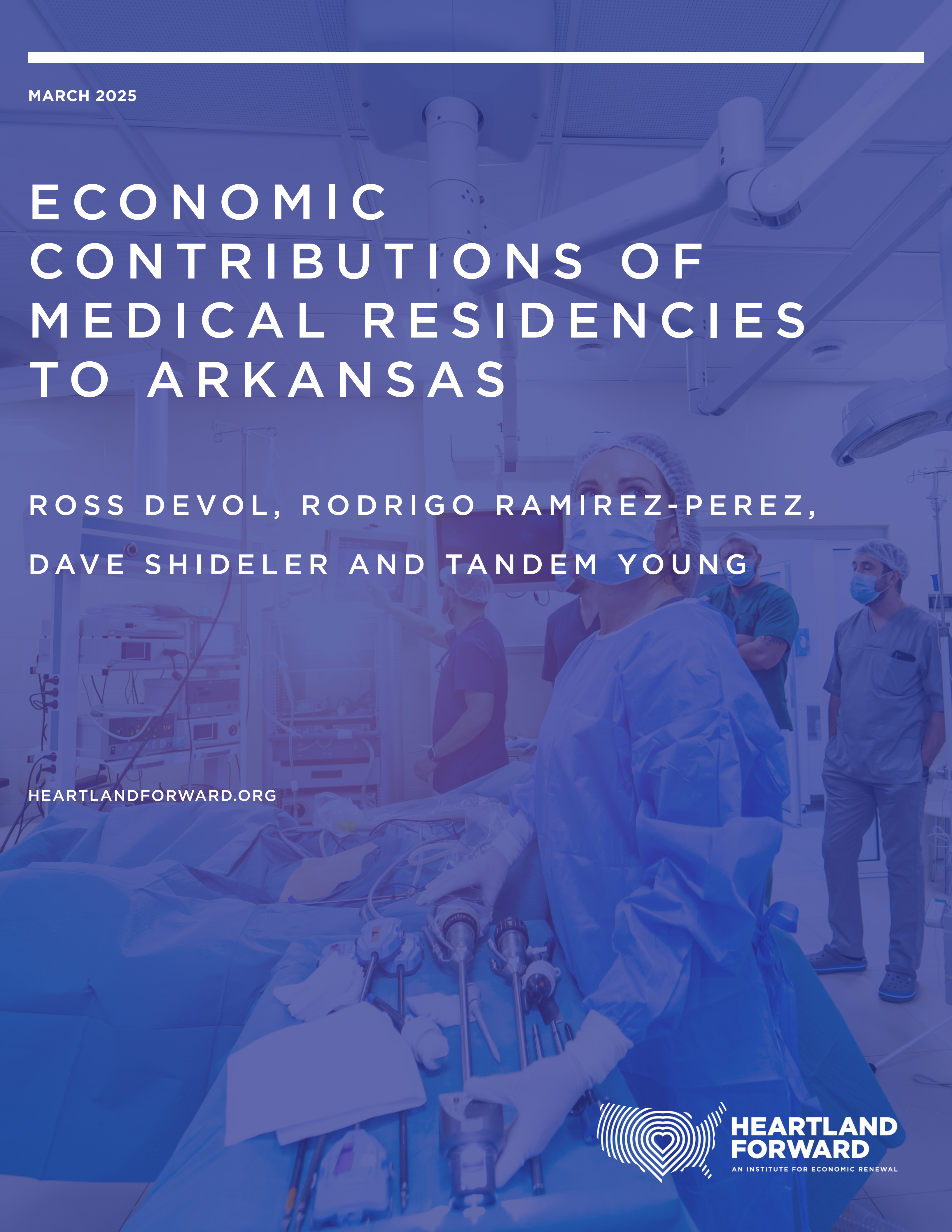


MARCH 2025

ECONOMIC CONTRIBUTIONS OF MEDICAL RESIDENCIES TO ARKANSAS

ROSS DEVOL, RODRIGO RAMIREZ-PEREZ,
DAVE SHIDELER AND TANDEM YOUNG

HEARTLANDFORWARD.ORG

HEARTLAND FORWARD
AN INSTITUTE FOR ECONOMIC RENEWAL

EXECUTIVE SUMMARY

According to Heartland Forward's estimates, gradually **adding 275 new residents over six years to the state's labor force could lead to an additional $465 million in economic activity in Arkansas**. This impact of $465 million, spread over 963 resident-years, equates to more than $482,000 per medical resident per year. Given the high average output per worker associated with medical residents, **it would take 586 workers producing at the state's average output per worker, working for six years, to generate the same level of economic activity**. According to the Center for Medicare and Medicaid Services (CMS) cost reports for 2021, the average cost per resident paid by CMS in Arkansas was approximately $115,000 annually.[1] Using this estimate, **the resulting return on investment could be over four times the initial investment**. Additional benefits are felt through output per worker, a measure of worker productivity. An additional 275 residents over 6 years could increase labor productivity by $54 on average per year due to increased access to health care as well as increased potential for health-related innovation.

