TOWARDS UNDERSTANDING TREATMENT PREFERENCES OF HOSPITAL PHYSICIANS

P. DENIJ', F. M. HAUKER-RUSKAMP, H. WESSELING and A. VERSLUIS

1Department of Health Sciences/Northern Centre for Healthcare Research, 2Department of Pharmacology and Clinical Pharmacology and 3Department of Pharmacy, University Hospital, University of Groningen, Ant.Deusinglaan 1, 9713 AV Groningen, The Netherlands

Abstract—Seventy-two physicians working in a university hospital in The Netherlands were interviewed to clarify their decision-making process when choosing drugs of preference. Each physician was questioned about the treatment choices for either one or two general case descriptions. The physicians considered only a limited set of different treatment options, on an average 1.7-3.0. Further, the physicians expressed their expectancies as regards various treatment alternatives, and the value or weight they attached to the principle aspects of a treatment. An analytical decision model was used as a reference to gain insight into the extent to which the physicians make decisions based on their own subjective expectancies and values. This model assumes that physicians follow a maximizing strategy by choosing the treatment they personally assess as optimal. It was found that a model including only biomedical expectancies and values predicted the preferred treatment correctly in no more than 53% of the cases. Sometimes, biomedical aspects were disregarded that should have been relevant according to the physicians themselves. Adding aspects of the social environment and experiences improved the prediction of the model substantially: 3 out of 4 treatment preferences could be understood by following an analytical maximizing strategy including biomedical aspects and social aspects and experiences. In the remaining cases, the physicians were not able to describe their decision in terms of this maximizing strategy, which points at the use of alternative decision strategies. One alternative decision strategy mentioned by the physicians was a ‘follow-the-routine’ decision rule.

Key words—decision making, choice behaviour, drug prescribing

INTRODUCTION

The question of how physicians choose drugs is still far from understood. Variation in the quantity and quality of prescribing has been described extensively [1]. In order to optimize the drug choice and prescribing behaviour, it is of considerable importance to understand the decision process of the physicians [1]. It is generally recognized that choosing a drug therapy in actual practice is normally not the result of full decision analysis [2, 3]. Such an analysis would require that a physician estimates the probabilities of all good as well as bad outcomes for each possible option. These estimates or so called ‘expectancies’ must then be weighed according to the ‘values’ assigned to each of these outcomes. Based on these expectancies and values the option with the highest overall assessment can then be calculated and chosen. This can be called an analytical maximizing strategy. In clinical practice, however, physicians do not ‘grow’ complete decision trees in their heads for each individual patient. Several deviations from a decision analytical approach have been found.

Earlier studies, based on expectancy-value models made clear that biomedical aspects* are not the only factors that influence clinical decisions [2]. In studies among family physicians the social environment—such as professional and patient acceptability—also seem to affect the drug choices [4–6]. The role played by these factors among physicians working in a hospital is less well documented. Which factors are considered in a specific situation, and how much weight or value is attached to each may differ from one physician to another and depend on the indication in question [7–9]. The expectancies the physicians have regarding the possible treatment options will also vary, since these (subjective) expectancies will be based on past experiences as well as theoretical knowledge [7, 10]. Whether these expectancies are always quantified is doubtful [11, 12].

Other deviations from decision analysis may result from the limited cognitive abilities of the human brain [13]. Because of these limitations physicians sometimes rely on simplified rules to make decisions [14, 13]. They might focus only on a small number of outcomes or a limited number of options. Among family physicians it has been shown that they do not consider all possible treatment options when making a drug choice [16]. When choosing a therapy

*All aspects that can be objectively attributed to a specific therapy are called biomedical aspects. This term is not fully adequate, because it embodies not only biomedical aspects such as efficacy, side effects, dosing frequency, and route of administration, but also costs. However, for reasons of readability we have used this term rather than the more accurate term ‘biomedical and cost aspects’.

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for frequently occurring problems, a physician will undertake a mental evaluation only of the therapies that come immediately into his or her mind, i.e. the evoked set. Options that are not part of the physician’s evoked set will not be chosen, although they might theoretically be the best choice. Furthermore, it has been suggested that physicians make different judgments when a case is viewed in general rather than as an individual patient [17]. When choosing a treatment for an individual patient, more patient specific demands or characteristics can determine the final choice. From these findings, it seems that the drug choice process should be divided in two parts:

1. the selection of the treatment(s) the physician prefers for a standard patient with a certain diagnosis, i.e. the evoked set and the treatment of first choice
2. the choice of a specific treatment for an individual patient.

