ENGINES OF OPPORTUNITY

HOW EDS AND MEDS INSTITUTIONS CAN BECOME MORE POWERFUL DRIVERS OF PROSPERITY IN AMERICA'S CITIES

Blueprint for Opportunity Series
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The Blueprint for Opportunity series advances a policy agenda for improving economic mobility to help Americans flourish. It focuses on strengthening America's cities in their vital role as engines of upward mobility. Cities and neighborhoods make a powerful difference to people's opportunities, and the local level is where most of the policy energy is in the United States today. America has numerous metro areas that score relatively high as cities of opportunity, but the Nation needs more.

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EXECUTIVE SUMMARY

Colleges, universities, and academic medical centers play a vital role as engines of learning, innovation, prosperity, and opportunity in America's cities. But they face growing tectonic stresses: declining public confidence in their programs and value propositions, weak completion rates, overly narrow and incremental research, threats to free inquiry, and unsustainable financial models.

America needs thriving higher education and academic medical institutions – "eds and meds" institutions – in cities across the country, which means the eds and meds sector needs to change in significant ways.

- Eds and meds institutions that perform best as engines of opportunity will be those that engage closely with surrounding communities to promote innovation ecosystems, develop talent, and build opportunity-rich cities. Success will demand "blue-sky" research addressing society's greatest challenges and recommitment to free inquiry and objective research. For most institutions, it will also require moving to a more sustainable financial path.

- Federal, state, and local policymakers plus philanthropic funders can best amplify the economic impact of eds and meds institutions by supporting innovative research, education, and placemaking strategies but also ensuring more accountability and competition.

This report explores which cities are performing best in building effective innovation ecosystems and talent pipelines. It presents new rankings of U.S. metro areas for university innovation and community college outcomes. It includes rankings of 177 leading universities and other research institutions for innovation impact. And it includes a first-of-its-kind dataset on the performance of one of the fastest-growing strategies in the eds and meds sector: urban innovation districts.

For leaders of eds and meds institutions, this report highlights numerous talent, innovation, and placemaking strategies high-performing institutions are pursuing to promote local prosperity and opportunity – and the results they're seeing.

For policymakers and philanthropic funders, this report makes a case for several policy priorities:

- Restore federal investment in research and development (R&D) to 1% of GDP to sustain America's leadership in basic science and innovation.
- Redirect funding streams to promote transformational research, knowledge transfer, and innovative education-to-career pathways.
- Step up investment in local and regional innovation ecosystems.
- Require more disclosure of student outcomes data, including for non-credit programs, as well as innovation impact data while ensuring transparency and accountability.
- Reform immigration law: More visas and looser work rules for foreign STEM students.
- Require eds and meds institutions to uphold free inquiry and speech for faculty and students: no suppression of or retaliation for ideologically unorthodox views.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Colleges, universities, and academic medical centers play a vital role as engines of learning, innovation, prosperity, and opportunity in America's cities. "Eds and meds" institutions will become even more essential to local economies as the world grows ever more dependent on complex knowledge and technology.

America's eds and meds institutions are part of the way through a long evolution – away from serving a narrow elite in an "ivory tower" setting and toward comprehensive engagement with local communities, businesses, and people. Changes both within eds and meds institutions and in the wider economy are causing tectonic stresses for many institutions and reputational challenges for the whole sector.

The institutions that most effectively drive economic development in the future will be ones that adapt rapidly to 21st century conditions, create pervasive cultures of innovation within their walls, and build deep external engagement with surrounding communities. The cities that prevail in achieving inclusive growth, in turn, will be places that harness the power and promise of great eds and meds institutions.

This report, fourth in the George W. Bush Institute-SMU Economic Growth Initiative's Blueprint for Opportunity series, addresses four questions:[*]

- How do eds and meds contribute to prosperity and opportunity in U.S. cities?
- Why and in what ways are eds and meds under stress today?
- How are eds and meds evolving to become more powerful engines of prosperity?
- How can policymakers and funders amplify the economic impact of eds and meds?

How eds and meds institutions contribute to prosperity in America's cities

Colleges, universities, and academic medical centers are among the preeminent anchor institutions in many cities – that is, large public or nonprofit institutions that provide significant local employment, have a substantial stake in their city's vitality, and are unlikely to move away.[1] Many eds and meds institutions have built increasingly large economic and physical footprints in their cities as demand for their services and the scale of their operations have grown.

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[*] As this report focuses primarily on the talent, innovation, and community engagement activities of America's colleges and universities, it addresses neither the vast topic of federal student finance nor the fraught question of race-based affirmative action in admissions. As for "meds" institutions, this report focuses mostly on academic medical centers and not the enormous range of hospitals and health care facilities that don't have a research or teaching mission, since patient care is not a principal focus of the report.

Academic medical centers take various institutional forms. Most are medical schools and affiliated hospitals that operate as constituent units of full-service universities. Some are large teaching hospitals that partner with a local medical school but operate independently of the medical school's parent university. Some are hospital systems that operate their own schools of medicine and sometimes other health care professions, like the Mayo Clinic. And a few are independent medical research institutes that operate neither degree programs nor significant patient care facilities, like the Whitehead Institute for Biomedical Research.

Cities with strong portfolios of knowledge-generating institutions tend to have higher income levels, lower poverty rates, and better upward mobility than other cities, we show in Section II, with new Bush Institute-SMU data on how eds and meds help create prosperity in America's cities. Eds and meds promote local prosperity and opportunity through three main channels:

- **Innovation:** Cities with robust eds and meds rank ahead of other cities for innovation, our data show. Knowledge-generating anchor institutions play leading roles in basic science, which fuels applied R&D activities. Successful local innovation ecosystems enhance opportunity for residents of all educational attainment levels.

- **Place:** Eds and meds institutions help shape their surrounding cities through real estate and community engagement activities. Effective placemaking attracts people and businesses and augments their productivity, advancing prosperity and opportunity for all residents.

- **Talent:** Eds and meds institutions help develop people's skills and cognitive abilities, preparing them to flourish in 21st century workplaces. Cities with strong eds and meds portfolios outperform other cities for associate and bachelor's degree attainment levels, leading to higher incomes and upward mobility. They also perform better than other cities in training people for in-demand occupations like nursing, information technology, and building trades.

Why and how eds and meds institutions are under stress today

Eds and meds are more vital to America's cities than they've ever been, but they also face unprecedented challenges that threaten their role as local economic anchors, as Section II explores. Tectonic stresses confronting the higher education sector include the following:

- Overly narrow and incremental research activities.
- Escalating threats to freedom of inquiry and objective research.
- Physical, intellectual, and cultural separation from the surrounding society.
- Growing questions about the economic relevance and rigor of their academic programs.
- Persistently low completion rates for some groups of students at most institutions.
- Outdated accreditation systems that limit innovation and competition.
- Unsustainable financial models.

These challenges have sparked rising doubts about the value proposition of higher education, declining public confidence in the sector, and falling enrollment. More and more institutions face financial distress. Experts within and outside the higher education community are increasingly calling for deep reforms.

Academic medical centers, meanwhile, face their own challenges, also involving separation from the wider communities in which they operate and financial sustainability.

Today's eds and meds institutions are products of 150 years of evolution in the higher education and health care sectors. The operating models that developed over this era helped make America's leading colleges, universities, and medical centers into towering success stories, but they face growing obsolescence in the changing 21st century environment. The good news: U.S. eds and meds institutions have a rich history of successful adaptation and reform, and they're continuing to evolve today.

How eds and meds institutions are evolving to become more powerful drivers of prosperity

Innovation: We've ranked 177 eds and meds institutions for innovation impact, updating rankings we published in a 2020 report. We've also ranked America's 100 largest metros as a whole for the innovation impact of their knowledge-generating institutions. Here's what our rankings show:

- The top-ranking institutions for overall innovation impact are the University of California system, the University of Texas System, the Massachusetts Institute of Technology, the University of Michigan, and the University of Washington, reflecting top-tier research and large research spending.

- Leading institutions for innovation impact productivity – those that turn research dollars into large innovation impact – include the California Institute of Technology, the University of Florida, Arizona State University, Carnegie Mellon University, Brigham Young University, the University of Arkansas for Medical Sciences, and the Whitehead Institute.

- The best-performing large metros for university innovation impact per capita are Durham-Chapel Hill, North Carolina; Madison, Wisconsin; Boston; Provo, Utah; and New Haven, Connecticut. The leading metros for overall innovation impact are Boston, New York, Los Angeles, Philadelphia, and San Francisco.

Faculty quality and top-notch technology commercialization efforts increase productivity, while large dependence on industry research funding reduces it, we show in Section IV. Many institutions are evolving to maximize the real-world innovation impact of their work:

- Promoting blue-sky, socially transformational research.
- Instilling institutionwide cultures of innovation and entrepreneurship.
- Optimizing technology commercialization operations.
- Supporting local innovation and entrepreneurship ecosystems.
- Partnering with local nonacademic organizations on research for social good.
- Ensuring freedom of inquiry.

Place: Eds and meds institutions are working with local partners on placemaking initiatives in their surrounding cities. These initiatives include:

- Building urban innovation districts.
- Revitalizing downtowns.
- Engaging in underinvested neighborhoods.
- Promoting new and renovated housing for residents, including employees.
- Strengthening physical connections between campuses and surrounding cities.

America's innovation districts – some of which are less than 10 years old – have been extremely successful in attracting high-skilled people, raising income levels, and creating jobs, we show with first-of-its-kind data in Section V. Among large, well-established districts, the most successful on these metrics are Atlanta's Tech Square, Philadelphia's University City, St. Louis's Cortex Innovation Community, Kendall Square in Cambridge, Massachusetts, and the University of Utah Research Park in Salt Lake City.

The districts in our dataset have also been relatively successful in stimulating housing development and avoiding displacement of nearby residents. Atlanta's Tech Square, Madison's University Research Park, and Raleigh's North Carolina State Centennial Campus are outperformers in these respects.

Talent: Section VI presents new rankings of America's 100 largest metropolitan areas for community and technical college outcomes, as well as rankings for overall educational attainment levels and for filling workplace needs in seven in-demand occupations. Highlights from the rankings:

- The Provo metro ranks first for community college outcomes. The top 15 performers include seven California metros plus Phoenix; Salt Lake City; Des Moines, Iowa; Greensboro, North Carolina; Madison; and San Antonio and El Paso, Texas.

