

Current and Projected Workforce of Nonphysician Clinicians

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Nonphysician clinicians (NPCs) are becoming increasingly prominent as health care providers. This study examines 10 such disciplines: nurse practitioners (NPs), physician assistants (PAs), nurse-midwives, chiropractors, acupuncturists, naturopaths, optometrists, podiatrists, nurse anesthetists, and clinical nurse specialists. The aggregate number of NPCs graduating annually in these 10 disciplines doubled between 1992 and 1997, and a further increment of 20% is projected for 2001. Assuming that enrollments remain at the levels attained in 2001, NPC supply will grow from 228 000 in 1995 to 384 000 in 2005, and it will continue to expand at a similar rate thereafter. The greatest growth is projected among those NPCs who provide primary care services. Moreover, the greatest concentrations of both practicing NPCs and NPC training programs are in those states that already have the greatest abundance of physicians. On a per capita basis, the projected growth in NPC supply between 1995 and 2005 will be double that of physicians. Because of the existing training pipeline, it is probable that most of the growth projected for 2005 will occur. The further expansion of both NPC and physician supply thereafter warrants careful reconsideration.

JAMA. 1998;280:788-794

FOR DECADES, physicians held a virtual monopoly as the principal providers of patient care services. Their dominance was established early in this century through state licensing and regulation, enhanced during the century's middle decades by third-party reimbursement, and facilitated over the past 25 years by the training of new physicians in numbers that eclipsed other disciplines.^{1,2} However, this dominance is being challenged by 3 new dynamics affecting nonphysician clinicians (NPCs).³⁻⁹ First, changes in state laws and regulations are enhancing the practice prerogatives of NPCs. Second, the market is creating new opportunities for NPCs to engage in clinical practice. And third, the number of NPCs being trained is growing.

See also pp 795 and 825.

These dynamics are occurring at a time when there is increasing concern about an impending oversupply of physicians.^{4,10-14} Indeed, an oversupply exists in some communities already. Although the magnitude of projected future physician surpluses is debated,^{4,14} it seems clear that an abundance of physicians will continue for another decade or more. It is less clear

how the increasing numbers and growing independence of NPCs will affect the demand for physicians in the future. Therefore, we examined the current supply and distribution of NPCs and the rates at which new NPCs are being trained, and we related these observations to previous studies of physician supply.^{4,10}

DEFINING NPCs

This study focuses on the 10 nonphysician disciplines that most strongly overlap the scope of medical and surgical services provided by physicians, referred to herein as *physician services*. Practitioners in each of these disciplines are authorized to assume the principal responsibility for patient care under at least some circumstances.⁹ Three of these are *traditional* disciplines, including nurse practitioners (NPs), certified nurse-midwives (CNMs), and physician assistants (PAs). Three are *alternative* disciplines, including chiropractors, naturopaths, and practitioners of acupuncture and herbal medicine. The final group of 4 is composed of *specialty* disciplines, including optometrists, podiatrists, certified registered nurse anesthetists (CRNAs), and clinical nurse specialists (CNSs). Although we have applied the term *nonphysician* to the 10 NPC disciplines that are the subject of this article, practitioners in several of them are normally referred to as *doctor* or *physician* through either state regulation or custom.

Practitioners in each of the 6 traditional and alternative disciplines provide primary care services, although they do not engage in the entire range of primary care or provide services of the complexity that are provided by primary care physicians.⁹ In addition to the 4 specialty NPC disciplines, some NPs and a large proportion of PAs also contribute to specialty care.

Many other licensed clinical disciplines also contribute to patient care but are not included in this analysis.^{15,16} Five professions overlap the work scope of physicians in the area of mental health care: psychologists, clinical social workers, psychiatric CNSs, counselors, and therapists. They have been excluded because there is little overlap between them and the medical and surgical arenas of care that are the focus of this analysis. Of the more than 20 other licensed health professions, some, such as dentists, have small areas of overlap with the scope of practice of physicians, but most do not, and none are considered in this analysis.

METHODS

Data Sources

Data relating to the numbers of NPC training programs and graduates and to the current and past numbers of practitioners were obtained from reports and articles published by professional, certifying, and other national organizations.¹⁷⁻⁴⁹ Data relating to training programs in the alternative disciplines were obtained directly from the individual schools and colleges, as previously reported.³ Published data were supplemented and updated by direct communication with professional organizations and state licensing boards and by information available through their Internet Web sites (Table 1). Data relating to physicians (doctors of medicine and doctors of osteopathy) were drawn from previously published studies.^{4,10}

Definitions

The term *advanced practice nurse* (APN) refers to NPs, CNMs, CRNAs, and CNSs. Advanced practice nurses who received training as both CNSs and NPs were counted as NPs. Those NPs and CNSs engaged primarily in education or research, in psychiatric and mental health

