ORIGINAL ARTICLE

Factors Influencing Medical Students' Choice of Specialty

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Background/Purpose: Medical school graduates are the source of a country's physicians. Determining how the graduates of these schools select their areas of specialization is the key to achieving a balanced distribution of doctors among all specialties. The purposes of this study were to determine the factors that influence medical students' choice of medical specialty, and to derive the relative weight of each factor.

Methods: We constructed a two-tiered analytic hierarchy process (AHP) model which was represented in a questionnaire sent to 500 senior medical students to survey their opinions. The relative weight of each factor in the model was calculated. Analysis of variance and *t* test were applied to test for any significant differences in opinion among the students.

Results: On the first tier of the AHP model, the aspect of "personal preferences and work achievement" had the highest weight of 0.460, followed by "specialty characteristics" with 0.291, and then the "specialty training process" with 0.249. Of the 14 criteria on the second tier, "personal intelligence/ability preference" had the highest weight of 0.197, followed by "career opportunities" with 0.107 and "lifestyle after completion of training" with 0.094.

Conclusion: This study found that personal intelligence/ability preference and career opportunities were more important factors to the current generation of students in choosing a specialty. Knowledge of these students' attitudes could form the basis for the development of strategies to enhance the attractiveness of specialties facing the problem of a shortage of manpower. [*J Formos Med Assoc* 2006;105(6):489–496]

Key Words: analytic hierarchy process, medical students, specialty choice

Each physician in Taiwan served an average of 705 persons at the end of 2003, which exceeded the target of 750 persons set by the Council for Economic Planning and Development and the Department of Health in 1987.[1] While Taiwan's physician manpower has exceeded the government's target, medical centers have found it difficult to recruit sufficient residents in the fields of surgery, gynecology and obstetrics, and anesthesia over the last few years, and have sometimes had no new residents in these specialties. As a consequence, there is an increasingly severe imbalance in the number of new physicians in different specialties.

The specialty of surgery was once the first preference of medical students in Taiwan, and the number of residents applying to specialize in surgery grew steadily every year. Following the implementation of National Health Insurance (NHI) in 1995, however, the number of residents applying to enter surgical departments has gradually fallen. In their 1998 report on surgical manpower, Chang et al noted that 91% of the investigated hospitals suffered shortages in surgical residents,

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while 50% had shortages in attending physicians.[2] These researchers also found that the unwillingness of residents to engage in surgical work, which was responsible for shortages in surgical manpower, was largely attributable to the health insurance payment system, heavy workloads, intense working pressures, and lower salaries. Chang and Yang reported that the specialty of gynecology/obstetrics suffered from similar circumstances.[3]

Medical school graduates are the source of a country's physicians. Their choices decide the manpower distribution among different medical specialties. Determining how the graduates of these schools select their areas of specialization is essential to achieving a balanced distribution of doctors among all specialties. Medical students consider many factors when selecting a specialty, including career planning, economic and non-economic factors.[3–6] While previous research has revealed that many factors affect medical students' choice of specialty, the relative weight of each of these factors remains unclear. Without this information, an effective incentive policy cannot be designed.

The purposes of this study were to use Saaty's analytic hierarchy process (AHP)[7,8] to investigate the factors that Taiwan's medical students consider when choosing their specialties, and to derive the relative weight of each factor. The results of this study may be helpful to guide policymakers seeking to use incentives to encourage more medical graduates to enter specialties currently attracting insufficient manpower, and achieve a more balanced distribution of specialist physicians.

Methods

Subjects

This study surveyed the opinions of senior medical students in Taiwan in 2004 about factors influencing their choice of specialties. Prior to beginning this study, we first explained the questionnaire content and research approach to the student representatives of each medical college via mail or the telephone. After receiving their approval, 500 questionnaires were sent to medical college upperclassmen in their 5th, 6th or 7th year of medical education. During the process, we found that most students were performing hospital clerkship/internship, and were very difficult to contact. Due to uneven degrees of cooperation among various colleges and students, it was also not possible to issue questionnaires in proportion to the number of students in each year and school.

