MEASURING AND RESPONDING TO CONSUMER PREFERENCES

FOR MEDICAL PRODUCTS AND SERVICES

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I. INTRODUCTION

To compete effectively in the health care market, hospitals must understand consumers' preferences and respond with attractive products and services. Even with programs that provide better health care and greater satisfaction, it may be difficult to get patients' or physicians' acceptance. Consumers' evaluations may involve diverse issues: financial concerns, perceived safety, anticipated effectiveness, and their time and effort to adopt--aspects that are often difficult to measure and quantify. This paper describes the application of an innovative survey technique by a major teaching hospital to help design, evaluate, and improve a new cardiac care program.

Obtaining quantitative measures of consumers' preferences and satisfaction helps hospital managers by:

- Indicating how well their current programs are fulfilling patients' needs
- Identifying areas in which customers' interests could be better met
- Revealing trends and changes in customers needs over time
- Testing whether new programs bring about higher levels of customer satisfaction
- Suggesting ways to get new programs utilized more quickly.

Preference measures are also useful as part of the intervention itself, for example, to monitor patients' concerns and periodically adjust the intervention individually, based on the results. The product is a highly responsive and more personalized health care system.

An example of an area in which preferences are particularly important but difficult to measure is in programs that address health risk factors, such as coronary risk interventions. Such programs must alter not only the physical health of the patient, but also the patient's perceptions of their physical health. Researchers have demonstrated that the two may not coincide. As an illustration, in patients with mild heart attacks and at low risk of further complications, occupational disability is determined largely by self-perceived health status, family concerns, and what the doctor recommends rather than by objective medical status or prognosis (1,2,3). Recovery from arthritic disease is similarly influenced by perceptual factors (4). As a third illustration, patients' abilities to accomplish risk-reducing behaviors such as quitting smoking, reducing stress, or changing dietary habits are determined largely by their confidence in being able to succeed in this task (5,6,7).

In these illustrations, perceptions pose a major barrier to success. This implies that the effectiveness of medical programs may be strengthened by focusing on the patient's mental selves as well as their physical selves.

The Need for Market Research

Manufacturers of consumer products have long known that they must respond to what customers perceive their needs to be, and have used market research to determine these needs. In the past, hospitals failed to embrace market research methodologies that have become almost routine in many other industries. Typically, hospital managers failed to view their services as "products" and their patients as "customers". Instead, their mission has been to provide whatever services and facilities are needed, at the highest quality level. This view was natural in an environment with abundant resources and little competition.

Hospitals have now had to modify their mission in view of the constraints imposed by competitive and regulatory pressures. Today's consumers face wider choices: even high-quality, low-cost health programs may fail to attract patients if they do not address their needs and perceptions. In this new environment, hospitals must strengthen the areas in which they excel, develop services that respond well to patients' needs, and market their services effectively so as to attract the patients they wish to serve. Other industries have addressed these issues of evaluation, design, and promotion through the techniques of consumer research and market analysis.

Eliciting Consumer Preferences

The focus of this paper is on a survey technique that elicits consumers' preferences and perceptions, and which provides consumer choice data needed by hospitals conducting market analysis. The technique is an application of the Analytic Hierarchy Process (AHP), an approach developed by Thomas L. Saaty for helping individuals prioritize objectives and rank the desirability of alternatives (a good background on the method is reference 8). A feature of this technique is that it provides quantitative choice data. While some qualitative methods (such as focus groups and guided interviews) are a useful first step or adjunct to quantitative techniques, they are limited by:

- The lack of "hard" data with which to compare individuals or groups and measure changes over time
- The difficulty in using them to predict how customers would respond to hypothetical new products
- The inability to incorporate the results in a formal market analysis model except by indirect assumptions.

Quantitative Market Analysis

Quantitative preference measures are useful by themselves as an evaluation tool, but are also a key component of a logical, defensible market analysis. A well-designed market analysis program involves several important steps:

1. Identifying what product characteristics matter most to consumers (e.g., price, location, waiting time, service type)
2. Depicting each of the competing products or services (including hypothetical ones) as a combination of these characteristics at specific levels
3. Modelling how customer choices depend on their values for products

4. Eliciting customer preferences for various levels of each product characteristic

5. Using the model to estimate market potential and market share over time for each competing product.

Our methodology is useful during the first and fourth steps.