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care, or in community health were excluded from this analysis. Primary care NPs include the categories of adult, family, pediatrics, gerontology, obstetrics and gynecology, and school and occupational health. *Acupuncture* refers to practitioners of acupuncture and herbal medicine, traditional Chinese medicine, and Oriental medicine, but it excludes those acupuncturists who limit their practice to addiction therapy and members of other professions who practice acupuncture. The category of NPCs who provide primary care services (*primary care NPCs*) includes all CNMs and alternative NPCs and those NPs and PAs who are engaged in primary care. Approximately 55% of PAs and 95% of NPs currently participate in primary care.^{18,23} It was assumed that this proportion would continue for PAs but that the percentage of NPs in non-primary care specialties would increase to 15% by 2015, in accord with recent changes in training preferences.^{25,37,38} *Specialty care NPCs* include optometrists, podiatrists, CRNAs, CNSs, and those PAs and NPs who are engaged in specialty care. The category of *primary care physicians* includes family physicians, general internists, general pediatricians, and obstetrician-gynecolo-

gists. *Specialty physicians* include all of the non-primary care specialties except psychiatry, which was excluded because the nonphysician mental health disciplines also were excluded.

Workforce Projections

Current Estimates and Future Projections.—Future numbers of NPCs were projected by adjusting the number of practitioners estimated for base year 1995 for the entry of new graduates and for the attrition of practitioners through death, retirement, or changes in career direction. Population estimates were taken from earlier studies and are similar to the US Census Bureau's middle series, as adjusted for undercounting of minority populations and underestimates of Hispanic birth rates.^{4,10}

Estimates of the current numbers of NPs, CNMs, PAs, and physicians include active practitioners only.^{19-23,29,30,34} Those engaged in other professional tasks (eg, teaching, research, supervision, and administration) or not engaged in the profession at all were excluded from both the current estimates and future projections. Similar data were not available for optometry, podiatry, or the 3 alternative disciplines. Therefore, both the current estimates and future projections in these 5 disciplines were modified based on the assumption that only 95% of those with active licenses are actually engaged in clinical practice.

The Training Pipeline.—Graduation rates for all NPC disciplines except CNSs have increased annually during the past 5 years. Because most NPC training programs span 2 to 5 years on a full-time or part-time basis, graduation rates for most disciplines could be extrapolated using actual enrollment data for 1994 to 1997. It is unclear how these rates will change over time, as the practice prerogatives and reimbursement opportunities in the NPC disciplines continue to expand⁹ while the numbers of NPCs in practice continue to swell. For purposes of our analysis, it was assumed that graduation rates will plateau over the next several years and remain unchanged thereafter (Table 2). If

training programs continue to expand or begin to close or contract, these projections will have to be adjusted accordingly.

Ages of Graduates and Practitioners.—Age cohorts used for these workforce projections were constructed based on information obtained from published surveys^{18,23,29-33} and communication with various professional organizations (Table 1). The mean ages of graduates were 40 years for APNs, 38 years for acupuncturists, 34 years for naturopaths, 33 years for PAs, 29 years for chiropractors, and 28 years for optometrists and podiatrists. Mean ages of practitioners were 45 years for APNs and acupuncturists, 43 years for naturopaths, 40 years for PAs, optometrists, and podiatrists, and 39 years for chiropractors.

Attrition.—Attrition rates include the loss of practitioners through death, retirement, or changes in career. For PAs and APNs, this attrition was assumed to be 3% at age 35 years, 9% at age 45 years, 14% at age 55 years, and 93% at age 65 years. These attrition rates include consideration of the approximately 15% of PAs and 10% of APNs who, although qualified to practice, are not employed in their professions, and another 5% to 10% of APNs who are employed in their professions but not engaged in direct patient care; these rates assume a sharp decline in practitioners at age 65 years.^{19-23,29,30,34} Projections of CNSs were further adjusted for the 25% of CNSs who are involved in teaching.^{23,29,30} The attrition rates for optometrists, podiatrists, and the alternative NPC disciplines were assumed to be 4% at age 35 years, 5% at age 45 years, 10% at age 55 years, and 90% at age 65 years. These attrition rates are higher than has been assumed for physicians.¹⁰

Work Effort.—Although it is recognized that not all NPCs work full-time, neither the current supply estimates nor the future projections were adjusted for full-time equivalent work effort, as has been done for physicians.⁴ These adjustments for physician work effort took into consideration the fact that female physicians provide less patient care over the course of

Table 1.—Supplementary Data Sources*

American Academy of Physician Assistants
Association of Physician Assistant Programs
American Nurses Association
American Nurses Credentialing Center
American Association of Colleges of Nursing
National Council of State Boards of Nursing
National League for Nursing
American Academy of Nurse Practitioners
National Organization of Nurse Practitioner Faculties
American College of Nurse-Midwives
American Association of Nurse Anesthetists
Council on Chiropractic Education
Federation of Chiropractic Licensing Boards
American Chiropractic Association
Accreditation Commission for Acupuncture and Oriental Medicine
National Acupuncture and Oriental Medicine Alliance
National Acupuncture Foundation
Council on Naturopathic Medical Education
American Association of Naturopathic Physicians
American Podiatric Medical Association
American Optometric Association

*Supplementary data and information were obtained from professional associations and organizations via telephone, fax, and Internet Web sites.