- The top performing metros for filling in-demand workplace needs are first-ranked Little Rock, Arkansas; Madison; Salt Lake City; Des Moines; Washington; Baltimore; Oklahoma City and Tulsa, Oklahoma; Baton Rouge, Louisiana; and Durham-Chapel Hill, North Carolina.

Colleges and universities are pursuing a wide range of measures to engage more closely with other parts of the talent development ecosystem, improve outcomes, and become more effective engines of upward mobility, we show in Section VI. These include:

- Improving pathways from high school through college to living-wage careers.
- More technical programs leading to specific occupations which also address employer needs.
- More employer-recognized certifications and other credentials embedded in programs.
- Increasing capacity, especially in high-demand fields.
- Restructuring programs and processes for student success.
- More flexible formats: Online programs, shorter degree programs, and apprenticeships.
- Better advising and holistic support for prospective and current students.
- Better physical spaces.
- Reducing operating costs and prices.

How policymakers can amplify the impact of eds and meds institutions

Federal policy: Congress should reestablish its longstanding commitment to American preeminence in science, innovation, and higher education, we argue in Section VII. This means strengthening America's eds and meds institutions and helping them become more powerful engines of local and regional prosperity. Congress should:

- Increase basic research funding significantly and promote blue-sky, transformational science.
- Step up investment in regional innovation ecosystems.
- Require more outcomes data from colleges and universities, including for noncredit programs.
- Reform immigration law: Provide more visas and reform work rules for foreign STEM students.

State policy: States can best amplify the impact of strong eds and meds institutions by modernizing higher education funding and regulatory policies to promote innovation, healthy competition, and greater focus on student outcomes. State legislatures and governors should:

- Increase funding emphasis on research excellence, technology commercialization, innovative education-to-career pathways, and student outcomes.
- Strengthen state data systems to document program outcomes and support better advisement.
- Require eds and meds institutions to uphold free inquiry and speech for faculty and students.

Local policy: Localities have deeper place-based knowledge and relationships than higher levels of government. Localities should:

- Use land-use authority to help local eds and meds repurpose real estate and develop new activities like innovation districts.
- Invest in quality-of-life amenities to support innovative placemaking initiatives.
- Act as a convener for local initiatives involving eds and meds institutions and other stakeholders.

Philanthropy: Funders should aim to strengthen local eds and meds institutions, education-to-career pathways, holistic student support programs, technology commercialization efforts, new data tools, and placemaking initiatives like inclusive innovation districts and downtown revitalizations.

II. EDS & MEDS INSTITUTIONS: VITAL ANCHORS IN LOCAL ECONOMIES

Eds and meds institutions and America's cities: What the data show

Colleges, universities, and hospitals have contributed to the success of great commercial cities for centuries. Cities like Bologna (in modern-day Italy) and Paris rose to prominence in part by establishing some of Europe's first universities.[2]

In the early years of the American republic, rapidly growing cities of the Eastern seaboard from Boston to Philadelphia were among the world's leaders in establishing colleges and broad-based primary education. Aggressive investment in higher education and innovation across Northern cities during the 19th century helps explain why the Northeast and Upper Midwest became the second place in the world after Britain to experience an industrial takeoff. It also helps explain why average incomes in the wealthiest Northern cities were four times higher by 1900 than those in the South, which had built far fewer schools and universities.[3]

Vast scale

Eds and meds play a more central role in cities today than ever before. First of all, they are far larger than in the past. **America's roughly 3,500 colleges and universities[*] employ approximately 3 million people, amounting to 2% of the nation's working population**.[4] **America's 155 M.D.-degree- granting medical schools, 38 osteopathic medical schools, and affiliated teaching hospitals[**] employ about 3 million people as well**.[5] (There is considerable overlap between the two employment figures, since most medical schools and many teaching hospitals are controlled by universities.) Other hospitals employ an additional 5 million American workers.[6]

The **University of Pennsylvania** and its affiliated medical center constitute by far the largest employer in Philadelphia, employing five times more people than the second largest employer. **Mass General Brigham** hospital system is the largest employer in the state of Massachusetts.[7]

Eds and meds provide essential education and health care services to their community. Colleges and universities had 17.2 million enrolled students as of spring 2023, with 13.1 million in four-year institutions and 4.1 million in community and technical colleges.[8]

Academic medical centers operate all but one of the nation's 48 comprehensive cancer centers, 71% of its Level I trauma centers, 40% of its uncompensated health care, and about 25% of all hospital services.[9] Longer lifespans, increasingly complex treatment options, and the aging of the baby boom generation will inevitably drive significant growth in the demand for sophisticated health care services.

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[*] This figure excludes institutions that grant graduate degrees but not undergraduate degrees.
[**] The study on which we base these estimates includes 258 teaching hospitals. By wider definitions, there are approximately 400 teaching hospitals in the United States.

Attracting talent

Eds and meds contribute to the quality-of-life amenities of their city by directly offering services like lectures, museums, wellness facilities, spectator sports, and health care services. Additionally, they spur the restaurant and retail activity that makes neighborhoods with a college-town vibe attractive to people of all ages.

Graduates of four-year institutions disproportionately stay in town after graduation, contributing to local economies. Fully 24% of all living graduates of Washington University in St. Louis, or 37,000 people, currently live in the St. Louis metro area, though more than 90% of the university's students come from out of state.[10] More than half of Southern Methodist University bachelor's degree graduates stay in the Dallas-Fort Worth area after graduation.[11] If a state increases its output of college graduates, approximately 30% of these graduates will still be in the state 15 years later, a 2008 Brookings Institution study on eds and meds showed.[12]

The quality and scale of local eds and meds institutions are also predictive of immigration rates, reflecting the outsized role of universities in attracting high-skilled immigrants and helping them thrive, as the Bush Institute-SMU Economic Growth Initiative documents in a 2022 report.[13]

Strong eds and meds, moreover, make local economies more resilient in the face of short-term shocks. The Boston and Philadelphia economies outperformed most other metros during and after the global financial crisis of 2007-2009 in significant part due to their top-tier eds and meds institutions.[14]

General benefits

Cities with strong eds and meds see greater prosperity and opportunity than other cities, all else equal, based on a new Bush Institute-SMU analysis of multiple indicators.

We've calculated a measure of the total "innovation impact" of the portfolio of knowledge-generating institutions in each of America's 385 metro areas: our "BushEds" indicator. We calculate a composite score for innovation impact for 177 universities, based on innovation outputs like patents, technology licenses, licensing income, startup companies, STEM graduates, and citations in other researchers' academic papers and patents, as we describe in greater detail in Section IV on "Innovation" and in Appendix 1. We also include a new ranking of U.S. universities for innovation impact. We add up scores for all the universities in each metro area to arrive at our BushEds measure of metrowide university innovation impact. We also calculate "BushEds per capita" scores for each metro, dividing our BushEds scores by metro-area populations to gauge the per-resident intensity of university innovation-focused activities in each U.S. metro area.

We've additionally calculated measures of the aggregate portfolio of research-oriented medical institutions in each metro: "BushMeds" and "BushMeds per capita." In this case, we calculate composite measures of overall scale for all U.S. hospitals using American Hospital Association data on beds, patient discharges, and revenues, then adjust each hospital's scale score based on a composite "quality" measure derived from *U.S. News & World Report* rankings of hospitals within 16 medical specialties. (See Section IV and Appendix 1 for detailed descriptions of our sources and methods.) We add up quality-adjusted scores for all the hospitals in each metro to arrive at metro-area BushMeds scores, and we divide these scores by metro-area populations to generate BushMeds per-capita scores.

And we've calculated a composite score measuring community and technical college outcomes—enrollment, retention, and graduation rates, as well as median earnings levels for graduates—for each of the nation's 100 largest metros.[*]

Each of these scores is highly predictive of how cities perform in economic terms.

- **Median household income:** Higher eds and meds scores are associated with higher income levels. Our BushEds, BushMeds, and community college measures are each predictive of median incomes in America's 100 largest metros, our simple regression analysis shows.[**]

  Do stronger eds and meds make cities more prosperous, or do cities that are wealthy for other reasons build better eds and meds institutions since they can afford them? The evidence overwhelmingly supports the former. We've calculated the age of the leading university in each metro area. This turns out to be correlated with BushEds per capita scores and highly predictive of metro-area incomes. University age is clearly not a result of current prosperity, since many of these universities were established 100 or more years ago. Universities came first, and the prosperity followed later. On the other hand, metro-area population size, which is highly correlated with median income, doesn't predict BushEds per capita scores. A similar analysis suggests better-than-average community college outcomes cause higher incomes, not the other way around.[***]

- **Upward mobility:** Metro areas that perform well for eds and meds innovation and community college outcomes based on our BushEds, BushMeds, and community college measures enjoy higher-than-average upward mobility for their residents. We assess upward mobility via a widely cited indicator developed by Harvard University economist Raj Chetty and colleagues, which is based on the adult incomes of people growing up in low-income families in each metro.[15]

- **Social capital:** Our BushEds and BushMeds scores are strongly predictive of metro-area social capital – that is, the trust, connectedness, and civic engagement that make a community tick. We measure this via an index developed by the U.S. Congress Joint Economic Committee (JEC).[16] Again, metro areas with older leading universities tend to have higher-than-average BushEds and

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[*] See Section IV for further analysis of our community college outcomes measure, Section V for analysis of our BushEds and BushMeds measures, and Appendix 1 for full explanations of how we computed each measure.

[**] See regression results in the online Data Appendix to this report.