INTRODUCTION

The presence of more medical professionals in an area has a number of benefits to the health and economy of a community. States with high levels of graduate medical education (GME) enjoy increased access to medical residents, which affords them a steadier labor supply for health professionals, better health outcomes for local communities, and more economic activity. Conversely, states with fewer medical residents tend to have worse health outcomes and less economic contribution from the health sector. Adding 275 new medical residents to Arkansas's residency pool by 2030 could have notable economic benefits. Medical residents, with their higher-than-average productivity, contribute to raising the state's economy through their direct labor. More importantly, though, over half of residents practice medicine within 100 miles of where they conducted their residency training,[2] so increasing the amount of active residencies in the state could result in more practicing physicians. This is why medical residents (graduate medical education) are the lifeblood of a state's health care provider system. Without sufficient residency slots, a state will incur more recruiting costs for physicians and, potentially, place the medical system itself in jeopardy. Indirectly, increasing the number of residents is likely to improve the health of the labor force, as more physicians would be available to address the population's health needs, ultimately enhancing overall workforce productivity and strengthening the physician labor supply in Arkansas. Additionally, increasing the number of medical residents also increases the likelihood of patents or other research-based outputs that could contribute to the state's economic output.

Based upon estimates obtained from our economic model, gradually **adding 275 new residents over six years to the state's labor force could lead to an additional $465 million in economic activity in Arkansas**. This impact of $465 million, spread over 963 resident-years, equates to more than $482,000 per medical resident per year. Given the high average output per worker associated with medical residents, **it would take 586 workers producing at the state's average output per worker,[3] working for six years, to generate the same level of economic activity**.

FINDINGS

According to the Center for Medicare and Medicaid Services (CMS) cost reports for 2021, the average cost per resident paid by CMS in Arkansas was approximately $115,000 annually.[4] Using this estimate, **the resulting return on investment could be over four times the initial investment**. Additional benefits are felt through output per worker, a measure of worker productivity. An additional 275 residents over 6 years could increase labor productivity by $54 on average per year due to increased access to health care as well as increased potential for health-related innovation (see Methodology section for a deeper discussion of the economic model underpinning this analysis).

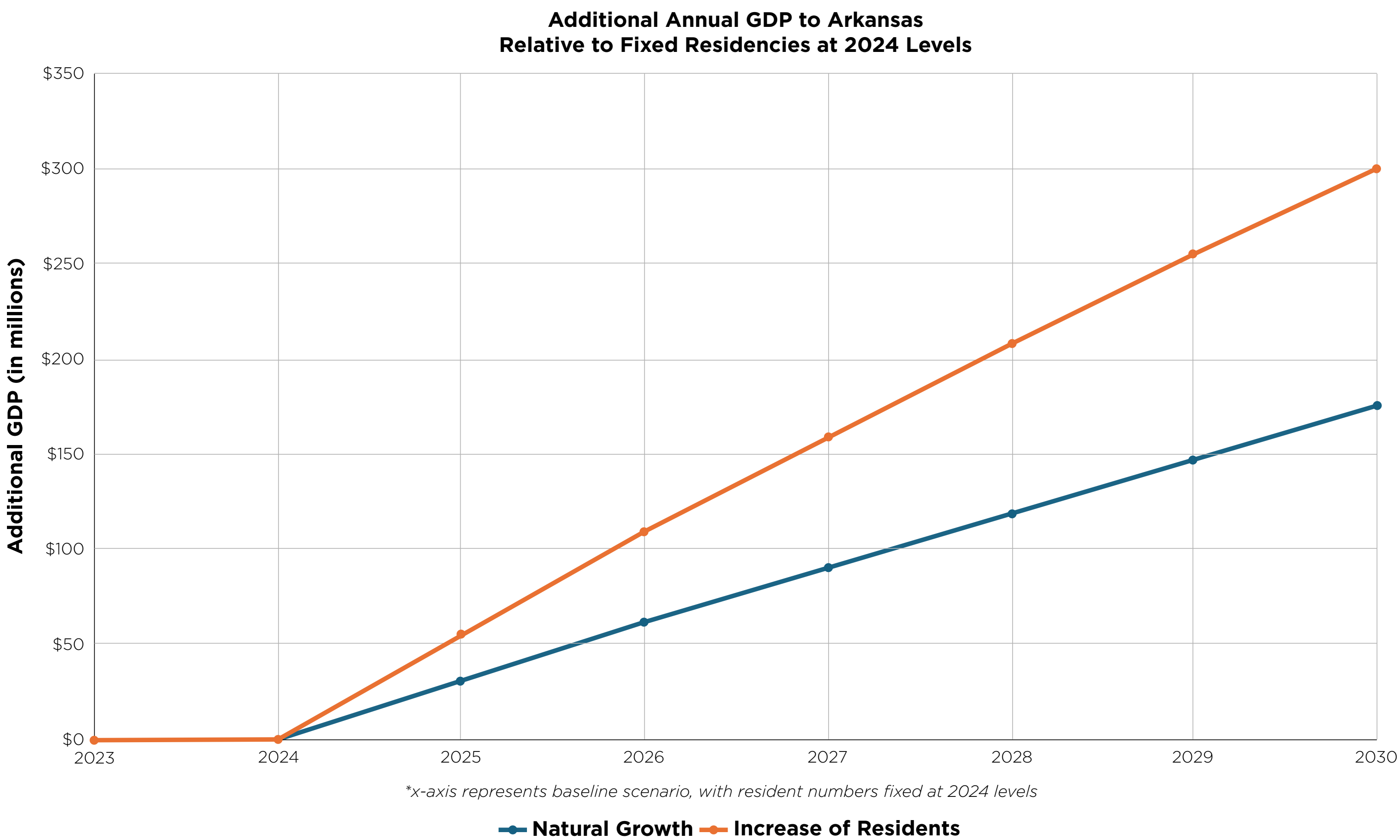
To explore the potential growth that could come from increased medical residencies in Arkansas, we assume all other activities continue their recent trends. We predict state GDP per worker, using a model consisting of medical residents per worker, medical patents per worker, health professions and clinical sciences graduates and state and year effects. We then compared three scenarios related to residency levels: 1) residencies are fixed at 2024 levels of 1,097 residents, 2) they follow a natural growth rate of adding about 52 residents annually as determined by historic trends and 3) they follow natural growth as well as see an increase of 46 residents annually for 6 years.

