

The Israeli Anesthesiology Physician Workforce

Charles Weissman MD^{1,3}, Leonid A. Eidelman MD⁴, Reuven Pizov MD⁵, Idit Matot, MD^{1,3}, Nava Klein BA RN¹ and Robert Cohn PhD^{2,3}

¹Department of Anesthesiology and Critical Care Medicine, Hadassah-Hebrew University Medical Center, Jerusalem, Israel

²Center for Medical Education, ³Hebrew University-Hadassah Medical School, Jerusalem, Israel

⁴Department of Anesthesiology, Rabin Medical Center, Petah Tiqva, Israel

⁵Department of Anesthesiology, Carmel Medical Center, Haifa, Israel

Key words: anesthesiology, workforce, healthcare systems, Israel

Abstract

Background: Anesthesiology is a vital specialty that permits the safe and humane performance of painful procedures. Most Israeli anesthesiologists are immigrants, while only a minimal number of Israeli medical school graduates enter the specialty. Unfortunately, the supply of immigrant physicians is declining due to falling immigration rates.

Objectives: To examine the current Israeli anesthesiology workforce and project future needs.

Methods: Demographic and professional information about Israeli hospital anesthesiologists was solicited from anesthesiology department heads. Data were also gathered about the past, present and projected future growth, age distribution and birth rate of the Israeli population. Needs and demand-based analyses were used to project future anesthesiology workforce requirements.

Results: Data on 711 anesthesiologists were obtained from 30 hospital anesthesiology department heads. Eighty-seven anesthesiologists (12.2%) graduated from Israeli medical schools and 459 (64.6%) graduated from medical schools in the former Soviet Union. Among the 154 anesthesiology residents ≤ 40 years old, only 13 (8.4%) graduated from Israeli medical schools. There are approximately 10.8 anesthesiologists per 100,000 population. Projections for 2005–2015 revealed a need for 250–300 new anesthesiologists.

Conclusions: The anesthesiology workforce is predominantly composed of immigrants. This has vast implications for the future viability of the specialty because of the continuing reduction in immigration, the lack of interest in the specialty by Israeli medical school graduates, and the projected need for many new anesthesiologists to replace retirees and to provide care to a growing and aging population.

IMAJ 2006;8:255–260

anesthetized. Such anesthetic care has been a key facilitator of the advances in surgical care over the past four decades. In Israel, anesthesiologists are the seventh largest specialist group and usually the largest or second largest specialty group in acute care hospitals. The Israeli population is expanding and growing older, thereby increasing the need for anesthesiologists. The potential for maintaining or increasing the number of anesthesiologists depends on the recruitment to the field of anesthesiology of Israeli medical school graduates and physician immigrants. However, few Israeli medical school graduates select the specialty as a career, while the pool of immigrant physicians, which over the past three decades has provided the bulk of the anesthesiology trainees, is rapidly diminishing. The present study characterizes the current Israeli anesthesiology workforce, projects future needs, and identifies steps to be taken to meet these needs in the decades to come.

Subjects and Methods

Information about each anesthesiologist employed in Israeli public and private hospitals was solicited from the heads of the 30 Israeli anesthesiology departments. This information included age, gender, employment status (full- or part-time), the country of medical school education and last anesthesiology residency, professional status (resident, certified specialist anesthesiologist), and medical school academic appointment, if any. Data collection involved completion of data forms and a questionnaire by the department heads followed by a review of the forms with a non-physician member of the research team. The questionnaires used the five-level Likert Scale.

Library, Medline, Israeli government (Ministry of Health, Central Bureau of Statistics) and Internet sources were queried to obtain information about the past, present and projected future growth, age distribution and birth rate of the Israeli population. The same sources provided immigration statistics and data on the physician workforce and national healthcare activities.

Descriptive statistics (mean \pm SD) and graphics were used to describe the characteristics of the anesthesiology workforce in Israel. Differences between subgroups were determined using Students *t*-test. $P < 0.05$ was considered statistically significant. The current number of anesthesiologists per population was calculated, along with projections of future national population

For Editorial see page 280

Anesthesiology is a vital specialty facilitating the safe and humane performance of painful and uncomfortable procedures. The anesthesiologist's role is no longer confined to operating rooms, but has expanded to labor and delivery suites, radiology departments, intensive care units, acute and chronic pain services, and emergency/trauma receiving areas [1]. Fueled by clinical and technological advances, anesthesiology practice has become increasingly sophisticated so that the elderly and chronically ill, as well as the critically ill and injured, are routinely

growth, aging, surgeries, births and cesarean sections used to estimate future anesthesiology workforce requirements. In situations where projections were not available from governmental sources, projections were made using best-fit regression analyses.