[***] See regression results in the online Data Appendix to this report. For purposes of our "university age" metric, we define the "leading" university in each metro as the one with the highest innovation impact score, based on the rankings in Section IV. We make on exception, defining Harvard University as the "leading" university in the Boston metro, even though Harvard has a modestly lower innovation impact score than MIT, in view of Harvard's unique position among America's universities. Our "university age" metric is also highly predictive of bachelor's degree attainment rates, while metro-area population isn't predictive of BushEds scores. This implies that the quality of institutions give rise to educational attainment rates, rather than the other way around. Regarding community college outcome scores: Enrollment and retention rates – the two components of our composite outcome scores that are least likely to be caused by overall income levels – are nonetheless highly predictive of median household income. On the other hand, median income of residents aged 45–64, which is strongly correlated with overall incomes, isn't predictive of community college enrollment or of the relative incomes of community college graduates – which means overall income levels probably don't account for differences in community college outcomes.

social capital scores today, suggesting that thriving universities give rise to robust social capital rather than the other way around. Cities with strong social capital outperform other cities for upward mobility and other measures of opportunity.[*]

Many other studies confirm the powerful effects of strong eds and meds on local income levels. After Sweden launched a program to build new research universities in several cities in the 1970s, cities hosting a new university saw significantly higher income growth than comparable cities.[17] Likewise, a 2018 UNESCO study of 78 countries found that regions with above-average growth in university activities from 1950 to 2010 achieved faster subsequent economic growth than other areas.[18]

Urban turnarounds

Eds and meds have played a pivotal role in many urban turnaround stories, particularly among America's Midwest and Mid-Atlantic cities.

Pittsburgh is one of America's best examples of an emerging turnaround centered on knowledge-generating institutions. After the city lost one-third of its population between 1970 and 1990, **Carnegie Mellon University**, the **University of Pittsburgh**, and the city's community colleges helped lead a series of public-private-nonprofit initiatives to refocus the local economy on knowledge-centric activities in place of Pittsburgh's declining steel industry. Carnegie Mellon has become one of the world's leading centers for robotics R&D, while the University of Pittsburgh was the eighth-largest university recipient of federal life science research funding in 2020. Pittsburgh ranks seventh among America's top 100 metros on our BushEds per capita metric and 13th on our BushMeds per capita score.[**]

Pittsburgh's universities and their community partners have developed a thriving innovation district; launched nationally respected seed-stage investment programs; increased the share of graduates who stay in Pittsburgh after graduation; convinced Apple, Alphabet, Amazon, Intel, Uber, and Thermo Fisher to build research facilities; and sparked a substantial building boom near the city's innovation district. The Pittsburgh metro's dependence on basic materials and manufacturing is now lower than U.S. averages.[19]

Philadelphia represents another emerging turnaround story. The **University of Pennsylvania**, **Drexel University**, and several community organization partners launched the West Philadelphia Initiatives in the early 1990s to revitalize one of the most troubled areas of the city. The effort has generated more than 5,000 jobs, higher incomes for residents, new investments in neighborhood schools, 1,000-plus housing units, almost 4,000 new trees, sharply lower crime rates, and improved quality of life.

Philadelphia's eds and meds also led the way in building the **University City District** and **uCity Square**, one of America's leading innovation districts, starting in 1997. Philadelphia has become one of the dozen top startup markets, according to Startup Genome's 2022 Global Startup Ecosystem Report. It ranked third among large markets for growth in life science lab and office real estate in 2022 and first for new office space taken up by biotechnology companies, based on Philadelphia ranks first among America's 10 largest metros on our BushEds per capita measure and second on our BushMeds per capita score, after New York[20].[***]

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[*] See regression results in the online Data Appendix to this report.
[**] See full rankings in Tables H and K in Appendix 2.
[***] See full rankings in Tables H and K in Appendix 2.

Eds and meds have figured prominently in the revival of many other metro-area economies, including West Lafayette, Indiana; Grand Rapids, Michigan; Winston-Salem, North Carolina; and Birmingham, Alabama. According to urbanists Bruce Katz and Jeremy Nowak, “There are few examples of urban revitalization that do not have university and medical centers playing some role.”[21]

Boomtowns

Rapid growth in eds and meds institutions has helped fuel economic booms in some of America’s fastest growing metros – cities that were generally late to develop large knowledge-generating institutions but have quickly been catching up to older cities with longer-established universities and medical centers. Examples include **Arizona State University** in Phoenix, the **University of South Florida** in Tampa, the **University of Houston**, and the **University of Texas at Dallas**. The booming Austin, Houston, Nashville, Phoenix, Raleigh, and Tampa metros all rank above average on our BushEds per capita measure despite late starts, while Dallas-Fort Worth ranks slightly below average.

New suburban boomtowns, moreover, are racing to create eds and meds institutions to help anchor their economies. In the Dallas-Fort Worth area, Frisco recently opened a **University of North Texas** branch campus with ultimate capacity for 9,000 students. Neighboring Prosper is becoming a major hub for pediatric medicine with large new facilities operated by Fort Worth-based **Cook Children’s Medical Center** and Dallas-based **Children’s Health**.

Thriving college towns

The economic benefits of nearby eds and meds are also visible in the extraordinary performance of America’s specialized college towns. We’ve identified 30 metro areas, all smaller than the nation’s 100 largest metros, as college towns, based on their populations of postsecondary students.[*] Unlike most smaller metros, college towns have outperformed the average U.S. metro in attracting both net in-migration from elsewhere in the United States and immigration from abroad since 2010.[**] They’ve also outperformed most metros for housing development, social capital, upward mobility, and income growth for their Black, Hispanic, and Asian populations as well as for people with an associate degree or some college.[22]

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[*] Our list of “college towns” consists of Ames, Iowa; Ann Arbor, Michigan; Athens, Georgia; Auburn, Alabama; Blacksburg, Virginia; Bloomington, Illinois; Bloomington, Indiana; Boulder, Colorado; Burlington, Vermont; Champaign-Urbana, Illinois; Charlottesville, Virginia; Chico, California; College Station, Texas; Columbia, Missouri; Fort Collins, Colorado; Gainesville, Florida; Greenville, North Carolina; Harrisonburg, Virginia; Iowa City, Iowa; Ithaca, New York; Lafayette-West Lafayette, Indiana; Lansing, Michigan; Lawrence, Kansas; Lubbock, Texas; Manhattan, Kansas; San Luis Obispo-Paso Robles, California; Santa Cruz, California; Santa Maria-Santa Barbara, California; State College, Pennsylvania; and Tallahassee, Florida.

[**] We define net domestic inbound migration rates as absolute net domestic inbound migration as a share of 2010 population and net immigration.

A case study from some of America's most disadvantaged places

Thirty-five tribal colleges and universities (TCUs) serve students living on America's Native American reservations. Fully 76% of students are from low-income families, compared with 20% at non-TCU institutions. Reservations with a TCU have higher high school graduation rates, entrepreneurship rates, and income levels than other reservations, according to a 2021 U.S. Minority Business Development Agency report.[23]

Fueling innovation

Metro areas with strong eds and meds and high educational attainment levels outperform other metros on multiple measures of innovation.

- **Innovation rank:** Our BushEds scores as well as metro-area educational attainment levels are strongly predictive of how metros rank on a composite innovation ranking we've created.[*]
- **Private-sector R&D investment:** Total metro-area university research spending as a share of local GDP is strongly associated with total business R&D spending as a share of local GDP. The evidence argues that university research spending influences business spending rather than the other way around.[**]
- **Venture capital investment:** Metros with high university research spending as a share of local GDP tend to see more venture capital investment in local companies per person than other cities.
- **Life science jobs:** Metros with high university research investment tend to have more life science jobs than other metros as a share of their population.[***]

Other studies confirm that strong eds and meds institutions are predictive of local business R&D investment, innovation, and growth in cities around the world.[24]

Strong eds and meds institutions promote private-sector innovation because business R&D often depends on basic research conducted at universities and medical centers. More than 73% of papers cited in private-sector patents originate from research at public or nonprofit eds and meds institutions.[25]

Private-sector innovation is becoming more dependent on eds and meds research than in the past, as universities and academic medical institutions conduct more and more of the nation's basic research.

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[*] We discuss relationships between Eds and meds institutions, educational attainment levels, and metro-area innovation in more detail in Section IV on "Innovation." See Appendix 1 for an explanation of our composite innovation ranks; Appendix 2, Table M for various innovation-related metrics at the metro-area level; and the online Data Appendix to this report for regression results we refer to here.

[**] The age of a metro's leading university, which is correlated with our BushEds measures, is highly predictive of business R&D spending. But variables strongly correlated with business R&D spending – shares of employment in the information sector and the professional, scientific, and management sector – aren't predictive of university research spending. See regression results in the online Data Appendix to this report.

[***] See correlations and regression results in the online Data Appendix to this report.

Private industry conducts 15% of U.S. basic science research today, down from 30% in the 1950s, based on National Center for Science and Engineering Statistics data. The private sector's falling role in science reflects the decline or closure of once-great industry research centers like Bell Labs, Xerox Park, and DuPont Central Research and Development. Nonfederal eds and meds institutions, meanwhile, now do about half of U.S. basic research, up from 35% in the 1950s.[26]

University research is also more innovative than private-sector R&D by some measures. Universities submit four times more patent applications per R&D dollar than private firms.[27] Industry innovation may also be declining because large companies employ a growing share of inventors and may constrain their productivity for bureaucratic reasons, according to a 2023 study of more than 750,000 inventors by U.S. Census Bureau and University of Chicago researchers.[28]

Ideas spread best at short distance

Technology spillovers from university research to the private sector disproportionately occur locally, which helps to explain the strong links between university research and local innovation.[29] Citations of a university's work in both patents and other academic papers are more likely to come from other researchers or companies located relatively close to the university.[30] One reason for this is that innovation often results from intense exchanges of knowledge and ideas among researchers, which seem to work best through face-to-face interactions.[31]

New ideas, moreover, tend to emerge in highly concentrated local places and then slowly diffuse outward, according to recent research by Stanford University economist Nicholas Bloom and colleagues. High-skill jobs resulting from new ideas tend to be concentrated in the locality where the innovation originates, while associated lower-skilled jobs spread more widely.[32]

Growing commitment

Eds and meds institutions have dramatically stepped up research activities in STEM fields in the decades since Congress passed the Bayh-Dole Act of 1980, enabling universities that receive federal research grants to assert intellectual property (IP) rights over inventions and license IP to for-profit partners for commercialization. This commitment is visible in the proliferation of science and engineering facilities across university campuses. **Total research investment across the sector amounted to $84 billion in 2021, up more than 30% over the previous 30 years in inflation-adjusted terms**. Since 1960, university research spending has more than quadrupled as a share of U.S. GDP.[33]

Eds and meds institutions have also realized tremendous growth in innovation outputs.