One might advance the hypothesis that, although physicians do not use decision analysis to decide for each individual patient, they resort to some kind of analytical maximizing strategy when they choose a treatment of preference for a standard patient. For the development of (re)education programs, it is important to know whether this is true, and if so, which aspects are relevant in this decision process. Therefore, the focus in this study is mainly on the decision-making process and not on the final outcomes. When we can explain and understand the treatment preferences of these physicians, the next question will be which treatment preferences are considered the best on theoretical grounds, and whether different treatment preferences differ with regard to the underlying decision process. This question, however, is addressed in a second part of the study and will be described in a separate paper.

In this part of the study, detailed analyses were performed of the treatment preferences of hospital physicians for 8 therapeutic fields. Questions addressed were ‘How many options does a hospital physician consider when confronted with a general problem?’, ‘Can the treatment preferences of hospital physicians be explained by an analytical search for the (drug) treatment that could be seen as optimal according to their own subjective expectancies and values (i.e. an analytical maximizing strategy)?’, and ‘Which decision criteria are relevant when choosing a drug treatment?’ Special attention was given to the possible influence of the professional environment on the treatment preferences, as physicians in a hospital setting may feel pressured to follow a certain hospital or ward policy.

When the hospital physicians use an analytical maximizing strategy, it should be possible to predict their treatment preferences correctly with a decision model based on their own expectancies and values. It may be expected that biomedical aspects alone will predict the treatment choices of physicians poorly; one could anticipate that inclusion of aspects of the social environment and personal experiences will improve the prediction significantly. However, when the physicians use more simplified decision rules or strategies not based on this maximizing principle, the overall predictive power of such models will be low. To establish the nature of possible simplifying rules or other decision strategies the reasons for choosing a specific therapy, as stated by the physicians, were explored.

**METHODS**

**Subjects and selection of therapeutic fields**

Physicians working in a 1000-bed university hospital in The Netherlands were interviewed about their treatment preferences in 8 therapeutic fields. This hospital is the fourth largest hospital in our country, and one of the 8 university hospitals. As 85% of the physicians had received some or all of their training within this university hospital, this sample can not be seen as representative of all hospital-based physicians. At the time of our research, the hospital did not have a drug formulary or local guidelines for therapeutics. This implies that the physicians have unconstrained treatment choice. However, on specific wards there may be certain routines regarding drug treatments which the physicians feel obliged to follow. Furthermore, the pharmacy delivers of each chemical entity only the brand or generic they keep in stock.

Therapeutic fields were selected in which variation in prescribing was observed which might be indicative of undesirable treatment preferences [18]. The selected fields were: (1) platelet inhibition for patients with a shunt or bypass (PI); (2) antihypertensive drugs for patients with renal problems (HY); (3) antiemetics after surgery (EM1); (4) antiemetics for patients on chemotherapy (EM2); (5) narcotic analgesics for severe pain after surgery (NA1); (6) narcotic analgesics for patients with cancer (NA2); (7) antibiotics for respiratory infections of unknown origin (AB); (8) vasodilatation for hemodynamically unstable patients (VA).

All 85 physicians working in the nine specialties that could involve patients in one of the selected fields were asked to participate in the study. The specialties involved were cardiology, internal medicine, surgery, intensive care, hematology, oncology, pulmonology, nephrology, and gastro-enterology. Seventy-seven physicians agreed to participate and of these 72 completed the interviews (response-rate 72/85 = 85%). Of the non-responders, 10 physicians did not cooperate (fully) because it would take too much of their time, one refused because he believed the results could never be anonymous considering the size and selection of the sample, another refused because the questions asked gave him the feeling that he was being audited against his will, and one physician left the hospital before he could be interviewed.
Of the 72 respondents, 49 had been in practice as a specialist between 1 and 26 years (average $8.4 \pm 6.7$ yr), and 23 were specialist-trainees. All 72 physicians were interviewed regarding their drug choices in one of the 8 selected fields depending on their specialty. The average frequency of patient contacts in those selected fields would be at least 1 patient per physician per day. Physicians familiar with more than one of the 8 selected fields, i.e. cardiologists, nephrologists, hematologists, internists, and one surgeon who frequently worked at the intensive care unit, were asked to be interviewed regarding a second therapeutic field. The numbers of respondents were respectively 20 for PI, 21 for HY, 10 for EM1, 18 for EM2, 12 for NA1, 7 for NA2, 15 for AB, and 8 for VA, thus in total 111 drug choices were evaluated. All interviews were conducted by the first author between June 1989 and January 1990; they took place at the physician’s office after an appointment had been made. The interviews took from 1 to 1.5 hr.

