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Applications of Resources-based Relative Value Scale in the National Health Insurance Scheme to Secure Adequate Supply of and Demand for Medical Specialists

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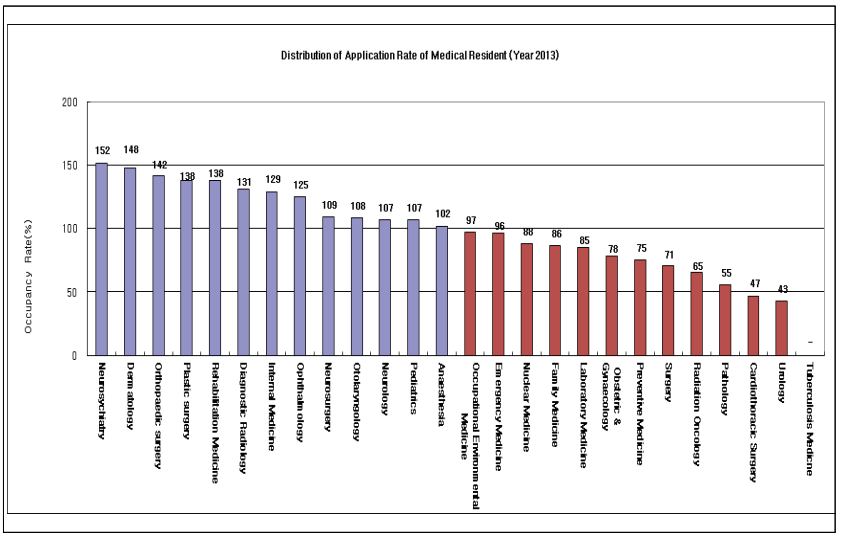
I Introduction

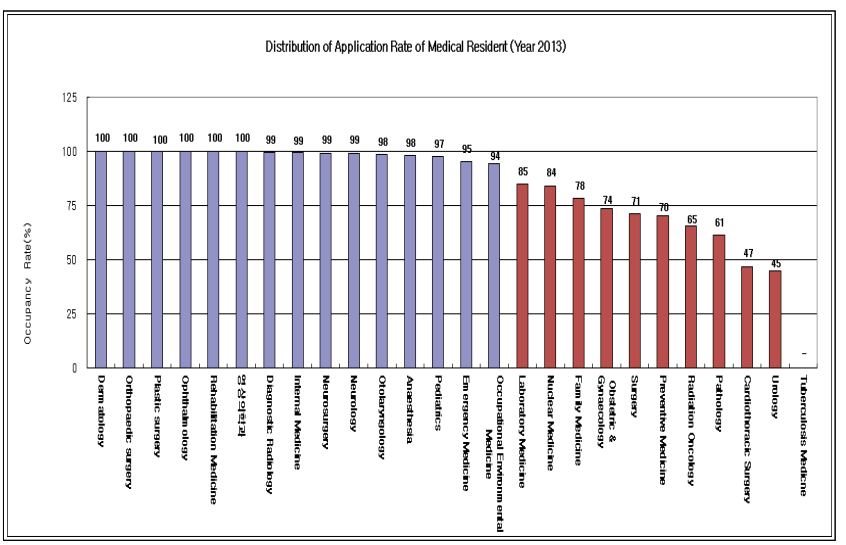
I Introduction

In Korea, there is some controversy over the imbalance in the supply of and demand for medical specialists, which has been caused by the preference of medical students for certain types of specialties. In particular, there is an imbalance in the numbers of applications submitted by medical students for different specialized medical fields, with the field of psychiatry, which shows the highest application rate, receiving 1.5 times more applications than the admission quota. The field of tuberculosis, however, received no applications. The medical resident enrollment rate, which is affected by the application rate, also shows a similar imbalance. There are 11 types of specialties with medical resident enrollment rates of 90 percent or less, and the rates for the fields of thoracic surgery and urology are even lower, at around 40 percent.

[Figure 1] Distribution of Application Rates of Medical Residents (2013)



[Figure 2] Distribution of Medical Resident Enrollment Rate (2013)



To improve the imbalance in student applications for different types of specialties, which is directly correlated to the imbalance in the supply of and demand for medical specialists, various policy measures have been put in place, including government subsidies for fields typically avoided by medical students and reductions of the intern and resident quotas in relevant fields. However, no significant improvements have been seen in the imbalance in student applications and shortages of specialists in certain fields. Rather, the gap between some fields with high application and enrollment rates and those with low rates has widened even further. Concerning the imbalance in the fields applied for by medical students over the last five years, the imbalance index for medical specialties with shortages of applicants (applying the concept of dispersion) increased from 32 in 2008 to 34 in 2012, and the imbalance index for the medical resident enrollment rate rose slightly as well, from 31 to 32, indicating that the imbalance in student applications persists.

Therefore, merely changing the subsidy amount for interns or residents or the overall quota of medical specialists will not bring about any significant improvement in the situation. In this regard, this study attempts to estimate the impact of the income of medical specialists and related variables, which have been pointed to as factors behind the imbalance in applications for different types of specialties, as well as to present ba-

sic data that can be used in the development of policy that aims to achieve balance in the supply of and demand for medical specialists in the long term.

II

Theoretical model and previous studies

Ⅱ Theoretical model and previous studies

The human capital approach was used for this study. According to this theory, potential workers consider employment benefits (potential monetary earnings and non-pecuniary returns) when choosing their occupations.

The function is as follows: Previous studies in Korea and overseas target mainly individual medical specialists, and focus on their demographic, social, and economic characteristics. Foreign studies view medical students' choice of types of specialties, especially those in primary care and other specialties, as the result of a complex decision-making process that is influenced by individual characteristics and other variables.

$$p_{ij} = f(E_{i1}, \cdots, E_{ij}, E_{ij+1}, \cdots, E_{in}; U_{i1}, \cdots, U_{ij}, \cdots, U_{in}; \frac{T_{i1}}{W_i}, \cdots, \frac{T_{ij}}{W_i}, \cdots, \frac{T_{in}}{W_i})$$

- E : Current relative value of post-investment lifetime earnings
- T : Foregone earnings
- W_i : Wealth
- U : Current value of forgone earnings resulting from not choosing a certain position

Most of the previous studies carried out in Korea on the choice of types of specialties by doctors during their residency also attempt to provide explanations based on the demographic, social, and economic characteristics of individuals, such as academic interests, personalities, aptitudes, academic grades, and expected income. However, few empirical studies have been done on the unique characteristics of specialized fields, including the income of medical specialists, risks of medical malpractice, cost-maintenance ratio, possibility of opening one's own clinic, and level of difficulty of medical specialist training.