- **Patents:** Total patents issued each year to U.S. universities and their faculty rose more than fourfold from 1980 to 2021, growing as a share of all U.S. patents issued to American inventors.

- **Spinout companies:** The number of spinout companies launched by eds and meds institutions increased to more than 1,000 per annum over the five years from 2016 to 2020 from about 200 per year in the early 1990s and virtually zero in the 1970s.

- **License income:** Income to universities from licensed intellectual property rose to more than $3 billion by 2018 from roughly $200 million in 1990, a sixfold increase adjusted for inflation.[34]

University research has given rise to many products with significant societal benefits, including the following:

- Automobile seatbelts (Cornell University).
- Global Positioning System technology (MIT).
- Beta-carotene-rich golden rice (Louisiana State University).
- Fluoride toothpaste (Indiana University).
- Factor IX hemophilia drugs (University of Washington).
- Cancer drug Cisplatin (Michigan State University).
- HIV/AIDS drugs Zerit and Emtriva (Yale University and Emory University).
- Calcium supplement Citracal (University of Texas Southwestern Medical Center).
- First gene therapy for Duchenne muscular dystrophy (Nationwide Children's Hospital).
- Pacemakers (University of Minnesota).
- Genome sequencing techniques (Tufts University).
- The spreadsheet (Harvard University).
- Web browsers (University of Illinois at Urbana-Champaign).
- The Google search engine (Stanford University)
- Lithium-ion batteries for electric vehicles (Stanford, MIT, University of Texas at Austin).

COVID-19 vaccines based on messenger RNA technology – one of humanity's most remarkable scientific achievements – were the result of research conducted over several decades at the University of Pennsylvania, the University of British Columbia, and the University of Mainz in Germany.[35]

Why local innovation matters

Cities that rank high for innovation tend to enjoy relatively high incomes across their working population, our analysis shows.[*]

Innovation – creating new products and figuring out how to deliver existing ones more efficiently – is the foundation for prosperity and opportunity in cities. Innovation necessarily precedes and enables the novel divisions of labor and exports to other places on which local economic growth depends, urbanist Jane Jacobs wrote in her classic book *The Economy of Cities*. If cities aren't innovating, they're dying.[36]

Homegrown innovation and entrepreneurship are key drivers of local prosperity, since imitation of technologies developed elsewhere is generally a losing strategy. Approximately 80% of job growth in cities, moreover, comes from existing businesses headquartered there.[37]

[*] See regression results in the online Data Appendix to this report.

Shaping the built environment: Place

Eds and meds institutions powerfully influence the built environment of their surrounding cities, often to a far greater extent than they realize.

Large universities typically have very large physical footprints in their hometowns. Many institutions have campuses that take up more than 500 acres. A few exceed 1,000 acres. The main campuses of Purdue University and the University of Michigan comprise more than 20,000 acres. Hospitals generally have smaller footprints, but academic medical center campuses still often amount to 100 to 200 acres apiece. In comparison, the central business districts of Houston, Chicago, Seattle, and San Francisco take up 1,200 acres, 1,000 acres, 800, and 300 acres, respectively.

Many eds and meds institutions, moreover, are actively engaged in acquiring and developing additional real estate, increasing their scale still further.

Decisions on land use, new development, and engagement in neighborhoods beyond traditional campuses can have profound effects on how neighborhoods evolve. Key questions include the following:

- Does new development reinforce sharp separations between campus and the surrounding city, or does it build physical connections between them?
- Do institutions work effectively with local partners on collaborative placemaking initiatives like building innovation districts, revitalizing downtowns, and investing in disadvantaged areas?
- Do institutions and their partners design and build attractive, accessible, walkable spaces where outside people and organizations as well as faculty and staff want to live, work, and play?
- Do institutions and local authorities encourage new housing near campuses?

Place matters

In today's knowledge-centric economy, high-skilled people increasingly chose where to live on quality-of-life grounds, and employers follow. Living near eds and meds campuses has proved attractive to many high-skilled people in recent decades. Additionally, well-designed spaces help people become more innovative and productive by amplifying opportunities to exchange ideas and collaborate.

Growing talent

Cities with strong eds and meds outperform other cities for talent development, based on numerous indicators:

- **Educational attainment levels:** Metro areas that perform well on our BushEds, BushMeds, and community college outcome measures tend to have higher-than-average population shares with a bachelor's degree or higher. Metros that outperform for community college outcomes also have higher-than-average numbers of associate degree holders of all ages.

- **Filling in-demand occupations:** Specific community college outcome measures like graduation rates in relevant fields are predictive of metro-area success in filling workplace needs for IT professionals; nurses; heating, ventilation, and air conditioning (HVAC) installers; electricians; and welders. Metros that score above average on our BushEds per capita score tend to outperform on filling needs for IT professionals, while those that rank high on our BushMeds per capita score outperform on filling nursing positions.[*]

Cities with strong colleges and universities tend to have higher educational attainment levels across all age groups for three reasons:

- Most people don't travel far for college, so enrollment rates depend on local institutions. Most low-income students travel less than 70 miles from home for college, which means people with nearby options are more likely to enroll and persist.[38]

- Graduates of strong local institutions disproportionately tend to stay, provided job opportunities and quality-of-life amenities are sufficiently attractive.

- Cities with strong eds and meds outperform other cities for innovation and overall prosperity, attracting highly educated people from elsewhere.

Raising individual productivity and earnings

Postsecondary education helps people become more productive and earn more than they otherwise could. And highly productive people are the foundation of highly prosperous cities.

- **Bachelor's degree holders:** The college wage premium – defined as the additional income earned by degree or credential holders on average versus people with only a high school diploma – stands at more than 80% of the average high school graduate's wages for bachelor's degree holders. This figure has steadily risen from about 50% in the 1980s and 40% in the 1960s. The college premium for bachelor's degree holders is roughly the same across racial groups: 65% to 70% for White, Black, and Hispanic graduates and slightly more for Asian graduates.

  The college premium for median bachelor's degree graduates amounts to $1.3 million over a lifetime in 2021 dollars – enough to justify the average of $34,000 in debt incurred by undergraduate students[**] who borrow to pay for college plus the roughly $130,000 opportunity cost of foregoing earnings while in school.[39]

[*] We analyze how eds and meds institutions and other factors influence talent development outcomes in greater detail in Section IV.

[**] Additional lifetime earnings for the median master's degree holder amounts to $1.7 million, while average combined undergraduate and graduate school indebtedness is about $80,000 and opportunity cost is $180,000. Additional lifetime earnings for the median professional degree holder amount to $3.2 million, while average combined undergraduate and graduate school indebtedness ranges from $80,000 to $300,000, depending on degree, and opportunity cost ranges from $180,000 to $250,000 (Anthony P. Carnevale, Ban Cheah, and Emma Winzinger, "The College Payoff: More Education Doesn't Always

Today's young workers continue to enjoy the earnings benefits of college degrees, contrary to a common narrative that college isn't worth the cost for their generation. Bachelor's graduates between ages 22 and 27 earn about 70% more than peers who stopped out after high school, according to a 2022 Pew Research study.[40]

- **Associate degree holders:** The average associate degree holder earns approximately 30% more than the average worker with only a high school diploma, based on 2020 data.[*] The associate degree premium varies modestly across racial groups: 43% for Asian American associate degree holders, 36% for Hispanic graduates, 24% for White graduates, and 21% for Black graduates. This premium adds up to additional lifetime earnings of $400,000 on average.[41]

- **Certificate holders:** Experts typically divide nondegree certificates into short-term certificates, which students can earn in less than a year, and long-term certificates. While reliable data on nondegree certificate holders is lacking, one study found an average wage premium of 12% for long-term certificate holders in North Carolina and 2% for those in Virginia. Another review of several studies estimates the national long-term certificate premium at 6% to 9%.[42] Studies of short-term certificate holders suggest a modest wage premium for a handful of in-demand fields like nursing and welding but no premium for most certificates.[43]

Wage premiums depend on the field:

- **Bachelor's degree holders:** The college premium exceeds 125% nationally for many in-demand fields but is below 40% in others. Additional lifetime earnings after deducting list-price tuition, fees, and opportunity cost exceeds $1 million in more than 50% of America's four-year engineering programs, 40% of computer science programs, and 30% of health and nursing programs, according to an analysis of nearly 30,000 programs by the Foundation for Research on Equal Opportunity using the U.S. Department of Education's "College Scorecard." On the other hand, more than half of America's visual arts, music, philosophy, and religion programs – and 28% of all undergraduate programs – have negative net returns.[44]

  Earnings differences across major fields are more significant than differences across colleges by some measures. For example, **Harvard University** graduates with a computer science degree earn 2.8 times more than Harvard graduates in English. But Harvard computer science graduates earn 98% more than computer science graduates from the **University of Texas at Arlington** (UTA), while Harvard English graduates earn only 20% more than UTA English graduates.[45]

- **Associate degree holders:** People who earn associate degrees in nursing and health care fields typically earn large additional wages relative to high school graduates. The median nursing

Mean More Earnings," Georgetown Center on Education and the Workforce, 2021, https://cew.georgetown.edu/wp-content/uploads/cew-college_payoff_2021-fr.pdf; "Average Student Loan Debt," Education Data Initiative, last updated May 22, 2023, https://educationdata.org/average-student-loan-debt).

[*] Another study finds an associate degree wage premium of approximately 30% to 44% over workers who entered community college but did not finish a degree or certificate. See Clive Belfield and Thomas Bailey, "The Labor Market Returns to Sub-Baccalaureate College: A Review" (working paper, Center for Analysis of Postsecondary Education and Employment, Columbia University, March 2017), https://ccrc.tc.columbia.edu/media/k2/attachments/labor-market-returns-sub-baccalaureate-college-review.pdf.

degree holder from **Ivy Tech** in Indianapolis earns an 87% premium over the median Indianapolis worker with only a high school diploma, while the median nursing graduate from **Utah Valley University** in Provo earns 77% more than their local peers who stopped out after high school.[46] But the median associate degree holder in liberal studies – the most common community college major nationally – earns no premium.[47]

College skeptics have recently noted that the college premium for young cohorts of bachelor's graduates, when measured by wealth rather than income, is only 40% today, lower than for older cohorts.[48] But the critics draw misleading conclusions from this data. First, young graduates already have high levels of student debt, but they haven't had time to accumulate the lifetime wealth benefits from a high earnings premium. Second, this analysis disregards other factors that have stunted wealth accumulation for young adults, above all historically high housing prices.

