



## Profile of Graduates of Israeli Medical Schools in 1981–2000: Educational Background, Demography and Evaluation of Medical Education Programs

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**Key words:** MD graduates, gender, medical curriculum, medical education, satisfaction

### Abstract

**Background:** In light of changes in the medical profession, the different requirements placed on physicians and the evolving needs of the healthcare system, the need arose to examine the medical education curriculum in Israel. This survey, conducted by the Samuel Neaman Institute for Science and Technology, summarizes 20 years of medical education in Israel's four medical schools, as the first stage in mapping the existing state of medical education in Israel and providing a basis for decision-making on future medical education programs.

**Objectives:** To characterize the academic background of graduates, evaluate their attitudes towards current and alternative medical education programs, and examine subgroups among graduates according to gender, medical school, high school education, etc.

**Methods:** The survey included graduates from all four Israeli medical schools who graduated between the years 1981 and 2000 in a sample of 1:3. A questionnaire and stamped return envelope were sent to every third graduate; the questionnaire included open and quantitative questions graded on a scale of 1 to 5. The data were processed for the entire graduate population and further analyzed according to subgroups such as medical schools, gender, high school education, etc.

**Results:** The response rate was 41.3%. The survey provided a demographic profile of graduates over a 20 year period, their previous educational and academic background, additional academic degrees achieved, satisfaction, and suggestions for future medical education programs.

**Conclusions:** The profile of the medical graduates in Israel is mostly homogenous in terms of demographics, with small differences among the four medical schools. In line with recommendations of the graduates, and as an expression of the changing requirements in the healthcare system and the medical profession, the medical schools should consider alternative medical education programs such as a bachelor's degree in life sciences followed by MD studies, or education programs that combine medicine with disciplines such as law, engineering, computer science, among others.

*IMAJ 2005;7:292–297*

Graduate surveys are periodically conducted by organizations and academic institutions to evaluate their educational programs and to stay abreast of professional developments among their graduates. Most of the surveys on Israeli medical graduates in the past were conducted within individual faculties. Surveys of a wider scope [1–3] were usually based on the Israel Medical Association database and examined trends and segmentations related to the

entire registered physician population, such as specialization, women in medicine, family medicine, among others. In light of changes in the medical profession, the different requirements placed on physicians and the evolving needs of the healthcare system, the need arose to examine the medical education curriculum in Israel. This survey, conducted by the Samuel Neaman Institute for Science and Technology [4], summarizes 20 years of medical education in Israel's four medical schools as the first stage in mapping the existing state of medical education in Israel and providing a basis for decision-making on future medical education programs.

### Goals of the survey

- To characterize the academic background of medical school graduates in Israel.
- To assess the attitudes of medical school graduates towards current medical education curriculum and alternative programs, as a basis for evaluating possible changes in the educational programs to meet the current and future needs of physicians.
- To evaluate trends and changes among medical school graduates and subgroups among them, such as male and female graduates, different medical schools, and others.

### Methods

#### Study population

The survey covered all graduates of the four medical schools who *completed* their studies in the years 1981–2000. The year 1981 was chosen because it was the first year in which students graduated from all four medical schools in Israel. The survey population comprised 5,687 graduates, from whom a sample group of 1:3 was selected.

The lists of graduates were supplied by the medical schools' administration offices after receiving approval for transfer of data between public entities according to the Privacy Protection Law of 1981. The information included name of graduate, address and ID number.

#### The questionnaire

A questionnaire with a stamped, addressed return envelope was sent to every third graduate on the list. The questionnaire included

open and quantitative questions scaled from 1 to 5. The time taken to complete the questionnaire was about 15 minutes. The addresses on envelopes returned as "incorrect address" or "unknown" were rechecked with the telephone company, through the Ministry of the Interior, or with the databases of the Israel Medical Association. In total, three rounds of questionnaires were sent; the third set of questionnaires lacked personal information of the graduate – i.e., name, age, family status, and identification of work place (name of hospital, clinic, etc.).

### Data analysis

The statistical analysis was performed using the SPSS program and GraphPad Prism I. The data were processed for the entire graduate population and subsequently segmented by medical school, gender, etc.