Data collection

The physicians were confronted with general patient descriptions, and questions were asked concerning their treatment of preference, their stated reason(s) for this choice, their evoked set, their expectancies as regards various treatment alternatives, and the value or weight they attached to the principal aspects of a treatment. The use of hypothetical patient descriptions has the advantage of controlling confounding factors, and presenting standardized situations to all physicians. At the same time, the use of standardized, hypothetical patients makes the situation less realistic, and may elicit more socially or professionally desirable behaviour as compared to actual practice. There is no clear consensus as to the validity of written case simulations for measuring actual (prescribing) behaviour, but such case descriptions seem to provide an effective research instrument for eliciting expectations and clarifying the decision-making process [19]. A typical case description in our study would read as follows:

Consider the situation that you have a patient who received a bypass; there are no complications and no abnormal conditions. Would you prescribe any treatment to prevent blood coagulation? If so, which treatment(s) would you prescribe?

The physicians were asked which treatment they would prefer. In an open-ended question, they were asked why they preferred this treatment; they could mention as many reasons for their choice as they deemed necessary. The physicians were also invited to mention all the alternatives they might consider in the situation presented. For each respondent, the list of treatments preferred and cited alternatives comprised his or her ‘evoked set’. The size of the evoked set was expected to differ for different indications, as well as for different physicians. It was tested whether physicians in the same (sub)setting tend to have similar evoked sets, and whether the evoked set expands with experience. Therefore, the relation was studied between the size of the evoked set, on the one hand, and the physician’s subspecialty (as an indication of the specific subspecialty of the physician) and the physician’s number of years in practice (as a measure of experience), on the other hand.

The physicians were furthermore asked to estimate for each therapeutic field the probabilities of the expected pros and cons of various possible drug treatments. In 7 of the therapeutic fields, the physicians evaluated a maximum of 5 or 6 treatments; in the eighth field, vasodilation, only 4 treatments were presented to the physicians. The physicians’ estimates can be seen as the expectancies regarding the principal aspects of each treatment. Aspects were included that have been identified in earlier studies among physicians as relevant for their treatment choice [4–6,20]. Moreover, the physicians were asked whether there were any other aspects—that were not in our questionnaires—which they considered relevant when choosing a therapy for these disorders. If so, the treatments were also rated on these additional aspects. In this way, we tried to include the full range of relevant aspects. The aspects in the questionnaire were:

1. ‘biomedical or knowledge aspects’: i.e. estimates of efficacy, rate of onset of the desired effect, side effects, frequency of dosage, routes of administration, costs, antibiotic resistance;
2. ‘aspects of the social environment’: i.e. expected professional approval (opinion of colleagues, consulted colleagues, local pharmacists, nurses, family physicians) and patient wishes as to the use of the drugs concerned;
3. ‘experiences’: i.e. their personal experience, that considered to exist generally with the drugs concerned, and that reported by others in clinical trials.

Examples of the questions put are given in Table 1. As can be seen, we asked for the subjective expectancies of the physicians, because we wanted to know whether the physicians choose the treatments that could be seen as optimal according to their own views. It was not the objective of this part of the study to identify the theoretically best care. As was already mentioned in the introduction, the question which decisions lead to the ‘best’ treatment preferences will be discussed in a separate paper.

The aspects of the social environment and the experiences were scored on a scale from 1 to 10, but when a physician had no idea about these aspects or had no experience with a specific drug, this was scored as 0. Although one can expect a correlation between the ‘social’ and ‘experience’ aspects and the estimates of the ‘biomedical’ aspects, it is assumed that these social and experience aspects will not be fully internalized in the biomedical expectancies of a
physician. It is assumed that they exert an additional influence on the drug choice process. When a physician, for instance, expects two treatments to be equal as regards the biomedical aspects, he may choose the treatment he has experience with, or the treatment his colleagues prefer. In that case, the biomedical aspects alone cannot predict his treatment preference, but the social or experience aspects can.

Apart from the above expectations, physicians were asked to express the weight or 'value' they attached to each of these aspects when choosing a therapy for that specific problem. These values were rated directly on scales from 0 ('aspect is not important at all') to 10 ('aspect is extremely important').

