

Priorities, factors and alternatives involved in the choice of medical specialty – an empirical study on year sixth medical students

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Abstract

Phenomenon. The process of career decision making by medical students has been the subject of many studies analyzing the choice. However, the studies have not analyzed determination of global priorities for the criteria of choice or alternatives regarding the choice of medical specialty. The goal of this paper is to determine the weights (priorities), factors and alternatives involved in the choice of specialty for year six medical students.

Approach. A sample of 202 final-year medical students at the Medical University was examined using Saaty's Analytic Hierarchy Process. During interviews, the students used the Saaty's scale to pair various factors influencing their choice of medical specialty. Analysis was performed to evaluate the crucial decisive criteria and various decisive models.

Findings. When choosing the medical specialty, the highest rank was given to "individual physician's aptitude and expected professional attainment" ($P = 0.4748$), followed by "the features of the medical specialty" ($P = 0.3636$) and "the process of training for the specialty" ($P = 0.1616$). The most important sub-criteria were "intellectual qualities and competencies useful in practicing the specialty", "place of work" and "opportunity to create one's own medical practice". A model of specialty choice was obtained. The most important criteria of choice were "opportunities for professional career in healthcare entities", "place of work", "opportunity to create one's own medical practice" and "expected income".

Insights. Understanding the factors influencing choice of specialty enables workforce planning to meet local and national healthcare needs. It also helps optimize the profile of medical education courses offered by medical universities. The results obtained, although limited in their generalisability, may support organizing specific curricula and strategies to encourage the choice of specialties in short supply.

Key words: Analytic Hierarchy Process (AHP), alternatives, decision making, medical specialty, medical students, priorities

Słowa kluczowe: proces decyzyjny, problem decyzyjny, specjalności medyczne, studenci medycyny



Ministerstwo Nauki
i Szkolnictwa Wyższego

Przygotowanie do wydania elektronicznego finansowane w ramach umowy 637/P-DUN/2019 ze środków Ministerstwa Nauki i Szkolnictwa Wyższego przeznaczonych na działalność upowszechniającą naukę.

Introduction

Effective workforce planning in the medical field is essential to meet local and national healthcare needs and to ensure the correct supply of medical professionals. It is particularly important when considering such issues as the under-supply of doctors in some specialties and localities, [1, 2] migration and dependency on international medical graduates, [2, 3] the high cost of employment, and underpayment of medical staff [4] as well as the duration of training and changes of specialty changes. [5–8] To allow effective planning of future employment in Medicine, it is first necessary to determine the factors which have the greatest influence on the choice of specialty for medical students.

A substantial body of literature already exists concerning the numerous factors influencing career preferences and decisions for medical professionals. These can be based on the individual characteristics of the medical student or doctor, the features of the specialty training process or the type of lifestyle and work connected with a certain medical specialty. The most commonly addressed personal characteristics include demographics [9–14], personality [9, 15–17], skills, values, aspirations [12, 18–21], academic and career opportunities [22] and expectations of family members [23–26]. As far as the training process itself is concerned, technological challenges, examples of physicians with the background, the possibility to obtain a residency position, the length of residency required, working hours and lifestyle during training all influence the decision to commence training [22, 27–32] as well as work-related hazards, such as infections from AIDS or hepatitis patients [33–35] and independent work [12, 32]. When selecting a specialty medical students may also consider the various features of future work which may follow from it. The most important aspects in this regard are the prestige [22, 27, 36], the financial rewards after training [12, 13, 37], the type and number of patients [12, 13], the lifestyle after completion of residency [32, 38, 39], and also the possibility of establishing a practice [23, 40].

Although the majority of previous studies concerning influencing the choice of medical specialty have focused on quantitative comparisons, descriptive statistics and nonparametric statistics, they do not discuss the actual weight of each factor. Studies examining the factors influencing the career choices of Taiwanese students [41, 42], found that the most important factors were “personal preferences/work achievement” and “personal intelligence/ability/preference” followed by “career opportunities and lifestyle”. One study showed that medical students were most concerned about obtaining affirmation of personal ability and a sense of accomplishment when selecting a specialty [41]. What is more, the majority regarded job position and future opportunity for promotion as second in importance. Quality of lifestyle was also an important concern for Taiwan medical students when selecting a specialty.

As the issue of medical specialty choice is a multiple criterion problem, influenced by many non-measurable