Continuous variables are expressed as mean  $\pm$  SD, and categorized variables as percentages. Comparisons among/within groups were performed by analysis of variance for independent/repeated measures respectively with the relevant ad hoc tests. The chi-square or corresponding tests for comparison of categorized values were used. A value of  $P < 0.05$  was considered significant.

## Results

### Graduate characteristics

Our sample represents about one-third of the population of graduates from the four medical schools in Israel during the years 1981–2000. After removing the disqualified questionnaires ( $n=126$ ), the undeliverable and the unallocated, the "corrected" sample group comprised 1,454 graduates. Of this group, 602 responded, constituting a 41.4% response rate. The data revealed the following characteristics:

- **Gender:** 56.2% of the respondents were male ( $n=327$ ) and 43.8% female ( $n=255$ ).
- **Age:** The average age of the respondents (in 2003) was  $39.5 \pm 6.1$  years. The age of female respondents was significantly lower than that of males at the time of the survey ( $38.5 \pm 6.0$  vs.  $40.3 \pm 6.0$ ) and at the start of their medical studies ( $21.3 \pm 2.1$  vs.  $23 \pm 2.2$ ).
- **Country of birth:** 78.4% of the respondents were born in Israel, the rest in Eastern Europe (8.7%), United States (6.1%), Western Europe, Central and South America, Africa and Asia.
- **Family status:** 85.8% were married, 10.4% were single, 3.2% were divorced and 0.6% were widowed at the time of the survey.
- **Number of children:** 71% had children; the average number of children per graduate was  $2.65 \pm 1.16$  (median 3 children).

There were no significant differences in demographic profile between graduates from the four medical schools in terms of gender, age at commencement of studies and at the time of the survey, percentage of Israeli-born graduates, family status and number of children.

- **Profession of spouse:** 41% of graduates' wives work in the healthcare sector, compared to 30.2% of graduates' husbands ( $P < 0.05$ ). We did not find any case of a female MD graduate's husband employed in nursing or pharmacies.

### Educational background

- **High school education:** 45.0% of Israeli graduates majored in biology in high school, 43.6% in exact sciences, 8.5% in humanities or other majors, and 2.9% in combined biology/exact science. We observed a significant increase in graduates who majored in exact sciences and a decrease in those who majored in biology and humanities ( $P < 0.05$ ), with no statistical gender difference ( $P = 0.09$ ).
- **Academic degrees prior to medical studies:** 8.7% of the graduates (excluding academic reserve\*) had an academic degree (bachelor's or master's) prior to starting their medical studies (6.6% of the population, including academic reserve): 7.6% had a bachelor's degree (two-thirds of the degrees in life sciences, the rest in psychology and exact sciences), and 1.1% had a master's degrees (all in life sciences). Two-thirds of the graduates with prior academic degrees were women. Fifteen percent of graduates with a prior academic degree completed a doctoral degree during their MD studies (compared to 2.8% for the entire graduate population).
- **Academic degrees (additional to MD degree) during and after medical studies:** 18.3% of the graduates have an additional academic degree beyond their MD degree. Of all graduates, 1.5% received a bachelor's degree (business administration, law, philosophy or engineering) and 9.3% a master's degree during (mostly in life and exact sciences) or after their medical studies (mostly in public health, health systems management or business administration). A PhD degree was completed by 3.6% of graduates – 2.1% during and 1.5% on completion of their medical studies. Almost all the PhD degrees were in life sciences. The percentage of women with a bachelor's degree prior to medical studies was significantly higher as compared to male graduates and lower for master's and doctoral degrees ( $P < 0.005$ ).
- **MD dissertation:** The topics of MD dissertations over the last 20 years were clinical projects (47.1%), basic/clinical laboratory research (33.4%), epidemiology (18.5%), literature survey (2.9%), and service quality (1.4%) (more than one descriptive category per project could be selected). No differences were found between categories of MD dissertations when segmented by gender or academic reserve. However, significant differences were found between medical schools [4]. About half (46.5%) the graduates claimed that their MD dissertation project enhanced their scientific writing abilities, widened their scientific experience (41.5%), increased their knowledge (38%), or improved their research techniques (30.5%) (more than one descriptive category could be selected). However, more than one-fifth of the graduates (22.9%) indicated that their final projects "did not make a contribution." The rate was significantly higher for clinical projects (28%) and lower for laboratory research dissertations (15.1%). A decline in the number of "did not make a contribution" responses, and an increase in the number of "enhanced my scientific writing abilities" responses were noted among the graduates of the last years.