Table 2.—Nonphysician Clinical Graduates

Year	Nurse Practitioners	Physician Assistants	Certified Nurse-Midwives	Chiropractors	Acupuncturists	Naturopaths	Optometrists	Podiatrists	Clinical Nurse Specialists	Certified Registered Nurse Anesthetists
1992	1500	1360	110	1665	600	70	1170	515	1700	160
1993	1750	1450	185	1590	645	100	1190	495	1560	190
1994	2525	1950	235	2600	680	115	1200	460	1550	225
1995	3600	2150	290	2925	715	140	1220	560	1350	275
1996	4800	2550	370	3670	880	155	1235	680	1425	290
1997	6350	2800	414	4100	1030	170	1235	645	1365	387
1998*	6600	3100	480	4430	1420	185	1250	710	1300	390
1999*	6850	3300	550	4944	1660	220	1250	725	1300	390
2000*	7100	3400	600	5175	1900	280	1250	725	1300	390
2001*	7250	3400	600	5200	2000	350	1250	725	1300	390

*Projected data.

their careers than male physicians, that older physicians have fewer patient contacts than younger physicians, and that salaried physicians work less than self-employed physicians.⁴ It is uncertain to what extent these factors apply to NPCs. However, women currently account for more than 90% of NPs, CNMs, and CRNAs, for approximately 60% of acupuncturists and naturopaths, and for 50% of PAs.^{19,20,30,31,35,42} In addition, although optometry, podiatry, and chiropractic graduates are on average in their late 20s, other NPC disciplines attract older students, thereby skewing the age spectrum of practitioners to older individuals. Moreover, a high percentage of NPCs work as employees of hospitals or clinics, many of which offer opportunities for part-time employment. Indeed, approximately 25% of NPs work part time.²⁰ Therefore, the data and projections presented herein must be interpreted in the context of factors such as these that are likely to affect the work effort of practitioners.

TRAINING PROGRAMS AND GRADUATES

Traditional NPCs

Nurse Practitioners.—Nurse practitioner training has increased substantially in recent years. Between 1992 and 1997, the number of institutions offering master's-level NP programs grew from fewer than 100 to more than 250.^{22,24,25} Enrollment increased even more. Whereas in 1992 there were fewer than 4000 NP students (approximately two thirds of whom were part-time), by 1997 total enrollment had grown 5-fold to more than 20 000.^{24,25} The result has been a 4-fold increase in the number of NPs graduating annually, from 1500 in 1992 to 6350 in 1997^{24,25} (Table 2), and further increases can be anticipated based on the recent surge in enrollment. Most NPs train in primary care.^{22,25} However, increasing numbers are training in acute care medicine and other specialty disciplines.^{20,25,37,38}

Although there currently are shortages of both teachers and training sites, job opportunities exist for NPs in most states, creating pressure to open additional training positions.^{22,25,36} Nonetheless, for purposes of projecting future numbers of graduates, we assumed that the recent growth in NP training programs would decelerate over the next several years and that no further changes would occur after 2001 (Table 2).

Certified Nurse-Midwives.—Although there are fewer CNMs, their training dynamics have been similar to those of NPs. Between 1992 and 1997, the number of CNM training programs doubled to 50, and the number of CNMs graduating annually increased 4-fold to 414,^{24,25} in part

because of the establishment of community-based distant learning programs. In projecting future graduation rates, we assumed that this growth in training would slow over the next several years and that no further changes would occur thereafter (Table 2).

Physician Assistants.—Between 1992 and 1997, the number of PA training programs increased by 50% to 76.^{26,39} As a result, the number of PAs graduating annually doubled, reaching 2800 in 1997 (Table 2). More than 20 additional PA programs have received provisional accreditation, although none has graduated students and many have not yet matriculated any students. Although this predicts continued growth in the numbers being trained, the magnitude of this growth is uncertain. For purposes of future projections, we have assumed that the numbers graduating annually would stabilize over the next several years and remain unchanged thereafter (Table 2).

Alternative NPCs

Chiropractic.—Over the past decade, the number of chiropractic colleges has remained constant at 16.^{3,32,41} Nonetheless, the number of chiropractic graduates has increased dramatically, more than doubling from 1665 in 1992 to 4100 in 1997.³ However, this rate of growth in the output of chiropractic colleges has been declining, and little further growth is projected (Table 2).

