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Choosing a Hospital: Analysis of Consumer Tradeoffs

In today's competitive health care industry, hospital administrators and marketers must determine how important various product/service attributes are to potential consumers and how those attributes influence consumer choice decisions. The authors outline an approach (the analytic hierarchy process) that can be used to assess or predict health care choice decisions by consumers. The analytic hierarchy process is a method for analyzing consumer choice behavior whereby a hierarchical structure is used to determine the relative preferences of consumers for health care alternatives. Marketing strategies based on the study findings are suggested.

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In today's increasingly competitive and complex health care environment, hospital marketing has become a popular topic in the literature (Berkowitz, Hillestad, and Effertz 1982; Boscarino and Steiber 1982; Clabaugh and Wallace 1982; Hisrich and Peters 1982; Lane and Lindquist 1988; Malhotra 1983; Robinson and Cooper 1980-81). Health care professionals need to develop market-driven strategic approaches and technical decision-making skills to arrive at solutions to the complex problems they face. A successful marketing approach to those problems requires a knowledge of how consumers make their choices of physicians, health insurance plans, and hospitals. It is imperative for managers to understand the underlying decision processes of consumers, who have become more knowledgeable and sophisticated in health care matters in recent years.

We outline an approach (the analytic hierarchy process) for assessing or predicting health care choice decisions by consumers. To illustrate the use of this technique, we apply it to understanding the factors consumers use in selecting a hospital for treatment when they have a choice in the health care marketplace. Lane and Lindquist (1988), for example, point out that "consumers appear to be becoming more health-conscious and better informed. Hence active participation in health care choices is becoming a reality in the marketplace." Essentially, health care marketers must discern what is important to consumers in their market, determine how their strengths compare with those

of their competitors, and then fit those strengths appropriately into a marketing program. A key aspect of success in health care marketing is the ability to develop market-driven strategies based on consumer choice behavior.

Gensch and Javalgi (1987) note that an important aspect of understanding consumer behavior is the study of the choice process. To understand consumer choice behavior, marketers have used several multiattribute models that involve different assumptions, structures, and purposes. These choice models can be classified broadly into two groups—compensatory models and hierarchical (sequential) models. Compensatory models are based on the assumption that attribute values are combined in a simultaneous way; included in this group are conjoint and logit models, both of which have been applied in the study of hospital choice decisions (e.g., Malhotra 1983; Wind and Spitz 1976). However, certain shortcomings of such models have been documented (e.g., Gensch and Javalgi 1987; Gensch and Svestka 1984; Tversky 1972). One of the indicated shortcomings is that these models do not reflect the cognitive process by which individuals make their choice.

The second type of modeling is the hierarchical noncompensatory approach, based on the assumption that the attributes are evaluated hierarchically. Researchers in such areas as psychology (Tversky 1972), artificial intelligence (Newell and Simon 1972), and marketing (Bettman 1971; Einhorn 1970;

Russ 1971) posit that individuals often use hierarchical processing models. These scholars clearly show that hierarchical representation does afford a better understanding of complex problems and is useful as a decision-making paradigm. Examples of this type of model include the elimination by aspect (Tversky 1972) and the maximum likelihood hierarchical (Gensch and Svestka 1984) models.

The purpose of our article is to investigate the use of a relatively new approach called the analytic hierarchy process (AHP) for the analysis of consumer choice. The AHP, developed by Saaty (1977, 1980), is a multi-objective, multiattribute decision-making tool whereby a pairwise comparison procedure is used to arrive at a scale of preference among the elements (attributes). The AHP is particularly suitable when subjective criteria (e.g., hospital reputation and quality of service) are involved and when the attributes and/or alternatives are considered intangible. The AHP provides a mechanism for synthesizing consumer decision processes underlying the selection of decision alternatives (in this case, hospitals).

The AHP is similar to some of the other commonly used compensatory models, such as conjoint analysis, in that it involves the notion of tradeoffs among attributes. In conjoint analysis, one uses a utility-based approach to generate the relative importance of attributes by requiring consumers to rank-order preferences for factorially generated combinations of attributes (Green and Srinivasan 1978; Green and Wind 1973). Though the AHP has an axiomatic foundation (Harker and Vargas 1987), it does not require estimation of a utility function or a mathematical function, such as regression, that combines attributes simultaneously. Instead, the AHP uses stated preferences at each level of the decision process. Specifically, the AHP requires pairwise comparisons to estimate the relative

importance of the elements at a given level.

Unlike the hierarchical noncompensatory models, in which the attributes of the alternatives are processed sequentially, the AHP constructs any multiattribute problem hierarchically and thereby establishes a matrix to carry out pairwise comparisons of the relative importance of the elements (e.g., attributes) that characterize each level of the hierarchy.