For these projections, we adjust the medical resident share of Arkansas' labor force by assuming the overall workforce will grow at a consistent rate for the next 5 years. Since the labor force is growing consistently over the next 5 years, we are able to evaluate the effects of having a higher proportion of the workforce who are medical residents. When medical residents remain at a fixed level, the ratio of medical residents shrinks since the overall labor force is growing. In scenario 2, where we add medical residents at the normal rate, this ratio stays roughly the same as it would otherwise, and in the final scenario, we increase the proportion of medical residents.

We compare the two outcomes of resident growth to a baseline case that assumes Arkansas's resident numbers stay stagnant at 2024 levels. Following a natural growth rate as exhibited by historical data, we estimate that GDP could reach $280.4 billion by 2030, approximately a $175.8 million increase relative to our baseline scenario. These projections also indicate that bringing the amount of medical residents in Arkansas from 2025 levels to a total of 1,687 medical residents (under scenario 3, historical growth and adding 275 additional over 6 years) could increase state GDP by $300 million in 2030 relative to baseline.

Over six years, the total economic impact from adding an additional 275 residents could be as high as $465 million more than that resulting from natural growth, and nearly $1.1 billion compared to the baseline scenario. This equates to a $200 increase in GDP per worker in the labor force. Arkansas is ranked 49th in the United States for active physicians per 100,000 people, and 37th for active primary care physicians. If we fail to make this investment, Arkansas will likely fall further behind in training medical residents, and by proxy, health care innovation and access.

Suffering more chronic conditions, Arkansans will experience higher rates of absenteeism and presenteeism (lower productivity of a worker when they show for work to avoid a sick day—this loss can be enormous). Further, Arkansans will earn lower incomes that come with less innovation in the regional economy. To realize these economic benefits, a coordinated strategy is needed to attain and retain more medical residents within the state and give those seeking residency a compelling reason to choose Arkansas.



Scenario Table Showing Residency Numbers and Associated Economic Impact

	2024	2025	2026	2027	2028	2029	2030	Total
Residents - Baseline Scenario (fixed at 2024 level)	1,097	1,097	1,097	1,097	1,097	1,097	1,097	
Natural Growth Scenario (residencies grow at 10 yr. compounded growth rate)	1,097	1,148	1,202	1,254	1,307	1,359	1,412	
New Residents Scenario (residencies grow by 46 annually above natural growth)	1,097	1,194	1,293	1,391	1,490	1,588	1,687	
Scenario (Resident-years)*	0	46	92	138	183	229	275	963
Estimated Contribution of 1 Resident per Worker	$476	$476	$476	$476	$476	$476	$476	
Projected Workforce	1,366,018	1,381,816	1,397,797	1,413,962	1,430,315	1,446,857	1,463,590	
Total Contribution from New Residents	$0	$25,710,104	$48,838,931	$69,922,593	$89,237,089	$107,115,049	$123,745,687	**$464,569,452**

* The scenario values are transformed by the natural logarithm before being multiplied by the estimated contribution per worker.

