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# The Economic Impact of Physicians in Texas

## *State Report*

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## Executive Summary

Physicians are a critical component of the health care system, providing care to patients across a variety of settings and within a multitude of specialties and subspecialties. Through the care provided to their patients, physicians can have a positive and lasting impact on the health of their patients and the community as a whole. However, the breadth of a physician's impact reaches far beyond just the provision of patient care. Physicians also play a vital role in the state and local economies by creating jobs, purchasing goods and services, and supporting state and community public programs through generated tax revenues.

This report focuses on physicians, both doctors of medicine (MDs) and osteopathy (DOs), who are primarily engaged in the practice of medicine (i.e., patient care activities as compared to those who focus on research or teaching). Physicians work in a wide range of practice types/sizes: private or group practices in offices and clinics or within a hospital. A recent American Medical Association (AMA) survey of physicians found that in 2016, the single specialty group accounted for the largest share of physicians (42.8%), while 24.6% practiced in multi-specialty groups, 16.5% were in solo practice and 7.4% were direct hospital employees.[1] Movement toward hospital-owned practices and employment directly by a hospital appears to have slowed since 2014 and the percentage of physicians who either worked in a practice with at least some hospital ownership or were direct hospital employees was 32.8% in both 2014 and 2016. With this in mind, this report focuses on all patient care physicians, regardless of whether they are office- or hospital-based.

Given the rapidly changing health care environment, it is critical to quantify the economic impact physicians have on society. This report provides data that can be used by key health care policymakers, legislators and thought leaders. It also demonstrates how physician practices both ensure the health and well-being of communities as well as support local economies and enable jobs, growth and prosperity.

[1] Kane KC. Updated Data on Physician Practice Arrangements: Physician Ownership Drops Below 50 Percent. Accessed at: https://www.ama-assn.org/sites/default/files/media-browser/public/health-policy/PRP-2016-physician-benchmark-survey.pdf.

This report provides estimates of the total economic impact of patient care physicians on the economy of Texas, across four vital economic barometers:

- Output,
- Jobs,
- Wages and benefits, and
- State and local tax revenue.

Total economic impact = direct + indirect economic impacts. The ***direct*** impact is the value of the four vital economic barometers that are produced from physicians while ***indirect*** impact includes the same barometers which are generated by the industries that are supported by physicians.

In addition, this report examines the economic impact across three broad specialty groups (i.e., primary care, non-surgical and surgical) as well as 10 specialties selected based on frequency and data availability (i.e., anesthesiology, cardiology, family medicine, general surgery, internal medicine, obstetrics/gynecology, orthopaedic surgery, pediatrics, psychiatry and urology).[2] Furthermore, this report provides the economic impact of select comparator industries (i.e., higher education, nursing and community care facilities, legal services and home health), in order to allow for an assessment of the economic impact of patient care physicians relative to these select industries.

Physician economic impact varies across states and is dependent upon the number of physicians in each state as well as other factors, such as the general economy and the health care environment in particular. As of December 2015, there were 736,873 patient care physicians within the 50 states and the District of Columbia.[3]

Of these, 51,333 physicians practiced in the state of Texas.

[2] Section 1.2 of the Appendix provides more details on how these 10 specialties were selected.

[3] This count is based on AMA Masterfile data as of December 2015. Based on that data, there were 1,022,483 post-residency MD and DO physicians with a preferred mailing address in one of the 50 states and the District of Columbia. We identified 755,802 physicians as providing patient care and an additional 57,696 as having an unknown type of professional activity (the remainder were either no longer active, or were engaged in other activities such as research or teaching). We imputed professional activity for those physicians for whom it was missing. Through this methodology an additional 36,887 physicians were identified as providing patient care, yielding a total number of 792,689. Of these, 55,816 had a missing state for their office and were excluded from the final analysis. For further detail on methods, see the Appendix.

**The overall findings in the state of Texas are as follows**:

- **Total Output**: In Texas, physicians created a total of $117.9B in direct and indirect economic output (i.e., sales revenues) in 2015. On average, each physician supported $2,296,892 in output.

- **Jobs**: In 2015, physicians supported 670,172 jobs (including their own), the total of direct and indirect positions. On average, each physician supported 13.06 jobs.

- **Wages and Benefits**: Physicians contributed $55,406.4M in direct and indirect wages and benefits for all supported jobs in 2015. On average, each physician supported $1,079,352 in total wages and benefits.

- **Tax Revenues**: Physicians supported $3,521.4M in local and state tax revenues in 2015. On average, each physician supported $68,599 in local and state tax revenues.

## Economic Impact Analyses

Economic impact analyses (EIAs) track the reach of revenues, jobs, spending and taxes generated by an activity as they flow through the local economy. EIAs incorporate both direct and indirect benefits.

### Direct Benefits

***Direct*** benefits, in the context of the patient care physician "industry", include: 1) medical revenues generated in the course of patient care (i.e., the value of output); 2) jobs created by the physician industry; 3) wages and benefits of physicians and employees who are hired to support the delivery of patient care; and 4) taxes that are paid by physicians and the positions that they create.

### Indirect Benefits

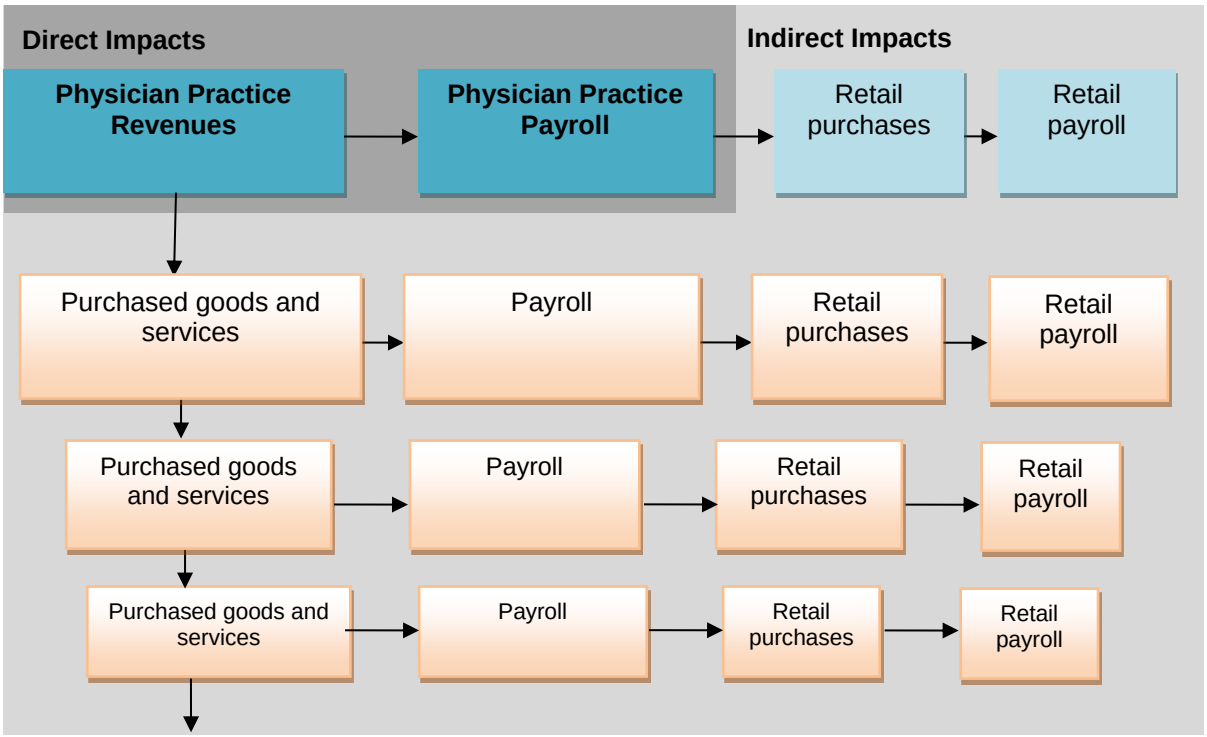
Economic activities supported by patient care physicians outside of their own industry represent the ***indirect*** benefits. These *business-to-business* effects include the supplies/equipment purchased by physicians, practice administrative services, cleaning/property maintenance services, and clinical and laboratory services.