Results

Thirty department heads provided data on 711 anesthesiologists currently employed in Israeli hospitals [Table 1, Figure 1]. Only 87 (12.2%) of the anesthesiologists graduated from Israeli medical schools. Eighty-five anesthesiologists (12.0%) are practicing part-time (age 50.0 ± 9.6 years); 20% are females and 54% are certified specialists. Fifty-eight percent of the anesthesiology residents are ≤ 40 years old [Table 2]. Among the anesthesiologists aged 31–40 years, 17 are Israeli medical school graduates (13 residents and 4 certified specialists). During these 10 years, these schools graduated about 2800 students. Therefore, $< 1\%$ of these graduates are currently hospital anesthesiologists. The investigators identified approximately 25 other certified specialist anesthesiologists working outside of hospital anesthesiology departments. They were performing hospital administrative

functions, administering anesthesia in small outpatient surgery facilities and practicing in non-hospital pain management clinics.

From 1970 to 2003, a total of 29,220 physicians received Israeli medical licenses. Most (48%) were immigrants from Eastern Europe including the former Soviet Union, 30% were Israeli medical school graduates and 22% were immigrants from other countries. These proportions contrast with the 64.6% and 12.2% of the anesthesiology workforce from the former Soviet Union and Israel, respectively [Table 1]. Immigration to Israel

Table 1. Characteristics of the Israeli anesthesiology workforce

	All (n=711)	Residents (n=264, 37.1%)	Certified specialists (n=373, 52.5%)	Others (n=74, 10.4%)
Age (yrs)	45.8 \pm 9.1	40.2 \pm 7.8	49.2 \pm 7.9	50.4 \pm 8.9
Range	26–73	26–64	31–73	39–70
Females	25.0%	31.1%	22.87%	14.9%
Age (yrs)				
Females	44.7 \pm 9.7	39.9 \pm 8.5	48.2 \pm 7.1	46.5 \pm 9.5
Males	46.4 \pm 9.0*	40.3 \pm 7.9	49.4 \pm 8.2	50.8 \pm 8.9
Medical school education				
Argentina	20 (2.8%)	7 (2.7%)	11 (3.0%)	2 (2.7%)
France	14 (2.0%)	1 (0.4%)	12 (3.2%)	1 (1.4%)
Israel	87 (12.2%)	13 (4.9%)	73 (19.6%)	1 (1.4%)
Italy	23 (3.2%)	4 (1.5%)	19 (5.1%)	0
Romania	37 (5.2%)	6 (2.3%)	28 (7.5%)	3 (4.1%)
S. Africa	9 (1.3%)	1 (0.4%)	8 (2.1%)	0
USA	15 (2.1%)	4 (1.5%)	11 (2.9%)	0
Former Soviet Union	459 (64.6%)	210 (80.3%)	182 (48.8%)	67 (90.5%)
Other	47 (6.6%)	17 (6.4%)	30 (8.0%)	0
Residency training				
Israel	657 (92.4%)		347 (93.0%)	53 (71.6%)
Former Soviet Union	32 (4.5%)		8 (2.1%)	20 (27.0%)
USA	11 (1.6%)		8 (2.1%)	0
Other	11 (1.6%)		10 (2.8%)	1 (1.4%)
Academic appointments				
Professor		3		
Professor emeritus		1		
Assoc Prof / Clinical Assoc Prof		7		
Assoc Prof / Clinical Assoc Prof emeritus		1		
Senior lecturer / Clinical senior lecturer		14		
Lecturer / Clinical lecturer		10		
Instructor		30		

Values are mean \pm SD.

* $P < 0.05$ vs. females

Table 2. Demographic characteristics of young anesthesiology residents ≤ 40 years old (n = 154)

Age (yrs)	34.9 \pm 3.5
Range	26–40
Females	33.1%
Age	
Females	34.7 \pm 3.8
Males	34.9 \pm 3.5
Medical school education	
Argentina	6 (3.9%)
France	1 (0.6%)
Israel	13 (8.4%)
Italy	4 (2.6%)
Romania	1 (0.6%)
S. Africa	1 (0.6%)
USA	3 (2.0%)
Former Soviet Union	113 (73.4%)
Other	12 (7.8%)

Values are mean \pm SD.