**Data analysis**

In order to determine whether the treatment preferences could be explained by an analytical maximizing strategy, overall assessments were calculated for each therapy and for each physician. All expectancies regarding the treatment aspects were recorded on scales from 0 to 100 and than weighed according to the values as stated by the physician, and totalled for each therapy. As we used directly rated value measures to calculate the overall assessments, a linear value function is assumed in this model. This method was chosen because it is an easy and quick method that yields high response rates and internal consistent assessments. The measure's validity and reliability might be lower than of more sophisticated and time-consuming utility measures, but it seems to be sufficiently valid for the explanation of preferences [21]. No configural models were tested, because linear models have proved to be very robust when monotone relations are assumed between the dependent and explaining variables [22].

The drug with the highest overall assessment is the model's prediction of the physician's first-choice drug. This prediction was compared to the preferred treatment as indicated by the therapy prescribed for that case. Kappas were calculated as a measure of agreement between the model's prediction and the preferred treatment. To clarify which of the aspects included were relevant for a correct prediction, the aspects were excluded from the model one by one. Because the number of respondents in each separate therapeutic field is small (n \( \leq 20 \)), this stepwise procedure was followed rather than a multiple regression analysis, e.g. discriminant analysis. When the model's predictive value was reduced after exclusion of a particular aspect, this aspect was considered relevant. Some physicians mentioned more than one treatment as equally preferable for an indication, whereas the model predicted only one treatment as the drug of first choice. On the other hand, the model sometimes predicted more than one treatment as optimal, whereas the physician preferred only one of them.

In such cases, the agreement was seen as not perfect, and scored as 1/N (N being the number of different treatments judged as being equal by either the model or the physician). In 17 of the 111 cases, the physicians were able or willing to evaluate only the therapy which they used themselves. These cases, in which only one treatment was evaluated, were excluded from this analysis.

To ascertain the value of the social environment and experiences in addition to biomedical aspects in explaining the treatment choices of physicians, the analysis was carried out twice; once using only biomedical aspects, and once using biomedical aspects, aspects of the social environment, and experiences. To test whether perceived constraints in the hospital setting were taken account of sufficiently in our model, the analysis was repeated excluding all treatment choices which according to the physicians were the result of either hospital or ward policy. Further, the physicians' reasons for their treatment preferences were screened for references to alternative decision rules or strategies.

Coefficients of relative variation (100 * \( \sqrt{\text{S}}(\text{X}) \)) were calculated to compare the variability of the overall assessments in each therapeutic field with the predictability of the preferred treatments in that field. When there is little variability in the overall assessments within a particular field, this might result in a low predictability. Pearson correlations were calculated to test the significance of this possible relationship.
Evoked set

In 7 of the 8 therapeutic fields, most hospital physicians mentioned more than one possible treatment option when confronted with a general case description. Only when deciding on a platelet inhibitor for patients with a shunt or bypass did 9 of the 20 physicians declare that they would consider just one treatment. Although 'no drug treatment' could have been an option to be considered, this was never suggested by any of physicians. The average size of the evoked sets ranged from 1.7 for the platelet inhibitors to 5.0 for antihypertensive treatment (Table 2). When considering a therapy for clinical respiratory infections of unknown origin, most physicians preferred combinations of, for instance, cephalosporines and aminoglycosides. These were counted separately when calculating the size of the evoked set. If instead they were counted as one (combination) therapy rather than as two separate ones, the average size of this evoked set would decrease to 3.5 ± 1.1.

No relation was found between the subspecialties of the physicians and the size of their evoked set. In all but two therapeutic fields, no relation was found between the number of years in practice and the size of the evoked set. Only with regard to the antihypertensive treatment and the platelet inhibition was a positive correlation found between the number of years in practice and the number of treatments in the evoked set of a physician (Pearson correlation = 0.42 for the antihypertensive treatment, P = 0.03; Pearson correlation = 0.68 for the platelet inhibition, P < 0.01).

Expectancies

In each therapeutic field, the expectancies physicians had of the treatments varied, especially with respect to efficacy. Whereas some physicians believed a certain drug was effective for only 40% of the patients as described, others believed that 90% of these patients would benefit from the treatment. With regard to side effects too, large differences in expectancies were encountered. For none of the treatments evaluated was a specific side effect assigned to it by all physicians. Ninety-four percent of all side effects mentioned were cited by less than 50% of the physicians. It appeared that significantly less side effects were assigned to treatments with which a physician had no personal experience than to more familiar treatments (Table 3, χ² = 38.5, P < 0.001). Depending on the drug class, the average number of minor side effects assigned to a drug varied between 1 and 2 (minimum of 0 and maximum of 7). For serious side effects the average number varied between 0.5 and 1 (minimum of 0 and maximum of 3).