STUDY OBJECTIVES

It is generally agreed in the choice methodology literature that individuals do not compare decision alternatives as "gestalts," or single entities, in making choice decisions (e.g., Gensch and Javalgi 1987; Gensch and Svestka 1979). Rather, individuals compare attributes of the alternatives and eventually select one choice from the set. The attributes (choice criteria) individuals consider in evaluating different hospitals, for example, and how individuals integrate their preference judgments to arrive at a final choice, are important to health care marketers.

The AHP can be viewed as appropriate for the analysis of multiattribute hospital choice decision problems that can be displayed in a hierarchical form. The motivation for this application stems from the fact that, though the usefulness of the AHP has been demonstrated in various disciplines (Zahedi 1986), including marketing (Javalgi, Armacost, and Hosseini 1989; Wind and Saaty 1980), its application for health care marketing has not been demonstrated.

In our study, the AHP is used for illustration to describe consumer preferences in hospital selection decisions. Consumers make preference judgments about the relative importance of various attributes embodied in the decision alternatives (hospitals). The crite-

ria consumers use in evaluating different hospitals and how they combine their preference judgments about various criteria to arrive at a final choice are important to health care marketers. The consumer's knowledge of the hospitals provides some reasonable basis for rating or evaluating the decision alternatives on a given criterion. The consumer's knowledge about the decision alternatives depends on previous personal experience, the experiences of associates and friends, and perceptions of the hospitals formed through exposure to advertising by the hospitals. Because consumers conjure up perceptions of institutions and their product/service offerings, the health care marketer's task, as part of a sound marketing strategy, is to create positive images in the minds of consumers to enhance those perceptions.

Our objectives in studying the potential application of the AHP in hospital selection decisions can be stated as research questions.

1. What product/service attributes (choice criteria) do consumers deem to be important in selecting a hospital? What is the relative importance (weight) of these criteria?
2. What are the relative preferences of consumers for the decision alternatives (hospitals) in terms of each of the attributes considered in the decision process?
3. How do consumers integrate the relative importance of the attributes (obtained in step 1) and the relative preferences for the hospitals on each attribute (obtained in step 2) to find a best alternative (hospital)?

THE AHP—A BRIEF DISCUSSION

The analytic hierarchy process, developed by Saaty (1977, 1980), is a framework and measurement system designed to analyze complex decisions and systems and evaluate alternate courses of action in terms of their priorities for achieving higher objectives of the systems. Using the AHP

in solving a decision problem involves three major stages: (1) describing a complex decision problem as a hierarchy, (2) using pairwise comparisons to estimate the relative importance of the various criteria on each level of the hierarchy, and (3) integrating the pairwise evaluations to develop an overall evaluation of the decision alternatives.

Developing the Decision Hierarchy

The first step in the AHP is to construct a graphic representation of a complex problem in terms of the overall goal or objective, the criteria, and the decision alternatives. Such a graph displays the hierarchy of the problem. There is no unique way to develop a hierarchy; one of the novel aspects of AHP is the flexibility it allows managers in constructing a hierarchy to fit their idiosyncratic needs. The decision

hierarchy consists of various levels representing the focus (or objective), criteria (or subcriteria), and decision alternatives. A decision maker or health care professional must know what kinds of criteria or subcriteria are important for evaluating a set of decision alternatives. The process of structuring the decision hierarchy in itself should help to improve decision-making because the decision maker becomes aware of the various factors that are important in the decision.