### Induced Benefits

Additional indirect benefits (i.e., induced effects)[4] arise when the employees of physicians and vendors, in turn, spend their earnings to support local businesses, which pay their employees and pay taxes (see **Figure 1**). With each cycle of spending there is some "leakage" (i.e., some spending goes outside the community, perhaps to a neighboring state, and, as a result, generates no additional local value). This leakage is not captured in the state-level analysis; however, it is captured in the national-level analysis (see the National Economic Impact of Physicians report).

[4] Induced effects are included as a portion of "indirect" effects for brevity.

**Figure 1. Economic Multipliers**




## Economic Impact Multipliers

Both the indirect and direct effects contribute to the "multiplier" used in an EIA. For patient care physicians, the total community impact is a *multiple* of the economic benefit that is generated directly from patient care activities. The multiplier reflects the number of times that each dollar generated in patient care activities circulates through the local economy, supporting local jobs and spending (as described earlier). There are separate multipliers for three of the four vital **direct benefit** economic barometers mentioned earlier.

- An **output multiplier** is used to calculate the total value (i.e., direct and indirect) of output created by an industry. Its value indicates the total economic output generated in an economy for every $1 in direct output.

- A **jobs multiplier** is used to calculate the indirect number of full-time equivalent jobs supported for every $1M in direct output created by an industry. The sum of direct and indirect jobs is the total number of full-time equivalent jobs supported by an industry.

- A **wages and benefits** multiplier is used to calculate the indirect wages and benefits supported for every $1 in direct output. The sum of direct and indirect wages and benefits is the total wages and benefits supported by an industry.

Multipliers are specific to geographic areas and particular industries and their values can vary widely. Multipliers are larger when a dollar earned by a business (e.g., a physician practice) is spent in the community, supporting jobs and other local businesses (who pay their employees, who in turn buy more goods and services, etc.). Multipliers are smaller when business revenues are spent (leaked) outside the community or are spent on goods or services that support fewer local jobs.

In general, multipliers for small community areas will be smaller compared to larger areas as establishments in smaller areas must often look outside of their immediate communities to find inputs. As health care is often considered to be local, health care multipliers tend to be higher than those for many other industries as physicians and their staff tend to live in the community and their services support the local community.

**The multipliers for Texas are as follows**:

- Output multiplier: 2.134, indicating an additional $1.13 of indirect output is generated for every $1 in direct output (see the Appendix for a discussion of the observed changes in output multipliers from 2011 to 2015).

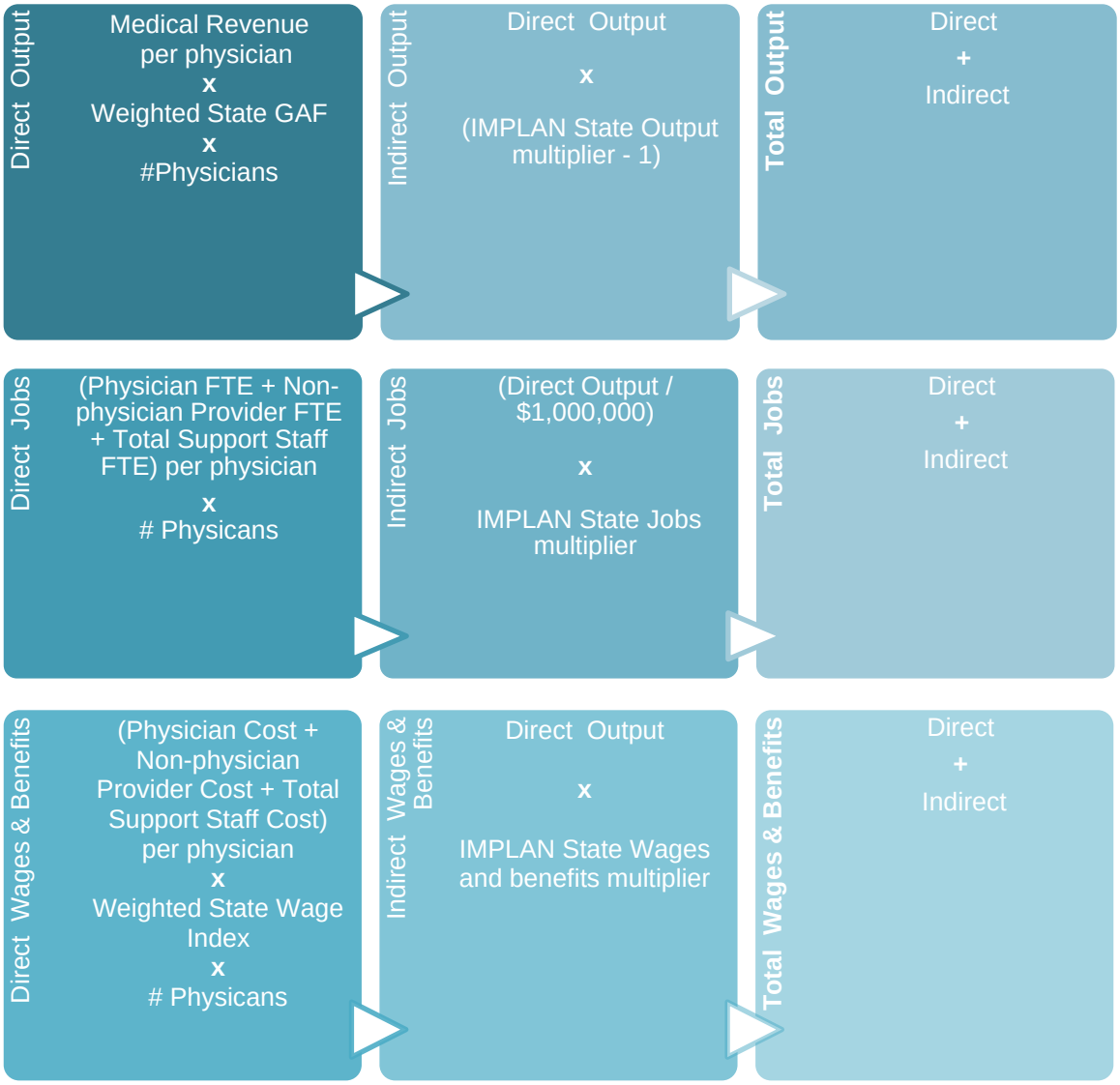
- Jobs multiplier: 7.665, indicating an additional 7.66 indirect full-time jobs are supported for every $1M in direct output.

- Wages and benefits multiplier: 0.388, indicating an additional $0.39 of indirect wages and benefits is generated for every $1 in direct output.

**Data Sources**

This study employed three primary data sources: the 2015 AMA Masterfile, 2015 medical practices data from a leading data aggregator, and 2015 IMpact analysis for PLANning (IMPLAN). The AMA Masterfile's number of physicians by state was combined with national per-physician revenue and cost data (which was geographically adjusted by state) and IMPLAN's economic impact multipliers by state, to estimate values for the direct, indirect and total economic impact of the physician industry. See **Figure 2** for an overview of methods and the Appendix for specific methodology.

**Figure 2. Overview of Methods**



## Economic Impact for Texas

**Table 1** provides a snapshot of the economic impact of patient care physicians in Texas. Direct and indirect economic benefits for each measure contribute to the overall benefit. Total output, jobs, and wages and benefits are also presented by broad physician specialty (**Table 2**), as well as for 10 specialties (**Table 3**).

**Table 1: Total Output, Jobs, Wages & Benefits, and State and Local Taxes Supported by Physicians in Texas, 2015**

| Economic Measure | Total | Per Physician |
|---|---|---|
| Number of Physicians | 51,333 | - |
| Output | $117.9 billion | $2,296,892 |
| Jobs | 670,172 | 13.06 |
| Wages & Benefits | $55,406.4 million | $1,079,352 |
| State and Local Taxes | $3,521.4 million | $68,599 |

### Output

Physicians generated $55,249.2M in direct output. The total output of patient care physicians sums the direct and indirect output generated by the industry. Physicians generated $117.9B in total output, or an average of $2,296,892 per physician.

### Jobs

A total of 51,333 patient care physicians were practicing in Texas as of December 2015. The number of jobs directly created by patient care physicians (including the number of physicians themselves) in the state was 246,714. The total number of jobs supported by patient care physicians in Texas was 670,172; the average physician supported 13.06 jobs in the economy, including his or her own.