The costs of the treatments were not well-known. The percentage of physicians who declared that they had no idea about these exists varied from 11% for antibiotics, 26% for platelet inhibitors, 30% for vasodilators, 36% for antihypertensives, and 52%
for narcotic analgesics, to 63% for antiemetics. Of all cost assessments made, only 31% approximated the actual price (that is, the estimated average costs per day were somewhere between the actual price of the minimum and the maximum advised dosage per day).

Only a limited number of treatments were believed to raise problems with respect to the rate of onset of effect, frequency of dosage, route of administration, or resistance. The rate of onset of effect was considered to be too slow for some antiemetics; frequency of dosage problems were seen for several forms of antihypertensive treatment and some of the platelet inhibitors.

Concerning the aspects of the social environment, it was notable that the opinion of the colleagues was the best known. More than half of the physicians had an idea about their colleagues' opinion regarding the platelet inhibitors, antiemetics, narcotic analgesics, antibiotics, and vasodilators. Only for the antihypertensive drugs did less than 50% of the physicians express views about the opinion of their colleagues. As regards the antiemetics for cancer patients, around 35% of the physicians expressed views about the opinion of the nurses. The opinions of the local pharmacist and the family physicians were unknown to more than three-quarter of the physicians in all fields.

The majority of the physicians had personal experiences with most drug treatments presented to them. Drugs with which only a few physicians had personal experiences were sufentanyl and fentanyl (for pain after surgery), and propranolol and methyldopa (for hypertensive patients). Physicians often did not know whether the experiences in clinical trials were positive or negative for the specific patients in the selected therapeutic fields. For most drugs, less than half of the physicians made estimates of the experiences reported in clinical trials.

**Perceived values**

When we look at the biomedical aspects which the hospital physicians believed to be relevant for their treatment choices, efficacy was seen as the most important in all therapeutic fields, followed by serious side effects (Table 4). On average, minor side effects and costs were perceived as the least important; in most cases these were less important than frequency of dosage and route of administration. Frequency of dosage was rated as particularly important when choosing an antihypertensive treatment or an analgesic for cancer patients.

Of the aspects of the social environment, the views of colleagues were relatively important. The patients' wishes were rated as important in both of the two fields where symptoms were treated rather than underlying pathology, i.e. emesis and pain. As could be expected this concerned only cancer patients and not patients after surgery, who usually are not in a position to express their wishes. In 5 out of 8 fields, the physician's own favourable experience with a treatment was perceived as being more important than the experience of others, such as that reported in clinical trials (Table 4). Only in one field did several physicians mention another factor of influence on their treatment choice, which we had not included in our list. This concerned the influence of a local

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**Table 4. Average values assigned to decision criteria (scale 0-10)**

<table>
<thead>
<tr>
<th>Field</th>
<th>PI</th>
<th>HY</th>
<th>EM 1</th>
<th>EM 2</th>
<th>NA 1</th>
<th>NA 2</th>
<th>AB</th>
<th>VA</th>
<th>Average</th>
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<tr>
<td>Efficacy</td>
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<td>9.3</td>
<td>9.6</td>
<td>9.6</td>
<td>9.6</td>
<td>9.8</td>
<td>9.8</td>
<td>9.8</td>
<td>9.9</td>
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<tr>
<td>Serious side effects</td>
<td>8.5</td>
<td>8.7</td>
<td>9.4</td>
<td>8.5</td>
<td>7.7</td>
<td>7.3</td>
<td>7.4</td>
<td>8.1</td>
<td>8.2</td>
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<tr>
<td>Rate of onset of effect</td>
<td>—</td>
<td>5.6</td>
<td>8.3</td>
<td>7.5</td>
<td>8.5</td>
<td>7.0</td>
<td>8.6</td>
<td>9.4</td>
<td>7.8</td>
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<td>Resistance problems</td>
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<td>7.1</td>
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<td>Frequency of dosage</td>
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<td>7.8</td>
<td>6.8</td>
<td>5.3</td>
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<td>4.8</td>
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<td>6.1</td>
<td>5.5</td>
<td>5.7</td>
<td>5.4</td>
<td>7.2</td>
<td>4.8</td>
<td>2.1</td>
<td>5.1</td>
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<td>5.2</td>
<td>5.2</td>
<td>4.0</td>
<td>4.7</td>
<td>6.0</td>
<td>4.7</td>
<td>4.3</td>
<td>4.8</td>
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<tr>
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<td>6.0</td>
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<td>4.5</td>
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<td>7.1</td>
<td>6.7</td>
<td>5.7</td>
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<td>5.3</td>
<td>7.8</td>
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<td>5.3</td>
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<td>5.8</td>
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<td>3.1</td>
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<td>5.5</td>
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<td>6.2</td>
<td>2.8</td>
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<td>2.2</td>
<td>3.3</td>
<td>1.1</td>
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<td>2.3</td>
<td>2.1</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
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<td>Personal experience</td>
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<td>8.3</td>
<td>8.9</td>
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<td>Amount of experience</td>
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<td>8.3</td>
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<td>8.0</td>
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<td>in general</td>
<td>8.8</td>
<td>7.6</td>
<td>8.0</td>
<td>8.0</td>
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<td>7.8</td>
<td>8.3</td>
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</table>