In what follows, we discuss the Analytic Hierarchy Process, describe an application, summarize some of our results, and discuss ways to extend this approach to other market research areas of interest to hospital managers.

II. METHODS

Measuring consumer preferences for alternative products, services, or treatments is complicated by:

- The diversity of issues involved, such as financial, emotional, and physical concerns, which makes it difficult to measure preferences on a common scale
- The sheer number of issues involved, which makes it difficult to structure simple choice models.
- The role of intangible influences, which make quantification difficult

The Analytic Hierarchy Process (AHP) is normally used to help individuals structure and analyze complex decisions. The technique and applications are described in the references by Saaty (8,9). Our use of the technique to measure preferences and describe choices is a novel application.

The scaling method derives quantitative weights that reflect the relative importance or strength of preference an individual attaches to aspects affecting an overall objective or concern. As a simple example, consider an individual contemplating purchase of a new car, and choosing between an Audi, a BMW, or a Celica. Suppose that the desirability of a car depends on its gas economy, styling, and price. AHP assists the decision maker in expressing the relative importance of each of these three concerns, evaluating each car model in terms of how well it fulfills each concern, and using these results to determine the overall desirability of each car model.

We will not describe the process in detail, however, the basic steps are as follows:

1. Describe the overall decision, objective, or concern (e.g., which car to buy).

2. Break the decision down into a set of independent influences or considerations that are of key concern (e.g., gas economy, styling, and price).

3. Break the influences down further as needed (generally only one or two levels are necessary).

4. Rate the desirability or importance of one alternative compared to another in terms of each lowest-level consideration (e.g., Audi vs. BMW vs. Celica in terms of gas economy). Repeat for all pairs of alternatives.

5. Obtain the relative weight of each aspect, i.e., its importance or influence on the next higher consideration (e.g., importance of gas economy relative to styling and price on the choice of a new car).

6. Calculate the overall value of each alternative by taking its strength with respect to each objective times the importance of that objective, and summing across all the objectives.

The Scaling Method

The preference scores or importance weights are derived from a set of pairwise comparisons. The respondent assigns a score between 1 and 9 that expresses the relative importance of one aspect over the other. The scale, shown in Figure 1, has been carefully designed and shown to use the most effective number of levels (9). When all possible combinations of two aspects are evaluated, the analysis generates a set of weights for each aspect that is most consistent with the elicited scores. The weights are obtained by calculating the eigenvector of a matrix containing the responses. These weights are on a ratio scale; for example, if two aspects have weights of 0.1 and 0.3, then the second is three times as important as the first.

Consistency Measures

Aside from the importance weights, AHP provides a measure of consistency in responses. This is possible because there is redundant information; the derived weights represent a "best fit" to the set of comparisons. The closeness of the fit is indicated by a "consistency ratio" that reflects the consistency of the respondent's scores relative to the consistency of a set of randomly-generated responses. For example, if a set of scores has a consistency ratio of 0.1, the responses are ten times more consistent than if they had been generated randomly; a ratio of 0.01 is 100 times more consistent than the random case.

Analytic Hierarchies as a Survey Technique

AHP has typically been used interactively: the analyst guides the decision-maker through the process and allows the individual to change responses to achieve acceptable consistency. Saaty suggests that if the consistency ratio is greater than 0.10, then the respondent should revise some responses. We could not do this since we administered the approach by written questionnaire--an approach that to our knowledge has not been previously tried. We set a threshold consistency ratio of 0.50 above which the respondent was excluded from the analysis.