### Wages and Benefits

Compensation (i.e., the wages and benefits that are paid to local residents) is also an important measure of an industry's value to the local economy.[5] The value of direct wages and benefits in Texas includes compensation paid to physicians and non-physician staff who are on payroll. This direct amount of wages and benefits totaled to $33,983.3M in the state in 2015. The total amount of wages

[5] For ease of reading, "wages and benefits" is used to mean salaries and wages plus other forms of compensation paid to employees. Values include wages and benefits to all support staff, non-physician practitioners and physicians.

and benefits supported by patient care physicians in Texas was $55,406.4M (including the indirect wages and benefits supported by the industry), or an average of $1,079,352 per physician.

### Taxes

The total tax contribution is computed by summing taxation on employee income, proprietor income, indirect business interactions, households, and corporations. Tax revenues are included from the patient care physician industry (direct) and from other affected industries (indirect). These are the "total" tax revenues supported by the industry.

The state and local taxes incorporated in this study include:

- **Social Insurance taxes**: the state portions of social insurance taxes, including both the employee and employer-paid portions (e.g., retirement plans, workers' compensation, and temporary disability insurance);
- **Personal taxes**: state and local income taxes, gift and estate taxes, motor vehicle taxes/fees, fishing/hunting and other license fees, property taxes, personal property taxes, and other fines/fees or donations;
- **Business taxes**: corporate profits and dividends taxes; and
- **Indirect business taxes**: property taxes, sales taxes, motor vehicle licensing, severance taxes, non-tax payments (e.g., rents and royalties, special assessments, fines, settlements and donations), and other taxes (including business licenses, documentary and stamp taxes).[6]

The aggregate local and state taxes generated by patient care physicians in 2015 totaled $3,521.4M, or an average of $68,599 per physician.

### Broad Specialty

Due to likely variation between specialties, we examined economic impacts across three broad specialty groups (primary care, non-surgical and surgical) (**Table 2**).

[6] Olsen DC. Using Social Accounts to Estimate Tax Impacts. MIG, Inc. Available through IMPLAN.com. (Paper originally given at the Mid-Continent Regional Science Association Meetings in Minneapolis, MN; June 11, 1999).

There were 20,371 physicians classified under the broad specialty of primary care (representing 39.7% of all patient care physicians), 23,251 physicians classified under non-surgical (representing 45.3%), and 7,710 physicians classified under surgical (representing 15.0%).

In each state, either primary care physicians or non-surgical specialties generated the highest output, jobs, and wages and benefits. This was partly due to physicians most often belonging to one of those two broad specialties and, for the most part, output, jobs, and wages and benefits were highest among the broad specialty with the most physicians in a state. In each state, surgical specialties generated the lowest output, jobs, and wages and benefits related to a smaller number of surgical specialists relative to primary care physicians or non-surgical specialists. In Texas, total output across broad specialties ranged from $19,494.9M for surgical to $51,879.6M for non-surgical. Total jobs ranged from 105,963 for surgical to 289,895 for non-surgical. Total wages and benefits ranged from $9,236.1M for surgical to $23,935.9M for non-surgical.

**Table 2: Total Economic Impact of Physicians in Texas, by Broad Specialty**

| Broad Specialty | Number of Physicians | Output ($ in millions) | Jobs | Wages & Benefits ($ in millions) |
|---|---|---|---|---|
| Primary care | 20,371 | $46,531.8 | 274,313 | $22,234.4 |
| Non-surgical | 23,251 | $51,879.6 | 289,895 | $23,935.9 |
| Surgical | 7,710 | $19,494.9 | 105,963 | $9,236.1 |
| Total | 51,333 | $117,906.3 | 670,172 | $55,406.4 |

### 10 Specialties

Lastly, we examined the economic impacts for 10 specialties (**Table 3**). In Texas, the number of patient care physicians ranged from a low of 650 for urology to a high of 6,694 for family medicine.

For the most part, state-level economic impacts were lowest among urologists and, in general, highest among family medicine and internal medicine specialists. One driver of this observation is specialty size. Those specialties often had the fewest and greatest numbers of physicians, respectively. In Texas, total output across the 10 specialties ranged from $1,876.4M for urology to $15,059.4M for family medicine. Total jobs ranged from 9,978 for urology to 93,234 for family medicine. Total wages and benefits ranged from $868.3M for urology to $7,150.4M for family medicine.

**Table 3: Total Economic Impact of Physicians in Texas, for 10 Select Specialties**

| Specific Specialty | Number of Physicians | Output ($ in millions) | Jobs | Wages & Benefits ($ in millions) |
|---|---|---|---|---|
| Anesthesiology | 3,413 | $5,659.6 | 28,425 | $3,264.6 |
| Cardiology | 1,845 | $3,952.3 | 24,266 | $2,079.0 |
| Family medicine | 6,694 | $15,059.4 | 93,234 | $7,150.4 |
| General surgery | 2,542 | $3,650.8 | 21,990 | $2,103.5 |
| Internal medicine | 6,524 | $11,021.3 | 69,101 | $5,238.6 |
| Obstetrics/Gynecology | 3,037 | $6,571.9 | 38,823 | $3,241.4 |
| Orthopaedic surgery | 1,585 | $5,188.5 | 29,366 | $2,345.9 |
| Pediatrics | 5,619 | $9,672.0 | 62,265 | $4,464.8 |
| Psychiatry | 2,228 | $3,496.0 | 18,324 | $1,614.9 |
| Urology | 650 | $1,876.4 | 9,978 | $868.3 |

## Comparator Industry Analysis

To help frame the relative economic impact of patient care physicians, we also assessed the economic impacts (output, jobs, and wages and benefits) of other industries both within and outside the health care industry:

1. Higher education (e.g., junior college, college, university, and professional schools),
2. Nursing and community care facilities,
3. Legal services, and
4. Home health.

IMPLAN was instrumental as it provides 2015 output, jobs, and wages and benefits data and multipliers for the following industries: junior colleges, colleges, universities, and professional schools (IMPLAN industry code 473), nursing and community care facilities (483), legal services (447), and home health care services (480).

**Table 4: Comparator Industry Total Economic Impacts in Texas**

| Industry | Output ($ in millions) | Jobs | Wages & Benefits ($ in millions) |
|---|---|---|---|
| Physicians | $117,906.3 | 670,172 | $55,406.4 |
| Higher Education | $10,916.6 | 78,850 | $4,715.6 |
| Nursing/Community Care Facilities | $21,439.4 | 233,765 | $9,287.7 |
| Legal Services | $43,458.6 | 265,407 | $16,378.3 |
| Home Health | $22,421.8 | 373,371 | $10,444.3 |

### Output

Physicians generated a greater total output than the higher education, nursing and community care facilities, legal services and home health industries in each state. The only exception was the legal services industry within the District of Columbia, with a total output of $16.1B compared to $8.0B for physicians. In Texas, physicians supported $117,906.3M in total output. Across comparator industries, total output ranged from $10,916.6M for higher education to $43,458.6M for legal services.

### Jobs

In most states, physicians supported more jobs than the higher education, nursing and community care facilities, legal services or home health industries. In the District of Columbia, the number of jobs supported by the legal services industry was the highest, while in North Dakota, the number of jobs supported by the nursing and community care facilities industry was the highest. In Texas, physicians

supported 670,172 total jobs. Across comparator industries, total jobs ranged from 78,850 for higher education to 373,371 for home health.

### Wages and Benefits

Physicians supported higher total wages and benefits than all comparator industries across the states, with one exception—the legal services industry in the District of Columbia. This suggests that physicians compensate their employees well, which allows these employees to purchase services from other industries in the state, thereby stimulating their state's economy. In Texas, physicians supported $55,406.4M in wages and benefits. Across comparator industries, total wages and benefits ranged from $4,715.6M for higher education to $16,378.3M for legal services.

# Appendix. Methodological Overview

Three primary data sources were employed in this study: the 2015 AMA Masterfile, 2015 medical practices data from a leading data aggregator, and 2015 IMPLAN. The AMA Masterfile's number of physicians was combined with the per-physician revenue and cost data and IMPLAN's economic impact multipliers to estimate values for the direct, indirect and total economic impact of the physician industry.

AMA Masterfile

The AMA Masterfile contains current and historical data on all physicians, including members and non-members of the AMA and graduates of foreign medical schools who are in the United States (U.S.) and meet educational standards for recognition as physicians. It includes information on geographic location, as well as physician characteristics such as specialty and major professional activity. Masterfile data as of December 2015 was used for this analysis.