Design and computation of the AHP questionnaire

The findings of previous studies about factors influencing students' choice of specialty were first identified by literature review. These factors were then used to construct the tiers of an AHP questionnaire. After its initial development, five specialist physicians practicing in different medical centers were consulted to make the first revision of the questionnaire. Three rounds of preliminary surveys were performed after the questionnaire was revised in accordance with the specialists' suggestions. Ten interns from different hospitals were asked to fill out the questionnaire during each survey, and the questionnaire was revised on the basis of their views.

The AHP questionnaire had two tiers targeting the "factors considered when selecting specialty". The first tier assessed the three aspects of personal preferences and work achievement, the specialty training process, and specialty characteristics. The second tier assessed the following 14 criteria: personal intelligence/ability preference,[5,9–14] academic opportunities,[5,12,15] career opportunities,[4,12,13] society's/family's expectations,[4,5,9,15] role model,[4,5,9–14,16–18] opportunity for operations (surgery, treatment, etc.),[5,13,14,18] work-related hazards (infectious hepatitis, AIDS),[4,5,10] length and difficulty of the training period,[5,9,10,12–15,19] work independently after completion of training,[4,5] future income,[4,5,9,10,12,13,15,19–21] lifestyle after completion of training,[4,10,12–14,21,22] type and number of patients served,[9,11,14,18,21] establishing one's own practice,[4,13,15,18] and prestige of specialty.[9,10,12,15,21] The definitions of these aspects/criteria are listed in Table 1.

Table 1. Definitions of aspects / criteria in AHP model

Aspects / Criteria	Definitions
Personal preferences and work achievement (4 items)	
Personal intelligence/ability preference	Personal concerns including intelligence challenge, ability preference
Academic opportunities	Opportunities to reach high academic standing or obtain a teaching position in the medical school
Career opportunities	Job position and future opportunity for promotion
Society's/family's expectations	Societal expectation, peer encouragement and family's expectations
Specialty training process (5 items)	
Role model	Referring to the behavior of supervisors, attending physicians or residents that impressed the student
Opportunity for operations (surgery, treatment, etc.)	Opportunities for performing a procedure (e.g. suturing, Foley catheter placement, etc.) or part of an operation on a patient
Work-related hazards (infectious hepatitis, AIDS)	The incidence of exposure to infections, such as infectious hepatitis, AIDS, or other infectious diseases
Length and difficulty of the training period	Length of training required, working hours, and breadth of knowledge or skill required
Work independently after completion of training	Probabilities of solo operation and independent practice after completion of training
Specialty characteristics (5 items)	
Future income	Financial rewards relative to other specialties
Lifestyle after completion of training	Personal free time for leisure, family and control of total weekly hours spent on professional responsibilities
Type and number of patients served	Perceived quality of patient–physician relationship, numbers and types of patient care delivered
Establishing one's own practice	The level of difficulties to establish one's own practice, including the practice cost, malpractice costs, practice risk
Prestige of specialty	Prestige of specialty within the medical profession

AHP is a popular technique often used to model subjective decision-making processes based on multiple attributes. This method first decomposes complex systems into clearly-defined tiers of elements, and then derives the relative weight and overall order of the elements on each tier via pairwise comparisons. The procedure for establishing an AHP model can be summarized in four steps described as follows.[7,8] Step 1 sets up the hierarchy system by decomposing the problem into a hierarchy of interrelated factors. In this study, we established the hierarchy system based on literature review and modified it based on medical experts' opinions and three rounds of preliminary surveys. Step 2 generates input data consisting of a pairwise comparison matrix to find the comparative weight among the attributes of the decision elements. Step 3 synthesizes the individual subjective judgments and estimates the relative weights. Step 4 determines the aggregating relative weights of the decision elements to arrive at a set of ratings for the decision alternatives/strategies.

Saaty used the principal eigenvector of the comparison matrix to find the comparative weights among the criteria of the hierarchy systems, and suggested using the consistency index (CI) to test the consistency of the intuitive judgment. In general, a CI value < 0.1 is satisfactory.[7,8] We used the AHP software Expert Choice Pro version 9.5 (Expert Choice Inc, Arlington, VA, USA) to compute priority values, CIs, consistency ratios and relative weighting valuations.

Statistical analysis

Saaty's AHP consistency test[7,8] was used to analyze data reliability. All valid questionnaires passed the consistency test. Qualified specialists tested the validity of the data. The relative weight of

each factor in the model was calculated, and analysis of variance and *t* test were applied to test for significant differences in opinions among the students.

