

## The Economic Benefit for Family/General Medicine Practices Employing Physician Assistants

Dana M. Grzybicki, MD, PhD; Paul J. Sullivan, PA-C; J. Miller Oppy, MD; Anne-Marie Bethke, PA-C; and Stephen S. Raab, MD

**Objective:** To measure the economic benefit of a family/general medicine physician assistant (PA) practice.

**Study Design:** Qualitative description of a model PA practice in a family/general medicine practice office setting, and comparison of the financial productivity of a PA practice with that of a non-PA (physician-only) practice.

**Methods:** The study site was a family/general medicine practice office in southwestern Pennsylvania. The description of PA practice was obtained through direct observation and semistructured interviews during site visits in 1998. Comparison of site practice characteristics with published national statistics was performed to confirm the site's usefulness as a model practice. Data used for PA productivity analyses were obtained from site visits, interviews, office billing records, office appointment logs, and national organizations.

**Results:** The PA in the model practice had a same-task substitution ratio of 0.86 compared with the supervising physician. The PA was economically beneficial for the practice, with a compensation-to-production ratio of 0.36. Compared with a practice employing a full-time physician, the annual financial differential of a practice employing a full-time PA was \$52,592. Sensitivity analyses illustrated the economic benefit of a PA practice in a variety of theoretical family/general medicine practice office settings.

**Conclusions:** Family/general medicine PAs are of significant economic benefit to practices that employ them.

(*Am J Manag Care* 2002;8:613-620)

in primary care settings, with 38% working in family/general medicine practice.<sup>3-6</sup>

In 1994, the American College of Physicians published a position paper<sup>4</sup> examining primary care nonphysician providers in which they supported expanded roles for PAs working in hospitals and ambulatory care settings. Few cost analyses of PA practice, however, have been published. Studies analyzing PA practice in primary care have concentrated on PA practice patterns<sup>7-10</sup> and PA scope of practice.<sup>10,11</sup> A cost-benefit study<sup>12</sup> showed the value of a primary care PA practice in a large HMO setting by analyzing office visit costs for patients with 4 specific diagnoses (shoulder tendinitis, acute otitis media, acute bronchitis, and acute urinary tract infection). Another study<sup>13</sup> performed at a single rural family/general medicine practice measured changes in study site workload and PA financial productivity as a consequence of adding 2 part-time PAs. No studies, to our knowledge, have provided a detailed description of daily PA practice and used this information to determine the financial implications of PA practice.

The purpose of this study was to determine the economic benefit for family/general medicine practices employing PAs by (1) describing tasks performed by a PA in a model family/general medicine

© Medical World Communications, Inc.

The physician assistant (PA) profession emerged in the 1960s in response to a shortage of primary care physicians and rising healthcare costs in the United States.<sup>1,2</sup> The original mission of the PA profession was to provide high-quality, cost-effective healthcare in rural and underserved areas. Despite increasing specialization of PA practice in accordance with the specialty distribution of practicing physicians in the United States, more than half of all PAs (52%) continue to practice

From Duquesne University School of Health Sciences (DMG, PJS) and the Departments of Pathology and Laboratory Medicine (DMG, SSR) and Performance Improvement (SSR), Allegheny General Hospital, Pittsburgh, PA; and Youghiogheny Primary Care Medicine, Connellsville, PA (JMO, A-MB).

This study was presented at the American Academy of Physician Assistants 28th Annual Meeting, Chicago, IL, May 29, 2000.

Address correspondence to: Dana Marie Grzybicki, MD, PhD, Department of Pathology and Laboratory Medicine, Allegheny General Hospital, 320 E North Street, Pittsburgh, PA 15212. E-mail: dgrzybic@wpahs.org.

practice, (2) comparing site practice characteristics with published national statistics to confirm the site's usefulness as a model practice, and (3) calculating the economic benefit of a PA practice compared with a non-PA practice.

... METHODS ...

**Description of the Study Site**

To describe the use of a PA in a family/general medicine practice, the daily activities of a PA in a group practice were observed and recorded by one of the study investigators (PJS). The observations were made during 26 site visits in September and October 1998. Semistructured interviews with the physician-owner of the practice and the PA were performed, and review of office records, billing records, and appointment logs was conducted. The site, Youghiogheny Primary Care Medicine, Connellsville, PA, was a southwestern Pennsylvania family/general medicine office serving a population of 9200. The practice comprised the family/general medicine physician who owned and supervised the practice (supervising physician), 2 employee physicians (1 part-time internist and 1 part-time family/general medicine practice physician), 1 part-time PA, and 1 nurse practitioner who worked three quarters of the time.