Medical Practices Data

The medical practices data aggregator provides national data on the financial characteristics of physician practices including total medical revenue and total payroll costs per full-time physician equivalent. Data are provided for a number of common specialties, as well as by three broad specialty types (primary care, surgical and non-surgical specialties). The data provides information to evaluate different aspects of medical practice performance and to help make policy decisions about medical practice operations. Data are provided for 2015.

IMPLAN

IMPLAN (IMpact analysis for PLANning) is the input-output economic impact modeling system developed by the Minnesota IMPLAN Group. IMPLAN is used to create models of economies allowing for in-depth examinations of economic impacts. The 2015 IMPLAN system estimates output, employment, and labor income multipliers for each industry, at the state and national level, as well as total tax revenues (state and local) generated using a Social Accounting System. Data are taken from a number of sources including the Bureau of Labor Statistics (BLS), the Bureau of Economic Analyses (BEA) and the U.S. Census Bureau.

## 1.1 2015 AMA Masterfile

The AMA Masterfile was used to estimate the number of post-residency physicians who provide patient care in each state, in aggregate and by specialty. Each record within the AMA Masterfile corresponds to one physician.

### Patient care physicians

As of December 2015, 1,022,483 physicians (excluding residents) had a preferred mailing address in one of the 50 states/DC.

The AMA Masterfile categorizes physicians by major professional activity (MPA), a variable based on physician-provided data on present employment and type of practice (see **Table A-1**). In order to arrive at our final sample for analysis, we first limited the AMA Masterfile data to 755,802 (73.9%) physicians whose MPA is the provision of patient care. These physicians are the population of interest, inclusive of both office- and hospital-based physicians as well as locum tenens physicians. Another 57,696 (5.6%) were identified as "not classified" because the AMA had not received any recent information as to their type of practice and present employment.

**Table A-1. 2015 AMA Masterfile Physicians by MPA Description**

| MPA | N | % |
|---|---|---|
| Office Based Practice | 634,315 | 62.0% |
| Hospital Based Full-Time Physician Staff | 119,994 | 11.7% |
| Locum Tenens | 1,493 | 0.2% |
| Administration | 13,813 | 1.4% |
| Inactive | 164,553 | 16.1% |
| Medical Teaching | 12,772 | 1.3% |
| Not Classified | 57,696 | 5.6% |
| Other | 4,773 | 0.5% |
| Research | 13,074 | 1.3% |
| **Total** | **1,022,483** | **100.0%** |

For the 57,696 (5.6%) physicians who did not provide any responses indicating whether or not they provide patient care on a regular basis, we imputed the physician's MPA/the provision of patient care. We assume that a portion of these unclassified physicians provide patient care on a regular basis. Therefore, we would underestimate the portion of physicians providing patient care on a regular basis if we were to exclude all unclassified physicians, and we would overestimate the portion of physicians providing patient care on a regular basis if we were to include all of them. We estimated a binary logit

model using GLM parameterization to model the likelihood of providing patient care (as a binary outcome, either providing or not providing patient care).

After examining the variable response distribution between physicians providing patient care, not providing patient care and unclassified, we decided on a final set of independent variables for inclusion and examined co-linearity between potential variables. Our final model included the following categorical variables: 1) age group, 2) gender, 3) physician is or is not board certified, 4) MD or DO, 5) CBSA level of the preferred address (i.e., Metropolitan or Micropolitan), 6) physician does or does not have an NPI number, 7) physician does or does not have a DEA number, 8) primary specialty, 9) physician is or is not an International Medical Graduate and 10) state of the preferred address is or is not the same as the state of the office. In addition, the following interaction terms were included: 11) age (continuous) * broad specialty, and 12) gender * broad specialty. The resulting model had a C-statistic of 0.892. For the output of the model, we specified the creation of a dataset which included an assigned probability to each physician of whether that physician provides patient care based on his/her available data for the independent variables used in the model. Based on the observed ratio of patient care to non-patient care among physicians with non-missing MPA (78.3 to 21.7), we used this event rate as the predicted probability threshold and categorized physicians with a probability of greater or equal to .783 as providing patient care and physicians with a probability of less than .783 as not providing patient care.

Of the 57,696 physicians with unclassified MPA, 36,887 (63.9%) were imputed as providing patient care, yielding a total number of 792,689 physicians providing patient care. Non-missing state of office location was required for this analysis, as the state is the location of the economic activity. Our final sample consisted of 736,873 physicians with a non-missing state for their office location.

### Region

Physicians were classified by state. The AMA Masterfile includes information on office location and preferred professional mailing address, which could be either home or office. Should a physician have an office in one state and reside in another, the office location variable was used because, as stated above, the office is the location of the economic activity.

### Specialty

The AMA Masterfile contains physician-reported data on a physician's primary specialty. Using this, physicians were mapped to three broad specialty types (primary care, non-surgical and surgical specialties) based on grouping for these broad specialty types by the medical practices data aggregator (see **Table A-2**). Physicians with missing primary specialty within a state were prorated to

the three broad specialty types in proportion to the number of physicians known to be in those broad specialties in that state. Additionally, we examined economic impacts for 10 specialties for which data were available from the medical practices data aggregator (see **Table A-3**):

1) Anesthesiology
2) Cardiology
3) Family medicine
4) General surgery
5) Internal medicine
6) Obstetrics/Gynecology
7) Orthopaedic surgery
8) Pediatrics
9) Psychiatry
10) Urology

## 1.2 2015 Medical Practices Data

The medical practices data aggregator provides physician data at the national level. Reports may be obtained at either the single specialty or the multispecialty level. Data was used to estimate per-physician output (revenue), jobs, and wages and benefits for 2015, by specialty. Only data for single specialty physicians were included in this analysis.

Data are provided for overall practices as well as by legal ownership of a practice (physician owned, hospital/integrated delivery system [IDS] owned or other). There were observed differences in medical revenue between physician-owned and hospital-owned practices, related to accounting differences. For hospital-owned practices, medical revenue is underreported, as some practice revenue is accounted for as hospital revenue, particularly that for ancillary services. Therefore, we calculated a weighted average of medical revenue considering both physician-owned and imputed hospital-owned revenue (see the Variables subsection under this same section for more details). Because data are provided at the national level, output and wages and benefits were geographically adjusted to specific states.

### Specialties

Practices that provide information to the medical practices data aggregator record the specialties of their member physicians. Those specialties are then mapped to three broad provider classification groupings: primary care, non-surgical specialist, and surgical specialist (see **Table A-2** for available single specialties and the single specialties that fall under the three broader groups).

Because physician specialty was used to link the medical practices data from a leading data aggregator with AMA data, specialty categories were cross-walked between the two datasets. While the Masterfile data offer flexibility in the creation of aggregate specialties from its 250+ specialty categories, the medical practices data aggregator software offers limited options with set definitions. The medical practices data aggregator specialties, therefore, were the limiting factor in our specialty-to-specialty match-up across files.

In this analysis, we used the high-level categorization of the three broad specialty categories: primary care, non-surgical and surgical specialties. This is a classification scheme defined by the medical practices data aggregator. We mapped AMA specialties to these three broad specialties. **Table A-2** shows which specialties the medical practices data aggregator included in the three broad categories, as well as the AMA primary specialties we allocated to each of the three in order to best match the medical practices data aggregator definitions.