\* Those who delay their military service in order to study

**Satisfaction with medical studies**

The graduates' satisfaction with their preclinical studies was significantly lower than with their clinical studies and their satisfaction with their studies in general ( $3.43 \pm 0.96$  vs.  $3.97 \pm 0.8$  vs.  $3.91 \pm 0.72$  respectively, mean  $\pm$  SD) (Friedman test  $P < 0.0001$ ) in all four medical schools (Dunn test  $P < 0.05$ ). As shown in Figure 1, some 15% of the graduates ranked their satisfaction with preclinical studies between "not satisfied" and "very unsatisfied" (scores of 1 and 2), and in total, the median value was 3 and less (on a scale of 5). Satisfaction increased significantly with regard to clinical studies (25.3% were "very satisfied") and overall medical studies (as a separate question). No difference in satisfaction level was found according to gender for each of the categories (Mann-Whitney test  $P < 0.05$ ). There were differences in the absolute level of satisfaction at different medical schools (Kruskal-Wallis test  $P < 0.05$ ) [4].

- *Missing/superfluous subjects in the medical curriculum:* The pre-clinical courses considered superfluous in the medical education program were physics (28.3%), mathematics (25.9%), chemistry (17.8%), exact sciences (3.7%), pathology/histology (2.4%) and anatomy (1.8%). Courses considered to be lacking and which the graduates suggested should be added were: clinical-based research techniques (27.2%), doctor-patient relations (26.2%), medical policy and health systems management (22.6%), law and ethics (18.6%), computer applications (17.1%), statistics (15.6%), and scientific writing, reading and use of databases (16.7%).
- *Choosing again to study medicine:* 12% indicated that they would not choose to study medicine again, and 23% were not certain. No significant differences were found according to gender or school of medicine. Of all graduates, 39% specified the subjects they would have preferred to study over medicine: namely, computers, law, engineering, arts (music, visual arts, movies and design), management, architecture, and psychology. Engineering was rated highest by male graduates and psychology by females (chi-square test  $P = 0.001$ )

**Alternative medical education programs**

The graduates were asked to rate five different options for medical education programs: 1) The 6 year MD program – the current curriculum in Israel today; 2) BSc in life sciences followed by MD studies; 3) BSc in relevant subjects such as engineering or business administration, followed by MD studies; 4) BA in any field followed by MD studies; 5) A combined program integrating medical curriculum and other disci-

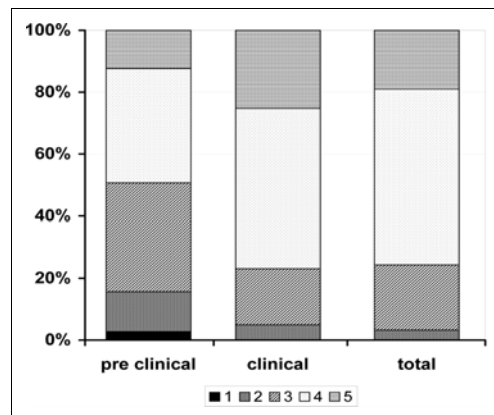
plines, such as medicine and law, medicine and business administration, medicine and engineering.

The graduates rated the existing 6 year MD curriculum highest as compared to the other options ( $4.07 \pm 1.15$ ) [Figure 2]. Sharing second place were the BSc in life sciences followed by MD studies ( $3.08 \pm 1.31$ ) and the combined program integrating MD studies and other disciplines ( $3.15 \pm 1.48$ ). A BSc in relevant topics such as engineering, followed by MD studies, was given third place ( $2.43 \pm 1.18$ ), and in last place, with a significantly lower rating than the other options, was a BA in any field followed by MD studies ( $2.04 \pm 1.22$ ) [Figure 2]. No significant differences were found according to gender or specific medical school.

