

**CONSTRUCTING AN AHP MODEL FOR FORMING EXPERTS' CONSENSUS
IN ESTABLISHING PAYMENT STANDARDS
-- THE CASE OF SURGICAL SPECIALISTS**

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Summary: *Many countries with health insurance systems conduct periodic payment standards reform. How to reach consensus in setting payment standards among different specialties with different agendas become critical issue. The purpose of this study is to construct an analytic hierarchy process (AHP) model for forming experts' consensus on the issue of "factors related to establishing payment standards in the national health insurance program". Under this goal, the first-tier contains four evaluation aspects, and the second-tier evaluation criteria include sixteen items in four groups. The AHP model was then used to condense the opinions of the experts through an empirical study. The results of our study strongly support that the AHP model constructed is effective in forming a consensus among surgical specialists.*

1. Introduction

Many countries with health insurance systems conduct periodic payment standards adjustment. The main reasons are to address continually rising health care costs and to ensure an equitable allocation of resources. From the data of the Organization for Economic Co-operation and Development (OECD) countries, the proportion of health care costs as a percentage of Gross Domestic Product (GDP) continues to rise in these years. For example, from 1970 to 2001, health care accounted were 6.9% to 13.9% in the United States' (US) GDP, 5.6% to 10.9% of Switzerland's, and 4.0% to 9.0% of Belgium's. In Taiwan, health care accounted for 3.4% of GDP in 1980 and 5.9% in 2003. Another impetus for payment standards reform is the allocation of health care resources, as the payment system can create economic incentives that influence the specialties chosen by medical professionals, their practice behavior, as well as choice of practice locations (Hsiao, Braun, Dunn, et al, 1988a ; 1988b).

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Taiwan's national health insurance (NHI) system which has been initiated in 1995 is a single-insurance provider system. The Bureau of National Health Insurance (BNHI) is the sole institution providing payment to health care providers. One of the most obvious impacts after implantation of NHI system is the changing distribution of physicians among various specialties. Economic incentives related to payment standards play a very important role in this change. Regardless of which type of payment system is used by a health insurance provider, the definition of payment standards within the system is one of the critical factors influencing health care costs overall.

As for determining health care payment standards, according to research findings by Hsiao, Braun and Dunn, et al (1988a), the levels of analysis are numerous, and touch upon many tangible cost considerations such as time of doctor visits, medical equipment, real estate depreciation, employee wages, and so on. Also, there are many intangible costs such as the mental and physical pressures, the amount of effort involved in different types of patient consultations, differences in specialty training requirements, etc. (Hsiao, Braun, Dunn, et al, 1988a, 1988b; Jegers.; Kesteloot ; Graeve et al, 2002) Therefore, the BNHI invited many experts' opinions from different specialties, and used those opinions as a basis for discussion while payment standards were set or adjusted. Finding and establishing an impartial, fair and reasonable means of defining payment standards is a topic worthy of research.

From the literature review, commonly used methods include the in-depth interview method, the focus group method, the nominal group method and the Delphi method (Chapple and Rogers, 1998; Hoddinott, and Pill, 1997; Giacomini and Cook, 2000; Gupta and Clarke, 1996; Malterud, 2001; Pope and Mays, 1995; Jones 1995). However, the methods described above are limited by the innate prejudices of specialists' opinions and the fact that they can mainly return qualitative data. It is therefore difficult to convert the opinions of these specialists into objective quantitative values, or to set payment standards values according to their conclusions.

The analytic hierarchy process (AHP) developed by Satty at the University of Pittsburg in 1971 is applied in this research (Satty, 1977, 1980). This is a process based on qualitative data, but utilizing mathematical models to formulate standards or target significance factors. The method converts the qualitative data from experts' opinions into quantitative data. Results obtained through this method have the advantages of traditional qualitative analysis as well as those of quantitative data.

The purpose of this study is to constructing a model for forming consensus among surgical professional group with regard to "factors related to establishing payment standards in the NHI program." This model is constructed mainly by using AHP method. The reference factors or criteria in the AHP model, as defined in the Hsiao's "resource-based relative value scale" (RBRVS) are used as a blueprint. The factors in Hsiao's RBRVS were modified by the surgical specialists in Taiwan through the opinions survey by Delphi method, and then applied the results to construct the AHP model. Finally, an empirical study was carried out to condense the opinions of the experts.

2. Methods

2.1 Subjects

Prior to beginning this study, we first explained the research methods and goals to the directors of nine surgical sub-specialty associations. After receiving their approval, nine associations were requested by email or telephone to select between 2-9 physicians to represent their sub-specialty (according to the number of association members). The nine associations are: general surgery, orthopedic surgery, neurosurgery, cardio-vascular surgery, thoracic surgery, plastic-reconstructive surgery, proctology, urology, and pediatric surgery. These representatives formed surgery association's NHI working group as a consultation group for this study. Finally, there were 26 physicians included in the NHI working group.

