Patients’ willingness to pay for anti-emetic treatment

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Background: Post-operative nausea and vomiting (PONV) is a common complication of anaesthesia. This study was conducted in 100 German and 100 Turkish patients scheduled for elective surgery under general anaesthesia to assess the amount patients were willing to pay for an anti-emetic that completely prevented PONV.

Methods: Post-operatively, using Dixon’s up and down method, patients completed an interactive computer questionnaire with a random starting point to determine how much of their own money they were willing to pay for a totally effective anti-emetic treatment.

Results: On average, participants were willing to pay €65 in Germany and €68 in Turkey to avoid PONV. However, patients who actually experienced PONV were willing to pay larger amounts: €96 in Germany and €99 in Turkey. The amount patients were willing to pay was related to female sex, history of motion sickness, non-smoking status and better education.

Conclusions: Despite differences in political and cultural origin, health care system and financial background, the amount patients were willing to pay for an effective anti-emetic was similar in both Germany and Turkey to that reported previously for the USA.

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Despite the development of newer anaesthetic agents, post-operative nausea and vomiting (PONV) remains a frequent problem (1–3). Although most episodes are self-limiting, in some cases PONV can lead to serious medical complications, such as wound dehiscence, oesophageal rupture and retinal detachment (4–6). More frequently, it is a significant concern to patients and can impair patient satisfaction (7, 8). Unfortunately, anti-emetics used singly have limited efficacy (9–12). Although preliminary studies on multimodal management were encouraging (13), our large multicentre trial of factorial design demonstrated that all tested combinations of anti-emetic drugs were additive only (14). As a consequence, the remaining risk for PONV is chiefly a function of the individual’s baseline risk and the number of interventions. Thus, about one in five patients at high risk still suffers PONV despite the use of prophylaxis with four anti-emetic interventions (14). The pathophysiology of nausea and vomiting is complex. On the basis of animal research, it is presumed to involve multiple receptors at the level of the chemo-receptor trigger zone (CTZ), the vomiting centres and elsewhere. This may be one reason why no single drug is fully effective, and why patients at high risk require a multimodal approach.

In conjunction with the costs known to be associated with PONV, the knowledge of risk reduction allows the determination of the cost-effectiveness of various anti-emetic strategies (15–18). In contrast with ‘pure’ cost-effectiveness or cost–benefit studies, which basically evaluate the expenditures of certain health outcomes per se only (15–22), or examine the costs of preventive vs. therapeutic measures only (21, 23), the willingness to pay (WTP) method also encompasses the impact of PONV on patient discomfort, anxiety and distress (19, 23–27). This technique, which originated in environmental economics, is increasingly used in health care to place a value on the benefits of a particular medical intervention or action (19, 23, 25–27). It can be used in medical screening, prevention, treatment and service provision, and may be the ideal adjunct to clinical trials assessing the benefits of one or more interventions in
comparison with an established standard procedure, a valuable factor in the context of numerous PONV studies (19, 23, 25–27). Thus, not only are certain health outcomes and associated costs analysed, but the personal impact of PONV interventions on patients is taken into account (19, 23, 25–27). This is important, as some patients who suffer from PONV rate it as more uncomfortable than post-operative pain (7, 28, 29). Previous studies in the USA have indicated that, in order to avoid PONV, patients would be willing to pay an average amount of $45.7 and £57 in adults and children, respectively (24).

We hypothesize that these estimates are highly dependent on the country, health care system, society and culture, and that values estimated in the USA will not necessarily apply to other countries. In this study, we attempted to identify the predictors for WTP and to estimate the amount patients would be willing to pay in Germany and Turkey.

Methods

After obtaining approval from the German and Turkish national ethical committees and written informed patient consent, we enrolled 100 adult patients in each country from two large university hospitals in Mannheim (Germany) and Edirne (Turkey). All participants were scheduled for elective day surgery under general anaesthesia. After patients had met the criteria for discharge from the post-anesthetic care unit, they were asked to complete an interactive computer questionnaire on their WTP. After patients had recovered from anaesthesia (with pain, dizziness or PONV well-controlled), a research fellow familiarized the patients on the ward with the interactive questionnaire and provided assistance if needed to complete the questionnaire.

