

## Health Research Brief

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# Employment of Advanced Practice Clinicians in Vertically Integrated Health Systems Reflects Larger Trends Toward Consolidation

We examined the intersection of two important recent trends in health care delivery: rapid growth in employment of nurse practitioners (NP) and physician assistants (PA) and consolidation of providers and hospitals into vertically integrated health systems. Using the Agency for Healthcare Research and Quality (AHRQ) [Compendium of U.S. Health Systems](#) and IQVIA OneKey database, we examined employment of NPs and PAs in health systems in 2018. We found that 4 in 10 NPs and PAs were employed in practice settings affiliated with systems. Employment in systems was higher in hospitals, multispecialty practice sites, and specialty practices associated with lucrative hospital services and lower in primary care practice sites. Systems offering a health plan and participating in a Medicare accountable care organization employed more NPs and PAs on average. Future research should examine further the intersection of these two trends to examine how employment in systems affects cost, access, and quality of care.

## Introduction

Changes to the health care workforce in the United States have been highlighted by rapid growth in employment of advanced practice clinicians, such as nurse practitioners (NP) and physician assistants (PA) (Auerbach et al. 2020; National Commission on Certification of Physician Assistants 2019; Martsolf et al. 2018). Concurrent with this trend, consolidation of medical practices and hospitals into vertically integrated health systems has increased, and more than half of U.S. physicians were affiliated with a health system in 2018 (Kimmey et al. 2021; Furukawa et al. 2020).

Despite the important and expanding role that NPs and PAs play in delivering care (Barnes et al. 2018; Morgan et al. 2019), little is known about the degree to which NPs and PAs are employed in practice settings affiliated with health systems. In

this study, we leveraged a new updated version of the AHRQ Compendium of U.S. Health Systems with expanded information on clinicians in systems in 2018 to examine the intersection of two important concurrent trends in the delivery of health care in the United States: growth of the NP and PA workforce and consolidation of clinicians and hospitals into vertically integrated health systems. We examined the extent of employment of NPs and PAs in health systems in 2018 and how NP and PA employment in systems varied across practice settings and types, states and scope-of-practice environment, and system characteristics.

We found that 41 percent of NPs and 45 percent of PAs were affiliated with a health system in 2018. NP and PA employment in systems was higher in hospital settings, multispecialty practices,

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and selected specialty practice sites (cardiology, hematology/oncology, and general surgery) and lower in primary care practice sites. Systems with a health plan and those participating in a Medicare accountable care organization (ACO) were associated with higher employment of NPs and PAs.

## Data and methods

We used the 2018 IQVIA OneKey database to identify NPs and PAs practicing in the United States in 2018 and their practice settings. The data contain 268,024 NPs and 120,490 PAs in 2018, which are similar to the national counts reported by the American Association of Nurse Practitioners (2019) and the National Commission on Certification of Physician Assistants (2019). We linked these clinicians to the 637 health systems in the 2018 AHRQ Compendium of U.S. Health Systems using a unique organization identifier common to both data sources. This linkage enabled us to identify NPs and PAs employed in practice settings affiliated with systems and the characteristics of systems.

We examined practice settings at three levels:

1. Type of practice setting: medical practice sites (note that medical practice sites are actual locations, not larger medical groups combining multiple sites), hospitals, long-term care facilities, ambulatory surgical centers, and other facility types
2. Type of medical practice site, which is defined by the specialties of the physicians in the sites: primary care practices (majority of the physicians are in primary care specialties), single specialty practices (majority are in a single specialty), and multispecialty practices (neither a majority in primary care nor any other specialty)
3. Specialties of single specialty medical practice sites

We calculated the percentage of NPs and PAs employed by practice settings affiliated with health systems overall and by type of practice setting. The types of practice settings reported in the analysis are mutually exclusive. Some NPs and PAs reported as in medical practice sites are also affiliated with

other practice settings, but NPs and PAs reported as in facility types other than medical practice sites are only employed by those facility types (for example, NPs and PAs reported as employed by hospitals are only affiliated with hospitals). Long-term care facilities include assisted living, home health, independent living, nursing homes, and residential facilities. Other facility types include facilities such as imaging centers, rehabilitation facilities, and clinics (clinics include birthing centers, facilities serving individuals with developmental disabilities, retail walk-in clinics, student health centers, and U.S. Navy fleet ships). Federally Qualified Health Centers are not one of the facility types (that is, practice settings) in the data, but they are identified; roughly 90 percent of Federally Qualified Health Center practice settings are included as part of the group of medical practice sites.