AHP appealed to us as a survey technique for several reasons. Decisions or preferences are structured in a logical heirarchy that is consistent with how people think, simplifying the respondent's task. Preference scores are obtained through pairwise comparisons that are easily understood. Since the scores are on a ratio scale they can be used directly in certain types of choice models such

Intensity of Relative Importance	Definition	Explanation
1	Equal importance.	Two activities contribute equally to the objective.
3	Weak importance of one over another.	Experience and judgment slightly favor one activity over another.
5	Essential or strong importance.	Experience and judgment strongly favor one activity over another.
7	Demonstrated importance.	An activity is strongly favored and its dominance is demonstrated in practice.
9	Absolute importance.	The evidence favoring one activity over another is of the highest possible order of affirmation.
2, 4, 6, 8	Intermediate values between the two adjacent judgments.	When compromise is needed.
Reciprocals of above non-zero numbers	If an activity has one of the above numbers assigned to it when compared with a second activity, then the second activity has the reciprocal value when compared to the first.	

Figure 1. Scale of Relative Importance

Source: Saaty(12), p. 843.

as the Power model described below. The consistency ratio indicates the reliability of the responses. Finally, by breaking the preferences or choices into components, we can measure how sensitive the choice is to particular aspects and project how the individual would respond to hypothetical alternatives such as new product offerings.

Analytic Heirarchies for Market Analysis

Market analysis models allow us to analyze the desirability or profitability of new products and services. One approach we have used is to estimate the market potential (fraction preferring each alternative product) based on the underlying preferences for attributes of each alternative.

The preference weights provided by the AHP scaling procedure can be used directly in such a model. Since these weights are on a ratio scale, they can be incorporated into the Power Model of choice probability (10,11). This model is simlilar to (and can be derived mathematically from) the commonly used Logit choice model. A key assumption of the Power Model is that when individuals choose from among a set of alternatives, they pick the one with the highest value. However, there is a deviation between the measured values and the true values on which they base their selection, due to:

- Temporal effects or aspects that are not included in the elicited scores, or
- Variation among consumers that causes the elicited scores to not be representative of the entire population.

The deviation between measured and true values is captured in the model by an additive "error" or "noise" term, i.e.,

$$\underline{w}_i = w_i + k, \tag{1}$$

where $\underline{w}_i$ and w_i are the true and measured values, respectively, for the ith alternative, and k is the error term. Assuming a particular form (called a Gumbel distribution) for the error term, there is a rather simple result. Given a set of alternatives $I=(1,2,3,\ldots)$, and preference scores $w_1,w_2,w_3,\ldots$ for each alternative, the probability of choosing the jth alternative is

$$\text{Prob}(j) = \frac{(w_j)^k}{\sum_{i \in I} (w_i)^k} \tag{2}$$

The parameter k can be estimated from actual choice data. If the w's are average weights for the population, then the probabilities are the market potentials for each product. Notice in (2) that if k=0, then each alternative gets an equal share of the market. At the other extreme, as k approaches infinity, the market share approaches 100% for the highest-valued alternative.

Once we have elicited the values and estimated k, our market share model is complete. We can then use this model to estimate how the market share potentials would be affected by strategies that influence the underlying preferences. An illustration of this approach is included in the application that follows. A further application we do not describe is to combine the market share model with a dynamics model to estimate future market share; this is useful when the focus is on growth in use of new medical products or services.

III. APPLICATION

We used the Analytic Hierarchy Process to obtain preference and satisfaction measures during a clinical trial of a new intervention for patients recovering from an uncomplicated myocardial infarction (MI). These patients were given an Occupational Work Evaluation (OWE) consisting of:

- A treadmill test three weeks after their MI followed by an explicit recommendation by a physician on when the patient can return

- Counseling by a physician and nurse regarding the patient's ability to resume activities and how to reduce the risk of further complications

- An audio-visual program and self-directed behavior change program to encourage smoking discontinuation, dietary changes, stress reduction, and increased exercise.

The primary aim of the trial was to demonstrate that the OWE can reduce unwarranted disability and return patients to work sooner than is usually recommended without an increased risk of cardiac events. Prolonged convalescence often hampers physical and emotional recovery and may incur significant financial costs to employers, insurers, and the patient himself. Early treadmill testing can also eliminate the need for more expensive diagnostic and therapeutic interventions. Patients have traditionally prolonged their convalescence several weeks beyond when they could safely return to work because of numerous barriers, including fears of another heart attack if they return too quickly, doctors' concerns about liability if they recommend a reduced convalescence period, financial disincentives such as disability insurance coverage, and the desire for a period of rest and recreation.