and non-tangible (elusive) factors the method used to solve the problem should allow such analysis. In the area of solving multiple criterion problems the literature contains many different methods [43] e.g. the DEA (Data Envelopment Analysis), the AHP (Analytic Hierarchy Process), the ANP (Analytic Network Process), the MAPPACC (Multicriterion Analysis of Preferences by Means Pairwise Actions and Criterion Comparisons), artificial neural networks etc., however, the AHP and the ANP are considered the best. Thus, in this research, it was decided to refer to the multiple criterion decision making tool of the Analytic Hierarchy Process [44, 45] that is characterized by its simplicity, applicability to various areas of science and high effectiveness in problem solving. That method allows one to make a multi-faceted problem analysis and make a decision among many variants, leading to an effective solution of the problem. The AHP method is by far the most popular among all the above listed methods. It has the highest number of publications in the largest databases of scientific journals, such as ScienceDirect, Wiley, Scopus etc. In sole ScienceDirect database, the key words: ‘analytic hierarchy process’ generate 24,915 articles, and the abbreviation ‘AHP’ 17,453. Multi criteria analysis-methods are mainly used to [44, 46, 47] structure a complex decision problem, when multi-objectives or multiple criteria need to be considered; include heterogeneous sets of criteria and conflicting objectives; compare different management alternatives; conduct a more rational, transparent, and comprehensive analysis and include both qualitative and quantitative data in the decision model. In Health Sciences the method was used many times, for example M.J. Liberatore and R.L. Nydick [48] show its use in 50 scientific papers, however, they do not include papers concerning the determination of weights of factors and alternatives in the choice of medical specialty. Beside articles mentioned by Liberatore and Nydick [48] there were two papers by Chang et al. [49] and Wang et al. [42] published which used the AHP in the choice of specialty. Nevertheless, although Chang et al. [41] and Wang et al. [42] also use the AHP to examine a choice of specialty, these papers do not incorporate any determination of global priorities (meaning the individual influence of each sub-criterion on the process of choosing medical specialty) for the criteria or alternatives regarding the choice of medical specialty.

The AHP combines concepts from mathematics and psychology. The method was created by Thomas L. Saaty from Pittsburgh University (USA) in the early 1970s. A wide range of decision problems have been solved using it from virtually any area [50]. It differs from other multicriteria decision making methods in a number of aspects: (a) presentation of the problem structure in hierarchical form, with the overall goal at the top of the hierarchy as well as decision alternatives at its lowest level (**Figure 1**); (b) conducting pairwise comparisons of elements at each level of the hierarchical structure using the specially devised Saaty’s preference scale (**Table 1**); (c) introducing a relative assessment scale (priorities) for quantitative and qualitative comparisons. The significance and preferences of the various

decision elements are linked in pairs with reference to the element which is immediately above in the hierarchy. On the basis of these comparisons local and global priorities are compared. Local priorities determine the relative importance of decision elements at each level of the hierarchical structure. They constitute a basis for the calculation of global priorities, which represent the share of each decision element from the various levels in the accomplishment of the main goal. The alternative with highest priority value is deemed to be the best and recommended for implementation in practice. All calculations are performed using the “Super Decisions” program (Adams and Saaty).

The differences in scales as well as measurement units are not a barrier in the application of the AHP since the method is based on direct significance degree comparisons as well as preferences of each decision elements pair without using physical units. This is why the AHP is also used with reference to analyses both quantitative as well as qualitative variables. For this reason the method can be used when we analyze a choice of medical specialty done by students. The AHP method has an advantage over a multi-dimensional scaling, for example Likert scale, in which

the weights for each criterion are assigned subjectively, almost automatically, without much mental effort. In the method of T. Saaty, participants’ evaluations are limited to verbal pairwise comparisons of adopted criteria which influence the main aim in the fundamental Saaty’s scale. To determine the priorities (weights) for the criteria qualitative assessments made by evaluated people are changed to quantitative appraisals according to Saaty’s scale. Subsequently, the logic of comparison criteria is checked on various stages of the research. In case one makes a mistake of the CR (consistency ratio) greater than 10%, a re-interview is carried out with the participant. This way of testing prevents in part a subjective assessment.

At the time of writing this article, no similar research could be found evaluating the crucial decisive criteria and various decisive models for choosing a medical specialty. The aim of the present study was to investigate the decisive factors in the choice of medical specialty among final-year medical students and to examine the decision models used for choosing the specialty. Additionally, its purpose was to compare results from different countries and make cross-cultural comparisons.

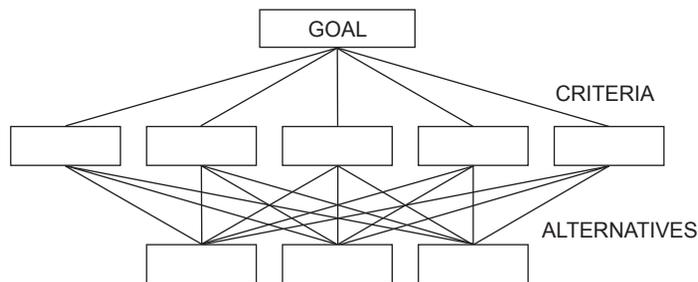


Figure 1. AHP decision hierarchy.

Source: Authors’ own study based on T.L. Saaty, *Decision Making for Leaders. The Analytic Hierarchy Process for Decisions in a Complex World*, RWS Publications, Pittsburgh, PA 2001 [50].

Scale	Definition	Explanation
1	Equal importance/preference/like hood	Two elements contribute equally to the goal/parent element
3	Weak dominance	Experience or judgment slightly favors one element over another
5	Strong dominance	Experience or judgment strongly favors one element over another
7	Demonstrated (very strong) dominance	Experience or judgment strongly very strongly favors one element over another (an element’s dominance is demonstrated in practice)
9	Absolute dominance	The evidence favoring an element over another is affirmed to the highest possible order
2, 4, 6, 8	Intermediate values	Further subdivision or compromise is needed
Reciprocals of the above	If activity <i>i</i> has one of the above nonzero numbers assigned to it when compared with activity <i>j</i> , then <i>j</i> has reciprocal value when compared with <i>i</i> .	i.e. If <i>x</i> is 5 times <i>y</i> , then <i>y</i> = <i>x</i> /5
Rationals	Rations arising from the scale	If consistency were to be forced by obtaining <i>n</i> numerical values to span the matrix

Table I. Saaty’s fundamental comparison scale (1–9).