We also calculated the percentage of NPs and PAs employed by type of medical practice site and practice site specialty. The practice types reported are mutually exclusive. NPs and PAs employed in multiple practice types are included in the multiple practice type group (for example, an NP in a primary care practice site and a cardiology single practice site, or a PA in a general surgery practice site and an orthopedic practice site). Roughly 60 percent of the NPs and PAs employed by multiple practice sites were employed by a primary care practice site (as well as at least one other practice type). Regarding NPs and PAs in primary care settings, we only report results for medical practice sites with a majority of primary care physicians; it is likely that some NPs and PAs employed in other practice settings (such as long-term care facilities, which include home health and nursing home services) are providing primary care. Also, NPs and PAs in practice sites with no physicians are included in the group labeled "In a practice site with no physicians," so the specialty focus of these nearly 13,000 NPs and 3,000 PAs is not identified and reported separately. For the results by specialty, we report results for the top 10 specialties by combined numbers of NPs and PAs working in the practice sites and all other specialties combined.

In addition, we calculated the percentage of NPs and PAs employed in practice settings affiliated with systems by state, and we examined whether there is a relationship between the scope-of-practice environments in states in which NPs and PAs practice and system affiliation. We categorized state scope-of-practice environments as full, reduced, or restricted practice for NPs using a categorization from the American Association of Nurse Practitioners (2021) and for PAs using the categorization in Valentin et al. 2020. We calculated the number of NPs and PAs per capita practicing in these groups of states by scope-of-practice environment and the percentages that are affiliated with systems.

Finally, we examined system characteristics associated with employment of NPs and PAs. In addition to examining the extent to which NPs and PAs were concentrated in a small number of very large systems, we calculated regression-adjusted numbers of NPs and PAs for types of systems controlling for the size of systems and other system characteristics.

Although NPs and PAs can be affiliated with multiple systems in the IQVIA data, when calculating the percentage of NPs and PAs in systems nationwide, we

counted each NP and PA once; that is, they were either affiliated with one or more systems or they were not affiliated with a system. When reporting the state-level results, NPs and PAs can be counted more than once if they are practicing in more than one state, but they will have the same system indicator for all states (in a system or not in a system). Similarly, NPs and PAs can be counted in more than one health system in the AHRQ Compendium of U.S. Health Systems, and thus, they can be counted more than once in the analysis of NPs and PAs by system characteristics.

## Results

Roughly 40 percent of NPs and 44.5 percent of PAs were employed in practice settings affiliated with systems in 2018 (Table 1). The percentage of NPs and PAs in systems varied substantially by practice setting. Among NPs and PAs employed by medical practice sites (which is the most common practice setting), just under 40 percent were affiliated with systems. System affiliation was much more common for NPs and PAs employed by hospitals; 74.1 and 80.8 percent were affiliated with systems, respectively.

The percentages of NPs and PAs affiliated with systems were lowest among those employed by

**Table 1. NPs and PAs employed in health systems in 2018, overall and by practice setting**

| Category                                | NP      |              | PA      |              |
|---|---------|--------------|---------|--------------|
|   | Total   | % in systems | Total   | % in systems |
| Overall                                 | 268,024 | 40.5         | 120,490 | 44.5         |
| <b>Practice settings</b>                |         |              |         |              |
| Medical practice sites                  | 160,608 | 38.3         | 76,736  | 38.8         |
| Hospitals <sup>a</sup>                  | 37,374  | 74.1         | 16,047  | 80.8         |
| Long-term care facilities <sup>a</sup>  | 2,512   | 13.3         | 353     | 12.2         |
| Ambulatory surgery centers <sup>a</sup> | 1,487   | 30.6         | 875     | 28.1         |
| Other facility types <sup>a</sup>       | 45,004  | 5.5          | 14,778  | 6.2          |
| Multiple facility types <sup>b</sup>    | 21,039  | 76.4         | 11,701  | 83.2         |

Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018).

<sup>a</sup> The NPs and PAs in these groups are only affiliated with the given facility type (for example, only hospitals).

<sup>b</sup> The NPs and PAs affiliated with multiple facility types (not including medical practice sites) are included in this group. Roughly 80 percent of these NPs and PAs are affiliated with a hospital and at least one other facility type.