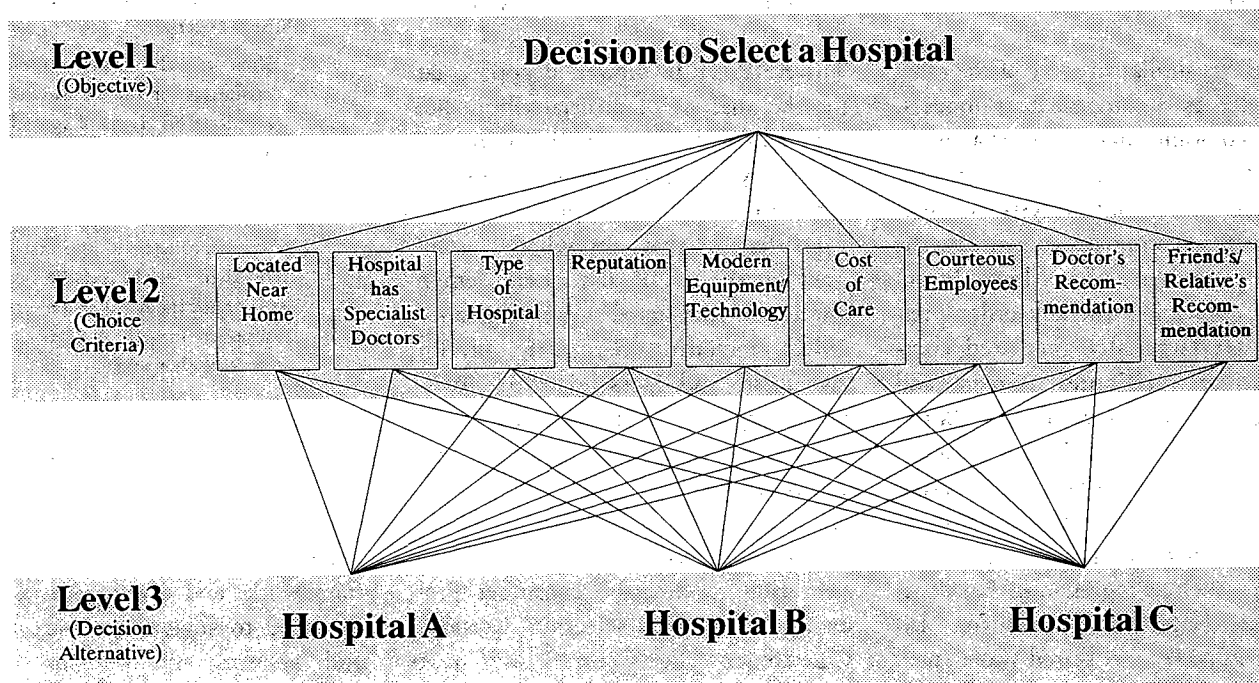
Figure 1 illustrates one possible hierarchy for the hospital choice problem. The top level of the hierarchy shows that the overall objective is to select the best alternative (hospital). The middle level of the hierarchy contains criteria (attributes). The selection of relevant criteria is of paramount importance in constructing the hierarchy. As we discuss

subsequently, in the hospital selection problem, nine criteria were selected for inclusion on the basis of a literature review and focus group interviews with randomly selected customers, physicians, and hospital administrators. The third and final level in the hierarchy represents the decision alternatives, here the choice of one of three hospitals. Obviously, as the number of levels of analysis, the number of attributes identified, and the number of decision alternatives increase, the more complex the AHP model becomes.

Establishing Priorities Among the Attributes in Terms of the Relative Importance

After construction of the hierarchy, the next step is to assess the relative importance of the level 2 attributes to the level 1 objective, and of the level 3 decision alternatives to each of the level

FIGURE 1
Decision Hierarchy for Selection of a Hospital



2 criteria. The set of priorities to be established in the hospital selection problem are (1) the nine criteria, listed in level 2 of the hierarchy (Figure 1), in terms of their contribution toward the selection of the hospital and (2) the three alternatives of level 3 (hospitals) in terms of the nine criteria of level 2. Establishing this set of priorities is based on pairwise comparisons, the building blocks of the AHP. To establish priorities for the nine level 2 criteria, attributes are compared with one another in terms of their importance in selecting a hospital, which is the major focus. One can ask, for example, how important "location" is in relation to "doctor's recommendation" as a factor in the selection of a hospital. Such comparisons are made by using a scale developed by Saaty (1980), shown in Table 1. Research and practical applications have confirmed that a 9-point scale, which is used in the AHP, is a reasonable basis for comparison of criteria (see Harker and Vargas 1987; Saaty 1977, 1980).

In Table 1, a rating of "strong importance" means one criterion is five times as important as the other criterion in the pairwise comparison; the rating of

"absolute importance" means one criterion is nine times as important as the other criterion. By definition, comparison of an attribute with itself results in a relative importance value of 1. In addition, the values of reciprocal comparisons are the reciprocals of the relative importance values. For instance, if the importance of "location" in relation to "doctor's recommendation" is 5, the importance of "doctor's recommendation" in relation to "location" is the reciprocal of 5, that is, 1/5. The relative importance values form a "reciprocal" matrix in which the lower triangle is the reciprocal of the upper triangle (Figure 2).

As shown in Figure 2, the diagonal elements are equal to one; therefore only

$(n(n - 1))/2$ comparisons are required if the level includes n criteria. For the hospital choice problem, with nine attributes at level 2, one must make $(9(9 - 1))/2 = 36$ pairwise comparisons, which results in one 9×9 pairwise comparison matrix. The same procedure is used to obtain the pairwise comparisons of the three decision alternatives (level 3) in terms of each level 2 attribute, which results in nine 3×3 pairwise comparison matrices for level 3. Practical application of the AHP has been benefited considerably by the development of computer software for its implementation. For instance, a decision support system called Expert Choice (Decision Support Software Inc. 1983) is in widespread use. It is a user-friendly procedure for implementing the AHP

FIGURE 2
Example of Reciprocal Matrix

Selecting a Hospital	Location	Doctor's Recommendation
Location	1	5
Doctor's Recommendation	1/5	1

TABLE 1
The Scale and Its Description

Intensity of 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 above zero	If activity i has one of the above nonzero numbers assigned to it when compared with activity j , then j has the reciprocal value when compared with i	
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix

Source: Saaty (1980, p. 54).

on a microcomputer. The researcher inputs pairwise comparison data and the computer software calculates the reciprocal values and diagonal elements. For larger problems requiring many comparisons, Harker (1987) has developed a procedure for using "incomplete" comparisons to reduce the amount of cognitive effort involved.

