

Using AHP to Analyze the Determinants of Medical Students' Choice of Specialty¹

Chih-Young Hung¹, Kuei-Ing Wang¹, Yuan-Huei Huang¹

¹Institute of Management of Technology, National Chiao Tung University,
1001 Ta-Hsueh Rd., Hsinchu, 300, Taiwan.

Tel: 886-3-5712121 ext: 57514

kywang54@ms25.hinet.net

Pei-Yeh Chang²

²Department of Pediatric Surgery, Chang Gung Children's Hospital,
No.7, Fu-Hsing Street, Kweishan, Taoyuan, 333, Taiwan

Tel: 886-3-3281200 ext: 8001

pychang@ms34.hinet.net

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Summary: *The purposes of this study are employed analytic hierarchy process (AHP) to investigate the important factors that Taiwan's medical students consider when choosing a specialty, and derive the relative weight of each factor. This study's questionnaire was sent to medical college upperclassmen. A 2-tier hierarchy model is constructed in the questionnaire. The three aspects on the first tier, 'personal preferences/work achievement' had the highest weight of 0.4601(1), followed by 'specialty characteristics' with 0.2907(2) and the 'specialty training process' with 0.2491(3). Of the 14 criteria on the second tier, 'personal intelligence/ability /preference' had the highest weight of 0.1967(1), followed by 'career opportunities' with 0.1072(2) and 'lifestyle after completion of training' with 0.0944(3). The results of this study may serve to guide policymakers -- if incentives are provided in consideration of factors important to medical students, more medical graduates may be willing to enter specialties currently attracting insufficient manpower, and achieve a balanced distribution of specialist physicians.*

1. Introduction

Each physician in Taiwan served an average of 705 persons at the end of 2003, which exceeded the 2000 target of 750 persons for each physician set by the Council for Economic Planning and Development and the Department of Health (DOH) in 1987 (Chiang, 1995). 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

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residents applying to specialize in surgery grew steadily every year. Following the implementation of National Health Insurance (NHI) in 1995, however, from 1996 the number of residents applying to enter surgical departments has fallen. Chang et al. point out in their 1998 research report on surgical manpower that 91% of the investigated hospitals suffered shortages of surgical residents, while 50% had shortages of attending physicians. The researchers also found that the unwillingness of residents to engage in surgical work, which caused the shortages of surgical manpower, could largely be attributed to the health insurance payment system, heavy workloads, intense working pressures, and lower salaries.

The graduates of medical schools are the source of the country's physicians. Their choices of specialties to practice decide the manpower distribution among different medical specialties. Finding out how the graduates of these schools select their area of specialization is the key to attaining a balanced distribution of doctors among all specialties. Medical students consider many factors when selecting a specialty, including such factors as career planning, economic aspects, and non-economic aspects, etc. (Yang, Tsai, 1999; Kao et. al, 2000; Chang et. al, 2001). While the foregoing research revealed that the health insurance system affects medical students' choice of specialty, what other factors do students consider when selecting a specialty? What is the importance of each type of factor? This is certainly a subject worth deeper exploration.

The purposes of this study are employed analytic hierarchy process (AHP) to investigate the important factors that medical college upperclassmen consider when choosing a specialty, and derive the relative weight of each factor. The results of this study may serve to guide policymakers -- if incentives are provided in consideration of factors important to medical students, more medical graduates may be willing to enter specialties currently attracting insufficient manpower, and achieve a balanced distribution of specialist physicians.

2. Review of Literature on Physicians' Choice of Specialty

Yang and Tsai (1999) studied the factors affecting choice of specialty among interns at a medical center in southern Taiwan. This study discovered that the major aspects affecting the interns' choice of specialty were, in order of importance, compensation factors (seven factors including possibility of starting one's own practice, difficulty of advancement, and relatively reasonable income), study experience (four factors including supervising physician, work environment, and sense of achievement), other persons' expectations (six factors including having a family member who suffers from a particular disease, family members' expectations, and influence of classmates and friends), and personal factors (including personal phobias and not wishing to directly face family members or patients). Kao et al. (2000) explored medical students' specialty preferences and relevant factors, and discovered that the main factor influencing specialty selection was personal interest, followed first by compatibility with personality, and second by workload and work pressure.

