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Research Article

Physician Workforce Planning in Israel-Analysis of the Entry Point to Residency

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Abstract

Background: The Israeli health care system suffers from lack of future medical planning. This work focuses on the trajectory of the beginning of residency. From the moment of receiving the medical license until the beginning of residency, many months often pass. The objectives of this study were to characterize the time period from the end of internship to the beginning of residency and suggest ways of improving it. **Method:** Retrospective cohort study and cross-sectional studies were performed. Data from the Ministry of Health regarding the receipt of the medical license was cross-referenced with data from the Israeli Medical Association regarding the beginning of residency. **Results:** Data on 1,065 physicians who received their medical license in 2014/16 and started residency was included in this study. For all physicians, the average waiting time for residency was 108.61 days. Doctors who studied in Israel waited less (107.60 days) than those who studied abroad (107.6 Vs 132.95 days, $p<0.01$). Two hundred and forty-two doctors answered the questionnaire. No statistically significant relationship was found between gender, age, hospital location and waiting time for residency. **Conclusion:** One of the milestones in the medical training process is entering residency. The entry process in Israel is not properly controlled and is often very delayed. This work focuses on this period of time and offers ways of streamlining.

Keywords: Health workforce; Residency; Physician manpower planning; Resident; Medical intern

Introduction

Much has been written about the problems involved in adapting the number of doctors in Israel to the changing needs of its healthcare system. Population growth, aging, changes in morbidity patterns, technological and scientific developments, an increase in the number of retiring physicians, the decline in the number of immigrant physicians, and inherent shortcomings in the training frameworks for physicians in medical schools are some of the problems affecting the medical manpower needed by the health system [1]. Planning for the medical reserve in Israel is a flawed process and has already been discussed in a number of committees. These committees addressed temporary issues concerning the medical workforce but did not discuss creating a future plan for the training of physicians or alternatively, creating a model that predicts the workforce according to the needs of the population. Personnel planning is a difficult task as it is based on assessing various factors and there is usually uncertainty of future trends that can affect the patterns of demand for health services and for physicians [1]. The main obstacles in medical personnel planning are poor prioritizing, lack of continuous policy, poor management of resources, lack of future planning and deficient knowledge needed for planning, and unforeseen circumstances [2].

Admission to residency is conditional on a number of factors, it is open-ended and can last from weeks to months. Reducing this waiting period can speed up the medical training process in Israel and avoid unwanted delays.

According to data from the Ministry of Health [3], in 2014, 1,184 new medical licenses were issued (an increase from 721 in 2010). There was also an increase in the number of residents. There were 1188 physicians who started their residency in 2014,

compared to 921 residents in 2010. In 2015, the number of medical licenses increased to 1259, and the number of residents who began residency in 2015 increased to 1250 [4]. This upward trend, which continued to 2016 as well, is due to the conclusions of a committee established by the Ministry of Health in 2010 and the implementation of its conclusions. Applying its conclusions halted the expected decline in the number of physicians, and indeed in 2016 there has been a moderate increase compared to 2010.

The main objective of this study was to measure the length of time from obtaining a medical license to the beginning of residency, and comparing it between the years 2014 and 2016 in Israel. This period of time was examined and characterized in terms of the various factors that might affect it. It is assumed that this time frame is a current weakness in the Israeli medical training process and it can be optimized as part of planning an Israeli medical future reserve.

Methods

This is a retrospective cohort study combined with a cross-sectional study in the form of a questionnaire. The study included all participants who met the following criteria: physicians who received their medical license from the state of Israel in 2014 and 2016, and began their residency during the same years. The study did not include participants who received their medical license in 2014 or 2016 but did not begin their residency in this period of time.