Acupuncture.—The number of schools of acupuncture and herbal medicine grew from 22 in 1990 to 33 in 1997,^{3,35,40,41} with a proportional increase in graduates to approximately 1000 (Table 2). We have assumed that 2 additional acupuncture colleges will open each year, increasing the total to 37 by 1999, and we have projected that graduation rates will rise to 2000 annually by the year 2001 and remain at that level thereafter. However, acupuncture currently is licensed in only 34 states, and the numbers being trained may be even greater as practice opportunities become more broadly available.⁹

Naturopathy.—Naturopathy is a small discipline. Over the past few years, 2 new naturopathy schools were opened, bringing the total to 4. These schools graduated 170 naturopaths in 1997.^{3,42} We have assumed that the output of naturopathy schools will continue to expand over the next several years and stabilize at the level of 350 annually that is projected for 2001 (Table 2).

Specialty NPCs

Optometry and Podiatry.—In contrast with the traditional and alternative NPC disciplines, training programs for specialty NPCs have remained relatively constant since 1990, although a new op-

tometry school opened in 1997.²⁷ Nonetheless, the number of graduates has had an upward bias during the past 5 years (Table 2), with a 6% increase in the number of graduating optometrists²⁷ and a 30% increase in graduating podiatrists.²⁸ We assumed that these upward trends would continue through 1999 and that the numbers of optometrists and podiatrists graduating annually would remain constant thereafter (Table 2).

CRNAs and CNMs.—During the past few years, a decrease in the number of CRNA trainees had been anticipated in the face of a perceived surplus of anesthesiologists. However, this has not occurred.²⁵ Indeed, the number of CRNA graduates has more than doubled over the past 5 years, to 390 in 1997.^{24,25} During the same period, the numbers of students graduating from the clinical tracks of medical and surgical CNS programs has declined, from 1700 in 1992 to 1365 in 1997,^{24,25} probably reflecting an increasing interest in NP careers.³⁸ We assumed that both of these trends would continue through 1998 and that graduation rates would stabilize thereafter (Table 2).

Aggregate Numbers of NPC Graduates

These data show that the number of NPCs graduating in the 10 disciplines discussed herein doubled during a period of 5 years, from 8850 in 1992 to 18 500 in 1997. Moreover, even assuming that program growth decelerates and graduation rates stabilize, we projected a further increase of 20% over the subsequent 4 years to 22 500 graduates in 2001. This expansion in NPC training is similar to the growth that occurred in the numbers of medical students during the 1970s. Some of its impact is being appreciated already. However, as occurred in medicine, the full impact on the NPC workforce will not be felt for another 15 years or more.

CURRENT AND PROJECTED NUMBERS OF PRACTITIONERS

Traditional NPCs

NPs are the largest group of traditional NPCs and the group that has undergone the most growth. In 1996, 71 000 nurses had formal preparation as NPs, principally at the master's level.³⁰ Approximately 63 000 of them were actively employed in nursing, more than double the number of employed NPs in 1990 (Figure 1).^{17,23,29,30,43-45} Based on the recent graduation experience and assuming that the recent acceleration of enrollment will slow and plateau over the next several years (Table 2), the number of NPs in clinical practice is projected to increase to 106 500 by 2005 and to 151 000 in 2015 (Figure 1).

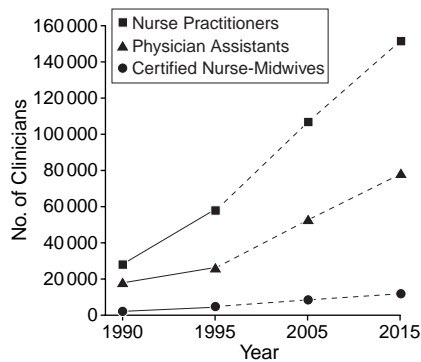


Figure 1.—Supply of traditional and alternative nonphysician clinicians, 1990 to 2015. Data include the actual numbers of active clinicians in 1990 and 1995 and the projected supply in 2005 and 2015. Others include numbers of actively licensed practitioners.

The number of PAs in clinical practice also has increased in recent years, from 11 000 in 1980 to 19 000 in 1990.^{17,18} In 1997 there were 29 000 actively practicing PAs (Figure 1).^{19,20,34} Assuming that graduation rates from PA programs continue to increase slowly over the next several years and plateau thereafter (Table 2), the number of practicing PAs is projected to grow to 53 200 in 2005 and to reach 79 000 by 2015.

There are fewer CNMs, but their numbers also have grown, doubling from 3000 in 1990 to 6000 in 1997 (Figure 1).^{23,29,30,43,45} Based on similar assumptions concerning graduation rates (Table 2), the number of CNMs engaged in clinical practice is projected to grow to 8900 in 2005 and to 12 400 by 2015.

Thus, if the rates of training in these 3 disciplines stabilize by 2001, the combined numbers of traditional NPCs will almost double, from 90 000 active practitioners in 1995 to 168 000 in 2005. If these training rates persist thereafter, the supply of traditional NPCs will increase further to 242 000 in 2015 (Figure 1). In per capita terms, this represents a growth from 34 per 100 000 population in 1995 to 57 per 100 000 in 2005 and 75 per 100 000 in 2015, an increase of 120% over 20 years.