College wage premiums have risen over the last four decades because workplace demand for workers with skills acquired in college has outstripped supply.

- **The supply of graduates has experienced impressive growth**. Sixty-two percent of young people now enroll in a postsecondary program immediately following high school, up from 49% in 1980. (Enrollment has declined over the last decade, as we discuss in Section III.) The share of students who graduate within six years has also trended upward over recent decades at both two- and four-year institutions. The number of people graduating each year with associate degrees is 10% higher than in 2010, while the number graduating with a bachelor's degree is 20% higher. And the share of 25- to 29-year-olds who've completed a bachelor's degree or higher has gone up to 40% in 2021 from 23% in 1980.[49]

- **But the demand for graduates has increased considerably faster.[50]** Technological progress has proved to be "skill-biased" in today's knowledge-centric economy, meaning that technological change has increased the productivity of and demand for high-skilled people who use new technologies effectively.[51] Increasing computerization and automation have spurred demand for highly educated workers with specialized training and cognitive skills and reduced demand for lower- and medium-skilled workers performing routine tasks, Massachusetts Institute of Technology David Autor and colleagues have shown.[52]

  Contrary to fears that automation lowers employment, industries that have seen greatest digitization have also seen higher-than-average job growth since the 1990s, particularly in large cities.[53] Also, novel technologies are creating new, growing categories of middle-skill work in occupations like computer support, medical technology, and audio-visual installation, even if the total number of middle-skill jobs has declined, economist Michael Strain of American Enterprise Institute points out.[54] **Rising automation, artificial intelligence (AI), and breakthrough life science will likely create strong demand for college-educated people in coming decades, McKinsey Global Institute predicts in a 2019 report on the future of work**.[55]

Four myths and a truth

Like the film *Four Weddings and a Funeral*, today's narratives on higher education contain both happy and unhappy elements, five of which can be summarized as "four myths and a truth."

Myth No. 1 is that most students major in esoteric fields that do little to enhance their career prospects. The truth: More than 60% of 2021 four-year college graduates majored in STEM, business, or other technical fields associated with in-demand, high-paying jobs, based on a Bush Institute-SMU analysis of U.S. Department of Education statistics. Just under 10% majored in "teach and protect" fields* that don't pay well but that society needs. The remaining 30% chose proverbial arts and humanities fields. The fastest growing college majors in two and four-year institutions are computer science, communications technology, precision manufacturing, logistics, and health professions. Lower-demand fields, like humanities, English, and ethnic and gender studies, are rapidly shrinking.[56]

Myth No. 2 is that large and growing proportions of graduates are stuck in low-paying jobs that don't require a bachelor's degree. In actuality, the share of graduates who fit this description has held steady at 10% to 15% for many decades, based on Bureau of Labor Statistics data.[57]

Myth No. 3 is that college premiums are primarily due to the "signaling" effect people convey to employers by getting accepted and graduating from college, rather than what they learn while enrolled. The truth: Approximately two thirds of the bachelor's degree premium reflects skills learned or enhanced in college, according to research by University of Pennsylvania economist Hanming Fang.[58] Employers demand sophisticated cognitive skills more than in the past and expect colleges to help students develop them, abundant evidence shows.[59] One caveat: There is considerable evidence that signaling effects may account for most of the wage premiums enjoyed by graduates of highly selective "Ivy-Plus" universities over graduates of other institutions.[60]**

Myth No. 4 is that a large share of students could attain the same wages through short-term industry-recognized certifications (IRCs) or apprenticeships rather than bachelor's or associate degree programs. The wage premium for IRCs associated with in-demand jobs remains modest. Most occupations requiring only an IRC are likely to grow more slowly than the economy as a whole, a Brookings Institution study predicts.[61] Rather, **current evidence points to rising demand for IRCs demonstrating in-demand skills *in addition to* or *as part of* degree programs**, according to Jeff Strohl of the Georgetown Center on Education and the Workforce.[62] High-quality workplace apprenticeship programs, meanwhile, can generate significant earnings benefits and are growing, but students often participate in them in conjunction with coursework at community and technical colleges.[63]

But contemporary narratives on higher education contain one important truth: **More and more people are joining living wage, upwardly mobile occupations in fields like health care technology and the building trades based on two-year associate degrees. The number of such workers has grown more than 80% since 1991. Worker shortages in these fields are generating growing wage premiums.**

College skeptics persuasively argue that more people should go into relatively high-paying skilled trades. But a community college degree is the main pathway to these occupations. Almost half of

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* "Teach and protect" fields (our term) include education, law enforcement, and military science.

** Wage premiums for graduates of highly selective elite college over graduates of other colleges are in any case modest after controlling for student SAT/ACT scores. See Stacy Dale and Alan B. Krueger, "Estimating the Return to College Selectivity over the Career Using Administrative Earnings Data" (National Bureau of Economic Research [NBER] Working Paper no. 17159, June 2011), https://www.nber.org/papers/w17159?utm_source=substack&utm_medium=email; Raj Chetty, David J. Deming, and John Friedman, "Diversifying Society's Leaders? The Determinants and Causal Effects of Admission to Highly Selective Private Colleges" (NBER Working Paper no. 31492, July 2023), https://opportunityinsights.org/paper/collegeadmissions/?utm_source=substack&utm_medium=email.

HVAC technicians and more than 60% of electrician technicians have associate degrees, employment firm Zippia reports. Also, while 13 states and a growing number of private-sector employers[*] are relaxing bachelor's degree requirements for certain jobs, the alternative pathways they're creating often involve some postsecondary coursework, sometimes leading to an associate degree.

Bachelor's and associate graduates benefit in ways that extend beyond earnings. They have lower divorce rates, lower smoking rates, better health outcomes, higher voting rates, more volunteer engagement, and greater investment in educational activities for their children than people without a degree even after holding incomes constant, according to a 2019 College Board study and other research.[64]

Benefits for other people too

People with some college or an associate degree earn more in metros with relatively high population shares holding a bachelor's degree or higher, Bush Institute data[**] and other studies show.[65] Similarly, technology sector workers earn more in cities with higher educational attainment levels, while poverty rates are lower. These benefits arise because cities with high educational attainment are more innovative and productive than other cities, benefiting all workers. Also, highly educated cities enjoy stronger social capital, strengthening local institutions to everyone's benefit.[***]

Metro areas with stronger-than-average eds and meds institutions – four-year universities, community colleges, and academic medical centers – have outperformed other metros for associate and bachelor's degree attainment levels, incomes, upward mobility, social capital, and innovation over the last decade. Eds and meds institutions play a central role in promoting prosperity and opportunity in America's cities.

[*] Toyota and AT&T are among the private-sector employers that have created job pathways involving both workplace experience and community college coursework (John Engler, Penny Pritzker, Edward Alden, and Laura Taylor-Kale, "The Work Ahead: Machines, Skills, and U.S. Leadership in the Twenty-First Century," Council on Foreign Relations Independent Task Force Report No. 76, 2018, https://www.cfr.org/report/the-work-ahead/report/The_Work_Ahead_CFR_Task_Force_Report.pdf).

[**] See metro-area ranking for innovation and related data in Appendix 2, Table X and regression results in the online Data Appendix to this report.

[***] These positive spillover benefits have significant economic effects. A 2008 Brookings report, making modest assumptions about spillovers, estimated using Michigan data that a sustained 10% increase in public-sector spending on a city's colleges and universities would over time lead to a 0.32 percentage point increase in the population share with a bachelor's degree or higher and a roughly 0.5% increase in median incomes. Using more generous estimates based on our quantitative analysis, we estimate effects twice as large on educational attainment levels and three times as large on median incomes. See Appendix 1 for an explanation of our calculations. (Timothy J. Bartik and George Erickcek, *The Local Economic Impact of "Eds and Meds": How Policies to Expand Universities and Hospitals Affect Metropolitan Economies* [Brookings Institution, December 2008], https://www.brookings.edu/wp-content/uploads/2016/06/metropolitan_economies_report.pdf.)

III. TECTONIC STRESSES AND CONTINUING EVOLUTION

Colleges and universities

Overly narrow and incremental research

America's colleges and universities face growing challenges that, for many institutions, threaten to undermine the vital contributions they make to local economies and to the nation a whole.

Research at eds and meds institutions has become too narrow in its choice of topics, according to a growing number of knowledgeable critics. It's also become too focused on reconfirming existing knowledge or making incremental advances rather than aiming for transformational insights or innovations.

"The entire innovation ecosystem is becoming more shortsighted and cautious," former MIT President L. Rafael Reif recently wrote.[66] Former University of South Florida President Steven Currall and colleagues add, "When it comes to technological innovation, the most groundbreaking discoveries often occur at the intersection of areas of knowledge," but university research has veered toward "excessive adherence to the boundaries of age-old scholarly fields," "extreme specialization," and "low-impact incremental research."[67]

A 2023 study published in *Nature* confirmed that university research has undergone a substantial shift over the past several decades. Lead author Michael Park of the University of Minnesota and colleagues used algorithms to study 25 million academic papers published between 1945 and 2010 and 3.9 million patents issued from 1976 to 2010 and found that the share of papers and patents that were "disruptive" – meaning they transformed people's scientific understanding and laid the foundation for life-changing innovation – declined significantly over the period.[*] The share focused on consolidating and reaffirming existing knowledge, meanwhile, rose. Figure 1 shows the downtrend in disruptive papers and patents across various fields.

