

# Scarcity of Primary Care Positions May Divert Physician Assistants Into Specialty Practice

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## Abstract

**Background:** Physician assistants (PAs) are often suggested as a partial solution to predicted primary care workforce shortages, but a declining proportion of PAs are entering primary care practice. Policy efforts have focused on increasing primary care PA supply, but low labor market demand might be constricting the primary care PA pipeline. **Method:** In this descriptive, cross-sectional study, we compare primary care and specialty job postings to each other and to occupied PA positions. Job posting data for 2014 are from a leading labor analytics firm. **Results:** Only 18% of job postings were in primary care, compared with 27% of occupied PA positions. The proportion of postings that were for primary care varied widely by state (9% to 40%) and were highest in the West. **Discussion:** Job availability is a potential barrier to PAs practicing in primary care, especially in some locations. Other job factors are examined and policy solutions are suggested.

## Keywords

physician assistants, primary care, health workforce

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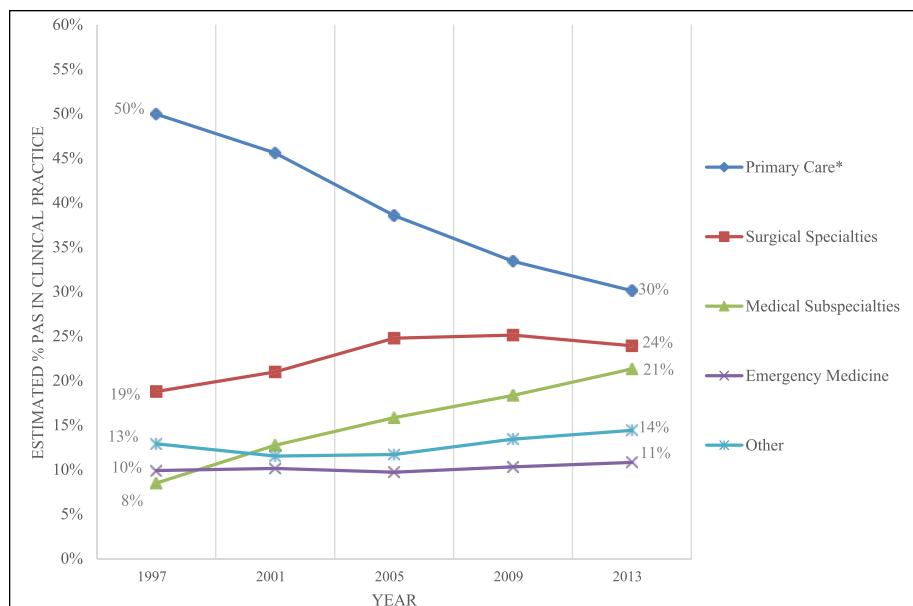
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## Background

Demand for primary care services in the United States is expected to increase sharply due to aging of the population, rising incidence of chronic disease, and the ability of newly insured patients to access care (Dall et al., 2013). Whether the primary care provider supply is sufficient to meet this increased demand is a subject of widespread concern (Association of American Medical Colleges, 2015; Peterson et al., 2012; Health Resources and Services Administration, 2013). Physician assistants (PAs) are often suggested as a potential partial solution to expected primary care physician shortages (Gottlieb & Emanuel, 2013; Green, Savin, & Lu, 2013; Health Resources and Services Administration, 2013), but a declining portion of PAs are choosing primary care practice (Morgan, Everett, Humeniuk, & Valentin, 2015).

The federal government has responded to the concern regarding adequacy of the primary care workforce by funding programs designed to bolster the primary care provider supply. While the bulk of these expenditures remain allocated to the physician workforce, the PA profession, which comprises about 10% of the primary care provider workforce, also receives funding (Agency for Healthcare Research and Quality, 2012). Federal training grants offer support to PA programs that undertake initiatives to increase their output of primary care PAs, and National Health Service Corps scholarships and loan forgiveness programs offset an individual's education expenses in exchange for the PA working in primary care in a medically underserved area (Kohn, 2013). Some states offer similar programs, and a number of organizations, including the Physician Assistant Education Association, make increased primary care participation of PAs a strategic goal (Physician Assistant Education Association, 2013). Despite these efforts, the proportion of PAs practicing in primary care continues to decline, from above 50% in the 1990s to near 30% in 2013, while the proportions of those practicing in medical and surgical subspecialties has increased (American Academy of Physician Assistants, 2014; Figure 1).

