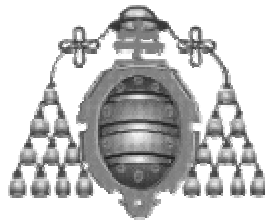**<u>UNIVERSITY OF OVIEDO</u>**

The Specialized Medical Formation in Spain: Dynamic Analysis

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February, 2001

1. INTRODUCTION

This work analyses, from a dynamic perspective, the current policies used in the allocation of specialized medical training vacancies. This work deals with the MIR[1] vacancies within the Spanish Health System. The significance of this study is stemmed from the political and social concerns caused by the implementation of the 1995 EU Regulations. Under these regulations all graduates have to obtain a specialized medical training qualification in order to practice in the Spanish Public Health System or in any other EU Member State. This has led to a steady increase in the number of MIR vacancies.

The end result of this fact is to guarantee specialized placement to medical graduates. However, this is causing instability within the Spanish Health System, as the number of allocated places considerably exceeds the actual training needs. This is creating an ever-increasing pool of specialized doctors, which has caused an imbalance between employment and training, therefore creating inefficiency within the system.

The further development of a simulated model, which uses dynamic system as methodology, has revealed the reasons why the observed behaviors of the subject have improved. This lead to an understanding of the system, it also contributes to an improvement in the management of the process of allocating vacancies.

This model has been expanded by revising the existing literature related to this topic. Further information has been gathered through in-depth interviews with people who provide services in the Spanish Health System. These interviewees are involved in, or have considerable knowledge of the current problems in the system.

Furthermore, there is a vast amount of legislation dealing with specialized medical training in Spain. This legislation has been extensively researched along with the examination of press coverage about this controversial subject throughout the last few years.

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[1] House physicians (intern).

This problem has been analyzed by using Agency Theory as a background by emphasizing individual behavior as a maximizer of its utility and the important existence of a conflict of interests related to the process of allocating vacancies. Pertaining to this theoretical framework and the information obtained by the previously mentioned forms, a simulation model has been created.

According to this model and by putting into a series of validation tests, especially the structural validation test and the test of statistical behavior, the sensitivity of the system can be analyzed according to the established principle and boundaries. This system allows one to detect the most important points of leverage so that improvements can be made in the evolution of the system.

Likewise, by analyzing the effects of the currently employed policies and by observing their impact on the system, a series of alternative policies that might improve the system are suggested.

The obtained results of the simulation endorse the central hypothesis that the policies of allocation of vacancies are a result of the opportunistic behavior of the agents who intervene in the allocation process. This advocates a necessity to implement a change in the current policies. However these changes tend to destabilize the system and create an untenable situation over a long period of time. Likewise, this shows the inefficiency of using support mechanisms whose effect is limited in the short term.

2. DYNAMIC ANALYSIS

With the purpose of analyzing the effects in the short, half and long term on the current allocation MIR vacancies a projection of the number of physicians by specialties during the next years[2] has been carried out. Thereby, it has been elaborated a simulation model, that generates, for every year and for each one of the considered specialties, the number of physicians.

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[2] Period of simulation: 2000-2020.

The simulation has been carried out for a scenario like the current one. That is to say, supposing; (1) that the *numerus clausus*[3] stays in similar levels to the current ones, (2) a supply of MIR vacancies equal to the mean of the last five years and, (3) the age of mandatory retirement stays at the seventy years old.

Starting from the results obtained in the simulation —Chart 1—, it can be concluded that for a scenario like the current one, and if the allocation process stays in the line of the allocations carried out in the previous years, the surplus of specialized doctors will be growing during next years. It is due to the existence of an important imbalance between the entrances and the exits in the system; which are determined, given the tendency of the system to be saturated, fundamentally by retirements that take place.

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[3] Restricted system of entry to University.

