Analysis of Senior Medical Students' Preferences in Specialty Choice A Survey in a Medical School in Northern Taiwan

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Background: Medical centers in Taiwan have found it difficult to recruit sufficient residents in the fields of surgery and gynecology & obstetrics over the last few years. It is important to realize why this phenomenon occurs. The purposes of this study are to investigate the important (critical) factors that Taiwan medical students currently consider when choosing their specialties, and to derive the relative weight of each factor.

Methods: We constructed a three-tier analytic hierarchy process (AHP) model in the questionnaire sent out to 200 senior students at a medical school in northern Taiwan. The relative weight of each factor in the model was calculated, and the Kruskal-Wallis test as well as the t-test was 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 0.455, followed by "specialty characteristics" with 0.281 and the "specialty training process" with 0.263 for all respondents. Of the 14 criteria on the second tier, "personal intelligence/ability preference" had the highest weight of 0.191, followed by "career opportunities" with 0.105 and "lifestyle after completion of training" with 0.093 for all respondents. As students got older, their perception of specialties changed. Students might modify their decision as their views of the various specialties evolve.

Conclusions: "Personal intelligence and/or ability preference" is the most important factor, while the economic factors, such as future income, is ranked lower (7th place). Knowledge of the attitudes of a new generation of medical students could form the basis for the development of strategies to enhance the attractiveness of specialties that currently lack sufficient applicants.

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

Since the implementation of National Health Insurance (NHI) in 1995, the number of residents applying to enter surgical specialties has fallen. 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.

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Chang et al. pointed out in their 1998 research report on surgical manpower that 91% of investigated hospitals suffered shortages of surgical residents, while 50% had shortages of attending physicians.[1] 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 work pressures, and low salaries. Chang and Yang (1999) discovered that the specialty of gynecology/ obstetrics (Gyn & Obs) suffered from similar problems.[2] It is important to realize why this phenomenon occurs and do something to improve the situation.

Medical school graduates are the source of a country's physicians. Finding out how the graduates of these schools select their areas of specialization is the key to achieving a balanced distribution of doctors among all specialties. Medical students consider many factors when selecting a specialty, such as career planning and economic factors.[2-5] Current studies in specialty choice have employed quantitative comparisons, descriptive statistics, focus groups and nonparametric statistics as research methods.[3,4,8-14,17] Those methods are mainly used in a simple decision making environment. Saaty's analytic hierarchy process (AHP) weighting is determined by evaluators who conduct pairwise comparisons to reveal the comparative importance of two criteria.[6,7] Medical students' choice of specialty is a complex decision-making process which involves multiple interrelated factors. Thus, this study used the AHP to investigate the important (critical) factors that senior medical students consider when choosing their specialties, and to derive the relative weight of each factor. More medical graduates may be willing to enter specialties currently attracting insufficient manpower such as surgery and gyn & obs, if incentives are provided in consideration of factors important to medical students.

METHODS

Subjects

In 2004, this study surveyed senior students at a medical school in northern Taiwan concerning their opinions about choosing specialties. The questionnaire was sent to 200 medical college upperclassmen, who were fifth-, sixth-, and seventh-year students.

Analytic hierarchy process (AHP)

The AHP technique was developed by Saaty in the 1970's as a tool 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 layers of elements, and then derives the relative weight and overall order of the elements on each layer via pairwise comparisons.[6,7] In this study the students compared a set of criteria and obtained his/her own value (judgment) on each criterion. The average values of all the students represent their views on the attributes of those criteria (shown in Table 3 and Table 4).

The procedure for establishing an AHP model can be summarized in four steps as follows:[6,7]

Step 1 Set up the hierarchy system by decomposing the problem into a hierarchy of interrelated factors. In this study, we established the hierarchy system based on a literature review and modified it using the opinions of medical experts and three preliminary surveys.

Step 2 Generate input data consisting of a pairwise comparison matrix to find the comparative weights among the attributes of the decision elements.

Step 3 Synthesize the individual subjective judgments and estimate the relative weights.

Step 4 Determine 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 hierarchy systems. If we wish to compare a set of n criteria pairwise according to their relative importance (weights), we then denote the criteria by $C_1,C_2,...,C_n$ and their weights by $w_1,w_2,...,w_n$. If $w = (w_1,w_2,...,w_n)^T$ is given, the pairwise comparisons may be represented by matrix A of the following formulation:

$$(A-\lambda_{max}I)w = 0 \qquad (1)$$

Equation (1) denotes that A is the positive reciprocal matrix of pairwise comparison values derived by intuitive judgments for ranking order. In order to derive the priority eigenvector, we must find the eigenvector w with respective λ_{max} which satisfies

$Aw = \lambda_{max} w$. Saaty suggested the consistency index (C.I. = $\frac{\lambda_{max} - n}{n-1}$) to test the consistency of intuitive judgment. In general, a value of C.I. of less than 0.1 is satisfactory. We used the AHP software product Expert Choice Pro (version 9.5, expertchoice, Arlington, VA22209) to compute priority values, consistency indices, consistency ratios and relative weighting valuations.