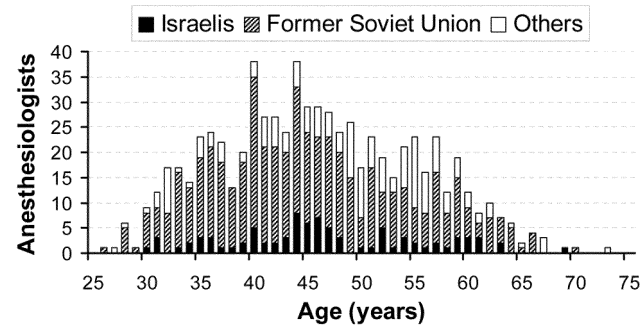


Figure 1. Age distribution of the 711 hospital department anesthesiologists included in this study. The black bars represent the graduates of medical schools in Israel, the hatched bars = graduates of medical schools in the former Soviet Union, and the white bars = graduates of medical schools in other countries. Note the increased number of graduates of Israeli medical schools in the 43–47 year age groups (who began anesthesiology residency around 1990). This reflects improved remuneration afforded by a 1988 wage agreement. However, this increase was short-lived when the 1990–1994 wave of immigration from the former Soviet Union increased the number of anesthesiologists, neutralizing these improvements.

has decreased drastically, from 200,170 immigrants in 1990 to 22,500 in 2004.

The majority (75%) of the anesthesiology department heads interviewed strongly agreed or agreed that there is currently a shortage of anesthesiologists and that this situation is most likely to worsen in the years to come.

The Israeli population has risen substantially, from 4.66 million in 1990 and 6.37 million in 2000 to 6.91 million at the end of 2004. Therefore, at present there are about 10.8 anesthesiologists per 100,000 population. The projections are for 8.1 million by 2015 and 9.3 million by 2025. The proportion and absolute number of inhabitants over the age of 65 years has also increased, from 462,000 (9.2%) in 1990 to 670,000 (9.9%) in 2003, and is estimated to further increase to 7.5 million inhabitants in 2010, 8.1 million by 2015 and 9.3 million by 2025. The increases in population and the elderly were accompanied by more surgeries (314,230 in 1990, 411,520 in 1995, and 501,570 in 2000) as reported by the Ministry of Health. Based on these data (60% increase in surgeries from 1990 to 2000), the projected number of surgeries per increase in population (using a linear regression model [$r^2 = 0.98$]) are 625,128 in 2005, 774,442 in 2015, and 943,762 in 2025. There was minimal need to adjust for the estimated increase in proportion (0.7%) of the population over age 65 from 2004 to 2015, since it was similar to the increase from 1990 to 2003. The rise in the proportion of the population older than 65 years from 2015 to 2025 is expected to be greater (1.9%). The birthrate in Israel rose from 103,349 in 1990 to 144,936 in 2003 (18.21 per 1000 population; 2005 estimation) [3]. It is expected to rise further in the future as the population increases, although the rate of increase is estimated to slow slightly as the average number of births/woman declines from 2.8 to 2.6. The cesarean section rate, which was 9.6% at the beginning of the 1990s [4], has risen to 17–18% [5]. Additionally, 40% of women receive epidural analgesia for their deliveries [5]. In Israel, 2% of acute care hospital beds are in intensive care units but some are closed due to the lack of funds. The demand for ICU admissions is greater than the bed supply, so 49% of patients needing ICU care (including those mechanically ventilated) are cared for in regular hospital departments [6].

The future Israeli anesthesiologist workforce was projected using two complementary methods [Appendix 1] [17]. Needs-based planning estimated future needs based on physicians required per capita. Three assumptions were used – one based on the status quo (10.8 anesthesiologists per 100,000 population) and the other two on modest increases in need per capita. The latter two assumptions were occasioned by the indication of the heads of the country's anesthesiology departments that there is presently a shortage of anesthesiologists. These projections showed that over the next 10 years more than 250–300 new anesthesiologists will be needed. The demand-based projection used the number of surgeries per anesthesiologist as the basis for its projections. It arrived at similar conclusions, namely, 294 new anesthesiologists [Appendix 1].