**Table A-2. 2015 AMA Masterfile and Medical Practices Data Aggregator Specialties, by Broad Specialty**

| Medical Practices Data Aggregator | AMA Masterfile |
|---|---|
| ***Primary Care*** | |
| Family Medicine (with OB) | Adolescent Medicine (Family Medicine) |
| Family Medicine (without OB) | Adolescent Medicine (Internal Medicine) |
| Family Medicine: Ambulatory only (no inpatient work) | Adolescent Medicine (Pediatrics) |
| Family Medicine: Sports Medicine | Family Medicine |
| Family Medicine: Urgent Care | General Practice |
| Geriatrics | Geriatric Medicine (Family Medicine) |
| Hospice/Palliative Care | Geriatric Medicine (Internal Medicine) |
| Hospitalist: Family Medicine | Gynecology |
| Hospitalist: Internal Medicine | Hospice & Palliative Medicine |
| Hospitalist: Ob/Gyn | Hospice & Palliative Medicine (Family Medicine) |
| Internal Medicine: General | Hospice & Palliative Medicine (Internal Medicine) |
| Internal Medicine: Ambulatory only (no inpatient work) | Hospice & Palliative Medicine (Obstetrics & Gynecology) |
| OB/GYN: General | Hospice & Palliative Medicine (Pediatrics) |
| OB/GYN: Gynecology (only) | Hospitalist |

| | |
|---|---|
| Pediatrics: General | Internal Medicine |
| Pediatrics: Adolescent Medicine | Internal Medicine/Family Practice |
| Pediatrics: Hospitalist | Internal Medicine/Pediatrics |
| Pediatrics: Hospitalist-Internal Medicine | Obstetrics & Gynecology |
| Pediatrics: Internal Medicine | Palliative Medicine |
| Pediatrics: Sports Medicine | Pediatrics |
| Pediatrics: Urgent Care | Sports Medicine (Family Medicine) |
| Urgent Care | Sports Medicine (Internal Medicine) |
| | Sports Medicine (Pediatrics) |
| | Urgent Care Medicine |
| ***Non-surgical*** | |
| Allergy/Immunology | Abdominal Radiology |
| Anesthesiology | Addiction Medicine |
| Bariatrics (Nonsurgical) | Addiction Psychiatry |
| Clinical Pharmacology | Adult Cardiothoracic Anesthesiology (Anesthesiology) |
| Critical Care: Intensivist | Adult Congenital Heart Disease (Internal Medicine) |
| Dentistry | Advanced Heart Failure and Transplant Cardiology (Internal Medicine) |
| Dermatology | Aerospace Medicine |
| Emergency Medicine | Allergy |
| Endocrinology/Metabolism | Allergy and Immunology |
| Gastroenterology | Anatomic Pathology |
| Genetics | Anatomic/Clinical Pathology |
| Hematology/Oncology | Anesthesiology |
| Hematology/Oncology: Oncology (only) | Anesthesiology Critical Care Medicine (Emergency Medicine) |
| Hyperbaric Medicine/Wound Care | Blood Banking/Transfusion Medicine |
| Infectious Disease | Brain Injury Medicine (Neurology) |
| Nephrology | Brain Injury Medicine (Physical Medicine & Rehabilitation) |
| Neurology | Cardiothoracic Radiology |
| Occupational Medicine | Cardiovascular Disease |
| Orthopaedic (Nonsurgical) | Chemical Pathology |
| Pathology: Anatomic and Clinical | Child & Adolescent Psychiatry |
| Pathology: Anatomic | Child Abuse Pediatrics |
| Pathology: Clinical | Child Neurology |
| Physiatry (Physical Medicine and Rehabilitation) | Clinical & Laboratory Dermatological Immunology |
| Podiatry: General | Clinical & Laboratory Immunology (Pediatrics) |
| Psychiatry: General | Clinical and Laboratory Immunology (Internal Medicine) |
| Pulmonary Medicine: General | Clinical Biochemical Genetics |
| Pulmonary Medicine: Critical Care | Clinical Cardiac Electrophysiology |
| Pulmonary Medicine: General and Critical Care | Clinical Cytogenetics |
| Radiation Oncology | Clinical Genetics |
| Rheumatology | Clinical Informatics (Pathology) |
| Sleep Medicine | Clinical Informatics (Preventive Medicine) |
| **Nonsurgical Subspecialist** | Clinical Laboratory Immunology (Allergy & Immunology) |
| Anesthesiology: Pain Management | Clinical Molecular Genetics |

Cardiology: Electrophysiology
Cardiology: Invasive
Cardiology: Invasive-Interventional
Cardiology: Noninvasive
Dermatology: Dermatopathology
Gastroenterology: Hepatology
Neurology: Epilepsy/EEG
Neurology: Neuromuscular
Neurology: Stroke Medicine
Ob/Gyn: Gynecological Oncology
Ob/Gyn: Maternal and Fetal Medicine
Ob/Gyn: Reproductive Endocrinology
Ob/Gyn: Urogynecology
Pain Management: Nonanesthesia
Pathology: Anatomic-Autopsy
Pathology: Anatomic-Cytopathology
Pathology: Anatomic-Neuropathology
Pathology: Anatomic-Renal
Pathology: Clinical-Hematopathology
Pathology: Clinical-Transfusion Medicine
Pediatrics: Allergy/Immunology
Pediatrics: Anesthesiology
Pediatrics: Bone Marrow Transplant
Pediatrics: Cardiology
Pediatrics: Child Development
Pediatrics: Clinical and Lab Immunology
Pediatrics: Critical Care/Intensivist
Pediatrics: Dermatology
Pediatrics: Emergency Medicine
Pediatrics: Endocrinology
Pediatrics: Gastroenterology
Pediatrics: Genetics
Pediatrics: Hematology/Oncology
Pediatrics: Infectious Disease
Pediatrics: Neonatal Medicine
Pediatrics: Nephrology
Pediatrics: Neurology
Pediatrics: Pulmonology
Pediatrics: Radiology
Pediatrics: Rheumatology
Psychiatry: Child and Adolescent
Psychiatry: Forensic
Psychiatry: Geriatric
Radiology: Interventional
Radiology: Diagnostic

Clinical Neurophysiology
Clinical Pathology
Clinical Pharmacology
Critical Care Medicine (Anesthesiology)
Critical Care Medicine (Emergency Medicine)
Critical Care Medicine (Internal Medicine)
Critical Care Medicine (Obstetrics & Gynecology)
Cytopathology
Dermatology
Dermatopathology (Pathology)
Developmental-Behavioral Pediatrics
Diabetes
Diagnostic Radiology
Emergency Medical Services
Emergency Medicine
Emergency Medicine/Family Medicine
Endocrinology, Diabetes & Metabolism
Epidemiology
Epilepsy (Neurology)
Family Medicine/Preventive Medicine
Forensic Pathology
Forensic Psychiatry
Gastroenterology
General Preventive Medicine
Geriatric Psychiatry
Gynecologic Oncology
Hematology (Internal Medicine)
Hematology (Pathology)
Hematology/Medical Oncology
Hepatology
Hospice & Palliative Medicine (Anesthesiology)
Hospice & Palliative Medicine (Emergency Medicine)
Hospice & Palliative Medicine (Physical Medicine & Rehabilitation)
Hospice & Palliative Medicine (Psychiatry & Neurology)
Hospice & Palliative Medicine (Radiology)
Immunology
Infectious Disease
Internal Med/Emergency Med/Critical Care Med
Internal Med/Phys Med and Rehabilitation
Internal Med/Psychiatry
Internal Medicine/Anesthesiology
Internal Medicine/Dermatology
Internal Medicine/Emergency Medicine
Internal Medicine/Medical Genetics
Internal Medicine/Neurology

| | |
|---|---|
| Radiology: Neurological | Internal Medicine/Preventive Medicine |
| Radiology: Nuclear Medicine | Interventional Cardiology |
| | Legal Medicine |
| | Maternal and Fetal Medicine |
| | Medical Biochemical Genetics |
| | Medical Genetics |
| | Medical Management |
| | Medical Microbiology |
| | Medical Oncology |
| | Medical Toxicology (Emergency Medicine) |
| | Medical Toxicology (Pediatrics) |
| | Medical Toxicology (Preventive Medicine) |
| | Molecular Genetic Pathology (Medical Genetics) |
| | Molecular Genetic Pathology (Pathology and Medical Genetics) |
| | Musculoskeletal Oncology |
| | Musculoskeletal Radiology |
| | Neonatal-Perinatal Medicine |
| | Nephrology |
| | Neurodevelopmental Disabilities (Pediatrics) |
| | Neurodevelopmental Disabilities (Psychiatry & Neurology |
| | Neurology |
| | Neurology/Diagnostic Radiology/Neuroradiology |
| | Neurology/Physical Medicine and Rehabilitation |
| | Neuromuscular Medicine (Neurology) |
| | Neuromuscular Medicine (Physical Medicine & Rehabilitation) |
| | Neuropathology |
| | Neuropsychiatry |
| | Neuroradiology |
| | Nuclear Cardiology |
| | Nuclear Medicine |
| | Nuclear Radiology |
| | Nutrition |
| | Obstetrics |
| | Obstetric Anesthesiology (Anesthesiology) |
| | Occupational Medicine |
| | Osteopathic Manipulative Medicine |
| | Pain Management |
| | Pain Medicine |
| | Pain Medicine (Anesthesiology) |
| | Pain Medicine (Neurology) |
| | Pain Medicine (Physical Medicine & Rehabilitation) |
| | Pain Medicine (Psychiatry) |
| | Pediatric Allergy |
| | Pediatric Anesthesiology (Anesthesiology) |
| | Pediatric Cardiology |