Alternative NPCs

Chiropractic is the most established of the alternative disciplines. Although the number of chiropractic colleges has remained unchanged since the 1980s, the number of chiropractors increased from 47 000 in 1990 to 52 000 in 1997 (Figure 2).^{3,17,33,46} Because of recent increases in enrollment, the number of chiropractors is projected to grow more rapidly, to 95 200 in 2005 and, if high levels of enrollment continue, to 145 000 in 2015.

There are fewer acupuncturists, but their numbers are growing rapidly. In 1990, there were approximately 5000 acu-

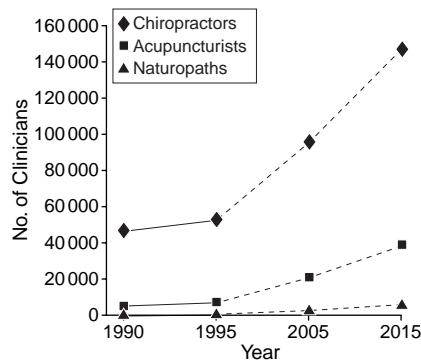


Figure 2.—Supply of alternative nonphysician clinicians, 1990 to 2015. Data include the actual numbers of active clinicians in 1990 and 1995 and their projected supply in 2005 and 2015.

puncturists in clinical practice.³ By 1997, this number had more than doubled to 11 000 in the states that licensed acupuncture.^{47,48} However, the pace of acupuncture training is increasing as interest in acupuncture grows,^{3,9} and the number of acupuncturists is projected to reach 21 000 by 2005 and almost 40 000 by 2015 (Figure 2). These projected numbers could be even greater if licensure spreads to the remaining states, as seems likely, and more training programs are established to service these regions.³

There are many fewer naturopaths, and not all of those in practice received their training from the 4 currently accredited colleges. In 1990 there were 800 licensed naturopaths, and this number grew to 1400 in 1997 in the 11 states that license naturopathy (Figure 2).⁴² In addition, there are approximately 500 naturopaths in the 40 states that do not currently offer licensure.³ Growth of licensed naturopaths is projected to accelerate,³ and the total number of practitioners is projected to reach 3500 by 2005 and almost 6600 by 2015.

Thus, like traditional NPCs, the number of alternative NPCs is projected to increase substantially during the coming years, from levels of approximately 60 000 in 1995 to 120 000 in 2005 and, if there is no change in the rate of training, to 190 000 in 2015. When expressed in per capita terms, the supply of alternative NPCs will increase from 23 per 100 000 in 1995 to 41 per 100 000 in 2005 and 59 per 100 000 in 2015, a growth of 150% over 20 years.

Specialty NPCs

In 1990 there were approximately 70 000 practitioners in the 4 disciplines counted among the specialty NPCs (Figure 3). This includes 25 000 optometrists, 11 500 podiatrists, 21 000 CRNAs, and 12 000 medical and surgical CNSs.^{17,29,49} Unlike the traditional and alternative disciplines, growth in the number of specialty

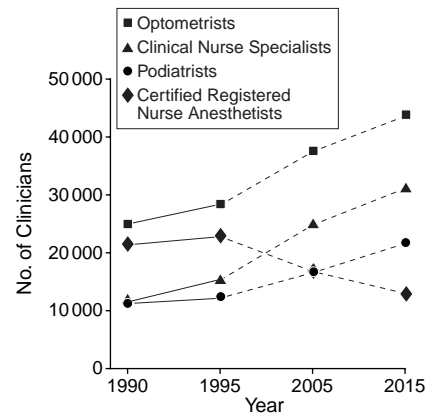


Figure 3.—Supply of specialty nonphysician clinicians, 1990 to 2015. Data include the actual numbers of active clinicians in 1990 and 1995 and the projected supply in 2005 and 2015.

NPCs has been moderate. Between 1990 and 1995 each of these disciplines increased by 10% to 20%.^{23,29-31,49} In the aggregate, the number of specialty NPCs grew from 70 000 (28/100 000) in 1990 to 78 000 (31/100 000) in 1995.

If training continues at existing rates, the number of optometrists will increase from 27 500 (10/100 000) in 1995 to 43 700 (13/100 000) in 2015. During the same period, the number of podiatrists is projected to grow from 12 400 (5/100 000) in 1995 to 22 000 (7/100 000) in 2015 (Figure 3). However, greater growth will occur among medical and surgical CNSs. Despite the fact that their enrollment has decreased over the past few years, as the focus has shifted to NP training (Table 2), the number of clinically active CNSs is projected to double from 15 500 (6/100 000) in 1995 to 31 000 (10/100 000) in 2015. In contrast, the number of CRNAs is projected to decline progressively from 22 600 (10/100 000) in 1995 to 12 900 (5/100 000) by 2015, as training fails to keep up with attrition (Figure 3).