NP = nurse practitioner; PA = physician assistant.

long-term care facilities and other facility types, which includes facilities such as clinics, rehabilitation facilities, and imaging centers. Among NPs and PAs employed by multiple facility types (but not affiliated with a medical practice site), 76.4 and 83.2 percent were affiliated with systems, respectively. The percentages are relatively high because roughly 80 percent of these NPs and PAs were employed by a hospital, which have high rates of system affiliation.

There was also fairly sizable variation in system affiliation among NPs and PAs employed by medical

practice sites and by practice specialty for single specialty practice sites (Table 2). Among NPs and PAs employed in medical practice sites, system affiliation was more common for those in multispecialty practices (roughly 50 percent) compared with those in single specialty practices (under 40 percent) and primary care practices (roughly 35 percent). Roughly 50 percent of NPs and PAs employed by medical practice sites of multiple types were affiliated with systems. NPs and PAs in medical practice sites with no physicians were least likely to be in systems, roughly 20 percent.

**Table 2. NPs and PAs employed in health systems in 2018, by practice type and practice specialty**

| Category   | NP     |              | PA     |              |
|--|--------|--------------|--------|--------------|
|  | Total  | % in systems | Total  | % in systems |
| <b>Practice types</b>  |        |              |        |              |
| Primary care   | 65,955 | 35.1         | 27,425 | 35.1         |
| Single specialty   | 50,500 | 39.7         | 28,247 | 37.6         |
| Multispecialty   | 21,030 | 49.4         | 11,850 | 48.5         |
| Multiple practice types  | 10,341 | 53.5         | 6,243  | 49.2         |
| In a practice site with no physicians                          | 12,782 | 19.4         | 2,971  | 23.1         |
| <b>Practice specialties (in descending order by NPs + PAs)</b> |        |              |        |              |
| Obstetrics and Gynecology                                      | 7,983  | 36.7         | 1,187  | 34.4         |
| Cardiology   | 5,426  | 63.8         | 2,047  | 65.8         |
| Orthopedic surgery   | 1,548  | 38.7         | 5,675  | 34.1         |
| Psychiatry   | 6,165  | 17.3         | 855    | 18.8         |
| Dermatology  | 1,540  | 10.8         | 3,372  | 7.9          |
| Hematology/oncology  | 3,763  | 57.8         | 1,087  | 56.9         |
| Emergency medicine   | 1,630  | 36.3         | 2,153  | 41.8         |
| Gastroenterology   | 2,053  | 35.2         | 1,208  | 31.8         |
| General surgery  | 1,419  | 62.6         | 1,186  | 61.3         |
| Neurology  | 1,751  | 50.0         | 684    | 45.8         |
| All other specialties  | 17,222 | 38.1         | 8,793  | 40.6         |

Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018). Notes: The results in the first panel include the 160,608 NPs and 76,736 PAs employed in a medical practice site from Table 1. Primary care medical practice sites are the most common practice type among NPs (41 percent among those in medical practice sites, and 25 percent of all NPs) and second most common for PAs (36 percent among those in medical practice sites and 23 percent of all PAs). The results in the second panel include the 50,500 NPs and 28,247 PAs employed in single specialty practice sites. NP = nurse practitioner; PA = physician assistant.

Larger percentages of NPs were employed by cardiology, obstetrics-gynecology, and hematology/oncology single specialty medical practice sites, and greater percentages of PAs were employed by dermatology, orthopedic surgery, and emergency medicine single specialty medical practice sites. NPs and PAs employed by cardiology, hematology/oncology, and general surgery were the most likely to be affiliated with systems; psychiatry and dermatology were the least likely.

There is substantial variation in the percentage of NPs and PAs employed by practice settings affiliated with systems by state, ranging from 8.8 percent of NPs and 2.9 percent of PAs in systems in Alaska to 63.4 percent of NPs and 67.7 percent of PAs in Wisconsin (Figure 1; detailed state-level results are available in Appendix A). Rates of system affiliation were highest in the upper Midwest and Northeast.

