

SPECIAL ARTICLE

WHERE HAVE ALL THE PRIMARY CARE APPLICANTS GONE?

JACK M. COLWILL, M.D.

NOT all aspects of the 1960s can be viewed with nostalgia. Nevertheless, many people have such feelings for the deep social concern of the times. During the 1960s Congress implemented Medicare and Medicaid and also initiated primary care programs for underserved rural and inner-city populations. Convictions about a shortage of physicians led first to an expansion in the size of medical school classes and then to a recognition that more primary care physicians were needed. With state and federal support, residency training in family practice expanded rapidly during the 1970s,¹ followed by the introduction of primary care tracks in internal medicine and pediatrics in the 1980s.² Despite these developments, many questioned whether the number of residency positions in primary care was adequate to meet the nation's needs.³⁻⁷

Today, however, the limiting factor in educating an adequate number of primary care physicians is not the number of residency positions. It is the declining number of applicants.⁸ A recurring question truly is, Where have all the applicants gone? This paper reviews current trends in student interest in primary care, discusses factors associated with these trends, and explores the role of medical schools in meeting tomorrow's needs for primary care physicians.

THE SHRINKING POOL OF APPLICANTS

The impending problem of too few applicants was revealed in 1987 by a sudden drop in the number of U.S. medical school graduates entering a training program in internal medicine through the National Residency Matching Program. Since that time, there have been further decreases in the number entering internal medicine, paralleled by declines in the number entering family practice and, to a lesser extent, pediatrics (Table 1).^{9,10} In 1991, 1367 (19 percent) fewer U.S. medical school graduates entered training programs in these specialties than in 1986.

The actual decline in interest in primary care is far greater than that reflected in the 1991 match data, because many in internal medicine and pediatrics choose to enter a subspecialty. The graduation questionnaire of the Association of American Medical Colleges (AAMC) demonstrates that interest in primary care has fallen from 36 percent of graduates in 1982 to 22.5 percent in 1989 — a decline of 37.5 percent (Ta-

ble 2).^{11,12} In 1989 only 11.7 percent of all medical school graduates planned careers in family practice, 6.0 percent in general internal medicine, and 4.8 percent in general pediatrics. Only 31 percent of those who selected residencies in internal medicine and 61 percent of those entering pediatrics planned careers in primary care. The AAMC graduation questionnaire, completed annually by 60 to 70 percent of graduating students, provides surprisingly accurate predictions of the overall percentage of graduates who ultimately practice in each major specialty.¹³

Table 3 shows overall changes in specialty preferences. The data demonstrate a pervasive trend toward increasing subspecialization and away from generalism. Interest is declining not only in primary care but also in general obstetrics and gynecology and general surgery. Declines in internal medicine, pediatrics, and obstetrics and gynecology are partially offset by increased interest in their subspecialties. The largest decline, 8.3 percent of graduates, has been in general internal medicine, and the largest increase, 5.8 percent, has been in the subspecialties of internal medicine. This increased preference for the subspecialties is almost entirely confined to cardiology, gastroenterology, and pulmonary medicine. Increases in other specialties can also be viewed as part of the broader trend toward increasing specialization. Contrary to what many may have expected, interest in surgery and its subspecialties has not increased. Perhaps students recognize that there is strong competition in these specialties for a limited number of positions, a number that has not changed substantially over the past decade.¹⁴⁻¹⁶

There has also been a dramatic drop in interest in family practice among students entering medical school. Data from the Medical College Admission Test questionnaire show that among entering medical students, interest in family practice fell from 37 percent in 1978 to 16 percent in 1987.⁸ Data from the new AAMC matriculation questionnaire for first-year medical students reveal that only 10 percent of entering medical students in 1988 and 1989 planned careers in family practice. The importance of this decline is highlighted by a cohort study of students who graduated from medical school in 1987, which showed that almost half of those entering family practice in 1987 had favored that specialty when they completed the Medical College Admission Test.¹⁷ Thus, declining interest in family practice among medical school entrants suggests that interest among graduates will continue to decline at least through 1992. These trends

From the Department of Family and Community Medicine, M228 Medical Sciences Bldg., University of Missouri-Columbia, Columbia, MO 65212, where reprint requests should be addressed to Dr. Colwill.

suggest that fewer than 20 percent of today's graduates are planning careers in primary care.

FACTORS ASSOCIATED WITH CHANGING SPECIALTY PREFERENCES

Multiple factors may lead to the selection of a specialty.^{18,19} In choosing a specialty, students match their personal characteristics and desires with their perceptions of the skills required and the gratifications anticipated from practice. These perceptions may be derived from direct educational experiences, role models, and hearsay comments. On the basis of such perceptions, students weigh the likelihood that a specialty will meet their desires in regard to practice content, contact with people, intellectual stimulation, the performance of procedures, fulfilling a social need, and obtaining desired prestige, lifestyle, and monetary rewards.