**Comparison of Study Site Practice With Published Averages**

To confirm the usefulness of the study site as a model for family/general medicine PA practice, data obtained from the study site were compared with current national published statistics regarding family/general medicine practices, family/general medicine practice physicians, and PAs. Statistics were obtained from the American Medical Association,<sup>14,15</sup> the Medical Group Management Association,<sup>16</sup> and the American Academy of Physician Assistants.<sup>3</sup> The mean time per ambulatory visit for primary care physicians<sup>17</sup> and the PA same-task substitution ratios<sup>18</sup> were obtained from the literature.

**Determination of the Economic Benefit of a PA Practice**

The economic benefit of a PA practice was measured by calculating a compensation-to-production ratio and by comparing the financial productivity of a PA practice with that of a physician-only (non-PA) practice.

A compensation-to-production ratio compared the PA's compensation (excluding retirement and fringe benefits) to the PA's productivity (gross patient charges).<sup>16</sup> This ratio represented the amount of compensation paid per \$1 of production. The smaller the ratio, the less money was paid in salary and the more money was generated. To protect the income privacy of the model PA, the compensation-to-production ratio was calculated by dividing the mean annual income of family/general medicine practice PAs<sup>3</sup> (\$64,951 × PA full-time equivalent) by the model PA's mean total annual patient charges.

The financial productivity (profit) of a PA practice was compared with that of a practice in which no PAs were employed. In this model, the baseline was a practice that employed a physician, and the course of action was to replace the physician with a PA. The criterion variable was the total annual financial productivity (profit) earned by the owner of the medical practice. This model was based on that of Regan and Harbert<sup>19</sup> in which the financial productivity of a practice depended on (1) revenue generation, (2) overhead reduction, and (3) increased practitioner activity. The course of action (replacing a physician with a PA) would lead to a net contribution to practice revenue generated by the PA minus any practice expenses (overhead) generated by the PA. In addition, any extra revenue generated by others in the practice because of the addition of the PA was included. In this model, the net contribution to practice revenue generated by the physician (minus any overhead) was debited to the practice as a course of the action. The net gain for the practice as a consequence of hiring a PA instead of a physician, the financial (profit) differential (X), is:

$$X = (\text{PA Revenue} - \text{PA Overhead} + \text{Extra Practice PA Revenue}) - (\text{Physician Revenue} - \text{Physician Overhead} + \text{Extra Practice Physician Revenue})$$

Physician assistant annual revenue generation for this practice was calculated as:

$$(\text{Mean Charge per Patient Seen by the PA}) \times (\text{Mean Number of Patients Seen by the PA per Week}) \times 48 \text{ wk/y}$$

The mean charge per patient was obtained from office billing records, the number of office patients seen by the PA was obtained from office appointment logs, and the number of work-weeks per year was obtained through semistructured interviews.

Charges were used for the calculation of revenue generation in this part of the analysis rather than collected reimbursements for 2 reasons. First, published national statistics relating to PA and physician revenue generation and productivity, which were compared with this practice in establishing its usefulness as a model, were expressed in terms of charges. Second, because patients seen in this practice were insured by multiple payers, reimbursement rates were highly variable. A similar calculation was performed for the revenue generated by a physician-only practice.

Overhead items include medical liability and malpractice insurance premiums; office expenses (eg, rent and mortgage); and payroll expenses, including fringe benefits, tax-deductible professional expenses (eg, expenses for medical materials and supplies), and tax-deductible expenses for any other expenses (eg, legal and accounting services).<sup>14</sup> All of these expenses, except for payroll expenses, were essentially the same in family/general medicine practices without vs with a PA. Given the fact that a PA's salary is less than a physician's, a practice's overhead is reduced if a PA is employed instead of a physician.<sup>19</sup> Annual overhead reduction was calculated as:

Mean Net Annual Income per Family/General Medicine Physician<sup>14</sup> × 0.56] – [Mean Annual Full-time Family/General Medicine PA Income<sup>3</sup> × 0.56]

The family/general medicine physician mean income figure used was \$140,900<sup>14</sup>; the mean family/general medicine PA income figure used was \$64,951.<sup>3</sup> The national mean income figures were used as overhead data to protect personal income data for the study participants. In this practice, it was assumed that no extra revenue was generated by others in the practice because of the addition of the PA.