Designing the AHP questionnaire

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

The AHP questionnaire had three 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,[4,8-13] academic opportunities,[4,11,14] career opportunities,[3,11,12] society /family expectations,[3,4,8,14] role model,[3,4,8-13,15-17] opportunity to do procedures (surgery, treatment, etc.),[4,12,13,17] work-related hazards (infectious hepatitis, AIDS),[3,4,9] length and difficulty of the training period,[4,8,9,11-14,18] work independently after completion of training,[3,4] future income,[3,4,8,9,11,12,14,18-20] lifestyle after completion of training,[3,9,11-13,20,21] type and number of patients served,[8,10,13,17,20] establishing one's own practice,[3,12,14,17] and prestige of specialty.[8,9,11,14,20] (please see Attachment 1). The definitions of the aspects/criteria are listed in Table 1. Students were asked to select their first preferred specialty among 10 specialties listed on the third tier. These 10 specialties are categorized from 23 specialties announced by Taiwan's Department of Health in 2004.

Statistical analysis

Saaty's AHP consistency test was used to ana-

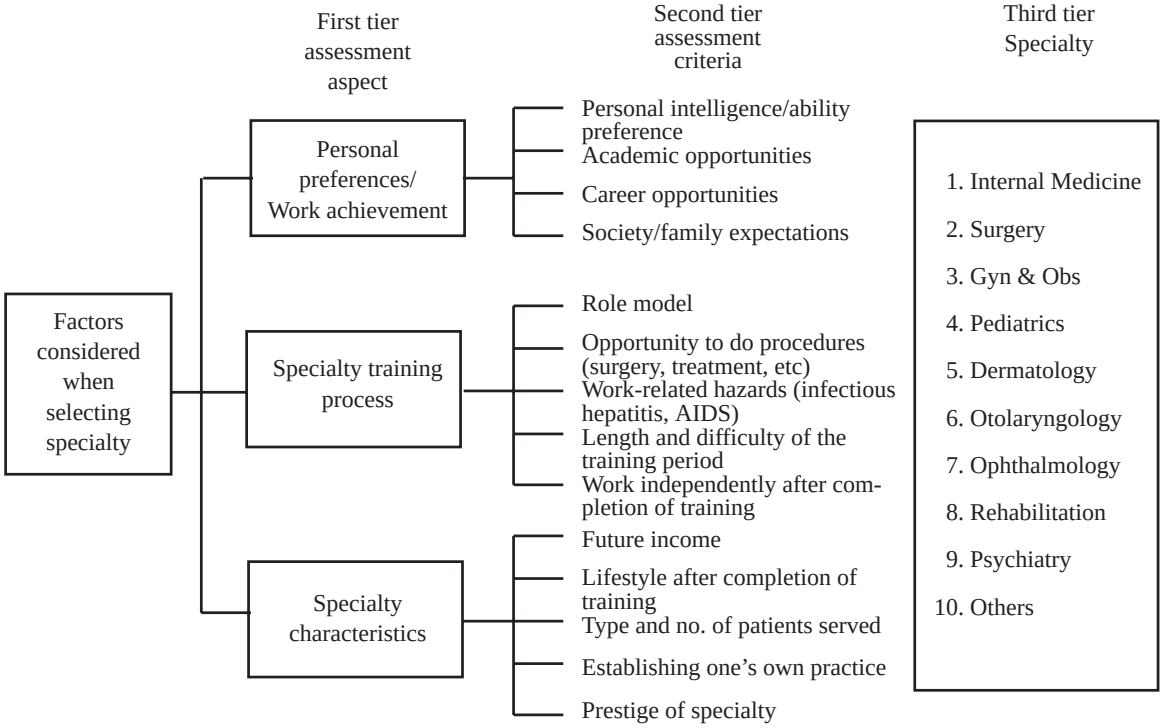

Fig. 1 The AHP three-tier framework for factors considered when selecting specialty

Table 1. Definitions of Aspects / Criteria in AHP Model

Aspects / Criteria	Definitions
Personal preferences and work achievement	Composed of four criteria: Personal intelligence /ability preference, Academic opportunities, Career opportunities and society /family expectations
Personal intelligence /ability preference	Personal concerns including personal preference and capacity, intellectual challenge
Academic opportunities	Opportunities to reach high academic standing or obtain teaching positions in medical schools
Career opportunities	Job positions and future opportunities for promotion
Society /family expectations	Societal expectations, peer encouragement and family expectations
Specialty training process	Composed of five criteria: Role model, Opportunity to do procedures, Work-related hazards, Length and difficulty of the training period and Work independently after completion of training
Role model	Referring to the behavior of supervisors, attending physicians or residents that impressed the student
Opportunity to do procedures (surgery, treatment, etc)	Opportunities to perform procedures (e.g., suturing, foley catheter placement, etc) or participate in operations
Work-related hazards (infectious hepatitis, AIDS)	The probability of being exposed 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	Opportunities to perform solo operations and possibility of independent practice after completion of training
Specialty characteristics	Composed of five criteria: Future income, Lifestyle after completion of training, Type and no. of patients served, Establishing one's own practice and Prestige of specialty
Future income	Financial rewards relative to other specialties
Lifestyle after completion of training	Personal time for leisure and family and control of total weekly hours spent on professional responsibilities
Type and no. of patients served	Perceived quality of patient-physician relationship, numbers of patients and types of patient care provided
Establishing one's own practice	Level of difficulty in establishing one's own practice including practice costs, malpractice costs, practice risks
Prestige of specialty	Prestige of specialty within the medical profession

lyze data reliability;[6,7] all valid questionnaires passed the consistency test. The validity of the questionnaire was also tested by several senior medical specialists. The relative weight of each factor in the model was calculated, and the Kruskal-Wallis (K-W) test as well as the t-test were applied to test for any significant difference in opinion among the students.

