A novel Approach to Modelling the Prescribing Decision, Integrating Physician and Patient Influences

Phil Mellor and Stuart Green
Adeiphi International Research Ltd, Bollington. UK

This paper describes a case study designed to demonstrate the feasibility of building a linked decision model based on the implications of distributed decision-making in healthcare, and thus to provide the ability to make quantified predictions of product offer performance.

The approach taken was to adapt an existing conjoint-based forecasting tool (CAPMOD”[4]), (Brice et al. 2000). Our results show that there is a subset of product attributes on which physicians and patients perceive substantive differences in terms of their relative importance in their views of therapy alternatives.

We also demonstrate that the observed differences in predicted share uptake between the separate, non-integrated physician and patient models and the integrated model do not necessarily follow from the observed differences in average relative importance between the two customer types, as would be the case for many existing simulation models. This additional insight into the decision-making process was possible through the use of a decision model, which includes the key element of individual physician—patient linkage with an associated cut-off threshold.

The paper describes the details of the approach and shows example outputs from the model. It will explore a number of interesting practical and theoretical issues that were encountered in the course of conducting this research.

Summary

The marketing need of our client was to make decisions on positioning options available to a new product for the treatment of an important and common disease, and one where patients are known to have views on their treatment. The marketing research was required to provide a decision support model based on a quantitative understanding of the potential impact of product profile options. A forecasting tool was designed that integrated insights both from the physician and the patient perspective.

The approach taken was based on established conjoint methodologies. Important features of the design were:

- A sampling frame that delivered the conjoint exercise in the context of individual physician—patient relationships (i.e. the physician considered a specific patient and that specific patient was then interviewed).
- A means to classify patients in terms of the extent to which they were actively engaged in the decision-making process leading to choice of therapy. Patients were categorised as 'passive' or 'active' in this context.
- The ability to represent the 'same' conjoint profiles to each respondent type despite the need to tailor the descriptions of the profiles' features according to respondent type understanding.
- An adaptation of the question asked of the sequence of therapy profile offers within the conjoint exercise. This adaptation introduced a concept of 'willingness to compromise' on any choice that a respondent would otherwise make, reflecting the influence of the other party to the decision.

The underlying philosophy at the heart of our approach is a belief that the best representation of decision 'reality' is obtained through an individual physician—patient level approach. By this we mean that this conducts the whole process of design, data collection, analysis and modelling at this level. In consequence there is no distortion through averaging effects, and specificity of context is maintained throughout.

By comparison of model predictions with and without synthesis of the two customer perspectives, we were able to demonstrate and characterise the nature and variability of the physician and patient interaction and its impact on the predicted share (and source of share) for the new product offers.

More specifically, we were able to show a maximum difference of *5%* patient share between the estimates from the model with synthesis of the customer perspectives and those without (for realistic product scenarios). We were also able to demonstrate that the observed differences in predicted share uptake between the two modelling exercises did not necessarily follow from the observed differences in average relative importance between the two customer types as described above, as would be the case for many existing simulation models. This additional insight into the decision-making process was possible through the use of a decision model, which includes the key element of individual physician—patient linkage with an associated cut-off threshold.

Future development of such models may be expected to deliver improved ability to forecast in important areas such as likely new product success and return on investment for promotional spend in different customer groups. As a result, we believe we have enhanced the capability of research to understand the complexity of the prescribing decision.

Introduction

There are several characteristics of the healthcare market which are considered distinct from many, if not all, other marketplaces, leading to a search for unique research solutions. One of the most striking of these is the complex nature of the decision-making process surrounding the choice of drug therapy. This is characterised most easily by the fact that a physician has ultimate (legal) responsibility for the prescription, whereas it is the patient who is the end user and — in some cases — the payer. In general, we might usefully describe this phenomenon as a *distributed decision-making process.*

As marketing researchers, we are aware of the issue and have qualitative insight into its nature. While this insight may be sufficient in many circumstances, it may be inadequate where there are trade-offs to be made in product offers, on which physicians and patients are likely to have different views of the value offered. Specifically it will not enable adequate prediction of how new product offers might perform in the marketplace.

Our approach was to start from the concept of individual respondent level threshold-based modelling as embodied in the CAPMOD™ adaptation to existing conjoint paradigms.