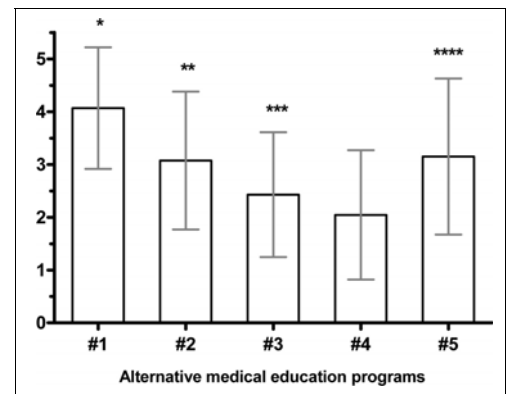
Graduates who held a prior academic degree gave top rating equally to the existing 6 year curriculum and a BSc in life sciences followed by MD studies. In second place, they selected the combined program (option 5), and equally in last place, a BSc in relevant subjects and a BA in any field, followed by MD studies. Respondents who indicated that they would not choose to study medicine again gave low ratings to all the options, although their relative ranking was similar to those of the entire graduate sample, except for conferring equal top rating to the existing 6 year program and the combined program (options 1 and 5).

**Discussion**

This survey presents a follow-up of graduates of Israel's four medical schools over a 20 year period, beginning in 1981 when all schools completed an MD program, through 2000. The survey does not intend to provide a quantitative summary of the entire physician population in Israel, and it certainly does not aim to provide exact statistics on the number of physicians and their occupations or other data that are available in the database of the Israel Medical Association (i.e., specialization, internship, number of academic reserve, etc.). Our survey population also includes medical school graduates who are not active in the clinical field and therefore are possibly not registered in the database of the Israel Medical Association. The purpose of the survey was to investigate



**Figure 1.** Distribution of satisfaction levels of graduates with preclinical studies, clinical studies, and overall MD studies, where 1 represents "very dissatisfied" and 5 represents "very satisfied" (n=575).



**Figure 2.** Graduates' ranking of preference for medical education programs (n=583), where 1 represents "least recommended" and 5 "most recommended." \*1 > 2,3,4,5; \*\* 2 > 3,4; \*\*\*3 > 4; \*\*\*\*5 > 3,4 (P < 0.05, Dunn test).

graduates of Israeli medical schools, their academic training track, and their opinions on current and alternative medical programs as input for possible future changes in the medical curriculum in Israel.

### Profile of the Israeli medical school graduate

The typical graduate of an Israeli medical school during the past 20 years could equally be a man or a woman, who was born in Israel, lived during his/her high school years in or near one of the large Israeli cities, majored at high school in either biology or exact sciences, and was 23 years old (male) or 21 years old (female) when he/she commenced medical school. When they started their MD studies, 8.7% of the graduates already had a bachelor's or master's degree. Today, most of the graduates are married with children, and more than one-third of them have spouses who work in the health sector. The demographic data are similar in terms of gender, which is in accordance with other surveys, showing a growing percentage of women in medicine [1,2,3,5] and equality in family status and in number of children per person. The number of children among the male and female graduates stands at  $2.6 \pm 1.2$  (median 3 children), which is a relatively high fertility rate for the western world [6].

### Educational background of the Israeli medical graduate

Most of the medical school graduates majored in biology or exact sciences in high school. In recent years, there has been an increase in the number of medical graduates who majored in exact sciences in high school, with some local differences between medical schools. This finding raises the question whether it reflects trends in high schools in Israel, the current technological development of the medical profession, or is merely an outcome of the different admissions criteria of the medical schools.

Eighteen percent of all Israeli medical school graduates have additional academic degrees beyond their MD degree; 8.7% had their bachelor's or master's degree before they started their MD studies, usually in life sciences or biology, and some in exact sciences and psychology. The other additional academic degrees were attained during or after MD studies. The lately acquired additional academic degrees were master's degrees in healthcare management or business administration, and doctoral degrees in life sciences. In various countries, attempts are being made to encourage medical school graduates to attain doctoral degrees and/or intensive research experience in order to promote clinical research [7,8]. Some reports suggest that students taking an intercalated degree are more interested in medical research and also favor in-depth strategic learning [9].