One important way that states differ relevant to NP and PA workforce is scope-of-practice laws that specify rules governing practice in the states. As expected, we find more NPs and PAs per capita in states with less restrictive scope-of-practice laws (Table 3). However, we do not find a clear relationship between scope-of-practice environment and NPs and PAs in systems (that is, system affiliation neither

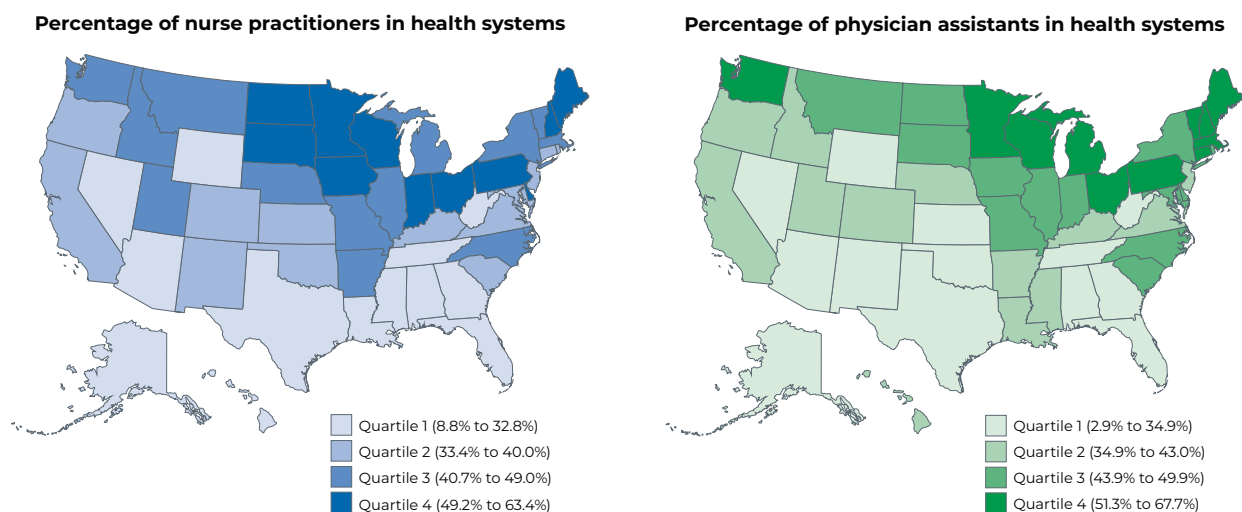
consistently increases nor decreases with more/less restrictive scope-of-practice environment).

Similar to physicians and hospitals, NPs and PAs in systems are heavily concentrated in a small number of very large systems. The largest 10 systems (which are 1.5 percent of all systems) have 6.8 percent of NPs and 8.7 percent of PAs (results not shown). By comparison, the smallest 388 and 432 systems combined have roughly the same numbers of NPs and PAs, respectively, as these 10 systems combined. We report the 10 largest systems by number of NPs and PAs in Appendix B. HCA Healthcare, Ascension Health, and Trinity Health (Michigan) have the largest number of NPs and PAs (nearly 2,700 NPs and over 1,400 PAs, on average).

Regarding the types of systems with the largest numbers of NPs and PAs, church-operated and for-profit systems have slightly more NPs than non-profit systems on average, controlling for system size and other system characteristics; there are no differences in numbers of PAs by ownership type (Figure 2 and Figure 3).

Systems operating in multiple states have substantially more NPs and PAs even after controlling for the number of physicians in systems. In addition,

**Figure 1. Percentages of NPs and PAs employed in health systems in 2018, by state**



Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018). NP = nurse practitioner; PA = physician assistant.