This approach is designed to address the scenario in which, for example, 'Product A' is preferred to 'Product B' but neither of these options is chosen — and to represent this outcome at the individual respondent level in the calculations performed within the decision model. It also overcomes limitations to simulation based on the need to input profiles for existing competitor products (i.e. the need to define the current market) as found with standard preference-based OLS (e.g. ACA) and choice-based logit models (e.g. CBC).

The adaptations we needed for our distributed decision-making (physician—patient) model included the following components:

- A sampling frame that delivered the conjoint exercise in the context of individual physician—patient relationships (i.e. the physician considered a specific patient and that specific patient was then interviewed).
- A means to classify patients in terms of the extent to which they were actively engaged in the decision process leading to choice of therapy. Patients were categorised as 'passive' or 'active' in this context.
- The ability to represent the 'same' conjoint profiles to each respondent type (physician and patient) despite the need to tailor the descriptions of the profiles' features according to respondent type understanding.
- An adaptation of the question asked of the sequence of therapy profile offers within the conjoint exercise. This adaptation introduced a concept of 'willingness to compromise' on any choice a respondent would otherwise make, reflecting the influence of the other party on the decision.

Methodology

The study was conducted in four countries with a total sample of 170 physicians and 170 patients.

Sampling frame

Clearly, for this study, both physician and patient sampling was required. Physicians were selected who were willing to seek patient consent both to discuss the patient's individual case and to recruit the same patient to a subsequent interview. We were aware that this sampling approach would cause logistical problems where either party declined to be involved, and that these problems would be exacerbated by a tight time line for completing fieldwork. As a result, we also adopted a 'surrogate' approach in which physicians discussed a particular — but anonymous — patient meeting the selection criteria and then recruited for interview a different patient to whom the physician felt they would have responded in a similar manner.

All interviews were conducted face to face in physician offices or patient homes, using a semi-structured interview approach.

Research instrument design

Patients were classified, both by themselves and their physicians, in terms of their engagement with decisions on their own therapy. Correspondingly, patients allocated themselves, or were allocated, to one of four categories in this respect. For the purpose of selection and analysis, two of these patient categories were labelled 'active' — denoting a threshold level of engagement in decisions on their therapy — and two patient categories were labelled 'passive' — denoting no engagement in the decision on their therapy.

Physicians selected for discussion patients whom they had classified in the 'active' categories. As it would be assumed that 'passive' patients would not alter the physician treatment decision, patients were recruited for interview only if they were in the 'active' categories as defined by the physicians.

The conjoint features matrix presented a major challenge in setting up the design for this study. For the linkage between physician and patient data to work effectively, it was essential we had a means to represent the 'same' product offer (represented by a conjoint stimulus card) in terms that were meaningful to both parties. There were two categories of attributes for which different approaches were adopted:

(1) *Transferable attributes.* These were attributes for which the same or similar descriptors could be adopted with both physicians and patients, without significant compromise to either party in terms of understanding. In this category were side-effects of products, dosing regimens and some of the attributes describing the efficacy of the product.

(2) *Non-transferable attributes.* These were attributes for which one customer type could not be expected to understand either the description or its significance. In this study, technical aspects of the product performance relevant to the physician fell into this category. Prior research had shown that patients had a poor understanding of these product attributes. For patients, the attributes were either not shown (e.g. drug interactions) or were shown, but patients were asked to ignore their corresponding features if they did not understand their significance. This was regarded as the most realistic approach in the circumstances: i.e. features 'ignored' translate into a low utility for the patient in the conjoint exercise. The utility for the physician then drives the result.

The conjoint stimulus cards were generated from the conjoint features matrix using the design module from Sawtooth Software's full profile OLS conjoint system, CVA. Substantial customisation of the traditional preference-based (ranking and/or rating) approach to assessment of cards was required to service the requirements of the study design, as is described below:

In both the physician and the patient interview, respondents rated the conjoint stimulus cards by placing them on a rating scale that incorporated a concept of compromise according to the influence of a third party. Essentially, the extent to which a particular offer, represented by a stimulus card, was valued was measured in terms of willingness to compromise. The concept of this scale is shown in Figure 1. Note that the physicians and patients completed the exercise in separate interviews. Figure 1 is merely a representation of the scales that each would see for comparison purposes.

- After rating all the conjoint stimulus cards on the scale, physicians and patients were also asked to indicate a 'cut-off' threshold. Respondents indicated a point on the scale (represented by a particular conjoint stimulus card) at which they would have chosen the product represented on the stimulus card rather than that which they actually chose. This 'switch point' represented the threshold between therapy actually used and profiles offered in the conjoint exercise.