NATIONAL DISTRIBUTION OF NPCs

Neither NPCs nor physicians are distributed evenly among the states (Figure 4), as has been noted previously.^{4,50-53} However, whereas the per capita supply of physicians varies among states by factors of 2.0 to 2.5, the per capita supply of NPCs varies by factors of 10 to 20. Several patterns emerge when these state data are examined. First, NPCs and physicians tend to follow similar patterns of distribution, with the greatest density of NPCs being in the Northeast, which also has the greatest concentration of physicians. Conversely, the lowest density of all NPCs is in the South, which also has the lowest per capita number of physicians. CRNAs are the exception, being most highly concentrated in states

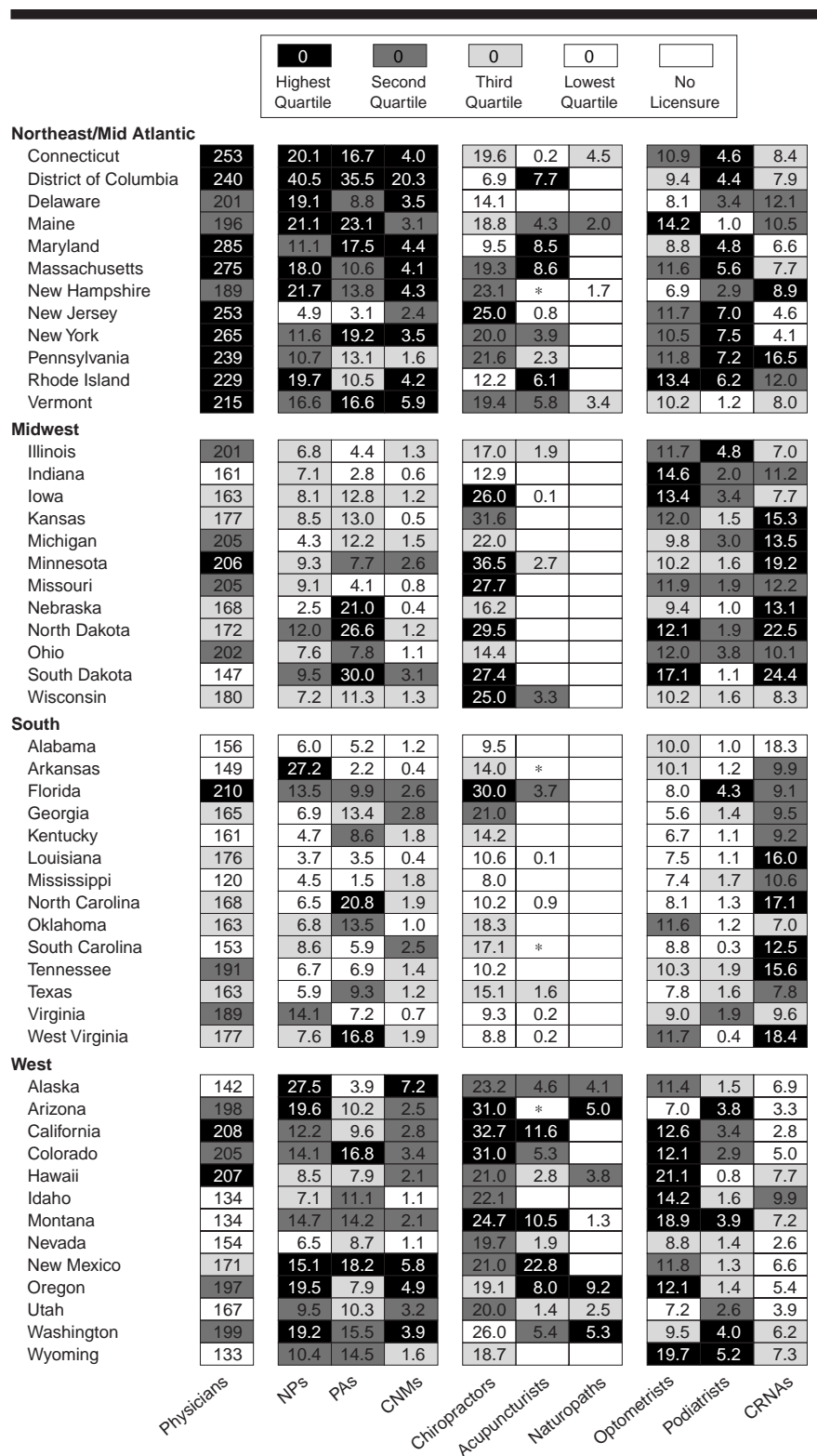


Figure 4.—State distributions of physicians and nonphysician clinicians per 100 000 population. Data are for 1995. Physicians are expressed as resident-adjusted patient care physicians,^{4,9} excluding psychiatrists. NPs indicates nurse practitioners; PAs, physician assistants; CNMs, certified nurse-midwives; and CRNAs, certified registered nurse anesthetists. Asterisks indicate that licensure is recent; state data are not yet available.

with fewer physicians. All 3 alternative disciplines are concentrated in the West, but acupuncturists and naturopaths are

also concentrated in the Northeast and chiropractors are prevalent in the Midwest.