RESULTS

A total of 185 (92.5%) questionnaires were returned, of which 184 (92%) questionnaires were valid. Questionnaires which were not completely filled out or did not pass the AHP consistency test were considered invalid. The 184 valid questionnaires were further classified by year and specialty. There were 90 5th-year, 56 6th-year, and 38 7th-year students; 67 students chose internal medicine, 29 students choosing surgery, and 3 students choosing gyn & obs as their first preference for a specialty (See Table 2).

Analyzing all valid samples (n = 184), the three aspects on the first tier, "personal preferences and work achievement" had the highest weight of 0.455,

Table 2. Medical Students' First Preference in Specialty Choice

Specialty	5th year	6th year	7th year	Total
Internal Medicine	41 (22.28%)	17 (9.24%)	9 (4.89%)	67 (36.41%)
Surgery	10 (5.43%)	10 (5.43%)	9 (4.89%)	29 (15.76%)
Gyn & Obs	3 (1.63%)	0 (0.00%)	0 (0.00%)	3 (1.63%)
Pediatrics	7 (3.80%)	8 (4.35%)	7 (3.80%)	22 (11.96%)
Rehabilitation	6 (3.26%)	4 (2.17%)	1 (0.54%)	11 (5.98%)
Dermatology	4 (2.17%)	5 (2.72%)	3 (1.63%)	12 (6.52%)
Otolaryngology	2 (1.09%)	0 (0.00%)	3 (1.63%)	5 (2.72%)
Ophthalmology	1 (0.54%)	1 (0.54%)	1 (0.54%)	3 (1.63%)
Psychiatry	2 (1.09%)	2 (1.09%)	1 (0.54%)	5 (2.72%)
Others	6 (3.26%)	6 (3.26%)	4 (2.17%)	16 (8.70%)
Not decided	8 (4.35%)	3 (1.63%)	0 (0.00%)	11 (5.98%)
Total	90 (48.91%)	56 (30.43%)	38 (20.65%)	184 (100.00%)

followed by "specialty characteristics" with 0.281 and "specialty training process" with 0.263. Of the 14 criteria on the second tier, "personal intelligence/ability preference" had the highest weight of 0.191, followed by "career opportunities" with 0.105 and "lifestyle after completion of training" with 0.093 (Table 3). Apart from overall weighting analysis, further analysis was performed on the basis of year and specialty.

Respondents were classified by year into three cohorts: fifth-year (n = 90), sixth-year (n = 56), and seventh-year medical students (n = 38). Here the three highest weights were for "personal preferences and work achievement", "specialty characteristics", and "specialty training process" in that order. Questionnaire data for fifth-, sixth- and seventh-year students all yielded the same weighing order (Table 3). 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 varied slightly among different cohorts. The criterion with the third-highest weight was "academic opportunities" for fifth-year medical students, and "lifestyle after completion of training" for sixth- and seventh-year students (Table 3).

As students grew older, their perception of specialties changed. Among the three years tested, the seventh year students valued personal intelligence/ ability preference the most ($p < 0.05$), and work-related hazards ($p < 0.01$) and academic opportunities the least ($p < 0.5$). The influence of academic opportunities decreased as the students got older (Table 3).

Respondents were also classified by their first preference for specialty. The three highest weights in order were: "personal preferences and work achievement", "specialty characteristics", and "specialty training process" for those who chose internal medicine, surgery, rehabilitation, dermatology, otolaryngology, psychiatry, and others (Table 4). The rank order changed to "personal preferences and work achievement", "specialty training process" and "specialty characteristics" for those who chose gyn & obs, pediatrics and ophthalmology (Table 4). On the second tier, "personal intelligence/ability preference" had the highest weights for all specialties except ophthalmology. The criterion with the second-highest weight was "career opportunities" for internal medicine, surgery, gyn & obs, pediatrics, and otolaryngology; "lifestyle after completion of training" for rehabilitation and dermatology; "personal intelligence/ ability preference" for ophthalmology and "academic opportunities" for psychiatry and others (Table 4). No significant differences were found in the weights of the first-tier aspects among the specialties. There were no significant differences in the weights of the second-tier criteria either, except in the criterion "work independently after completion of training" ($p < 0.1$). When a t-test was done to compare the weights of the criteria in surgery and

Table 3. AHP Assessment Aspects and Criteria Weight Analysis by Year

Aspect/Criteria	All n = 184		5th -year n = 90		6th -year n = 56		7th -year n = 38		K-W test Sig.
	aspect	criteria	aspect	criteria	aspect	criteria	aspect	criteria	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Personal preferences and work achievement	0.455 (0.195)		0.453 (0.186)		0.434 (0.198)		0.492 (0.212)		0.292
Personal intelligence /ability preference		0.191 (0.127)		0.181 (0.118)		0.170 (0.117)		0.246 (0.148)	0.032†
Academic opportunities		0.084 (0.065)		0.096 (0.072)		0.078 (0.061)		0.066 (0.048)	0.035†
Career opportunities		0.105 (0.073)		0.103 (0.069)		0.109 (0.076)		0.103 (0.077)	0.932
Society /family expectations		0.075 (0.059)		0.073 (0.050)		0.076 (0.079)		0.077 (0.044)	0.413
Specialty training process	0.263 (0.150)		0.265 (0.143)		0.278 (0.166)		0.237 (0.141)		0.453
Role model		0.049 (0.040)		0.050 (0.040)		0.047 (0.035)		0.051 (0.046)	0.977
Opportunity to do procedures (surgery, treatment, etc)		0.050 (0.041)		0.053 (0.046)		0.043 (0.032)		0.054 (0.041)	0.561
Work-related hazards (infectious hepatitis, AIDS)		0.057 (0.053)		0.064 (0.051)		0.056 (0.060)		0.040 (0.042)	0.003‡
Length and difficulty of the training period		0.042 (0.040)		0.038 (0.027)		0.052 (0.055)		0.033 (0.036)	0.076*
Work independently after com pletion of training		0.066 (0.061)		0.060 (0.058)		0.080 (0.071)		0.059 (0.049)	0.296
Specialty characteristics	0.281 (0.149)		0.282 (0.142)		0.288 (0.159)		0.270 (0.151)		0.801
Future income		0.063 (0.056)		0.066 (0.059)		0.067 (0.056)		0.048 (0.046)	0.253
Lifestyle after completion of training		0.093 (0.062)		0.088 (0.051)		0.099 (0.070)		0.097 (0.072)	0.933
Type and no. of patients served		0.052 (0.049)		0.052 (0.047)		0.051 (0.056)		0.052 (0.044)	0.799
Establishing one's own practice		0.033 (0.027)		0.032 (0.024)		0.033 (0.031)		0.033 (0.028)	0.953
Prestige of specialty		0.040 (0.035)		0.043 (0.035)		0.037 (0.031)		0.040 (0.042)	0.676