- For physicians, the context for this 'cut-off' was consideration of a patient who differed from the patient in the conjoint exercise only in that the physician felt that the decision on therapy choice would be theirs alone (i.e. the physician would place this patient in the 'passive' category).

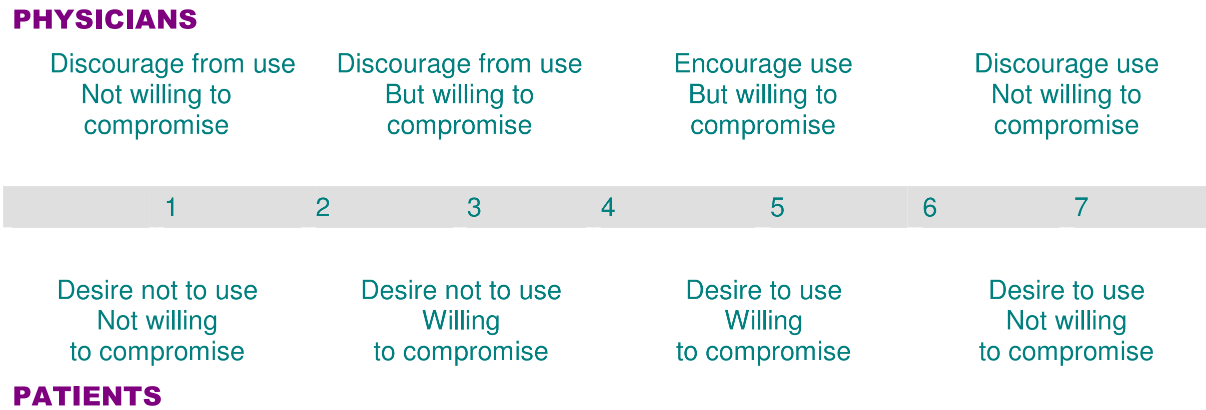

Figure 1 Conceptual representation of scale used in the research

Decision model

A decision model was developed based principally on the data generated through the modified conjoint trade-off exercise described above.

The model provided patient share estimations for any new product profile scenarios inputted. This calculation proceeded via a notional scoring of the input profiles against the scale represented in Figure 1. Two different calculation approaches were adopted depending on the patient category:

(1) For *passive* patient categories, the *physician data only* were used to generate predictions of patient share (since these patients were held to have no active role in the choice of their therapy). The calculation used the 'cut-off' threshold described above to derive an uptake probability for any input profile at the individual physician level.

(2) For *active* patient categories, the notional scoring for any input profile was generated from *both physician and corresponding patient data,* and this scoring compared to the cut-off threshold value for each to provide an uptake probability. A decision rule on combining the two probabilities to produce a 'linked' value was then applied. The base case rule was a simple averaging, which is used in the results reported below. The base case is equivalent to assuming equal weight of both parties to the ultimate choice decision. The facility to alter the weights allows the outcome of change in relative impacts of patients and physicians, for example through increased DTC promotion to be modelled.

Results

Physicians in the sample reported that an average of approximately *45%* of their patients fitted into the 'active' categories as defined for the research. This figure is used as the weighting factor for the two calculation routes used in the decision model (see above).

Across the whole sample, 30% of the interviews were conducted with a direct linkage (i.e. where the physician discussed a patient who was subsequently interviewed). The remainder were conducted as 'surrogate' interviews (in which physicians discussed a particular — but anonymous —patient meeting the selection criteria and then recruited for interview a different patient about whom the physician felt they would have responded in a similar manner). There was wide variation in the percentage of interviews conducted with direct linkage across the different countries.

Robust analysis of differences of response patterns between these two types of linkage was not possible within each country due to sample limitations. At the whole sample level, such analysis was not conducted since the proportion of matched to unmatched pairs varies between countries, and any observed differences could equally be explained by country (cultural) bias in the samples. The limited investigations we did conduct did not lead to any indications of major differences between matched and unmatched pairs.

The conjoint exercises delivered the mean relative importance of attributes for the two customer groups shown in Figure 2.

The key areas in which physicians and patients differed, on average, is in their views of the importance of short-term side-effects, one of the efficacy indicators and the dosing schedule. As a result, we may expect to see differences between a physician only and a physician—patient linked model where we vary the features offered based on these attributes.