Pediatric Critical Care Medicine
Pediatric Dermatology
Pediatric Emergency Med (Emergency Med)
Pediatric Emergency Medicine (Pediatrics)
Pediatric Endocrinology
Pediatric Gastroenterology
Pediatric Hematology-Oncology
Pediatric Infectious Disease
Pediatric Nephrology
Pediatric Pathology
Pediatric Pulmonology
Pediatric Radiology
Pediatric Rehabilitation Medicine
Pediatric Rheumatology
Pediatric Transplant Hepatology
Pediatrics/Anesthesiology
Pediatrics/Dermatology
Pediatrics/Emergency Medicine
Pediatrics/Medical Genetics
Pediatrics/Physical Medicine and Rehabilitation
Pediatrics/Psychiatry/Child & Adolescent Psychiatry
Pharmaceutical Medicine
Phlebology
Physical Medicine and Rehabilitation
Procedural Dermatology
Proctology
Psychiatry
Psychiatry/Family Medicine
Psychiatry/Neurology
Psychoanalysis
Psychosomatic Medicine
Public Health and General Preventive Medicine
Pulmonary & Critical Care Medicine
Pulmonary Disease
Radiation Oncology
Radiological Physics
Radiology
Reproductive Endocrinology and Infertility
Rheumatology
Selective Pathology
Sleep Medicine
Sleep Medicine (Internal Medicine)
Sleep Medicine (Otolaryngology)
Sleep Medicine (Pediatrics)
Sleep Medicine (Psychiatry & Neurology)

| | |
|---|---|
| | Spinal Cord Injury Medicine |
| | Sports Medicine (Emergency Medicine) |
| | Sports Medicine (Physical Medicine & Rehabilitation) |
| | Transplant Hepatology (Internal Medicine) |
| | Undersea & Hyperbaric Medicine (Emergency Medicine) |
| | Undersea & Hyperbaric Medicine (Preventive Medicine) |
| | Vascular and Interventional Radiology |
| | Vascular Medicine |
| | Vascular Neurology |
| ***Surgical*** | |
| Ophthalmology | Abdominal Surgery |
| Orthopaedic Surgery: General | Adult Reconstructive Orthopaedics |
| Otorhinolaryngology | Colon and Rectal Surgery |
| Surgery: General | Complex General Surgical Oncology (Surgery) |
| Urology | Congenital Cardiac Surgery (Thoracic Surgery) |
| **Surgical Subspecialist** | Cosmetic Surgery |
| Dermatology: Mohs Surgery | Craniofacial Surgery |
| Ophthalmology: Corneal and Refractive Surgery | Dermatologic Surgery |
| Ophthalmology: Glaucoma | Endovascular Surgical Neuroradiology (Neurological Surgery) |
| Ophthalmology: Neurology | Endovascular Surgical Neuroradiology (Neurology) |
| Ophthalmology: Oculoplastic and Reconstructive Surgery | Endovascular Surgical Neuroradiology (Radiology) |
| Ophthalmology: Retina | Facial Plastic Surgery |
| Orthopaedic Surgery: Foot and Ankle | Female Pelvic Medicine (Urology) |
| Orthopaedic Surgery: Hand | Female Pelvic Medicine and Reconstructive Surgery (Obstetrics & Gynecology) |
| Orthopaedic Surgery: Hip and Joint | Foot and Ankle Orthopaedics |
| Orthopaedic Surgery: Oncology | General Surgery |
| Orthopaedic Surgery: Shoulder/Elbow | Hand Surgery |
| Orthopaedic Surgery: Spine | Hand Surgery (Orthopaedics) |
| Orthopaedic Surgery: Trauma | Hand Surgery (Plastic Surgery) |
| Orthopaedic Surgery | Hand Surgery (Surgery) |
| Pediatrics: Otorhinolaryngology | Head and Neck Surgery |
| Pediatrics: Surgery | Hospice & Palliative Medicine (Surgery) |
| Pediatrics: Cardiovascular Surgery | Neurological Surgery |
| Pediatrics: Neurological Surgery | Neurotology (Otolaryngology) |
| Pediatrics: Plastic and Reconstruction Surgery | Ophthalmic Plastic and Reconstructive Surgery (Ophthalmology) |
| Pediatrics: Urology | Ophthalmology |
| Podiatry: Surgery-Foot and Ankle | Oral & Maxillofacial Surgery |
| Podiatry: Surgery-Forefoot only | Orthopaedic Surgery |
| Surgery: Bariatric | Orthopaedic Surgery of the Spine |
| Surgery: Breast | Orthopaedic Trauma |
| Surgery: Cardiovascular | Otolaryngology |
| Surgery: Colon and Rectal | Pediatric Cardiothoracic Surgery |
| Surgery: Endovascular (Primary) | Pediatric Ophthalmology |
| Surgery: Neurological | Pediatric Orthopaedics |

| | |
|---|---|
| Surgery: Oncology | Pediatric Otolaryngology |
| Surgery: Oral | Pediatric Surgery (Neurology) |
| Surgery: Plastic and Reconstruction | Pediatric Surgery (Surgery) |
| Surgery: Plastic and Reconstruction-Hand | Pediatric Urology |
| Surgery: Thoracic (Primary) | Plastic Surgery |
| Surgery: Transplant | Plastic Surgery within the Head & Neck |
| Surgery: Transplant-Heart | Plastic Surgery within the Head & Neck (Otolaryngology) |
| Surgery: Transplant-Heart/Lung | Plastic Surgery within the Head & Neck (Plastic Surgery) |
| Surgery: Transplant-Kidney | Sports Medicine (Orthopaedic Surgery) |
| Surgery: Transplant-Liver | Surgical Critical Care (Surgery) |
| Surgery: Trauma | Surgical Oncology |
| Surgery: Trauma-Burn | Thoracic Surgery |
| Surgery: Vascular (Primary) | Transplant Surgery |
| | Traumatic Surgery |
| | Urology |
| | Vascular Surgery |

The second categorization of specialties was at a more granular level of detail than that of the three broad groups. The availability of data from the medical practices data aggregator is limited based on respondent count. We selected 10 specialties for which necessary data were available. **Table A-3** presents the full allocation of AMA primary specialties mapped to the single specialties of interest provided by the medical practices data aggregator. It is a limitation that there may be potentially differing subspecialties grouped under the selected specialties for AMA versus the medical practices data aggregator.

**Table A-3. 2015 AMA Masterfile Specialties, by Specialties of Interest**

| Specialties of Interest |
|---|
| ***Anesthesiology*** |
| Adult Cardiothoracic Anesthesiology (Anesthesiology) |
| Anesthesiology |
| Anesthesiology Critical Care Medicine (Emergency Medicine) |
| Critical Care Medicine (Anesthesiology) |
| Hospice & Palliative Medicine (Anesthesiology) |
| Internal Medicine/Anesthesiology |
| Pain Management |
| Pain Medicine (Anesthesiology) |
| ***Cardiology*** |
| Advanced Heart Failure and Transplant Cardiology (Internal Medicine) |
| Cardiothoracic Radiology |
| Cardiovascular Disease |
| Clinical Cardiac Electrophysiology |
| Interventional Cardiology |
| Nuclear Cardiology |
| Pediatric Cardiology |
| ***Family Medicine*** |
| Adolescent Medicine (Family Medicine) |
| Emergency Medicine/Family Medicine |
| Family Medicine |

Family Medicine/Preventive Medicine
Geriatric Medicine (Family Medicine)
Hospice & Palliative Medicine (Family Medicine)
Internal Medicine/Family Practice
Sports Medicine (Family Medicine)