The detailed questionnaire in the post-operative interview has been described previously (24). In short, it consists of three sets of questions. The first set introduces the patient to the format of the questionnaire and ensures that the participant understands the concept of WTP. A hypothetical scenario is presented to assess whether each patient understands the WTP concept. If the answers of the participants are appropriate, they are deemed to have understood the concept and are allowed to proceed to the next part of the questionnaire. In the case of an inappropriate answer, the WTP concept is explained again, and the patient has to answer that particular question correctly before continuing with the questionnaire. The second set of questions deals with the value participants place on the avoidance of PONV and the amount of money they would be willing to pay for a hypothetical drug that completely prevents PONV. The computer asks the patients whether they would choose a new anti-emetic that would completely abolish the incidence of PONV or a routine anti-emetic that would still allow a certain chance of PONV. If the respondent chooses the routine anti-emetic, the random price $x$ of the new drug is decreased by a factor of eight ($x/8$) and the question is repeated up to eight times, the price being reduced proportionally after each question. If the respondent chooses the new anti-emetic, the price of this substance is increased by a factor of eight ($8x$) and the question is repeated again up to eight times. This process continues until the price of the new anti-emetic reaches a value at which the respondent reverses the preference. After eight repetitions, patients are asked the amount of money they would be willing to pay for the new anti-emetic. The maximum cost of the anti-emetic is set at €390, and the minimum cost at €1.6. The third set of questions assesses demographic data, functional health status, income, educational level and other factors that may affect the responses.

Participants were not paid or otherwise compensated for participation in order to avoid enrolling a disproportionate fraction of low-income patients. A ‘play money bias’ was eliminated by noting that the drug would be an ‘out-of-pocket expense’. This intentional deception was approved by the national ethical committees and noted in the informed consent. We also tried to assess any ‘play money effect’ by evaluating the value of the optimal anti-emetic therapy if someone else, i.e. insurance companies, paid for it. A starting point bias was eliminated by randomly varying the cost of a new anti-emetic between €3.9 and €39, which represents a reasonable range and is consistent with the acquisition costs for intravenous drugs such as anti-emetics or anaesthetics.

In the questionnaire, patients were also asked how important they deemed the prevention of nausea and vomiting. The estimation was accomplished using a visual analogue scale (VAS) graded from 0 to 100 mm. The prevention of nausea and vomiting was considered as very important if patients placed VAS values above 50 mm. All values in the questionnaire and in the text are given in euros (€1 equalled approximately $1.20 US at the time the study was conducted).

Statistical analysis

A power calculation indicated that 80 patients in each centre would be adequate to detect a significant
relationship between WTP values and the presence or absence of PONV with $\alpha = 0.05$ and $\beta = 0.2$. As the power of these estimations depends not only on the difference and the variance, but also on the actual incidence of PONV, we decided to study 100 patients per centre. Descriptive statistics were calculated and are reported. Univariate and multivariate linear regressions were fitted to relate WTP to possible predictors. Data are reported as the mean (95% confidence interval) or mean ± standard deviation. $P < 0.05$ was considered to be statistically significant.

Results

All 200 patients enrolled in the study (100 in Germany and 100 in Turkey) completed the computer questionnaire. The patients in the two countries were similar in terms of their history of PONV (yes/no: Germany, 27/73; Turkey, 21/79; $P = 0.321$) and the evaluation of their health compared with others; however, they differed with regard to previous surgery (yes/no: Germany, 71/29; Turkey, 54/46; $P = 0.013$) and motion sickness (yes/no: Germany, 16/84; Turkey, 35/65; $P = 0.002$).

On average, the WTP values to avoid PONV were €65 in Germany and €68 in Turkey (non-adjusted means). Overall, these values increased to €96 and €99, respectively, when nausea or vomiting occurred post-operatively. Other factors potentially associated with the patients’ WTP were sex, smoking status, smoking level, history of motion sickness ($P < 0.001$) and educational level ($P = 0.004$). In contrast, age, previous surgery, history of PONV, household income, health status and centre did not play a significant role.

A multiple linear regression model was used to assess the effect of independent predictors and to correct for potential confounders on the amount of money patients were willing to pay. According to this multivariate analysis, independent predictors for WTP were non-smoking status, history of motion sickness, and educational level (Table 1).