Developing an Overall Evaluation of the Decision Alternatives

Once the relative importance of the criteria and alternatives in the decision hierarchy has been determined, the AHP provides a framework and method for integrating preferences into an overall preference rating for each criterion. This part of the AHP is referred to as *synthesization*. Describing the mathematical aspects of the AHP and how the various priorities are calculated is beyond the scope of our article. Saaty (1977, 1980) and Harker and Vargas (1987) provide more information.

Another important consideration in using the AHP is the notion of *consistency* (see Appendix A for a more technical discussion of consistency analysis). Consistency is the degree to which the perceived relationships between elements in the decision hierarchy tend to be maintained as successive pairwise comparisons are made. It is important because comparisons lacking consistency may indicate that the respondent did not understand the differences in the choices presented or was unable to assess accurately the relative importance of the elements being compared.

Consistency is perhaps best described by an example. If the importance of "location" in relation to "reputation" is 4 and the importance of "reputation" in relation to "friend's recommendation" is 2, the importance of "location" in relation to "friend's recommendation" is 8 (4×2) for a consistent decision maker. The AHP gives a measure of the consistency of pairwise

comparison judgments by computing a *consistency ratio* (see Appendix A). Saaty (1980) provides a rule that the consistency ratio should not exceed .10. If the rule is violated, one must refine the information on the criteria/alternatives being compared in terms of the criterion of comparison. Values of the consistency ratio of .10 or lower are considered to indicate a reasonable level of consistency in the pairwise comparison. Jensen (1984) and Saaty and Vargas (1984) give more information on consistency.

The process just described delineates the situation at the individual level in determining relative preferences throughout the hierarchy. If the judgments of a group of individuals are to be aggregated, the collective judgment itself must have the property of reciprocity. Aczel and Saaty (1983) have demonstrated that the geometric mean of the set of individual judgments satisfies this property. Therefore, one can easily extend the process to accommodate a group of individuals by using the geometric means of the pairwise comparisons. We use the group approach in our analysis. A detailed step-by-step description of how the AHP operates is summarized in Appendix B. In the next section, we describe the data collection procedure. Then we present the analysis and report the study findings. Finally, we discuss implications and directions for future research.

DATA DESCRIPTION

The first task in the data collection procedure was to identify the relevant choice criteria (attributes) that influence consumer choice of hospitals. Focus group interviews with hospital administrators, physicians, and consumers were conducted to identify relevant factors used by consumers in selecting a hospital. A literature review and recent findings on hospital choice by consumers (Berkowitz and Flexner 1981; Boscarino and Steiber 1982; Lane and Lindquist 1988; Malhotra 1983; Na-

tional Research Corporation 1986) provided a basis for evaluating the results from the focus groups. Nine choice criteria were identified as salient for our study: located near home/convenience, hospital has specialist doctors, type of hospital, modern equipment or technology, reputation, cost of care, courteous employees, doctor's recommendation, and friend's/relative's recommendation. These nine attributes are shown in level 2 of the hierarchy (Figure 1).

The focus group members indicated that they were familiar with and/or had experience with the three major competing hospitals compared in the study, as well as with other hospitals. The three hospitals (referred to as A, B, and C to protect their identity) are the decision alternatives listed on level 3 of the decision hierarchy (Figure 1). These three hospitals were chosen because focus group members explicitly indicated that they could make reasonable perceptual evaluations about them on the nine criteria listed on level 2 of the hierarchy. Though all of the focus group members were likely to be familiar with these three large competing hospitals, their level of familiarity with the hospitals depended on their own previous experience, the experiences of friends and relatives with those institutions, and their perceptions of the hospitals based on the marketing activities and promotional programs of the institutions.

The three hospitals are all within a few miles of each other in a large mid-western city. Hospital A has 430 beds and the occupancy rate is 66.3%; it is operated by a religious order and is known for its open-heart surgery and burn units. Hospital B, a county hospital, has 318 beds and the occupancy rate is 70.6%. It is known for its level-one trauma center. Hospitals A and B are both teaching hospitals. Hospital C has 486 beds and the occupancy rate is 60.7%. It is not known for any specialty units.