Source: Own study based on T.L. Saaty, *Decision Making for Leaders. The Analytic Hierarchy Process for Decisions in a Complex World*, RWS Publications, Pittsburgh, PA 2001 [50].

Methods

The study was performed on a group of 202 students (140 women and 62 men) at the Medical University in Poland (Medical University of Łódź), in their sixth and final year of the undergraduate medical course (the study group comprised all final year medical students). Information was gathered concerning demographical data and preferred medical specialties. Among the 202 students assessed, 195 had chosen one of the possible 24 specializations, while the remaining seven had not decided yet (**Table II**). All of the 6th year students were asked to participate in this study after having finished their psychiatry classes. Most of them participated willingly and the participation rate was 98.7%. Since it was the first study carried out with the application of the AHP its results could be treated as preliminary. The sample cannot be treated as representative for the population of Polish or European students.

While comparing the criteria pairwise, the students were asked to verbally describe the subjective importance of the given criterion or sub-criterion of their choice of medical specialty. They made those comparisons speaking to each questionnaire item comparing two criteria and it was marked with them on each item (scale). In subsequent calculations, this was used as a basis for verbal opinions, which were converted into numerical scores to quantify the comparative importance of the main criteria and sub-criteria.

The following steps (stages) were adopted to determine the factors influencing the choice of medical specialty. Firstly, the problem was posed, in this case,

	Medical specialty	Number of students	Percentage of total (%)
1.	Surgery	24	11.9
2.	Paediatrics	23	11.4
3.	Internal Medicine	17	8.4
4.	Gynaecology	17	8.4
5.	Cardiology	16	7.9
6.	Anaesthesiology	16	7.9
7.	Ophthalmology	13	6.4
8.	Dermatology	11	5.4
9.	Radiology	9	4.5
10.	Psychiatry	8	4.0
11.	Neurology	7	3.5
12.	Orthopaedics	6	3.0
13.	ENT	5	2.5
14.	Family medicine	4	2.0
15.	Oncology	4	2.0
16.	Urology	3	1.5
17.	Haematology	3	1.5
18.	Endocrinology	2	1.0
19.	Emergency medicine	2	1.0
20.	Cardiosurgery	1	0.5
21.	Contagious diseases	1	0.5
22.	Rehabilitation	1	0.5
23.	Nephrology	1	0.5
24.	Neurosurgery	1	0.5
25.	No preference	7	3.5
	Σ =	202	100.0

Table II. Medical specialty chosen by final-year medical students. Source: Own study.

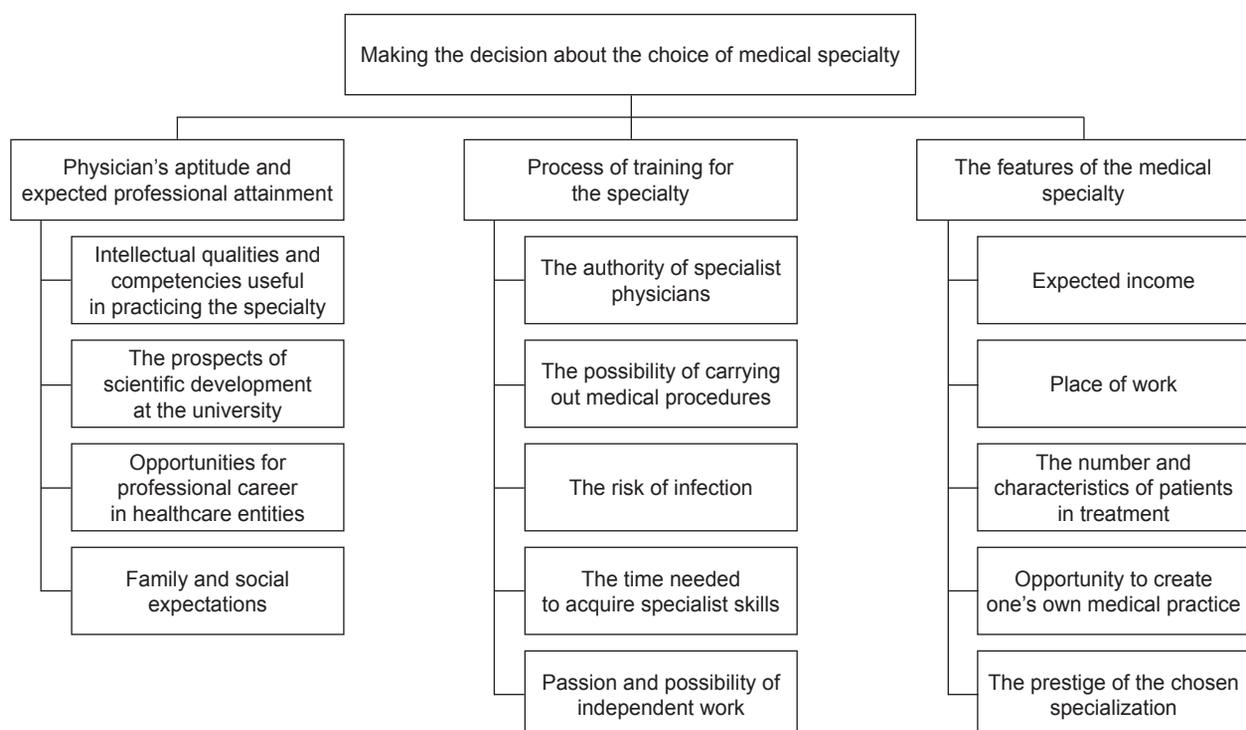


Figure 2. The hierarchy tree for the choice of medical specialty by final-year medical students.