In a second analysis, we determined the percentage of patients willing to pay €65 or more (the median) for the anti-emetic prophylaxis. Patients with a non-smoking status, history of motion sickness ($P < 0.001$), higher educational level ($P = 0.003$) and females ($P = 0.005$) were willing to pay €65 or more. Age, previous surgery, history of PONV, total personal income and centre (Germany or Turkey) were not significantly associated with a WTP value of €65 or more.

In order to determine the independent predictors of whether patients were willing to pay €65 or more for the prevention of PONV, we conducted a multiple logistic regression analysis (Table 2). According to this analysis, non-smokers were four times and patients with a history of motion sickness were two and a half times more likely to be willing to pay €65 or more for effective anti-emetic prophylaxis. Patients with some college education or a completed college degree were almost eight times more likely to be willing to pay €65 or more.

The centre (country) did not significantly influence WTP in any of these analyses.

Discussion

Our results indicated that patients in Germany and Turkey were willing to pay €65 and €68, respectively, to prevent PONV. Patients who actually suffered from PONV were willing to pay substantially more, i.e. almost €100. Furthermore, the WTP value of €65 or more was significantly related to a history of motion sickness, non-smoking status, female sex and educational level, the first three factors having been identified previously to increase the risk of PONV (28, 30, 31).

We assumed that the estimates for WTP were highly dependent on the country, health care system, society and culture, and that previous values estimated in the USA would be considerably higher.

| Table 1 | Multivariate linear regression results for the patients’ ‘willingness to pay’. |
|---------|-----------------|-----------------|-----------------|
|         | Coefficient     | Adjusted        | $P$             |
| Sex     | Male 0          | 60              | 0.256           |
|         | Female 7.91     | 68              |                 |
| Smoker  | Yes 0           | 48              | < 0.001         |
|         | No 30.81        | 79              |                 |
| History of PONV | No 0 | 62              | 0.568           |
|         | Yes 4.25        | 66              |                 |
| History of motion sickness | No 0 | 56              | 0.046           |
|         | Yes 15.45       | 71              |                 |
| Education | Grade school or less 0 | 44              | 0.017           |
|         | Some high school or high school graduate 24.67 | 69              |                 |
|         | Some college or college graduate 33.18 | 78              |                 |
| Centre  | Germany 0       | 61              | 0.516           |
|         | Turkey 5.69     | 66              |                 |
| Constant | 12.33           |                 | < 0.001         |

PONV, post-operative nausea and vomiting. Currency was rounded to the nearest whole number.

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than those estimated in Germany or Turkey. Therefore, in order to compare these results with those from other studies, we used the same questionnaire and methodology as employed by Gan et al. (24), which we considered to be the most rigorous in this setting. It should be noted that German patients were presented with euros and Turkish patients with the Turkish lira as their currency (current exchange rate was considered). To our surprise, the WTP value was in the same range as that reported previously for the USA. Gan et al. (24) reported that adult patients were willing to pay the equivalent of €43.7 for an anti-emetic that would completely prevent PONV, and that this amount was significantly greater if the patient developed PONV. In a similar study, Diez (25) found that the parents of children were willing to pay, on average, €75 for the prevention of PONV, and more than 35% of the parents surveyed would spend €150 or more in order to avoid this complication in their children.

The findings of the current study are particularly remarkable considering the differences in the economic background and health care systems of Germany and Turkey. This difference in the economic situation between the two countries can be demonstrated using the gross national income (GNI) per citizen, an indicator of the economic wealth of a country. For 2003, the GNI was approximately €19,700 for Germany, but only €2177 for Turkey. Although health care is comprehensive in both countries, with almost every diagnostic test and therapeutic treatment provided without cost to patients, the quality of health care is more uniform in Germany. In addition, the countries have substantial differences in culture.

The educational level of the patient was the strongest predictor for WTP; this predictor is associated with family income and health status (data not shown), which may indicate that better educated patients have a greater awareness of health care problems. This is also in accordance with the observation that non-smoking patients were willing to pay more; this factor was statistically significant in both multiple linear and multiple logistic regression analyses, indicating that it is an independent predictor. Again, this may be because non-smokers have a better awareness of and place greater value on health care problems. The third important predictor was a history of motion sickness. Interestingly, this did not present as an independent predictor in the analyses by Gan et al. (24) and Diez (25).