ICU = intensive care unit

Discussion

Almost all anesthesiologists practicing in Israeli hospitals today are immigrants who graduated from non-Israeli medical schools but who received their anesthesiology training in Israel. Graduates of the four Israeli medical schools constitute only about an eighth of Israeli anesthesiologists, while at present about one graduate of an Israeli medical school class annually enters anesthesiology residency. This immigrant predominance has implications for the future of the anesthesiology workforce since immigration, in general, and from the former Soviet Union, in particular, continues to decrease.

Anesthesiology is a specialty beset by current and future personnel shortages the world over. Many countries, e.g., the United States, Great Britain, Canada, Hong Kong, Sri Lanka and France, have reported shortages [8,9]. In the present study, 75% of Israeli anesthesiology department heads indicated that there was a shortage of anesthesiologists. Such shortages are problematic for a nation's healthcare system because anesthesiologists provide both a wide range of services and in-hospital coverage 24 hours a day, 365 days a year. In the UK, it was estimated that anesthesiologists underpin two-thirds of an acute trust's (hospital group) income [10]. In some countries, including Israel, these shortages have resulted in limiting the number of elective surgeries.

The current Israeli anesthesiology workforce, composed entirely of physicians, has about 10.8 anesthesiologists per 100,000 persons. This is similar to the European average of 10.8/100,000 persons and less than the French ratio of 14.75/100,000 persons [11,12]. However, in some European countries, e.g., Sweden, Switzerland and France, nurse anesthetists augment the physician anesthesiology workforce. This is also true in the U.S. where there are 9.4 anesthesiologists per 100,000 persons and 9.3 nurse anesthetists per 100,000 persons. Other reasons for differences between the number of anesthesiologists per population in various countries are practice patterns (e.g., proportion of urban vs. rural practice, hours worked per week), proportion of elderly patients, scope of anesthetic practice (e.g., German anesthesiologists are responsible for emergency departments), and the characteristics of surgical and obstetric care (epidural analgesia and cesarean section rates). However, it is important to note that the number of anesthesiologists per population is not static and is increasing in many countries, e.g., in Australia it increased from 9.9 in 1995 to 10.9 per 100,000 population by 2001 [13].

The demand for more anesthesiology services is not confined only to surgeries. Obstetric anesthesiology activity is projected to increase out of proportion to the increases in deliveries as the percent of cesarean births increases from the current 17–18% due to both more medical indications (e.g., recommendations not to attempt vaginal delivery after a cesarean delivery) and patient preference [14]. Cesarean rates are already higher in the U.S. (27.3% in 2003), Ireland (23.6% in 2002) and Australia (21.6% in 2001) [15,16]. Additionally, labor epidural analgesia rates are expected to rise, reflecting greater demand for this treatment [17]. The number of anesthesiologists trained in intensive care

medicine will rise, as the already inadequate numbers of ICU beds increase to care for a larger and older population. Areas outside operating rooms will also require more anesthesiology services, e.g., sedations for pediatric and invasive radiologic procedures and chronic pain services [1,18]. Another area likely to see an increase in the demand for anesthesiologists is cosmetic surgery, which is becoming increasingly more popular.

These projections of future anesthesiology workforce needs are likely low due to the aforementioned factors, as well as leakage from the specialty. Leakage is the number of workers prematurely leaving a workforce, e.g., when young physicians switch specialty during residency or emigrate to another country. The latter is an issue among Israeli physicians, including anesthesiologists, who are attracted to more financially attractive posts in the U.S., Canada or elsewhere. It is reported that 1959 Israeli physicians are currently practicing in the USA, Canada, Australia and the UK [19]. Leakage also occurs when physicians change careers, e.g., enter industry or become administrators (two Israeli anesthesiology-certified medical school graduates were so identified). Further leakage occurs at an accelerating, age-associated rate in those over age 55 due to mortality, and illness-related or voluntary early retirement [20]. Age-associated leakage is of special concern as the Israeli mandatory retirement age increases from 65 to 67 years. Another factor is the increasing number of women physicians who constitute 50% of current Israeli medical students, 25% of the present anesthesiologist workforce and 33% of the anesthesiology residents < 40 years old. The greater number of women has implications for workforce participation given the higher birthrate in Israel (2.6 live births per women) compared to other developed countries, coupled with liberal maternity leave (mandatory 3 months plus an optional additional 9 months) and child-related sick leave. An underestimation of future anesthesiology workforce needs has occurred with similar projections in other countries. Most notable is the 1994 study that grossly underestimated U.S. anesthesia workforce needs, leading to a shortage of anesthesiologists [21]. Studies in Britain and Australia underestimated needs partially because of the failure to account for early retirements and the longer anesthesia times needed for laparoscopic as compared to open surgery [7].