The programs discussed above seek to increase the *supply* of PAs prepared for primary care employment, but scant attention has been devoted to the labor market *demand* for primary care PAs. Since wages offered are an indicator of demand in the health worker labor market, increasing PA salaries overall and higher salaries for PAs in specialty practice suggest that the job market demand for PAs is strong (Quella, Brock, & Hooker, 2015), and that the demand for specialty PAs is stronger than that for primary care PAs (Morgan et al., 2015). Drivers of demand for PAs include task-shifting and skill mix strategies (McPake, Scott, & Edoka, 2014). Demand for PAs is affected by the potential for shifting tasks from more highly trained (physicians) to less highly trained (PAs and nurse practitioners[NPs]) workers, a potential that varies by specialty (World Health Organization, 2008). Specialties experiencing a shortage of physicians might have increased incentive to shift tasks toward other provider types. The potential for task shifting, which varies across specialties, is integral to determination of the skill mix that will produce optimal efficiency and quality outcomes. In addition to these microeconomic factors, legal influences including scope of



**Figure 1.** Trends in clinical specialties for physician assistants (PAs), 1997 to 2013.

\*Primary Care includes Family Medicine (with and without Urgent Care), General Internal Medicine, Primary Care, General Pediatrics, and Geriatrics. This differs slightly from the definition in other analyses in this article due to limitations in the availability of trend data.

Source. AAPA Census/Annual Survey Reports, 1997 to 2013.

practice regulations (Davis, Radix, Cawley, Hooker, & Walker, 2015; Stange, 2014) and social issues such as protection of professional status (Ferraro & Southerland, 1989) impinge on individual hiring decisions differently in the various medical specialties. All of these dynamics suggest that labor market demand for PAs might vary by practice specialty.

The labor market for PAs is different than that of physicians for two reasons. First, while physicians specialize in the course of their training, the PA training model is general, enabling PAs entering the job market to accept employment in any specialty. Although specialty choice is influenced by many supply side factors, such as education program emphasis and personal preferences, availability of job opportunities also affects specialty choice (Singer & Hooker, 1996; Wright & Orcutt, 2011). Second, since PAs must work with physician supervision, they typically cannot create their own positions and are dependent on job openings for employment.

Newly certified PAs reported in 2014 that the biggest barriers to securing a position were (a) requirements for experience, (b) geography, and (c) lack of jobs in their preferred specialty (National Commission on Certification of Physician Assistants [NCCPA], 2015b). Observations from PA program faculty indicate that some new graduates have difficulty securing jobs in primary care (J. M. Coombs, personal communication,

December 30, 2014; V. Snyder, personal communication, December 30, 2014), suggesting that job availability might present a bottleneck in the PA primary care pipeline. Furthermore, primary care positions for PAs are often cross-posted for NPs, meaning that PAs may be competing with NPs for primary care postings.

In this project, we describe the national employment market for PAs, comparing specialty and primary care job postings to existing filled PA positions. Guided by the factors identified as barriers by recent graduates and PA faculty, we compared primary care and specialty job postings with regard to availability, location, experience requirements, and whether the job was also open to NPs.

### ***New Contributions***

This is the first study to evaluate the national job market for PAs by specialty and is, to our knowledge, the first to engage the question of whether comparatively low demand for primary care PAs might contribute to growing PA specialization. Understanding labor market demand for PAs could potentially illuminate new strategies for bolstering the numbers of primary care providers.

Traditional labor market data sources, including the Bureau of Labor Statistics and the Census Bureau, do not provide information on PA jobs by specialty of practice. We use an emerging source of data (real-time labor market information [RT LMI] from Internet job postings) as an indicator of market demand for PAs by medical specialty. Internet job postings are appropriate for analyzing skilled health sector jobs because near 90% of these positions are posted online and because the postings include sufficient detail for analysis of practice specialty and other job attributes (Carnevale, Jayasundera, & Repnikov, 2014; Maher & Maher, 2014). The methods that we used to examine, improve, and analyze the data may be useful to future researchers interested in using similar data.

## **Method**

### ***Data Source***

National data on 2014 job postings for PAs were purchased from Burning Glass Technologies (BGT, 2015). BGT collects job postings using an Internet “spider” to continuously crawl over 38,000 websites in search of job postings. Data for specific variables, such as job title, location, and employer, are then extracted from each posting. Finally, BGT deduplicates the postings (BGT, 2015; B. Taska, personal communication, August 26, 2015). Additional details on the methods used by BGT to acquire, extract, code, and deduplicate the data (BGT, 2015; B. Taska, personal communication, August 26, 2015), a summary of data quality findings by independent investigators (Carnevale et al., 2014; Maher & Maher, 2014), and additional details regarding our data handling methods are provided in the appendix.

