you would like to pay for the new drug? Please write in the amount. $___

If your insurance were to pay for the new drug, how much do you think it would be worth? Please write in the amount. $___
Now we would like to ask you a few questions about yourself. The answers that you give are absolutely confidential and will not be discussed in association with your name. In order for us to understand your answers, we need to know a little about your background.

Are you married? 1. Yes 2. No 3. I do not want to answer this question

Do you have any children? 1. Yes 2. No


What was the last grade of school that you completed?
1. Grade school or less (grades 0–8)
2. Some high school (9–12)
3. High school graduate (12)
4. Some college or junior college (2 year degree)
5. College graduate
6. Post graduate work or degree

What was the approximate total income in your household last calendar year, BEFORE TAXES? Include amounts earned by you and others in your household, as well as other types of income (such as Social Security, interest, dividends, etc.). Please write in the amount. If you do not know your income or if you do not want to answer this question, skip to the next question.

Let's try the question again in a different way. Which category best describes the total income that you and the others in your household received last year, BEFORE TAXES.

1. Under $15,000 2. $15,000–$30,000 3. $30,000–$45,000 4. $45,000–$60,000 5. $60,000–$75,000 6. $75,000–$100,000 7. $100,000–$200,000 8. Over $200,000 9. I do not want to answer this question

How many people share that income? __ I do not want to answer

Are you male or female? 1. Male 2. Female

What do you consider yourself primarily?
1. African-American 2. White 3. Hispanic 4. Other 5. I do not want to answer this question

Which category best describes your situation?
1. Full time worker (30 or more hours a week) 2. Part time worker (under 30 hours a week) 3. Working at home 4. Student 5. Not working for other reason

Do you generally use an aid to help you get around?
1. Yes, a cane or crutches 2. Yes, a walker 3. Yes, a wheelchair 4. No, none of the above 5. I do not want to answer this question

Compared to other people the same age as you, how would you rate your own health?
1. Excellent 2. Good 3. Fair 4. Poor 5. I do not want to answer this question

What main type of insurance do you have?
1. Private indemnity (go anywhere to any physician) 2. Medicare 3. Worker’s compensation 4. Medicaid or other state program 5. HMO (any plan that requires primary care doctor to approve other care) 6. None 7. Other

THAT’S ALL! We really appreciate that you’ve taken the time to help us with our survey. Please tell the interviewer that you have finished, and thanks again for your help.
References