2.2 Delphi method

The Delphi questionnaire was designed based on the RBRVS system as a blueprint, with the addition of the results of the literature review. Two rounds of surveys were conducted with each specialization group for the purpose of modifying factors in RBRVS, and forming a consensus of physician's opinions on factors related to establishing payment standards in the NHI program.

2.3 Establishing the AHP model

The AHP model for the surgical specialty (see fig. 1) was constructed based on the consensus among surgical specialists through the Delphi method. With the goal of building consensus on “factors related to establishing payment standards in the NHI program,” the first-tier contains four evaluation aspects: physician's total work input, physician's practice costs, physician's malpractice costs and specialty training costs. The second-tier evaluation criteria include 16 items in four groups: time required to perform the service, mental and decision-making effort invested, technical skill and physical effort, mental effort and judgment, psychological stress, pre-service and post-service work, personnel wages, medical supplies, medical equipment, office rents, iatrogenic errors, medical disputes, patient or family violence, risk of injury (from medical instruments) or infection (from serious contagious disease), basic specialty techniques, difficult specialty techniques, and rare specialty techniques.

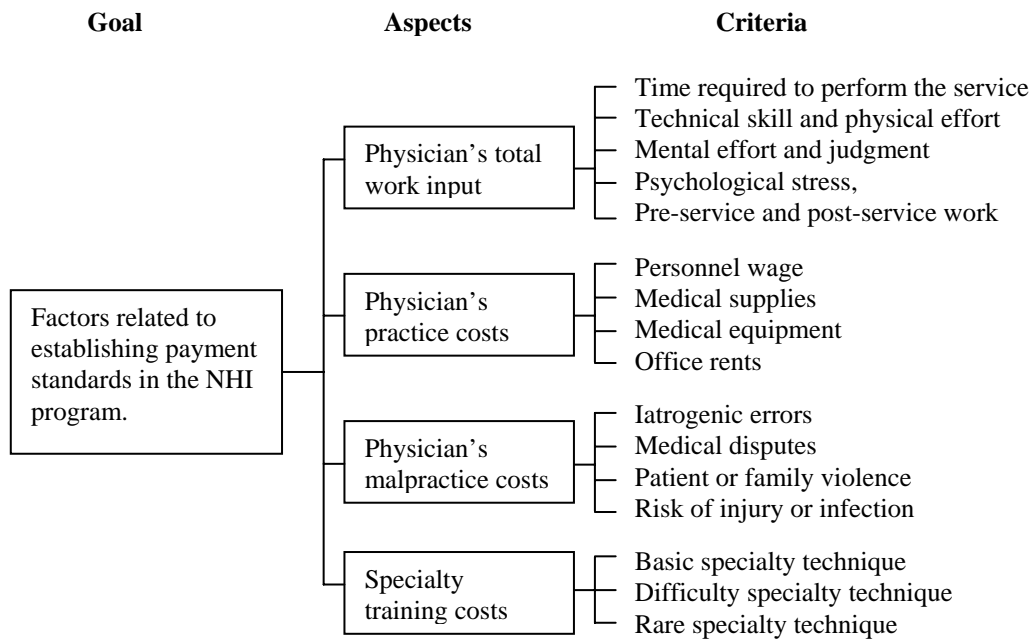


Figure1 The AHP model constructing for the surgical specialty

2.4 Empirical study of AHP model

On March 15, 2003, the surgical association's NHI working group meeting was held. Representatives of each sub-specialty were invited to participate in the study and respond to the AHP model survey. In total, there were 26 participants from surgical specialties. During the process of the empirical study, every effort was made to provide all specialists access to the same information, and to conduct the surveys in the same way for each participant so that the results would return the best possible relative values for payment standards.

During meetings, the same reference materials were provided to each representative participant. These reference materials included database analysis results from Taiwan's National Health Research Institute

from the years 1997 to 2001, proportions of medical costs of each medical specialty, an analysis of personnel figures for each specialty, literature review results and related reference data from foreign countries. The meetings first explained the relative value concept, followed by an explanation of the factor definitions in the AHP model. After ensuring that each respondent fully understood how to complete the survey questionnaire, the surveys were given to respondents to complete.

After they were completed, the results were compiled using the AHP software product Expert Choice Pro (version 9.5) to compute priority values, consistency indices, consistency ratios and relative weighting valuations; and Microsoft Excel (version XP) to calculate relative weighting among each factor.

3. Results

3.1 Characters of participants

100% of the surveys were returned by surgery respondents (26/26), and 96% of those returned were valid (25/26). The invalid survey could not pass the AHP consistency verification tests.

The 26 physicians participating in the study were divided to three groups according to the characters of surgical sub-specialties, service hospital levels and years of seniority (see Table 1). Of these, general surgery accounted for 34.6% (9/26), the largest proportion. In terms of service hospital level, medical centers accounted for the highest percentage in surgery respondents, with 46.2% (12/26) employed at medical centers. As for seniority, the majority of subjects in surgery had between 11 and 30 years of seniority, 73.1% (19/26), respectively. The highest level of seniority in surgery was 39 years (neurosurgery).