In the second phase of the data collection procedure, a questionnaire was formulated to obtain the pairwise comparisons of the criteria and the alternatives for individual respondents in a format developed for other AHP studies. In the research instrument (part of which is reproduced in Appendix C), detailed instructions were given on how to use the 1-to-9 scale for making pairwise comparisons.¹ Pretests of the questionnaire indicated that approximately 30 to 35 minutes would be needed to complete it. Individuals in the pretest found no difficulty in making evaluations of the three hospitals on the nine criteria listed on level 2.

In mid-1988, 500 survey instruments were mailed to a randomly selected sample of the population. The sample was drawn from a telephone directory (the most widely used frame for sampling human populations) of the Standard Metropolitan Statistical Area (SMSA) of the major midwestern city where the three hospitals are located.² Respondents from this randomly chosen sample group may not necessarily have been former patients of the hospitals considered in the study. However, because all of the respondents were residents of the market area served by the hospitals, they were potential customers for those hospitals.

A mail survey was chosen because of cost constraints and the nature of the data required. A \$1 bill was included

to encourage the respondents to complete the form and return the questionnaire. Of the 500 questionnaires, 235 were returned (a response rate of 47%), of which 220 were used in the analysis. The remaining 15 questionnaires were unusable as the respondents failed to provide information necessary for the analysis. Because of the relatively high rate of response, no attempt to sample from the nonresponders was deemed necessary.

ANALYSIS AND FINDINGS

To address our first study objective—determining what product/service characteristics consumers deem important in their hospital choice decision and prioritizing those choice criteria according to their relative importance in affecting the choice decisions—we examined the respondents' judgments on the nine criteria listed on level 2 of the hierarchy. The geometric mean of each pairwise comparison for the set of respondents was calculated and the AHP software program was used to calculate the vector of priorities for the level 2 attributes. The values in the priority vector range from 0 to 1. Table 2 reports this priority vector along with the consistency ratio (C.R.). Note that the consistency ratio is within the acceptance range (i.e., $C.R. = .021 < .10$), indicating reasonably consistent results.

Interpretation of the Level 2 Priorities

On the basis of Table 2, the most important criteria are: located near home/convenience; hospital has specialist doctors, reputation, modern equipment/technology, courteous employees, doctor's recommendation, friend's/relative's recommendation, and hospital type. The weights indicate that the convenience factor (weight = .21) is almost twice as important as courteous employees (weight = .11) in hospital selection. Similarly, attributes such as reputation and modern equipment/technology are also almost twice as important as cost of care. Other criteria such as hospital type are of relatively less importance than doctor's recommendation and friend's/relative's recommendation in hospital selection.

Interestingly, the criterion "located near home/convenience" is the most important in our study; it also ranked first in the Boscarino and Steiber (1982) study. The choice criteria "hospital has specialist doctors" and "hospital has best modern equipment/technology" ranked third and fourth in the Boscarino and Steiber study, and rank second and fifth in our study. Hospital reputation was found to be an important dimension of shopping for hospitals in the Berkowitz and Flexner (1981) study, and the AHP also shows that attribute to be an important criterion influencing consumer choice.

¹This information, though it increased the length of the research instrument, was deemed necessary to generate completed questionnaires and a reasonably good response rate. Because of the length of the instrument and the purpose of the study (i.e., to demonstrate the usefulness of the AHP), questions on the respondents' background characteristics were not included. However, we believed that the reasonable response rate and random nature of the sampling process would reflect sample characteristics similar to those of nonrespondents.

²As documented in the U.S. *Statistical Abstract* (1985), 97% of U.S. households have telephones. In recognition of the fact that some percentage of those households have unlisted telephone numbers, the study population consisted of households in the SMSA with listed telephone numbers.

TABLE 2
Priority Vectors for Level 2 of the Decision Hierarchy

Attribute	Priority Vector
Located near home/convenience	.210
Hospital has specialist doctors	.201
Reputation	.141
Modern equipment/technology	.132
Courteous employees	.110
Cost of care	.071
Doctor's recommendation	.064
Friend's/relative's recommendation	.040
Type of hospital	.031
Level 2 C.R. = .021	

Choosing a Hospital

The cost or price of care ranked eighth in importance (of 10 attributes) in the Boscarino and Steiber study and tenth of 14 attributes in the National Research Corporation study (1986); in our study it ranks sixth in importance of nine attributes. The attributes "type of hospital" and "friend's/relative's recommendation" received very low rankings in our study; this finding is consistent with the results of previous research (e.g., Malhotra 1983; National Research Corporation 1986).