***General Surgery***
Abdominal Surgery
Colon and Rectal Surgery
Complex General Surgical Oncology (Surgery)
Craniofacial Surgery
Dermatologic Surgery
General Surgery
Hand Surgery
Hand Surgery (Surgery)
Head and Neck Surgery
Hospice & Palliative Medicine (Surgery)
Oral & Maxillofacial Surgery
Pediatric Surgery (Surgery)
Surgical Critical Care (Surgery)
Surgical Oncology
Thoracic Surgery
Transplant Surgery
Traumatic Surgery
Vascular Surgery

***Internal Medicine***
Adolescent Medicine (Internal Medicine)
Adult Congenital Heart Disease (Internal Medicine)
Clinical and Laboratory Immunology (Internal Medicine)
Critical Care Medicine (Internal Medicine)
Diabetes
Geriatric Medicine (Internal Medicine)
Hematology (Internal Medicine)
Hepatology
Hospice & Palliative Medicine (Internal Medicine)
Internal Med/Emergency Med/Critical Care Med
Internal Med/Phys Med and Rehabilitation
Internal Medicine
Internal Medicine/Dermatology
Internal Medicine/Emergency Medicine
Internal Medicine/Medical Genetics
Internal Medicine/Neurology
Internal Medicine/Preventive Medicine
Medical Oncology
Nutrition
Sleep Medicine (Internal Medicine)
Sports Medicine (Internal Medicine)
Transplant Hepatology (Internal Medicine)

***Obstetrics/Gynecology***
Critical Care Medicine (Obstetrics & Gynecology)
Female Pelvic Medicine and Reconstructive Surgery (Obstetrics & Gynecology)
Gynecologic Oncology
Gynecology
Hospice & Palliative Medicine (Obstetrics & Gynecology)
Maternal and Fetal Medicine
Obstetric Anesthesiology (Anesthesiology)
Obstetrics
Obstetrics & Gynecology
Reproductive Endocrinology and Infertility

***Orthopaedic Surgery***
Adult Reconstructive Orthopaedics
Foot and Ankle Orthopaedics
Hand Surgery (Orthopaedics)
Musculoskeletal Oncology
Orthopaedic Surgery
Orthopaedic Surgery of the Spine
Orthopaedic Trauma
Osteopathic Manipulative Medicine
Pediatric Orthopaedics
Sports Medicine (Orthopaedic Surgery)

***Pediatrics***

Adolescent Medicine (Pediatrics)
Child Abuse Pediatrics
Child Neurology
Clinical & Laboratory Immunology (Pediatrics)
Developmental-Behavioral Pediatrics
Hospice & Palliative Medicine (Pediatrics)
Internal Medicine/Pediatrics
Medical Toxicology (Pediatrics)
Neonatal-Perinatal Medicine
Neurodevelopmental Disabilities (Pediatrics)
Pediatric Allergy
Pediatric Anesthesiology (Anesthesiology)
Pediatric Cardiothoracic Surgery
Pediatric Critical Care Medicine
Pediatric Dermatology
Pediatric Emergency Medicine (Pediatrics)
Pediatric Endocrinology
Pediatric Gastroenterology
Pediatric Hematology-Oncology
Pediatric Infectious Disease
Pediatric Nephrology
Pediatric Ophthalmology
Pediatric Otolaryngology
Pediatric Pathology
Pediatric Pulmonology
Pediatric Radiology
Pediatric Rehabilitation Medicine
Pediatric Rheumatology
Pediatric Transplant Hepatology
Pediatrics
Pediatrics/Anesthesiology
Pediatrics/Dermatology
Pediatrics/Emergency Medicine
Pediatrics/Medical Genetics
Pediatrics/Physical Medicine and Rehabilitation
Sleep Medicine (Pediatrics)

***Psychiatry***

Addiction Psychiatry
Child & Adolescent Psychiatry
Forensic Psychiatry
Geriatric Psychiatry
Hospice & Palliative Medicine (Psychiatry & Neurology)
Internal Med/Psychiatry
Neurodevelopmental Disabilities (Psychiatry & Neurology
Neuropsychiatry
Pain Medicine (Psychiatry)
Pediatrics/Psychiatry/Child & Adolescent Psychiatry
Psychiatry
Psychiatry/Family Medicine
Psychiatry/Neurology
Psychoanalysis
Psychosomatic Medicine
Sleep Medicine (Psychiatry & Neurology)

***Urology***

Urology
Pediatric Urology

**Variables**

Variables used for each of the broad and 10 specialties included data per physician on output, jobs and wages and benefits. We calculated the following for each of the three broad specialties and the 10 specialties:

1) **Medical revenue per physician**. The reported medical revenue from the medical practices data aggregator varies between physician-owned practices vs. hospital-owned practices. Medical revenue is underreported among hospital-owned practices due to accounting differences whereby some practice revenue is accounted for as hospital revenue. To address this, we separately assessed physician-owned practice medical revenue and hospital-owned practice medical revenue. We calculated the ratio of mean wages and benefits to mean revenue among physician-owned practices, assuming this ratio is the same as for hospital-owned practices. We made the assumption that compensation is the same for physician-owned vs. hospital-owned practices, assuming resources are mobile and substitutable between the two types of practices. This assumes that the average productivity of resources (proxied by compensation costs per revenue) is the same across similarly-scaled practices, independent of ownership. We then applied the inverse of this physician-owned practice ratio to hospital-owned practice mean wages and benefits in order to impute hospital-owned practice revenue. We used this imputed value of hospital-owned revenue in place of that reported by the medical practices data aggregator. Finally, we calculated a weighted average of mean physician-owned revenue and mean imputed hospital-owned revenue based on respondent Ns. Because practice revenues vary according to geographic variation in price levels and costs of services, we calculated estimates at the national level and adjusted medical revenue using weighted state values for Medicare's 2015 Geographic Adjustment Factor (GAF). The mean medical revenue in a state was calculated as the national weighted mean for medical revenue **x** the weighted state Medicare GAF.

2) **Total jobs per physician** (sum of mean physician, non-physician provider and support staff FTEs). For the non-physician and support staff categories, the medical practices data aggregator reports means that are calculated based only on respondents that have staff in that category. The N shown for each mean reflects that. In particular, there was a much lower N for non-physician provider FTEs relative to support staff FTEs, as most reporting practices did not employ non-physician provider staff. For these two categories, we calculated adjusted mean jobs (inclusive of practices with no staff in that category) using the reported N for physician costs as the total N. In most cases, the reported N for physician costs was slightly

higher than the reported N for support staff FTEs. For the most part, this adjustment lowered the mean non-physician provider FTEs and slightly lowered the mean support staff FTEs.

3) **Total wages and benefits per physician** (sum of mean physician, non-physician provider and support staff cost). As with jobs, the mean non-physician provider costs and mean support staff costs per physician that are provided by the medical practices data aggregator are based only on respondents that have staff in that category. We calculated adjusted mean costs for these two categories in a similar fashion as for adjusted mean FTEs. For the most part, this adjustment lowered the mean non-physician provider cost and slightly lowered the mean support staff cost. Because wages and benefits spending varies by local wage levels, we calculated estimates at the national level and adjusted wages and benefits using weighted state values for Medicare's 2015 Wage Index. The mean per-physician wages and benefits in a state was calculated as the national mean for wages and benefits **x** the weighted state wage index.

The mean was used for all variables reported by the medical practices data aggregator. However, means are sensitive to outliers and in cases where the mean was greater than the 90$^{th}$ percentile for a variable, the median was used. The median was used in place of the mean for nonsurgical support staff cost for all practices and hospital-owned practices, and for surgical nonphysician provider cost and support staff cost for all practices and hospital-owned practices.

All needed data points were available with the exception of: mean medical revenue, physician cost, non-physician cost and support staff cost for internal medicine and psychiatry physician-owned practices, mean non-physician cost for general surgery physician-owned practices, mean non-physician cost for anesthesiology and urology hospital-owned practices and mean support staff cost for hospital-owned anesthesiology practices. These data points were not reported (due to fewer than 10 practices of an individual specialty providing a response), but were necessary to calculate physician-owned revenue and imputed hospital-owned revenue. In these instances, we used the medical revenue or adjusted cost for the relevant broad specialty as a proxy.

**Medical Practices Data Aggregator Geographic Limitation**

Physician practice revenues and wages and benefits vary according to geographic variation in price levels and costs of services. However, the medical practices data aggregator does not provide data at the state level; therefore, we calculated specialty-specific estimates at the national level and geographically adjusted revenue and wages and benefits.