### ***Variable Construction***

We examined 42,768 job postings that advertised PA jobs and excluded postings that advertised nonclinical jobs (336), postings for jobs in Guam and Puerto Rico (5), and

postings for which we could not identify a specialty (8,290), resulting in a final sample of 34,137 PA job postings.

**Practice Specialty.** Two trained coders assigned specific practice specialties to each posting. Specialty and primary care categories are based on the designations used in the NCCPA's statistical profile of recently certified PAs (NCCPA, 2015b). Our research analyst repeated coding of a subset of the coders' work and provided coaching until >95% agreement was reached regarding assignment of a specialty of practice to each posting. Many of the postings to which our coders could not assign a specialty listed only the setting or a specific hiring entity. Two clinician authors (PM and PD) examined a subset of these posts and agreed that it was not possible to determine the specialty for most, and that the remaining postings were distributed among specialties in proportions that correlated to the larger data set, suggesting no systematic bias in whether these postings were likely to advertise a job in primary versus specialty practice (see the appendix). Noncoded postings were omitted from our analysis.

**Job Location.** Since most postings clearly indicated a location, we did not find errors in BGT's geographic codes, and used these codes as provided in the original vendor data set.

**Practitioner Type.** We used text analytics to assign a variable indicating whether each job was posted for a PA only or for either a PA or NP.

**Years of Experience.** Because our examination of the data showed a number of errors in the variable created by BGT for years of experience required in each posting, we created decision rules to correct this variable. The jobs that were coded with a small integer (1, 2, 3, and 5) had accuracy >80%, but jobs coded with fractions of years or higher integer values were typically inaccurate. For example, we found that all postings that were coded as requiring "18 months" of experience were actually advertising for patient care of children over "18 months" of age. Jobs that were coded as requiring >5 years of experience were typically found to mention that the practice site had been in business for the number of years specified. Likewise, very few postings were coded as requiring 4 years of experience, and these most often referred to a requirement for a 4-year college degree. Therefore, we created a dichotomous variable that divided the sample into those jobs that required 1 or more years of experience (specifically requiring 1, 2, 3, or 5 years of experience) and classified the remaining jobs as not requiring experience.

**Primary Care Versus Specialty Practice Job Postings.** To compare the specialty distribution of the job openings with the data described below for occupied positions, we defined primary care as family medicine, general practice, general internal medicine, and general pediatrics.

**Occupied Positions.** Data on occupied PA positions in 2014 were obtained from a survey of all certified PAs (response rate 89%) conducted by the NCCPA (2015a).

## Analysis

In our descriptive cross-sectional study, we compare the number of primary care and specialty job postings to each other and to the number of occupied PA positions in primary care and specialties. Association of practice specialty with other variables (experience requirements and cross-posting of PA positions for NPs) was examined by chi-square analysis, with statistical significance level set at  $p < .05$ . We then visualize the location of primary care and specialty job postings and compare the proportion of job postings that are in primary care across states by quintiles using geographic information system methods.

## Results

In 2014, the overwhelming majority (82%) of PA job postings were for positions in specialties ( $n = 28,047$ ), while only 18% of PA job postings were for primary care positions ( $n = 6,091$ ). Of approximately 100,000 PA positions *occupied* in 2014, 73% was in specialty care and 27% was in primary care (Figure 2).

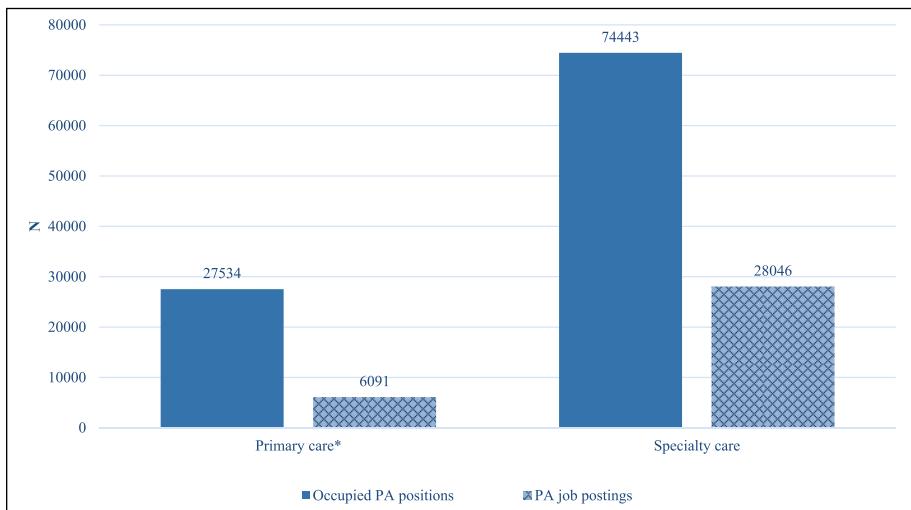
A slightly larger proportion of specialty postings (37%) than primary care postings (29%) required at least 1 year of experience ( $p < .01$ ). Slightly more primary care jobs (41%) than specialty jobs (35%) were posted for a PA or an NP ( $p < .01$ ).