	2000	2005	2010	2015	2020
Allergology	—	44.98 %	84.00 %	117.91 %	149.25 %
Morbid anatomy and histopathology	—	22.57 %	44.35 %	54.85 %	55.41 %
Anesthetics	—	28.71 %	50.78 %	62.49 %	63.95 %
Angiology and vascular surgery	—	54.32 %	101.92 %	148.55 %	171.15 %
Gastroenterology	—	28.50 %	53.30 %	68.48 %	73.15 %
Cardio–vascular diseases	—	34.83 %	61.84 %	72.26 %	83.41 %
Cardio–vascular surgery	—	22.05 %	36.02 %	41.17 %	33.08 %
General surgery	—	14.56 %	28.36 %	33.59 %	22.65 %
Oral and maxillae–facial surgery	—	60.89 %	110.39 %	153.46 %	191.08 %
Pediatric surgery	—	14.53 %	22.67 %	22.09 %	-1.74 %
Thoracic surgery	—	39.47 %	72.36 %	93.42 %	101.31 %
Plastic surgery	—	39.16 %	68.61 %	89.44 %	98.33 %
Dermatology	—	32.67 %	59.54 %	78.77 %	86.71 %
Endocrinology and diabetes mellitus	—	20.46 %	37.62 %	48.53 %	53.99 %
Clinical pharmacology and therapeutics	—	45.83 %	84.89 %	122.39 %	144.27 %
Geriatrics	—	63.77 %	120.37 %	170.94 %	211.32 %
Hematology	—	20.89 %	37.82 %	43.99 %	34.90 %
Intensive care medicine	—	49.00 %	93.71 %	126.59 %	133.19 %
General medicine	—	42.12 %	60.77 %	70.22 %	60.96 %
Nuclear medicine	—	37.93 %	75.51 %	106.55 %	125.51 %
Preventive medicine	—	43.89 %	81.36 %	115.32 %	138.09 %
Renal diseases	—	27.08 %	51.51 %	64.01 %	57.00 %
Respiratory medicine	—	21.54 %	43.09 %	58.24 %	62.28 %
Neurological surgery	—	35.75 %	63.12 %	74.86 %	66.48 %
Clinical neurophysiology	—	54.11 %	103.48%	139.55 %	156.64 %
Neurology	—	39.27 %	75.55 %	103.12 %	120.02 %
Obstetrics and gynecology	—	29.53 %	52.97 %	68.04 %	72.89 %
Ophthalmology	—	21.23 %	41.89 %	56.07 %	55.85 %
Medical oncology	—	60.83 %	118.71 %	169.21 %	210.34 %
Radiotherapy	—	33.23 %	69.81 %	98.47 %	122.86 %
Otolaryngology	—	19.90 %	38.84 %	50.82 %	48.98 %
Pediatrics	—	15.78 %	29.66 %	38.03 %	37.54 %
Psychiatry	—	33.86 %	61.68 %	79.37 %	89.10 %
Diagnostic radiology	—	25.09 %	48.26 %	63.10 %	65.76 %
Rehabilitation	—	35.11 %	64.04 %	85.00 %	91.78 %
Rheumatology	—	28.03 %	51.96 %	68.88 %	74.18 %
Orthopedic surgery	—	33.33 %	60.51 %	77.40 %	79.18 %
Urology	—	22.22 %	44.44 %	58.64 %	55.41 %
Community medicine (primary care medicine)	—	7.67 %	15.00 %	20.43 %	17.40 %
Estomatology	—	-5.17 %	-9.49 %	-15.18 %	-26.07 %
Hydrology	—	38.73 %	72.52 %	104.95 %	129.27 %
Physical education medicine	—	29.95 %	56.08 %	81.94 %	104.78 %
Legal medicine	—	31.92 %	58.07 %	83.46 %	97.30 %

CHART 1. EVOLUTION OF THE NUMBER OF PHYSICIANS FOR NEXT YEARS AND BY

SPECIALTIES

Percentages accumulated about initial value

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It has their reason, if it is observed the current distribution of physicians —Charter 2—, by age groups and by the different specialties. Most of the physicians are in ages between 36 and 50 years old. This is why the current age of specialized doctors that are employed will determine the distribution in the future of the entire group of professionals, and it will stop in next years the access to the labor market to new specialized doctors.

Obviously, it will depend on each specialty, those specialties with younger physicians will have little capacity of access, and while in the specialties that have more personal in the older groups the situation will be the opposite one.