**Table 3. NPs and PAs employed in health systems in 2018, by state scope-of-practice environment**

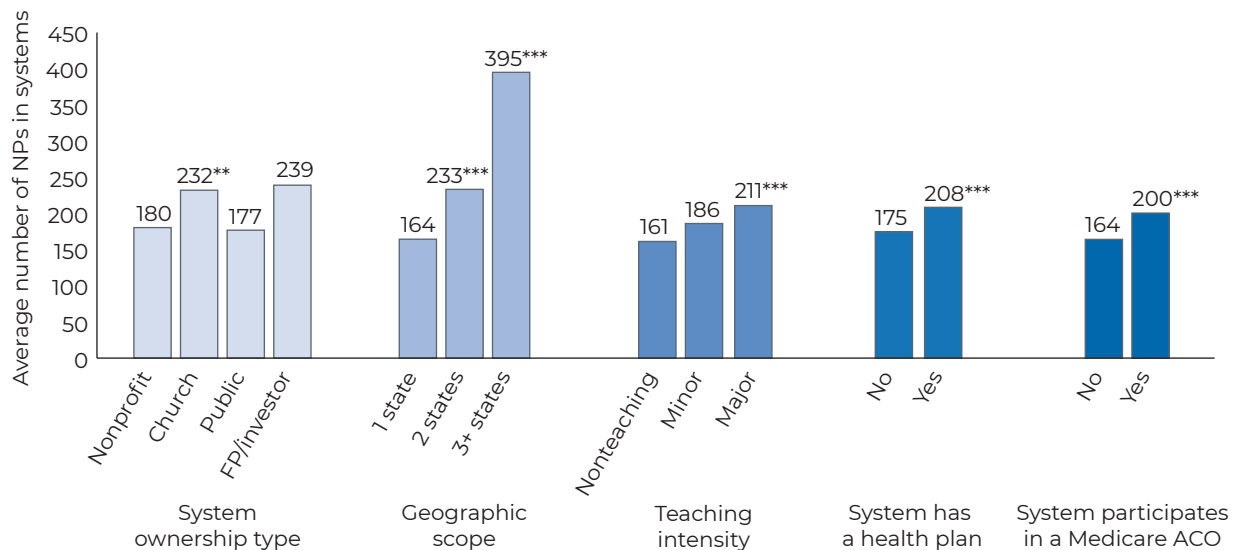
| SOP practice environment | NP                      |              | PA                      |              |
|--------------------------|-------------------------|--------------|-------------------------|--------------|
|                          | # per 10,000 population | % in systems | # per 10,000 population | % in systems |
| Full                     | 9.1                     | 40.9         | 5.0                     | 49.1         |
| Reduced                  | 9.0                     | 45.1         | 3.4                     | 39.8         |
| Restricted               | 7.8                     | 35.5         | 3.6                     | 45.2         |

Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018).

Notes: The results are the (1) numbers of NP/PAs in the states in the given category divided by the total population in the states and (2) numbers of NP/PAs in the states in the categories employed in practice settings affiliated with systems divided by the numbers of NP/PAs in the states. Full, reduced, and restricted refer to state practice environments for nurse practitioners defined in American Association of Nurse Practitioners (2021). Full, reduced, and restricted refer to state practice environments for physician assistants defined in Valentin et al. 2020, although the authors used the terms ideal, average, and restricted.

NP = nurse practitioner; PA = physician assistant; SOP = scope of practice.

**Figure 2. Number of NPs employed in health systems in 2018, by system characteristics**



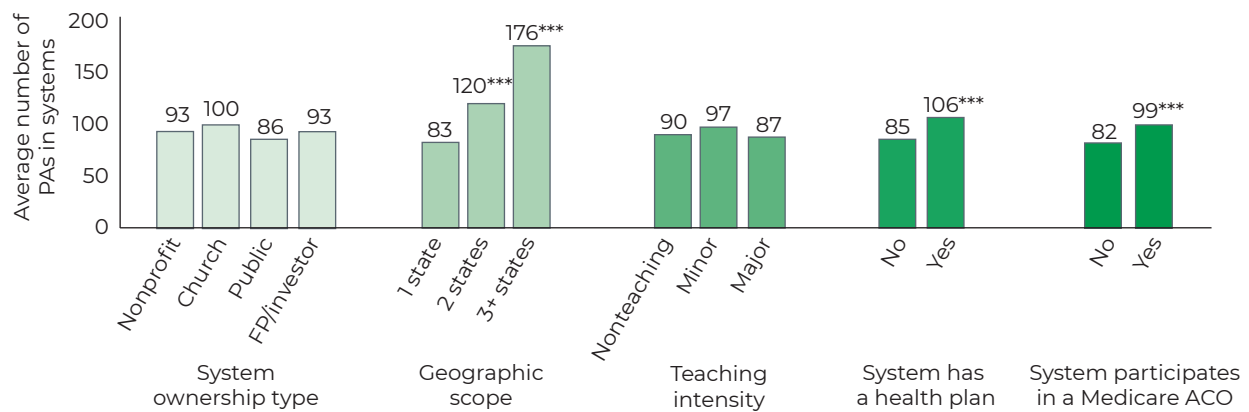
Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018).

Notes: The system characteristics are as follows: ownership type (nonprofit, church affiliated, public/government, for-profit/investor-owned), geographic scope (hospitals in one state, two states, three or more states), systemwide teaching intensity (nonteaching [that is, no residents]; minor teaching, resident-to-bed ratio greater than zero but less than 0.25; major teaching, resident-to-bed ratio greater than or equal to 0.25), system operates a health plan, and system has physicians participating in a Medicare ACO. For more detail on the construction of the characteristics, see AHRQ Compendium technical documentation at <https://www.ahrq.gov/sites/default/files/wysiwyg/chsp/compendium/2018-compendium-techdoc.pdf>.

\* p < 0.10; \*\* p < 0.05; \*\*\* p < 0.01.