The reasons for this variability in the per capita prevalence of NPCs among states are not clear. One factor appears to be the practice environments encountered. Sekscenski et al⁵⁰ observed a correlation between state practice prerogatives and the prevalence of NPs, PAs, and CNMs in the various states. We have confirmed this observation and extended it to the alternative NPC disciplines.⁹ It is likely that a more even distribution of NPCs would occur if practice prerogatives were expanded in those states that currently are restrictive, a trend that appears to be occurring.⁹

A second factor accounting for geographic variation may be the location of the colleges and schools that train NPCs. States that are higher than the mean for the numbers of NPCs per capita have most of the training programs in these disciplines. This applies to 100% of the podiatry and naturopathy programs, 85% of the acupuncture programs, 70% of the optometry and CRNA programs, and 65% of the chiropractic and NP programs. Conversely, states that are in the bottom quartile for the numbers of chiropractors, acupuncturists, naturopaths, and podiatrists have no training programs for these disciplines.

Finally, the general tendency for some regions to have a high per capita concentration of all practitioners, both physicians and NPCs, and for others to have relatively low concentrations, may relate to differences in the culture or expectations of the community or to the organization of its health care services. However, as has been pointed out in relation to future physician supply,⁴ the degree to which NPCs are in excess supply in the future will depend, in large part, on whether they distribute themselves more uniformly throughout the nation.

BALANCING NPC AND PHYSICIAN SUPPLY

Long-range workforce projections are subject to many intervening influences, whereas projections of less than 10 years have a greater likelihood of accuracy. The training pipeline of 2 to 5 years for most NPCs adds a degree of validity to projections of shorter duration. Thus, although projections for 2015 are subject to considerable error, projections for 2005, only 7 years from now, may be reasonable approximations. What will be the balance between physicians and NPCs?

During the period from 1995 to 2005, the total workforce of NPCs is projected to increase by two thirds, from 228 000 to 384 000. In per capita terms, this represents a growth from 87 per 100 000 in 1995 to 132 per 100 000 in 2005, an increment of 45 per 100 000. During this time, the aggregate supply of patient care physicians

will grow from 566 000 in 1995 to a peak of 765 000 in 2010.⁴ Considering only practicing patient care physicians (excluding residents), physician supply will grow by 24 per 100 000 between 1995 and 2005.^{4,10} Although this increment is significant and, to some, even alarming, it is only half as large as the projected growth of NPC supply.

As a consequence of this growth, several of the NPC disciplines will become as large as some of the major specialties of medicine. For example, there will be more chiropractors in 2005 than general internists and more PAs than general pediatricians.^{4,10} The number of NPs in clinical practice in 2005 will equal the number of family physicians and will exceed by a factor of 2 the number that was predicted to be required for that year by the National Advisory Council on Nurse Education and Practice.⁴⁵

The greatest growth overall is projected to occur among primary care practitioners within the 6 traditional and alternative disciplines (Figure 2). In the aggregate, primary care NPCs will increase by 118 000 between 1995 and 2005, an increment of 35 per 100 000, while primary care physicians will increase by 59 000, an increment of only 11 per 100 000. In 1995, the number of primary care physicians greatly exceeded the number of NPCs who provided primary care services, but in 2005 these 2 groups will be almost equal (Figure 5). However, the practices of NPCs are largely limited to wellness care and the treatment of uncomplicated acute and chronic conditions,⁹ a range of care that encompasses approximately 50% to 75% of the office visits to primary care physicians.⁵⁴⁻⁵⁹ Thus, it is in this relatively narrow spectrum of low-complexity general care that the greatest growth in NPC supply is projected to occur.

In contrast, smaller increments of growth are projected in the supply of NPCs who provide specialty care, including those NPs and PAs who provide specialty services (Figure 5). In per capita terms, the number of NPCs providing specialty care will increase by 10 per 100 000, an increment that is similar to the projected increment in the number of specialty physicians of 13 per 100 000.^{4,10} However, these comparisons are more dramatic for selected disciplines. For example, the ratio of optometrists to ophthalmologists is currently approximately 2:1, but the differential growth in their supply will increase the ratio to 2.5:1 in 2005. Similarly, the ratio of CNMs to obstetrician-gynecologists is 1:6; however, a similar increment in growth is projected for each discipline between 1995 and 2005, resulting in an increase of this ratio to 1:4. In contrast, despite recent concerns about an oversupply of anesthesiologists, the

combined per capita supply of anesthesiologists and CRNAs is projected to remain relatively constant during the next decade.