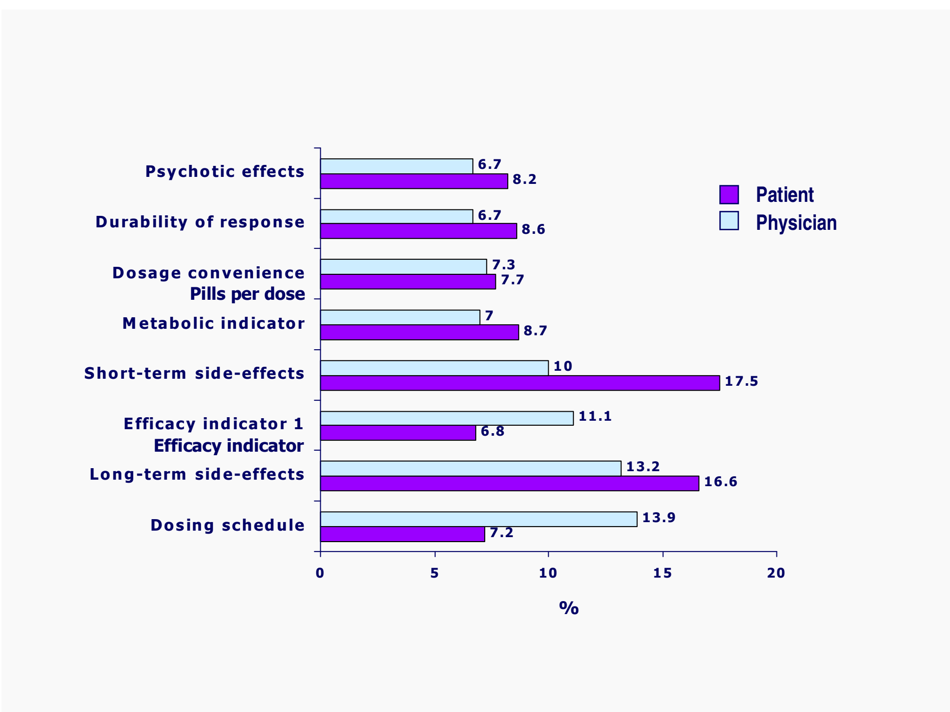

Figure 2 Relative importance of attributes used in the decision model

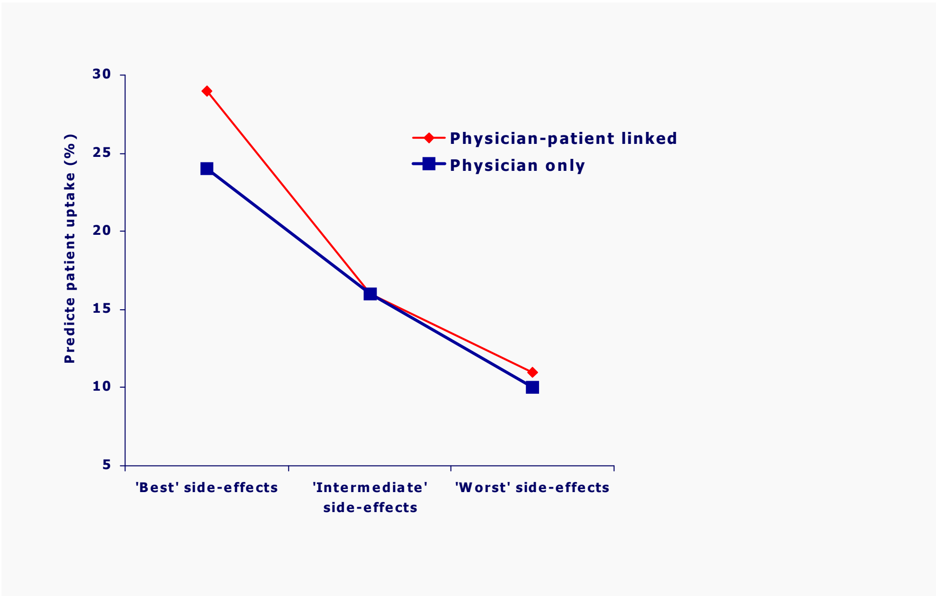

Figure 3 Patient share estimates for input profile scenarios in the decision models: side-effects features varied

A large number of potential product scenarios can be represented in the decision model described above. In the scenarios conducted for this paper, a specific profile was input to the decision model and one attribute varied across its available features (described as 'best' to 'worst' in Figures 3 and 4) to record the impact on share estimation. This exercise was carried out for the side-effect attribute and the dosing schedule attribute.