Retrospective cohort study-data was collected from two sources and cross-referenced: data regarding the issuance of the medical licenses was collected from the Ministry of Health (MOH) while data regarding the beginning of residency (marked by the opening of a residency log-book) was collected from the Israeli Medical Association (IMA). In this discreet way, data was collected without revealing the identity of the participants. The start time of the study was set as 1.1.2014 and the end time of the study was set as 31.12.2016.

Cross-sectional study- questionnaires were distributed to 242 residents who began their residency in 2014 and 2016. The questionnaire collected demographic data such as age, gender, nationality and marital status, geographical data and data explaining the delay in beginning of residency if there was such a delay. The questionnaires were designed to collect data that solely addressed the commencement of the residency.

The sample size was calculated using the WINPEPI software. Since no numerical data were found in the literature for comparison purposes, a pilot study of about 20 residents was conducted across the country regarding the length of waiting time. Results ranged from one month (minimum waiting time) to 12 months (maximum waiting time among respondents). A one-month unit was considered clinically important in this study. The sample size was calculated using the multivariate model (PROBIT regression) that predicted the time between receiving the medical license and the date of residency commencement (0-12 months), with this time being limited to 12 months for the purposes of the present study. The calculated sample size was 220 subjects. This sample size allowed classifications according to the various demographic cross-sections in a way that yielded sufficient statistical power.

Data analysis was performed using the SPSS statistical software. First, descriptive statistics were produced. Subsequently, a one-variable analysis was performed, using a T-test and Mann-Whitney test. Finally, a linear type regression was performed that predicted the time between the date of medical license receipt and the date of residency commencement using variables that emerged as significant in the univariate analysis.

Results

National residency file- Data were obtained for 2458 physicians. One thousand one hundred and eighty-two doctors received their medical licenses in 2014. One thousand two hundred and seventy-six people received their medical licenses in 2016. Of all the physicians who received their medical license in 2014, only 558 began their residency during the same year and were included in the study sample. One thousand two hundred and seventy-six physicians received their medical license in 2016. Of all the physicians who received their license in 2016, only 498 began their residency that year. One thousand and fifty-six physicians were included in the sample according to the inclusion criteria described above. Table 1 describes the residency type distribution of the participants. Most physicians specialized in internal medicine (N=267, 26.5%). Most physicians were non-surgeons (N=853, 80.7%) with the minority being surgeons (N=203, 19.2%). For all physicians, the waiting time for the start of the residency lasted an average of 108.61 days (CI=27.71-195.81). Table 2 shows the lengths of waiting time for residency according to the type of specialty. A significant difference was found in the waiting time for residency among the different specialties ($p<.01$). Residents in thoracic surgery wait on average the longest time (mean 179 days), and residents in oncology wait the shortest time (mean=64 days). Physicians who studied in Israel (mean=107.60, IQR=113) Waited less time (days) for admission to an approved residency than physicians who studied abroad (mean=103, IQR=142.25) ($p<.01$). There was no statistically significant difference in waiting time for surgical residency (mean=99.5, IQR=125.5) compared with non-surgical residency (mean=88, IQR=133) ($p=.35$). A one factor analysis was conducted to compare the waiting time for residency between the years 2014 and 2016 and the result was non- significant.

Residency Type	N	%
Obstetrics and Gynecology	94	8.9
Pediatrics	149	14.1
Internal Medicine	267	26.5
Neurology	31	2.93
Anesthesiology	52	4.92
Orthopedics	39	3.7
Ear-Nose-Throat	22	2.08
Oncology	18	1.7
Urology	22	2.08
General Surgery	57	5.4
Plastic Surgery	7	0.66
Neurosurgery	13	1.23
Vascular Surgery	5	0.47
Ophthalmology	30	2.84
Family Medicine	90	8.52
Dermatology	14	1.32
Psychiatry	50	4.73
Thoracic Surgery	8	7.57
Rehabilitation	12	1.13
Emergency Medicine	17	1.6
Geriatrics	14	1.32
Pathology	9	0.85
Radiology	25	2.36
Nuclear Medicine	5	0.47
Occupational Medicine	5	0.47
Legal Medicine	1	0.09

Table 1: Residency distribution by the National files.