Is the parallel growth projected in the supply of NPCs and physicians appropriate for the future needs of the US health care system? This question must be viewed in the context of the changing roles of NPCs. Their breadth of clinical responsibility is expanding as their regulated scope of practice, prescriptive privileges, and independent authority are increased.⁹ At the same time, they are gaining easier access to reimbursement from private and governmental insurers, and they are being integrated more readily into both managed care organizations and physician group practices.^{54,55,58} Hospitals also are looking to NPCs for tasks currently being performed by resident physicians.^{60,61} As a consequence, NPCs are undertaking broader roles, both under the umbrella of physician direction and as practitioners. Moreover, not all of the services that NPCs provide overlap those of physicians: some are supplementary or adjunctive. Others (such as case management) may decrease the need for physician services even though they do not directly overlap the services of physicians. Therefore, although growing numbers of NPCs are certain to affect the demand for physicians, the quantitative nature of this relationship requires additional investigation.

Thus, it is not clear whether the increment of 68% in NPC supply that we have projected between 1995 and 2005 will be appropriate for the needs of the nation. Indeed, there is likely to be significant geographic variation in the ability to absorb this number of practitioners. However, if training continues at the rates projected, NPC supply will grow by an additional 40% between 2005 and 2015, to 540 000. In per capita terms this represents a total supply of NPCs of 170 per 100 000, a level 29% greater than in 2005 and almost double the per capita NPC supply in 1995. During the same period total physician supply will be at its maximal levels, in a range of 237 to 247 per 100 000.⁴ It seems unlikely that the health care system will be able to absorb both this number of physicians and the large number of NPCs that is projected.

The first increment in the growth of NPC supply, to 384 000 in 2005, is likely to occur. Most NPCs who will be practicing in 2005 are either in practice already or in the training pipeline. While immediate changes in NPC enrollment could temper this supply, a significant infrastructure of training NPCs has been created, and there are no signs that it will contract soon. Interest in these professions remains high, and they are among the occu-

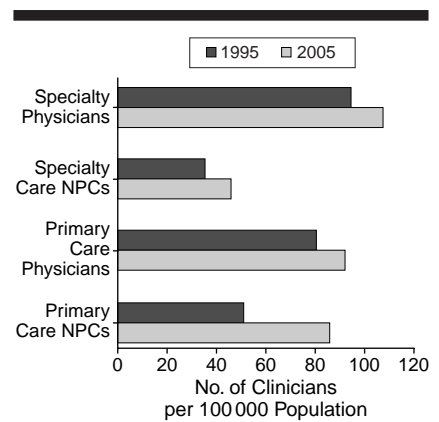


Figure 5.—Primary care and specialty physicians and primary care and specialty nonphysician clinicians (NPCs) in 1995 and 2005. Primary care physicians include family physicians, general internists, general pediatricians, and obstetrician-gynecologists. Specialty physicians include all other patient care physicians except psychiatrists. Primary care NPCs, include primary care nurse practitioners, primary care physician assistants, certified nurse-midwives, chiropractors, acupuncturists, and naturopaths. Specialty NPCs include specialty nurse practitioners and physician assistants, optometrists, podiatrists, certified registered nurse anesthetists, and medical and surgical clinical nurse specialists. Data for physicians include practicing patient care physicians; residents are excluded. Workforce estimates are expressed as clinicians per 100 000 population.

pations most strongly recommended by the US Department of Labor.⁶²

In contrast, the growth in NPC supply that we have projected beyond 2005 is more malleable, and our projection of 540 000 NPCs in 2015 is theoretical. Achieving this number will depend on the continued training of large numbers of NPCs. It does not seem tenable to produce such a plethora of NPCs while also producing such a plethora of physicians. While physician groups have focused attention on the downsizing of graduate medical education,¹² most NPC disciplines have not voiced concern about an impending surplus within their own disciplines or among providers overall, although debate is beginning to occur among PAs.^{34,63} A broader dialogue seems imperative.

Finally, what will be the impact of additional NPCs on the demand for physicians? The answer depends on a better understanding of the elements of physician services that NPCs will undertake. This includes not only a further assessment of their scope of practice, prescriptive privileges, and autonomy, but also an analysis of their actual roles and responsibilities in clinical practice. Although a lack of sufficient information of this nature makes firm conclusions impossible, it seems clear from the numbers alone that NPCs will exert a significant impact. Although this is likely to affect both primary care physicians and specialists, the dis-

proportionate numbers of NPCs who are being trained to provide various primary care services, coupled with their expanding practice prerogatives,⁹ suggests that the greatest impact of the growing workforce of NPCs will be on the future demand for primary care physicians.

This work was supported by a grant from The Robert Wood Johnson Foundation, Princeton, NJ, and a contract from the Bureau of Health Professions, US Department of Health and Human Services, Rockville, Md.

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