Abbreviations: K-W test: Kruskal-Wallis test; Mean (SD): Mean (standard deviation); Sig.: significance; *: $p < 0.1$; †: $p < 0.05$; ‡: $p < 0.01$

dermatology, however, significant differences were found in several criteria, specifically "work independently after completion of training" ($p < 0.01$), "work related hazards" ($p < 0.05$), "length and difficulty of the training period," and "opportunity to do procedures" ($p < 0.1$) (Table 5). Since the test results might have been influenced by the sample sizes, we compared those specialties with larger sample sizes (n > 10). Significant differences were found in "work independently after completion of training" ($p < 0.01$) and "work related hazards" ($p < 0.1$) (Table 5).

DISCUSSION

Babbott et al. suggested 16 important factors in medical students' choice of specialty.[8] Of these, medical students paid particular attention to (in order) "intellectual content," "diagnostic challenge," "type of patients seen," and "role model." DeWitt et al. suggested that the factors of preferred location,[12]

Table 4. AHP Assessment Aspects and Criteria Weight Analysis by Specialty (First Preference)

Aspect/Criteria	Internal Medicine	Surgery	Gyn & Obs	Pedia -trics	Rehabili -tation	Derma -tology	Otolaryn -gology	Ophthal -mology	Psychia -try	Others	K-W test Sig.
	n = 67	n = 29	n = 3	n = 22	n = 11	n = 12	n = 5	n = 3	n = 5	n = 16	
Personal preferences /work achievement	0.478 (0.186)	0.420 (0.180)	0.493 (0.019)	0.435 (0.212)	0.405 (0.275)	0.422 (0.224)	0.544 (0.237)	0.481 (0.204)	0.533 (0.279)	0.483 (0.183)	0.75
Personal intelligence /ability preference	0.189 (0.120)	0.177 (0.117)	0.188 (0.122)	0.211 (0.151)	0.187 (0.163)	0.160 (0.136)	0.291 (0.152)	0.130 (0.072)	0.257 (0.185)	0.220 (0.123)	0.566
Academic opportunities	0.094 (0.061)	0.070 (0.061)	0.083 (0.038)	0.062 (0.031)	0.064 (0.072)	0.090 (0.100)	0.079 (0.033)	0.059 (0.052)	0.120 (0.105)	0.109 (0.076)	0.138
Career opportunities	0.111 (0.077)	0.100 (0.066)	0.149 (0.109)	0.099 (0.071)	0.099 (0.082)	0.099 (0.072)	0.097 (0.045)	0.221 (0.192)	0.104 (0.063)	0.085 (0.040)	0.956
Society /family expectations	0.085 (0.079)	0.073 (0.053)	0.072 (0.017)	0.063 (0.039)	0.054 (0.034)	0.073 (0.038)	0.077 (0.035)	0.071 (0.040)	0.053 (0.051)	0.070 (0.038)	0.936
Specialty training process	0.245 (0.121)	0.270 (0.188)	0.293 (0.136)	0.316 (0.165)	0.245 (0.174)	0.261 (0.133)	0.201 (0.063)	0.398 (0.272)	0.216 (0.180)	0.241 (0.128)	0.779
Role model	0.056 (0.045)	0.045 (0.037)	0.050 (0.039)	0.052 (0.042)	0.034 (0.026)	0.039 (0.025)	0.036 (0.019)	0.079 (0.062)	0.039 (0.018)	0.036 (0.024)	0.690
Opportunity to do procedures (surgery, treatment etc)	0.048 (0.032)	0.056 (0.049)	0.059 (0.036)	0.063 (0.57)	0.034 (0.033)	0.035 (0.023)	0.048 (0.19)	0.072 (0.066)	0.032 (0.030)	0.051 (0.061)	0.384
Work-related hazards (infectious hepatitis, AIDS)	0.055 (0.043)	0.047 (0.049)	0.055 (0.058)	0.060 (0.050)	0.063 (0.090)	0.086 (0.050)	0.039 (0.015)	0.109 (0.153)	0.073 (0.093)	0.039 (0.026)	0.355
Length and difficulty of the training period	0.034 (0.026)	0.036 (0.033)	0.041 (0.027)	0.053 (0.040)	0.057 (0.079)	0.062 (0.056)	0.032 (0.033)	0.022 (0.014)	0.018 (0.014)	0.045 (0.031)	0.234
Work independently after completion of training	0.052 (0.044)	0.086 (0.079)	0.089 (0.097)	0.087 (0.065)	0.056 (0.069)	0.039 (0.029)	0.047 (0.014)	0.117 (0.110)	0.054 (0.055)	0.070 (0.054)	0.082*
Specialty characteristics	0.276 (0.130)	0.310 (0.213)	0.214 (0.154)	0.249 (0.136)	0.351 (0.144)	0.317 (0.173)	0.254 (0.180)	0.121 (0.068)	0.251 (0.101)	0.276 (0.088)	0.389
Future income	0.062 (0.047)	0.076 (0.087)	0.033 (0.022)	0.052 (0.042)	0.077 (0.060)	0.084 (0.069)	0.072 (0.062)	0.039 (0.036)	0.036 (0.038)	0.047 (0.026)	0.560
Lifestyle after completion of training	0.087 (0.051)	0.098 (0.080)	0.089 (0.044)	0.085 (0.052)	0.127 (0.084)	0.117 (0.077)	0.073 (0.051)	0.037 (0.035)	0.062 (0.025)	0.110 (0.062)	0.370
Type and no. of patients served	0.051 (0.035)	0.059 (0.092)	0.051 (0.064)	0.048 (0.030)	0.069 (0.070)	0.050 (0.036)	0.037 (0.017)	0.013 (0.010)	0.042 (0.021)	0.052 (0.035)	0.276
Establishing one's own practice	0.032 (0.025)	0.028 (0.023)	0.017 (0.014)	0.035 (0.028)	0.053 (0.032)	0.033 (0.019)	0.047 (0.039)	0.014 (0.007)	0.052 (0.074)	0.032 (0.018)	0.290
Prestige of specialty	0.044 (0.039)	0.049 (0.042)	0.024 (0.024)	0.030 (0.021)	0.025 (0.009)	0.034 (0.023)	0.026 (0.022)	0.017 (0.008)	0.060 (0.048)	0.035 (0.027)	0.246