Source: Own study.

the determination of the factors and their priorities (weights) influencing the choice of medical specialty by final year medical students. Secondly, the main goal was identified, this being the optimal choice of medical specialty by final-year medical students. Thirdly, the internal and external factors determining the process of choosing the medical specialty were discovered. Fourthly, the multi-level structure of the problem was constructed in the form of a hierarchy tree comprising the main goal, main criteria, sub-criteria and so on for each factor (**Figure 2**). A literature search was performed by using PUBMED and using search words: “medical students AND career choice”, “medical specialty preference”, “medical specialty choice”, “students’ choice of specialty”. Grounded on factors from the literature a decision hierarchy tree was constructed and the questionnaire for interviews prepared. Three main criteria and within their framework sub-criteria were chosen according to the published research.

Three characteristics were adopted as the main criteria: individual physician’s aptitude and expected professional attainment, the process of training for the specialization, and the features of the medical specialty. These characteristics were assigned the following definitions. “Individual physician’s aptitude and expected professional attainment”: this term is understood in different senses by many researchers, but relates primarily to the relatively fixed qualities of the physician’s personality, his intellectual potential, aspirations and expectations concerning his family or social circle. “The process of training for the specialty” concerns the factors associated with the training process: it is dependent on the medical procedures to be performed and any associated possibility of harm to the student, the qualities of instructors/directors of the specialty, as well the length of time needed and difficulty of acquiring the necessary medical skills. The third characteristic, “The features of the medical specialty” is associated with the place and organization of work of the specialist physician, expected income and prestige relating to the given specialty, the type and number of patients.

The next step was to define the sub-criteria within the framework of the adopted main criteria. The following sub-criteria were adopted for the criterion “Individual physician’s aptitude and expected professional attainment”: a. Intellectual qualities and competencies useful in practicing the specialization – knowledge, experience, situations which demand the consideration of various types of information before formulating (a) Conclusion, relatively fixed personal qualities including emotional and manual ones, (b) The prospects of professional development at the university – research and teaching activities, (c) Opportunities for professional career in healthcare entities – consisting of pursuits connected to the professional sphere, which are shaped by a person’s value hierarchy, (d) Family and social expectations – perceived expectations of relatives and/or society concerning the choice of specialization. In the criterion “The process of training for the specialty”, the following sub-criteria were distinguished: (a) The authority of specialist physicians

– positive examples of behavior, (b) Passion and possibility of independent work, (c) The possibility of carrying out medical procedures – the opportunity to practice the diagnostic process, or conduct treatment including the performance of surgical operations, (d) The risk of infection – the possibility of getting infected by a virus, e.g. HIV or HCV, (e) The time needed to acquire specialist skills. Finally, the following sub-criteria were adopted for the third criterion “The features of the medical specialty”: (a) Expected income – financial gain from the work done in the medical specialization, (b) Place of work – the opportunity to work in an office, a health center or hospital, or at a university, (c) The number of patients in treatment and their characteristics – the variety of patients with different illnesses with varying degrees of advancement (for example, emergency and serious conditions, chronic illnesses, less serious illnesses, the type of medical procedures) elements of prevention, diagnosis, treatment and rehabilitation to be performed by the physician, (d) Opportunity for the graduate to start a medical practice – the mode and hours of work, regulated hours of work, duty hours and time for family, (e) The prestige of the chosen specialization (a subjective criterion of stratification, consisting of emotionally-based evaluation and objective stratification factors) – the level of education, profession, lifestyle and income.

Following this, the dominance (prevalence) of the main criteria was defined within the framework of the hierarchical structure by making pairwise comparisons for each option against all others, with regard to their importance in choosing the specialty [51]. The evaluators of the criteria were expected to answer a series of questions: which of the criterion ranks has the greatest importance for the student on the process of choosing a medical specialty, which of the sub-criteria is more important in relation to the given criterion, and to what degree are they more important on the scale from equally important to absolute dominance. The evaluator marked the dominance of one criterion above another on the verbal scale from weak to absolute (extreme) dominance, using a pairwise comparison table. If one criterion did not outweigh another, i.e. two criteria were equivalent in the student’s opinion, the evaluator marked them as being of equal dominance, writing this fact in the dominance table as “equilibrium”.

The preferences for sub-criteria (intensity level) were then defined within the framework of the hierarchical structure. This was performed by pairwise comparison of their importance in relation to the value of each main criterion, using the Saaty fundamental preference scale. Verbal opinions about the comparative importance of the main criteria were quantified by conversion into numerical scores according to Saaty. The comparative importance of the sub-criteria was quantified based on the verbal opinions. Priorities (weights) were then calculated, local from the interval $[> 0, < 1]$ for each criterion (P_k) and sub-criterion (P_s), by normalizing eigenvectors for the comparison matrix. The computed weights allow the criteria to be ranked according to their importance in choosing the medical specialty.