Three fourths of the students who completed the 1989 graduation questionnaire indicated that they had considered an alternative specialty.¹² Surprisingly, the major alternative specialty considered by those entering general internal medicine or pediatrics was not a subspecialty of the discipline they chose. Only 4.6 percent of the students entering general internal medicine seriously considered an internal medicine subspecialty, but 38.3 percent considered family practice or general pediatrics. Conversely, among those planning a career in a medical subspecialty, only 4.1 percent considered general internal medicine as an alternative, whereas 35.2 percent considered other subspecialties of internal medicine, pediatrics, and surgery. These data suggest that students tend to view themselves as either specialists or generalists and thus, in considering alternative careers, are likely to select other general or specialized fields.

Funkenstein noted that the "ideology of an era" also seems to have a major effect on the popularity of various specialties among medical students.²⁰ During the 1970s, when national enthusiasm about fulfilling unmet needs in primary care was high, more students selected careers in primary care. Many of these were

Table 2. Interest in Primary Care among U.S. Medical School Graduates in 1982 and 1989.*

SPECIALTY	PERCENT OF GRADUATES		PERCENT DECLINE
	1982	1989	
Family practice	15.5	11.7	24.5
General internal medicine	14.3	6.0	58.0
General pediatrics	6.2	4.8	22.6
Total primary care	36.0	22.5	37.5

*Data are from the AAMC^{11,12} and include specialties that were selected and the first choices of those who were undecided.

students whom Funkenstein would have predicted would enter a subspecialty. Apparently, their basic values were heavily influenced by the "ideology of the era."

In a 25-year longitudinal survey of college freshmen, Astin documented a profound change in the responses to two questions that may serve as proxy indicators of changing values among students (Fig. 1).²¹ The percentage of freshmen who felt that a meaningful philosophy of life was very important dropped from 82 percent in 1966 to 40 percent in 1986. Conversely, the percentage of students who thought it very important to be financially well off nearly doubled, from about 40 percent to almost 80 percent. During this period, interest in business as a career skyrocketed, and interest in careers in education declined.

Many who work with medical students believe they are increasingly seeking to pursue family-oriented activities, follow personal avocations, and obtain high incomes, thus mirroring the changing values of society.²²⁻²⁶ Indeed, the specialties in which student interest is declining have in common an orientation toward generalism, a perception that work hours are unpredictable, and lower anticipated income. Conversely, the specialties in which student interest has increased are more narrow in focus and provide high incomes, predictable work hours, or both. The surgical subspecialties and some medical subspecialties are exceptions. Less attractive medical subspecialties have a lower income-generating potential than cardiology, gastroenterology, and pulmonary medicine.²⁷

The average net income earned by physicians in each specialty is highly correlated with the number of applications per residency position and the percentage of positions filled by U.S. medical school graduates through the National Residency Matching Program (Fig. 2).^{28,29} Nevertheless, only 11 percent of the students completing the AAMC graduation questionnaire in 1989 indicated that financial considerations were important. Twenty-eight percent of those entering anesthesiology and 20 percent of those entering thoracic surgery reported that income was important; less than 2 percent of those entering primary care perceived income to be a determining factor. A study of students who graduated from Jefferson Medical College between 1987 and 1989 demonstrated that the peak income expectation of students in their first year

Table 1. U.S. Medical School Graduates Matched with Positions by the National Residency Matching Program in 1986 and 1991, According to Primary Care Specialty.*

SPECIALTY	NO. OF GRADUATES		PERCENT DECLINE
	1986	1991	
Internal medicine†	4,069	3,058	25
Family practice	1,680	1,374	18
Pediatrics‡	1,366	1,316	4
Total primary care	7,115	5,748	19
Total matched	13,756	12,985	6

*Data are from the National Residency Matching Program.^{9,10}

†Includes categorical, medicine/pediatrics, and primary care (preliminary programs have been excluded because most graduates in them enter other specialties).

‡Includes categorical and primary care.

Table 3. Specialty Preferences of U.S. Medical School Graduates in 1982 and 1989.*

SPECIALTY	PERCENT OF GRADUATES		CHANGE IN % OF GRADUATES, 1982-1989	% CHANGE, 1982-1989
	1982	1989		
Decreasing preference				
General internal medicine	14.3	6.0	-8.3	-58
Family practice	15.5	11.7	-3.8	-24
General obstetrics and gynecology	6.6	4.6	-2.0	-30
General pediatrics	6.2	4.8	-1.4	-23
General surgery	6.5	5.5	-1.0	-15
Increasing preference				
Internal medicine subspecialties	7.6	13.4	+5.8	+76
Anesthesia	4.6	6.2	+1.6	+35
Dermatology	1.1	2.7	+1.6	+145
Radiology	4.7	6.3	+1.6	+34
Pediatric subspecialties	1.8	3.1	+1.3	+72
Physical medicine and rehabilitation	0.5	1.8	+1.3	+260
Emergency room medicine	2.5	3.7	+1.2	+48
Obstetrics and gynecology subspecialties	1.2	2.1	+0.9	+75
Psychiatry	4.8	5.7	+0.9	+19
Preventive medicine	0.2	0.4	+0.2	+100
Preference unchanged†				
Neurology	1.8	2.1	+0.3	+17
Ophthalmology	3.6	3.4	-0.2	-6
Pathology	2.3	2.1	-0.2	-9
Surgical subspecialties	13.7	13.0	-0.7	-5