Results

This study's questionnaire was sent to 500 5th and 6th year medical students at domestic colleges of medicine and 7th year students at domestic medical centers. A total of 354 (71%) questionnaires were returned, of which 283 (57%) questionnaires were valid (Table 2). Questionnaires that were not completely filled out or did not pass the AHP consistency test were considered invalid. The 283 respondents returning valid questionnaires were further classified by the attributes of gender and year. There were 82 female and 201 male respondents, including 91 in the 5th year, 79 in the 6th year, and 113 in the 7th year.

By using the AHP pairwise comparison matrix, each student compared a set of criteria to obtain his/her own value (judgment) on each criterion. The average of values integrated from the student represented their view on the attribute of those criteria (shown in Tables 3 and 4). Analyzing all valid samples (n = 283) revealed that of the three aspects on the first tier, "personal preferences and work achievement" had the highest weight of 0.460, followed by "specialty characteristics" with 0.291 and "specialty training process" with 0.249.

Table 2. Population, sample size and response rate

Year	Students, *n*	Questionnaires distributed, *n*	Questionnaires returned, *n* (%)	Valid questionnaires, *n* (%)
5th	1070	200	112 (56)	91 (46)
6th	976	150	108 (72)	79 (53)
7th	954	150	134 (89)	113 (75)
Total	3000	500	354 (71)	283 (57)

Table 3. Analytic hierarchy process assessment aspects and criteria weight analysis by gender*

	Male (n = 201)		Female (n = 82)		p
	Aspect	Criteria	Aspect	Criteria	
Personal preferences and work achievement	0.451 ± 0.197		0.482 ± 0.213		0.238
Personal intelligence/ability preference		0.182 ± 0.124		0.233 ± 0.149	0.003†
Academic opportunities		0.084 ± 0.066		0.076 ± 0.056	0.289
Career opportunities		0.112 ± 0.077		0.096 ± 0.073	0.130
Society's/family's expectations		0.073 ± 0.055		0.078 ± 0.072	0.599
Specialty training process	0.252 ± 0.158		0.243 ± 0.149		0.648
Role model		0.048 ± 0.041		0.045 ± 0.034	0.584
Opportunity for operations (surgery, treatment, etc.)		0.049 ± 0.041		0.052 ± 0.043	0.586
Work-related hazards (infectious hepatitis, AIDS)		0.049 ± 0.038		0.045 ± 0.039	0.549
Length and difficulty of the training period		0.039 ± 0.029		0.036 ± 0.030	0.518
Work independently after completion of training		0.068 ± 0.048		0.065 ± 0.045	0.762
Specialty characteristics	0.297 ± 0.166		0.275 ± 0.152		0.303
Future income		0.068 ± 0.062		0.052 ± 0.048	0.034‡
Lifestyle after completion of training		0.094 ± 0.067		0.095 ± 0.066	0.964
Type and number of patients served		0.051 ± 0.042		0.058 ± 0.052	0.276
Establishing one's own practice		0.036 ± 0.030		0.033 ± 0.029	0.367
Prestige of specialty		0.048 ± 0.042		0.039 ± 0.033	0.123

**Data are presented as mean ± standard deviation; †$p < 0.01$ and ‡$p < 0.05$ on t test.*

Table 4. Analytic hierarchy process assessment aspects and criteria weight analysis by year*

