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Pediatrician workforce planning: The Israeli experience and projections of pediatric manpower 1995–2025

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Abstract

Introduction: In the coming years a worldwide physician shortage is expected. However, little is known regarding pediatrician workforce planning worldwide. The main factors influencing the shortage of physicians include a long and expensive training, physicians' migration, changing career patterns, early retirement, gender and novel technologies.

In this ecological descriptive study we studied past (1995-2006) and future (through 2025) pediatrician workforce trends in Israel. We compared the Israeli pediatrician workforce to other countries.

Main outcome: ratio of pediatricians < 65 years-of-age per 1,000 children.

Results: The recommended ratio of pediatricians in the USA per 1,000 children grew by more than 50% from 1990 (0.49) to 2000 (0.77). In 2006, the average ratio of pediatricians in Israel per 1,000 children was 10% less than that recommended in the USA. Average ratio of pediatricians per 1,000 children in 77 countries is half (0.38) of the recommended ratio in USA, year 2000.

Conclusion: Lack of system outcomes measures, in addition to differences, between countries of about 100%, regarding the required ratios of pediatricians/per 1,000 children provides us with an evidence that one parameter cannot forecast an efficient pediatric workforce. Since planning is a very complex task, decision makers in different health care systems need more indices to plan a cost effective pediatric workforce.

Key words

Pediatricians' workforce, Planning, Child health

1 Introduction

Health system human resources have a major effect on patient health. However, there is no formula to determine the right number of health care workers, with the right skill mix in the right place doing the right things. In the coming years a

worldwide physician shortage is expected [1]. Most health care workforce imbalances are related to complex social, political, and economical forces that differ from country to country. The main factors influencing the shortage of physicians include long and expensive training [2, 3], physicians' migration to other countries [4], changing career patterns, early retirement [5], and the influence of professional [6], gender [7], and novel technologies upon the work force [8]. In Israel, a physician shortage is expected in the coming years, due to the sharp decrease in immigrant physicians from the former Soviet Union, population growth, the limited number of Israeli medical school graduates, uneven geographic distribution of physicians, career pattern changes, increasing numbers of female physicians, and insufficient physicians in key practice skills, *i.e*., anesthesiologists, general surgeons and pathologists [9, 10].

Little is known regarding pediatrician workforce planning worldwide. This is essential to achieve optimal physical, mental, and social health for children at all ages [5]. Toward the end of the last century the median number of children per pediatrician in 34 countries in Europe was 2094 (range 401 to 15,150) [11]. In comparison, in the USA the number of pediatricians continues to grow in both absolute and per capita numbers. Compared to other specialties, pediatricians tend to work fewer hours per week [5] and more part time jobs [3]. Pediatrics was the first residency in the history of the USA in which female physicians became the majority [5]. In the current article we will try to analyze for the first time, past and future (years 1995-2025) trends in the pediatric workforce in Israel, using a universal formula specifically design for pediatrician manpower planning. Research has shown that the choice of medical specialty by medical students in the United States went through great changes in the last few years [19]. A study conducted between 1996 and 2002 found that specialty fields such as dermatology and anesthesiology, which traditionally had very low rates of interest among the graduating students, had multiplied the number of their candidates by tens and hundreds of percentages (anesthesiology – a rise of 500%, dermatology – a rise of 1,000%). More than 55% of the students said that the factor that most strongly influenced their choice was the ability to have a "controllable lifestyle", meaning having time that is free of the demands of their work, that could be dedicated to their leisure activities and families, and which is controlled by them. A similar change was noticed among Israeli medical school graduates [20], which demonstrated a rise in the popularity of specialties such as radiology and anesthesiology between 1980 and 1995. This means that workforce planning had to take a shift, and make the proper adjustments towards the new preferences of medical students (an idea that two decades ago would have been considered absurd by itself). These factors have created a change in the specialty choices of graduating medical students [19] in the United States in the last few years. Specialty fields that are perceived as less time intensive are gaining popularity. This means that the issues of quality of life and leisure time are becoming more and more important as determining factors of physicians' satisfaction. This has caused workforce planning to be even more complicated due to the rise in the percentage of female physicians. Thus, among 5,704 U.S. physicians [21] differences were found between male and female physicians. Women were more satisfied than men with their work relations and field of choice, but were less satisfied with their autonomy at work, workload, and salary. Differences between genders [22] were also based on salary issues, prestige, and academic ranking. If we consider the fact that women comprise close to 50% of the workforce in fields like pediatrics, this means a big change that has been seen worldwide, as well as in Israel [16, 23].