ACO = accountable care organization; FP = for profit; NP = nurse practitioner.

**Figure 3. Number of PAs employed in health systems in 2018, by system characteristics**



Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018).  
 Notes: The system characteristics are as follows: ownership type (nonprofit, church affiliated, public/government, for-profit/investor-owned), geographic scope (hospitals in one state, two states, three or more states), systemwide teaching intensity (nonteaching [that is, no residents]; minor teaching, resident-to-bed ratio greater than zero but less than 0.25; major teaching, resident-to-bed ratio greater than or equal to 0.25), system operates a health plan, and system has physicians participating in a Medicare ACO. For more detail on the construction of the characteristics, see AHRQ Compendium technical documentation at <https://www.ahrq.gov/sites/default/files/wysiwyg/chsp/compendium/2018-compendium-techdoc.pdf>.  
 \* p < 0.10; \*\* p < 0.05; \*\*\* p < 0.01.

ACO = accountable care organization; FP = for profit; PA = physician assistant

systems with high teaching intensity have more NPs (no differences in numbers of PAs), and systems with a health plan and those with physicians participating in a Medicare ACO have more NPs and PAs on average. Another way to describe NP and PA affiliation with systems is in relation to the number of system physicians: on average, a system has 10.9 NPs and 6.9 PAs for each 100 physicians after controlling for other system characteristics (Appendix C).

## Discussion

More than 4 in 10 NPs and PAs were employed in a health system in 2018. This figure is lower than the percentage of physicians affiliated with systems in 2018, 51 percent (Furukawa et al. 2020). NP and PA employment in systems was highest in hospitals, which is consistent with the high percentage of hospitals in systems; 72 percent of hospitals and 91 percent of hospital beds were in systems in 2018 (Furukawa et al. 2020).

NPs and PAs employed in specialty and multispecialty practice sites were more likely to be affiliated with a system relative to those in primary care practice sites. In particular, those in cardiology, hematology/

oncology, and general surgery practice sites were more likely to be affiliated with systems, a finding that is consistent with a prior study finding that physicians in these specialties were more likely to be affiliated with systems (Machta et al. 2020). This finding could reflect differences in labor composition across practice types (Barnes et al. 2020) or higher rates of health system integration among specialties associated with lucrative hospital services (Machta et al. 2020).

System affiliation was highest in the upper Midwest and Northeast, which is consistent with the pattern observed for consolidation of physicians, but less consistent with patterns for hospital consolidation, which is more spread out across the United States (Kimmey et al. 2021; Heeringa et al. 2017). Consistent with prior studies, restrictiveness of state scope-of-practice environment was associated with per capita supply of NPs and PAs (Barnes et al. 2018). However, scope-of-practice environment was not associated with the percentage of NPs and PAs employed in systems, which may reflect heterogeneity in scope-of-practice laws (AANP 2021; Valentin et al. 2020).

Variation in employment in systems was related to system characteristics. Systems offering a health plan

and participating in a Medicare ACO were associated with higher employment of NPs and PAs. This finding is consistent with financial incentives for expanded use of nonphysician practitioners under value-based payment (Nyweide et al. 2020).

We examined the intersection of two important trends: increased care delivered by NPs and PAs and

consolidation of clinicians into vertically integrated health systems. Because of recent findings that vertical integration is associated with greater costs but not greater quality of care, it is important that future research examine whether employment in systems has ramifications for cost, access, and quality of care (Morgan et al. 2019).