Residency Type	Mean Waiting Time	Interquartile Range (IQR)
Thoracic Surgery	179.00	197.50
Plastic Surgery	152.00	145.25
Pathology	100.50	229.75
Orthopedics	137.50	149.00
Geriatrics	154.00	166.5
Family Medicine	106.00	145.00
Ophthalmology	114.00	142.50
Obstetrics and Gynecology	102.00	175.00
Rehabilitation Medicine	143.00	82.00
Radiology	94.00	125.00
Ear-Nose-Throat	106.00	121.50
General Surgery	91.00	131.00
Pediatrics	95.50	121.75
Dermatology	71.00	208.75
Emergency Medicine	86.00	91.00
Neurology	72.00	144.40
Internal Medicine	80.00	110.00
Psychiatry	79.50	118.75
Anesthesiology	65.00	71.75
Oncology	64.00	116.5

Table 2: Differences in waiting time for specialization according to national data file.

Residents' questionnaire- two hundred and forty-two residents from across the country filled out a questionnaire regarding their demographic and professional details. Their demographic details are shown in Table 3. No statistically significant difference was found between gender, nationality, age, final medical school grade, and hospital location (center/periphery) and waiting time

for residency. However, the type of residency was shown to have an impact on the waiting time ($p<0.01$). Table 4 demonstrates the waiting time for residency according to the questionnaire. A linear regression analysis was performed, with the explanatory variables being age, gender, score upon degree completion, surgical specialization, nationality, and country of study. The regression findings showed a significant correlation between waiting time and nationality, so that Jewish physicians waited less time for admission to residency (beta=-.20, p=0.01). No significant association was found with the type of specialization (surgical or not) or the country of study. Forty-two percent from the residents who answered the questionnaire claimed that their residency was delayed due to factors inherent to the system. Ninety-two of them answered that the reason for delay was due to lack/shortage in availability of slots.

	Mean	SD	Range	N	%
Gender					
Male				73	30.4
Female				169	69.6
Nationality					
Jewish				222	92
Arab				20	8
Marital status					
Married				167	69.2
Divorced				3	1.2
Single				72	29.6
Medical school country					
Israel				100	45.4
Abroad				120	54.5
Type of specialization					
Family medicine				17	7.1
Gynecology				23	9.6
Internal medicine				55	22.6
Pediatrics				32	14.2
Orthopedics				14	6
Neurosurgery				3	1.3
Ophthalmology				10	4.2
E.N.T.				10	4.2
Emergency medicine				4	1.7
Neurology				2	0.8
Psychiatry				5	2.1
Heart surgery				4	1.7
General surgery				9	3.8
Vascular surgery				2	0.8
Oncology				3	1.3
Anesthesiology				10	4.2
Public health				1	0.4
Dermatology				6	2.5
Radiology				6	2.5
Occupational medicine				1	0.4
Plastic surgery				8	3.3
Urology				4	1.7
Age	31.24	2.58	20-39		
Average final grade	86.22	5.38	70-98		

Table 3: Demographic characterization of those completing the residency questionnaire.

Specialization	MEAN	IQR
Radiology	300	960
Emergency medicine	15	1222
Orthopedics	150	420
E.N.T.	270	562.5
Gynecology	60	165
Public health	180	0
Pediatrics	105	120
Ophthalmology	60	172.5
Dermatology	90	217.5
Neurosurgery	90	0
Family medicine	60	135
Internal medicine	60	127.5
General surgery	45	60
Anesthesiology	0	90
Cardiac surgery	10	0

Oncology	30	0
Urology	270	562.5
Vascular surgery	30	0
Neurology	0	0
Psychiatry	0	90

Table 4: Differences in waiting time for internships according to the questionnaire.