A group of 201 employed men under age 60 were recruited in five hospitals in an HMO chain; 99 were randomized to receive the OWE ("Intervention" Group) and 102 to receive standard treatment ("Usual Care" Group). The OWE was provided by a clinic associated with a large teaching hospital.

Questionnaires were administered to each patient in-hospital and at five other times over the six months following their discharge. We used the Analytic Hierarchy Process in these questionnaires for three main purposes:

1. To evaluate the effectiveness of components of the intervention as perceived by the patient. This guided design and improvement of the intervention.

2. To measure patients' perceptions of the importance of various health risks. This suggested ways to make the intervention more relevant to each patient.

3. To determine patients' return-to-work preferences and the importance of aspects affecting the return-to-work decision. This indicates how best to promote earlier return to work.

Some of these goals were also addressed by other questions in the patient surveys, but our focus is on questions that used the AHP technique. As an example, we obtained hard measures of smoking activity on each of the questionnaires and at each visit, which allowed us to evaluate whether the intervention was effective in altering smoking behavior. Our AHP questions regarding health risks were targeted at perceptions of health risks rather than actual behaviors. The next section describes how each of the preceding objectives was addressed in the patient surveys and summarizes the results obtained.

IV. RESULTS

Effectiveness of intervention components

In trying to evaluate programs involving several components, it is typically difficult if not impossible to separate out the influence of each component on the outcomes of importance. The Occupational Work Evaluation combines diagnostic, therapeutic, and behavioral interventions in one "package". The components synergistically promote outcomes such as earlier return-to-work, increased physical activity, dietary changes, stress reduction, smoking discontinuance, and improved overall health. While we could not measure how each OWE component influences these outcomes, the AHP scaling method measures what the patients perceive to be the relative effectiveness of each component.

We had patients rate the importance of four components of the intervention on their health recovery and return to work:

- Treadmill test
- Nurse's counseling and feedback
- Physician's advice
- Audio-visual program.

This question was asked at one and six months post-MI. As an example, the one-month question is shown in Figure 2.

The average weights patients assigned to each component are shown in Figure 3. We also analyzed a set of responses obtained from 41 patients at the start of the trial, depicted as the third set of bars labeled "Pilot". These pilot results guided refinement of the intervention. Based on these responses, we learned that:

- For the pilot set of 41 patients analyzed, the audio-visual program was rated very poorly, receiving less than one-tenth of the importance of the other components. We then attempted to enhance the influence of the A/V program by simplifying it and promoting it more strongly. Apparently this effort paid off; by the end of the trial the average weight had increased from 0.08 to 0.29 ($p<.0003$).

- The treadmill test is perceived to be the most important part of the intervention, receiving 41% of the weight at one month and 32% at six months.

- While the doctors are rated more influential than the nurses at one month, by six months the situation is reversed. The nurses take on a key role in coordinating the intervention after the initial treadmill test.

Respondents had few problems in answering these questions: 83% completed them and of these, 94% had acceptable consistency ratios. The average consistency for these respondents is 0.12.

Perceptions of Health Risk Factors

While still in the hospital, patients rated the importance of five risk-reducing behaviors on their recovery:

Finally, we are interested in how different aspects of your visit at Stanford have influenced your feelings about your health and your ability to return to work. On each line below, we ask you to compare two different aspects of your Stanford visit. For each line, circle one number from 1 to 9 on the side of the aspect that has influenced you more as far as your feelings about your health and your ability to return to work are concerned.