2 Patients and methods

Type of study: An ecological descriptive study. In ecological study the unit of analysis is the group, not the individual, and statistical measures like correlations are obtained between exposure rates and disease rates among different groups or populations. This type of study is easy, quick, and inexpensive. It lets you focus your interest upon ecological effects in the population level, but it is not without flaws. It has design limitations (you need information about populations at large), and observation made at the group level may not represent the exposure-disease relationship at the individual level. This is also known as ecological fallacy, and it occurs when incorrect inferences about the individual are made from group level data.

Time period: Past trends for 1995-2006 and forecast through 2025.

Setting: At the end of 2006, Israel had an estimated population of 7.2 million inhabitants, of which 1.9 (28%) million were children aged 0-14 years (compared to an average of 17% in other western countries). All children in Israel are entitled to a defined assortment of services specified in the National Health Insurance act that was legislated in 1995.

Pediatric care in Israel is highly accessible. Waiting times are considered minimal. Care is provided by board certified pediatricians, family physicians, and general practitioners (mainly immigrants from the former USSR) [12]. In 2003, 75% of the physicians who provided health care to children in the community were board certified specialists in pediatrics [13]; 99% of the primary care pediatricians were employed by a health plan as either salaried or independent physicians (IPs). Increasing gaps were found in the level of service and accessibility to medical services in different geographic areas [13]. For example, higher levels of morbidities in the South and North, compared to other areas in the country. Family health centers, owned and operated by the government, are the primary source of screening pregnant women and children during their first years of life. These centers are involved in intensive outreach efforts in immunization and child health. As a result, vaccination coverage is high, > 90% in 2000.

In 2006, hospital care (989 pediatric beds) was provided by residents and board certified pediatricians [14]. During 1995-2006, there was an increase of only 10 beds country-wide. The number of residents graduating in pediatrics is steady, an average of 80 new specialists per year.

2.1 Study population

The pediatric population includes children aged 0-14 years. Excluded were children aged 14-18 years, since data on this age group are limited and they may obtain medical services from non-pediatricians (*i.e.*, general and family physicians). According to the Israeli Ministry of Health (MOH) in 2012 there were 2.6 million children in Israel (ages 0-17), which compromised 33% of the population. 70% of these children were Jewish in origin. In 2012 171,000 babies were born, and the average number of children per family was 2.4. 31.4% of the pediatric population are 0-4 years, 28.3% are 5-9, 26% 10-14 and 14.3% 15-17.

Included are pediatricians of working age (≤ 65 years). Excluded are general practitioners, family physicians, and retired pediatricians (> 65 years of age). According to the Israeli MOH in 2012 there were 35,327 licensed physicians in Israel. The rate of physicians until the age 65 was 3.26 per 1,000. Almost a thousand new licenses were granted in 2012. The percentage of women is steadily increasing and is now 42%, and half of the new licenses were granted to female physicians. The rate of physician who have finished residency is 1.75 per 1,000. In 2012, 652 physicians have finished residency, of them 12% were pediatrics specialists (78). According to the MOH there are 2045 licensed pediatricians in Israel. Half of those specialist are women, and 53% of those specialist are until the age of 55.

2.2 Main outcome variable

Ratio of pediatricians < 65 years-of-age per 1,000 children – the total number of registered pediatricians of working age divided by total number of children (in thousands) aged 0-14 years.