III

Research methods

III Research methods

The unit of analysis of this study is not individual medical specialists nor their personal characteristics but the types of specialties, or groups, and the inherent characteristics of each field. The reason for this is that the imbalance in applications for medical specialties is fundamentally a result of the inherent differences between the various types of specialties, such as expected income after becoming a medical specialist, level of difficulty of medical specialist training, nature of medical consultations and treatments, and working conditions in the given type of specialty, rather than the characteristics of individual specialists.

Regarding the source materials used for the study, the statistics on the income of medical specialists in different types of specialties (2001-2013) were obtained from the National Health Insurance Service, while the statistics on the amounts of medical fees in different types of specialties, weighted relative value units in different fields, and medical service usage data (2008-2013) were obtained from the Health Insurance Review and Assessment Service. Data related to the difficulty of training and medical consultations and treatments by medical specialists were collected through a questionnaire survey, conducted via regular mail, of 26 societies of medical professionals

in different types of specialties.

The variables related to the dependent variable of applications for medical specialties are the application rate and enrollment rate of medical residents. However, as the ultimate goal is to increase the enrollment rate of medical specialties suffering from shortages of medical specialists, the dependent variable that will be used in this model is the medical resident enrollment rate. The explanatory variables include the expected income of medical specialists, earnings from medical consultations and treatments, and medical fees, as well as factors indicating job stability and the characteristics of different types of specialties. The income of medical specialists is based on the income statistics used for calculating health insurance premiums, while the earnings from medical consultations and treatments is based on the medical fees per medical specialist. The medical fees consist of the weighted relative value units for different types of specialties, weighted conversion factor, and number of medical procedures. As the income of medical specialists is an endogenous variable, it is estimated using instrumental variables. The variables indicating job stability are the existence of legal employment regulations, provision of medical specialist subsidies, and increase/decrease of the medical specialist quota. On the other hand, the variables representing the characteristics of different types of specialties are the difficulty of training and medical consultations and treat-

ments, uninsured cost ratio, and relative importance of different types of specialties.[1)]

The medical resident enrollment rate model was built using panel data from 26 types of specialties over the period for which data was available (2001-2013). The distinction between major and minor types of specialties was made based on the analysis of reasons for the concentration of medical specialists. The reduced form equation, which provided the basis for the estimation, is as follows.

$$
\begin{aligned}
S_{j,t} &= X_{j,t}\beta_1 + Z_{j,t}\beta_2 + P_{j,t}\beta_3 + \epsilon_{j,t} \\
W_{j,t} &= MP_{j,t}\beta_1 + TH_{j,t}\beta_2 + NOI_{j,t}\beta_3 + \epsilon_{j,t} \qquad (1) \\
&\text{(단, } \epsilon_{j,t} = \mu_j + \lambda_t + \nu_{jt})
\end{aligned}
$$

1) Here, the variables indicating job stability that were considered include: proportions of clinics providing medical services in specific types of specialties, whether or not a particular field is essential to the establishment of a hospital, proportion of employment at hospitals or higher institutions, existence of legal employment regulations, payment of medical specialist subsidies, and increase/decrease of the medical specialist quota. Problems such as multi-collinearity occurred due to the extremely high correlation among different variables, and the model was analyzed based on the extraction of a few factors through factor analysis. However, no significant results were found. Thus, factors showing high congruity or unusually high correlation with each other were excluded. In the end, the job stability variables that were included in the model were the existence of legal employment regulations, payment of medical specialist subsidies, and increase/decrease of the medical specialist quota (percent). Concerning the variables representing the characteristics of the types of specialties, the application of markup appeared to have high correlation with other variables and was thus excluded from the model.

Here,

j : 26 specialties

t : Time series, year (t=2001...2013)

$S_{j,t}$: Medical resident enrollment rate

$X_{j,t}$: Vector of explanatory variables related to specialist subsidy, including a constant term

$Z_{j,t}$: Vector of variables related to job stability (ex: existence of a legal stipulation on obligatory employment)

$P_{j,t}$: Vector related to characteristics of speciality (ex: provision of training subsidy)

$W_{j,t}$: Monthly income of specialty

$MP_{j,t}$: Vector of relative value units of specialty related to medical fees and number of medical procedures

$TH_{j,t}$: Vector related to types of medical organizations of specialists

$NOI_{j,t}$: Vector related to uninsured cost ratio of specialty

$\beta_1, \beta_2, \beta_3$: Vector of each coefficient value

μ_j : Effectiveness of each unobserved specialty

λ_t : Unobserved effectiveness of time series

$\nu_{j,t}$: Remainder stochastic distribution, an error term, of which the average for all specialties (j) and times (t) is 0, and dispersion is independent and identical to $\sigma 2$

Panel analysis is used for the medical resident enrollment rate model. The reason for this is that the year-by-year data on different types of specialties include cross-sectional data and time-series data, and thus error terms in the model are likely to be comprised of confounding variables in the cross-sectional data, time-series data, and confounders generated due to the combination of the two sets of data. In particular, as the model deals with 26 different types of specialties, it does not reflect demographic, social, or economic characteristics, such as the academic interests, personalities, peer relations, academic grades, occupations of parents, and economic levels of the individual applicants. In addition, it should be noted that some unobserved variables have not been included in the model.

The enrollment rate of medical residents is influenced by different factors at different times, and thus it is almost impossible to include all such variables in the analysis model. Furthermore, as different application rates and enrollment rates are presented for disparate types of specialties, in the case of empirical analysis of different fields, an analysis model that takes into consideration the uniqueness of each field is required. Therefore, a statistical examination of various uncontrolled variables should be conducted, making the panel analysis method ideal for the empirical analysis of the concentration of medical specialty applications in specific types of specialties.

IV Results

1. Basic statistics and appropriateness of the panel analysis
2. Analysis of the medical resident enrollment rate model
3. Effects of key variables influencing medical resident enrollment rate
4. Analysis of t medical specialist income model
5. Group-specific effects and preference index for different types of specialties

Ⅳ Results

1. Basic statistics and appropriateness of the panel analysis

Table 1 presents the basic statistics for the variables used in the panel analysis. The average application rate and enrollment rate for various types of specialties between 2001 and 2013 were 105.4 percent and 81.2 percent, respectively.