Figure 3 shows more detail regarding the distribution of positions in occupied versus advertised positions by specialty category. Among occupied positions, the largest portion of specialty positions is in surgical specialties (26%), followed by medical subspecialties (21%), emergency medicine (14%), and other specialties (12%). Primary care demonstrated a substantially lower percentage of posted job positions (18%) compared with the percentage of PAs working in the field (27%). Conversely, the “other specialty” had a substantially higher percentage of PA job postings compared with the percentage of PAs working in the field (18% vs. 12%).

The map in Figure 4 compares the proportion of PA job openings in primary care positions compared with specialty PA postings by state. States average 19.0% primary care job postings, with substantial variation among states ( $SD = 7.3\%$ , median = 16.9%, range from 9.1% in Rhode Island to 40.3% in Hawaii). In general, states with the highest percentage of primary care PA jobs are located in the Western United States.

## Discussion

This analysis comparing occupied PA jobs with job postings in 2014 shows that the job market is weaker for primary care positions than for specialty positions, with only 18% of job postings seeking PAs to work in primary care. Other sources show that the job market for PAs overall is robust (Bureau of Labor Statistics & U.S. Department of Labor, 2014; Forbes.com, 2014; Quella et al., 2015), but, in contrast to our study, these reports do not analyze primary care jobs separately from specialty jobs. Although the potential for higher earnings in specialty practice impacts PA job choices, our findings



**Figure 2.** Number of occupied physician assistant (PA) positions compared with job postings by primary care versus specialty practice, 2014.

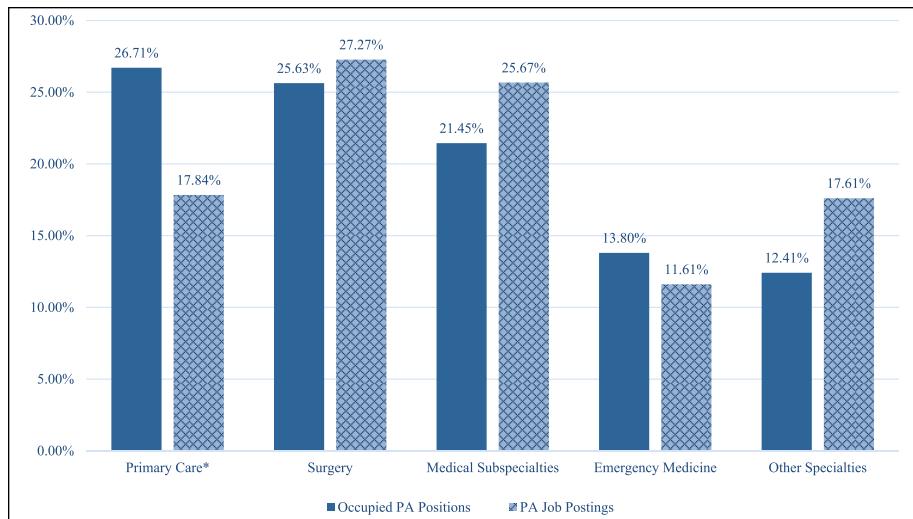
\*Primary Care includes Family Medicine (with and without Urgent Care), General Internal Medicine, Primary Care, and General Pediatrics.

Source. National job postings data from Burning Glass Technologies (2015), coded by authors; and national data on occupied positions from the National Commission on the Certification of Physician Assistants (2014).

suggest that the much greater availability of specialty PA jobs may also contribute to the continued trend of PAs opting to work in specialty practice.

In 2014, there were about 7,556 PA graduates (NCCPA, 2015a) and 6,100 primary care job postings, theoretically offering primary care positions for the majority of graduates. But our study found that almost one third of these positions require experience, reducing primary care positions available to new graduates to about 4,300. These new graduates would then need to compete for these jobs with existing PAs wishing to change jobs as well as with NPs (for 40% of the postings), who outnumber PAs and who might have an advantage due to experience in primary care in another nursing role. And the primary care job openings are not distributed uniformly across or within states, adding to the difficulty new graduate PAs may face securing jobs in primary care. Indeed, our findings are congruent with the factors that newly certified PAs report as barriers to securing employment, namely, experience requirements, geography, and lack of jobs in their preferred specialty (NCCPA, 2015b).