Results

Each criterion was compared against all others with regard to the main goal for all students from the sample. The comparison itself was based on the computation of the geometrical mean for answers from each respective specialization group.

The following priorities were obtained for the main criteria. Concerning the choice of medical specialty, the highest rank was given to “Individual physician’s aptitude and expected professional attainment” ($P = 0.4748$), with the following sub-criteria: intellectual qualities and competencies useful in carrying out the specialty, prospects of scientific development at the university, opportunities for professional career in healthcare entities, family and social expectations. This was followed by “The features of the medical specialty” ($P = 0.3636$). Of the three analyzed main criteria, the least important was “The process of training for the specialty” ($P = 0.1616$). The sum of all analyzed priorities in relation to a main goal equaled to 1 (100%) and the estimated discrepancy coefficients were lower than 10%, which was the precondition for further analysis performed with the ‘Super Decisions’ software.

For “Individual physician’s aptitude and expected professional attainment”, the highest-ranked sub-categories were as follows: “Intellectual qualities and competencies useful in carrying out the specialization” ($P = 0.4872$) “Opportunities for professional career in healthcare entities” ($P = 0.2643$), “The prospects of scientific development at the university” ($P = 0.1431$), “Family and social expectations” ($P = 0.1053$).

For the main criterion “The process of training for the specialty”, the most important sub-category was “Passion and possibility of independent work” ($P = 0.3738$), followed by “Possibility of carrying out medical procedures” ($P = 0.2696$), “The authority of the specialist physician” ($P = 0.1596$), “The time and difficulty of obtaining the specialization” ($P = 0.1596$) and finally, “The risk of infection” ($P = 0.0751$).

For “The features of medical specialty”, the highest priority was awarded to the sub-criterion “Place of work” ($P = 0.3032$), followed closely by “Opportunity to create one’s own medical practice” ($P = 0.2243$). The sub-criteria “Expected income”, “Prestige of the chosen specialty”, “The number and characteristics of treated patients” were given similar priorities ranging from $P = 0.1520$ to $P = 0.1673$.

Criteria (Local Priorities – P_k)	Sub-criteria	Local priorities (P_s)	Global priorities (P_g)
Individual physician’s aptitude and expected professional attainment ($P_k = 0.4748$)	Intellectual qualities and competencies useful in practicing the specialty	0.4872	0.2313
	The prospects of scientific development at the university	0.1431	0.0679
	Opportunities for professional career in healthcare entities	0.2643	0.1255
	Family and social expectations	0.1054	0.0501
		$\Sigma = 1.0$	$\Sigma = 0.4748$
The process of training for the specialty ($P_k = 0.1616$)	The authority of specialist physicians	0.1596	0.0258
	The possibility of carrying out medical procedures	0.2696	0.0436
	The risk of infection	0.0751	0.0121
	The time needed to acquire specialist skills	0.1220	0.0197
	Passion and possibility of independent work	0.3737	0.0604
		$\Sigma = 1.0$	$\Sigma = 0.1616$
The features of the medical specialty ($P_k = 0.3636$)	Expected income	0.1520	0.0553
	Place of work	0.3032	0.1103
	The number and characteristics of patients in treatment	0.1673	0.0608
	Opportunity to create one’s own medical practice	0.2243	0.0816
	The prestige of the chosen specialty	0.1533	0.0557
$\Sigma = 1.0000$		$\Sigma = 1.0$	$\Sigma = 0.3636$
Sum			$\Sigma = 1.0$

Table III. The criteria and sub-criteria examined in the process of choosing medical specialty by final year medical students, and their global priorities.

Source: Own study.

Consistency indicators (CR) indicating the logical consistency of verbal pairwise comparisons conducted in this research study did not exceed 10%, fulfilling the requirements of Saaty's method. The eigenvalue approach of the AHP provides a measure for the consistency of the judgments (consistency ratio), aiming to improve the coherence among redundant judgments [46]. Computation of consistency indicators CR (logical consistency of verbal pairwise comparisons) to the main criteria and partial sub-criteria provides a measure of the probability that the pairwise comparison matrix was filled in purely at random. The number 0.2 says that there is a 20% chance that the decision maker will answer the questions in a random manner [52]. The inconsistency measures the logical inconsistency of judgments and is useful for identifying possible errors in judgments as well as actual inconsistencies in the judgments themselves. In general, the consistency ratio should be less than 0.1 [53]. If the consistency ratio is greater than 0.1 (10%) then the students have to re-evaluate their judgments in pairwise comparison matrix until the ratio is finally less than 0.1 (10%).

Table III lists the local priorities for the main criteria and their sub-criteria. Global priorities for each sub-criterion are also presented. The local priority for

a criterion indicates the influence on the main objective of a particular group of factors in the decision-making process. Thus, for example, the factors in "The features of the medical specialty" as a whole account for 36.36% of the choice of medical specialty, while those constituting "The process of training for the specialty" account for 16.16%. The local priorities for sub-criteria shown in **Table IV** indicate the influence of each of the sub-criteria on choosing the specialty in the decision-making process. In this way, for example, "Family and/or social expectations" have a 10.54% influence on "Individual physician's aptitude and expected professional attainment", while "Opportunities for professional career in healthcare entities" account for 26.43% of "Individual physician's aptitude and expected professional attainment".