The implications of the findings in Table 2 are clear. Consumers develop perceptions of a hospital in terms of the criteria (attributes) that are embodied in it. Some of those attributes are deemed more important and others less important in the choice of a hospital. Health care marketers must recognize that consumers currently do not appear to be particularly sensitive to the hospital cost attribute, despite all that has been reported about escalating health care costs. Perhaps some specific segments of the market (e.g., the elderly) may be responsive to such news; however, the general public currently shows less emphasis on costs in choosing a hospital. When changes are made by insurers and/or when cost-sharing and higher deductibles become mandatory, consumers may develop greater sensitivity to hospital costs.

Though health care marketers recognize that some characteristics, such as location (delivery place), cannot be changed easily, what *can* be done is to create a positive image in the minds of consumers about characteristics that are unique to the particular institution or that give it an outstanding reputation in contrast to its competitors. By doing so, health care marketers may be able to overcome the emphasis on location or convenience and entice consumers to come to the delivery place because it is perceived as an institution providing high quality service.

To address our second research objec-

tive—to determine the relative preference for each decision alternative (hospital) in terms of the nine attributes listed in level 2 of the hierarchy—we compared the three hospitals (the level 3 decision alternatives) on a pairwise basis in terms of each attribute in level 2. Thus, we had nine 3×3 matrices. Again, we computed the geometric means of the pairwise comparisons; using this information, we obtained priority vectors for each decision alternative on each criterion. This information, as well as the consistency ratio for each priority vector, is reported in Table 3; for the purpose of further calculations, the level 2 attribute weights also are listed.

Interpretation of Level 3 Priorities

The results in Table 3 indicate that hospital A is clearly preferred on four of the criteria: located near home/convenience, type of hospital, modern

equipment/technology, and cost of care. The AHP findings also suggest that hospitals A and B are equally preferred on the attribute "hospital has specialist doctors." On the criterion "reputation," hospital B is preferred to hospital A and hospital C. On the attribute "courteous employees," hospital A and hospital B appear to be equally preferred, but hospital C received twice the preference rating on this criterion. No differences are found among the three hospitals on two criteria: doctor's recommendation and friend's/relative's recommendations. Implied in the findings in Table 3 is the conclusion that the relative preferences for hospitals (decision alternatives) vary over the nine criteria. Furthermore, the results show the particular attribute on which each hospital is least preferred. This information is of great importance to hospital managers and marketing executives who need to improve and/or modify product/service attributes so as

TABLE 3
Priority Vector for Levels 1, 2, and 3 of the Decision Hierarchy

Attribute	Level 2 Attribute Priority	Level 3			C.R.
		Hospital A Weight	Hospital B Weight	Hospital C Weight	
1. Located near home/convenience	.210	.450	.250	.300	.009
2. Hospital has specialist doctors	.201	.400	.400	.200	.000
3. Type of hospital	.031	.392	.300	.308	.001
4. Modern equipment/technology	.132	.350	.341	.309	.002
5. Reputation	.141	.331	.362	.307	.001
6. Cost of care	.071	.401	.354	.245	.003
7. Courteous employees	.110	.250	.250	.500	.000
8. Doctor's recommendation	.064	.333	.333	.333	.000
9. Friend's/relative's recommendation	.040	.333	.333	.333	.000
Level 2 C.R.	.021				
Composite or global priority		.370	.325	.305	

to increase the preference for their hospitals.

Our next objective was to integrate the relative importance of the nine attributes obtained in level 2 and the relative preferences of the alternatives on each of the attributes to establish the composite or global priorities of the choice alternatives. To calculate these priorities, the local priority of an alternative (hospital) in terms of each criterion is multiplied by the priority of the corresponding criterion, and the resulting products are summed over all attributes to obtain the composite or global priority for selection of that alternative. The overall priorities of the hospitals are reported in the bottom row of Table 3.

On the basis of the results in Table 3, which gives the local priorities in terms of each criterion and the local priorities for each hospital (alternative), hospital A is the first choice (weight = .370), followed by hospital B (weight = .325) and hospital C (weight = .305).³ That hospital C was least preferred is clearly evident when we examine the results indicative of the comparative performance of the hospitals on each criterion listed on level 2.

IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The AHP approach provides interesting insights into the nature of the consumer selection process as it might apply to three hospitals in one particular community. Gaining an understanding

³The preference ranking of hospital C is consistent with its occupancy rate (60.7%), which is lower than that of hospital A (66.3%) and hospital B (70.6%). However, the preference ranking of hospital B is lower than that of hospital A even though hospital B's occupancy rate is higher than that of hospital A. This finding can be attributed to the fact that preferences/attitudes may not be totally congruent with behavior. The discrepancy between attitudinal judgments and actual behavior has been acknowledged in the marketing literature (Runyon and Stewart 1987).

of what product/service attributes consumers deem to be important in any health care context—in this case, selecting a hospital—and how those attributes are prioritized according to their relative importance will enable health care professionals and marketers to devise appropriate marketing strategies. To illustrate how this understanding might benefit health care marketers, the following discussion suggests how the AHP results obtained in our study could be used to formulate such strategies.