AS FAR AS MY HEALTH AND RETURN TO WORK ARE CONCERNED:

ASPECT A	A is completely more important		A is strongly more important		A is somewhat more important		A is slightly more important		A & B are equally important		B is slightly more important		B is somewhat more important		B is strongly more important		B is completely more important		ASPECT B
Taking the treadmill test	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9		Talking with the Stanford nurse(s)
Taking the treadmill test	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9		Talking with the Stanford physician
Talking with the Stanford nurse(s)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9		Talking with the Stanford physician

Figure 2. Question on Intervention Effectiveness

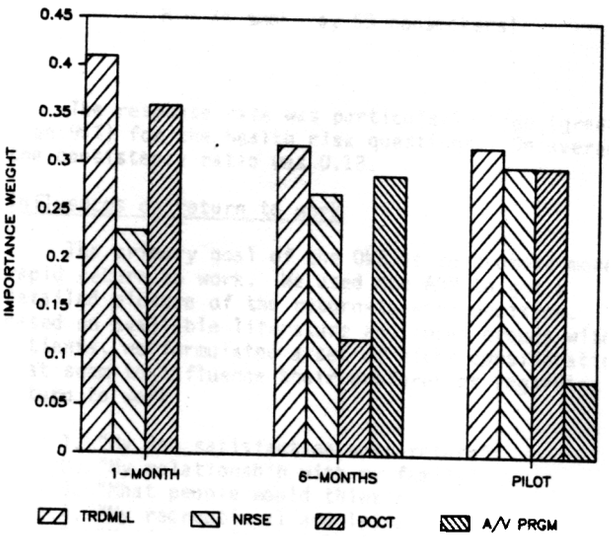

Figure 3. Importance of Intervention Components

N = 68 at 1 month, 66 at 6 months, 41 in Pilot
Note: A/V Program not evaluated at 1 month

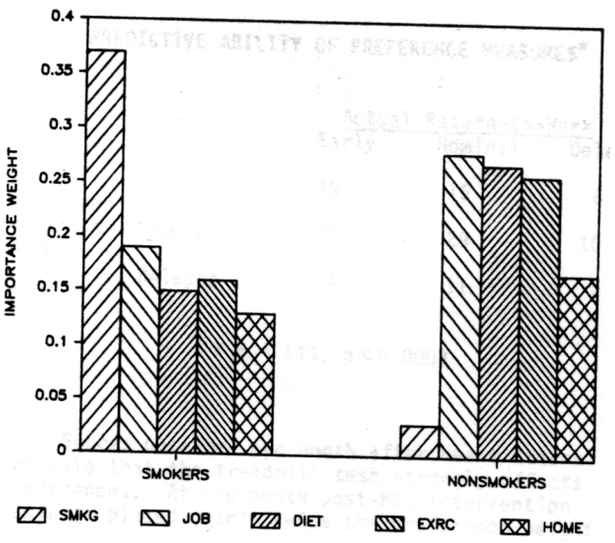

Figure 4. Perceived Importance of Health Risks

N = 85 smokers, 77 nonsmokers

- Quitting smoking
- Reducing job stress
- Improving eating habits
- Improving physical activity
- Reducing stress at home

These items address key components of the intervention, and include commonly-perceived contributors to heart attack. Figure 4 depicts the average weights for these aspects, separated by smokers and nonsmokers. As expected, smokers assigned the greatest importance (37%) to quitting smoking; aside from this, the other factors received roughly equal importance.

More important than the average scores, there is much variation between individuals. Each aspect ranked as the most important one to some patients, and as the least important one to others. This justifies a multi-faceted intervention that addresses a broad range of needs. The strength of these types of interventions might be enhanced by using such ratings to help medical staff personalize the intervention and provide more individualized attention.

At the conclusion of the intervention six months post-MI, patients rated the importance of changes they had accomplished in the five risk areas. The results, separated by smokers and nonsmokers, are

depicted in Figure 5. These weights correspond closely with the weights from six months earlier.

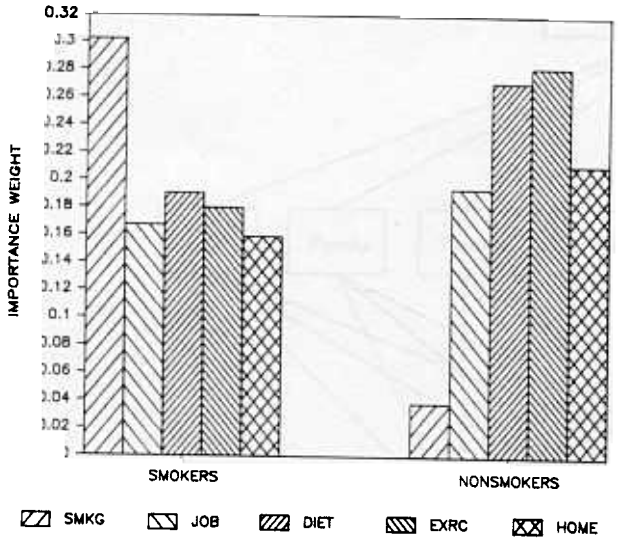

Figure 5. Perceived Benefit of Health Changes

N = 74 smokers, 53 nonsmokers)