The authors make a compelling case that falling rates of disruptiveness aren't due to declines in "low-hanging fruit" – that is, dwindling availability of potentially transformational research topics. Rather, they suggest that academic incentive structures that encourage highly specialized, incremental research[**] explain why transformational research is declining at once in every field.[68]

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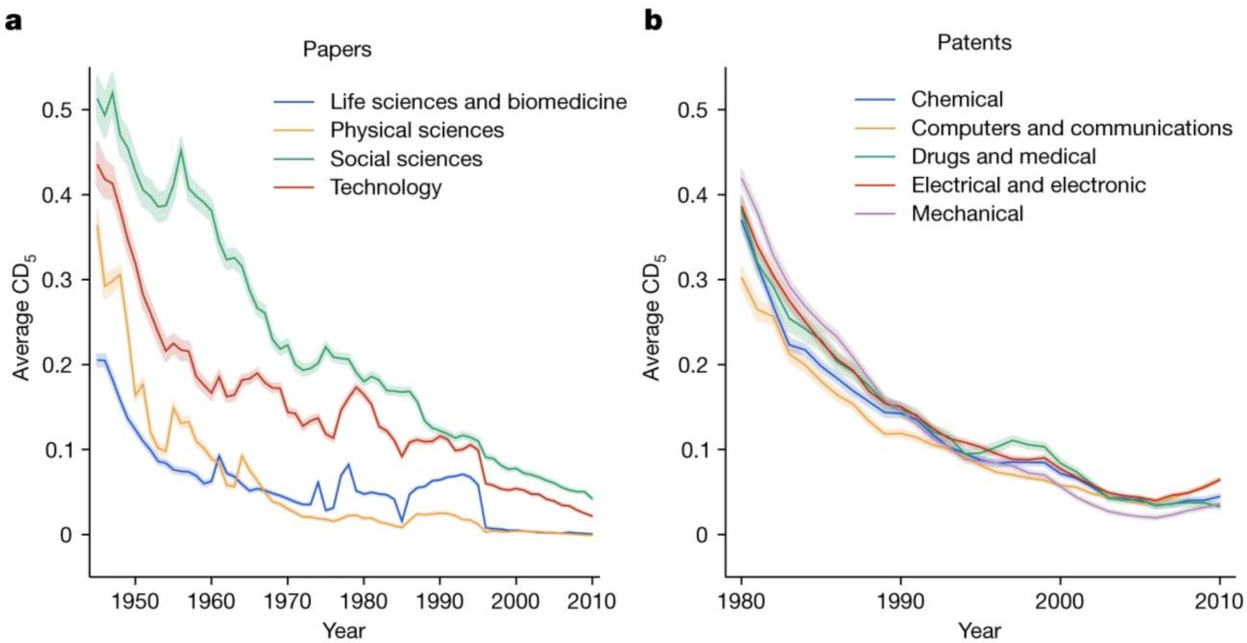
[*] Park and colleagues measure the "disruptiveness" of a paper or patent partly by the extent to which subsequent papers and patents that cite it also cite previous works that the paper or patent cites. Their intuition: "If a paper or patent is disruptive, the subsequent work that cites it is less likely to also cite its predecessors; for future researchers, the ideas that went into its production are less relevant." Park et al. also measure the "disruptiveness" of a paper or patent by the frequency of specific words in its text, with very similar results. See Michael Park, Erin Leahey, & Russell J. Funk, "Papers and Patents Are Becoming Less Disruptive Over Time," *Nature* 613 (January 4, 2023): 138–44, https://www.nature.com/articles/s41586-022-05543-x.

[**] For more evidence of changes within academia and federal grant-making agencies, see James S. Langer, "Enabling Scientific Innovation," *Science* 338, no. 6104 (October 12, 2012): 171, https://doi.org/10.1126/science.1230947. For evidence of declining research productivity in specific fields like semiconductors and pharmaceuticals, see Fabio Pammolli, Laura Magazzini, & Massimo Riccaboi, "The Productivity Crisis in Pharmaceutical R&D," *Nature Reviews Drug Discovery* 10 (2011): 428–38, https://www.nature.com/articles/nrd3405; Nicholas Bloom et al., "Are Ideas Getting Harder to Find?"

Figure 1
Declining disruptive research



Source: Michael Park et al., "Papers and patents are becoming less disruptive over time," *Nature* 613 (January 4, 2023): 138–144, https://www.nature.com/articles/s41586-022-05543-x#Sec2. The y-axis term "Average CD5" represents the proportion of papers and patents containing "disruptive" science as a share of total papers and patents.

Threats to free inquiry, free expression, and objective research

Another profound threat to the teaching and research missions of eds and meds institutions is the growing turn against free inquiry and scientific objectivity within colleges and universities. Some 60% to 90% of college students report that they self-censor what they say in classrooms and write in papers to avoid crossing the imprecise lines of campus orthodoxies. Colleges reinforce their fears through increasingly prevalent policies to encourage anonymous reporting of even the smallest missteps.[69]

Faculty members, meanwhile, face the chilling effects of required ideological loyalty oaths and punitive administration bureaucracies, according to research by the Foundation for Individual Rights and Expression. More than a third of moderate and right-of-center faculty indicate they've been disciplined for expressing unorthodox views. **The president of Johns Hopkins University recently warned of "an unmistakable pulse of dogmatism on campuses**."[70]

This shift away from campus free speech, even when aimed at fostering inclusion in some respects, has calamitous consequences for learning and science. Students who hear a range of conflicting views and engage in unfettered classroom discussions develop better critical thinking and

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American Economic Review 110, no. 4 (2020): 1104–44, https://www.aeaweb.org/articles?id=10.1257/aer.20180338.

problem-solving skills, studies by psychologists Jay Van Bavel and Dominic Packer show. Those who don't tend to fall into narrow, unoriginal ways of thinking and learn less from peer interactions.[71]

High-profile scientists from Harvard Medical School, the University of Pennsylvania Medical School, and the University of Chicago have described worrisome trends. More and more areas of biology and other fields are becoming off-limits in academic departments and professional journals, some charge. Journal editors are lowering scientific standards for papers that support reigning ideological propositions, according to others. U Penn Medical School administrators are working to *reduce* the amount of science in the medical curriculum to make room for ideologically driven content, a former associate dean wrote in 2023.[72]

Separation from local communities

Many colleges and universities are too culturally and physically separated from their surrounding cities and the nonacademic world in general, some critics suggest. A substantial share of academic research, particularly in humanities fields, addresses issues far removed from most people's lives, in language impenetrable to nonacademics. "Much of American university research is too disconnected from the needs of society," according to Steven Currall, former President of the University of South Florida.[73]

In numerous cities and college towns, university faculty members live and work a world apart from the surrounding community, with little to no meaningful interaction with "town" residents. Journalist Nick Burns writes that American academics are typically "…out of touch with the society they claim to care so much about" and "…radically more isolated from their surrounding communities than their European counterparts." He adds that life on campus can also cause students' views of the world to "narrow," not only because of ideological conformity but also because of cultural isolation.[74]

Separation of universities from host cities and towns is most visible in the stark lines that often physically divide campuses from everyplace else. Too many campuses are literally walled off from their community in fortress-like facilities, particularly in struggling places, writes economist Raghuram Rajan in his book *The Third Pillar: How Markets and the State Leave the Community Behind*.[75]

In some cities, the absence of trust and shared purpose between university and community has led residents to oppose physical expansion of university campuses, sometimes with good reason. Rapid expansion of the **University of Cincinnati**'s campus starting in the 1960s caused significant shrinkage of the housing stock, displacement of longtime residents, and local business failures in nearby neighborhoods.[76] In Harrisonburg, Virginia, many residents have opposed the growth of **James Madison University** over the last four decades, citing congestion, noise, land encroachment, and removal of university-acquired properties from the city's tax base.[77]

More recently, neighborhood organizations have fought plans to expand the **University of California at Berkeley**. In 2022, they won a legal case that went to California's Supreme Court, which effectively ordered the university to shrink its student body.[78] Policymakers in New Haven and the state of Connecticut have repeatedly tried to tax **Yale University** and block its expansion.[79]

Town-gown separation has a long history. **What's new**, however, **is fast-growing distrust among people who view the privileged position of universities as out of step with a society far more egalitarian and inclusive than the one in which today's leading institutions rose to prominence**.

Relevance and rigor

One of the most significant issues confronting the nation's higher education sector is the widespread belief that many academic programs are out of touch with employer demands and unhelpful in preparing students for careers. Employers report that college graduates are significantly less prepared for the workplace than graduates themselves think they are and express declining trust in what bachelor's degrees signify, two recent surveys show.[80]

A substantial proportion of the public, including many college-age people, agree. Fully 56% of respondents in a 2023 *Wall Street Journal*-NORC poll – and 42% of those with a college degree – concurred with the statement, "College is not worth the cost because people often graduate without specific skills and with a large amount of debt."[81] In another survey, 38% of college-educated respondents said they've realized "little" or "no" return from their degree, compared with 23% who reported "high" returns on their investment. Presented with a list of 66 priorities colleges should focus on, the top three answers included good-paying jobs after college along with affordability and graduation without debt.[82]

This growing disconnect between colleges and employers reflects shifts both within college academic programs and in the external economic environment. Employers indicate growing doubts about the workplace relevance of esoteric humanities majors and the skills students are learning in their coursework. They also point to what they view as declining rigor in many programs. Average full-time students in four-year degree programs do less than half as many hours of academic work outside the classroom as their 1960s peers did. A third of students do less than five hours of homework a week.[83]

At the same time, **rising technological complexity and specialization in the economy mean employers demand a different set of skills than students have traditionally learned in undergraduate programs**. In-demand skills include competence in specific technologies as well as more general capabilities like strategic planning, project management, quantitative analytics, and negotiation.[84]

Low completion rates

While degree completion rates among college students have been rising for several decades, they remain strikingly low. **Just two thirds of students at four-year institutions[*] graduate within six years today**. Sixty percent of Hispanic students and 46% of Black students graduate in six years. Among students from families with incomes low enough to qualify for a federal Pell grant, the six-year graduation rate is only 39%.[85]

Completion rates are considerably lower for students at two-year community and technical colleges. Thirty-seven percent of full-time students and 19% of part-time students graduate with an associate degree or certificate within eight years. Among students born between 1979 and 1982 into families in the lowest-fifth income level, the six-year completion rate was in the single digits.[86]

[*] Data is for the cohort of students who started college in 2014 (Véronique Irwin et al., *Report on the Condition of Education 2023* [NCES 2023-144, National Center for Education Statistics, May 2023], https://nces.ed.gov/pubs2023/2023144.pdf).