Culler and Bazzoil (1985) discovered in their study of the physician labor supply that an extremely significant positive correlation existed between physicians' working time and compensation rate. Phelps (1991) pointed out that future income influences physicians' decision whether to specialize and their choice of specialty. Rice (1983) suggested that insurance payments may influence physicians' provision of medical service. This study found that (1) service density tends to rise with falling payment standards; (2) service volume in the area of surgery tends to raise with falling payment standards; and (3) auxiliary medical treatment behavior tends to increase with falling payment standards. Such noneconomic factors 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. Furthermore, appropriate policies may be correcting a perceived maldistribution of physicians among specialties. (Kiker, Zeh, 1998).

Research has found that those who are mentored experience considerable benefits such as higher salaries and promotions (Roche, 1979; Dreher, Ash, 1990). Day & Allen (2004) examined the relationship between

career motivation and self-efficacy with protégé career success. Their findings showed that career motivation mediated the relationship between career mentoring and performance effectiveness, but only marginal support was received for career self-efficacy as mediator between mentoring and career success. Babbott (1991) suggested 16 most important factors in medical students' of specialty, including excellent courses or clerkships in the area, examples of a physician in this specialty, working hours, good income, prestige within the medical profession, intellectual content, challenging diagnostic problems, minimum of uncertainties in diagnosis, encouragement from faculty/other students/family, lack of overcrowding, type of patients encountered, possess necessary skill, length of residency and others. Of these factors, the medical students paid particular attention to the items in order of "intellectual content," " diagnostic challenge," " type of patients seen," and "role model."

DeWitt (1998) suggested that the factors of preferred location, salary, working hours, time for family, breadth of knowledge/skills required, breadth of clinical problem, addressed in practice, mentors, and opportunity for continuity of care influence graduates' choice of a specialty. Azizzadeh et al. (2003) analyzed the specialty choice of four-year medical students in the US in relation to the factors of were career opportunities, academic opportunities, experience on core rotation/subinternship, role model(s) in that specialty (mentors), length of training required, lifestyle during residency, work hours during residency, ability to obtain residency position, concern about loans/debt, call schedule, lifestyle after training, work hours after training, financial rewards after training, intellectual challenge, patient relationships/interaction, prestige, future patient demographics, and gender distribution in the specialty. It was found that prestige and career opportunities are more important to students seeking surgical residencies. Concerns about lifestyle and work hours during residency and perceived quality of patient/physician relationships were deterrents to surgery as a career choice.

3. Research Method

3. 1 Analytic Hierarchy Process (AHP)

Decision-makers frequently encounter many mutually-influencing factors when analyzing complex problems. When this situation arises, the decision-makers must determine the relative importance of factors to provide a basis for assessment. Saaty developed the AHP technique in the 1970's for making effective decisions and achieving consensus from divergent judgments. AHP can be used to resolve complex decision-making problems. 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 (Saaty, 1980; Teng & Tzeng, 1987).

The AHP method involves the arrangement of the elements (criteria) of a decision-making problem as a hierarchical structure, followed by pairwise comparison of importance in accordance with the decision-makers' subjective preferences to obtain the relative weight of each element (criterion). AHP analysis consists of the following six steps: (1) Arrangement of the elements; (2) setting of tiers; (3) establishment of a pairwise comparison matrix; (4) derivation of the comparison matrix's priority vector and the maximized eigenvalue; (5) derivation of a consistence index and consistence ratio; and (6) calculation of overall tier weight (Saaty, 1980; Teng & Tzeng, 1987).

3. 2 Subjects and Questionnaire Reliability and Validity

This study's questionnaire was sent to medical college upperclassmen, who are fifth-, sixth-, or seventh-year. Saaty's AHP consistency test was used to analyze data reliability; all valid questionnaires passed the consistency test. Qualified specialists tested the validity of the data: Five specialist physicians practicing at a medical center provided their views concerning data validity.