〈Table 1〉 Basic Statistics of Key Variables

Variable	Average	Standard Deviation	Minimum Value	Maximum Value	Year
Application Rate (%)	105.4	44.08	0	258	2003~2013
Enrollment Rate (%)	81.2	24.31	0	100	2001~2013
Monthly Income (KRW 10,000)	680	204	196	1399	2001~2013
Number of Procedures (millions)	12,133	19,940	0.5	105,627	2008~2013
Conversion Factor	65.1	2.08	62.1	69.6	2008~2013
Relative Value Units	144.9	112.14	61.5	798	2008~2013
Medical Fees Earned by Specialist (KRW 10,000)	41,217	29,308	19	113,580	2008~2012
Existence of Legal Stipulation on Obligatory Employment	0.32	0.47	0	1	2001~2013
Payment of Training Subsidy	0.33	0.47	0	1	2001~2013
Level of Difficulty of Training and Medical Procedures	2.9	0.68	1.9	4.3	2001~2013
Increase/Decrease of Medical Specialist Quota (%)	2.4	13.34	-37.5	128.6	2001~2013
Existence of Major Specialty	0.6	0.49	0	1	2001~2013

Table 2 shows the changes in the average ratio of key variables. According to the table, the medical resident application rate has been decreasing since reaching a peak of 113 percent in 2004, and the enrollment rate has been dropping gradually since reaching 88 percent in 2004, maintaining a rate between 82 percent and 84 percent. First, for the panel analysis, the authors examined whether there was sufficient variability among the different types of specialties as well as among other major explanatory variables. Over 80 percent of the fluctuation of the enrollment rate was attributable to specific changes within the different types of specialties. Also, 70 to 80 percent of the variability of the explanatory variables appeared to be due to individual time change regarding most variables, excluding the monthly income of medical specialists. These results indicate that panel analysis, which reflects both the cross-sectional and time-series characteristics of data, is suitable for the analysis of the medical resident enrollment rate model.

〈Table 2〉 Changes in the Average Ratio of Key Variables (2001-2013)

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Application Rate (%)			106	113	112	112	110	106	106	103	99	96	96
Enrollment Rate (%)	70	70	80	88	86	85	83	82	84	82	80	82	83
Monthly Income (KRW 10,000)	442	468	518	537	565	624	690	749	734	836	848	901	931
Number of Procedures (millions)								10,230	11,153	12,042	12,585	13,132	13,658
Conversion Factor								62.2	63.4	64.6	65.4	66.8	68.3
Relative Value Units								129.2	136.5	145.4	147.5	155.6	155.4
Medical Fees Earned by Specialist (millions)								36,288	39,022	42,426	43,326	45,024	-
Existence of Legal Stipulation on Obligatory Employment	0.35	0.35	0.35	0.35	0.35	0.35	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Payment of Training Subsidy	0.00	0.00	0.38	0.38	0.38	0.38	0.38	0.42	0.46	0.42	0.42	0.35	0.35
Increase/Decrease of Medical Specialist Quota (%)		7.55	-1.21	0.83	10.87	9.35	4.85	1.51	2.17	1.05	-0.12	-6.16	0.00

〈Table 3〉 Explanatory Power of Key Characteristic Variables of Each Speciality

Variable	F-Value	p	Changes caused by changes in independent speciality's time[1)]
Application Rate (%)	3.475	0.000	0.888
Enrollment Rate (%)	5.940	0.000	0.821
Monthly Income (KRW 10,000)	116.621	0.000	0.189
Number of Procedures (millions)	11.662	0.000	0.721
Relative Value Units	6.189	0.000	0.829
Medical Fees Earned by Medical Specialist (KRW 1,000,000)	10.250	0.000	0.754
Increase/Decrease of Medical Specialist Quota (%)	3.744	0.000	0.879

Note: 1) (1-R2) was calculated using R2 drawn from (2).

2. Analysis of the medical resident enrollment rate model

With regard to the results of the analysis of the medical resident enrollment rate model (with the key policy variable being the income of medical specialists), the variables that influence the enrollment rate included the income of medical specialists, job stability, and characteristic variables of the different types of specialties,[2)] when examined with a focus on the results of

2) Among the characteristic variables of the different types of specialties, the variable of the payment of medical specialist training subsidies was the only one for which the results of the pooled OLS and panel analysis showed different signs. This appears to be the result of problems with the omitted variables that occur when the causes of the gaps between the medical resident enrollment rates of the different types of specialties are analyzed

the fixed effects model, which is considered to be more suitable than the random effects model (results of pooled OLS and panel analysis using the two models are presented in Table 4).

〈Table 4〉 Estimated Fixed Effects of Medical Resident Enrollment Model (Key Policy Variable: Income of Medical Specialists)

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		74.736***	5.477	-	-	80.503***	12.778
Income of Medical Specialists	Income of Medical Specialists (KRW 10,000)	.034***	.005	.012***	.004	.014***	.004
Job Stability	Legal Stipulation on Obligatory Employment	4.114*	2.174	3.338	6.931	4.543	4.605
	Training Subsidy	-16.336***	2.821	6.370***	2.430	4.151*	2.379
	Increase/Decrease of Medical Specialist Quota (%)	-.142*	.077	-.136***	.052	-.138***	.052
Characteristics of Different Specialties	Level of Difficulty of Training and Medical Procedures	-7.983***	1.646	-	-	-10.523**	4.385
	Existence of Major Specialty	18.422***	2.937	-	-	31.855***	6.337
R Square		0.435		0.772		0.325	

without controlling for the group effects of the different specialties. Therefore, it can be seen that the result of the panel analysis is more valid than that of the pooled OLS model, and that the fixed effects model, which allows for the estimation of coefficients by differentiating the group effects of disparate specialties, is more appropriate in the panel analysis. In addition, the test statistics obtained from the results of the analysis of the fixed effects model further indicate the suitability of the model. Concerning these test statistics, the explanatory power of the model (R2) that analyzed only the group effects of the different types of specialties was 74.9 percent, while that of the model that used only the independent variables included in the model was 43.5 percent and that of the model that included both the group effects and the independent variables was 77.2 percent. The results of the likelihood ratio test and F-test for each model were all found to be significant.

Table 5 shows the coefficient values of the group effects of the different types of specialties, estimated using the fixed effect model. The group effects of the different fields were all found to be statistically significant. In particular, the effect of the field of tuberculosis was the lowest at 9.56, while that of plastic surgery was the highest at 92.12. This cannot be explained by the independent variables, and means that the explanatory power of the omitted variables in the field of tuberculosis is 9.56, while that of the field of plastic surgery is much higher at 92.12.

Table 6 shows the results of the analysis of the medical resident enrollment model, in which the key variable of income was divided into the income of medical specialists at clinics and income of medical specialists at hospitals, whereas Table 7 presents the estimated values of the characteristic effect coefficient, obtained using the fixed effects model. Tables 8 and 9 show the estimation results obtained through a model that divides the types of specialties into major fields and supporting and minor fields.