In order to compute the influence of each sub-criterion on the process of choosing a medical specialty, its global priority was estimated. It is calculated by multiplying the local priority for the main criterion by the local priority of the given sub-criterion. Thus, for example, the global priority for "Opportunities for professional career in healthcare entities" results from the multiplication of the local priority for "Individual physician's aptitude and expected professional attainment" ($P = 0.4748$)

Criteria/sub-criteria ↓	All students		Women		Men		Surgery		Paediatrics	
	P_l	P_g								
Individual physician's aptitude and expected professional attainment	0.475		0.476		0.472		0.232		0.530	
Intellectual qualities and competencies useful in practicing the specialty	0.487	0.231	0.493	0.235	0.473	0.223	0.424	0.098	0.532	0.282
The prospects of scientific development at the university	0.143	0.068	0.141	0.067	0.147	0.069	0.193	0.044	0.130	0.069
Opportunities for professional career in healthcare entities	0.264	0.126	0.265	0.126	0.266	0.126	0.270	0.063	0.229	0.121
Family and social expectations	0.105	0.050	0.101	0.048	0.114	0.054	0.113	0.026	0.109	0.058
The process of training for the specialty	0.162		0.158		0.169		0.117		0.145	
The authority of specialist physicians	0.160	0.026	0.151	0.024	0.181	0.031	0.136	0.016	0.242	0.035
The possibility of carrying out medical procedures	0.270	0.044	0.265	0.042	0.278	0.047	0.428	0.050	0.185	0.027
The risk of infection	0.075	0.012	0.073	0.011	0.078	0.013	0.049	0.006	0.068	0.010
The time needed to acquire specialist skills	0.122	0.020	0.118	0.019	0.131	0.022	0.087	0.010	0.113	0.016
Passion and possibility of independent work	0.374	0.060	0.393	0.062	0.332	0.056	0.300	0.035	0.391	0.057
The features of the medical specialty	0.364		0.366		0.359		0.651		0.325	
Expected income	0.152	0.055	0.128	0.047	0.224	0.080	0.139	0.090	0.140	0.046
Place of work	0.303	0.110	0.328	0.120	0.248	0.089	0.236	0.153	0.242	0.079
The number and characteristics of patients in treatment	0.167	0.061	0.171	0.062	0.149	0.053	0.164	0.106	0.240	0.078
Opportunity to create one's own medical practice	0.224	0.082	0.226	0.083	0.216	0.078	0.228	0.148	0.220	0.072
The prestige of the chosen specialty	0.153	0.056	0.147	0.054	0.163	0.059	0.233	0.153	0.158	0.051
Σ =		1.0		1.0		1.0		1.0		1.0

Table IV. The local and global weights for criteria and sub-criteria for all of the students, both sexes and in the two specialty most frequently chosen by medical students of the Medical University (Local priorities – P_l , Global priorities – P_g).

Source: Own study.

Model A	Model B	Model C	Model D
The prestige of the chosen specialty	The prestige of the chosen specialty	Expected income	Place of work
Expected income	The number and characteristics of patients	The number and characteristics of patients	Characteristics of medical procedures
Place of work	Characteristics of medical procedures	Place of work	The number and characteristics of patients
The possibility of carrying out medical procedures	The risk of a lawsuit	Possibility of a professional career	Passion and possibility of independent work
The risk of infection	The time needed to acquire specialist skills	The risk of infection	The time needed to acquire specialist skills
Difficulties in acquiring practical skills	Passion and possibility of independent work	The possibility of carrying out medical procedures	Difficulties in acquiring practical skills
Personality traits	Family expectations	Scientific and teaching work at university	Personality traits
Family expectations	Scientific and teaching work at university	Career aspirations	Relationship with the patient
Intellectual qualities and competencies	Relationship with the patient	Family expectations	Career aspirations

Table V. Characteristics of decision alternatives for choosing medical specialty by final year medical students.

Source: Own study.

Sub-criteria	Global priorities (P_g)	Model A	Model B	Model C	Model D
Individual physician's aptitude and expected professional attainment	0.2313	0.417 (0.096)	0.083 (0.019)	0.083 (0.019)	0.417 (0.096)
Intellectual qualities and competencies useful in practicing the specialty	0.0679	0.096 (0.007)	0.368 (0.025)	0.368 (0.025)	0.169 (0.011)
The prospects of scientific development at the university	0.1255	0.143 (0.018)	0.143 (0.018)	0.571 (0.072)	0.143 (0.018)
Opportunities for professional career in healthcare entities	0.0501	0.300 (0.015)	0.300 (0.015)	0.300 (0.015)	0.100 (0.005)
	$\Sigma = 0.4748$				
The process of training for the specialty	0.0258	0.375 (0.010)	0.375 (0.010)	0.125 (0.003)	0.125 (0.003)
The authority of specialist physicians	0.0436	0.400 (0.017)	0.100 (0.004)	0.400 (0.017)	0.100 (0.004)
The possibility of carrying out medical procedures	0.0121	0.375 (0.004)	0.125 (0.002)	0.375 (0.004)	0.125 (0.002)
The risk of infection	0.0197	0.100 (0.002)	0.400 (0.008)	0.100 (0.002)	0.400 (0.008)
The time needed to acquire specialist skills	0.0604	0.083 (0.005)	0.417 (0.025)	0.083 (0.005)	0.417 (0.025)
	$\Sigma = 0.1616$				
The features of the medical specialty	0.0553	0.375 (0.021)	0.0125 (0.007)	0.375 (0.021)	0.125 (0.007)
Expected income	0.1103	0.318 (0.035)	0.045 (0.005)	0.318 (0.035)	0.318 (0.035)
Place of work	0.0608	0.063 (0.004)	0.313 (0.019)	0.313 (0.019)	0.313 (0.019)
The number and characteristics of patients in treatment	0.0816	0.083 (0.007)	0.083 (0.007)	0.417 (0.034)	0.417 (0.034)
Opportunity to create one's own medical practice	0.0557	0.417 (0.023)	0.417 (0.023)	0.083 (0.005)	0.083 (0.005)
	$\Sigma = 0.3636$				
MODELS	$\Sigma = 1.0000$	0.264	0.187	0.276	0.274