3. 3 Design of the AHP Questionnaire

This study first reviewed the foregoing literature to determine relatively important factors influencing physicians' choice of a specialty. These factors were then used to construct the tiers of an AHP questionnaire. After its completion, five specialist physicians practicing from different medical centers were consulted for 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 the structure shown in Fig. 1.

The AHP questionnaire had two tiers targeting the "factors considered when selecting specialty training." The first tier assessed the three aspects of personal preferences/work achievement, the specialty training process, and specialty characteristics. The second tier assessed 14 criteria: personal intelligence/ability/preference, academic opportunities, career opportunities, Society's /family's expectation, role model, opportunity for operations (surgery, disposition, etc.), work-related hazards (infectious hepatitis, AIDS), length and difficulty of the training period, work independently after completion of training, income after completion of training, lifestyle after completion of training, type and number of patients served, establishing one's own practice, and prestige of specialty.

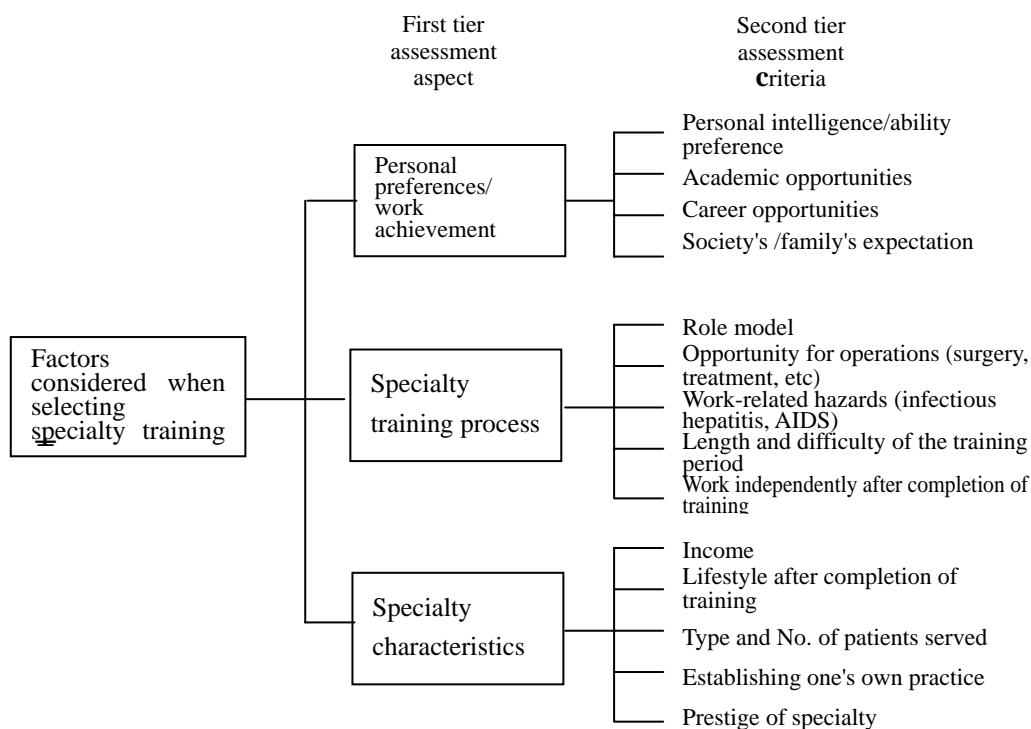


Figure 1 The AHP's two-tier framework for factors considered when selecting specialty

4. Results and Analyses

This study's questionnaire was sent to 500 fifth- and sixth-year medical students at domestic colleges of medicine and seventh-year students at domestic medical centers. A total of 354 (71%) questionnaires were returned, of which 283 (57%) questionnaires were valid. Questionnaires which were not completely filled out or did not pass the AHP consistency test were considered invalid.

4.1 Analysis of Respondents' Personal Information

Table 1 shows the 283 respondents returning valid questionnaires classified by the attributes of gender

and year. There were 82 female and 201 male respondents; seventh-year students constituted the largest year cohort (113).