〈Table 5〉 Estimated Fixed Effects of Medical Resident Enrollment Model (Key Policy Variable: Income of Medical Specialists)

Group		Specialty			Group		Specialty		
		Coeff.	S.E.	T-ratio			Coeff.	S.E.	T-ratio
1	Internal Medicine	85.805	3.376	25.418	14	Urology	77.889	3.376	23.073
2	Pediatrics	83.437	3.376	24.717	15	Tuberculosis Treatment	9.565	3.376	2.834
3	Neurology	89.257	3.376	26.441	16	Rehabilitation Medicine	90.739	3.376	26.88
4	Psychiatry	88.389	3.376	26.184	17	Anaesthesia	82.501	3.376	24.44
5	Dermatology	91.979	3.376	27.247	18	Diagnostic Radiology	70.016	3.376	20.741
6	Surgery	61.228	3.376	18.138	19	Radiation Oncology	51.65	3.376	15.3
7	Cardiothoracic Surgery	34.555	3.376	10.237	20	Laboratory Medicine	51.657	3.376	15.303
8	Orthopaedic Surgery	88.193	3.376	26.126	21	Pathology	39.169	3.376	11.603
9	Neurosurgery	86.819	3.376	25.719	22	Family Medicine	82.241	3.376	24.363
10	Plastic Surgery	92.121	3.376	27.289	23	Emergency Medicine	65.954	3.376	19.538
11	Obstetrics and Gynecology	61.075	3.376	18.093	24	Nuclear Medicine	68.174	3.376	20.195
12	Ophthalmology	90.341	3.376	26.762	25	Industrial Medicine	67.267	3.376	19.927
13	Otolaryngology	91.574	3.376	27.127	26	Preventive Medicine	22.654	3.376	6.711

〈Table 6〉 Results of Medical Resident Enrollment Model (Key Policy Variable: Income of Specialists, Divided Between Clinics and Hospitals)

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		77.550***	5.544			81.257***	13.086
Income of Medical Specialists	Income of Specialists at Clinics (KRW 10,000)	.008	.005	.0014	.004	.002	.004
	Income of Specialists at Hospitals (KRW 10,000)	.023***	.007	.010*	.005	.011**	.005
Job Stability	Legal Stipulation on Obligatory Employment	3.485	2.215	3.089	6.958	4.241	4.676
	Subsidy for Medical Residents	-15.919***	2.866	6.590***	2.427	4.510*	2.379
	Increase/Decrease of Medical Specialist Quota (%)	-.135*	.079	-.138***	.052	-.140***	.052
Characteristics of Different Types of Specialties	Level of Difficulty of Training and Medical Procedures	-8.053***	1.681	.000		-10.638**	4.497
	Existence of Major Specialty	18.420***	2.994			32.062***	6.492
R Square			0.418		0.772		0.312

〈Table 7〉 Estimated Fixed Effects of Medical Resident Enrollment Model (Key Policy Variable: Income of Specialists, Divided Between Clinics and Hospitals)

Group		Specialty			Group		Specialty		
		Coeff.	S.E.	T-ratio			Coeff.	S.E.	T-ratio
1	Internal Medicine	86.347	3.386	25.500	14	Urology	78.033	3.386	23.045
2	Pediatrics	83.642	3.386	24.701	15	Tuberculosis Treatment	9.065	3.386	2.677
3	Neurology	89.658	3.386	26.477	16	Rehabilitatio n Medicine	90.983	3.386	26.869
4	Psychiatry	88.833	3.386	26.234	17	Anaesthesia	82.895	3.386	24.480
5	Dermatology	92.707	3.386	27.378	18	Diagnostic Radiology	70.531	3.386	20.829
6	Surgery	61.506	3.386	18.164	19	Radiation Oncology	52.065	3.386	15.376
7	Cardiothoracic Surgery	34.600	3.386	10.218	20	Laboratory Medicine	51.976	3.386	15.349
8	Orthopaedic Surgery	88.468	3.386	26.126	21	Pathology	39.510	3.386	11.668
9	Neurosurgery	87.339	3.386	25.793	22	Family Medicine	82.239	3.386	24.287
10	Plastic Surgery	92.569	3.386	27.337	23	Emergency Medicine	66.155	3.386	19.537
11	Obstetrics and Gynecology	61.280	3.386	18.097	24	Nuclear Medicine	68.946	3.386	20.361
12	Ophthalmology	91.303	3.386	26.963	25	Industrial Medicine	67.367	3.386	19.895
13	Otolaryngology	91.677	3.386	27.074	26	Preventive Medicine	22.629	3.386	6.683

〈Table 8〉 Estimation Results of Medical Resident Enrollment Rate Model (Key Policy Variable: Major Specialty)

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		102.095***	4.384	-	-	116.136***	8.151
Income of Medical Specialists	Income of Medical Specialist (KRW 10,000)	.014***	.004	.004	-.010	.004	.004
Job Stability	Legal Stipulation on Obligatory Employment	1.229	1.648	4.901	-.200	.155	2.978
	Subsidy for Medical Residents	-33.349***	2.747	3.174	-4.560	-19.363***	2.966
	Increase/Decrease of Medical Resident Quota (%)	.101	.148	.126	1.510	.172	.126
Characteristics of Different Types of Specialties	Legal Stipulation on Obligatory Employment	-5.721***	1.282	-	-	-8.367***	2.500
	Training Subsidy	-	-	-	-	-	-
Increase/Decrease of Medical Specialist Quota (%)		0.605		0.751		0.544	

〈Table 9〉 Estimation Results of Medical Resident Enrollment Rate Model (Target Analyzed: Subsidy and Other Specialties)

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		24.573**	12.107			28.201	29.203
Income of Medical Specialists	Income of Medical Specialist (KRW 10,000)	.060***	.010	.031***	.007	.033***	.007
Job Stability	Legal Stipulation on Obligatory Employment	12.888***	4.454			17.703	12.662
	Subsidy for Medical Residents	-1.926	4.690	14.993***	3.285	14.007***	3.258
	Increase/Decrease of Medical Resident Quota (%)	-.081	.104	-.127**	.062	-.125**	.062
Characteristics of Different Types of Specialties	Legal Stipulation on Obligatory Employment	-1.053	3.442	-	-	-.184	10.094
	Training Subsidy	-	-	-	-	-	-
Increase/Decrease of Medical Specialist Quota (%)		0.302		0.773		0.201	

With regard to the results of the analysis of the medical resident enrollment rate model (with the key policy variables being health-insurance-covered medical expenses and medical fees), Table 10 presents the estimation results obtained using a model that includes the earnings from health-insurance-covered medical fees per medical specialist, excluding non-covered expenses, while Table 11 shows the estimation results from a model that includes relative value units and number of medical procedures that correspond to medical fees rather than the in-

come variable. In the fixed effects model, the relative value units appeared to influence the medical resident enrollment rate at a significance level of 10 percent. The elasticity of medical fees in the medical resident enrollment rate was found to be between 0.01334 and 0.18235. Meanwhile, the elasticity of the number of medical procedures was between -0.02958 and -0.02961.