Three sensitivity analyses were performed to determine how changes in assumptions affected the financial productivity of a PA practice compared with a non-PA practice.<sup>20</sup> In the first sensitivity analysis, the percentage reimbursement (compared with total charge) was varied. For this analysis, reimbursement percentages of 50%, 60%, 80%, and 100% were examined. The practice and practitioner characteristics for this analysis were the same as the model practice, except that the PA and physician were assumed to be full-time employees. Therefore, the PA worked 48 wk/y and saw 80.4 patients per week at a charge of \$46 per office visit. The PA's annual revenue generation was calculated as:

(\$46 per Patient) × (Reimbursement Rate) × (80.4 Patients per Week) × 48 wk/y

The supervising physician worked 48 wk/y and saw 93.0 patients per week at a charge of \$45 per office visit.

In the second sensitivity analysis, the number of patients seen per day (18, 20, 22, and 25) by the PA was varied. Both PA and physician were assumed to work full-time. The physician was assumed to see 93.0 patients per week at a charge of \$45 per patient. The reimbursement rate was assumed to be 100%.

In the third sensitivity analysis, the total number of annual patient visits was varied. Assumptions about the practices were that (1) physicians and PAs worked 48 wk/y; (2) physicians and PAs saw 20 office patients per day; (3) the charge per patient visit for a physician and a PA was \$45 and \$46, respectively; and (4) the PAs and physicians were paid based on published mean full-time annual incomes of \$64,951 and \$140,900, respectively. Based on the number of annual patient visits, a specific number of PAs or physicians would be needed in the practice in addition to a supervising physician. For example, for a practice with a total of 14,700 office visits per year, the number of physicians or PAs needed in the practice in addition to the supervising physician would be 2 ( $\{[14,700 \text{ patients per year} / 48 \text{ wk/y}] / 5 \text{ d/wk}\} / 20 \text{ patients per day}$ ). The financial differential of the PA practice compared with the physician-only practice was calculated.

Permission for this study was granted by the Duquesne University institutional review board.

## ... RESULTS ...

### Description of the Model PA Practice

Based on a review of office records of the annual number of patient visits, this practice had approximately 13,000 patient visits in 1998, with the following distribution of revenue by contract type: HMO, 60%; Medicare, 16%; Medicaid, 3%; and private, fee for service, 21%.

The supervising physician spent an average of 31 h/wk in the office. The average number of office hours per week for a physician in family/general medicine was 33.7<sup>14</sup>; therefore, the supervising physician in this model practice was a 0.92 full-time equivalent. The 2 additional employee physicians together worked an average of 42 h/wk (1.25 full-time equivalents), the PA worked an average of 19 h/wk (0.56 full-time equivalents), and the nurse practitioner worked an average of 31 h/wk (0.92 full-

**Table 1.** Patient Characteristics From a Random Sample of Physician Assistant (PA) and Supervising Physician Office Visits at the Model Family/General Medicine Practice

Patient Characteristic	Practitioners, %	
	Supervising Physician (n = 46)	PA (n = 45)
Females	56	56
Routine checks and chronic conditions	82	60
Acute conditions	18	40
Insurance coverage		
Medicare	22	19
Medicaid	0	7
HMO	70	60
Private, fee for service	8	14

time equivalents), for a total staffing of 3.65 full-time equivalent providers during a typical workweek. All providers worked a 48-wk work-year, the current median number of weeks of practice by a family/general medicine physician.<sup>14</sup>

The practitioner workload distribution of the patient population for this practice was as follows: supervising physician, 25%; additional physicians, 36%; PA, 16%; and nurse practitioner, 23%.

A recent study<sup>10</sup> examining the use of PAs and nurse practitioners in primary care from 1995 through 1999 reports that these practitioners provided an average of 11% of visits. The PA treated a mean of 18.0 patients per day. Based on an average of 7.0 hours of patient contact per day, this was equivalent to a mean of 23.3 min per patient, including consultation time with the supervising physician. The supervising physician treated a mean of 21.4 patients per day, with a mean of 19.6 min per patient.