*Data are from the AAMC.^{11,12}

†Change of less than 0.9 percent of U.S. graduates (approximately 150 students) or of less than 50 percent of those entering a specialty.

of medical school was an independent predictor of their choice of a specialty. Furthermore, among first-year students with a preference for family practice, those with lower income expectations were twice as likely to enter family practice as those with higher income expectations.³⁰ Students may not recognize the subtle effect that financial considerations have in their choice of a specialty.

The effect of educational debt on the selection of a specialty is probably limited. In 1989, debts incurred by students averaged \$42,374 but showed no consistent pattern among specialties.³¹ The debts of graduates who planned careers in primary care were similar to those of graduates who strongly considered a primary care specialty but then selected another (Table 4).

During the past four years, minor changes in the values and career

goals of entering college freshmen suggest that social concern is increasing in this group. Responses to the proxy-indicator questions in Figure 1 show a slight reversal of previous trends. Students are also indicating an increasing desire to influence social values.²¹ Interest in careers in primary and secondary education is increasing, whereas interest in business degrees is plummeting. After a decade of decline, the number of students applying to medical schools is increasing.²³ It is unlikely, however, that these trends alone will reverse the movement toward increasing specialization among medical school graduates.

THE EFFECT OF THE ACADEMIC MEDICAL CENTER ON SPECIALTY PREFERENCES

Many, believing that specialty preferences can be explained by market forces, argue that medical education does not influence the selection of a specialty. Observations by Funkenstein reinforce this view.²⁰ He noted that shifts in specialty preference occurred simultaneously among graduating students and entering students, much as today's declining interest in family practice is occurring simultaneously among medical school entrants and graduates.

Although forces outside medical education do influence the choice of a specialty, trends in the selection of family practice provide several lines of evidence that link the educational process with the selection of a specialty. Babbott et al. found that preference for family practice among medical students dropped from 26 percent before admission in 1983 to 13.5 percent at graduation in 1987.¹⁷ Only half made their decision to enter family practice during the course of medical school. In contrast, 90 percent of those entering internal medicine made that decision during medical school. Certainly, medical education broadened

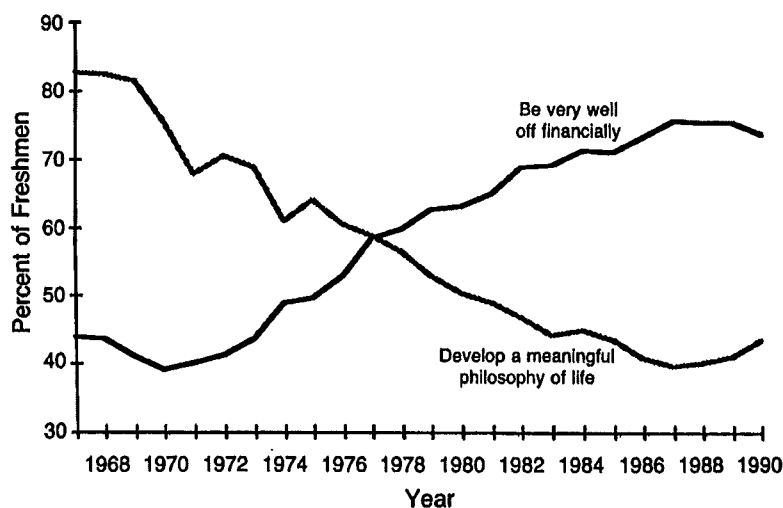


Figure 1. Trends in the Life Goals of College Freshmen.

Values shown are the percentages of students who identified each goal as either essential or very important. Adapted from Astin²¹ with the permission of the publisher.

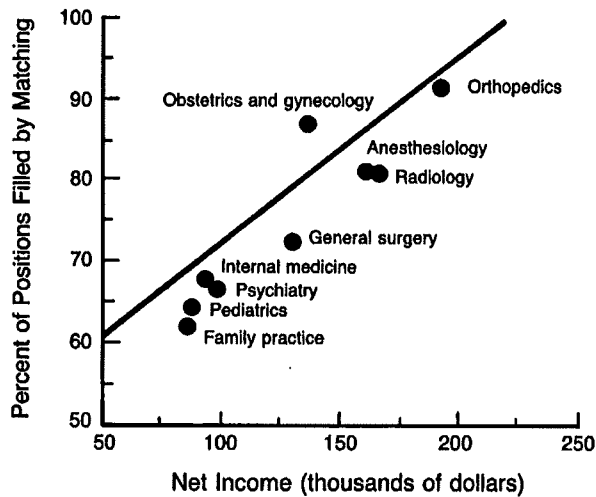


Figure 2. Correlation between Income Derived from Practicing a Specialty and the Percentage of Available Residency Positions Filled by Matching.