Abbreviations: K-W test: Kruskal-Wallis test; Mean (SD): Mean (standard deviation); Sig.: significance; *: $p < 0.1$

salary, working hours, time for family, breadth of knowledge/skills required, breadth of clinical problems addressed in practice, mentors, and opportunity for continuity of care influence graduates' choice of a specialty. Azizzadeh et al. analyzed the specialty choice of four-year medical students in the US in relation to factors such as career opportunities and[11] academic opportunities. It was found that prestige and career opportunities were more important to students seeking surgical residencies.[11]

Past studies have found that economic factors and amount of future income were important considerations for medical students selecting a specialty.[3,4,8,9,11,12,14,18-20] In contrast, this study found that "future income" and "establishing one's own practice" - two criteria that are highly linked with eco-

Table 5. K-W Test for Six Specialties with over 10 Samples and T-test for Surgery vs. Dermatology

Aspect/Criteria	Internal Medicine	Surgery	Pedia -trics	Rehabili -tation	Derma -tology	Others	K-W test for 6 specialties	t-test for surgery vs. dermatology
	n = 67	n = 29	n = 22	n = 11	n = 12	n = 16	Sig.	Sig.
Personal preferences /work achievement	0.478	0.420	0.435	0.405	0.422	0.483	0.691	0.970
Personal intelligence /ability preference	0.189	0.177	0.211	0.187	0.160	0.220	0.735	0.688
Academic opportunities	0.094	0.070	0.062	0.064	0.090	0.109	0.021	0.425
Career opportunities	0.111	0.100	0.099	0.099	0.099	0.085	0.868	0.963
Society /family expectations	0.085	0.073	0.063	0.054	0.073	0.070	0.823	0.993
Specialty training process	0.245	0.270	0.316	0.245	0.261	0.241	0.673	0.873
Role model	0.056	0.045	0.052	0.034	0.039	0.036	0.326	0.656
Opportunity to do procedures (surgery, treatment etc)	0.048	0.056	0.063	0.034	0.035	0.051	0.335	0.075*
Work-related hazards (infectious hepatitis, AIDS)	0.055	0.047	0.060	0.063	0.086	0.039	0.078*	0.032†
Length and difficulty of the training period	0.034	0.036	0.053	0.057	0.062	0.045	0.175	0.079*
Work independently after completion of training	0.052	0.086	0.087	0.056	0.039	0.070	0.01†	0.008‡
Specialty characteristics	0.276	0.310	0.249	0.351	0.317	0.276	0.520	0.920
Future income	0.062	0.076	0.052	0.077	0.084	0.047	0.459	0.795
Lifestyle after completion of training	0.087	0.098	0.085	0.127	0.117	0.110	0.455	0.476
Type and no. of patients served	0.051	0.059	0.048	0.069	0.050	0.052	0.605	0.743
Establishing one's own practice	0.032	0.028	0.035	0.053	0.033	0.032	0.226	0.577
Prestige of specialty	0.044	0.049	0.030	0.025	0.034	0.035	0.304	0.257

Abbreviations: Sig.: significance; *: $p < 0.1$; †: $p < 0.05$; ‡: $p < 0.01$

nomic incentives - were both assigned low weights. When interviewed, medical center residents stated that since students hadn't yet entered the workforce, they paid less attention to economic incentives when choosing a specialty. 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 (Table 3). This criterion was assigned last place by those who chose internal medicine, surgery, gyn & obs, dermatology and others.