Table1 the attributes of gender and year of respondents

Gender	No.	Percentage	Year	No.	Percentage
Male	201	71	Fifth-year	91	32
Female	82	29	Sixth-year	79	28
			Seventh- year	113	40
Total	283	100	Total	283	100

4.2 AHP Criteria Weight and Analysis

Analyzing the entire valid samples (n=283), the three aspects on the first tier, 'personal preferences/work achievement' had the highest weight of 0.4601, followed by 'specialty characteristics' with 0.2907 and the 'specialty training process' with 0.2491(see Table 2). Of the 14 criteria on the second tier, 'personal intelligence/ability/preference' had the highest weight of 0.1967, followed by 'career opportunities' with 0.1072 and 'lifestyle after completion of training' with 0.0944 (Table 3). Apart from overall weighting analysis, a further analysis was performed on the basis of gender and year.

4.2.1 Analysis by Gender

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 0.4511, followed by 'specialty characteristics' with 0.2971 and 'training process' with 0.2518(Table 2). Of the 14 criteria on the second tier, 'personal intelligence/ability/preference' had the highest weight of 0.1819, followed by 'career opportunities' with 0.1115 and 'lifestyle after completion of training' with 0.0942 (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 0.4823, followed by specialty characteristics with 0.2752 and training process with 0.2425(Table 2). Of the 14 criteria on the second tier, personal intelligence/ability/preference had the highest weight of 0.2330, followed by career opportunities with 0.0964 and lifestyle after completion of training with 0.0946 (Table 3).

4.2.2 Analysis by Year

Respondents were classified by year into three cohorts: fifth-year medical students (n=91), sixth-year students (n=79), and seventh-year students (n=113). With regard to the three aspects on the first tier, questionnaire data for fifth-, sixth- and seventh-year students all yielded the same weighing order. Here the three highest weights were for 'personal preferences/work achievement', 'specialty characteristics', and 'specialty training process' in that order (Table 4). With regard to the 14 criteria on the second tier, while 'personal intelligence/ability/preference' and 'career opportunities' had the highest and second-highest weights for all three cohorts, the criterion with the third-highest weight was varied slightly among different cohorts: The criterion with the third-highest weight was 'academic opportunities' for fifth-year medical students, 'lifestyle after completion of training' for sixth- and seventh-year students (Table 5).

Table2 AHP 1st-tier assessment aspect weight analysis by gender

	Male n=201	Female n=82	Overall n=283
Personal preferences/work achievement	0.4511(1)	0.4823(1)	0.4601(1)
Specialty training process	0.2518(3)	0.2425(3)	0.2491(3)
Specialty characteristics	0.2971(2)	0.2752(2)	0.2907(2)

Table3 AHP 2nd-tier assessment criteria weight analysis by gender

	Male	Female	Overall
	n=201	n=82	n=283
Personal intelligence/ability preference	0.1819(1)	0.2330(1)	0.1967(1)
Academic opportunities	0.0844	0.0756	0.0818
Career opportunities	0.1115(2)	0.0964(2)	0.1072(2)
Society's /family's expectation	0.0733	0.0775	0.0745
Role model	0.0482	0.0454	0.0474
Opportunity for operations (surgery, treatment, etc)	0.0488	0.0520	0.0497
Work-related hazards (infectious hepatitis, AIDS)	0.0485	0.0447	0.0474
Length and difficulty of the training period	0.0388	0.0355	0.0378
Work independently after completion of training	0.0676	0.0649	0.0668
Income	0.0679(5)	0.0516(9)	0.0632(7)
Lifestyle after completion of training	0.0942(3)	0.0946(3)	0.0944(3)
Type and No. of patients served	0.0508	0.0574	0.0527
Establishing one's own practice	0.0362(14)	0.0325(14)	0.0351(14)
Prestige of specialty	0.0481	0.0391	0.0455

Table 4 AHP 1st-tier assessment aspect weight analysis by year (n=283)