To illustrate the impact of the linked model, the same scenarios were conducted for a non-linked model, in which the physician data alone were used to generate the share estimation in the model (equivalent to physicians having 'passive' patients only). Figure 3 shows the estimated patient uptake among patients in the physician sample for these product scenarios where the side-effect features only were varied.

If we consider the result for the side-effect variation scenarios, we observe a divergence between the linked and non-linked models at the 'best' side-effect feature, with close correspondence between the models for the other side-effect feature options. The divergence relates directly to the higher relative importance attached to the side-effects observed in Figure 2, and suggests that this relative importance is strongly driven by the patients' relatively high utility attached to the 'best' side-effect offer in the profiles.

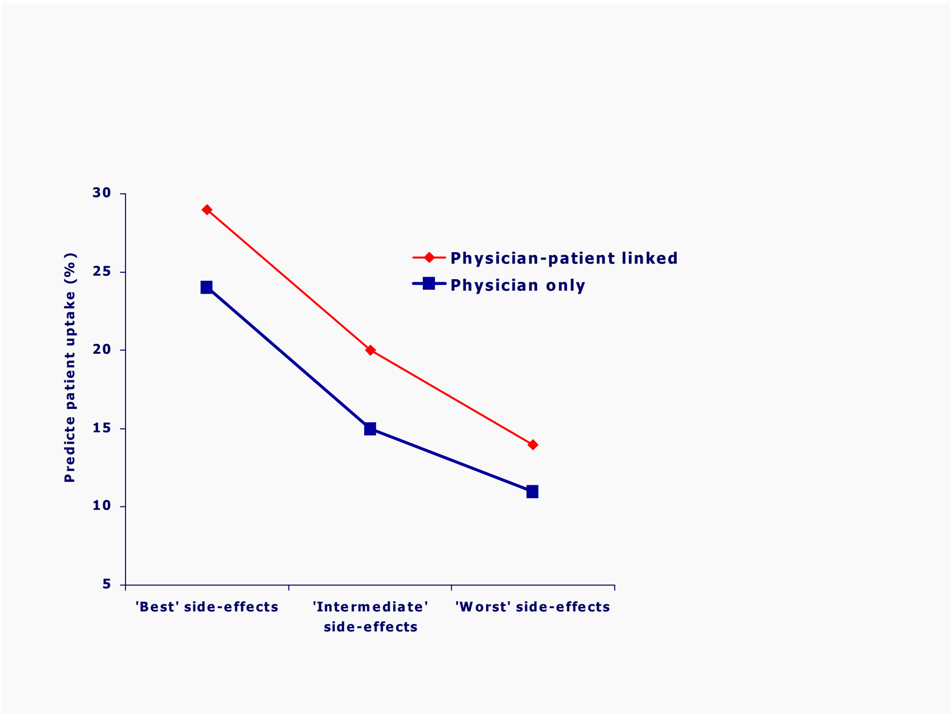

Figure 4 Patient share estimates for input profile scenarios in the decision models: dosing schedule features varied

If we now consider the dosing schedule scenario results shown in Figure 4, we see a different outcome. The two lines representing linked and non-linked models maintain a relatively constant distance between each other on the chart. This distance at the ‘best’ dosing point is the same as that observed in the side-effect feature divergence in Figure 3 (since the side-effect attribute was held at the ‘best’ level while dosing schedule was varied and vice versa). The relatively small change in this distance between the two lines for the other dosing levels suggests a relatively limited patient impact on physician decisions with respect to dosing schedules as profiled in this research. This is because the distance between the lines for these other dosing levels is already explained by the ‘best’ side-effect phenomenon described above. This result is observed despite the fact that substantive differences in perceived importance of dosing schedule are observed in Figure 2.

For an explanation of this apparent contradiction, we must reflect on the fact that our decision model is based on individual physician—patient linked calculations, and leads to a very important observation that goes to the heart of understanding the nature of the distributed decision-making in this situation.