This study demonstrates that there will be a dearth of anesthesiologists in the next 10 years unless steps are taken to recruit Israeli medical school graduates into the specialty. This is a difficult challenge due to the lack of interest in anesthesiology on the part of graduates of Israeli medical schools. Of the 154 anesthesiology trainees \leq 40 years old included in this study, only 8.4% are Israeli medical school graduates. This group was examined separately since it represents the classic age group of resident physicians, i.e., those recently graduated from medical school. Typical Israeli graduates begin residency training around age 30, due to a 2–4 year military commitment for men and women at 18 years, 6 years of medical school and a year of rotating internship. Additionally, the major source of anesthesiologists, immigrant physicians, is drying up. This has sparked the Council of Higher Education to recommend doubling the output of the Israeli medical schools, while simultaneously reducing the

number of physicians per 1000 persons from the current 3.4 to 2.7 by 2021 [22]. This initiative will only aid anesthesiology if some of these graduates are attracted to the specialty. Potential measures for attracting more students to anesthesiology include improved remuneration (a tactic that improved recruitment of Israeli graduates at the beginning of the 1990s) [Figure 1], better working conditions, increased academic opportunities (only 5.1% of the 711 hospital anesthesiologists hold the rank of lecturer or higher), and improving the image of the specialty among the public and physicians. Other measures include providing recruitment incentives and ease in securing positions after completing residency. Barring success in recruitment efforts, other measures to continue providing anesthesiology services at present levels include extending working hours (until 6 p.m. to 8 p.m.) and postponing retirement until age 70. However, the former idea might increase burnout among professionals who provide in-hospital coverage 24 hours per day 365 days per year. Another potential measure is the use of anesthesia extenders, such as nurse anesthetists. However, Israel is facing a nursing shortage and has no infrastructure for training extenders [23]. Although other countries have responded to shortages by recruiting anesthesiologists from other countries, the current Israeli foreign worker and immigration laws are not conducive.

Conclusions

The Israeli anesthesiology workforce is currently not a locally sustainable resource. This workforce will suffer shortfalls as immigration diminishes, unless measures are instituted to attract and retain more Israeli medical school graduates. Anesthesiology, the seventh largest specialty in Israel, constitutes 4.5% of certified specialists, a proportion similar to that in the U.S. (4.4% in 1999) and New Zealand (4.3% in 2003) [24]. However, in the USA, 6% of graduating medical students enter anesthesiology in contrast to < 1% in Israel [25]. To provide 300 anesthesiologists over the next 10 years, at least 5% of Israeli medical graduates should enter the specialty each year. With the planned increases in Israeli medical graduates from 300 to 600 per year, this could provide about 30 new anesthesiologists per year. Until these schools reach 600 graduates per year, it will be imperative to recruit the remaining new anesthesiologists from among the dwindling supply of immigrant physicians or import them from other countries. However, it is a challenge to recruit 5% of Israeli medical students into anesthesiology and then retain them in the specialty and in the country. This will require an in-depth examination of why anesthesiology is such an unpopular specialty among Israeli medical students, and then taking significant steps to rectify the situation.

This paper has broader implications than just the specialty of anesthesiology. Modern healthcare systems require a multitude of primary care physicians, specialists and sub-specialists to provide their populations with comprehensive state-of-the-art care. Therefore, it no longer suffices to assess a nation's physician supply by only examining the overall number of physicians per population; it is also necessary to examine the numbers of each type of generalist and specialist. Some countries routinely

monitor their supply of various types of physicians and project future shortages or surpluses. These projections are used to recommend or control the number of training positions for each specialty. Similar efforts have never been undertaken in Israel, leading to a lack of detailed information about the current physician workforce and a dearth of projections about future needs for generalists and specialists. This study is an initial attempt at such an endeavor. However timely it may be for the specialty of anesthesiology, it should be noted that there is a lag of at least 6–7 years from when a medical student decides to enter anesthesiology training until specialty certification. Therefore, steps need to be taken posthaste to prevent an anesthesiologist shortage.