METHODOLOGY

We estimate the accumulated economic impact of medical residency on its home state as accurately as possible, given the limited amount of data that is readily available for all states. Using linear regression techniques, we construct a model of GDP per worker as a function of:

- Number of medical residents per worker[5]
- Number of medical patents issued per worker
- Health professions & clinical sciences graduates
- Year effects
- State effects

The model has a high degree of explanatory power (R-squared value of 0.965—a perfect fit would approach 1.0) when estimated on 35 years of data (1988-2023) for the 50 states and Washington, D.C.

We employed a model selection process to determine the optimal lag structure for our time series data. We know that economic output does not increase instantaneously, as it takes time for the resident to complete their training and the research discoveries to be confirmed and receive funding for commercial applications. Medical professionals finishing residency may also take time to find jobs and become highly productive in their chosen field. We hypothesized that the lag structure would follow the expected length of the average medical residency – between 3 and 5 years. The model selection algorithm determined a lag of four years to best fit the data, confirming our expectation.[6]

We used data from the American Medical Association (AMA) archived Green Books and GME reports from the Accreditation Council of Graduate Medical Education (ACGME) for totals of active medical residents by state and year.[7] This data covered 1984-1990 and 2002-2023, respectively. For years 1991-2001, we estimated the values for each state using a machine learning model (XGBoost).[8] This model was executed state-by-state, yielding a less than 7% prediction error per state.[9]

Our model uses data on patents filed under class D24 with the U.S. Patent and Trademark Office. Patents in this class reflect innovations in medical and laboratory equipment.[10] By incorporating this information, we are able to capture the unique research element of the medical discipline and its effect on state economic output. We also leverage data on health professions and clinical sciences graduates from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), denoted by Classification of Instructional Programs (CIP) code 51.[11] This allows us to account for supply-side factors in the labor market for health sciences professionals.

Examining output per worker isolates the specific effect we wish to identify without the need to control for population size or changes over time. Allowing a unique effect for each calendar year (year effects) should incorporate overall macroeconomic conditions and trends that influence economic output in all states similarly from year to year. Our model also allows each state to have a unique value (state effects) which predicts output per worker. These estimates capture the unique industrial and demographic mix, as well as the capital and educational infrastructure, of a state, that influence the economy. This estimate will reflect unique state characteristics that change slowly over time, such as overall educational attainment, labor force participation rate, and public health baselines.

ENDNOTES

[1] Center for Medicare and Medicaid Services. (n.d.). Cost reports. CMS.gov. https://www.cms.gov/data-research/statistics-trends-and-reports/cost-reports?redirect=%2FCostReports%2F02_HospitalCostReport.asp

[2] Association of American Medical Colleges. (2024). Table C4. physician retention in state of residency training, by last completed GME Specialty. AAMC. https://www.aamc.org/data-reports/students-residents/data/report-residents/2024/table-c4-physician-retention-state-residency-training-last-completed-gme

[3] The average output per worker in Arkansas for 2023 was $132,262.

[4] Center for Medicare and Medicaid Services. (n.d.). Cost reports. CMS.gov. https://www.cms.gov/data-research/statistics-trends-and-reports/cost-reports?redirect=%2FCostReports%2F02_HospitalCostReport.asp

[5] Natural log of this variable used in estimation to compress the range of values.

[6] Optimal model was determined based on minimization of the Akaike information criterion (AIC).

[7] https://www.acgme.org/about/publications-and-resources/ama-green-books/, https://apps.acgme-i.org/ads/Public/Reports/Report/13

[8] For more information on XGBoost, see https://xgboost.readthedocs.io/en/stable/

[9] Models were run state-by-state to promote stability and accuracy. Normalized root mean squared error (RMSE) values were below 7%, with the exception of Missouri (11.7%), Montana (29.9%), Wyoming (16.7%), and Idaho (25.3%). Several of these states have low resident counts prior to 1990, leaving our model to rely heavily on post-2002 data for forecasting

[10] https://www.uspto.gov/web/patents/classification/uspcd24/defsd24.htm

[11] https://nces.ed.gov/ipeds, https://nces.ed.gov/ipeds/cipcode/cipdetail.aspx?y=56&cipid=91026