Adapted from Shulkin²⁹ with the permission of the publisher.

many students' perceptions of internal medicine. The failure to recruit large numbers of students into family practice suggests that the institutional milieu may have fostered the selection of internal medicine and its subspecialties and discouraged the selection of family practice. Today's declining interest in general internal medicine and general pediatrics and the increasing interest in their subspecialties may reflect the dominant role of subspecialization in these departments.

A second line of evidence that the educational process affects the choice of a specialty is the marked variation among schools in the percentage of students who enter family practice.³² Ten-year mean percentages range from 1.7 to 34.9 percent. The differences between schools seem too great to be explained solely by the selection of students interested in a career in family practice. Indeed, some characteristics of institutions seem to influence the selection of family practice. Each of the 50 medical schools with the most graduates entering family practice has a department of family medicine.³² Only 3 of the 20 medical schools with the lowest percentage entering family practice have such departments. Likewise, state-supported schools and schools with more curricular time in family practice produce more family physicians.³³⁻³⁵ Those with

the largest percentage of graduates entering family practice are more likely to be community-based.³²

IMPLICATIONS OF CURRENT TRENDS

The decline of generalism and the trend toward specialization have been perhaps the dominant forces in medicine and society during this century.³⁶⁻³⁸ Today's declining interest in primary care cannot be viewed as a cyclic change. Current trends indicate that the United States is moving toward a health care system composed predominantly of subspecialists. Only 34 percent of physicians describe themselves as generalists today,³⁹ and less than a quarter of physicians will function as generalists in the next century if current trends continue.

By contrast, in most other Western nations primary health care is delivered predominantly by generalists, and the number of residency positions and their distribution according to specialty are regulated. General practitioners make up 50 percent of Canadian and 70 percent of British physicians.^{40,41} Generalists also constitute approximately half of all physicians in health maintenance organizations — the most cost-efficient delivery organizations in our health care system.^{42,43}

Today's trend toward subspecialization is associated with what many believe to be a surplus of physicians.^{3,44} Nevertheless, major geographic problems in access to care persist and are related in part to subspecialization.⁴⁵ The expected movement of physicians to areas of need is limited by the fact that a large population base is required to support most specialists.^{46,47} Consequently, only family physicians are located in rural areas in a proportion similar to the population at large.⁴⁸

The combination of more and more specialization and an increasing supply of physicians will contribute to escalating health care expenditures. More physicians can be expected to provide more services, even though the amount of service provided by individual physicians may decrease.⁴⁹⁻⁵⁹ Subspecialists are increasingly likely to provide principal care to patients whose problems lie in their areas of expertise.⁶⁰ Many of these services would previously have been provided by generalists. The degree to which subspecialists will also serve broadly as generalists, providing truly accessible, continuing, comprehensive, and coordinated care for most problems of unselected patients is unknown. Because of the narrower focus of their education, they are likely to seek consultation more frequently and to use the technology and procedures of their subspecialties more often than generalists would. Consequently, both increasing numbers of physicians and increasing subspecialization have negative implications for the control of health care expenditures.

Weiner suggests that future changes in health care, such as an expansion of the role of health maintenance organizations, increased funding of preventive services, and the implementation of universal health

Table 4. Average Debt of Students with Educational Loans.*

SPECIALTY	AVERAGE DEBT (\$)		% OF STUDENTS INDEBTED	
	SPECIALTY CHOSEN	SPECIALTY NOT CHOSEN	SPECIALTY CHOSEN	SPECIALTY NOT CHOSEN
Family practice	41,005	42,129	84.4	82.6
General internal medicine	43,355	42,041	81.0	79.7
General pediatrics	37,709	40,292	79.1	82.2

*Data are derived from the AAMC 1989 graduation questionnaire.¹²

insurance, will increase the need for generalists more than that for subspecialists.⁶¹

With an oversupply of physicians, the nation is probably better served by an abundance of generalists than by an abundance of subspecialists. Unfortunately, it is the subspecialists who are becoming more numerous, despite many reports on physician manpower recommending that more generalists be educated.^{3,6,23,44} An increasing number of generalists will reduce the difficulty of finding a personal physician, improve the movement of physicians into areas of need, enhance the efficiency of care, and make health care less costly.