Acknowledgment. Supported by a grant from the Israel National Institute for Health Policy and Health Service research

References

- McGlennan A, Gold S, Cooper G: Anaesthesia. *Br Med J Careers* 2005;311:83–7.
- The Elderly in Israel. *Statistilite #46* Jerusalem: Central Bureau of Statistics, 2003.
- CIA World Factbook – Field Listing – Birth Rate. www.cia.gov/cia/publications/factbook/fields/2054.html.
- Mor-Yosef S, Samueloff A, Schenker JG. The Israel perinatal census. *Asia Oceania J Obstet Gynecol* 1992;18:130–45.
- Cohain JS. Midwifery in Israel. *Midwifery Today Int Midwife* 2004;71:50–1.
- Simchen E, Sprung CL, Galai N, et al. Survival of critically ill patients hospitalized in and out of intensive care units under paucity of intensive care unit beds. *Crit Care Med* 2004;32:1654–61.
- Duncan PG. Anesthesia human resources in Canada. *Can J Anesth* 2000;47:99–104.
- Schubert A, Eckout G, Tremper K. An updated view of the national anesthesia personnel shortfall. *Anesth Analg* 2003;96:207–14.
- Engen Dam Morewood GH, Ghazar NJ, Ashbury T, VanDenKerkhof EG, Wang J. A demand-based assessment of the Canadian anesthesia workforce – 2002 through 2007. *Can J Anesth* 2005;52:18–25.
- Australian and New Zealand College of Anaesthetists. Submission to the Health Workforce Study of the Productivity Commission.
- Pontone S, Brouard N, Scherpereel P, Boulardi G, Arduin P, for the CFAR-SFAR-INED Working Group. Demography of French Anaesthesiologists. Results of a national survey by the French College of Anaesthesiologists (CFAR) and the national Society of Anaesthesia and Intensive Care (SFAR), supported by the National Institute for Demographic Studies (INED). *Eur J Anaesthesiol* 2004;21:398–407.
- Rolly G, MasRae WR, Blunnie WP, Dupont M, Scherpereel P. Anaesthesiological manpower in Europe. *Eur J Anaesthesiol* 1996;13:325–32.
- Australian medical workforce advisory committee. The specialist anaesthesia workforce in Australia: an update:2001-2011. AMWAC Report, 2001.5.
- Ben-Meir A, Schenker JG, Ezra Y. Cesarean section upon request: is it appropriate for everybody? *J Perinat Med* 2005;33:106–11.
- National Center for Health Statistics (USA). National Vital Statistics Reports. Vol. 52, No. 10, 2003.
- Ganesan G: Deliveries in Singapore: Volume and Resources. 2004; www.getforme.com/previous2004/161204_deliveiriesinsingapore2001to1003.htm.
- Bucklin BA, Hawkins JL, Anderson JR, Ullrich FA. Obstetric anesthesia workforce survey. *Anesthesiology* 2005;103:645–53.
- Gozal D, Drenger B, Levin PD, Kadari A, Gozal Y. A pediatric sedation/anesthesia program with dedicated care by anesthesiologists and nurses to procedures outside the operating room. *J Pediatr* 2004;145:47–52.
- Mullan F. The metrics of the physician brain drain. *N Engl J Med* 2005;353:1810–18.
- Rosborough L. Health Human Resources: Balancing Supply and Demand – Interdisciplinary Teams: Planning for the Future Health Canada 2004; www.hc-sc.gc.ca/sr-sr/pubs/hpr-rps/bull/2004-8-hhr-rhs/method_e.html.
- Moyers JR. The evolution of human resources needs in the USA. *Best Pract Res Clin Anesthesiol* 2002;16:423–41.
- Council for Higher Education (Israel). Report of the Committee Examining the Future Need for Physicians. 2002.
- Rotem O, Toran O. The projected shortage of registered nurses in Israel. *Harefuah* 2004;143:799–803 (Hebrew).
- New Zealand Workforce Statistics 2003. www.nzhis.govt.nz/stats/specstats-p.html.
- Dorsey ER, Jarjoura D, Rutecki GW. Influence of controllable lifestyle on recent trends in specialty choice by US medical students. *JAMA* 2003;290:1173–8.