Although the supervising physician's mean daily patient load was 3.4 patients per day higher than the PA's patient load, the supervising physician routinely demonstrated a broader range in the total number of patients seen per day (range, 15-27). The mean time for an ambulatory visit to a primary care physician was 16.3 ± 9.7 min.<sup>17</sup> The supervising physician averaged 85.6 total office visits per week, or 93.0 total office visits per week if his office hours were increased to the national mean. The mean total number of office visits per week for a family/general

medicine practice physician was 102.0.<sup>14</sup> Similarly, the PA in this practice averaged 45 office visits per week, which translated into 80.3 office visits per week for full-time status. The mean number of patient visits per week by PAs was 100.2.<sup>3</sup> Therefore, the same-task substitution ratio for this supervising physician and PA was 0.86 (80.3/93.0). The national substitution ratio for family/general medicine practice PAs was 0.84.<sup>21</sup>

In the model practice, approximately 72.7% of patients had routine acute or chronic medical conditions (eg, upper respiratory tract infections or essential hypertension) and were scheduled for appointments with the supervising physician, PA, or nurse practitioner on a time-available basis. The remaining 27.3% of patients had complex medical conditions or multisystem problems and were specifically assigned to a physician. The average patient age for the practice was 52 years, and 58% of the patient population was female.

A comparison of patient characteristics obtained from the random sample of 91 office visits for the supervising physician and PA is given in **Table 1**. Compared with the supervising physician, the PA saw younger patients with more acute conditions. The mean age of patients seen by the physician and by the PA was 64 and 46 years, respectively. These observations are in agreement with data from previously published studies.<sup>10,13,22</sup> The tasks performed

**Table 2.** Physician Assistant Tasks

History and physician examination
Patient education and counseling
Prescribe medications
Referral to specialist physicians
Excision or cryotherapy of skin lesions
Fluorescein eye examination
Vision and hearing screening
Abscess incision and drainage
Wound repair
Administration of intramuscular injections
Routine gynecological examination
Phlebotomy
Allergy screening
Ordering clinical laboratory tests and radiology
Precept physician assistant students
Participation in clinical research projects

by the PA are summarized in Table 2.

Review of the office billing records revealed that the mean charge per office visit for the supervising physician, PA, nurse practitioner, and additional physicians was \$45, \$46, \$47, and \$61, respectively. Taking into consideration the relative workload distribution for each of the practitioners, the mean office visit charge for the practice was \$52. The average fee for a family/general medicine office visit for an established patient was \$53.<sup>14</sup> The observed difference between the PA and supervising physician mean charge was consistent with data<sup>12,22</sup> regarding differences in PA and physician practice patterns.

**Comparison of Study Site Practice and Practitioner Characteristics With Published Averages**

A summary of study site practice and practitioner characteristics and the corresponding published averages is given in Table 3. The study site characteristics were similar to published averages (within 90% of the published value). Comparison of PA tasks with those published in the literature<sup>11</sup> showed a similarity in scope of practice for this PA. Thus, this practice was deemed to be a reasonable model for assessing the economic benefit of PA practice.

**Determination of the Economic Benefit of PA Practice**

The annual revenue generated by the PA in this practice (0.56 full-time equivalents) was \$99,360 (\$46 mean charge per patient x 45 patients per week x 48 wk/y). The compensation-to-production ratio for this PA was 0.36 [(0.56 x \$64,951) / (\$99,360)]. The mean compensation-to-production ratio based on gross patient charges for primary

**Table 3.** Comparison of Model Practice and Practitioner Characteristics With Published Averages

Model Practice and Practitioner Characteristic*	Published Averages
Self-employed group practice with PA seeing outpatients only	60% of group practices employ nonphysician practitioners <sup>14</sup> 37% of PAs employed in group practices <sup>3</sup> 68% of PAs see outpatients only <sup>3</sup>
Practice in community of 9200	31% of PAs work in communities of <50,000 <sup>3</sup>
Distribution of practice revenue Medicare: 16% Medicaid: 3% Private (fee for service): 21% HMO: 60%	Medicare: 30.0% <sup>14</sup> Medicaid: 12.5% <sup>14</sup> Private: 44.6% <sup>14</sup> All managed care: 46.0% <sup>30</sup>
Supervising family/general medicine practice physician office h/wk: 31.0*	33.7 <sup>14</sup>
PA and physician 48-wk work-year*	48 <sup>14</sup>
Average charge per office visit All practitioners: \$51.69* Supervising physician: \$45.00 PA: \$46.48	Mean charge per office visit for a family/general medicine practice physician for an established patient: \$53.00 <sup>16</sup>
Mean time per office visit Supervising physician: 19.6 min* PA: 23.3 min*	16.3 ± 9.7 min <sup>17</sup>
Mean office visits per week (adjusted to full-time), No. Supervising physician: 93.0* PA: 80.3	Family/general medicine practice physician: 102.0 <sup>14</sup> Family/general medicine practice PA: 100.2 <sup>3</sup>
Same-task substitution ratio for PA: 0.86*	Family/general medicine practice PA: 0.84 <sup>18</sup>