2.3 Data sources

- Statistics regarding number of children from the Israel Central Bureau of Statistics.
- Data from the Ministry of Health regarding registered pediatricians. These data include all board certified pediatricians in Israel, regardless of their active participation in the workforce.
- Data from the Israel Medical Association. This organization performs board certification exams of pediatricians.

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2.4 Data analysis

Descriptive statistics (means, S.D., percentages, and graphs) were used as the main outcome measures. Lack of a proper comparison group prevented us from presenting any analytical statistics. The data in this model are calculated on the basis of accumulated experience in Israel in the years 1996-2006. Study assumptions (see the table) and the equation to forecast the pediatrician workforce (see equation) in Israel.

Table. Assumption according to universal parameters influencing pediatrician workforce

Parameter	Study Assumption*
Active workforce	Number of pediatricians < 65 years old in 2006 is 1791 [12]. Expected number of children (ages 0-14) in 2025 is 2376 (thousands).
New specialists	The average number of new specialists annually is 80 [12] and is expected to remain at this level until 2025.
Immigration rate	Influx of immigrant physicians does not change the number of graduating pediatricians [12].
Emigration rate and career change	5% of pediatricians do not practice in their profession due to emigration or career change [15].
Sub-specialists	A. The percentage of sub-specialists will remain constant (~27% of all pediatricians). B. About 50% of all sub-specialists will have part-time jobs in a primary pediatric clinic [5].
Employment	Changes in employment characteristics (the increase of pediatricians characteristics working part-time) will decrease the pediatrician workforce by 1.5% a year [5].
Gender	A. Compared to male physicians, female physician productivity is 0.90 [5]. B. Growth in number of female pediatricians will remain the same as in the past.
Retirement rate	A. The equation is based on retirement age of 65 years for both males and females. B. The average retirement rate of physicians in the near future is 3% per year [9].
Technology	Changes in technology will increase the demand for pediatricians by 1% per year [16].
Non-physician	In the next 12 years there will be no Physician Assistants or Nurse clinicians Practitioners in Israel [17].

* Study Assumption – are adjusted in accordance with Israeli parameters

$$TP_y=N_y-(E_y+R_y+D_y+C_y)+TP_{(y-1)} \quad (1)$$

TP_y: The number of pediatricians in practice (TP) in a certain year (y) in the state of Israel

N_y: The number of new specialists who were certificated to work as pediatricians in Israel in a certain year (y)

E_y: The number of pediatricians emigrating from Israel in year y

R_y: Retiring pediatricians in year y

D_y: Pediatrician deaths during year y

C_y: Career change of pediatricians in year y

$TP_{(y-1)}$: The number of pediatricians working in Israel in the year preceding year y

All study assumptions are based on national and international data, literature review, and opinions of key leaders in the Israeli health care system (Ministry of Health officials, hospital directors, Israel Medical Association [IMA] officials, health insurance officials) and key personnel in the Israeli pediatric workforce (heads of pediatric departments in all general hospitals and pediatric directors in health insurance funds – see also our previous study [16]).

For the purpose of the current study we used an equation (see equation) to forecast the needs of the pediatrician workforce with respect to one parameter: the total size of the pediatric group between the ages of 0 and 14 years. It is beyond the

study's scope to include in this equation parameters that may influence demand for pediatricians, *i.e.*, distribution of pediatricians in various geographic areas, hospital needs (hospitalists, residents), the presence of other primary care providers (general and family physicians), needs for sub-specialists, public demand for pediatric care (visits per week), and the growth in ethnic diversity (Jewish *vs.* non-Jewish population) of the nation. Even though this is a simplistic model, we believe it adds invaluable data upon the pediatric work force.

3 Results

3.1 Children population growth

In the years 1995 and 2006, the numbers of children aged 0-14 were 1,638.6 and 1,999.2 (thousands), respectively, an increase of 22%. In 2012, the number of children aged 0-14 was 2,227.1 (thousand), which is an increase of 36% in comparison to 1995, and an increase of 11.5%. Compared to 2006, the number of children aged 0-14 in 2025 is expected to be 2,376 (thousands), an increase of 19%.