〈Table 10〉 Estimation Results of Medical Resident Enrollment Rate Model (Key Policy Variable: Health-Insurance-Covered Medical Fees)

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		106.798***	6.176			105.854***	13.535
Income of Medical Specialists	Medical Fees Earned by Medical Specialists (ten thousand won)	.000083*	.000050	-.000037	.340	.0000042	.000033
Job Stability	Legal Stipulation on Obligatory Employment	4.857	3.083			3.065	6.675
	Subsidy for Medical Residents	-31.367***	3.895	-3.704	3.771	-5.898*	3.514
	Rate of Increase/ Decrease of Medical Resident Quota (%)	.208	.190	-.061	.095	-.033	.095
Characteristics of Different Types of Specialties	Level of Difficulty of Training and Medical Procedures	-4.887**	2.441			-11.176**	4.844
	Existence of Major Specialty	-2.675	4.179			17.539**	7.177
R Square		0.479		0.898		0.302	

〈Table 11〉 Estimation Results of Medical Resident Enrollment Rate Model (Key Policy Variable: Medical Fees and Number of Procedures)

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		106.765***	7.38222	-	-	101.229***	14.336
Medical Fees	Relative Value Units	.03105**	0.01474	.0647*	0.034	0.037	0.023
	Number of Procedures (per person)	.00012**	.00005	-.00019*	0.000	.000	.0001
Job Stability	Legal Stipulation on Obligatory Employment	5.333	3.27971			3.246	6.597
	Subsidy for Medical Residents	-30.051***	4.22347	-1.659	3.877	-7.247**	3.592
	Increase/Decrease of Medical Resident Quota (%)	0.183	0.18334	-0.051	0.098	-0.039	0.091
Characteristics of Different types of specialties	Level of Difficulty of Training and Medical Procedures	-7.648***	2.69376			-11.825**	4.873
	Existence of Major Specialty	-1.370	4.50828			20.329***	7.415
R Square		0.533		0.925		0.351	

3. Effects of key variables influencing medical resident enrollment rate

□ Expected income effect

The effect of expected income was estimated based largely on three variables. The first variable is monthly income. The medical resident enrollment rate differs according to the income earned by medical specialists in particular types of specialties, with the rate appearing to increase with income (See Table 4). However, when looking at the difference between

clinics and hospitals, a somewhat different pattern emerged. Although the income variable of medical specialists at hospitals had statistical significance, that of medical specialists at clinics did not (See Table 6). When the distinction was made between major clinical fields and other clinical fields, income appeared to have no significant influence in major fields, while it appeared to have a notable influence in other fields (See Tables 8 and 9). Therefore, the effect of the income of medical specialists in different types of specialties on the medical resident enrollment rate was found to be greater in supporting and minor types of specialties than in major specialties. These results point to the necessity of increasing the income of medical specialists in different types of specialties in order to reduce the imbalance in the medical resident application rates for different medical specialties. However, due to the rather modest influence of the variable, the implementation of a policy measure to achieve such an increase in income would likely have only a limited effect. According to the results of the fixed effects model in Model 1, an increase of KRW 1,000,000 in monthly income would raise the enrollment rate of medical specialists by 1.2 percentage points. This effect can be predicted based on income elasticity as well. The income elasticity of medical specialists was between 0.0377 and 0.09152, which is extremely low. Based on this, it was estimated that a one-percent increase in income would lead to an increase in the medical resident en-

rollment rate of between 0.0377 percent and 0.09152 percent. When differentiating between hospitals and clinics, the income elasticity of medical specialists at clinics was estimated to be between -0.02289 and 0.01782, while that of specialists at hospitals was estimated to be between 0.12410 and 0.12999, suggesting that the impact of income on the enrollment rate of medical residents was much larger for medical specialists at hospitals than for those at clinics. The income elasticity of the enrollment rate in major types of specialties was between -0.02900 and 0.01080, while that in supporting and minor fields was between 0.16258 and 0.22284, showing that the income elasticity was higher in minor fields than in major ones.

The second variable is medical consultation/treatment income I, i.e., the amount of medical fees per medical specialist in different types of specialties. This was used as one of the proxy variables representing expected income and appeared to have no statistical significance in either the fixed effects model or the random effects model. It also had no major impact on the enrollment rate of medical residents. This is because the amount of medical fees is not representative of the income of medical specialists in different types of specialties due to the exclusion of non-covered expenses and differences among fields in which consultations and treatments are provided and fields for which insurance claims are made, among others. The elasticity of the amount of medical fees in relation to the medi-

cal resident enrollment rate was between -0.03274 and -0.00489, which is not meaningful, because it is inelastic and in negative terms.

The third variable is medical consultation/treatment income II, which is composed of relative value units, conversion factor, and number of medical procedures. These are additional indicators that represent expected income. The conversion factor is not divided among the different types of specialties; it is divided only between hospitals and clinics. The model thus included only the variables of weighted relative value units in different types of specialties and the number of medical procedures per medical specialist. The relative value units included in the model were the weighted relative value units reflecting the number of medical procedures, which can be seen as the average price of medical service only, excluding the conversion factor in different types of specialties. Thus, high weighted relative value units represent high average medical fees, due to the great frequency of medical procedures with high relative value units. In the fixed effects model, the relative value units for medical fees were statistically significant at a level of 10 percent and appeared to have some influence on the enrollment rate of medical residents. Meanwhile, although the number of medical procedures, which represents the usage of medical services, was statistically significant at a level of 10 percent, it showed a negative correlation. That is, even if the en-

rollment rate of medical residents increased in types of specialties that involve a high frequency medical procedures with high relative value units, the number of medical procedures would have a negative impact. The reason being that the price of medical treatment tends to drop as the number of medical procedures provided increases. Thus, it seems that what affects the medical resident enrollment rate is not merely the frequency of medical procedures but the high relative value units as well, which leads to a high average price for medical services. Despite this impact of the relative value units, the elasticity of medical fees (relative value units), in relation to the medical resident enrollment rate, was estimated to be between 0.01334 and 0.18235, indicating inelasticity. In other words, for every one-percent increase in the relative value units, the medical resident enrollment rate would increase by between 0.01334 and 0.18235 percent. In addition, the elasticity of the number of medical procedures was estimated to be between -0.02958 and -0.02961.

□ Effect of payment of subsidy for medical specialists

The payment of medical specialist training subsidies, one of the variables representing the group effects of specific types of specialties, appeared to have an effect on the enrollment rate of medical specialists.[3] According to the estimation based on the model that did not differentiate between different income

levels of medical specialists, the enrollment rate of medical residents in fields not favored by applicants and are thus targets of medical specialist training subsidies appears to have increased by 6.37 percentage points (See Table 4). In the model in which the income of medical specialists was estimated based on the division between hospitals and clinics, the payment of medical specialist training subsidies showed an increase of 6.59 percentage points, which differs only marginally from the previous model (See Table 6).