IMPLICATIONS FOR UNDERGRADUATE MEDICAL EDUCATION

Educating physicians for primary care has not been a high priority in most medical schools.⁶²⁻⁶⁴ Nevertheless, many schools have developed successful programs to increase the number of graduates entering primary care. Jefferson Medical College combines a separate selection process with special educational programs for students from rural areas who have an interest in family medicine.⁶⁵ The Washington, Alaska, Montana, Idaho Program at the University of Washington offers selective admission to applicants from those states and community-based educational experiences.⁶⁶ The University of Minnesota increases the number of graduates entering rural family practice through its Rural Physician Association Program, which places students in rural practice settings for nine months, and through the Duluth Program, which selectively admits students interested in rural practice.^{67,68} The experiences of the Upper Peninsula Program of Michigan State University⁶⁹ and programs at Southern Illinois University, East Carolina Medical School, the University of North Dakota,⁷⁰ the State University of New York at Syracuse-Binghamton,⁷¹ and other medical schools demonstrate that it is possible to have a high percentage of graduates enter primary care. The selective admission of students interested in careers in primary care, changes in curriculum that emphasize primary care, and the placement of students in community-based settings are common features of these programs.⁷²

What barriers prevent other institutions from emulating such programs? The academic medical center itself is a major obstacle.⁷³ The typical medical school, with its tertiary-care teaching hospital, provides a different culture from that of the community, with its orientation toward primary and secondary care. Academic medical centers emphasize the application of science and technology to the treatment of disease in individual patients. Their faculty members value in-depth knowledge, inquiry, and a detailed approach to care. Their organizational structures and sources of funding emphasize research and the delivery of tertiary care. In this environment, generalism tends to be defined in terms of the absence of specialization rather than in terms of its positive fea-

tures of breadth, comprehensiveness, and integration.⁷⁴ Most medical education occurs in this tertiary-care milieu, producing a major socializing force toward specialization.

The selection of medical students emphasizes academic achievement — especially in science — and places relatively less emphasis on the students' commitment to service, specialty preferences, orientation toward people, and views on income, lifestyle, and prestige. The curriculum focuses on the biologic sciences and hospital-based specialty and subspecialty rotations rather than on epidemiology, behavioral sciences, and primary care rotations. Schools are more likely to have developed M.D.-Ph.D. programs than special programs to prepare primary care physicians. Subspecialty faculty members have the most contact with students and transmit their enthusiasm for their specialties to them. The selection process, curriculum, and educational setting are all admirably designed to prepare subspecialists. Medical faculties have thus tended to replicate themselves.

Faculties evaluate their schools' educational programs according to National Board examination scores, the prestige of residencies their students obtain, and the percentage of graduates who enter academic medicine. Unfortunately, most schools lack objectives that define the desired distribution of their graduates according to specialty or geographic area.

The Liaison Committee on Medical Education stipulates that each medical school "must define its objectives and make them known to faculty and students," but it does not state explicitly that each medical school should establish objectives for the distribution of its graduates according to specialty, geographic area, or both and should measure its performance against those standards.⁷⁵

Thus, the setting and cultural milieu of undergraduate medical education, plus the belief that the educational process does not shape the selection of a specialty, have limited the commitment of medical schools to prepare their graduates for careers in primary care. Academic medical centers have responded admirably to some of their public trusts but less well to the public expectation that they produce the number and kinds of physicians needed.⁶²

In the final analysis, each medical school should establish objectives that are endorsed by the faculty and made public. If faculty members are committed to meeting the need for primary care physicians, then a series of programmatic decisions are likely to be made.

First, the institution will select students whose characteristics make them more likely to enter careers in primary care. The validity of a student's stated specialty preference appears to be undervalued. My analysis of the data of Babbott et al. on the 1987 cohort of U.S. graduates¹⁷ demonstrates that 50 percent of those indicating a preference for surgery on the Medical College Admission Test questionnaire selected one

of the surgical specialties, and 47 percent of those indicating a preference for family practice planned a career in primary care at graduation. Many believe that applicants falsely profess a preference they think the admissions committee is looking for. However, the success of schools such as Jefferson Medical College in selecting students who enter family practice suggests that a comprehensive assessment of an applicant's personal characteristics and values, combined with attention to specialty preferences, results in a high level of predictive validity. Although much research has already been undertaken on the characteristics of students who enter careers in primary care, much further research is needed.^{19,76-78}

Second, the educational milieu and curriculum will change to enhance interest in primary care. Successful programs generally include important community-based educational experiences.^{32,72,73} These experiences must involve the same supervision and quality control as those in tertiary-care centers. Weak primary care programs, regardless of where they are located, are unlikely to influence students to choose a career in the field.

A strong argument can be made that the primary care disciplines should be united in a single primary care department. This new department or program would have the critical mass of faculty members necessary to assume a central role in both primary care education and the general education of medical students. It would sponsor residency programs leading to board certification in each primary care specialty. The clinical base would include large primary care populations. Its laboratory would be the practice and the community. Its research would encompass clinical problems and issues in health care delivery. Both its educational programs and its research would draw from clinical epidemiology and the behavioral sciences. The collective educational effect of this department would do much to enhance the selection of careers in primary care.