For all respondents in this study, "personal preferences and work achievement" had the highest weight in the first tier, followed by "specialty characteristics" and the "specialty training process." with 0.263. In the second tier "personal intelligence/ability preference" had the highest weight of the 14 criteria followed by "career opportunities" and "lifestyle after completion of training". "Personal preferences and work achievement" still retained the highest weight on the first tier, when respondents were grouped by year. "Personal intelligence/ability preference" also had the highest weight on the second tier for *both groupings. This finding is similar to the results of Kao et al. (2000)[4] and other studies,[8-13] 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 the criteria on the second tier, the criterion of "career opportunities" had the second-highest weight for students in all year cohorts. This is similar to the findings of Yang and Tsai (1999),[2] Azizzadeh et al. (2003)[11] and DeWitt et al. (1998),[12] 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. This research found that "lifestyle after completion of training" had the second-highest weight for those who chose rehabilitation, dermatology and other specialties as their first preference. There were no significant differences in the weights of the second-tier criteria, except in the criterion "work independently after completion of training." Since the test results might have been influenced by the sample sizes, however, we compared the six specialties with sample sizes larger than 10. Significant differences were found in "work independently after completion of training" and "work related hazards." When we compared the weights of the criteria in surgery, in which there is a lack of applicants in Taiwan, and dermatology, which has many applicants, significant differences were found in the weights of the criteria "work independently after completion of training", "work related hazards", "length and difficulty of the training period," and "opportunity to do procedures" (Table 5). It can be assumed that the recent significant increase in the number of residents applying to specialize in ophthalmology, dermatology, and rehabilitation (Chang and Yang, 1999) is connected with the importance and differences placed on these criteria.[2]

In this study, 67 students chose internal medicine and 29 students chose surgery as their first preferred specialty (Table 2). This result is inconsistent with the existing phenomenon that surgery is facing a shortage of surgical residents. 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. We interviewed residents from different specialties and senior medical students in this medical center and found that surgery and internal medicine are ideally their first choice of specialty. But residents indicate when they graduate from medical school, and make their decisions in specialty selection, they will include some practical factors in addition to ideals, in their consideration. In addition, even though this study found that income is no longer an important factor (weight of 0.063, ranked 7th), students still care about the relative fairness of compensation when choosing their specialty. If the NHI can set up a fair and reasonable fee schedule in the form of higher compensation for physicians in specialties with relatively high levels of labor, risk, and training costs, such as surgery, gynecology and obstetrics, and anesthesia, more young physicians would be encouraged to enter these very demanding fields.

In summary, through the AHP model, we can identify factors that concern medical students when they are choosing a specialty, as well as the relative weight of each factor. During internship, students can gain a thorough understanding of the characteristics and potentials of each specialty. The experienced specialists they encounter can help them choose the most suitable specialties. Students might modify their decisions as their views of the various specialties evolve. This study recommends that emphasis be placed on the design of incentives that will create a formative environment in which young physicians can pursue their own interests and talents, and have chances for further promotion. Policymakers must recognize the changing needs of the current generation of medical students when designing strategies to enhance the attractiveness of specialties that currently lack sufficient residents.

Taiwan's medical students take common courses and introductory basic and clinical medicine courses during the first four years of medical school. The fifth and sixth years are taken up by clinical internship courses, and the seventh year consists of clinical practicum courses. Medical students make their specialty choice after finishing the practicum course. The subjects of this study were senior medical students. Because most students were performing hospital internships, they were widely dispersed and difficult to contact. The various medical schools and students in different years displayed uneven degrees of cooperation with regard to returning the questionnaires. The return rate at the subject medical school was over 90% (92.5%), and questionnaires were spread evenly among the different years. However, this study explored the opinions of students in only one medical school, and this is a limitation of this research. Follow-up researchers can employ time-series analysis and compare different schools with the same model in order to understand the differential effects of the factors and their long-term variation.