Although the requirement for experience and the willingness of employers to hire either a PA or an NP are not materially different for primary care and for specialty positions, the larger numbers of positions available in specialties may make it easier for a new PA to obtain a specialty position. And higher salaries in specialties will make these positions attractive to many graduates (Morgan et al., 2015; Singer & Hooker, 1996).

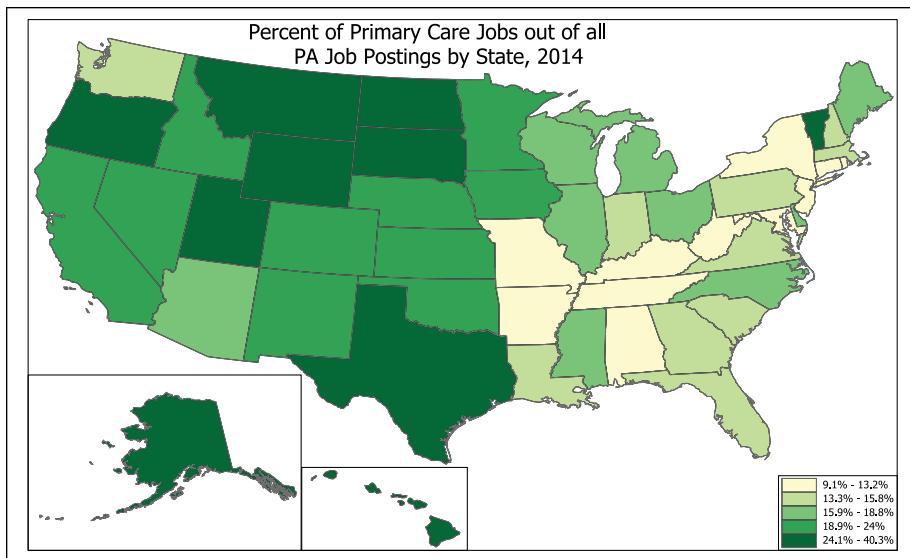


**Figure 3.** Physician assistant (PA) job postings by clinical specialty, compared with occupied PA jobs, 2014.

\*Primary Care includes Family Medicine (with and without Urgent Care), General Internal Medicine, Primary Care, and General Pediatrics.

Source. National job postings data from Burning Glass Technologies (2015), coded by authors; and national data on occupied positions from the National Commission on the Certification of Physician Assistants (2014).

Given frequent news reports and policy statements regarding primary care provider shortages (Association of American Medical Colleges, 2015; Peterson, Liaw, Tran, & Bazemore, 2015), the suggestion that primary care job availability may be a limiting factor in increasing the PA presence in primary care may come as a surprise. Yet there are several reasons that specialists might be more eager than primary care physicians to hire PAs. Turf battles and conflicts surrounding evolving scope of practice may be less acute in specialties, where PAs and physicians often work very closely together (Cunningham, 2010). Medical sociologists Ferraro and Southerland's work suggests that hierarchy in the medical profession puts a greater distance in status between specialists and PAs than between primary care physicians and PAs. This wider status differential might lead specialists to be less threatened by the incursion of PAs into their domain (Ferraro & Southerland, 1989). Also, earnings differentials between physicians and PAs are much wider in the specialties (Morgan et al., 2015), potentially affecting physician willingness to hire PAs in at least two ways. First, the impact of PAs on practice profits may be more advantageous to specialists due to the much lower cost of hiring a PA relative to a physician. Second, insofar as salary is a reflection of status, specialists, who often earn three to five times as much as the PAs they employ, may feel less threat to their status than do primary care physicians who earn only twice as much as primary care PAs.



**Figure 4.** Comparison of the percentage of primary care job postings by state, 2014.

Note. PA = physician assistant.

Source. National job postings data from Burning Glass Technologies, coded by authors.

### Strengths and Limitations

Advantages of job posting data include real-time collection that supports identification of emerging trends. Job posting data also provide richer detail than do the surveys traditionally used to monitor employment markets. For example, neither Census Bureau nor Bureau of Labor Statistics data provide information on specialty of practice, a necessity for our investigation. Our study did not address a number of factors that are known to affect job choice, most notably higher earnings in specialty practice (Hooker, Cawley, & Asprey, 2010). Few job postings divulge the salary offered. Our study did not address job turnover rates, which might vary by specialty. Specialties with faster turnover would be expected to have more job postings as employers seek to fill vacated positions. Other limitations of job posting data include the inability to identify unposted positions, potential for coding errors, and missing data on specialty. These limitations have been minimized, as we discuss in the appendix.