However, in the model where the estimation was made based on the division between major types of specialties and supporting and minor types of specialties, some differences in the impact of the medical specialist training subsidy emerged. Although the effect of the training subsidy was not statistically significant in the fixed effects model, targeting major types of specialties, the effect was found to be greater in the analysis that targeted supporting and minor types of specialties, with the medical resident enrollment rate in fields receiving training

3) This impact shows different signs for the results of the pooled OLS and panel analysis. This is believed to be a result of the problems with the omitted variables that occur when the causes of the differences in the medical resident enrollment rates of different types of specialties are analyzed without controlling for the group effects of different fields. Thus, the results of the panel analysis are seen as more valid than the results of the pooled OLS model. Also, in the panel analysis method, as the medical specialist training subsidy is a policy measure that targets the types of specialties usually avoided by applicants, the results of the fixed effects model, which makes estimations based on the particular characteristics of each type of specialty, are judged to be more valid.

subsidies rising by 14.99 percentage points (See Tables 8 and 9). However, this effect is not attributable to the training subsidy alone; it also seems to be the result of the government's policy efforts to increase the enrollment rate of medical residents in such fields as thoracic surgery and obstetrics and gynecology, which include the training subsidy, reduction of the medical specialist quota, and additional medical fees,[4] which was not reflected in this report. The reduction of the medical specialist quota seems to have made a significant contribution to increasing the enrollment rate of medical residents.

□ Effect of the level of difficulty of training and medical consultations and treatments

The difficulty of training and medical treatments and consultations,[5] one of the variables representing the characteristics of different types of specialties, appears to have a significant impact on the enrollment rate of medical residents. Medical fields with difficult training processes that also involve medical treatments and consultations with high levels of diffi-

4) As of July 1, 2009, the government applied a medical fee that adds 100 percent of prescribed points for 201 types of medical treatments and surgeries in the field of thoracic surgery, which struggles with a low medical resident application rate, to resolve the shortage of medical manpower in the field. It also applied a 30-percent addition for 322 types of medical treatments and surgeries in the field of general surgery.

5) A survey was conducted of 26 societies of medical specialists regarding the level of difficulty of their training process and medical treatments and consultations based on a five-point Likert scale.

culty struggle with low medical resident enrollment rates. For every one-point increase in the score representing the difficulty of training and treatments and consultations, the enrollment rate is estimated to decrease by 10.523 percentage points. In the model that estimated the income of medical specialists by differentiating between hospitals and clinics, when the effect of the score representing the difficulty of training and medical treatments and consultations increased by one point, the medical resident enrollment rate dropped by 10.638 percentage points, differing only marginally from the model that did not distinguish between the incomes of medical specialists at hospitals and clinics. However, in the model that differentiated between major fields and supporting and minor fields, the difference in the effect of the difficulty of training and medical treatments and consultations was significant. According to the results of the random effects model targeting major fields, the effect of the variable representing the difficulty of training and medical treatments and consultations was statistically significant at -8.367. The results of the analysis targeting supporting and minor fields, however, showed the effect to be quite low, at -0.184, and not statistically significant.

□ Effect of increase/decrease of the medical specialist quota

The increase/decrease of the medical specialist quota, which was categorized as a variable representing the characteristics

of different types of specialties, appeared to have some impact on the enrollment rate of medical residents. In general, for every one-percent increase in the medical specialist quota, the enrollment rate decreased by 0.135 percentage points. This highlights the necessity of determining the appropriateness of the medical specialist quota and adjusting it to increase the medical resident enrollment rate. This tendency is consistent with the results of the model that distinguished between the incomes of medical specialists at clinics and hospitals, where every one-percent increase in the medical specialist quota caused a 0.138-percentage-point decrease in the enrollment rate. However, in the model where estimations were made by differentiating between major fields and supporting and minor fields, there was a difference in the statistical significance of the increase/decrease of the medical specialist quota (percent). Although the coefficient of the increase/decrease of the quota in the model that targeted only major types of specialties was not statistically significant, at 0.126, the coefficient in the model that targeted supporting and minor fields was statistically significant at -0.127. The increase/decrease of the medical specialist quota had no effect on the medical specialist quota in major fields. In other fields, however, a one-percent increase in the medical specialist quota led to a 0.127-percentage-point decrease in the medical resident enrollment rate.

□ Effect of job stability

One of the variables representing the characteristics of different types of specialties was whether a certain field belongs to a major clinical field. This variable appeared to have some influence on the medical resident enrollment rate. In the random effects model, the enrollment rate of major clinical fields was 31.855 percentage points higher than that of supporting and other fields. A similar tendency emerged in the model that distinguished between the incomes of medical specialists at clinics and hospitals. However, as a variable representing job stability, the existence of legal employment regulations appeared to have no notable effect.

□ Group effects of different types of specialties

In the panel analysis, the coefficient values of the group effects of different types of specialties estimated through the fixed effects model were all statistically significant, with the field of tuberculosis showing the lowest significance at 0.565 and plastic surgery showing the highest at 92.121. This produced a value of 9.565 for the explanatory power of the omitted variables representing the medical resident enrollment rate, which cannot be explained by independent variables, in the field of tuberculosis, while that of plastic surgery was much higher at 92.121. A high value signifies that the existing in-

dependent variables explain only a small part of the medical resident enrollment rate of a specific field, and that the impact of the unique group effects of the field on the enrollment rate is relatively large. The fields of plastic surgery, dermatology, and otolaryngology showed the highest values, indicating that some unique characteristics of these fields, which are not clearly understood, had a stronger impact than those of other fields. The estimated coefficient values were all positive, which suggests that group effects unobserved in most other types of specialties caused the increase in the enrollment rate. This also implies that the degree of influence of unique characteristics on the enrollment rate varies in each field and raises the need for a policy to manage the medical specialist quota based on the characteristics of different types of specialties. The existence of unique, unobserved characteristics in each field was confirmed with statistical significance (See Tables 5 and 7), which indicates that the medical resident enrollment rate features different aspects and patterns in different types of specialties.

〈Table 12〉 Effects of Key Variables Influencing the Medical Resident Enrollment Rate (Results of Fixed Effect Model)

Group		26 Specialties	Major Specialty	Subsidies and Other Specialties
Income (KRW 10,000)	All	.012***	0.004	.031***
	Clinics	0.0014	-	-
	Hospitals	.010*	-	-
Earnings from Medical Treatment I	Medical Fees per Specialist	-0.000037	-	-
Earnings from Medical Treatment II	Relative Value Units	0.0647*	-	-
	Number of Procedures	-00019*	-	-
Payment of Training Subsidy		6.370***	3.174	14.993***
Level of Difficulty of Training and Medical Procedures		-10.523**	-8.367***	-0.184
Increase/Decrease of Medical Specialty Quota (%)		-.136***	0.126	-.127**
Existence of Major Specialty		31.855***	-	-

Note: These estimation results are from the fixed effects model. However, the "Level of Difficulty of Training and Medical Procedures" is from the random effects model.