According to the results obtained in the simulation, it is concluded that certain specialties will have imbalance problems by surplus, as in the case of Oral and Maxillae–Facial Surgery, Geriatrics or Medical Oncology, among others. However, other specialties will be unbalanced by shortage, as Pediatric Surgery or Estomatology. The results are agreed with those obtained by other authors, as well as with the predictions made by some of the interviewed[4] experts.

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[4] It should be indicated that this study could be adjusted to carry out the analysis in other countries.

ESPECIALIDAD	26 a 30	31 a 35	36 a 40	41 a 45	46 a 50	51 a 55	56 a 60	61 a 65	> 65
Allergology	0	8,9	46,7	25,3	7,1	6,2	3,6	1,8	0,4
Morbid anatomy and histopathology	0	3	24	26,6	21,9	16,7	5,8	1,3	0,7
Anesthetics	0	3,6	18,5	20,5	24	18,5	7,7	4,6	2,6
Angiology and vascular surgery	0	2,1	32,6	23,2	27,4	4,2	2,1	5,3	3,1
Gastroenterology	0	6,6	15,6	20,3	23,8	18	7,2	4,8	3,7
Bioquímica Clínica	0	5,9	47,9	35,3	4,2	5	1,7	0	0
Cardio–vascular diseases	0	1,2	9,2	22,1	28,8	18,3	10,1	5,7	4,6
Cardio–vascular surgery	0	1	10,3	16,5	28,9	18,6	13,4	6,2	5,1
General surgery	0,1	1,6	13,2	26,2	28,7	16,2	6,2	4,4	3,4
Oral and maxillae–facial surgery	0	2,5	32,5	28,8	12,5	11,3	7,5	3,7	1,2
Pediatric surgery	0	1,5	12,4	21,2	36,5	14,6	9,5	2,2	2,1
Thoracic surgery	0	4,1	16,3	24,5	24,5	18,3	4,1	4,1	4,1
Plastic surgery	0	4,1	26,5	19,4	24	14,8	7,7	3,1	0,4
Dermatology	0	5,8	23,4	26,9	21,1	12,8	5,3	2,7	2
Endocrinology and diabetes mellitus	0	6,6	20,5	25,4	16,7	14,4	6,9	6,1	3,4
Clinical pharmacology and therapeutics	0	10,8	39,8	25,8	19,4	0	2,1	2,1	0
Geriatrics	0	13,9	29,1	24,1	15,2	7,6	2,5	2,5	5,1
Hematology	0,3	5,6	21,5	13,3	30,1	17	9,1	2,3	0,8
Intensive care medicine	0	4,1	12,7	24,8	38,2	15,9	3,3	0,5	0,5
General medicine	0	2,2	31,9	37,8	17	8,1	1,5	1,5	0
Preventive medicine	0	7,4	40,3	24	15,9	4,7	4,7	1,5	1,5
Renal diseases	0	5,2	24,4	19,2	31,1	16,5	3,6	0	0
Respiratory medicine	0,2	5,2	21,5	23,8	21,3	13,1	5,5	5,5	3,9
Neurological surgery	0	0	8,6	12,9	37,9	25	5,2	6	4,4
Clinical neurophysiology	0	4,3	17,9	16,2	33,3	19,7	5,1	2,6	0,9
Neurology	0,5	8,5	23,3	22,3	21,3	12,8	7,7	1,3	2,3
Obstetrics and gynecology	0	3,7	15,3	21,3	24,2	16,4	10,4	5,2	3,5
Ophthalmology	0	6	26,8	21,6	23,4	11,6	4,8	3,3	2,5
Medical oncdogy	0	13,2	34,9	24,8	14,7	9,3	3,1	0	0
Radiotherapy	0	9,3	31,3	33,3	10,7	10,7	3,3	0,7	0,7
Otolaryngology	0	3,2	20,1	27,7	23,9	13	5,6	4,6	1,9
Pediatrics	0	4,2	14,1	19,8	21,9	15,3	9,6	8	7,1
Psychiatry	0,1	4,7	21,8	21,5	20,9	18,1	7	4,3	1,6
Diagnostic radiology	0	4,9	27,1	26,2	21,4	12,6	4,8	1,7	1,3
Rehabilitation	0	3,4	26,6	23,9	24,9	12,8	5,5	2,3	0,6
Rheumatology	0	4	29	25,5	20,7	12,1	4,3	2,7	1,7
Orthopedic surgery	0	1,6	13,4	21,7	29,5	17,9	8,5	4,4	3
Urology	0	1,3	18,1	28,2	27,4	13,9	4	3,4	3,7
Community medicine(primary care medicine)	0,5	16,9	28,9	35,8	11	3,3	1,4	1,1	1,1
Estomatology	0	1,1	31,1	43,4	11,8	5,3	3,1	2,7	1,5
Hydrology	0	6,4	45,7	35,1	10,6	1,1	0	0	1,1
Physical education medicine	0	7,8	57,1	29,1	3,1	0,7	0,4	0,2	1,6
Legal medicine	0	2,8	42,7	35,7	12,6	2,8	0,7	2,1	0,6