Although this paper has emphasized the role of medical schools in modifying the distribution of their graduates according to specialty, solutions must also lie in graduate medical education, in patterns of remuneration, and in the practice environment.

Many who plan generalist careers in internal medicine and pediatrics decide during residency to subspecialize. The heavy orientation toward inpatients, organization of inpatient wards according to subspecialty, encouragement by faculty members to take up subspecialty fellowships, limited experience in primary care, and limited number of generalists to serve as role models all contribute to this shift toward subspecialization. The primary care orientation of residency training must be strengthened, and the number of subspecialty fellowships reduced.

Government and other third parties have a central role in making primary care more attractive through reimbursement reform, the reduction of bureaucratic hassle,⁷⁹ and support of primary care education. The single most important financial incentive

to enter primary care will exist when the income from primary care equals that from practice oriented toward procedures. Although the new Medicare fee schedule will narrow discrepancies between specialties, its effect will be limited until other third-party payers also reduce payment differentials. In addition, governmental programs of loan forgiveness might encourage medical school graduates to enter primary care practice and bypass subspecialty fellowships.

Medical schools will face substantial additional expenses as they move their educational programs into ambulatory and community settings. Teaching medical students in these settings reduces physicians' productivity and increases overhead.⁸⁰⁻⁸³ Decentralizing educational programs requires much coordination, which further increases costs. Grant programs can catalyze these changes, but long-term support will be required. Both the Washington, Alaska, Montana, Idaho Program and the Area Health Education Center model of community-based education promote primary care, just as education in tertiary-care centers promotes subspecialization.

I believe that neither society nor the medical profession benefits from the decline in interest in primary care. We need a partnership between the government and our medical schools to promote interest in careers in primary care. The carrot of incentives is preferable to the stick of regulation in ensuring an appropriate balance of medical specialties.

I am indebted to Phil Szenas for data from the AAMC graduation questionnaire, to David Babbott, M.D., for providing data, and to Gerald Perkoff, M.D., and Robert Blake, M.D., for helpful criticism of the manuscript.

REFERENCES

1. Colwill JM. Graduate education in family medicine — its ambulatory emphasis. In: Institute of Medicine. Primary care physicians: financing their GME in ambulatory settings. Washington, D.C.: National Academy Press, 1989:76-91.
2. Noble J, Starfield B, Friedman R. Assessment of the development and support of primary care residency training: general internal medicine and pediatrics: final report. Rockville, Md.: Department of Health and Human Services, 1988.
3. Council on Graduate Medical Education. First report of the Council. Vol. 1. Washington, D.C.: Department of Health and Human Services, 1988.
4. Schroeder SA. The making of a medical generalist. *Health Aff (Millwood)* 1985;4:22-46.
5. Barnett PG, Middling JE. Public policy and the supply of primary care physicians. *JAMA* 1989;262:2864-8.
6. Institute of Medicine. A manpower policy for primary health care. Washington, D.C.: National Academy of Sciences, 1978.
7. Bowman MA. Family physicians: supply and demand. *Public Health Rep* 1989;104:286-93.
8. Colwill JM. Primary care education: a shortage of positions and applicants. *Fam Med* 1988;20:250-4.
9. NRMP 1986 results. Evanston, Ill.: National Residency Matching Program, 1986.
10. NRMP 1991 results. Evanston, Ill.: National Residency Matching Program, 1991.
11. 1982 Graduation questionnaire. Washington, D.C.: Association of American Medical Colleges, 1982.
12. 1989 Graduation questionnaire. Washington, D.C.: Association of American Medical Colleges, 1989.
13. Singer AM. The class of 83: a follow-up study of 1983 medical school graduates through the first six postgraduate years. Washington, D.C.: Department of Health and Human Services, 1990.
14. Crowley AE. Graduate medical education in the United States. *JAMA* 1982;248:3271-5.