Discussion

Medical personnel planning is one of the complex processes that a health care system experience. "Physician's density" or, the number of physicians per population is an important measure for assessing the quality of medicine and its accessibility in each country. In the literature, there is no number of physicians per population that is defined as the gold standard. Planning a medical reserve is a difficult challenge as it needs to be tailored to future population planning and it must take into account a prolonged medical training duration of almost 15 years [5]. Over the years, various models have been used to predict the number of physicians needed for the rate of population growth [2]. None of the models took into account the delay in entering residency. An OECD article presented models from several countries used to design a medical reserve. According to the article, the supply and demand of each system should be examined [6]. The "demand" Includes population size and aging, morbidity, technological advancement and economic growth. The "supply" consists of inflow, outflow and stock. Based on this model, the Ministry of Health has set a value of 2.9 doctors per 1,000 people from which it is not allowed to go down. A number of possible solutions have been proposed to strengthen the medical staff, including increasing the number of medical students in Israel, encouraging Israeli graduates abroad to quickly enter the Israeli medical system, by among other things, allowing them to do an internship based on the USMLE test. Monetary incentivations were also offered to attract physicians to certain specializations [7]. The issue of physicians starting residency was not discussed.

The process of beginning a residency is a process that should happen quickly and naturally after completing the seventh year required internship. In practice, there are factors that delay the doctor's entry into residency.

The study examined whether the variables of age, gender, degree completion average score, surgical residency, place of residency, nationality and country of medical study affect the length of waiting time for residency. The variables were examined in two types of databases. From the data in the national database and in agreement with our hypothesis, we found that physicians who studied in Israel wait less compared to graduates abroad. Conversely, the waiting time for a surgical specialization was not longer than non-surgical specializations and no difference was found in the waiting time for residency between the years 2014 and 2016. Unlike our hypothesis, there were no differences in waiting times for residency in the variables, degree completion average score and place of residency.

According to the data from the questionnaire, we found that there is no relationship between gender, nationality, degree completion average score, residency geographical location (center/periphery) and the starting of the residency, but the type of residency was found to be related, with some specialties predicting longer waiting times. The data presented in this work do not completely reflect this. The lack of available slots for residency and the lack of transparency regarding future slots constitute a limitation to the study since it is not possible to judge on the demand side but only on the supply side. The demand side may be a separate issue for a separate work.

In an attempt to understand what were the factors delaying the start of residency, the respondents were asked to describe whether the beginning of their residency was delayed, and if so whether the reason was personal or systemic. Forty-two percent of the respondents indicated that the start of their residency was delayed by unrelated constraints. Ninety-two doctors detailed the reason for the delay. Half of them stated that the reason was lack of or unavailability of a specific residency slot. It appears that the root of the problem lies in the fact that there is no available data regarding current and future slots and there is no help available for young physicians navigating them towards specializations with available positions.

In Israel, many students are forced to acquire their education outside the country because the number of places for medical studies is limited. The process of controlling the number of applicants for medical studies, the process of young doctors entering the internship and then their chosen specialty is incompletely monitored. This is reflected in the results presented. There is no control over the number of candidates and their future deployment for different specializations. There are no tools to estimate how many general practitioners, surgeons, internists or pediatricians will be in a few years depending on the growing and changing needs of the state.

In New Zealand, a model was developed by the Ministry of Health to predict the number of physicians needed in each residency. The needs of the state were compared to data collected from medical students that presented the field of specialization that they desired. The chosen point in time is 2028, 14 years after graduation and residency, a point at which students are already supposed to be specialists. The results of the study showed that there are statistically significant differences between the students' intentions and the needs of the health system. In particular, it was

observed that there may be a shortage in the number of General Practitioners (GPs) [8]. In the US, on the other hand, according to a model conducted, it was observed that in 2026 there are more places to specialize than candidates. Competitive specialties such as orthopedics are also expected to suffer from shortages within ten years [9]. In Croatia [10], which experienced the same problem with the entry of young doctors into the labour market, economic incentives were given by the government to hospitals to encourage increased entry of interns into the labour force.