Year	Fifth-year	Sixth-year	Seventh-year
	n=91	n=79	n=113
Personal preferences/work achievement	0.453(1)	0.437(1)	0.482(1)
Specialty training process	0.264(3)	0.269(3)	0.223(3)
Specialty characteristics	0.283(2)	0.294(2)	0.295(2)

Table 5 AHP 2rd-tier assessment criteria weight analysis by year (n=283)

Year	Fifth-year	Sixth-year	Seventh-year
	n=91	n=79	n=113
Personal intelligence/ability preference	0.180(1)	0.168(1)	0.230(1)
Academic opportunities	0.095(3)	0.080	0.072
Career opportunities	0.105(2)	0.112(2)	0.106(2)
Society's /family's expectation	0.073	0.076	0.074
Role model	0.050	0.049	0.045
Opportunity for operations (surgery, treatment, etc)	0.053	0.049	0.048
Work-related hazards (infectious hepatitis, AIDS)	0.064	0.051	0.031(14)
Length and difficulty of the training period	0.038	0.046	0.032
Work independently after completion of training	0.060	0.073	0.068
Income	0.067(6)	0.069(7)	0.056(7)
Lifestyle after completion of training	0.089(4)	0.096(3)	0.098(3)
Type and No. of patients served	0.052	0.050	0.055
Establishing one's own practice	0.032(14)	0.035(14)	0.037(12)
Prestige of specialty	0.042	0.044	0.049

5. Discussion and Conclusions

Our study indicates that for all respondents, 'personal preferences/work achievement' had the highest weight (0.4601) of the three aspects on the first tier, followed by 'specialty characteristics' with 0.2907 and the 'specialty training process' with 0.2491. The 'personal intelligence/ability/preference' had the highest weight of 0.1967 of the 14 criteria on the second tier, followed by 'career opportunities' and 'lifestyle after completion of training'. It was discovered that 'personal preferences/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 the results of Kao et al. (2000) and Babbott (1991), 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.

Looking at the weights of 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 & Tsai (1999), DeWitt (1998), and Azizzadeh et al. (2003), 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 of 'lifestyle after completion of training' weight was generally included among the top three of the 14 criteria, which parallels the research findings of DeWitt (1998) and Azizzadeh et al. (2003). It can be assumed that the recent significant increase in the number of residents applying to specialize in ophthalmology, dermatology, and rehabilitation, etc. (Chang & Yang, 1999) is connected with the importance placed on this criterion.

Past studies have found that economic factors and amount of income were uniformly important considerations for medical students selecting a specialty (Culler, Bazzoil, 1985; Phelps, 1993; Yang & Tsai, 1999). In contrast, this study found that 'income after completion of training' and 'establishing one's own practice' – two criteria that are highly linked with economic incentives – were both assigned low weights. As indicated in Table 3, income was ranked seventh (0.0632) by all respondents, and establishing one's own practice had the lowest weight (0.0351). When interviewed medical center residents the reasons for the low ranking of economic factors include the fact that students' family are much better than that of earlier generations; medical students no longer feel it necessary to shoulder the entire economic burden for the family. Another reason is that the students still haven't entered the workplace and therefore don't pay as much consideration to economic incentives when choosing a specialty. This point is illustrated in Table 5: while 'establishing one's own practice' was ranked last among the 14 criteria by fifth- and sixth-year students, this criterion rose to 11th among seventh-year students.

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' are lower than 'personal intelligence/ ability/ preference' and 'future development.'

This study recommends that emphasis 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, and have chances for further promotion. In addition, even though this study found that income is no longer an important factor affecting choice of specialty, students still care about the relative fairness of compensation when choosing their specialty. Taiwan's NHI is a sole-insurer system, and insurance payments are the sole source of income for the vast majority of physicians. If the NHI can set up a fair and reasonable fee schedule in the form of higher compensation for physicians in the specialty requiring

relatively high levels of labor, risk, and training cost, such as surgery, gynecology and obstetrics, and anesthesia, etc., more young physicians would be encouraged to enter these very demanding fields.

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