The average annual pediatric population growth between 1995 and 2006 was 1.82% per year, and was 1.64% in the years 2006-12, and is expected to be 0.96% per year between 2006 and 2025.

3.2 Pediatrician workforce

In 2006 the ratio of practicing pediatricians aged < 65 per 1,000 children aged 0-14, was 0.71. In 2012 it was 0.88. This ratio is expected to be 0.78 in 2025.

In 2006, of all registered pediatricians, 53% were in the age group of 45-64 years, 20% were younger than 44 years, and 27% were older than 65 years. In 2010, 25% were younger than 44 years, 63% were in the age group of 45-64 years and 27% were older than 65 years. Of all registered pediatricians, 52% of pediatricians were born in Israel and 21% were born in Eastern Europe.

In the last decade, regardless of the growth in the total number of children, the number of pediatric beds in Israel, as well as the number of pediatric residents, remained constant, *i.e.*, 80 new residency graduates per year. However, the percentage of females graduating from pediatric residency programs increased from 32% in 1990 to 64% in 2006 (see Figure 1). In 2010, this resulted in the fact that 47% of all pediatric specialist in Israel were females. The number of pediatricians with a sub-specialty increased from 299 (20% of total pediatricians) in 1995 to 480 (27% of total pediatricians) in 2006, an increase of 60%. In 2006 the five leading pediatric subspecialties were: neonatologists (n = 111), neurologists (n = 58), hemato-oncologists (n = 54), pulmonologists (n = 52), and endocrinologists (n = 49). More recent data about sub-specialty could not be obtained.

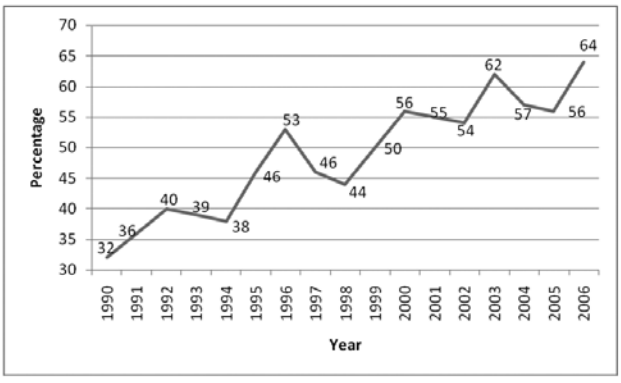

Figure 1. Percentage of females among board certified pediatricians, 1990-2006

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By forecasting pediatrician workforce (see equation), the expected total number of pediatricians < 65 years-of-age in 2025 will be 2,877 and the predicted ratio of pediatricians per 1,000 children aged 0-14, in 2010, 2015, and 2025 will be 0.70, 0.79, and 0.78, respectively. In the presence of increased internal population growth (at about 1.8% per year) and no increase in number of pediatric graduates (n = 80) we predict a 10% increase in the ratio of pediatricians (from 0.70 to 0.78) due to low rates of retirement in the next decade.

International ratios of pediatricians per 1,000 children are presented in Figure 2. The recommended ratio of pediatricians in the USA per 1,000 children grew by more than 50% from 1990 (0.49) to 2000 (0.77). In 2006, the average ratio of pediatricians in Israel per 1,000 children was 10% less than that recommended in the USA, whereas the number has risen in 2012 to 0.88, but the projection for 2025 is a lot less appealing.