However, after all is said and done, the main actors are the medical students. An article published this year in the Lancet [11] calls on statesmen and decision makers to adjust their strategy according to the willingness and desires of the students in their country. Further investigations examining the imbalance between future state needs and the students' desires can be helpful.

In summary: the medical reserve planning process is not an accurate scientific process and therefore needs to be updated frequently. Initially, the existing situation should be assessed reliably and only then, should we try and predict the future needs. In addition, Israeli policy makers should read the world map and be inspired by what is happening in other countries.

The medical training process is lengthy and forms a significant part of medical reserve planning. The medical training process has many delaying factors both personal and systemic. Factors such as policies and budgets were not discussed in this work.

The point in time which we have chosen to discuss is the beginning of residency. According to the data presented above, the factors that cause a delay in the beginning of residency are country of study, the type of specialization and lack of available positions.

Beyond the actions discussed in the past, additional solutions that may be provided to the current distress are:

- There should be a constant flow of information between MOH and IMA regarding the inflow, outflow and stock of physicians. Residencies in need should be pointed out as well as the ones which are surplus and this data should be reflected publicly. This communication might mitigate and balance the workforce.
- The growth rate of physicians in Israel based on the Israeli training system alone is not satisfactory. Many doctors are forced to acquire their education abroad. Recognition of this fact and the creation of an integrated curriculum in which students from abroad are integrated into the Israeli medical system at the beginning of the clinical years will encourage their absorption and exposure to the Israeli system and may help expedite their entry into residency.
- Publishing a snapshot of the available positions per residency annually and a future snapshot for the next five years. It should be the duty of every department to publish the medical reserve plan of his or her department.
- Defining specialties with shortage of residents on an annual basis and creating incentives to those interested.
- Occupational mentoring to medical students, orienting students according to existing professional deficiencies, providing answers and advice, creating incentives for students who choose specializations with a shortage of manpower.

There are a few limitations in this study: First, there is an information bias. There may be other factors beyond what was studied that can delay physicians from entering residency such as the number of departments that they contacted before starting the residency, or whether they conducted further research on the subject, why they chose a specific department, and what were their considerations. There may also be other systemic factors such as a temporary hold on slots due to political or security factors, or an economic situation in which the state is in at a certain point in time. These data could have helped in a more in-depth analysis of the issue and therefore, our conclusions are limited.

A possible memory/reporting bias. This bias is possible when filling out the questionnaires. Residents whose beginning of residency was simple and without difficulties may not remember or report exactly the details as other residents whose beginning of residency was fraught with difficulties will report.

Another bias is the sample size bias. In terms of filling out the questionnaires, I met the target of 220 questionnaires (242 were filled out) but only 92 people elaborated on the delay in starting residency. If there were more questionnaires elaborated upon, other problems might have surfaced.

Conclusion

Physician density planning in the Israeli healthcare system is a challenging task to execute and involves many factors that should be taken into consideration. In Israel the gate into residency is not monitored properly and therefore some specialties are outnumbered while others are missing manpower. The health care system should question constantly its effectiveness and offer ways for improvement. Shortage in available positions for residents is one of many problems, on the other hand, a situation in which the supply is greater than the demand is also unfavorable. The constant, up to date, publicly open, flow of information between MOH and IMH is one way of dealing with this difficulty along with proper students' education and adjusted budget.

Availability of Data and Materials

The data that support the findings of this study are available from the ministry of health and the Israeli medical association but restrictions apply to the availability of these data and so are not

publicly available. Data are however available from the authors upon reasonable request and with permission of the ministry of health and the Israeli medical association.

Author's Contributions

SLK: performed the research, analyzed the data and wrote the paper; GS: analysis and interpretation of data; RG: conception and design of the research.

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