From our data on graduates who attained additional academic degrees we cannot predict their rate of success in their clinical pursuits or in their level of involvement and success in research or in healthcare management. There seem to be differences between graduates who completed a doctoral degree during their MD studies (MD/PhD program) and those who achieved their degree after their MD studies. The percentage of women physicians holding a doctoral degree (particularly those who completed an MD/PhD program) is significantly lower than that of male graduates, which is the case in other countries as well [7].

### Medical education programs

- Current medical education programs:* Graduates' satisfaction with their preclinical studies was lower than their satisfaction with clinical studies for all four medical schools. The dissatisfaction with preclinical studies and the feeling that some were superfluous have also been reported in other countries, and changes in medical education programs such as integrating basic science and preclinical courses with the clinical studies are being implemented accordingly [10–12]. The courses that graduates felt were missing and should be added reflect changes in the medical profession and physicians' requirements. The medical profession is becoming increasingly interdisciplinary, requiring expertise in supplementary areas such as research, medical economics, ethics and law, use of new technologies, advanced technical skills, management of a broad range of systems and frameworks, and human resources management. The courses that graduates felt were missing can be divided into three main groups: a) courses designed to provide better training for conducting research, including basic and clinical research techniques, computer applications, statistics, scientific writing and reading, and use of databases; b) courses designed to function more efficiently within the healthcare system in Israel, such as medical policy and management of healthcare systems, and courses in ethics and law; and c) courses to improve doctor-patient relations. Similar courses were reported to be lacking in medical programs in other parts of the world as well, likely reflecting a worldwide trend [13]. Yet, specific criticism regarding superfluous or missing courses is more effective when it is elicited in retrospective surveys at a faculty level and segmented by years. Completing an MD dissertation as a requirement for an MD degree is a subject of contention within the medical and academic communities in Israel. In most countries in the world, except for Germany for example [14], a MD dissertation is not compulsory and other means are used to increase the students' involvement in research, such as encouraging a year of research [9,14,15]. No correlation was found between major studies in high school and category of MD dissertation. Some differences were found in the categories of MD dissertations at the different medical schools [4]. Forty percent of the graduates were satisfied with their MD dissertation and acknowledged that the projects contributed to improving their scientific writing capabilities, scientific experience, research techniques and knowledge (one or more of these). Satisfaction with dissertations on basic research and epidemiology was significantly higher than that of the clinical dissertations. More than one-fifth of the graduates (22.9%) responded that their final projects "did not contribute anything," even though these numbers decreased in recent years and may reflect an improvement in training or in matching the MD dissertation to the student's interests.
- Alternative medical education programs:* Medical education programs are the subject of increasing discussion, particularly in light of the changing requirements of the medical occupation, national evolutions and global trends. While in the U.S. the most common medical programs comprise 4 years of postgraduate work [16,17], the European prototype is 5–7 years of medical

studies divided between preclinical and clinical courses, which is similar to the system in Israel [17]. Recently, attempts have been made, for example in Australia, to change the format of the medical school to a 4 year graduate medical course [18] and to consider other alternative education programs [19]. Until recently, all medical schools in Israel maintained the traditional 6 year format, although alternative medical programs are being developed here as well.

The graduates of all four medical schools in Israel rated the current traditional 6 year medical curriculum highest of all other options. In second place, they rated equally the option of a bachelor's degree in life sciences followed by MD studies, and the medical program combined with engineering, law, computers, or other relevant disciplines. Interestingly, those graduates who had a bachelor's or master's degree prior to commencing their medical studies gave top rating equally to the current 6 year program and to the bachelor's degree in life sciences followed by MD studies. The latter, in fact, most closely resembles their own training route (albeit on an ad hoc and not a faculty-sponsored basis).