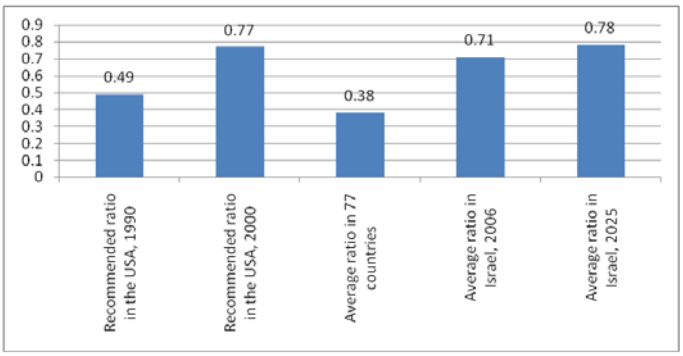

Figure 2. Ratio of pediatricians per 1,000 children – international comparison

Average ratio of pediatricians per 1,000 children in 77 countries is half the recommended ratio in USA, year 2000, and Israel seems to be joining this dangerous trend.

4 Discussion

Pediatrician workforce planning is a challenging task in a dynamic and ever-changing health care environment. Therefore we studied past (1995-2006) and future (2006-2025) trends of the pediatrician workforce in Israel. In addition, we compared our findings to other countries.

Our main findings are:

- In contrast to the USA health care system, the number of board certified pediatricians in Israel remained constant in the last decade. During 1995-2025 the number of new pediatric resident graduates has been and will remain constant (n = 80 per year), while the population will grow by more than 30%. This sheds a grim forecast upon our ability to provide good and affordable healthcare for children in Israel in the next decade.
- The ratio of pediatricians aged ≤ 65 per 1,000 children aged 0-14, was 0.71 in 2006, 10% less than the latest recommended ratio from the USA, but almost twice the average ratio of 77 countries. In 2025, this ratio will increase by 10% (to 0.78) *i.e.*, more than 10% of the latest recommended ratio from the USA, more than 100% of the average ratio of 77 countries.
- As in the USA, continued growth in the number of female pediatricians was noted: the percentage of females among graduating pediatric residents doubled from 32% in 1990 to 64% in 2006. Considering the fact female physicians tend to have more part-time jobs, this trend seems to weaken even more the affordability and availability of pediatricians.

When doing an analysis of the 1995-2012 period we found that many factors influence the size and composition of the child health care workforce. Therefore we analyzed, for the first time, the pediatric workforce in Israel by collecting data

from the two main key players participating in the training and planning of the pediatrician workforce in Israel: the MOH and the IMA. We found a good match between the data (number of pediatricians) of the MOH and the IMA. However, these data are only a headcount of certified pediatricians without considering their employment status and characteristics. These data sources do not include information on other primary care physicians (*i.e.*, general practitioners and board certified family physicians) taking care of children. We roughly estimated, that as in the USA [5], more than 25% of the non-pediatrician primary care physicians are treating children. Hence, the total number of physicians (pediatricians and non-pediatricians) taking care of children is greater than our presented results. This study limitation, lack of national reliable data, was found in similar reports [9] regarding pediatrician workforce. Therefore, comparison of our findings with other countries require a standardized reliable data base (based on a consensus guide line) which include factors such as physician personal and employment characteristics, geographic distribution, career changes, and type and number of non-pediatricians.

When looking at these key factors and their influence the pediatrician/population ratio change over that period, one can see that in recent years changes have occurred in the pediatrician workforce. Most of those reported are from the USA, and thus the USA is our main comparison group. The number of licensed US pediatricians increases constantly: an average of 722 physicians between 1966 and 1970, and 2,754 in 1997 [6]. By 2000, women were 62.5% of all residents in pediatrics and 50% of all specialists in pediatrics [5]. Those numbers continued to increase, and in 2001 and 2002 women were 69% of all US residents who finished their residency [3]. Pediatrics was the first residency in the history of the USA in which women became the majority [5]. This trend has a significant influence on the medical service. The percentage of pediatricians working in part-time jobs increased from 11% in 1993 to 15% in 2000 [3]. These changes occurred while pediatrician salary decline by 4% between 1997 and 2002 [3] and was lower compared to the other specialties [18]. In Israel similar changes occur mainly in regard to the significant increase of the percentage of board certified women in the pediatric workforce.