	5th year (*n* = 91)		6th year (*n* = 79)		7th year (*n* = 113)		*p*
	Aspect	Criteria	Aspect	Criteria	Aspect	Criteria	
Personal preferences and work achievement	0.453 ± 0.185		0.437 ± 0.201		0.482 ± 0.214		0.289
Personal intelligence/ability preference		0.180 ± 0.118		0.168 ± 0.119		0.230 ± 0.148	0.002†
Academic opportunities		0.095 ± 0.072		0.080 ± 0.063		0.072 ± 0.054	0.031†
Career opportunities		0.105 ± 0.071		0.112 ± 0.078		0.106 ± 0.079	0.799
Society's/family's expectations		0.073 ± 0.050		0.076 ± 0.067		0.074 ± 0.056	0.950
Specialty training process	0.264 ± 0.144		0.269 ± 0.161		0.223 ± 0.158		0.072
Role model		0.050 ± 0.040		0.049 ± 0.037		0.045 ± 0.040	0.637
Opportunity for operations (surgery, treatment, etc.)		0.053 ± 0.046		0.049 ± 0.039		0.048 ± 0.042	0.707
Work-related hazards (infectious hepatitis, AIDS)		0.064 ± 0.051		0.051 ± 0.045		0.031 ± 0.026	0.001‡
Length and difficulty of the training period		0.038 ± 0.027		0.046 ± 0.039		0.032 ± 0.028	0.031†
Work independently after completion of training		0.060 ± 0.052		0.073 ± 0.066		0.068 ± 0.058	0.422
Specialty characteristics	0.283 ± 0.142		0.294 ± 0.168		0.295 ± 0.174		0.422
Future income		0.067 ± 0.059		0.069 ± 0.058		0.056 ± 0.052	0.228
Lifestyle after completion of training		0.089 ± 0.051		0.096 ± 0.070		0.098 ± 0.074	0.606
Type and number of patients served		0.052 ± 0.045		0.050 ± 0.044		0.055 ± 0.043	0.759
Establishing one's own practice		0.032 ± 0.024		0.035 ± 0.030		0.037 ± 0.033	0.585
Prestige of specialty		0.042 ± 0.034		0.044 ± 0.035		0.049 ± 0.042	0.527

**Data are presented as mean ± standard deviation; †$p < 0.05$ and ‡$p < 0.01$ on ANOVA test.*

Of the 14 criteria on the second tier, "personal intelligence/ability preference" had the highest weight of 0.197, followed by "career opportunities" with 0.107 and "lifestyle after completion of training" with 0.094. Apart from the overall weighting analysis, a further analysis was performed on the basis of gender and year.

Weight calculation results for valid questionnaires (n = 201) received from male respondents showed that, of the three aspects on the first tier, "personal preferences" had the highest weight of 0.451, followed by "specialty characteristics" with 0.297 and "training process" with 0.252 (Table 3). Of the 14 criteria on the second tier, "personal intelligence/ability preference" had the highest weight of 0.182, followed by "career opportunities" with 0.112 and "lifestyle after completion of training" with 0.094 (Table 3). As for calculation results for valid questionnaires (n = 82) from female students, of the three aspects on the first tier, "personal preferences" had the highest weight of 0.482, followed by "specialty characteristics" with 0.275 and "training process" with 0.243 (Table 3). Of the 14 criteria on the second tier, "personal intelligence/ability preference" had the highest weight of 0.233, followed by "career opportunities" with 0.096 and "lifestyle after completion of training" with 0.094 (Table 3). Analysis using t test found that female students cared about "personal intelligence/ability preference" more than male students (0.233 *vs.* 0.182, $p < 0.01$), but the weight of "future income" for male students was higher than that for female students (0.068 *vs.* 0.052, $p < 0.05$). No significant differences were found in the weight of the first tier aspects and the other 12 criteria on the second tier.

Respondents were classified by year into three cohorts: 5th year (n = 91), 6th year (n =79), and 7th year medical students (n = 113). With regard to the three aspects on the first tier, questionnaire data for 5th, 6th and 7th year students all had the same weighting order. Here, the three highest weights were for "personal preferences and work achievement", "specialty characteristics", and "specialty training process" in that order (Table 4). There was no difference in the weighting of the three aspects among the three cohorts. With regard to the 14 criteria on the second tier, while "personal in-

telligence/ability preference" and "career opportunities" had the highest and second-highest weights in all three cohorts, the criterion with the third-highest weight varied slightly among the different cohorts. The criterion with the third-highest weight was "academic opportunities" for 5th year medical students, but was "lifestyle after completion of training" for 6th and 7th year students (Table 4). There were significant differences between students in the 5th and 7th years, as well as between the 6th and 7th years in the weighting of "personal intelligence/ability preference", "academic opportunities", "length and difficulty of the training period" ($p < 0.05$), and "work-related hazards" ($p < 0.01$). Of the other 10 criteria on the second tier, no significant differences were found for students in the 5th, 6th and 7th years.