The criteria in level 2 of the decision hierarchy can be classified into two broad categories: marketing mix characteristics and institutional characteristics. The product/service attributes reflecting the essence of the marketing mix that hospitals can offer are: the *product/service dimension* (courteous employees, specialist doctors), the *pricing strategy* (cost of care), the *delivery of products/services* (location), and the *promotion strategy* (doctor's recommendation, friend's/relative's recommendation). The remaining characteristics, *reputation* and *modern equipment/technology*, can be classified more appropriately as institutional characteristics. In Table 4, we

report the results in each of these areas; viewing the attributes in terms of the marketing mix helps in interpreting the results upon which managerial decisions can be based.

Table 4 indicates that hospitals A and B are equally preferred on the criterion "hospital has specialist doctors," but both hospitals are least preferred on the criterion "courteous employees." Therefore, the administrators of both hospitals A and B should improve their preference ratings by taking steps to cause their employees to be perceived as more courteous and friendly toward their consumers (patients).

On delivery of products/services, hospital A is indicated as most convenient, followed by hospital C and then hospital B. On the pricing dimension, the preferences for the three hospitals change slightly. Hospital A is most preferred, followed first by hospital B and then by hospital C. To compete with hospital A, the managers of both hospitals B and C must modify their pricing strategies.

Interestingly, in the area of promotion

TABLE 4
Marketing Mix and Institutional Characteristics^a

Criteria	Hospital A	Hospital B	Hospital C
Marketing Mix Characteristics			
Product/Service Dimension			
Courteous employees	.250*	.250	.500
Hospital has specialist doctors	.400	.400	.200
Pricing Strategy			
Cost of care	.401	.354	.245
Delivery of Products/Services			
Located near home/convenience	.450	.250	.300
Promotion Strategy			
Doctor's recommendation	.333	.333	.333
Friend's/relative's recommendation	.333	.333	.333
Institutional Characteristics			
Reputation	.331	.362	.307
Type of hospital	.392	.300	.308
Modern equipment/technology	.350	.341	.309

^aThe numbers are the level 3 priority numbers from Table 3. They are rearranged according to the marketing mix and institutional characteristics.

strategies, Table 4 suggests that all three hospitals are equally preferred. To be competitive, hospitals must use advertising and promotion more heavily to differentiate themselves from their competitors. Research indicates that, in the years ahead, advertising will have an increasingly significant role in health care marketing (Berkowitz, Hillestad, and Effertz 1982).

Examining the preferences for the two attributes classified as institutional characteristics in Table 4, we see that hospital B is most preferred on reputation, followed by hospital A and then hospital C. However, on modern equipment/technology, hospital A is most preferred, followed by hospital B and hospital C. The same order of preference holds for the criterion "type of hospital." Hence, the managers and marketing executives of hospital C must recognize that simply improving the basic elements of the marketing mix will not be adequate to enable hospital C to surpass hospital B and/or hospital A in overall preference. Hospital C's managers must devise programs to create a positive perception in the minds of consumers that hospital C has, for example, modern equipment/technology and the specialized medical staff to perform advanced operations within a reasonable cost range. It is important for hospital managers to discern what perception potential customers have of their hospital's reputation and the products/services offered; it is the marketer's job to create positive perceptions as a consistent part of the marketing strategy.

Criteria on which a particular hospital is preferred can be used to enhance positioning strategies. The basic concept of positioning is the perceptual differentiation of the organization/institution and its products/services from the competitors. Institutional characteristics seem to have an important role in consumer choice decisions. Health care consumers' needs and wants and the benefits to be derived from products and

services tend to vary in the marketplace. Thus, one can divide the market by using different segmentation designs (Wind 1978) and then, by employing the AHP, generate much information about the target markets. By responding to the appropriate marketing mix and organizational characteristics, hospital marketers can develop a marketing program that is responsive to consumer needs in the health care marketplace.

CONCLUSION

The modeling of consumer preferences by the analytic hierarchy process could have an important role in health care marketing. The ability of the AHP to synthesize multiattribute preferences and provide diagnostic information, thereby enabling decision makers to understand better the behavioral process underlying choices, makes it an attractive tool for health care marketers. The AHP also can be used to study the consumer decision process related to the choice of, for example, physicians, health care insurance plans, dentists, midwives, pharmacists, and optometrists, as these and similar choice problems can be structured in a hierarchical form similar to the one used in our study. Development of such a hierarchy provides information that is essential to the identification of managerial implications for strategic planning of the marketing mix.

The AHP offers potential not only in analyzing consumer choice decisions, but also in redesigning specific products/services, introducing new service concepts, and determining the direction for new product development. Hospital managers and marketing executives could benefit greatly from using the AHP. It would enable them to accomplish such tasks as product development while at the same time assuring them that their strategies are driven by critical marketing considerations, because market-driven business

plans require the choice and evaluation of interrelated components.