We learn from this that would be relevant for forecasting the future course of the ratio that the shortage of board certified pediatricians would only rise and navigate the primary care physicians to work more with kids aged 0-14. Considering the fact that these trends also influence primary care physician this means a larger gap in the care of children in the near future. For example, if the percentage of women in board certified pediatricians is less than 50% (47% in 2010), in primary care the percentage is more than 50% (56% in 2010). Thus one can not expect a real solution from primary care physicians, and even worth is the new residency plan that allows part time residency, which is a good solution for female pediatricians, but it shrinks even more the number of physicians attending children aged 0-14.

Predicting pediatrician workforce needs a universal general equation (see equation) that takes into account relevant parameters (see the table) influencing physician manpower planning. We used universal parameters already describe as affecting pediatric workforce. For each parameter we applied assumptions (see the table) in accordance to past, current and expected trends in the Israeli pediatric workforce. These parameters are factors known to influence the number of pediatricians in any country. The importance the presented formula (see equation) is that it can be used by decision makers in different health care systems, using different weight, according to the specific characteristics of the health care systems. The limitation of this general formula is that it can be useful to predict only one parameter, the ratio between pediatrician workforce and pediatric population. This robust parameter does not necessarily reflect demands for pediatric workforce.

One might argue that with regard to most of the parameter that influence the pediatric workforce, we assume that future values will be the same (or close to) past values. However, some of the parameters might change (*e.g.* retirement ages) and change is distinctly possible for others (*e.g.* the proportion of new Israeli graduates who will choose pediatrics as a specialty). If we consider the fact that the Israeli law changes slowly a radical change in retirement age is unlikely. On the other hand, the proportion of new Israeli graduates who will choose pediatrics as a specialty is only declining and thus in the last agreement between the IMA and the Health ministry pediatrics was considered a profession in need, and new residents in pediatrics were supposed to get some grants from the government. Alas, due to budget cuts this blessed initiative was stopped and in the near future no real change seems likely.

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The demand for pediatrician is multifactorial and it is aimed to achieve the optimal physical, mental, and social health for children at all ages [5].

An equation which include additional parameters may better reflect accurate planning based on demand for pediatricians, *i.e*., distribution of pediatricians in various geographic areas, hospital needs (hospitalists, residents), the presence of other primary care providers (general and family physicians), needs for sub-specialists, public demand for pediatric care (number of visits per pediatrician), the growth in ethnic diversity of a nation, the effect of novel technologies (such as immunizations) on the pediatric workforce. If one considers the fact the distribution of pedestrians across regions in Israel is quite varied and that in the periphery their shortage is already a fact (even though we have no precise data upon that, our experience in Soroka shows us this on a daily basis), it is not surprising that one of the main achievements of the last physicians strike was a periphery grant for pediatricians who start their residency in peripheral areas, with a surge of new residents in pediatric divisions who are located at the periphery of Israel. Alas, due to cutbacks these grants were stopped or diminished and with them the shortage will be more pronounced in these areas.

More studies that provide outcomes in relation to the number and specialties of pediatricians per 1,000 children are needed. Ratio's differences (pediatricians per 1,000 children) of more than 100% cannot help decision makers, to compare and to plan an efficient pediatrician's workforce. Such ratio's do not help to predict physical, mental or social health, outcomes for children [5]. To achieve this goal, development of more detailed parameters will enable us to establish comparable international criteria for a cost effective planning of pediatric workforce. With such universal criteria decision makers will be able to compare equal outcomes of quality of care in different health care systems and react (planning and training) by using better the scarce resources of their health care system.

5 Conclusion

Forecasting the pediatric workforce becomes increasingly complex because of multiple parameters that are incorporated in models that determine pediatrician demand. The current used ratio "number of pediatricians per 1,000 children" does not reflect an effective planning goal which is comparable indices between different health care systems. Further studies are needed to develop indices that will enable decision makers in different health care systems to plan an efficient pediatric workforce.

Conflict of interests

The authors declare that they have no conflict of interests.

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