### Implications

We have identified job availability as a potential barrier to PAs practicing in primary care. Geographic limitations, requirements for experience, and competition from NPs may also limit PAs from securing primary care positions. Additional investigations are needed to confirm whether, how, and to what extent demand factors may be constricting the final step of the PA primary care pipeline. If the problem of low labor market

demand for primary care PAs is confirmed, potential policy solutions include financial incentives, job-locating assistance, and educational outreach. An example of an incentive program is the Rural Health Clinics Act, which rewards clinics that employ PAs or advanced practice nurses with advantageous reimbursement. Advanced real-time job information and/or primary care job coaches could help match PAs to primary care jobs. Educational approaches could be targeted to help primary care employers understand how to best work with PAs, including new graduates. It would be inefficient to invest scarce resources in training PAs for the primary care workforce if those graduates are unable to secure primary care employment.

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### Declaration of Conflicting Interests

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### References

- Agency for Healthcare Research and Quality. (2012). *Primary care workforce facts and stats No. 3: Distribution of the U.S. primary care workforce*. <http://www.ahrq.gov/research/findings/factsheets/primary/pcwork3/pcwork3.pdf>
- American Academy of Physician Assistants. (2014). *2013 AAPA annual survey data tables* (p. 34). Alexandria, VA: Author.
- Association of American Medical Colleges. (2015). *The complexities of physician supply and demand: Projections from 2013 to 2025*. Washington, DC: Author.
- Bureau of Labor Statistics & U.S. Department of Labor. (2014). *Occupational outlook handbook (2014-15 ed.): Physician assistants*. Washington, DC: Author.
- Burning Glass Technologies. (2015). *Burning Glass: Careers in focus*. Retrieved from <http://burning-glass.com/>
- Carnevale, A., Jayasundera, T., & Repnikov, D. (2014). *Understanding online job ads data: A technical report*. Retrieved from [https://cew.georgetown.edu/wp-content/uploads/2014/11/OCLM.Tech\\_.Web\\_.pdf](https://cew.georgetown.edu/wp-content/uploads/2014/11/OCLM.Tech_.Web_.pdf)

- Cunningham, R. (2010). *Tapping the potential of the health care workforce: Scope-of-practice and payment policies for advanced practical nurses and physician assistants*. Retrieved from [https://www.nhpf.org/library/background-papers/BP76\\_SOP\\_07-06-2010.pdf](https://www.nhpf.org/library/background-papers/BP76_SOP_07-06-2010.pdf)
- Dall, T. M., Gallo, P. D., Chakrabarti, R., West, T., Semilla, A. P., & Storm, M. V. (2013). An aging population and growing disease burden will require a large and specialized health care workforce by 2025. *Health Affairs*, 32, 2013-2020. doi:10.1377/hlthaff.2013.0714
- Davis, A., Radix, S., Cawley, J., Hooker, R. S., & Walker, C. (2015). Access and innovation in a time of rapid change: Physician assistant scope of practice. *Annals of Health Law*, 24, 286-336.
- Ferraro, K., & Southerland, T. (1989). Domains of medical practice: Physicians' assessment of the role of physician extenders. *Journal of Health and Social Behavior*, 30, 192-205.
- Forbes.com. (2014). *No. 1 best master's degree for jobs: Physician assistant studies*. Retrieved from <http://www.forbes.com/pictures/fjle45gfk/no-1-best-masters-degree-for-jobs-physicians-assistant-studies/>
- Gottlieb, S., & Emanuel, E. J. (2013, December 4). No, there won't be a doctor shortage (Op-ed). *The New York Times*. Retrieved from [http://www.nytimes.com/2013/12/05/opinion/no-there-wont-be-a-doctor-shortage.html?\\_r=0](http://www.nytimes.com/2013/12/05/opinion/no-there-wont-be-a-doctor-shortage.html?_r=0)
- Green, L. V., Savin, S., & Lu, Y. (2013). Primary care physician shortages could be eliminated through use of teams, nonphysicians, and electronic communication. *Health Affairs*, 32, 11-19. doi:10.1377/hlthaff.2012.1086
- Health Resources and Services Administration. (2013). *Projecting the supply and demand for primary care practitioners through 2020* (U.S. Department of Health & Human Services). Rockville, MD: Author.
- Hooker, R. S., Cawley, J. F., & Asprey, D. P. (2010). *Physician assistants: Policy and practice* (3rd ed.). Philadelphia, PA: F. A. Davis.
- Kohn, L. (2013). *Health care workforce: Federally funded training programs in fiscal year 2012* (GAO-13-709R). Washington, DC: Retrieved from <http://www.gao.gov/assets/660/656960.pdf>
- Maher & Maher. (2014). *Real-time labor market information: An environmental scan of vendors and workforce development users* (In collaboration with Jobs for the Future & New York City Labor Market Information Service). Retrieved from <http://www.jff.org/publications/real-time-labor-market-information-environmental-scan-vendors-and-workforce-development>
- McPake, B., Scott, A., & Edoka, I. (2014). *Analyzing markets for health workers: Insights from labor and health economics*. Retrieved from <http://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-0224-9>
- Morgan, P., Everett, C., Humeniuk, K., & Valentin, V. (2015). Specialty choice among US physician assistants: Distribution, salaries, and comparison to physicians. *Journal of the American Academy of Physician Assistants*. Retrieved from <http://forum.paeaonline.org/wp-content/uploads/proceedings2015/T221.pdf>
- National Commission on Certification of Physician Assistants. (2015a). *2014 Statistical profile of certified physician assistants*. Retrieved from <https://www.nccpa.net/Uploads/docs/2014StatisticalProfileofCertifiedPAsPhysicianAssistants-AnAnnualReportoftheNCCPA.pdf>
- National Commission on Certification of Physician Assistants. (2015b). *2014 Statistical profile of recently certified physician assistants*. Retrieved from <https://www.nccpa.net/Uploads/docs/RecentlyCertifiedReport2014.pdf>
- Peterson, S. M., Liaw, W. R., Phillips, R. L., Jr., Rabin, D. L., Meyers, D. S., & Bazemore, A. W. (2012). Projecting US primary care physician workforce needs: 2010-2025. *Annals of Family Medicine*, 10, 503-509. doi:10.1370/afm.1431