CHART 2. SPECIALTIES FOR GROUPS OF AGE

(CESM , 1999)

In view of the results that have been obtained on this first analysis, it can be affirmed that the current allocation policies will harm, even more, the future situation of the medical community (Hypothesis_1, Hypothesis_2) —Graph 1—. So, in order to reduce the imbalance, it is studied the effect that would have on the system several alternative policies of allocation.

In short the answer of the system was analyzed under three alternative policies of allocation —according to the social necessities, formative necessities, or forecast—.

Regarding the allocation of MIR vacancies according to the social necessities (Hypothesis_3), although intuitively, seems a reasonable and appropriate measure of allocation. However, it is demonstrated that this policy generates an oscillatory behavior in the specialized doctors' "gap[5]" —Graph 2—. The specialized doctors' "bag" is increased and it only begins to decrease when a bigger discharge of the system takes place for retirements. Although this bag is improved in the starting moments of the simulation the "gap" oscillates for surplus and shortage; because this policy instead of keeping in mind the existing formative delays, it only takes in account the immediate necessities.

Similar result is obtained using an allocation policy according to the formative necessities of the system (Hypothesis_4). These policies consist on determining the formative necessities, according to the social necessities of the system and of the specialized doctors' "bag". The results show an oscillatory behavior in the "gap" —Graph 3—, although it contributes to reduce the specialized doctors' bag faster that in the previous case.
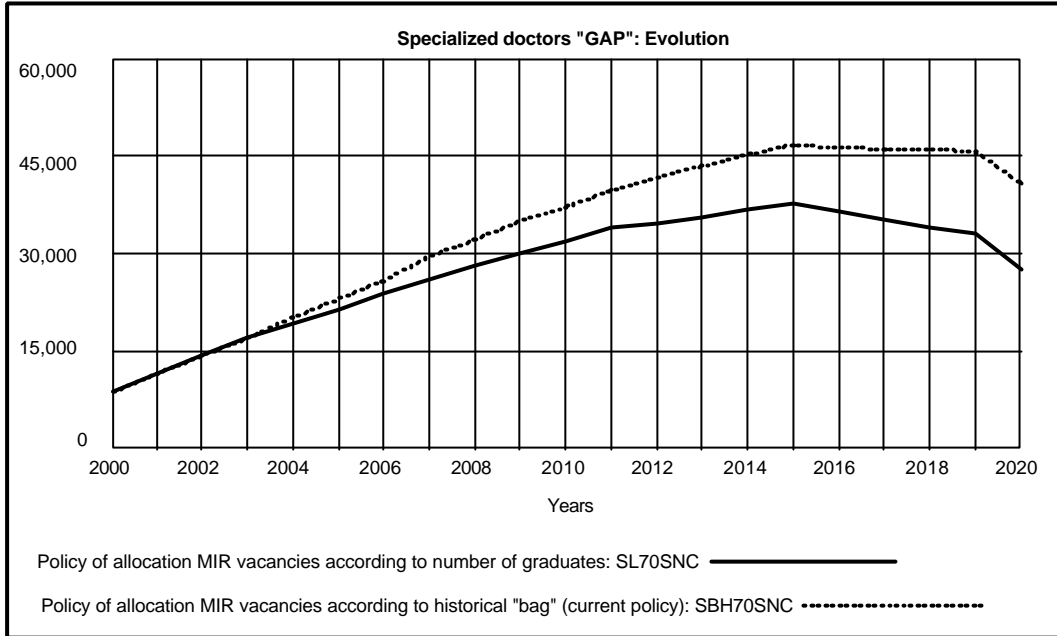
Finally, the impact on the system of an allocation policy based on a control of the delays (Hypothesis_5) is analyzed, allocating according a forecast of the social necessities. The obtained results show that a policy of this type improves the system and eliminates the imbalances of the "gap" —Graph 4—. That is to say, the system spreads to be balanced, eliminating the specialized doctors' "bag" and the "gap". The historical bag also decreases in the long term; nevertheless, the necessity of cutting the MIR vacancies during next
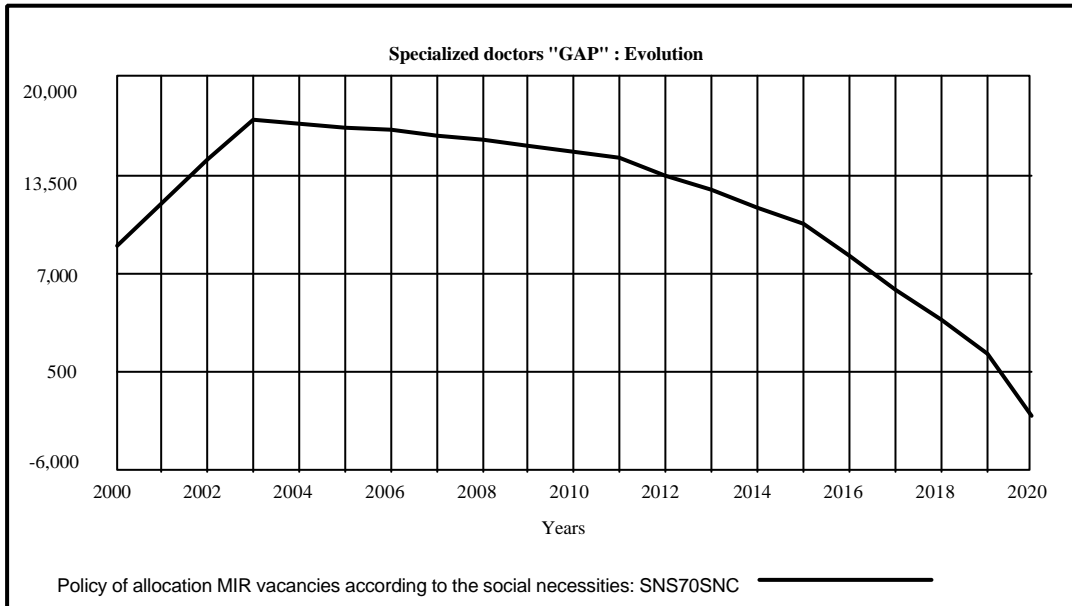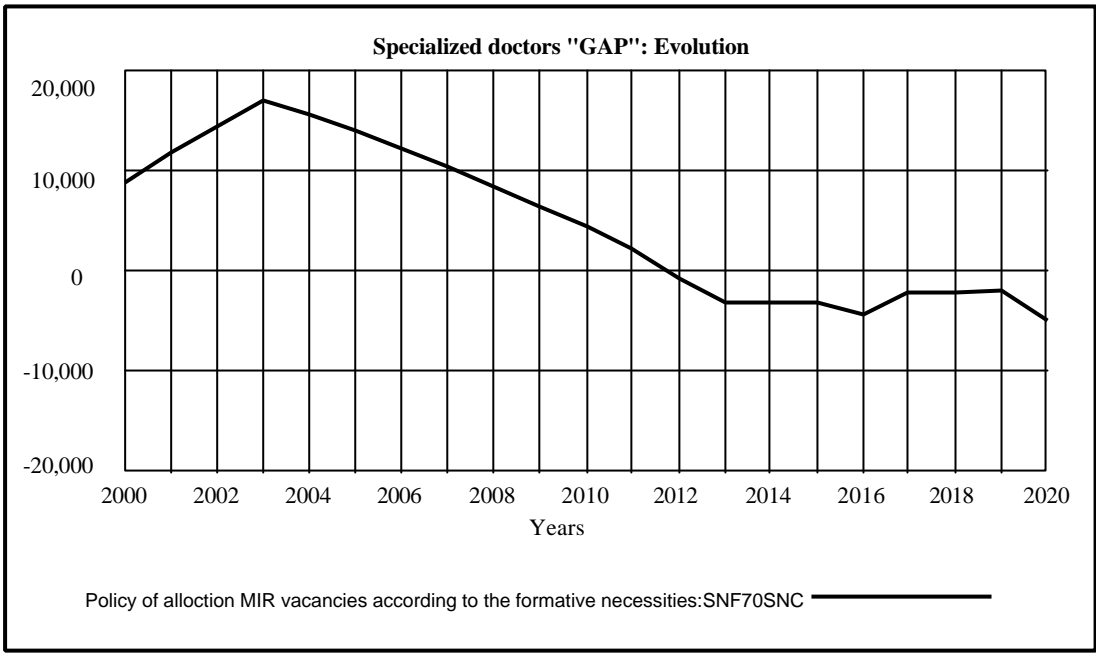
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[5] Imbalances among supply and demand.