The option to study medicine combined with engineering, law or computer sciences now exists in the different medical schools in Israel as an expression of market requirements and the needs of physicians. It is in accordance with the finding that law, computers and engineering were rated by the graduates as preferable alternative professions to medicine. The option of a combined studies program was ranked second by all the graduates, equal to the bachelor's degree studies in life sciences followed by MD studies. It should be noted that graduates who indicated that they would not study medicine again rated the combined program highest, together with the current 6 year program. It could be that this rating reflects their discomfort with the existing program and their perspective on how medical studies could be improved. The medical studies program, which was rated lowest by all the graduates, was the bachelor's degree studies in any subject followed by medical studies, in the format which is common, for example, in the United States.

About one-tenth (12%) of the graduates would not choose again to study medicine. We could not find particular characteristics of this subpopulation in parameters such as specialization, gender, faculty, high school education, etc.

#### Characteristics of subgroups

- *The four medical schools:* The graduates of the four medical schools in Israel are similar demographically in gender, age at commencement of studies, and age at the time of the survey. Slight differences can be found in academic background such as high school education, and MD dissertations [4]. Even so, the attitudes expressed by the graduates were similar regarding alternative medical education programs and their willingness to choose to study medicine again. Graduates from all four medical schools equally expressed their low level of satisfaction with preclinical studies compared to clinical studies, despite differences in the absolute levels of satisfaction in specific medical schools.

In light of the small differences between graduates at the different medical schools, the changes taking place in the medical system and the healthcare profession in Israel and the world, as well as the needs of the patients, a national medical curriculum should be considered, as was suggested for all European nations [20]. Alternatively, the differences between the medical schools and their sovereignty should be preserved, setting some standards in practical clinical skills and national examinations [21].

- *Female and male graduates:* No differences were found in the demographic and family characteristics between male and female graduates by categories of country of birth, family status and number of children, except for the significantly lower age of women when they commenced their studies (mostly due to 2 years military service for females compared to 3 years for males), and accordingly at the time of the survey. No differences were found in academic background, including high school education and category of MD dissertations. Yet, significant gender differences were found regarding additional academic degrees. While more female graduates have a prior academic (bachelor's) degree than do males in the higher degrees (master's and doctoral), they are significantly under-represented, particularly in the MD/PhD program. No differences could be found in their willingness to choose to study medicine again, their satisfaction with clinical and preclinical studies, and their preferences regarding alternative medical programs.

#### Conclusions

The profile of graduates of the four medical schools in Israel is primarily homogenous demographically, with small differences in academic background and training. The graduates are acquiring additional academic studies in spite of their advanced age relative to graduates in other countries, and their relatively long training. The graduates from all four medical schools have similar opinions on the current and alternative medical education programs. In view of the changing needs in the medical profession, and the preferences of graduates, the preclinical studies should be improved and courses should be added that enhance skills in research, doctor-patient relationship [22], and healthcare management. The current 6 year MD program is the most favored by all graduates. Next come bachelor degree studies in life sciences followed by MD studies, or MD studies combined with disciplines such as law, engineering and computer science. The main gender characteristic was an under-representation of female MD graduates with additional doctoral degrees.

#### Limitations of the survey and suggestions for the future

The principal difficulty in conducting this survey was locating the current addresses of graduates (due to outdated records in the medical schools), tracking graduates overseas, and defining the non-responding population. We suggest the establishment of a central bank of addresses and electronic addresses of graduates from all medical schools. This bank will be continuously updated and will be used for a longitudinal follow-up of graduates,

identifying changes in their professional status and receiving online feedback on national issues in the medical field.

We suggest that attempts be made to locate students who did not complete their medical studies, determining why, and at what stage they stopped, to match their medical school acceptance data and their current professional profile.

There is a need to follow the careers of the MD/PhD students and their commitment to research according to qualitative parameters such as academic and clinical appointments, research grants, and publications in peer-reviewed journals [23,24]. Sufficient time has passed since the introduction of MD/PhD programs in each of the four medical schools – and this is now possible.

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**Acknowledgments.** Special thanks to Zohar Linder and Golan Tamir for their contribution to this work. This survey was partly sponsored by a grant from the Ministry of Health.