PA = physician assistant.  
\*Within 10% of the published value.

care PAs was 0.30.<sup>16</sup> Assuming no aspects of this PA's practice changed except for a conversion to full-time status, the annual revenue generated based on office visit charges alone was \$177,523. The median gross charge for full-time primary care PAs was \$205,254.<sup>16</sup>

The annual overhead reduction by employing this PA in this practice was determined to be \$42,531: [mean net annual income per family/general medicine physician (140,900) × 0.56] – [mean national annual full-time family/general medicine PA (64,951) ×

**Table 4.** Comparison of Physician Assistant (PA) Practice and Physician-Only Practice in Terms of Annual Revenue Generation and Financial Productivity at Variable Reimbursement Percentages for Office Visits

Reimbursement, %	Revenue Generation, \$		Financial Productivity, \$		
	PA Practice	Physician-Only Practice	PA Practice	Physician-Only Practice	Financial Differential, \$
100	177,523	200,880	112,572	59,980	52,592
80	142,019	160,704	77,068	19,804	57,264
60	106,514	120,528	41,563	-20,372	61,935
50	88,762	100,440	23,811	-40,460	64,271

0.56]. The total annual financial productivity of this 0.56 full-time equivalent PA was \$63,040.

In **Table 4**, the effect of variable office visit reimbursement percentages on practice revenue generated and financial productivity are given. Because the supervising physician in this practice (as well as in most practices) sees more patients on average than the PA, the PA generated less revenue based on office visit billing alone, regardless of the reimbursement percentage. Because the mean charge per office visit in the model practice was approximately 15% lower than the mean national average, these estimates of revenue generation and financial productivity were conservative. As the reimbursement percentage decreased, the financial differential between the PA practice and the physician-only practice increased. Notably, under the analysis assumptions (physician sees 93 patients per week at an average charge of \$45 per patient and a physician income of \$140,900) at a reimbursement rate of 60%, the financial productivity of the physician dropped below zero.

In **Table 5**, the effect on financial productivity as the number of PA office visits per day (18, 20, 22, 25) varied is given. For this analysis, the reimbursement percentage for office visits was assumed to be 100%, and the physician consistently saw 93 patients per week. Because overhead costs remained the same for both practices, as more patients were seen per day by the PA, the financial differential between the PA practice and the physician-only practice increased.

In **Table 6**, the effect on financial productivity as the number of annual patient visits varies is given. As practices became larger and employed more PAs instead of physicians, the financial differential between the PA practice and the physician-only practice increased.

... DISCUSSION ...

The results of this study illustrate the economic benefit of a model family/general medicine practice

**Table 5.** Comparison of Physician Assistant (PA) Practice and Physician-Only Practice in Terms of Annual Revenue Generation and Financial Productivity at a Variable Number of Office Visits per PA

PA Office Visits per Day, No.	Revenue Generation, \$		Financial Productivity, \$		
	PA Practice	Physician-Only Practice	PA Practice	Physician-Only Practice	Financial Differential, \$
18	177,523	200,880	112,572	59,980	52,592
20	196,954	200,880	132,003	59,980	72,023
22	217,046	200,880	152,095	59,980	92,115
25	246,634	200,880	181,683	59,980	121,703

that employs a PA. This study focused on one particular practice, and additional, larger studies are necessary before these data may be assumed to be generalizable. Nonetheless, the practice we studied is similar to other family/general medicine practices. Many of the practice and practitioner characteristics observed in the model practice were similar to published average statistics for family/general medicine practices, physicians, and PAs. The tasks performed by the PA in the model practice were in agreement with the scope of practice of family/general medicine PAs reported in the literature.<sup>11</sup> The sensitivity analyses addressed several variables that impacted total financial productivity of PAs; these analyses showed consistent economic benefit of PA practices compared with non-PA practices. Our findings also are in agreement with the few studies relating to the economic benefit of PAs in primary care<sup>12</sup> and family/general medicine office settings.<sup>13</sup>

One advantage of performing a relatively in-depth analysis of a single practice was that it provided detailed information relating to practice characteristics of a family/general medicine PA. Although much of this information has been reported piecemeal in national statistics, communications, or large database or survey studies, few studies have described PA practice by using a case study approach. Although we observed multiple practitioners, the purpose of this study was to examine the PA and her economic benefit to the practice. Therefore, we have not included detailed information regarding the other practitioners.