Medicare uses three Geographic Practice Cost Indices (GPCIs), physician work (PW), practice expense (PE) and malpractice (MP), weighted at approximately 51%, 45% and 4%, respectively, in 2015, to arrive at the GAF to adjust payments to physicians.[7] Medicare calculates the three GPCIs for payment areas known as Medicare localities. Localities are states and sub-state regions. There are 89 Medicare payment localities which are defined by state boundaries (e.g., Wisconsin), metropolitan statistical areas (MSAs) (e.g., metropolitan St. Louis, MO), portions of an MSA (e.g., Manhattan), or rest-of-state areas that exclude metropolitan areas (e.g., rest of Missouri). Practice revenues were adjusted using Medicare's 2015 GAF. The 2015 GAF is available for January – March 2015 and April – December 2015. A weighted annual 2015 GAF was calculated. The weighted 2015 GAF was used when the locality is at the state level. For localities which are at the sub-state region level, a weighted GAF was calculated for the state based on the underlying county population. A county-level file with 2015 population from the U.S. Census Bureau was used, mapped to a file with the counties included in the 2015 localities from the Centers for Medicare and Medicaid Services (CMS).[8]

Because wages and benefits vary by geographic region, we adjusted national level wages and benefits spending by a state-level wage index incorporating both physician wages and clinical and administrative office staff wages. Medicare provides the 2015 Wage Index for core based statistical areas (CBSAs) for urban (MSAs) and rural areas.[9] A weighted state-level wage index was calculated based on the underlying county population. The 2015 county-level population file was again utilized.

**Medical Practices Data Aggregator Limitations**

Limitations of the data reported by the medical practices data aggregator include: 1) bias towards larger practices, 2) differences by practice ownership (physician vs. hospital owned), 3) sensitivity to outliers and 4) availability only at the national level. We cannot adjust for the possible data bias towards larger practices. However, we attempted to minimize this bias by including data for all practices with fewer than three physicians instead of relying on the default setting which only provides data for practices with three or more physicians. We corrected for underreporting of revenue by hospital-owned practices by imputing the mean per-physician revenue in hospital-owned practices and using these imputed values rather than the reported means. Because means may be sensitive to outliers, in cases where the mean was greater than the 90$^{th}$ percentile for a variable, the median was used. We also

[7] Addendum D Geographic Adjustment Factors (GAFs). CY 2015 PFS Final Rule Addenda. CMS-1612-FC. Available at: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/PFS-Federal-Regulation-Notices-Items/CMS-1612-FC.html.

[8] United States Census Bureau. American Fact Finder. Available at: https://factfinder.census.gov/bkmk/table/1.0/en/PEP/2015/PEPANNRES.

[9] FY 2015 Final Rule Wage Index Tables. FY 2015 Wage Index Home Page. Available at: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Wage-Index-Files-Items/FY-2015-Wage-Index-Home-Page.html?DLPage=1&DLEntries=10&DLSort=1&DLSortDir=descending.

note that 2012 differed from other years in terms of reported physician-owned revenue, likely due to errors in reporting. For example, it appears that one large physician-owned practice underreported their revenue in 2012, resulting in a lower average value in 2012 compared to previous and following years. Geographic adjustment was used to address the limitation that data are only available at the national level.

## 1.3 2015 IMPLAN

IMPLAN data contain industry-based output, employment, and labor income multipliers, as well as tax data by state and at the national level.

### Multipliers

Multipliers are specific to a state and to a particular industry. State-level and national 2015 multipliers for “Offices of physicians” (IMPLAN industry code 475) were used. Of note, for the 2012 analysis, 2011 IMPLAN multipliers were used for “Offices of physicians, dentists, and other health practitioners” (IMPLAN industry code 394), a composite industry which was later changed to distinct industries. Related to this, IMPLAN had 440 industries in 2011 which increased to 536 industries by 2015. Upon creation of each model’s geographies, the software calculates multipliers for output, employment (based on millions of dollars of output) and labor income (based on dollars of output). Type SAM (Social Accounting Matrix) output multipliers were used to apply to direct revenue. Type SAM multipliers consider the direct, indirect and induced effects where the induced effect is based on information in the Social Account Matrix. Type SAM multipliers tell us how a specific industry responds to an impact on itself (i.e., rounds of indirect and induced purchasing that occur in that industry). Indirect and induced effect multipliers were used to calculate total jobs and total wages and benefits. A jobs multiplier (the sum of indirect and induced effect employment multipliers) was applied to direct revenue in millions of dollars, in order to calculate indirect and induced jobs per million dollars of output. A wages and benefits multiplier (the sum of indirect and induced effect labor income multipliers) was applied to direct revenue, in order to calculate indirect and induced wages and benefits per dollar of output.

We noted an 8.6% increase in the national output multiplier from 2011 to 2015. The average change was 8.2% with a minimum of 1.6% and a maximum of 14.1%. Other health-related industries saw increases, including a 15.9% increase in the national output multiplier for home health services. All state values in the model are forced to sum to U.S. control totals, so a change at the national level will be reflected in all states. The observed increases in health-related national multipliers are consistent with the increase in the growth of health care spending. National health expenditure grew 5.8% in

2015 and accounted for 17.8% of GDP.[10] Physician and clinical services expenditures grew 6.3% in 2015, an acceleration from growth of 4.8% in 2014, and the first time since 2005 that the growth rate exceeded 6.0%. Health care spending accounted for 17.2% of GDP in 2012.[11]

### Tax Analyses

Patient care physicians also generate tax revenues at the local and state levels. IMPLAN software estimates the impact of economic activity on state and local tax revenues, including income, sales, and property taxes. Tax impacts were estimated at the state and national levels using a contribution analysis, where existing total direct output provides the initial effects of the analysis.[12] Tax calculations were based on 2015 IMPLAN modeling presented in 2015 dollars, using calculated 2015 direct output.

The total tax contribution is computed by summing taxation on employee income, proprietor income, indirect business interactions, households, and corporations. Tax revenues are included from physician practices and from other affected industries (indirect); i.e., these are the "total" tax revenues supported by the industry.

The state and local taxes incorporated in this study include:

- Social Insurance taxes: the state portions of social insurance taxes, including both the employee and employer-paid portions (e.g., retirement plans, workers' compensation, and temporary disability insurance);
- Personal taxes: state and local income taxes, gift and estate taxes, motor vehicle taxes/fees, fishing/hunting and other license fees, property taxes, personal property taxes, and other fines/fees or donations;
- Business taxes: corporate profits and dividends taxes; and
- Indirect business taxes: property taxes, sales taxes, motor vehicle licensing, severance taxes, non-tax payments (e.g., rents and royalties, special assessments, fines, settlements and donations), and other taxes (including business licensing, documentary and stamp taxes).

While patient care physicians also generate federal tax revenue, the federal tax revenue is beyond the scope of this analysis.

[10] National Health Expenditures 2015 Highlights. Available at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/highlights.pdf.
[11] Martin et al. National Health Spending in 2012: Rate of Health Spending Growth Remained Low for the Fourth Consecutive Year. *Health Affairs*. 2014;33:67-77.
[12] Estimating the Contribution of a Current Industry Using IMPLAN. MIG, Inc. Available at: http://support.implan.com/index.php?option=com_content&view=article&id=351:351&catid=212:contribution-analysis.

## 1.4 Data Analysis

The data from the three source datasets were combined and the following measures were calculated by state:

1) Direct impacts of physicians (state-level total medical output, total jobs and total wages and benefits per physician from the medical practices data aggregator **x** counts from the AMA Masterfile)
2) Indirect impacts of physicians
    a. Calculated direct output **x** (IMPLAN output multiplier – 1)
    b. (Calculated direct output/$1,000,000) **x** IMPLAN jobs multiplier
    c. Calculated direct output **x** IMPLAN wages and benefits multiplier
3) Total impacts of physicians (direct and indirect impacts summed for output, jobs and wages and benefits);
4) Tax revenues obtained from physicians.

At the state level, direct, indirect and total impacts were calculated in aggregate (as the sum of primary care, non-surgical and surgical broad specialties) as well as for the 10 specialties. Direct impacts by state (sum of primary care, non-surgical and surgical broad specialties) were aggregated to the national level, and then national IMPLAN multipliers were applied to calculate national total impacts. Tax revenues were also calculated at the national and state levels.