### Appendix A. NPs and PAs employed in health systems in 2018, by state

|           | NPs            |                         |              | PAs            |                         |              |
|-----------|----------------|-------------------------|--------------|----------------|-------------------------|--------------|
|           | Total          | # per 10,000 population | % in systems | Total          | # per 10,000 population | % in systems |
| <b>US</b> | <b>268,024</b> | <b>8.2</b>              | <b>40.5</b>  | <b>120,490</b> | <b>3.7</b>              | <b>44.5</b>  |
| AK        | 818            | 11.1                    | 8.8          | 561            | 7.6                     | 2.9          |
| AL        | 4,240          | 8.7                     | 22.7         | 681            | 1.4                     | 22.6         |
| AR        | 2,782          | 9.2                     | 41.0         | 436            | 1.4                     | 36.9         |
| AZ        | 6,246          | 8.7                     | 24.4         | 2,823          | 3.9                     | 27.6         |
| CA        | 18,344         | 4.6                     | 37.6         | 10,256         | 2.6                     | 38.0         |
| CO        | 4,525          | 7.9                     | 38.1         | 3,238          | 5.7                     | 37.4         |
| CT        | 3,643          | 10.2                    | 40.0         | 2,218          | 6.2                     | 55.9         |
| DC        | 1,256          | 17.9                    | 50.1         | 530            | 7.5                     | 53.8         |
| DE        | 1,092          | 11.3                    | 49.2         | 510            | 5.3                     | 48.8         |
| FL        | 21,720         | 10.2                    | 24.8         | 7,410          | 3.5                     | 25.5         |
| GA        | 8,426          | 8.0                     | 32.8         | 4,283          | 4.1                     | 34.8         |
| HI        | 703            | 4.9                     | 30.7         | 284            | 2.0                     | 37.7         |
| IA        | 3,433          | 10.9                    | 52.1         | 1,227          | 3.9                     | 49.9         |
| ID        | 1,488          | 8.5                     | 40.7         | 1,021          | 5.8                     | 35.1         |
| IL        | 9,578          | 7.5                     | 47.9         | 3,336          | 2.6                     | 44.1         |
| IN        | 6,771          | 10.1                    | 49.9         | 1,432          | 2.1                     | 49.7         |
| KS        | 2,807          | 9.6                     | 34.1         | 1,080          | 3.7                     | 34.6         |
| KY        | 5,498          | 12.3                    | 36.6         | 1,325          | 3.0                     | 38.3         |
| LA        | 4,282          | 9.2                     | 31.7         | 1,127          | 2.4                     | 38.4         |
| MA        | 8,951          | 13.0                    | 48.9         | 3,293          | 4.8                     | 62.8         |
| MD        | 5,604          | 9.3                     | 38.3         | 3,090          | 5.1                     | 48.8         |
| ME        | 1,629          | 12.2                    | 52.9         | 882            | 6.6                     | 64.4         |
| MI        | 7,308          | 7.3                     | 49.0         | 4,954          | 5.0                     | 57.8         |
| MN        | 5,048          | 9.0                     | 59.2         | 2,769          | 4.9                     | 61.7         |
| MO        | 6,155          | 10.0                    | 45.4         | 1,053          | 1.7                     | 46.7         |
| MS        | 3,818          | 12.8                    | 32.1         | 259            | 0.9                     | 37.5         |
| MT        | 964            | 9.1                     | 41.9         | 662            | 6.2                     | 49.4         |
| NC        | 8,222          | 7.9                     | 42.0         | 6,276          | 6.0                     | 43.9         |
| ND        | 1,054          | 13.9                    | 52.9         | 500            | 6.6                     | 48.4         |
| NE        | 1,798          | 9.3                     | 45.3         | 1,156          | 6.0                     | 39.4         |
| NH        | 1,870          | 13.8                    | 52.5         | 847            | 6.2                     | 58.0         |
| NJ        | 6,347          | 7.1                     | 38.7         | 2,497          | 2.8                     | 34.9         |

|    | NPs    |                         |              | PAs    |                         |              |
|----|--------|-------------------------|--------------|--------|-------------------------|--------------|
|    | Total  | # per 10,000 population | % in systems | Total  | # per 10,000 population | % in systems |
| NM | 2,136  | 10.2                    | 35.3         | 797    | 3.8                     | 34.9         |
| NV | 1,872  | 6.2                     | 19.9         | 969    | 3.2                     | 23.2         |
| NY | 16,749 | 8.6                     | 42.6         | 12,083 | 6.2                     | 48.5         |
| OH | 12,246 | 10.5                    | 56.1         | 3,480  | 3.0                     | 58.8         |
| OK | 2,997  | 7.6                     | 33.4         | 1,556  | 3.9                     | 34.7         |
| OR | 3,361  | 8.0                     | 35.4         | 2,045  | 4.9                     | 43.0         |
| PA | 10,164 | 7.9                     | 55.4         | 7,308  | 5.7                     | 59.0         |
| RI | 1,253  | 11.9                    | 37.8         | 489    | 4.6                     | 44.4         |
| SC | 4,190  | 8.2                     | 40.0         | 1,512  | 3.0                     | 44.6         |
| SD | 969    | 11.0                    | 61.2         | 596    | 6.8                     | 47.1         |
| TN | 10,124 | 15.0                    | 28.7         | 1,929  | 2.8                     | 31.6         |
| TX | 19,550 | 6.8                     | 32.1         | 7,944  | 2.8                     | 30.2         |
| UT | 1,975  | 6.2                     | 42.2         | 1,280  | 4.0                     | 36.9         |
| VA | 7,361  | 8.6                     | 36.8         | 3,058  | 3.6                     | 37.8         |
| VT | 756    | 12.1                    | 41.0         | 402    | 6.4                     | 53.0         |
| WA | 6,053  | 8.0                     | 45.1         | 3,387  | 4.5                     | 51.3         |
| WI | 5,551  | 9.5                     | 63.4         | 2,773  | 4.8                     | 67.7         |
| WV | 1,896  | 10.5                    | 30.8         | 976    | 5.4                     | 30.6         |
| WY | 471    | 8.2                     | 20.2         | 291    | 5.0                     | 16.2         |

Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018), and U.S. Census Bureau.

NP = nurse practitioner; PA = physician assistant.

**Appendix B. The 10 largest health systems by number of nurse practitioners and physician assistants**

| Health system name                 | Number of nurse practitioners | Number of physician assistants | Number of nurse practitioners and physician assistants |
|------------------------------------|-------------------------------|--------------------------------|--|
| HCA Healthcare                     | 3,069                         | 1,455                          | 4,524  |
| Ascension Health                   | 2,799                         | 1,207                          | 4,006  |
| Trinity Health                     | 2,209                         | 1,607                          | 3,816  |
| Kaiser Permanente                  | 1,646                         | 1,438                          | 3,084  |
| Catholic Health Initiatives        | 1,974                         | 847                            | 2,820  |
| Providence Saint Joseph Health     | 1,589                         | 955                            | 2,543  |
| UPMC                               | 1,028                         | 972                            | 2,000  |
| Advocate Aurora Health             | 1,426                         | 552                            | 1,978  |
| Northwell Health                   | 1,073                         | 873                            | 1,946  |
| The Cleveland Clinic Health System | 1,329                         | 583                            | 1,912  |

Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018).

Note: For a few systems, the number of NPs and PAs does not equal the sum of NPs and PAs because a very small number of NPs are also PAs.

**Appendix C. Associations between system characteristics and the number of NPs and number of PAs employed in health systems**

| System characteristics  | NPs         |                | PAs         |                |
|---|-------------|----------------|-------------|----------------|
|   | Coefficient | Standard error | Coefficient | Standard error |
| Number of physicians (x 100)                                  | 10.9        | 0.4***         | 6.9         | 0.2***         |
| <b>Ownership type (nonprofit is the omitted group)</b>        |             |                |             |                |
| Church  | 51.6        | 23.8**         | 6.4         | 13.0           |
| Public/government   | -3.6        | 15.9           | -7.5        | 8.7            |
| For-profit/investor   | 58.6        | 39.9           | -0.1        | 21.8           |
| <b>Geographic scope (1 state is the omitted group)</b>        |             |                |             |                |
| 2 states  | 68.9        | 20.3***        | 37.4        | 11.1***        |
| 3+ states   | 230.7       | 34.6***        | 93.1        | 18.9***        |
| <b>Teaching intensity (no residents is the omitted group)</b> |             |                |             |                |
| Some residents but <.25 resident-to-bed ratio                 | 24.8        | 15.5           | 7.2         | 8.5            |
| ≥.25 resident-to-bed ratio                                    | 49.6        | 17.5***        | -2.3        | 9.6            |
| System offers insurance product                               | 33.9        | 14.2**         | 20.9        | 7.8***         |
| System participates in Medicare ACO                           | 36.3        | 13.1***        | 17.4        | 7.2**          |

Source: Authors' analysis of data from the AHRQ Compendium of U.S. Health Systems (2018) and IQVIA OneKey (2018).

Notes: The system characteristics are: ownership type (nonprofit, church affiliated, public/government, for-profit/investor-owned), geographic scope (hospitals in 1 state, 2 states, 3+ states), systemwide teaching intensity (nonteaching [that is, no residents]; minor teaching, resident-to-bed ratio greater than zero but less than 0.25; major teaching, resident-to-bed ratio greater than or equal to 0.25), system operates a health plan, and system has physicians participating in a Medicare ACO. For more detail on the construction of the characteristics, see AHRQ Compendium technical documentation at <https://www.ahrq.gov/sites/default/files/wysiwyg/chsp/compendium/2018-compendium-techdoc.pdf>.

\* p < 0.10; \*\* p < 0.05; \*\*\* p < 0.01

ACO = accountable care organization; NP = nurse practitioner; PA = physician assistant.

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