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REFERENCES

1. Chang KJ, Chen CN, Chu SH. Survey and analysis of surgical manpower after the implementation of NHI. J Med Education 1998;2:45-53. (in Chinese)
2. Chang YS, Yang CL. A preliminary look at the effect of National Health Insurance on changes in the number of different specialists. Chin J Public Health, Taipei 1999;18:123-37. (in Chinese)
3. Yang MJ, Tsai JH. Specialty choices of students at a college of medicine and relevant factors. J Med Education 1999;2:15-22. (in Chinese)
4. Kao MY, Lu PH, Li MP, Wang WD. Medical students' specialty preferences and exploration of relevant factors. J Med Education 2000;4:23-37. (in Chinese)
5. Chang MS, Wang TL, Wang TH. Specialist physicians today and manpower planning. National Medical Manpower Planning Policy Recommendations 2001:13-26. (in Chinese)
6. Saaty TL. The analytic hierarchy process. New York: McGraw-Hill, 1980:50.
7. Teng CY, Tzeng KH. Characteristics and utilization of AHP (I) (II). J Chin Stat Association 1987;27:1,5-21. (in Chinese)
8. Babbott D, Levey GS, Weaver SO, Killian CD. Medical student attitudes about internal medicine: a study of U.S. medical school seniors in 1988. Ann Intern Med 1991; 114:16-22.
9. Newton DA, Grayson MS, Whitley TW. What predicts medical student career choice? J Gen Intern Med 1998;13:200-3.
10. Kassebaum DG, Szenas PL. Factors influencing the specialty choices of 1993 medical school graduates. Acad Med 1994;69:163-70.
11. Azizzadeh A, McCollum CH, Miller CC 3rd, Holliday KM, Shilstone HC Lucci A Jr. Factors influencing career choice among medical students interested in surgery. Curr Surg 2003;60:210-3.
12. DeWitt DE, Curtis JR, Burke W. What influences career choices among graduates of a primary care training program? J Gen Intern Med 1998;13:257-61.
13. Burack JH, Irby DM, Carline JD, Ambrozy DM, Ellsbury KE, Stritter FT. A study of medical students' specialty-choice pathways: trying on possible selves. Acad Med 1997;72:534-41.
14. Kiker BF, Zeh M. Relative future income expectation, expected malpractice premium cost, and other determinants of physician specialty choice. J Health Soc Behav 1998;39:152-67.
15. Wright S, Wong A, Newill C. The impact of role models on medical students. J Gen Intern Med 1997;12:53-6.
16. Paukert JL. From medical student to intern: where are the role models? JAMA 2001;285:2781.
17. Valentino J, Blue AV, Donnelly MB, Stratton TD. The most valuable critical incidents in a 4th-year acting internship in surgery. Teach Learn Med 1999;11:75-9.
18. Rosenthal MP, Diamond JJ, Rabinowitz HK. Influence of income, hours worked, and loan repayment on medical students' decision to pursue a primary care career. JAMA 1994;271:914-7.
19. Phelps CE. Physicians in the marketplace, Health Economics. 2nd ed. New York: Addison-Wesley, 1997:185-215.
20. Fincher RM, Lewis LA, Rogers LQ. Classification model that predicts medical students' choices of primary care or non-primary care specialties. Acad Med 1992;67:324-7.
21. Dorsey ER, Jarjoura D, Rutecki GW. Influence of controllable lifestyle on recent trends in specialty choice by US medical students. JAMA 2003;290:1173-8.

Attachment 1

Questionnaire on factors considered when selecting specialty

Dear future doctors,

The purpose of this study is to investigate your future choice of medical specialty and factors affecting your decision. The results of the study will be used as a reference for improvement of medical education and specialist training. Please take ten minutes to complete this questionnaire. Your opinions are of value in helping us perfect the specialist training system in our country.

Chang Gung Children's Hospital, Chief of Department of Surgery — Chang, Pei Yeh
National Chiao Tung University, Associate Professor — Hung, Chih Young
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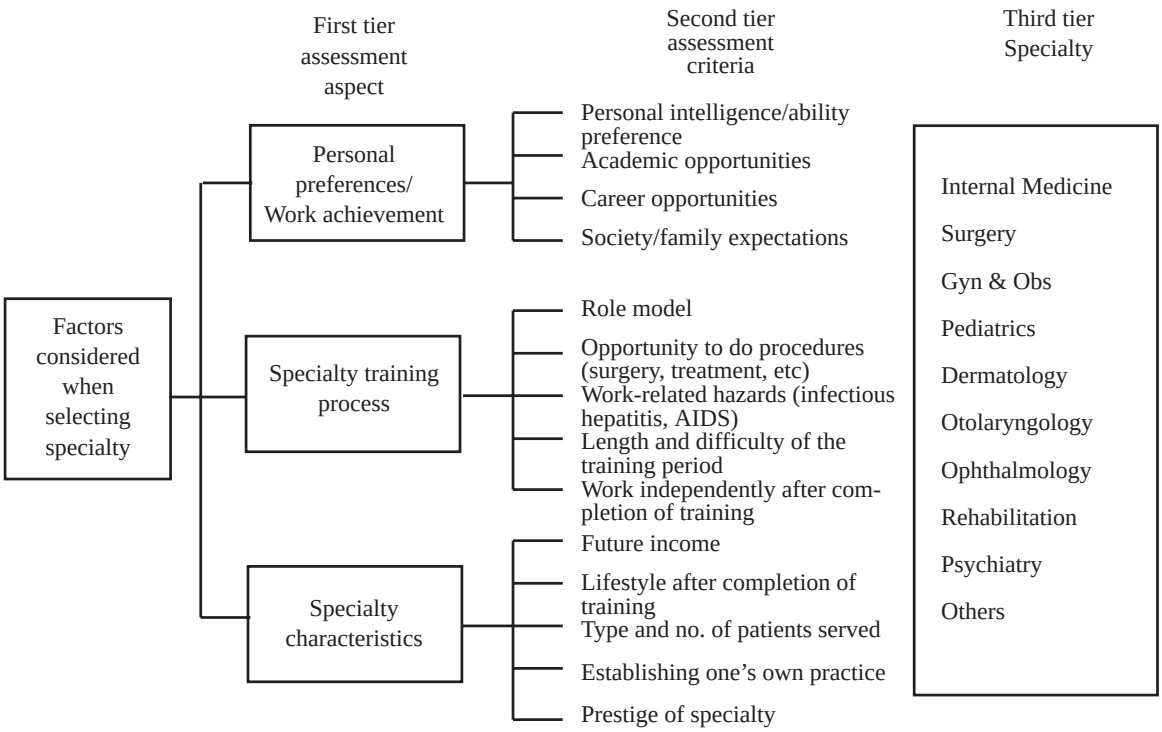

Specialties classified as:
Internal Medicine: Internal Medicine, Family Medicine, Neurology
Surgery: Surgery, Orthopedics, Neurosurgery, Urology, Plastic Surgery, Oral Maxillofacial Surgery
Others: Anesthesiology, Radiology, Emergency Medicine, Pathology, Nuclear Medicine, Occupational Medicine