years will suppose an increment in itself; unless they take the appropriate decisions at the undergraduate levels —more restrictive *numerus clausus*—.
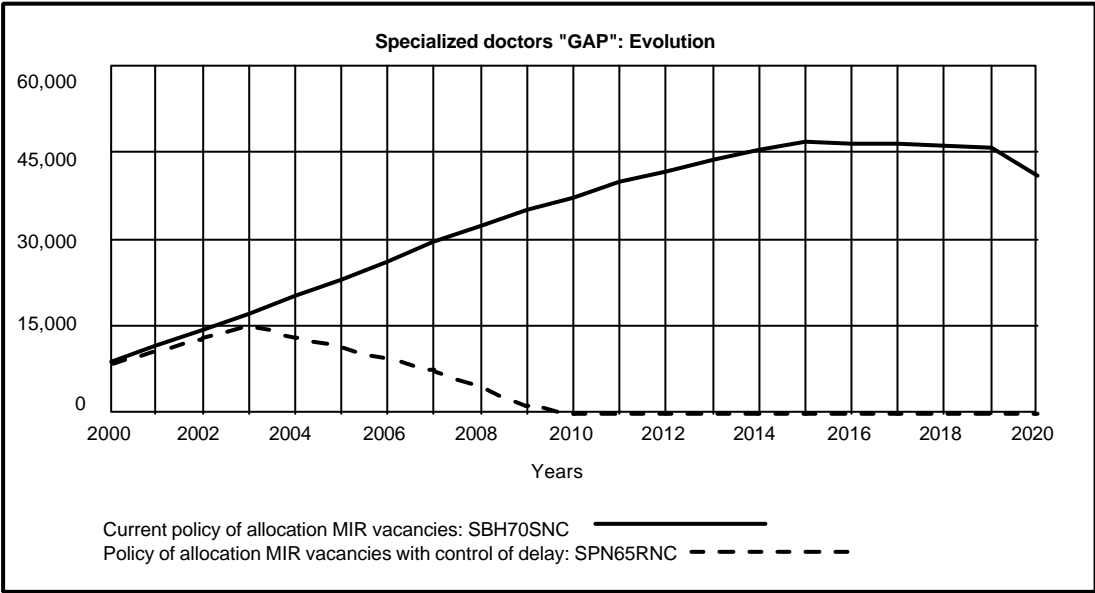

GRAPH 1. EVOLUTION OF SPECIALIZED DOCTORS "GAP" (HYPOTHESIS_1, HYPOTHESIS_2)

GRAPH 2. EVOLUTION OF SPECIALIZED DOCTORS "GAP" (HYPOTHESIS_3)

Specialized doctors "GAP": Evolution

Policy of alloction MIR vacancies according to the formative necessities:SNF70SNC

GRAPH 3. EVOLUTION OF SPECIALIZED DOCTORS "GAP" (HYPOTHESIS_4)

Specialized doctors "GAP": Evolution

Current policy of allocation MIR vacancies: SBH70SNC
Policy of allocation MIR vacancies with control of delay: SPN65RNC

GRAPH 4. EVOLUTION OF SPECIALIZED DOCTORS "GAP" (HYPOTHESIS_5)

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