Our calculations regarding the overhead reduction component of financial productivity used national mean salary/income data for family/general medicine PAs and physicians to maintain the privacy of the practitioners collaborating in the study. The sensitivity analyses indicated that one of the major factors impacting the economic benefit of hiring a PA instead of a physician was the salary differential between a PA and a physician. Variability in PA salaries occurs as a consequence of multiple factors, including PA years of experience, population of the geographic area, type of community served, whether call is taken, and whether the PA has supervisory experience for other providers.<sup>3</sup> Therefore, the economic benefit of PA employment would be expected to vary with these factors as well. As PA salaries approach physician salaries, the economic benefit of PA practice decreases.

**Table 6.** Comparison of Physician Assistant (PA) Practice and Physician-Only Practice in Terms of Financial Productivity at a Variable Number of Annual Patient Visits

Annual Patient Visits, No.	PAs or Physicians Needed in Addition to 1 Supervising Physician, No.	Financial Differential of PA Practice vs Physician-Only Practice, \$
4900	0	0
7350	0.5	40,375
9800	1.0	80,749
12,250	1.5	121,123
14,700	2.0	161,498
17,150	2.5	201,872
19,600	3.0	242,247

We assumed that the PAs and physicians working in the theoretical practices were functional substitutes, meaning that there were no significant differences in the management (eg, resource utilization) or patient outcomes (eg, quality of care) of the patients seen by the different practitioners. This assumption may be a limitation of this analysis; however, little detailed information comparing PA and physician practice, particularly regarding the outcomes of patients managed by PAs and physicians, is available. Rudy et al<sup>23</sup> found no difference in clinical outcomes for patients treated by nurse practitioners, PAs, and resident physicians. Our study and several previous studies have shown that primary care PAs and physicians provided overlapping services,<sup>10-12,24-26</sup> and additional studies have shown a continuous high level of patient satisfaction with PA care,<sup>27-29</sup> one measure of quality. Resource utilization studies, additional outcomes studies, and studies examining the details of PA practice (eg, PA use of supervising physician consultation) are needed to elucidate the true degree of PA-physician substitution occurring in primary care. In reality, PAs and physicians are not interchangeable providers for a percentage of patients, and physicians often treat those patients with more complex medical conditions. This was true in the model practice. Economic analysis of primary care practices employing physician extenders must take into account patient mix for comparisons to be valid.

Presently, more than half of all group practices employ at least 1 nonphysician provider.<sup>14</sup> Our results show that one of the advantages of employ-

ing a PA rather than another physician in a family/general medicine practice is the economic benefit for the practice, estimated here as \$40,000 to \$80,000 annually for a full-time PA.

... CONCLUSIONS ...

In this model family/general medicine practice, a part-time PA managed 16% of the practice workload and saw office patients who tended to be younger and who presented more often with acute conditions compared with patients seen by the supervising physician. The PA in this practice was economically beneficial, with a same-task substitution ratio of 0.86, a compensation-to-production ratio of 0.36, and a gross annual financial productivity (adjusted to 1.0 full-time equivalent) of \$112,572. Sensitivity analyses assuming variations in several practice parameters showed consistent economic benefit of a PA practice compared with a physician-only practice.

... REFERENCES ...