The relative importance scores shown in Figure 2 are derived from individual utility scores across the sample of physicians and patients with subsequent averaging of attribute importance statistics for each individual. The magnitude of any particular attribute relative importance is related directly to the range of utilities for the attribute features. Hence the result for dosing schedules in Figure 2 represents, on average, a tendency for patients' range of feature utilities to be greater than those ftr the physicians. All that is required to explain the result of the model scenario is a tendency for those patients with a wider range of dosing schedule feature utilities (relative to their physician's) to also be those patients who have a 'high cut-off' threshold (i.e. there would be a low probability of choice from their perspective despite a high product utility). The decision model in this study includes the key element of individual physician—patient linkage with an associated cut-off threshold, which allows this sophistication of choice behaviour to be accounted for.

In the scenarios considered for this paper, we observe a maximum divergence of approximately *5%* in terms of predicted patient uptake in absolute terms. It is more potent however to consider **it** in the context of the levels of predicted uptake generally observed. As an illustration, this 5% difference in patient share represents a 20% increase on the share predicted for the physician-only model.

We were able to generate a maximum 18% difference in predicted patient share between the linked and physician-only models in sensitivity analyses. This occurred where the 'active' patient population was increased to *75%* of all patients.

Discussion

The purpose of this study was to demonstrate the feasibility of building a linked decision model based on the implications of distributed decision-making in healthcare, and thus provide the ability to make quantified predictions of product offer performance. We believe that this project has demonstrated such feasibility and therefore represents an important contribution to defining and understanding the nature of these decisions.

The underlying philosophy at the heart of our approach is a belief that the best representation of decision 'reality' is obtained through an individual physician—patient level approach. By this we mean that the whole process of design, data collection, analysis and modelling is conducted at this level. In consequence there is no distortion through averaging effects, and specificity of context is maintained throughout.

In the course of planning and executing this project we encountered several challenges in terms of methodology, instrument design, sampling and modelling capability which, in consequence, led to a project of considerable complexity. The most important of these are described below:

The approach to sampling set one of the greatest logistical challenges. This resulted from the need to obtain consent from both parties prior to proceeding, and meant that we experienced particularly high recruitment failure rates with corresponding impact on the fieldwork deadline. We were forced to rely heavily on the substituted patient (i.e. a patient selected by the physician who was not the subject of the physician interview). We believe that this problem could have been remedied simply by extension of the fieldwork time line. However the high refusal rate this would have created may well have led to questions of the sample at the level of the model user.

The issue of sampling for such a study is likely to be highly dependent on the nature of the disease. In this project, the disease is highly debilitating (potentially fatal) with many potential sensitivities to be considered in the market research context. On the other hand, it is also a disease area characterised by prominent and active patient engagement.

- Preparatory work to establish the extent and nature of any patient role in therapy decisions is desirable. At a fundamental level, this can provide a guide to the potential return on what will be a complex and expensive project. It can also be an opportunity to define the most appropriate language for the rating scales and conjoint feature descriptions to be used.
- We have highlighted the considerations in designing conjoint feature matrices for the two customer groups that deliver the optimal balance of comparability and comprehension. One particular consideration that requires further investigation is the consequence in practice if one customer group does not understand what is being offered — or does not appreciate its consequences (typically the patient in healthcare). For our project we took the view that any such features should be ignored, as the other party to the decision would then prevail in determining the feature's value (as a consequence of the calculations used in the model). This, of course, takes no account of such a customer having a view on the feature's value after an explanation has been given — a likely scenario in healthcare.
- Another area in which further work needs to be done is to better define the basis for combining the uptake probabilities of each physician—patient relationship, leading to a group estimate of product uptake. For the purpose of our study we have used the mathematical basis of this as a sensitivity parameter which was varied to understand its impact on the uptake prediction. The base case (described above and used to generate the results shown) was to apportion equal weights to physician and patient uptake probabilities. This interpretation is consistent with the labelling of the scale but it is valid to challenge such an assumption and to model variations in the parameter, as was undertaken for this project. In essence, we are trying to address the question, 'How are differences of opinion on the value of a particular offer between physician and patient resolved in the consulting situation so that a particular product offer is chosen — and what is the best mathematical representation of this?'

We believe that this study shows the need to capture the patient influence in models of physician behaviour. We have shown that it cannot necessarily be assumed that physicians 'know their patients' and that combining separate physician and patient models at the aggregate level will p.oduce accurate results. Future development of such models may be expected to deliver improved ability to forecast in important areas such as likely new product success and return on investment for promotional spend in different customer groups.

References

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