15. Rowley BD, Baldwin DC Jr, McGuire MB, Etzel SI, O'Leary CJ. Graduate medical education in the United States. *JAMA* 1990;264:822-32.
16. Karnell LH. Residency manpower trends. *Bull Am Coll Surg* 1991;76(6):26-7.
17. Babbott D, Baldwin DC Jr, Killian CD, Weaver SO. Trends in evolution of specialty choice: comparison of US medical school graduates in 1983 and 1987. *JAMA* 1989;261:2367-73. [Erratum, *JAMA* 1990;263:815.]
18. Mowbray RM. Research in choice of medical specialty: a review of the literature 1977-87. *Aust N Z J Med* 1989;19:389-99.
19. Kassler WJ, Wartman SA, Silliman RA. Why medical students choose primary care careers. *Acad Med* 1991;66:41-3.
20. Funkenstein DH. Medical students, medical schools, and society during five eras. Cambridge, Mass.: Ballinger, 1978.
21. Astin AW. *The American freshman: 25 year trend*. Los Angeles: University of California, 1991.
22. Schwartz RW, Jarecky RK, Strodel WE, Haley JV, Young B, Griffen WO Jr. Controllable lifestyle: a new factor in career choice by medical students. *Acad Med* 1989;64:606-9.
23. *Supplying physicians for future needs: the report of the Task Force on Physician Supply*. Washington, D.C.: Association of American Medical Colleges, 1991.
24. McCarty DJ. Why are today's medical students choosing high-technology specialties over internal medicine? *N Engl J Med* 1987;317:567-9.
25. Griffen WO Jr, Schwartz RW. Controllable lifestyle as a factor in choosing a medical career. *Am J Surg* 1990;159:189-90.
26. Tardiff K, Cella D, Seiferth C, Perry S. Selection and change of specialties by medical school graduates. *J Med Educ* 1986;61:790-6.
27. Mann NS, Wallace TI, Hyder SA. Medical-specialties matching program 1988-1989. *N Engl J Med* 1987;317:1416-7.
28. Ebell MH. Choice of specialty: it's money that matters in the USA. *JAMA* 1989;262:1630.
29. Shulkin DJ. Choice of specialty: it's money that matters in the USA. *JAMA* 1989;262:1630.
30. Rosenthal MP, Turner TN, Diamond J, Rabinowitz HK. First year medical student income: expectation as predictor of specialty choice. Presented at the 24th Conference of the Society of Teachers of Family Medicine, Philadelphia, May 4-8, 1991. abstract.
31. Park R. Graduating medical students' debt and specialty choices. *Acad Med* 1990;65:485-6.
32. Schmittling G, Graham R, Hejduk G. Entry of US medical school graduates into family practice residencies: 1990-1991 and ten-year summary. *Fam Med* 1991;23:297-305.
33. Campos-Outcalt D, Senf J. Characteristics of medical schools related to the choice of family medicine as a specialty. *Acad Med* 1989;64:610-5.
34. Rabinowitz HK. The relationship between medical student career choice and a required third-year family practice clerkship. *Fam Med* 1988;20:118-21.
35. Kaufman A, Mennin S, Waterman R, et al. The New Mexico experiment: educational innovation and institutional change. *Acad Med* 1989;64:285-94.
36. Peabody FW. *Doctor and patient*. New York: Macmillan, 1930.
37. Overpeck MD. Physicians in family practice 1931-67. *Public Health Rep* 1970;85:485-94.
38. Stevens R. *American medicine and the public interest*. New Haven, Conn.: Yale University Press, 1971.
39. Roback G, Randolph L, Seidman B. Physician characteristics and distribution in the U.S. Chicago: American Medical Association, 1990.
40. Schroeder SA. Western European responses to physician oversupply. *JAMA* 1984;252:373-84.
41. Iglehart JK. Canada's health care system: addressing the problem of physician supply. *N Engl J Med* 1986;315:1623-8.
42. Mulhausen R, McGee J. Physician need: an alternative projection from a study of large, prepaid group practices. *JAMA* 1989;261:1930-4.
43. Steinwachs DM, Weiner JP, Shapiro S, Batalden P, Coltin K, Wasserman F. A comparison of the requirements for primary care physicians in HMOs with projections made by the GMENAC. *N Engl J Med* 1986;314:217-22.
44. *Graduate Medical Education National Advisory Committee. Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health and Human Services. GMENAC report*. Hyattsville, Md.: Department of Health and Human Services, 1980.
45. Politzer RM, Harris DL, Gaston MH, Mullan F. Primary care physician supply and the medically underserved. *JAMA* 1991;266:104-9.
46. Schwartz WB, Newhouse JP, Bennett BW, Williams AP. The changing geographic distribution of board-certified physicians. *N Engl J Med* 1980;303:1032-8.
47. Kindig DA, Movassaghi H. The adequacy of physician supply in small rural counties. *Health Aff (Millwood)* 1989;8:63-76.
48. Kletke PR, Marder WD, Wilke RJ. A projection of the primary care physician population in metropolitan and non-metropolitan areas. In: Grady ML, ed. *Primary care research theory and methods*. Rockville, Md.: Agency for Health Care Policy and Research, 1991:261-9.
49. Grumbach KG, Lee PR. How many physicians can we afford? *JAMA* 1991;265:2369-72.