Correspondence: Dr. C. Weissman, Dept. of Anesthesiology and Critical Care Medicine, Hadassah-Hebrew University Medical Center, P.O. Box 12000, Jerusalem 91120, Israel.
Phone: (972-2) 677-7269
Fax: (972-2) 642-9392
email: charles@hadassah.org.il

Appendix 1. Anesthesiology Workforce Projections

METHOD 1: NEEDS-BASED ANALYSIS

Projections: 2005–2015

STEP 1: Number of retirees (assuming retirement age of 67 years) = 110 retirees

STEP 2: Anesthesiologists needed due to increase in population from 6.9 million at the beginning of 2005 to an estimated 8.1 million in 2015.

Assumption #1(status quo): 10.8 anesthesiologists/100,000 population: 130 added anesthesiologists

Assumption #2 (1 added anesthesiologist per hospital department): 11.2 anesthesiologists / 100,000 population – 162 additional anesthesiologists

Assumption #3 (2 added anesthesiologists per hospital department): 11.6 anesthesiologists / 100,000 population – 194 additional anesthesiologists

STEP 3: New anesthesiologists needed by 2015 (number needed to replace retirees [Step 1] + provide service to the increased population [Step 2]): Assumption #1: 240 anesthesiologists; Assumption #2: 272 anesthesiologists; Assumption #3: 304 anesthesiologists.

Projections: 2016–2025

STEP 1: Number of retirees (assuming retirement age of 67 years) = 212 retirees

STEP 2: Anesthesiologists needed due to increase in population from 8.1 million at the beginning of 2016 to an estimated 9.3 million in 2015.

Assumption #1(status quo): 10.8 anesthesiologists/100,000 population – 130 added anesthesiologists

Assumption #2 (1 added anesthesiologist per hospital department): 11.2 anesthesiologists / 100,000 population – 139 additional anesthesiologists

Assumption #3 (2 added anesthesiologists per hospital department): 11.6 anesthesiologists / 100,000 population – 149 additional anesthesiologists

Assumption #4 (3 added anesthesiologists per hospital department): 12.1 anesthesiologists / 100,000 population – 160 additional anesthesiologists

STEP 3: New anesthesiologists between 2016 and 2025 (number needed to replace retirees [Step 1] + provide service to the increased population [Step 2]): Assumption #1 – 342 anesthesiologists; Assumption #2 – 351 anesthesiologists; Assumption #3 – 361 anesthesiologists; Assumption #4 – 372 anesthesiologists.

METHOD #2 – DEMAND-BASED ANALYSIS

Projections: 2005–2015

STEP #1: 2005: 625,128 (estimated) surgeries. Therefore, there are 879 surgeries per hospital department anesthesiologist per year.

STEP #2: 2015: 774,442 (estimated) surgeries. If each hospital

anesthesiologist anesthetizes 879 surgery cases per year, a total of 881 hospital department anesthesiologists will be needed. This is 170 more than the current 711 anesthesiologists.

STEP #3: 2015: Number of new hospital anesthesiologists needed: 110 to replace retirees (see Method 1 – Step 1) + 170 anesthesiologists to care for increased surgeries. A total of 280 new anesthesiologists.

STEP #4: 2015: 280 new anesthesiologists for hospital departments + an additional 5% for those working outside hospital departments. Total: 294 new anesthesiologists.

Projections: 2016–2025

STEP #1: 2005: 625,128 (estimated) surgeries or 879 per hospital department anesthesiologist

STEP #2: 2025: 943,762 (estimated) surgeries. If each hospital anesthesiologist anesthetizes 879 surgeries per year, a total of 1074 hospital department anesthesiologists will be needed. Therefore, the need is for 193 more anesthesiologists in 2025 than in 2015.

STEP #3: 2015: New hospital anesthesiologists needed: 212 to replace retirees (see Method 1 – Step 1) + 193 anesthesiologists to care for increased surgeries. A total of 405 new anesthesiologists.

STEP #4: 2015: 405 new anesthesiologists for hospital departments + an additional 5% for those working outside hospital departments. Total: 420 new anesthesiologists.