A substantial majority of students entering community colleges say they hope to transfer to a four-year institution after graduating and pursue a bachelor's degree, but only 22% of full-time students succeed in transferring within eight years.[87]

The Bush Institute and Texas 2036, a policy and advocacy organization, have documented the dispiriting fall off of young people at progressive stages of the education system. Of 360,000 Texans who finished eighth grade in 2012, 81% graduated from high school, 52% enrolled in some form of college, and just 22% completed any form of postsecondary degree or credential within six years.[88]

America has 40 million people who've done some college coursework but earned no credential, up from 31 million as recently as 2014. These Americans enjoy little to no earnings advantage over what they would likely earn with a high school diploma or less and often have student debt to deal with as well.[89]

America owes its low completion rates partly to K–12 education systems that fail to prepare young people to succeed at postsecondary work and flourish in the workplace. But **disappointing college graduation rates are also a source of growing distrust of colleges and universities among many Americans who wonder why these institutions fail so many students – particularly so many of the most vulnerable ones**. Weak completion rates are partly due to inadequate student advisement both before and during college, insufficient support for at-risk students, inflexible program formats, poorly designed pathways for transferring from community colleges to four-year institutions, and cost, as Section IV shows.

Outdated accreditation systems that limit innovation and competition

The current accreditation system for U.S. colleges and universities is poorly suited to today's needs and represents an obstacle to much-needed evolution in the eds and meds sector.

Today's system creates excessive barriers to market entry by disruptive innovators, many critics argue. The challenges facing the eds and meds sector call for greater competition, including from innovative market entrants. A well-functioning market, for instance, would determine the fate of universities that move further in the direction of suppressing free inquiry or those that prioritize large bureaucracies or gold-plated amenities over student access, outcomes, and research excellence.

The accreditation system doesn't offer a clear path to accreditation for organizations aiming to offer quality Industry-Recognized Certification (IRC) programs. While accreditation was originally intended to keep low-quality operators out of the higher education market, good data tools with student outcome information would mitigate this problem to a significant degree. Moreover, any system that protects an industry's incumbent operators with nearly insuperable barriers to new entrants is almost certain to make the industry hidebound and inefficient.

Federal student finance policies powerfully reinforce this barrier to disruptive innovators by limiting financial aid programs to students attending accredited institutions.

Current accreditation systems, moreover, fail in many ways to convey useful information to prospective students and their families and advisors. For one thing, incumbents virtually never lose their accreditation. Accreditation reports are highly secretive, which means that even serious criticisms are generally invisible to prospective students. Current processes also typically pay little attention to student outcomes.

Accreditation committees often have significant conflicts of interest. If officials of two universities participate in evaluating each other, they're unlikely to call attention to deficiencies.

Accreditation also risks becoming an instrument for ideological suppression of free inquiry and expression. Accreditors have started to threaten the accreditation status of universities in states with higher education policies at odds with the policy preferences of accreditors, most recently in response to new Florida state policies on diversity, equity, and inclusion and academic curriculum.[90]

Finally, new federal Department of Education rules require an accrediting agency to sign off on college mergers. This complicates what can sometimes be the best path to keep the operations of a distressed institution going for the good of current students.[91]

Unsustainable financial models

America's colleges and universities currently depend on a financial model that many experts believe is unsustainable.

Average list-price tuition approximately tripled from 1950 to 2000, then tripled again between 2000 and 2023. List-price tuition has increased more than three times faster than median wages since 1980.[92]

List-price, however, doesn't accurately capture what the average student pays. Today's college pricing model relies on what economists call "price discrimination" – charging each student what they're willing and able to pay. This means charging list-price for students from high-income families[*] and offering other students discounts that vary with their family's means. Net prices realized by universities rose only slightly faster than overall inflation between 2006 and 2019, since universities increased the share of students to whom they extend tuition discounts.[93] Also, the number of international undergraduate students studying at U.S. institutions, who nearly always pay full price, has declined 13% since 2019.[94]

Colleges and universities have been able to raise list-price tuition paid by high-income families at rates well above inflation because these families have been willing to devote a growing share of their income to their children's education over time.

They've been able to raise net prices charged to moderate-income families, meanwhile, because the federal government has been willing to fund a vast buildup of student indebtedness. Federal Pell grants cover only 30% of in-state tuition and required fees at public universities today, down from 75% in 1980. So, required borrowing for the average student has risen considerably faster than list-price tuition. More than 40% of 2023 graduates finished college with over $50,000 in debt.[95] This means that colleges can only sustain current revenue growth rates going forward if student indebtedness rises even faster.

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[*] The "Varsity Blues" scandal demonstrated that some ultra-high-net-worth families are willing to pay elite institutions far *more* than list-price tuition. Universities mostly try to capture this high willingness to pay through annual fund solicitations to wealthy student families. See Ed d'Agostino and Gary Shilling, "Coping with a Higher Education Cost Spiral," transcript of recorded conversation, Mauldin Economics, June 16, 2023, https://www.mauldineconomics.com/download/gmu-transcript-gary-shilling.

University operating costs have also increased faster than overall inflation. There is fierce debate over how much of the growth in university fixed expenses is attributable to the rising costs of delivering core educational services that students demand and how much is attributable to unnecessary noncore costs.

On the one hand, higher education is subject to what economists call "Baumol's cost disease":[*] Just as society hasn't figured out how to perform a horn quintet with fewer than five musicians, colleges haven't discovered how to deliver quality education consistently with fewer professors per student, so costs rise faster than in industries that have achieved larger productivity gains. In addition, providing a state-of-the-art college education now requires far more computers, course management software packages, health facilities, career centers, and accommodations for students with disabilities than in the past.[96]

On the other hand, some university leaders acknowledge that the higher education sector has increased spending over time on unnecessary and unproductive activities, including compensation "arms races" for star faculty, reduced faculty teaching loads, and excessive growth in nonteaching administration jobs.[97] For instance, Yale University now has as many non-teaching administrators as undergraduates, the College Fix reports.

Regardless of how much of today's fixed costs are essential, **university leaders consistently say that their top worry is the financial stability of their institutions**.[98]

Reputation challenges, declining enrollment, and sustainability

These tectonic stresses are causing the public, and prospective students in particular, to lose confidence in the value proposition of America's colleges and universities.

In a July 2023 Gallup poll, just 36% of respondents expressed "a great deal" or "quite a lot" of confidence in the higher education sector, down from 57% in 2015.[99] Another poll revealed that 52% of current college students believe higher education is headed in "the wrong direction," compared with 23% who think it's going in "the right direction."[100] The Gallup and other surveys show especially large declines in confidence among self-identified Republicans and people living outside major cities, reflecting growing perceptions about ideological conformity on campuses.[101]

Many political and education leaders share these concerns about college's value proposition. Governors and state legislators are increasingly raising concerns about spiraling list-price tuition, surging student debt, administrative bloat, program content, and academic elitism, according to longtime university president Gordon Gee and author Stephen Gavazzi.[102] Former Governors James Hunt of North Carolina and Thomas Kean of New Jersey have called the financial model of American colleges "fundamentally broken."[103] Many college leaders agree the sector hasn't done enough to improve completion rates, curtail costs, and deliver a better value proposition.[104]

Rising doubts about the college value proposition are most visible in declining enrollment. The share of high school graduates who enroll in a postsecondary institution immediately after high

[*] The term "Baumol's cost disease" honors the originator of the insight, economist William Baumol, who first suggested an analogy between horn quintets and other "production" processes. See William J. Baumol and William G. Bowen, *Performing Arts: The Economic Dilemma* (New York: Twentieth Century Fund, 1966).

school has fallen to 62% in 2023 from an all-time high of 69% in the late 2000s. Enrollment rates were declining before the pandemic but accelerated downward after 2020. The share of high school graduates enrolling in four-year institutions has decreased modestly, but precipitous declines in community and technical college enrollment explain most of this change.[105*]

Absolute numbers enrolling in four-year institutions have grown slightly since 2010 since more students are graduating from high school today. But the number enrolling in community and technical colleges has fallen almost 40% over the same period. Community college enrollment declines have been most pronounced among vulnerable and underrepresented populations: part-time students, older students, Black students, and lower-income students. The number of male students enrolled in community colleges has also fallen sharply over this period.[106]

It's ironic that declining enrollment has primarily affected community and technical colleges, in view of heavy public focus on the value proposition of bachelor's degrees and the widespread belief that more young people should opt for community college or trade school over four-year institutions. According to community college leaders, factors accounting for falling enrollment include good job opportunities at employers like Amazon and Walmart, perceived difficulties in transferring to a four-year university after two years, and above all, falling confidence that associate degrees are worth the time and expense.[107]

Looking ahead, overall enrollment is on track to decline further since fewer students will be completing high school each year, reflecting sharp declines in birth rates after 2007.[108]

Growing evidence suggests America's higher education financial model is bumping up against significant limits. Net tuition per student realized by four-year institutions has declined approximately 10% since 2019, adjusted for inflation, presumably because institutions have increased tuition discounts to entice prospective students. More colleges are announcing staff layoffs. Almost 600 four-year institutions have closed or been absorbed by other institutions since 2017.[109] A new Bain & Co. tool to assess the financial resilience of colleges and universities concludes 30% of institutions are in "strong" condition while 30% are in "weak" condition; it projects that the latter share will rise to 40% by 2026.[110]

Declining enrollment together with low completion rates mean the United States has lost its once-commanding lead in educational attainment levels. Approximately 43% of Americans aged 25 to 34 have a bachelor's degree or its equivalent today, compared with more than 50% in France, Belgium, and Sweden, and over 55% in South Korea, Japan, Ireland, Norway, and The Netherlands.[111**]

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[*] Are growing doubts about the college value proposition irrational in view of the fact that college wage premiums are higher than ever today? It depends on the student and their goals. Wage premiums are too low to justify the cost (at least in financial terms) for degrees in a number of fields, as we document in Section II. If a student is thinking about majoring in an in-demand field, their expected net return hinges on what they believe is the probability they will complete their degree. If they assign a sufficiently low probability, they're right to doubt the college value proposition, despite large wage premiums for people who complete their degrees in in-demand fields.

[**] The United States led all other countries in bachelor's degree attainment rates as recently as the 1990s ("The Most Educated Nations," Statistics and Data, accessed October 1, 2023, https://statisticsanddata.org/data/most-educated-countries-1870-2017/).