Italic figures in each of the three sections is the criterion with the highest average value. PI = platelet inhibition after shunt or bypass; HY = antihypertensive drugs for patients with renal problems; EM1 = antiemetics after surgery; EM2 antiemetics for patients on chemotherapy; NA1 = narcotic analgesics for severe pain after surgery; NA2 narcotic analgesics for patients with cancer; AB = antibiotics for respiratory infections of unknown origin; VA = vasodilation for hemodynamically unstable patients.
expert on blood coagulation when choosing a platelet inhibitor. The opinion of this expert received a high rating, averaging 8.8.

The models' predictions

A linear additive model including only biomedical aspects predicted the treatments actually preferred by the physicians only to a slight to moderate extent. The percentage of agreement varied from 17% to 88%, and in all but one therapeutic field, kappa did not exceed 0.50 (Fig. 2). For all fields taken together the average agreement was 53% (kappa 0.36). When the social environment and experiences were included in the model, the agreement between the preferred treatments and the model's predictions increased considerably in most fields. When all aspects that did not contribute to the correct prediction were deleted (see also the next paragraph), the percentages of agreement ranged from 61% to 100%, kappa from 0.48 to 1.00 (on average 77%, kappa 0.63). The aspects included in each therapeutic field are specified in Table 5 and 6 (see below). Together they form the best predictive model; i.e. no single aspect or combination of aspects gave a better prediction of the preferred treatment. Thus, on average in 23% of the cases the treatments that the physicians preferred could not be correctly predicted using their own expectancies and values.

A low predictability could be the result of too small a degree of variability in the overall assessments within a particular field. However, there was no significant relationship between the coefficient of relative variation of the overall assessments calculated in each field and the percentage of agreement.

Table 5. Relevant biomedical aspects in the best predictive model (in ranked order of importance)

<table>
<thead>
<tr>
<th>PI</th>
<th>HY</th>
<th>EM1</th>
<th>EM2</th>
<th>NA1</th>
<th>NA2</th>
<th>AB</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI efficacy &gt; serious and minor side effects, frequency of dosage &gt; costs</td>
<td>EM2 efficacy, minor side effects</td>
<td>NA2 efficacy &gt; costs &gt; frequency of dosage &gt; route of administration</td>
<td>AB efficacy &gt; costs &gt; resistance problems</td>
<td>VA efficacy and rate of onset of effect &gt; costs &gt; serious and minor side effects</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| PI = platelet inhibition after shunt or bypass; HY = antihypertensive drugs for patients with renal problems; EM1 = antiemetics after surgery; EM2 = antiemetics for patients on chemotherapy; NA1 = narcotic analgesics for severe pain after surgery; NA2 = narcotic analgesics for patients with cancer; AB = antibiotics for respiratory infections of unknown origin; VA = vasodilation for hemodynamically unstable patients. |

Table 6. Relevant aspects of the social environment and experiences in the best predictive model (in ranked order of importance)