Table VI. A comparison of the developed models with regard to all sub-criteria in the process of choice of medical specialty by final year medical students.

Source: Own study.

by the local priority of “Opportunities for professional career in healthcare entities” ($P = 0.1431$). The calculated global priority is thus equal to $P_g = P_l \times P_s, P_g = 0.4748 \times 0.1431 = 0.0679$.

The results from Table IV indicate that women and men use similar criteria in choosing the medical specialty, as the global priorities for the two groups are not significantly different. When choosing Surgery as a specialty, the students rated the criteria “Possibility of creating one’s own medical practice”, “Prestige of the chosen specialty” and “Place of work” most highly. When choosing “Pediatrics”, the respondents chose “Intellectual qualities and competencies useful in practicing the specialty”, “Opportunities for professional career in healthcare entities” and “Place of work”.

Decision alternatives (models of choice) were then developed. To determine what guides final year medical students in their choices of medical specialty, four hypothetical models (decision alternatives) were developed based on available literature. These were constructed based on the three most significant sub-criteria from each group of main criteria. The following models of choice of medical specialization were proposed (see Table V).

Criteria of the Model A have been discussed by [22, 33, 37], of Model B by [12, 27, 36], of Model C by [12, 13, 37], and of Model D by [22, 27]. To choose the best model, all models were compared with each other with regard to all 15 sub-criteria present in the hierarchy tree (Table VI).

The AHP method was found to provide an objective way of choosing the best alternative. Of the four examined models, the most suitable for choosing medical specialty was found to be Model C, followed closely by Model D and then Model A, with Model B being the least suitable (Figure 3).

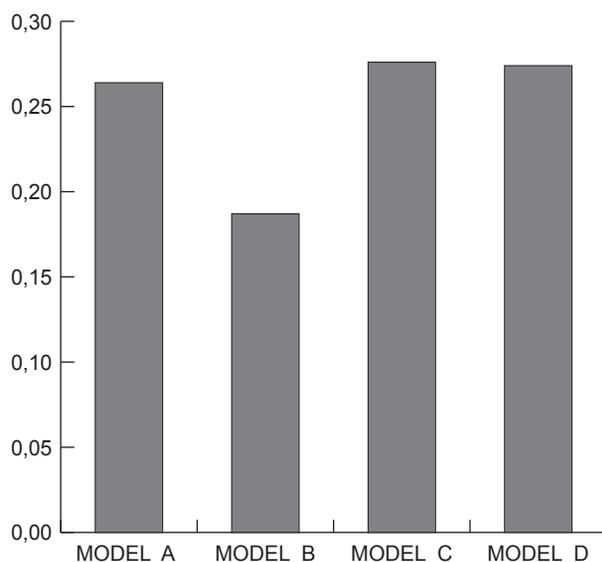


Figure 3. A comparison of global models of medical specialty by final-year medical students.

Source: Own study.

Discussion

The choice of specialty by medical students is a multi-dimensional process including many factors. Statistical analysis showed that the chosen criteria and sub-criteria influence the choice regardless of age or sex. The most important criterion for choosing the specialty was “Individual physician’s aptitude and expected professional attainment”, followed by “the features of the medical specialty”, with “The process of training for the specialty” being the least significant. The results imply that evaluated medical students are most concerned about the development of their own personality traits, and the fulfillment of their intellectual abilities and aspirations when choosing a specialty. This was also reflected in the students’ choice of sub-criterion “Intellectual qualities and competencies useful in practicing the specialty”. In addition, “Place of work” and “Opportunity to create one’s own medical practice” influenced their choices strongly. In sub-criteria of “the process of specialty training”, the respondents emphasize “Passion and chance to work independently”, although it was the least important option. It can be assumed that personal development, independent work and the chance to open a private practice had the greatest influence on choosing the specialty.

Surgery and Pediatrics were declared as the most interesting medical specialties. Those preferring Surgery chose “Opportunity to create one’s own medical practice”, “The prestige of the chosen specialty” and “Place of work” as the most influential criteria for their decision. Whereas for those interested in Pediatrics, most impacting factors were the development of “Intellectual qualities and competencies useful in practicing the specialty”, “Opportunities for professional career in healthcare entities” and “Place of work”. What is more, of the four models of specialty preference analyzed, the highest priority was achieved by the one whose most important criteria were “Opportunities for professional career in healthcare entities”, “Place of work”, “Opportunity to create one’s own medical practice” and “Expected income”. It indicates that when making a specialty choice, medical students regard working conditions and economic factors as the most significant factors.