The response rate was particularly high (greater than 95%) for the health risk questions. On average the consistency ratio was 0.18.

Influences on return to work

The primary goal of the OWE is to promote more rapid return to work. We used the AHP to get a detailed picture of the return-to-work decision. Based on available literature and focus groups with patients, we formulated a set of eight considerations that seem to influence their preferences regarding return to work:

1. "My job satisfaction upon return"
2. "My relationship with my family"
3. "Mhat people would think about me"
4. "My recreational and leisure time activities"
5. "My future financial situation"
6. "My health"
7. "My employer's attitudes about my returning"
8. "What my doctor recommends"

On the questionnaire, these aspects are stated neutrally in terms of how they influence the preference for earlier or later return, i.e., different patients may prefer earlier or later return as far as one aspect alone is concerned. The questionnaire elicits, first, the relative strength of importance of each aspect in the patient's return-to-work decision, and second, for each aspect separately, the relative strength of preference for each of three different return-to-work times:

- One month post-MI ("Early")
- Three months post-MI ("Nominal")
- Six months post-MI ("Delayed").

The issue of time preference is thus divided into a two-level "hierarchy": first, time preferences with respect to each aspect, and second, the importance of each aspect. This hierarchy is depicted in Figure 6.

Figure 7 shows the average importance ratings patients assigned to the eight considerations. Most important are health concerns, the doctor's recommendation, family influences, and financial concerns; the first two are together more important than all other considerations combined. We were surprised to find that the employer's concerns have little importance.

Based on the preferences for the three return-to-work times with respect to each of the eight considerations, we calculated overall preferences for early, nominal, and late return to work. The actual return-to-work times were categorized as follows:

- Early: 0 to 59 days
- Nominal: 60-119 days
- Delayed: 120 days or more

The results in Table 1 show that return-to-work preferences measured soon after discharge are highly predictive of the actual behaviors of patients ($p<0.0003$).

TABLE 1

PREDICTIVE ABILITY OF PREFERENCE MEASURES*

		Actual Return-to-Work		
		Early	Nominal	Delayed
Preferred Return-to-Work	Early	46	15	6
	Nominal	20	29	10
	Delayed	4	11	2

* N = 143, $p<0.0003$

Scores obtained one month after heart attack indicate that the treadmill test strongly affects preferences. At one month post-MI, intervention patients placed nearly twice the preference weight on early return to work compared to usual care patients (0.40 vs. 0.24, respectively).

Choice Model

The results in the preceding section suggest that to maximize the effectiveness of the intervention, effort should be targeted towards changing what the doctor recommends and on improving the patient's health perceptions. These were, in fact, two key aims of the intervention. Direct feedback to doctors following the treadmill test was aimed at overcoming their reluctance to recommend early return to work. The treadmill test and audiovisual program promoted patients' self-confidence for resuming work and their self-perceived health recovery. The payoff was in significantly reduced convalescence: full-time return to work occurred at a median of 51 days in Intervention patients and 72 days in Usual Care patients (p .002).