<table>
<thead>
<tr>
<th>PI</th>
<th>HY</th>
<th>EM1</th>
<th>EM2</th>
<th>NA1</th>
<th>NA2</th>
<th>AB</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI experience reported in trials &gt; personal experience</td>
<td>EM1 opinion of consulted colleague (anaesthetist) &gt; personal experience</td>
<td>EM2 opinion of colleagues</td>
<td>NA1 personal experience &gt; opinion of consulted colleague (anaesthetist)</td>
<td>NA2 personal experience</td>
<td>AB experience in general &gt; opinion of consulted colleague (infection specialist)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PI = platelet inhibition after shunt or bypass; HY = antihypertensive drugs for patients with renal problems; EM1 = antiemetics after surgery; EM2 = antiemetics for patients on chemotherapy; NA1 = narcotic analgesics for severe pain after surgery; NA2 = narcotic analgesics for patients with cancer; AB = antibiotics for respiratory infections of unknown origin; VA = vasodilation for hemodynamically unstable patients.
or kappa (Pearson correlation coefficient = -0.2, \( P > 0.05 \)). The discrepancy between the choices made and the subjective overall assessments could also be the result of the constraints the physicians experience when choosing a drug within the hospital setting. Physicians might feel pressured to follow a certain ward routine with regard to the preferred treatment, although this is not in agreement with their personal assessment of the treatments. In that case, their treatment preferences reflect what they can do and their overall assessments reflect what they want to do. To test this hypothesis, the reasons were screened that the physicians themselves gave for their treatment choices. A reason mentioned for almost a quarter of the choices was “it is the standard therapy on this ward or in this hospital”. A recalculation of the model’s prediction excluding all these treatment choices led to an increase in the overall agreement of only 0.6%, suggesting that our model took account of the perceived preferences of the hospital sufficiently (possibly through the inclusion of the ‘social environment’ aspects). However, it remains possible that we did not capture all aspects of the decision process accurately enough with our model. Analysis of the reasons the physicians themselves gave for their choice of treatment can give some insight in this. Of the reasons given by physicians to explain a choice that could not be predicted by the analytical maximizing strategy, 9 were referring to the biomedical aspects of the treatment or its alternatives, 8 mentioned that it was the standard therapy in the hospital, and 4 were referring to the good experience the physician had with the treatment. These are all aspects that were included in the model, but may have been incorrectly weighed. Other reasons mentioned by the physicians were “I am used to choosing this treatment” (7x) and “I learned to do it that way” (1x). Finally, some physicians said they had no specific reasons for their choice” (3x).

Relevance of aspects

As described above, a stepwise procedure was followed to determine which of the aspects included in the model were relevant for a correct prediction. It appeared that the relevance of the various aspects differed from one therapeutic field to another. Of the biomedical aspects, efficacy was the most important predictive element in all but 2 fields (Table 5). In all but 3 fields, side effects and costs were important as well. Frequency of dosage, route of administration, and rate of onset of effect appeared to be relevant aspects in 4, 3, and 1 field(s) respectively. As far as the other aspects were concerned, personal experience was found to be relevant in 5 fields, whereas the opinion of experts or colleagues appeared to be relevant in 4 fields (Table 6). In one therapeutic field (VA), none of the aspects of the social environment or experiences affected the correctness of the prediction regarding the treatment of first choice.

**DISCUSSION**

The objective of this study was to develop further insight into therapeutic decision making, and in particular, into the treatment preferences of hospital physicians. Although our focus was on the decision-making process and not on its outcomes, it should be noted that when looking at quality of care or cost-effective care one decision strategy is not necessarily better than the other. Knowing which decision strategies might be used, however, offers us leads for the development of more efficient (re)educational programs. In this study, therapeutic fields were selected in which problematic drug choices were found to be made in one of the university hospitals in The Netherlands. Therefore, the findings help us understand why certain therapeutic decisions are being made, but should not be interpreted as being representative for all therapeutic decisions made by all hospital physicians.

It is not realistic to expect that the physicians evaluate all possible treatment options available when choosing a therapy. Confronted with a general patient description, the hospital physicians considered only a limited set of alternatives, on average 1.7–5.0 different treatments. This tallies with the research findings among Dutch family physicians whose evoked sets have been found to contain 3–5 treatments [16]. In two of the therapeutic fields, the size of the evoked set was related to the experience of the physicians. The more years of experience, the more hypertensive and platelet inhibition treatments were considered by the hospital physicians. No association was found between the size of the evoked set and the (sub)setting of the physician.