- Peterson, S. M., Liaw, W. R., Tran, C., & Bazemore, A. W. (2015). Estimating the residency expansion required to avoid projected primary care physician shortages by 2035. *Annals of Family Medicine, 13*, 107-114.
- Physician Assistant Education Association. (2013). *Physician assistant education association 2013 strategy*. Retrieved from <http://www.paeaonline.org/index.php?ht=a/GetDocumentAction/i/153450>
- Quella, A., Brock, D., & Hooker, R. (2015). Physician assistant wages and employment: 2000-2025. *Journal of the American Academy of Physician Assistants, 28*, 56-63.
- Singer, A. M., & Hooker, R. S. (1996). Determinants of specialty choice of physician assistants. *Academic Medicine, 71*, 917-919.
- Stange, K. (2014). How does provider supply and regulation influence health care markets? Evidence from nurse practitioners and physician assistants. *Journal of Health Economics, 33*, 1-27. doi:10.1016/j.jhealeco.2013.10.009
- World Health Organization. (2008). *Task shifting: Global recommendations and guidelines*. Retrieved from <http://www.who.int/healthsystems/TTR-TaskShifting.pdf>
- Wright, K. A., & Orcutt, V. L. (2011). Physician assistant specialty choice: A factor analysis. *Journal of Physician Assistant Education, 22*(2), 20-24.

## Appendix

### Data From Burning Glass Technologies

BGT specializes in providing RT LMI based primarily on job posting data. BGT collects job postings using an Internet “spider” to continuously crawl over 38,000 websites in search of job postings (Maher & Maher, 2014). Data for specific variables, such as job title, location, and employer, are then extracted from each posting (BGT, 2015). Finally, BGT deduplicates the postings as described below. The applicability of RT LMI data for our project is dependent on three main factors: comprehensiveness of job identification, adequate deduplication, and accuracy of data fields.

**Comprehensiveness.** Jobs that are not posted online will not be included in the products produced by RT LMI vendors. An analysis of RT LMI vendors conducted by independent researchers led by Anthony Carnevale at Georgetown University compared BGT online job postings with Bureau of Labor Statistics data for job openings by industry. BGT job postings correlated closely with BLS job openings. The percentage of jobs posted online varied by profession, with over 80% of jobs requiring a college degree, and an even higher proportion of health care sector jobs estimated to be posted online. An estimate of the proportion of health care sector jobs posted online was not provided, but it is reasonable to conclude that the BGT process captures 90% or more of health sector jobs requiring advanced degrees (Carnevale et al., 2014).