Our results partly confirm those of Taiwanese researches [41] and [42] in that “Individual physician’s aptitude and expected professional attainment” was given the greatest importance, followed by “The features of the medical specialty” and “The process of training for medical specialty”. Medical students regard personal development, position at work and opportunity for promotion as having the greatest influence when choosing their specialty. However, while the third most important factor in the Taiwanese study was “Lifestyle after completion of the training”, our study found it to be “Passion and possibility of independent work” followed by “Place of work”. It can be assumed that for all of the students, both in Taiwan and in Europe, personal and career development are significant factors when considering specialty preferences. However, lifestyle after training completion did not appear to be as important among the group

of Polish (European) students, who instead emphasized their passion for the work and a need for independent activity during specialty training. This may reflect both differences in economic status of doctors in Taiwan and in specialty training process. It could be supposed that the Taiwanese students perceive doctors as having a satisfying income, secure and stable jobs which satisfy their needs, and therefore their interest in lifestyle after training appears more important. Otherwise, the process of training may generally give them more independent work whereas in Poland independence during training might be something expected by students. However, this assumption would need further research.

Although some studies based on Taiwanese students have found expected income and the possibility of opening a private practice to be not as important as expected [41,42] other studies have shown that the potential financial rewards after obtaining medical specialty are of high importance to students [12, 13, 37]. Our findings indicate that financial rewards are of high importance to this studied group: Future revenue and the possibility of opening a private practice, which brings supplemental income, were mentioned as essential criteria, followed by such factors as “Opportunities for professional career in healthcare entities” and “Place of work”. In Poland, expected income is still a major issue for future doctors since the health system is underfinanced and salaries do not allow an acceptable standard of living to be achieved by working at only one position.

While the most preferable specialties in the present study were Surgery and Pediatrics, Wang et al. found them to be Internal Medicine and Surgery, with Pediatrics in the third place [42]. The students in the present study gave “Opportunity to create one’s own medical practice”, “The prestige of the chosen specialty” and “Place of work” as the most influential criteria for choosing Surgery, and “Intellectual qualities and competencies useful in practicing the specialty”, “Opportunities for professional career in healthcare entities” and “Place of work” when choosing Pediatrics. In contrast, Wang et al. [42] report that students marked Personal intelligence/ability preference, Career opportunities and Lifestyle after completion of training as the most important criteria for Surgery, and Personal intelligence/ability preference, Career opportunities and Work independently after the training while when choosing Pediatrics. In the present study, students preferring surgery seemed more concerned about additional income, prestige and place of work compared to development of their personal traits, career and lifestyle in Wang et al. [42] It can be assumed that these variations are due to differences in economic status of doctors, which is probably much lower in Poland, resulting in students focusing more on economic issues than personal development and lifestyle. Our results are consistent with previous findings indicating that Surgery residents are more likely to be interested in modern technology, prestige and higher income [29]; however, these studies were not based on an

AHP approach. On the other hand, respondents preferring Pediatrics emphasized the development of intellectual abilities, career and place of work in both the present study and that of Wang et al. [42]. These similarities may occur because of the close resemblance in the work, the personality of those preferring Pediatrics [54] or the similarity of the financial rewards. However, this would need further research.

The use of AHP allowed detailed results to be obtained, which have scientific significance and practical value for the both University and health care in general. The results show not only the most important factors influencing choice of specialty but also the relative weight of each factor. This knowledge may be valuable for young physicians when making their decisions for a professional career, and for public services to assure the availability of an appropriate number of specialists in all medical domains. It could be used in medical career counseling, and may be used by government services to create strategies encouraging, supporting, and fostering student interest in specializing in under-supplied medical specialties. This study also provides the opportunity for further research on other factors and models influencing choice of specialty, as well as on the differences between countries in this regard. It also shows the possible applications of the AHP method in similar studies.

This study has some limitations. The group of examined students is quite small. It was planned and carried out with participation of sixth-year students attending one medical university, which restricts the possibility of generalizing the conclusions for the whole population of medical students in Poland or in Europe. However, the small size of the group was the result of the long interviewing procedure carried out with the students. In addition, the number of compared factors was above nine, which raised the probability of false responses; ideally this number should be between five and nine.

To conclude, the criteria examined in the study influence the choice of medical specialty to various degrees. When choosing medical specialties, students marked such qualities as personality, intellectual potential and aspirations as being the most important. What is more, the employed model found the most important criteria for choosing specialty to be “Opportunities for professional career in healthcare entities”, “Place of work”, “Opportunity to create one’s own medical practice” and “Expected income”. These results not only indicate which factors have the greatest influence on the choice of specialty but also suggest incentives that could be created to promote the development of their interests and influence their choice of medical specialty. Understanding the factors influencing the choice of medical specialty by students enables workforce planning to meet local and national healthcare needs and helps develop the educational process. This understanding is particularly important for Poland, as it has one of the most expensive medical education systems, with many of the graduates emigrating to western Europe after their course.

Acknowledgement

We offer our warm thanks to all those who willingly participated in this study. We also wish to thank Edward Lowczowski, who helped with proofreading of the manuscript and dr Magdalena Kotlicka-Antczak for help in organizing the data collection. We also greatly thank the late Professor Jolanta Rabe-Jablonska for her support in this study.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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