Discussion

Medical students' choice of specialty is a complex decision-making process involving multiple interrelated factors. Yang and Tsai[4] found that the major aspects affecting interns' choice of specialty were compensation factors, study experience, other people's expectations, and personal factors. Kao et al found that the main factor influencing specialty selection was personal interest, followed first by compatibility with personality, and second by workload and work pressure.[5] Phelps reported that future income influenced physicians' decision about whether to specialize and their choice of specialty.[20] Kiker and Zeh concluded that noneconomic factors such as planned location of practice, length of residency, type of medical school attended, predictable working hours, and prestige of practice may affect physicians' choice of specialty.[15] Furthermore, appropriate policies may be needed to correct a perceived maldistribution of physicians among specialties.

This study found that for all respondents, "personal preferences and work achievement" had the highest weight (0.460) of the three aspects on the first tier, followed by "specialty characteristics" with 0.291 and "specialty training process" with 0.249. "Personal intelligence/ability preference" had the highest weight of 0.197 of the 14 criteria on the second tier, followed by "career opportunities" and "lifestyle after completion of training". Results indicated that "personal preferences and work achievement" still retained the highest weight on the first tier when the respondents were grouped either by gender or by year. The "personal intelligence/ability preference" also had the highest weight of the 14 criteria on the second tier for both groupings. This finding is similar to those of Kao et al[5] and other studies,[9–14] and reveals that medical students are most concerned about obtaining affirmation of personal ability and a sense of accomplishment when selecting a specialty; incentives should, therefore, be designed to emphasize these aspects. But, when analyzed by gender, female students cared about "personal intelligence/ability preference" more than male students (0.233 *vs.* 0.182, $p < 0.01$).

Among the criteria on the second tier, the criterion of "career opportunities" had the second-highest weight for both male and female students and students in all year cohorts. This is similar to the findings of Yang and Tsai,[4] Azizzadeh et al[12] and DeWitt et al,[13] and indicates that the vast majority of medical students regard job position and future opportunity for promotion as second in importance when choosing a specialty. Quality of life is also an important consideration for medical students selecting a specialty. The criterion "lifestyle after completion of training" was generally included among the top three of the 14 criteria, which parallels the findings of Yang and Tsai,[4] Newton et al,[10] and others.[12–14,21,22] It can be assumed that the recent significant increase in the number of residents applying to specialize in ophthalmology, dermatology, and rehabilitation noted by Chang and Yang[3] is connected to the importance placed on this criterion.

Previous studies have found that economic factors and amount of future income were uniformly important considerations for medical students selecting a specialty.[4,5,9,10,12,13,15,19–21] In contrast, this study found that "future income" and "establishing one's own practice" — two criteria that are high-

ly linked with economic incentives — were both assigned low weights. When medical center residents were interviewed about the reasons for the low ranking of economic factors, they noted that students' families are now much better off than in earlier generations, and that medical students no longer feel it necessary to shoulder the entire economic burden of the family. Another possible reason may be that because the students have not yet entered the workplace, they do not give as much consideration to economic incentives when choosing a specialty. This hypothesis is supported by the data in Table 4, which shows that while "establishing one's own practice" was ranked last among the 14 criteria by 5th and 6th year students, this criterion rose to 11th place among 7th year students. Analysis by gender revealed that the weight of "future income" for male students was higher than that for female students (0.068 *vs.* 0.052, $p < 0.05$).

The highest weight among the second tier criteria did not vary much among the different groups of students. It can be assumed that those students who are able to excel under the extreme competition of Taiwan's university entrance examination and enter a college of medicine are outstanding students. These students are the subject of very high expectations on the part of their families and society. They tend to choose specialties that reflect their personal interests and provide opportunities for future development. This may explain why the weights of "degree of difficulty" and "degree of hazard" were lower than those of "personal intelligence/ability preference" and "future development". Lower class students sensed higher pressure on work hazards, with weights for 5th, 6th and 7th year students of 0.064, 0.051 and 0.031, respectively ($p < 0.01$).

In summary, using the AHP model, this study identified the factors that affected medical students' choice of specialty, as well as the relative weight of each factor. Emphasis needs to be placed on the design of incentives that will create a well-rounded, formative environment in which young physicians can pursue their own interests and talents, with opportunities for further promotion. This study found that future income is no longer an important factor affecting students' choice of specialty in Taiwan. Policy makers must recognize the changes in the needs and expectations of the current generation of medical students. Knowledge of these students' attitudes could form the basis for the development of strategies to enhance the attractiveness of some specialties with the problem of manpower shortages, such as surgery and gynecology/obstetrics.

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