A quantitative choice model was developed to explictly analyze the importance of the various

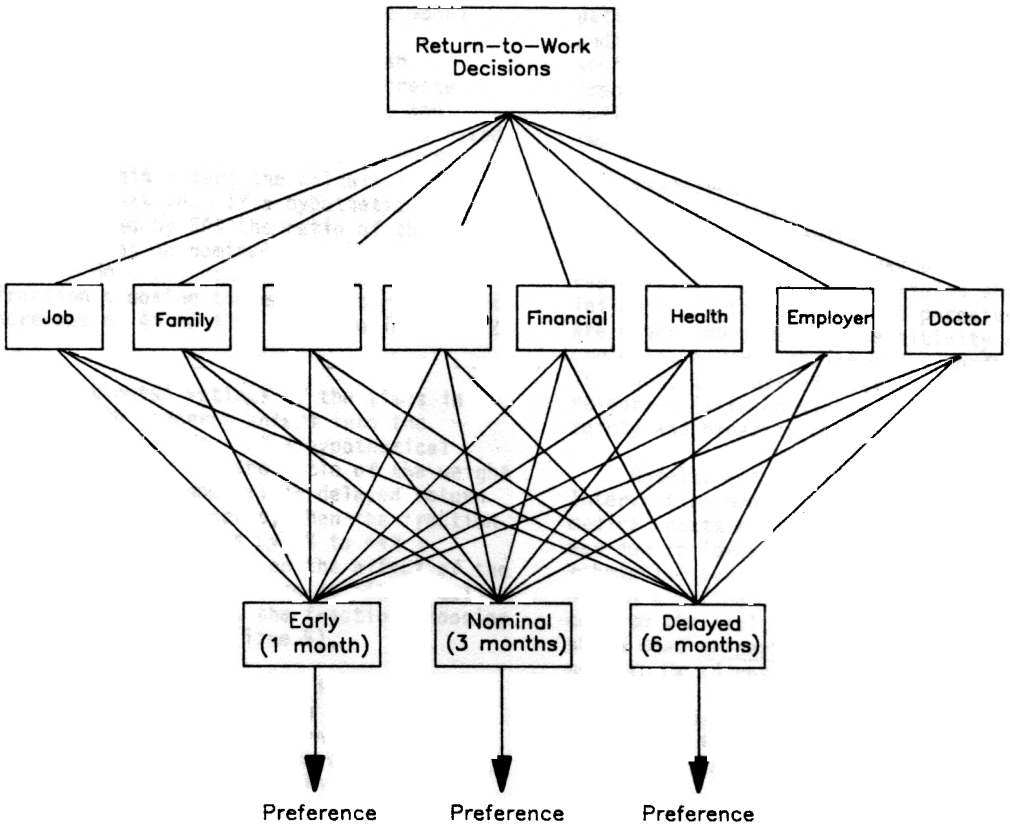

Figure 6. Hierarchy of Aspects Influencing Return to Work Preferences

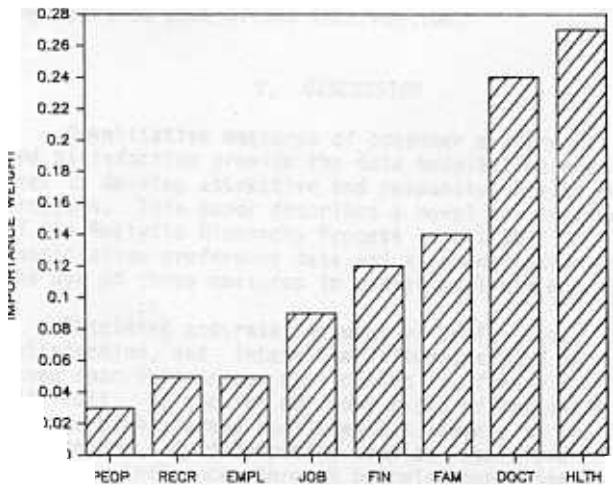

Figure 7. Influences on the Return-to-Work Decision

N = 157

return-to-work influences. We used a Power Model that estimates the fraction of patients choosing each return-to-work interval given their preferences (Usual Care group only). The parameter k (eqn. 1) was estimated by minimizing the squared error between the predicted and actual choices. The results in Table 2 show that the predicted fractions (line 2) correspond very closely with the actual fractions that were observed (line 1).