Table 1 Three character-distributions of 26 participants

Surgical sub-specialties	Participants	Service hospital level	Participants	Seniority (years)	Participants
General	9	Medical center	12	≤ 10	5
Orthopedic	3	Regional hospital	8	11~20	13
Plastic	2	Local hospital	4	21~30	6
Neurology	2	Basic Clinic	2	≥ 31	2
Proctology	2				
Urology	2				
Pediatric	2				
Cardiovascular	2				
Thoracic	2				
Total	26		26		26

3.2 Relative weighting Rankings of AHP Valuation Factors

See Table 2 for the analysis of relative weightings in valid survey responses. In the first-tier evaluation aspects, the rankings of factors among the 25 surgery respondents were: (1) physician's total work input (0.393); (2) physician's malpractice costs (0.251); (3) specialty training costs (0.194); and (4) physician's practice costs (0.162). In the second-tier valuation criteria, of the 16 factors, the top five ranked as follows: (1) mental effort and judgment (0.093); (2) technical skill and physical effort (0.091); (3) difficult specialty techniques (0.089); (4) psychological stress (0.083); and (5) personnel wages (0.080).

Table2 The relative weightings in valid 25 survey responses

Aspects and Criteria	First-tier weighting	Second-tier weighting
Physician's total work input	0.393(1)	
Time required to perform the service		0.065
Technical skill and physical effort		0.091(2)
Mental effort and judgment		0.093(1)
Psychological stress,		0.083(4)
Pre-service and post-service work		0.061
Physician's practice costs	0.162(4)	
Personnel wage		0.080(5)
Medical supplies		0.031
Medical equipments		0.035
Office rents		0.016
Physician's malpractice costs	0.251(2)	
Iatrogenic errors		0.055
Medical disputes		0.067
Patient or family violence		0.059
Risk of injury or infection		0.062
Specialty training costs	0.194(3)	
Basic specialty technique		0.051
Difficulty specialty technique		0.089(3)
Rare specialty technique		0.054

4. Discussion

The RBRVS system has been used in the US Medicare for more than ten years and has been accepted by a of majority physicians as a reasonable payment standard (Harris-Shapiro, 1998; Schackelford, 1999; Rotarius , 2001). Grimaldi's review of the results concluded that physician workloads accounted for 50% of Medicare payments, while practice costs accounted for 46%, and malpractice insurance accounted for 4% (Grimaldi , 2002).

As shown in Table 2, this study found that in the first-tier, surgery specialists' primary consideration was physician's total work input, accounting for 39.3%. This is not far from the results in the US after implementation of the RBRVS system. Ranked second was physicians' malpractice costs, accounting for 25.1%. This is very different from that of the RBRVS results in the US. From this one can deduce that Taiwanese surgeons are far more concerned with issues such as medical disputes arising from their practice or violence from dissatisfied patients than their American counterparts.

The third ranked factor was "specialty training costs". At 19.4%, it was similar to the results for practice operating costs. Practice operating costs among Taiwanese physicians accounted for only 16.2% of the total, whereas in the US, that figure come to 46%. A possible reason for this is that the American medical system is an open system, wherein doctors can choose multiple locations in which to conduct their practice, and in which the operating costs are comparatively high. In Taiwan, the medical system is a closed system in which most hospitals limit physicians to working in a single location. Because most physicians work in a single hospital, they are less affected by practice costs and therefore less concerned, or less recognized with this factor for setting payment standards.

The key feature of the AHP method is to use the factors (criteria) related to policy decisions to create a hierarchy structure, and then conduct comparative significance analysis according to policymakers' subjective perceptions. The results in this study indicate that the AHP models designed for surgical specialty is easy to understand conceptually and easy to implement. Moreover, they can effectively achieve consensus among numerous specialists and policymakers. By using this method, we can display

complex evaluation factors for relative values in medical payment standards in a simple hierarchical structure, and include all relevant variables that affect the goal at different levels in the model. Then, after comparative evaluation by experts in the field, these factors can be ranked according to importance and associated with specific numerical values.

The relative weights of each factor in this study represent the results of consensus reached among different surgical sub-specialty groups. The results can be directly used to formulate standard values as the basis for establishing payment standards. This study focused only on surgical specialists. We recommend that in future studies, the same method and model can be used with other specialties. Studies can then be expanded to cover multiple fields and the results can be used as reference values for cross-specialty consensus values. Using this type of model, relative values can be set as a basis for future payment system reforms. Once relative values for a particular specialty have been found, using the above research method they can be expanded to form the basis for setting payment standards for inter-specialty payments.

In summary, the analytic hierarchy process (AHP) as defined by Satty includes an exacting calculation procedure so that conclusions will have the advantages of both qualitative data and quantitative data, thereby overcoming some of the traditional limitations of qualitative data research, such as biased opinions among specialists and difficulties in finding consensus. The AHP system, in contrast, can more effectively lead to consensus among different specialty groups, and is therefore extremely useful in integrating the opinions of different groups and resolving complex, multiple-factor policymaking issues. Additionally, the consensus-derived ranking values arrived at through the AHP calculation process contain a strong persuasiveness and are therefore well suited to form the basis for defining payment standards.

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