〈Table 13〉 Income Elasticity of the Medical Resident Enrollment Rate

Group		Income Elasticity of Enrollment Rate
Income (KRW 10,000)	All	0.0377 ~ 0.0915
	Clinics	-0.02289 ~ 0.01782
	Hospitals	0.1241 ~ 0.1299
Earnings from Medical Treatment I	Medical Fees Earned per Specialist	-0.03274 ~ -0.00489
Earnings from Medical Treatment II	Relative Value Units	0.01334 ~ 0.18235
	Number of Procedures	-0.02958 ~ -0.02961

4. Analysis of the medical specialist income model

The medical specialist income model involves the problem of endogeneity[6] and requires the estimation of medical specialists' income, which is a key factor that influences the enrollment rate of medical residents.[7] The results of the fixed effects model, presented in Table 14,[8] showed that the statistical significances of the relative value scale for medical fees and the number of medical procedures, which determine the income of medical specialists, were extremely low. For every one-point increase in the weighted relative value units, medical specialist income rose by KRW 5,280, and for every additional medical procedure conducted, income increased by KRW 10.

The elasticity of medical fees in relation to medical specialist income (relative value units) was extremely low at 0.13490

6) In the model, medical specialist income was estimated using instrumental variables, due to the problem of endogeneity. However, it was not possible to prove that the medical specialist income variable possessed endogeneity through the Durbin-Wu-Hausman Test, and thus it was treated as an exogenous variable. This is believed to be because medical specialist income is part of a larger group of data for a certain type of specialty and does not directly represent personal income, as well as due to the lack of appropriate instrumental variables included in the model.

7) In particular, to increase medical specialist income, which is a policy variable, it is necessary to increase medical service usage or medical fees. Although medical service usage cannot be increased through policy, it is possible to adjust the medical fees. Thus, this study aims to discover to what extent medical fees can influence medical specialist income.

8) In the pooled OLS and panel analysis, the results of the fixed effects model and random effects model showed that the panel analysis was more valid. In the panel analysis, the fixed effects model was found to be more appropriate than the random effects model, because the null hypothesis was rejected based on the results of the Hausman test.

(fixed effects model) and 0.11513 (random effects model), while the elasticity of the number of medical procedures per medical specialist was 2.6 times higher than that of medical fees, at 0.05199, in the fixed effects model and 4.6 times higher, at 0.02517, in the random effects model. This indicates that the effects of the relative value units and medical fees on medical specialist income was greater than that of medical service usage (See Table 15).

〈Table 14〉 Results of Income Model

Variable		Pooled OLS		One Way Model			
				Fixed Effects Model		Random Effects Model	
		Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
(Constant)		-2079.68**	798.70			1766.61**	827.69
Medical Fees	Relative Value Units	.390***	0.133	0.528	0.366	.377**	0.191
	Number of Procedures (per person)	.00115***	0.000	0.001	0.001	.001**	0.001
Service Types of Different Medical Organizations	Proportion of General Hospitals	27.896***	7.966	-15.597	11.556	-11.156	8.353
	Proportion of Hospitals	34.548***	8.066	-9.450	11.396	-2.674	8.503
	Proportion of Clinics	25.753***	7.992	-42.567***	10.364	-13.574	8.349
Uninsured	Proportion of Uninsured	4.488***	1.230	0.201	1.224	1.517	1.076
R Square		0.461		0.831		0.321	
Fixed vs. Random Effects (Hausman)				42.22			
P-value				.000			

〈Table 15〉 Relative Value Units of Income of Medical Specialists and Elasticity of Number of Procedures

Variable		Income of Medical Specialists and Elasticity of Number of Procedures
Earnings from Medical Treatment II	Relative Value Units	0.13490 ~ 0.11513
	Number of Procedures	0.05199 ~ 0.02517

5. Group-specific effects and preference index for different types of specialties

□ Group effects of different types of specialties

The group-effect coefficient for each type of specialty is presented in Tables 16 and 17. The group-specific effect of a certain field[9] represents the characteristics of the field that influence the medical resident enrollment rate. It indicates the degree of influence of the unobserved omitted variables that affect both the dependent and independent variables included in the model. Moreover, the coefficient of the group-specific effect quantifies the characteristics of each type of specialty.

The group-specific coefficient represents the unique characteristics of each type of specialty that affect the medical resi-

9) There is a wide range of factors that influence the medical resident enrollment rate, and as some cannot be measured at all or are difficult to measure accurately, it is impossible to measure all the variables correctly and reflect them in the model. In the panel analysis reflecting this problem, the unobserved, omitted variables were considered in order to better estimate the coefficients. In other words, in the fixed effects model of the panel analysis, group-specific coefficients of different types of specialties can be estimated using error term decomposition.

dent enrollment rate. The value of the coefficient differs among the different fields, with a high value indicating a greater influence of the unobserved variables among the factors preferred by medical specialty applicants.

Therefore, to reduce the imbalance of the medical resident enrollment rate, it is necessary to adjust the level of preference for different types of specialties based on a weighted average and develop a policy for the management of the supply of and demand for medical specialists based on the characteristics of different fields.

□ Medical specialist preference index for different types of specialties

Concerning the medical specialist preference index for different types of specialties (or the attractiveness index for different fields), fields with index values lower than the average group-specific coefficient value are considered to have low preference, and these values need to be adjusted based on a weighted average. The preference for each type of specialty (R) is calculated as follows: $R_i = \frac{X_i}{Xa}(i = 1,2,\cdots,26)$. Here, Xa is the average value of the estimated fixed effects of different specialties.

Tables 13 and 14 show the preference index for different specialties calculated using the group-specific coefficient of

each specialty. When Ri〈1, the medical resident enrollment rate based on the characteristics of a certain field will be less than the overall average. Thus, the imbalance of the medical resident enrollment rate can be addressed by increasing the enrollment rate based on the unique characteristics of each field, bringing it closer to the average level. Types of specialties in which Ri≤1 are at a relative disadvantage compared to other fields in terms of the medical resident enrollment rate.