**Deduplication.** Since employers might advertise employment opportunities on multiple sites, Internet spiders are expected to gather many duplicate postings. This could lead to overestimation of job openings unless the collection of job ads is successfully deduplicated. BGT’s deduplication process eliminates any postings with matching

employer, job title, and location that recurs within a 2-month window (Carnevale et al., 2014; B. Taska, personal communication, August 26, 2015). According to BGT, this process removes 75% of postings. BGT evaluated the accuracy of their deduplication process by comparing it with humans reading postings and concluded that the automated procedure leaves less than 10% duplicate postings. Although BGT asserts that upgrades have likely improved this number, they cannot provide an updated estimate at this time (B. Taska, personal communication, August 26, 2015).

Since BGT only considers a posting to be a duplicate if it is repeated within 2 months, jobs that remain open for many months might be counted more than once. Our in-house manual targeted search for duplicates among 40 postings found 3 duplicates (7.5%), and 2 of these were for the same job that had apparently remained posted for over 2 months. If the time that a job remains posted is longer for some specialties than others, this could bias our results, but we have no reason to suspect this differential time to fill positions.

**Accuracy of Data Fields.** The data fields required for our analysis were specialty of practice, location, job title, and experience required. We manually coded the specialty of practice field. We found the location field as prepared by BGT to be very accurate, but the job title and experience-required fields had significant errors that we addressed as discussed below.

### ***Additional Data Coding Performed at Our Facility***

**Job Title Field.** The PA job field had significant errors that resulted in 23% of postings not being for a PA job. The majority of these postings were for jobs that had “PA” in the text of the advertisement, such as jobs found in Pennsylvania (abbreviated “PA”) or for legal jobs that often have the suffix of “PA” (for a type of legal entity called a professional association). Because our coders read each posting, these were easily eliminated.

**Practice Specialty Field.** We found that we could not use text analytics to code practice specialty because many job ads listed specialties affiliated with the practice or specialties available in the area for referral purposes in addition to the specialty of practice for the posted position. Therefore, two coders in our office coded this field manually. Coders were given a menu of specialties to choose from as they read each posting. Our research analyst repeated coding of a subset of the coders’ work and provided coaching until >95% agreement was reached.

Our coders were unable to assign a medical specialty to a significant portion of the postings (12%) because the text of the postings did not provide sufficient information. A subset of 100 of the job postings that could not be assigned a specialty were evaluated by two clinicians on our team, who agreed that it was not possible to determine the specialty for 80% of these postings, and that the remaining postings were distributed among specialties in proportions that correlated to the larger data set. Therefore, these postings were dropped from the data before we conducted the analyses presented in this article.

*Duration of Experience.* Some values that BGT had assigned for the duration of experience required were found to be inaccurate, so decision rules were devised to address this problem. The jobs that were coded with a small integer (1, 2, 3, and 5) had accuracy >80%, but jobs that had coded for fractions of years or higher integer values were typically inaccurate. For example, we found that all postings that were coded as requiring “18 months” of experience were actually advertising for patient care of children over “18 months” of age. Jobs that were coded as requiring >5 years of experience were typically found to mention that the practice site had been in business for the number of years specified. Likewise, very few postings were coded as requiring 4 years of experience, and these most often referred to a requirement for a 4-year college degree. Therefore, we created a dichotomous variable that divided the sample into those jobs that required 1 or more years of experience (specifically requiring 1, 2, 3, or 5 years of experience) and classified the remaining jobs as not requiring experience.

*Was Job Also Open to NPs?* We were able to create a dichotomous variable indicating whether the job was open for both NPs and PAs by searching for text strings correlating to the NP profession.

- Burning Glass Technologies. (2015). Burning Glass: Careers in Focus. Retrieved September 1,, 2015, from <http://burning-glass.com/>
- Carnevale, A., Jayasundera, T., & Repnikov, D. (2014, April). Understanding Online Jobs Data: a technical report. from [https://cew.georgetown.edu/wp-content/uploads/2014/11/OCLM.Tech\\_.Web\\_.pdf](https://cew.georgetown.edu/wp-content/uploads/2014/11/OCLM.Tech_.Web_.pdf)
- Maher and Maher, Jobs for the Future, & New York City Labor Market Information Service. (2014). Real-Time Labor Market Information: An Environmental Scan of Vendors and Workforce Development Users. from <http://www.jff.org/publications/real-time-labor-market-information-environmental-scan-vendors-and-workforce-development>
- Taska, B. (2015, August 26,). [Email communication].