As reported previously (7, 28, 29), we expected that patients with a past experience of PONV would show an increased WTP in order to avoid this complication. Surprisingly, a history of PONV, a factor recently judged to be equivalent to a history of motion sickness in terms of PONV risk, was not a predictor for WTP (30, 32). One reason may have been the lack of power to detect an effect, although, with a total of 200 patients, this study was more than twice as large as the previous investigation (24). Therefore, we believe that it is more likely that this was an incidental finding. Previous large studies with over 1000 patients have failed to identify age or non-smoking status as independent predictors for PONV, and this has now been shown in many other studies (28, 33). A similar explanation may be proposed for the observation that income did not influence WTP significantly. The finding that WTP in this study was not related to personal income is particularly remarkable as the average income in Germany is much greater than that in Turkey. Our findings on the relationship between WTP and personal income contrast with those in the previous reports by Gan et al. (24) and Dietz (25), which indicated that WTP to prevent PONV was significantly dependent on the individual household income of patients in the USA and UK.

The costs incurred by health care providers for the treatment of PONV reported by pharmaco-economic

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Odds ratio (95% confidence interval)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (female)</td>
<td>0.068</td>
<td>1.15 (0.58–2.27)</td>
</tr>
<tr>
<td>Smoker (no)</td>
<td>0.703</td>
<td>4.08 (2.04–8.15)</td>
</tr>
<tr>
<td>History of PONV (yes)</td>
<td>– 0.007</td>
<td>0.99 (0.47–2.06)</td>
</tr>
<tr>
<td>History of motion sickness (yes)</td>
<td>0.462</td>
<td>2.52 (1.13–5.63)</td>
</tr>
<tr>
<td>Education (grade school or less)</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Education (some high school or high school graduate)</td>
<td>0.429</td>
<td>5.28 (1.69–16.47)</td>
</tr>
<tr>
<td>Education (some college or college graduate)</td>
<td>0.807</td>
<td>7.71 (2.14–27.81)</td>
</tr>
<tr>
<td>Centre (Turkey)</td>
<td>0.258</td>
<td>1.68 (0.83–3.39)</td>
</tr>
<tr>
<td>Constant</td>
<td>– 0.243</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 2

PONV, post-operative nausea and vomiting.
studies vary considerably. According to Carroll et al. (34), in 1994, the cost was approximately €17 when drug, therapy supplies and personnel costs for delayed discharge were considered, and up to €35 when lost revenues were taken into account. An economic analysis in 2000 of a previously conducted multicentre trial revealed additional costs of more than €128 in patients who developed PONV (20, 35). Thus, in this study, the WTP value found to prevent PONV is well within the range of the costs from the health care provider’s perspective. In this context, it should also be emphasized that patients, because of increasing economic restraints in the European health care system, are very well aware of the costs of drug therapy or a prolonged hospital stay.

The estimates of the WTP value in this study were based on the assumption that the anti-emetic was 100% effective. However, an IMPACT study has shown that single-drug prophylaxis with ondansetron, dexamethasone, droperidol or total intravenous anaesthesia reduces the risk by no more than 30% (14). Therefore, particularly in high-risk patients, a triple combination of anti-emetics and/or total intravenous anaesthesia may be advisable, which may be well within the range of the costs evaluated by the WTP method in this study.

Very recently, in over 800 patients, van den Bosch et al. (36) evaluated the WTP values to prevent postoperative pain or nausea and vomiting. This study determined the WTP values for pain and PONV to be €34 and €17, respectively. The reason for the lower WTP values than observed here remains unclear. One can only speculate as to whether differences in methodology (a sophisticated computer program with multiple questions and random starting points was not used, but, rather, a single question with six numerical values to choose from) or context (when asking for the WTP value to prevent pain and PONV, the WTP value for pain might simply be larger because it can be expected to occur more frequently after surgery) played a larger role (37).

In conclusion, using the WTP method, we have shown that patients are willing to pay €65–68 for total prevention of PONV; this corroborates the previously described importance of PONV prevention for patients (7, 28, 29). Non-smoking patients and patients with a history of motion sickness were willing to pay more for the prevention of PONV. However, the strongest predictor was educational level. The fact that the values were similar in Germany, Turkey and the USA suggests that the WTP value may be independent of political and cultural origin, health care system and financial resources.

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