〈Table 16〉 Coefficient of Unique Characteristics of each Specialty and Preference Index

Group		Model I (Applying Average Income)		Model II (Differentiating between Income of Hospitals and Clinics)	
		Coefficient of Unique Characteristics	Preference Index	Coefficient of Unique Characteristics	Preference Index
1	Internal Medicine	85.805	1.22	86.347	1.23
2	Pediatrics	83.437	1.19	83.642	1.19
3	Neurology	89.257	1.27	89.658	1.27
4	Psychiatry	88.389	1.26	88.833	1.26
5	Dermatology	91.979	1.31	92.707	1.32
6	Surgery	61.228	0.87	61.506	0.87
7	Cardiothoracic Surgery	34.555	0.49	34.600	0.49
8	Orthopaedic Surgery	88.193	1.26	88.468	1.26
9	Neurosurgery	86.819	1.24	87.339	1.24
10	Plastic Surgery	92.121	1.31	92.569	1.31
11	Obstetrics and Gynecology	61.075	0.87	61.280	0.87
12	Ophthalmology	90.341	1.29	91.303	1.30
13	Otolaryngology	91.574	1.31	91.677	1.30
14	Urology	77.889	1.11	78.033	1.11

Group		Model I (Applying Average Income)		Model II (Differentiating between Income of Hospitals and Clinics)	
		Coefficient of Unique Characteristics	Preference Index	Coefficient of Unique Characteristics	Preference Index
15	Tuberculosis Treatment	9.565	0.14	9.065	0.13
16	Rehabilitation Medicine	90.739	1.29	90.983	1.29
17	Anaesthesia	82.501	1.18	82.895	1.18
18	Diagnostic Radiology	70.016	1.00	70.531	1.00
19	Radiation Oncology	51.650	0.74	52.065	0.74
20	Laboratory Medicine	51.657	0.74	51.976	0.74
21	Pathology	39.169	0.56	39.510	0.56
22	Family Medicine	82.241	1.17	82.239	1.17
23	Emergency Medicine	65.954	0.94	66.155	0.94
24	Nuclear Medicine	68.174	0.97	68.946	0.98
25	Industrial Medicine	67.267	0.96	67.367	0.96
26	Preventive Medicine	22.654	0.32	22.629	0.32
Average		70.163	1.00	70.474	1.00

〈Table 17〉 Coefficients of Unique Characteristics and Preference Index of Different Specialties (Differentiating Between Major Specialties, Subsidy, and Other Specialties)

Group	Major Specialties			Group	Subsidy and Other Specialties		
	Specialty	Coefficient of Unique Characteristics	Preference Index		Specialty	Coefficient of Unique Characteristics	Preference Index
1	Internal Medicine	98.125	1.06	15	Tuberculosis Treatment	-8.357	-0.24
2	Pediatrics	94.749	1.03	17	Anaesthesia	72.833	2.07
3	Neurology	97.22	1.05	18	Diagnostic Radiology	51.633	1.47
4	Psychiatry	99.087	1.07	19	Radiation Oncology	31.229	0.89
5	Dermatology	99.243	1.08	20	Laboratory Medicine	36.055	1.02
6	Surgery	81.319	0.88	21	Pathology	23.575	0.67
7	Cardiothoracic Surgery	60.568	0.66	23	Emergency Medicine	44.533	1.26
8	Orthopaedic Surgery	97.993	1.06	24	Nuclear Medicine	49.52	1.41
9	Neurosurgery	97.405	1.06	25	Industrial Medicine	47.504	1.35
10	Plastic Surgery	98.438	1.07	26	Preventive Medicine	3.554	0.10
11	Obstetrics and Gynecology	84.039	0.91				
12	Ophthalmology	99.065	1.07				
13	Otolaryngology	98.227	1.07				
14	Urology	84.002	0.91				
16	Rehabilitation Medicine	97.874	1.06				
22	Family Medicine	88.258	0.96				
Average		92.226	1.00	Average		35.208	1.00

V

Policy Implications

V Policy Implications

□ Policy direction I: Leveling-off of the preference for different types of specialties[10)]

The concentration of applications in certain types of specialties, which has led to the imbalance in the medical resident enrollment rate, can be partly explained by models based on medical specialist income, job stability, and the characteristics of each field. It is also partly attributed to the unique characteristics of different fields that are not explained by these models. Therefore, it is necessary to take steps to reduce the inequity of the group effects of different fields, while maintaining appropriate medical specialist quotas for each field. In relation to this, the appropriateness of the medical specialist quotas in types of specialties with low enrollment rates, which are especially problematic, needs to be considered.

There are policy means that can be used to increase the enrollment rate by adding a certain percentage to the medical fees or using policy variables to standardize the preference indices for fields with a preference index—calculated based on

10) Application of the preference standardization measure to different fields is limited, because the medical specialist quota in each field is influenced more by hospitals' demand for medical specialists than by public demand, and is thus distorted.

the group-specific effects of each field—lower than one that have been found to have an appropriate medical specialist quota. Concerning policy means for reducing the influence of the group-specific effects of different fields, policy variables such as the income variable, level of difficulty of training and treatments and consultations, and adjustment of the medical specialist quota can be applied. Also, means of stabilizing legal employment can be considered for the purpose of enhancing job stability based on the characteristics of the different types of specialties. It is necessary to increase medical fees in order to raise the income of medical specialists. However, as the elasticity of medical fees in relation to income is low, this measure is expected to have only limited success in increasing medical specialist income through medical fees. Another way to increase income is to control the number of medical specialists according to an appropriate scale. If there are too many medical specialists in one particular field, it is only natural that the income per medical specialist will fall due to the limitation of the overall amount of medical service usage.

□ Policy direction II: Regional concentration of medical specialists and possible means of resolving the distortion of medical specialist manpower

The shortage of medical specialists in some types of specialties due to the fall of the medical resident enrollment rate

should be approached by first differentiating between metropolitan and non-metropolitan areas. Notably, the shortage of medical specialists is more serious in non-metropolitan areas, which is seen to have low correlation with the medical resident enrollment rate. Therefore, the systematic coordination of various systems related to health insurance and medical policies is needed to resolve the problems of the regional concentration of medical specialists and the distortion of medical specialist manpower. Although there could be many solutions to these problems, this study proposes three policy measures. The first is the introduction of the regional markup system for health insurance related to essential medical services that are in low demand and uneconomical. The second is a measure for decreasing the regional imbalance by supporting the personnel expenses of medical specialists at private hospitals that provide essential medical services that are in low demand and uneconomical. Finally, the third is a measure through which the government establishes local clinics (health centers) to be run by the private sector and provides basic operating expenses.

□ Policy direction III: Appropriate management of types of specialties that provide essential medical services under the government's supply and demand plan

One of the reasons behind the fall of the medical resident enrollment rate not explained by the models, the medical spe-

cialist quota in Korea is influenced by the demand for medical specialists by hospitals rather than public demand. For this reason, the current quota of medical specialists fails to satisfy the needs of the public.

Accordingly, the medical specialist quota has become distorted, largely due to market manpower distortion caused by the control of market manpower demand. As medical specialists are not being produced at a rate high enough to satisfy the needs of the market, it is inevitable that the income gap will widen and the application rates for relevant fields will grow.

Therefore, medical fees should first be adjusted to an appropriate level that enables optimum medical care by the best possible medical specialists. Moreover, it is necessary to set the medical specialist quota based on demand estimates for each type of specialty, in consideration of the supply of medical specialists, as well as on the overall medical specialist demand forecast. In the future, if the data needed to estimate the supply of and demand for medical specialists in different types of specialties become available, it will be possible, and necessary, to increase the medical specialist quota in fields with high market demand, allowing the surplus medical manpower to develop and grow into medical specialists that the market needs, and estimate the number of essential medical specialists at the national level.

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