Our findings demonstrate the suitability of using the AHP—for which easy-to-use software is now available to perform all the calculations needed—in evaluating the hospital selection process. Marketers in the health care industry should be encouraged to consider using this versatile approach in their planning and decision making.

APPENDIX A

Consistency Analysis

As used in our study, "being consistent" means that when pairwise comparisons are made to relate n elements so that each element is represented in the data matrix at least once, the remainder of the matrix can be generated from the relationship $a_{ik} = a_{ij}a_{jk}$. This relationship suggests that, if a_{ij} represents the importance of criterion i over criterion j and a_{jk} represents the importance of criterion j over criterion k , then a_{ik} (the importance of criterion i over criterion k) must be equal to $a_{ij}a_{jk}$ for the judgments to be consistent.

It has been demonstrated that the eigenvector corresponding to the largest eigenvalue of the matrix provides the relative priorities of the elements (Saaty 1980). Thus, we obtain from the matrix of paired comparisons the vector of weights reflective of the relative importance of the various elements (criteria).

Saaty (1980) has shown that, for a reciprocal matrix, $\lambda_{\max} = n$, where λ_{\max} is the largest eigenvalue of a matrix of order n , the following consistency index (C.I.) is used to measure deviation from consistency.

$$\text{C.I.} = \frac{\lambda_{\max} - n}{n - 1}$$

The formula suggests that, when the

judgment is perfectly consistent, $\lambda_{max} = n$. That is, the consistency index equals zero in the perfectly consistent case. A measure of departure from consistency is provided by the difference between the maximum eigenvalue and the dimension of the comparison matrix (n).

The preceding consistency index is compared with what it would be if a respondent's numerical judgments were taken at random from the scale 1/9, 1/8, 1/7, 1/6, . . . , 1, 2, . . . , 9 (using a reciprocal matrix).

Using sample sizes of 500 each, Saaty (1980) has established, for different-order random-entry reciprocal matrices, the following average consistency index.

Size of matrix (n)	1	2	3	4	5	6	7	8	9
Random consistency	0	0	.58	.90	1.12	1.24	1.32	1.41	1.45

If one divides the C.I. by the random consistency number for the same size matrix, the consistency ratio is obtained.

APPENDIX B

Summary Steps of the Analytic Hierarchy Process

1. Define the problem and identify the relevant criteria pertaining to the problem.
2. Structure the hierarchy from the overall managerial purpose (level 1) through relevant additional levels containing criteria, subcriteria, and the decision alternatives.
3. Construct a pairwise comparison matrix of the relative contribution or impact of each element on each governing objective or criterion in the adjacent upper level. In such a matrix of the criteria (attributes), the first attribute on the vertical axis is compared with each

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attribute on the horizontal axis in a pairwise manner. Then, the second attribute on the vertical axis is compared with each of the horizontal-axis attributes, and so on. The total number of pairwise comparative judgments needed is $n(n - 1)/2$ —specified by the set of elements developed in step 2.

4. Once the pairwise comparison data have been obtained and the reciprocals have been entered together with n -unit entries down the main diagonal, the eigenvalue problem is solved and the consistency is tested.
5. Repeat steps 3 and 4 for all levels and elements in the hierarchy.
6. Hierarchical composition is used now to integrate the relative importance values of the criteria and the relative preferences for the decision alternatives to establish the composite or global priorities of the alternatives. To calculate these priorities, the local priority of an alternative in terms of each criterion is multiplied by the priority of the corresponding criterion, and the resulting products are summed over all attributes to obtain the composite or global priority for selection of that alternative.

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APPENDIX C
Sample Questionnaire^a

Relative Importance of Location/Convenience	Compared to	Hospital has Specialist Doctors	Type of Hospital	Reputation	Cost of Care	Hospital has Modern Equipment/Technology	Courteous Employees	Doctor's Recommendation	Friend's/Relative's Recommendation
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Relative Importance of Hospital has Specialist Doctors	Compared to	Type of Hospital	Reputation	Cost of Care	Hospital has Modern Equipment/Technology	Courteous Employees	Doctor's Recommendation	Friend's/Relative's Recommendation
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Relative Importance of Type of Hospital	Compared to	Reputation	Cost of Care	Hospital has Modern Equipment/Technology	Courteous Employees	Doctor's Recommendation	Friend's/Relative's Recommendation
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Relative Importance of Reputation	Compared to	Cost of Care	Hospital has Modern Equipment/Technology	Courteous Employees	Doctor's Recommendation	Friend's/Relative's Recommendation
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^aThe rating scale used by respondents to make pairwise comparison is described in Table 1.

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