1. Stead EA. Conserving costly talents: Providing physician's new assistants. *JAMA* 1966;198:1108-1109.
2. Nelson EC, Jacobs AR, Johnson KG. Patients' acceptance of physician assistants. *JAMA* 1974;228:63-67.
3. American Academy of Physician Assistants. 1999 AAPA Physician Assistant Census Report. Alexandria, VA: American Academy of Physician Assistants; 2000.
4. Sox HC, Ginsburg JA, Scott HD. Physician assistants and nurse practitioners. *Ann Intern Med* 1994;121:714-716.
5. American Academy of Physician Assistants. *Physician Assistants Statistics and Trends 1991-1998*. Alexandria, VA: American Academy of Physician Assistants; 1999.
6. American Academy of Physician Assistants. *Information Update: Projected Number of People in Clinical Practice as PAs as of January 1, 2000*. Alexandria, VA: American Academy of Physician Assistants; 1999.
7. Hirshberg AJ, Holliman CJ, Wuerz RC, Chapman DM. Case management by physician assistants and primary care physicians vs emergency physicians. *Acad Emerg Med* 1997;4:1046-1052.
8. Jones TV, Bunner SH. Approaches to urinary incontinence in a rural population: A comparison of PAs, nurse practitioners, and family physicians. *J Am Board Fam Pract* 1998;11:207-215.
9. McCaig LF, Hooker RS, Sekscenski ES, Woodwell DA. Physician assistants and nurse practitioners in hospital outpatient departments, 1993-1994. *Public Health Rep* 1998;113:75-82.
10. Hooker RS, McCaig LF. Use of physician assistants and nurse practitioners in primary care, 1995-1999. *Health Aff* 2001;20(4): 231-238.

11. Dehn RW, Hooker RS. Clinical activities of Iowa family practice PAs. *J Am Acad Physician Assistants* 1999;12:63-77.
12. Hooker RS. A cost-benefit analysis of physician assistants in primary care. Presented at: the 27th Annual Meeting of the American Academy of Physician Assistants, Atlanta, GA, June 1, 1999.
13. Sekhon LJ. Medical practice evaluation: adding a physician assistant. *Del Med J* 1998;70:253-255.
14. Center for Health Policy Research (American Medical Association). *Socioeconomic Characteristics of Medical Practice 1999-2000*. Chicago, IL: American Medical Association; 1999.
15. Center for Health Policy Research (American Medical Association). *Socioeconomic Characteristics of Medical Practice 1995*. Chicago, IL: American Medical Association; 1995.
16. Medical Group Management Association. *1999 Physician Compensation and Production Survey*. Englewood, CO: Medical Group Management Association; 1999.
17. Blumenthal D, Causino N, Chang YC, et al. The duration of ambulatory visits to physicians. *J Fam Pract* 1999;48:264-271.
18. Larson EH, Hart LG, Ballweg R. National estimates of physician assistant productivity. In: *WWAMI Center for Health Workforce Studies Working Paper #57*. Vol 7, No. 08. Seattle, WA: University of Washington School of Medicine; 2000.
19. Regan DM, Harbert KR. Measuring the financial productivity of physician assistants. *Drug Med Group Management J* 1991; Nov/Dec:46-52.
20. Boardman AE, Greenberg DH, Vining AR, Weimer DL. *Cost-Benefit Analysis: Concepts and Practice*. Upper Saddle River, NJ: Prentice-Hall Inc; 1996:196-197.
21. Nelson EC, Jacobs A, Cordner K, Johnson KG. Financial impact of physician assistants on medical practice. *N Engl J Med* 1975;293:527-530.
22. Crandall LA, Santulli WP, Radelet ML, Kilpatrick KE, Lewis DE. Physician assistants in primary care: Patient assignment and task delegation. *Med Care* 1984;22:268-282.
23. Rudy EB, Davidson LJ, Daly B, et al. Care activities and outcomes of patients cared for by acute care nurse practitioners, physician assistants, and resident physicians: A comparison. *Am J Crit Care* 1998;7:267-281.
24. Anderson AL, Gilliss CL. Nurse practitioners, certified nurse midwives, and physician assistants in California. *West J Med* 1998;168:437-444.
25. Birkholz G, Viens DC. Medicaid claims data comparisons for nurse practitioners, physician assistants, and primary care physicians in New Mexico. *J Am Acad Nurse Pract* 1999;11:3-10.
26. Jacobson PD, Parker LE, Coulter ID. Nurse practitioners and physician assistants as primary care providers in institutional settings. *Inquiry* 1998-1999;35:432-446.
27. Baer LC, Baldwin KA, Sisk RJ, et al. Development of an instrument to measure community acceptance of nurse practitioners and physician assistants. *J Nurs Meas* 1999;7:63-77.
28. Perry K. Patient survey: Physician extenders. Why patients love physician extenders. *Med Econ* 1995;72:58-63, 67.
29. Oliver DR, Conboy JE, Donahue WJ, Daniels MA, McKelvey PA. Patients' satisfaction with physician assistant services. *Phys Assist* 1986;10:51-4, 57-60.
30. Center for Health Policy Research (American Medical Association). *Socioeconomic Characteristics of Medical Practice 2000-2002*. Chicago, IL: American Medical Association; 2001.