50. Hughes JS. How well has Canada contained the cost of doctoring? *JAMA* 1991;265:2347-51.
51. Schwartz WB, Sloan FA, Mendelson DN. Why there will be little or no physician surplus between now and the year 2000. *N Engl J Med* 1988;318:892-7.
52. Aaron H, Schwartz WB. Rationing health care: the choice before us. *Science* 1990;247:418-22.
53. Barer ML. Controlling medical care costs in Canada. *JAMA* 1991;265:2393-4.
54. Eisenberg JM. *Doctors' decisions and the cost of medical care*. Ann Arbor, Mich.: Health Administration Press Perspectives, 1986.
55. Rosenblatt RA, Lishner DM. Surplus or shortage? Unraveling the physician supply conundrum. *West J Med* 1991;154:43-50.
56. Evans RG, Lomas J, Barer ML, et al. Controlling health expenditures — the Canadian reality. *N Engl J Med* 1989;320:571-7.
57. Fuchs VR, Hahn JS. How does Canada do it? A comparison of expenditures for physicians' services in the United States and Canada. *N Engl J Med* 1990;323:884-90.
58. Wennberg JE. Outcomes research, cost containment, and the fear of health care rationing. *N Engl J Med* 1990;323:1202-4.
59. Wilensky GR, Rossiter LF. The relative importance of physician-induced demand in the demand for medical care. *Milbank Mem Fund Q Health Soc* 1983;61:252-77.
60. Aiken LH, Lewis CE, Craig J, Mendenhall RC, Blendon RJ, Rogers DE. The contribution of specialists to the delivery of primary care: a new perspective. *N Engl J Med* 1979;300:1363-70.
61. Weiner JP. The effects of future health care system trends on the demand for physician services: an assessment of selected specialties. Washington, D.C.: Department of Health and Human Services, 1991.
62. Schroeder SA, Zones JS, Showstack JA. Academic medicine as a public trust. *JAMA* 1989;262:803-12.
63. Bloom SW. Structure and ideology in medical education: an analysis of resistance to change. *J Health Soc Behav* 1988;29:294-306.
64. Ginzberg E. Do we need more generalists? *Acad Med* 1989;64:495-7.
65. Rabinowitz HK. Evaluation of a selective medical school admissions policy to increase the number of family physicians in rural and underserved areas. *N Engl J Med* 1988;319:480-6.
66. Adkins RJ, Anderson GR, Cullen TJ, Myers WW, Newman FS, Schwarz MR. Geographic and specialty distributions of WAMI Program participants and nonparticipants. *J Med Educ* 1987;62:810-7.
67. Verby JE, Newell JP, Andresen SA, Swentko WM. Changing the medical school curriculum to improve patient access to primary care. *JAMA* 1991;266:110-3.
68. Boulger JG. Family medicine education and rural health: a response to present and future needs. *J Rural Health* 1991;7:105-15.
69. Brazeau NK, Potts MJ, Hickner JM. The Upper Peninsula Program: a successful model for increasing primary care physicians in rural areas. *Fam Med* 1990;22:350-5.
70. Stratton TD, Geller JM, Ludtke RL, Fickenscher KM. Effects of an expanded medical curriculum on the number of graduates practicing in a rural state. *Acad Med* 1991;66:101-5.
71. Emey SL, Allen DL, Siska KF. Effect of a year-long primary care clerkship on graduates' selection of family practice residencies. *Acad Med* 1991;66:234-6.
72. Hynes K, Givner N. The effects of area health education centers on primary care physician-to-population ratios from 1975 to 1985. *J Rural Health* 1990;6:9-17.
73. Colwill JM. Barriers to an enhanced linkage between education and delivery of primary care. In: *Health Resources and Services Administration, ed. Proceedings of the Second HRSA Primary Care Conference*. Washington, D.C.: Health Resources and Services Administration, 1990:329-41.
74. *Idem*. Reflections on generalism in medicine. *Fam Med* 1988;20:405-6, 462.
75. Liaison Committee on Medical Education. *Functions and structure of a medical school*. Washington, D.C.: Association of American Medical Colleges, 1991.
76. Rezler AG, Kalisham SG. Who goes into family medicine? *J Fam Pract* 1989;29:652-6.
77. Wilson JL, Hallett J. Students' attitudes toward career choice: a family practice perspective. *J Med Educ* 1985;60:56-8.
78. Cullison S, Reid C, Colwill JM. Medical school admissions, specialty selection, and distribution of physicians. *JAMA* 1976;235:502-5.
79. Wood AP. Survey reveals growing disenchantment among FPs. *Fam Pract News* 1991;21:1, 10-2.
80. Pawlson LG, Watkins R, Donaldson M. The cost of medical student instruction in the practice setting. *J Fam Pract* 1980;10:847-52.
81. Pawlson LG, Schroeder SA, Donaldson MS. Medical student instructional costs in primary care clerkship. *J Med Educ* 1979;54:551-5.
82. Kirz HL, Larsen C. Costs and benefits of medical student training to a health maintenance organization. *JAMA* 1986;256:734-9.
83. Garg ML, Boero JF, Christiansen RG, Booher CG. Primary care teaching physicians' losses of productivity and revenue at three ambulatory-care centers. *Acad Med* 1991;66:348-53.