◎ Basic information of respondents
Sex: □Male_____ □Femal _____ , Age ：_____
Medical school:_____
Grade: □Fifth year Student □Sixth year Student □Seventh year Student □Resident
Training hospital: □Clinic □Local hospital □Regional hospital □Medical center
Specialty: Please fill 1~10 in the blank before the specialty that you will possibly choose in the future, 1 for highest priority, 10 for lowest priority
□Internal Medicine □Surgery □Gyn & Obs □Pediatrics □Dermatology
□Otolaryngology □Ophthalmology □Rehabilitation □Psychiatry
□Others _____ (please fill in specialty)

◎ If you want to receive the results of this study, please leave email address:
_____@_____

I. Please compare the relative importance of each goal and mark [v] in the blank

	Relative importance ratio (9 is with the most importance, 1 is with the least importance)																	
	9:1	8:1	7:1	6:1	5:1	4:1	3:1	2:1	1:1	1:2	1:3	1:4	1:5	1:6	1:7	1:8	1:9	
Personal preferences/Work achievement																		Specialty training process
Personal preferences/Work achievement																		Specialty characteristics
Specialty training process																		Specialty characteristics

II. The relative importance of each criterion (please make pairwise comparison, choose a blank in each line and mark [v])

1. Under the goal of "Personal preferences/Work achievement", Please compare the relative importance of criteria, and mark [v] in the blank

	Relative importance ratio (9 is with the most importance, 1 is with the least importance)																	
	9:1	8:1	7:1	6:1	5:1	4:1	3:1	2:1	1:1	1:2	1:3	1:4	1:5	1:6	1:7	1:8	1:9	
Personal intelligence/ ability preference																		Academic opportunities
Personal intelligence/ ability preference																		Career opportunities
Personal intelligence/ ability preference																		Society /family expectations
Academic opportunities																		Career opportunities
Academic opportunities																		Society /family expectations
Career opportunities																		Society /family expectations

2. Under the goal of "Specialty training process", Please compare the relative importance of criteria, and mark [v] in the blank

	Relative importance ratio (9 is with the most importance, 1 is with the least importance)																	
	9:1	8:1	7:1	6:1	5:1	4:1	3:1	2:1	1:1	1:2	1:3	1:4	1:5	1:6	1:7	1:8	1:9	
Role model																		Opportunity to do procedures, (surgery, treatment, etc)
Role model																		Work-related hazards (infectious hepatitis, AIDS)
Role model																		Length and difficulty of the training period
Role model																		Work independently after completion of training
Opportunity to do procedures (surgery, treatment, etc)																		Work-related hazards (infectious hepatitis, AIDS)
Opportunity to do procedures (surgery, treatment, etc)																		Length and difficulty of the training period
Opportunity to do procedures (surgery, treatment, etc)																		Work independently after completion of training
Work-related hazards (infectious hepatitis, AIDS)																		Length and difficulty of the training period
Work-related hazards (infectious hepatitis, AIDS)																		Work independently after completion of training
Length and difficulty of the training period																		Work independently after completion of training

3. Under the goal of "Specialty characteristics", Please compare the relative importance of criteria, and mark [v] in the blank

	Relative importance ratio (9 is with the most importance, 1 is with the least importance)																	
	9:1	8:1	7:1	6:1	5:1	4:1	3:1	2:1	1:1	1:2	1:3	1:4	1:5	1:6	1:7	1:8	1:9	
Future income																		Lifestyle after completion of training
Future income																		Type and no. of patients served
Future income																		Establishing one's own practice
Future income																		Prestige of specialty
Lifestyle after completion of training																		Type and no. of patients served
Lifestyle after completion of training																		Establishing one's own practice
Lifestyle after completion of training																		Prestige of specialty
Type and no. of patients served																		Establishing one's own practice
Type and no. of patients served																		Prestige of specialty
Establishing one's own practice																		Prestige of specialty

醫學系高年級學生專科選擇偏好—以北台灣某醫學院爲例

王貴英 張北葉[1] 洪志洋[2] 黃元惠[3]

背 景： 近年來，台灣各醫學中心發生外科與婦產科醫師住院醫師招生人數不足，對此現象必須加以瞭解並探究其原因。本篇研究即在探討現有台灣醫學系高年級學生在選科時的重要考量因素及其權重。

方 法： 本研究以層級分析法 (AHP) 架構三層級分析模型，調查北台灣某醫學院醫學系高年級學生，在選科時心目中的第一志願及各考量因素的權重。並以無母數 K-W 分析法與 t 檢定來檢定不同年級以及選擇不同專科的學生看法是否有差異。

結 果： 第一層考量構面的排序和權重排序分別爲：「個人喜好及工作成就」(0.455)、「專科特性」(0.281) 及「專科訓練過程」(0.263)。第二層 14 項考量準則權重最高的是「個人智慧／能力偏好」(0.191)，其次是「事業機會」(0.105) 和「完成訓練後的生活型態」(0.093)。本研究發現受試學生隨著年級的增加，對專科的認知會有所改變。

結 論： 個人智慧或能力的偏好，是醫學系學生選科最重要的考量因素；經濟因素（未來收入）權重排序雖然位居第七，但學生在眞正選科時仍非常重視該項因素。瞭解新生代醫學系學生的選科態度，有助於設計良好誘因，以吸引學生加入住院醫師人數不足科別，如外科和婦產科。

(長庚醫誌 2007;30:339-53)

關鍵詞： 醫學系學生，專科選擇，層級分析法

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