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## References

1. Reis S, Goldfracht M, Tamir A, van Raalte R, Spenser T, Hermoni D. Trends in medical specialty choice among Israeli medical graduates 1980-1995. *IMAJ* 2001;3:973-7.
2. Notzer N, Brown S. Women's status in medicine in Israel – 1995. *Harefuah* 1995;129:449-51 (Hebrew).
3. Lachman R, Noy S, Oppenheim D. The "profile" of Israeli physicians: personal, employment and role characteristics of physicians in public hospitals. *Harefuah* 1991;121:489-93 (Hebrew).
4. [http://www.neaman.org.il/publications/publication\\_item.asp?fid=488&-parent\\_fid=0&iid=2186](http://www.neaman.org.il/publications/publication_item.asp?fid=488&-parent_fid=0&iid=2186).
5. Cooper RA. Impact of trends in primary, secondary and postsecondary education on applications to medical school. I: Gender considerations. *Acad Med* 2003;78:855-63.
6. U.S. Census Bureau 2004, <http://www.census.gov/ipc/prod/wp02/tabA-09.pdf>.
7. Fang D, Meyer RE. Effect of two Howard Hughes medical institute research training programs for medical students on the likelihood of pursuing research careers. *Acad Med* 2003;78:1271-80.
8. Wilkerson L, Abelmann WH. Producing physician-scientists: a survey of graduates from Harvard-MIT program in health sciences and technology. *Acad Med* 1993;68:214-18.
9. McManus IC, Richard P, Winder BC. Intercalated degrees, learning styles, and career preferences: prospective longitudinal study of UK medical students. *Br Med J* 1999;319:542-6.
10. Custers EJ, Ten Cate OT. Medical students' attitude towards and perception of the basic sciences: a comparison between students in the old and new curriculum at the University Medical Center Utrecht, the Netherlands. *Med Educ* 2002;36:1142-50.
11. Kaufman DM, Mann KV. Basic sciences in problem-based learning and conventional curricula: students' attitudes. *Med Educ* 1997;31:177-80.
12. West M, Mennin SP, Kaufman A, Galey W. Medical students' attitude towards basic sciences: influence of a primary care curriculum. *Med Educ* 1982;16:188-91.
13. Barzansky B, Etzel SI. Educational programs in US medical schools, 2002-2003. *JAMA* 2003;290:1190-6.
14. Dewey M. Students' evaluation of research during medical studies: medical dissertation in Germany. *Med Educ* 2003;37:278-80.
15. Smith FG, Harasym PH, Mandin H, Lorscheider FL. Development and evaluation of a research program for medical students at the University of Calgary Faculty of Medicine. *Acad Med* 2001;76:189-94.
16. Brotherton SE, Simon FA, Tomany SC. US graduate medical education, 1999-2000. *JAMA* 2000;284:1121-6.
17. Jones R, Higgs R, de Angelis C, Prideaux D. Changing face of medical curricula. *Lancet* 2001;357:699-703.
18. Prideaux D, Teubner J, Sefton A, Field M, Gordon J, Price D. The consortium of graduate medical schools in Australia: formal and informal collaboration in medical education. *Med Educ* 2000;34:449-54.
19. Horton R. Why graduate medical schools make sense. *Lancet* 1998;351:826-8.
20. Breipohl W, Johansson C, Hansis M, et al. Undergraduate medical education: tendencies and requirements in a rapidly developing Europe. *Folia Med* 2000;42:5-16.
21. Pettersen HB, Bovim G, Brodal P, Ogreid D, Fonnebo V. Medical education in Norway, one common education, four different models. *Tidsskrift Den Norske laegeforening* 1997;117:2798-803.
22. Friedberg M, Glick SM. Evaluation of innovative school's graduates by department heads at other hospitals. *Med Teacher* 1997;19:36-9.
23. Lee JS. MD-PhD students in the 1990s: finding a niche for a dual degree. *JAMA* 1995;274:1736-7.
24. Fang D, Meyer RE. Ph.D. faculty in clinical departments of U.S. medical schools, 1981-1999; their widening presence and role in research. *Acad Med* 2003;78:167-76.

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