TABLE 2

CHOICE MODEL RESULTS*

	Fraction Choosing Each Internal		
	Early	Nominal	Delayed
(1) Actual	.35	.50	.15
(2) Predicted by model	.39	.48	.13
Sensitivity Cases:			
(3) To doctor's concerns	.43(+4%)	.44(-4%)	13
(4) To health concerns	.44(+5%)	.44(-4%)	.12(-1%)
(5) To employer's concerns	.40(+1%)	.47(-1%)	
(6) To both doctor and health	.49(+9%)	.41(-7%)	.11(-2%)

* Based on usual care patients

Sensitivity analysis using this choice model allows us to estimate the effectiveness of hypothetical interventions. For example, an intervention aimed at the doctors could increase their acceptance of earlier return-to-work, and thereby alter patients' choices. Patients had rated the three return-to-work times in terms of their doctor's concerns; this enters the calculation of the score for each alternative. If a hypothetical intervention increased by 50% the ratio of the weight on early to the weight on nominal or delayed return in terms of their doctors' concerns, then the predicted fraction choosing the early return-to-work interval increases by 4% to 43%, as shown in Table 2 (line 3).

Similarly, patients' ratings of the times in terms of their health concerns enters into the calculated preference scores. If a hypothetical intervention increases by 50% the ratio of the weight on early to the weight on nominal or delayed return in terms of their health concerns, then the fraction choosing early return increases by 5% to 44% (line 4). A similar calculation on the effect of the employers' concerns shows that there is little gain by intervening on the employer; the fraction choosing early return rises by only 1% (line 5).

Finally, the combined effect of intervening on both the doctor and the patient as in the preceding cases yields 48% choosing early return, a gain of 9% (line 6). By comparison, in the Intervention group, the fraction that actually returned in the early period was 59%.

These results suggest that the intervention was well-targeted since it focused on the patient and his doctor. In fact, results such as these obtained during a pilot period helped us refine the intervention. We had found, for instance, that patients assigned little importance to their employers as far as their return-to-work decisions are concerned; we therefore did not try to influence employers as part of the intervention.

V. DISCUSSION

Quantitative measures of consumer preferences and satisfaction provide the data hospital managers need to develop attractive and responsive health care programs. This paper describes a novel application of the Analytic Hierarchy Process to elicit quantitative preference data and a demonstration of the use of these measures in market analysis models.

Obtaining accurate measures of preferences, satisfaction, and intangible influences such as those described in our application is often difficult. We ascribe our good rates of responses and our high average consistencies largely to the AHP methodology. By decomposing complex issues and measuring influences through pairwise comparisons, the respondent's task is greatly simplified. The redundancy of information provided by each individual's responses improves the confidence in the calculated weights.

From the results, we gained several important insights. In this particular program, patients value the attention they received from nurses highly, and in later months might even prefer more time from the nurses than they would from the physicians. We found that each component of this multi-faceted program appeals strongly to at least a portion of the patients. However, we learned that if the audio-visual component were not strengthened, it would have little overall influence on patients. Importance scores showed that the influence of the audio-visual program increased greatly after it was improved.

Preferences elicited in-hospital were highly predictive of the actual times patients chose to return to work. Despite the fact that the OWE promotes risk-reducing behavior changes and a more rapid return to work, the results show that the influence of the doctors and perceived health status are major impediments. Sensitivity analysis employing a Power choice model confirms that in this instance, the most effective use of health care resources is to convince doctors and patients of the safety and benefits of early return.

Results not yet reported show that in the Intervention Group, there were substantially reduced medical costs compared to the Usual Care Group. This was due to lower rates of testing, surgery, and rehospitalization. Thus the program provides better health and financial outcomes to patients at reduced cost to the health care system. The market analysis shows that perceptual rather than economic issues need to be addressed to promote adoption of the OWE.

Hospitals can use the methods introduced here to evaluate existing programs and help design effective and appealing new programs. Our application demonstrates a market analysis system that uses the calculated AHP scores directly. This approach allows hospital managers to do "what-if" analyses of product design and marketing strategies in terms of their impact on market share and revenue.

But this one-time use of the AHP scores is only a start. The techniques can also be incorporated into medical programs that provide personalized attention and feedback to patients based on elicited preferences and perceptions. By collecting such information at regular intervals, a long-term intervention remains highly effective and attentive to each individual. Work is ongoing to develop a microcomputer-based system that helps medical staff elicit and retrieve such information routinely and respond to it effectively.

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