As was the case with family physicians, biomedical aspects alone did not predict the preferred treatments very well. This finding shows that even in a standardized situation, without the confrontation with an actual patient, other (non-biomedical) aspects influence the drug choice process. This was especially visible when the alternative therapies did not differ greatly in their perceived biomedical properties. For instance, narcotic analgesics for cancer patients or antiemetics after surgery were seen as approximately equivalent as regards the biomedical aspects, and the choice made among these agents was therefore better predicted by the aspects of the social environment and personal experiences (see also below). On the other hand, the physicians considered that vasodilators differed considerably from one another as regards their biomedical aspects; as a result, the choice made between them could largely be predicted on the basis of these aspects. In this case, the other aspects had nothing to add. The influence of the social environment was also shown by the reasons given by the physicians for their choices; one reason frequently mentioned was that the preferred treatment was considered to be the standard treatment in the hospital or on the ward.
The study as a whole showed that 23% of the choices made could not be correctly predicted with the physicians' own expectancies and values even after the inclusion of the social environment and experiences. This percentage is fairly similar to the figures reported when family physicians were, for instance, choosing between anti-diabetics, anti-hypertensives, or treatments for renal colic; the percentage not correctly predicted varied in those instances from 13 to 30% [4, 5]. There could be several explanations why 1 out of every 4 treatment preferences could not be predicted correctly with our model. First, we might not have captured all relevant aspects. However, all physicians were asked to mention all aspects they considered relevant. One aspect often mentioned by the physicians as a reason for their choice was the 'perceived ward or hospital policy', but it appeared that this aspect was sufficiently taken account of in our model. Second, we might have weighed the aspects incorrectly or included aspects that were not really relevant. Although the aspects that did not contribute to the correct prediction were deleted from the final model, the analysis of the reasons given by the physicians to explain their treatment preferences revealed that some aspects might have been incorrectly weighed; 21 of these reasons referred to aspects that were included in the model. Some physicians may have put more or less weight on certain aspects than they had expressed in the value scores. Third, some of the treatment preferences might be the result of more simplified decision rules or strategies not based on the maximizing principle, as was suggested when studying clinical decisions relating to patients with coronary artery disease or pulmonary problems [9, 23]. One decision strategy reported to be employed in our study was the application of an analogy with the treatment used in managing such cases in the past, which could be reflections of a "follow-the-routine" rule or of case-based reasoning. Several physicians choose a treatment, because it was their routine choice, but gave no specific reasons underlying this routine. Some evidence for this kind of habitual processes was also found in a study that focused on the rationales for prescribing antibiotics [24].

There was a difference between the aspects which the physicians considered to be important for their treatment choice and those which in fact proved to be relevant for this choice. One might be tempted to regard this as the difference between ideal and reality, but that is not accurate. One explanation for this discrepancy is that in some instances the various treatment options did not differ in certain respects. The examples of the narcotic analgesics and the antiemetics were already mentioned. A lack of perceived differences between individual drugs also explains why frequency of dosage rather than efficacy or serious side effects appeared to be the most important aspect taken into account when choosing an anti-hypertensive treatment, for these drugs differed much more in the former respect than the latter. A similar explanation holds for the relatively major role played by considerations of costs when choosing a vasodilator, despite the fact that the physicians in this field did not consider this aspect to be of great importance. Due to the considerable differences in costs, this aspect did become relevant.

However, not all discrepancies between the importance of certain aspects as perceived by physicians when questioned (Table 4) and their relevance when the actual choice is made (Tables 5 and 6) can be explained by (a lack of) product differentiation. Some aspects actually seemed to be disregarded. For instance, the antibiotic treatment preferred by most physicians had been rated by them as 'unfavourable' both because of serious side effects and frequency of dosage. Including these aspects in the model did not improve the prediction of the preferred treatment. When the choice had been based on these aspects, the physicians should have preferred an alternative treatment. The same could be said for the rate of onset of effect in the case of antiemetics selected for patients with cancer. The choices made by most physicians in that field showed a preference for a treatment which scored low on the rate of onset of effect, although they had reported this was a relatively important aspect. This phenomenon of the physicians' difficulty to describe their decision-making process accurately has been reported before, e.g. as regards the treatment of rheumatoid arthritis or the therapy for menopausal women [25, 26].

The three questions in this study can be answered as follows. As expected, the hospital physicians did not consider or evaluate all possible treatment alternatives, but only a limited set (i.e. their evoked set), when confronted with a general, standard patient. The size of this set depends on the therapeutic field, as well as the physician. Secondly, not all treatment preferences can be explained by an analytical maximizing strategy. Other strategies are used, such as a 'follow-the-routine' decision rule. Thirdly, the relevant decision criteria for choosing a treatment of preference, both reflected in the opinions elicited from the physicians as well as their actual choices, include not only biomedical aspects, but also the opinion of colleagues and personal experiences. Sometimes biomedical aspects which should have been relevant according to the views expressed by the physicians are disregarded. Whether differences in this decision-making process are related to differences in quality of care will be the subject of a separate paper. Then also some implications for (re)education and intervention programs will be discussed.

In this study, we used general patient descriptions to get insight in decisions related to the treatment preferences for standard patients. Although it is assumed that such general treatment preferences underlie many of the choices made in actual practice, they do not represent treatment decisions for individual patients. In individual patients, specific demands
or characteristics can determine the final choice. To get insight in such everyday decisions of physicians a follow-up study will be conducted using realistic descriptions of individual patients.

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REFERENCES