Academic medical centers

Separation from local communities

Many of America's academic medical centers are also too culturally and physically separated from surrounding communities, critics argue. Paul Starr wrote in his 1982 book *The Social Transformation of American Medicine* about "gleaming palaces of modern science, replete with the most advanced specialty services," next to "neighborhoods that had been medically abandoned, that had no doctors for everyday needs, and where the most elementary public health and preventive care was frequently unavailable."[112]

Divisions between imposing medical complexes and underinvested neighborhoods have by some measures grown more pronounced since Starr wrote his book. Many large nonprofit medical centers have closed patient-care facilities in urban areas with low income levels and high shares of uninsured residents in recent years while building or buying facilities in affluent areas, a 2022 *Wall Street Journal* analysis showed.[113]

Like colleges and universities, academic medical centers increasingly face local pushback to expansion plans, since residents sometimes believe a larger hospital footprint will displace people nearby without providing improved patient care to underserved populations. For example, local activists have opposed a new 14-acre medical research and hospital campus in Charlotte, North Carolina, planned by **Atrium Health** and its affiliated **Wake Forest School of Medicine**.[114]

Unsustainable financial models

Academic medical centers also face growing financial sustainability challenges.

One significant issue is that the federal government covers a much smaller share of operating costs than in the past. Federal funding today pays for about 50% of university research, a majority of which takes place in academic medical centers,[*] compared with 60% in 2010.[115] Within America's medical schools, federal research grants and contracts now cover 14% of total operating costs, down from 24% in the 1970s and 22% as recently as 2004. As a share of direct research costs, external research funding now pays for only 50% to 75% at most academic medical centers.[116] Tuition also covers a far smaller portion of operating costs than before. This means academic medical centers have become much more dependent on patient care revenues, which cover 63% of expenses compared with 21% in the 1970s.[117]

As for patient care, revenues per patient are under pressure from multiple trends: shifts toward outpatient services and away from higher reimbursement inpatient services, greater dependence on government payers rather than private insurance, and slow growth in Medicare and Medicaid reimbursement rates.[118] Operating costs, meanwhile, have increased considerably faster than revenues since 2020. Labor costs for nurses and other hospital workers have increased approximately 20% since 2019, reflecting national

[*] Total federal funding of university research amounted to approximately $40 billion in 2019, of which just under $24 billion went to academic medical centers controlled by universities ("National Patterns of R&D Resources | 2020–2021," National Center for Science and Engineering Statistics, https://ncses.nsf.gov/data-collections/national-patterns/2021; Association of American Medical Colleges, "U.S. Medical School Revenues," 2022, https://www.aamc.org/data-reports/faculty-institutions/report/us-medical-school-revenues).

shortages of nurses and other health care professionals. America's shortfall of nurses – some 250,000 to 300,000 based on historically normal staffing ratios – will almost surely exceed 1 million RNs by 2033 on current trends, amounting to a 20%-plus shortfall at the average hospital.[119]

The result: **Roughly two thirds of hospitals, including large academic centers like Duke Health, experienced negative operating margins in 2022**.[120] Academic medical centers are trying various strategies to cope with these pressures, including the following:

- Acquiring other local hospitals to increase their negotiating power vis-à-vis insurance companies and suppliers (as the **University of California at San Francisco Medical Center** has done).

- Partnering with large hospital systems to help cover research and teaching costs (as **Wake Forest Health** has done with **Atrium Health** of Charlotte, now part of Chicago-based Advocate Health).

- Spinning out academic medical centers from the parent university into separate entities to increase the former's financial flexibility and reduce risk to the university (as **Vanderbilt University** has done).[121]

All these avenues raise reputational risk for academic centers, since they often result in higher health care costs for patients or unwanted competitive pressures on smaller community hospitals.

Continuing evolution

America's eds and meds institutions have evolved in ways that help account for both their great strengths in talent development and innovation and their current challenges.

First, **America's colleges, universities, and academic medical centers – including public as well as nonprofit institutions – have always run their research activities with relatively high independence from state control, in markets characterized by competition and accountability**. After World War II, the federal government made the critically important decision to become the primary funder of basic science. However, Congress created a model in which peer-review committees rather than civil servants decide which projects to fund and autonomous universities rather than government labs do most of the actual research.

This history largely explains why U.S. eds and meds institutions have strongly outperformed most international peers in conducting innovative research and producing a well-educated population for much of the past 100-plus years.[*] But federal and state lawmakers and grantmakers increasingly threaten this autonomy today with ideologically driven measures demanded by both wings of the political spectrum.

[*] Columbia University economist Miguel Urquiola makes a strong case for why relative independence from state control and robust competition account for the rise of leading U.S. institutions to global dominance in scientific research in his 2020 book *Markets, Minds, and Money: Why America leads the World in University Research* (Cambridge, Massachusetts: Harvard University Press). See also Richard C. Levin, "The University in Service to Society," in *The Worth of the University* (New Haven: Yale University Press, 2013), 86–7.

Second, **the federal government has a long record of reinforcing the dominant position of America's most prestigious institutions with research dollars**. Concentration of resources and prestige among a few dozen institutions has been a double-edged sword. Gathering scarce research talent in a handful of locations contributed to the rise of the United States as the dominant nation in scientific research in the early-to-mid 20th century, as Columbia University economist Miguel Urquiola argues.[122] But it has also raised barriers to entry for innovative new players and fueled growing public apprehension about exclusion and elitism in higher education.

Third, **America has a long record of counterbalancing the dominance of elite universities and academic medical centers with a vast array of egalitarian institutions offering widespread access to quality education and health care**. These include:

- America's 110 land-grant universities, established in every state under the pathbreaking Morrill Act of 1862 and subsequent legislation.[123]
- "Extension" systems to disseminate useful innovations in agriculture and other fields, established under the 1914 Smith-Lever Act.[124]
- Community and junior colleges, established by state and local governments after 1900.[125]
- Integrated postsecondary systems addressing workforce needs and offering pathways for student transfers, initiated in California in the 1960s and imitated across the nation.[126]
- High-quality community hospitals across the country, funded by the 1946 Hill-Burton Act.[127]

These institutions have been hugely successful in bringing postsecondary education opportunities to more than half of America's young people and good health care access to the vast majority of Americans. However, **they generally came of age with highly standardized, one-size-fits-all operating models – widely compared to late 19th and early 20th century industrial manufacturing processes – and, like many firms of that era, have become inflexible, bureaucratic, and resistant to change**.[128]

Michael Crow, President of Arizona State University, argues that "the organizational frameworks we call universities … have not evolved significantly beyond the configurations assumed in the late 19th century."[129] Georgetown University's Anthony Carnevale adds, "Higher education is struggling to adjust in the transition from an industrial to a post-industrial economy."[130] And Gordon Gee concludes: "The choice, it seems to me, is this: reinvention or extinction."[131]

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This analysis points to a clear agenda for what America's eds and meds institutions must do to restore public confidence and reinforce their vital role as engines of prosperity in their own cities and beyond:

- Recalibrate eds and meds research to a greater emphasis on potentially transformational work.
- Reaffirm the vital importance of free inquiry, free expression, and objective research.
- Engage far more deeply with surrounding communities, businesses, and people.
- Shift to a more sustainable balance of liberal arts and career-connected learning.
- Improve student completion rates and economic outcomes.
- Raise the number of high-quality institutions to reduce concentration among elite universities.
- Put eds and meds institutions on a more financially sustainable path.

The good news: Numerous eds and meds institutions across the United States are experimenting and innovating to address these challenges. Many institutions are answering the 1997 call of Ernest

Boyer, former president of the Carnegie Foundation for the Advancement of Teaching, to become "more vigorous partner[s]" with surrounding communities throughout their teaching, research, and community engagement activities.[132]

In 2015, the Association of Public and Land-Grant Universities and the University Economic Development Association released an influential report calling on eds and meds institutions to embed local and regional economic development goals throughout their mission, engage closely with local partners, advance the workforce needs of local economies, measure outcomes rigorously, and preserve their core values of academic and intellectual integrity. The report suggested a now widely accepted taxonomy classifying eds and meds activities that contribute to local economies into three categories – talent, innovation, and place.

More recently, Gee and Gavazzi called on eds and meds institutions to recognize their role as anchor institutions in their communities and to make themselves into "go-to [institutions] for citizens across a wide range of academic, business, and technological needs."[133]

America's eds and meds face several tectonic stresses that threaten to undermine their vital role as engines of prosperity and opportunity, including:

- **Overly narrow and incremental research.**
- **Threats to free inquiry and objective research.**
- **Separation from local communities.**
- **Growing questions about the relevance and rigor of academic programs.**
- **Low completion rates.**
- **Outdated accreditation systems that block innovation and competition.**
- **Unsustainable financial models, for both universities and academic medical centers.**

To restore public confidence and reinforce their vital role as engines of prosperity in their own cities and beyond, America's eds and meds institutions should:

- **Recalibrate research to a greater emphasis on potentially transformational work.**
- **Reaffirm the vital importance of free inquiry and objective research.**
- **Engage far more deeply with surrounding communities, businesses, and people.**
- **Shift to a more sustainable balance of liberal arts and career-connected learning.**
- **Improve student completion rates and economic outcomes.**
- **Raise the number of high-quality institutions to reduce concentration and exclusivity among elite institutions.**
- **Put eds and meds institutions on a more financially sustainable path.**

IV. INNOVATION

The innovation impact of U.S. universities and research institutions

Which eds and meds institutions are performing best: Updated rankings

Innovation impact ranking: Table 1 shows America's 15 highest-performing universities for innovation impact, based on a composite scoring approach we introduced in a 2020 report* and have updated here.**

We define innovation impact as research-driven output that crosses beyond the walls of research institutions and influences the wider society and economy. We construct our composite scores based on nine metrics that capture universities' impact through patenting, technology commercialization, new business formation, influence on research and patenting by others, and production of STEM graduates.

Sources and Methods

Our composite innovation impact scores are based on institutions' performance on nine "output" metrics from 2016 to 2020:

- Patents issued per year.
- Intellectual property (IP) licenses signed per year.
- IP license income earned per year.
- Spinout companies formed around university IP per year.
- IP licenses signed with spinout companies per year.
- Citations of papers by university researchers in other academic papers over the period.
- Citations of papers by university researchers in issued patents over the period.
- Number of bachelor's and master's degree graduates in STEM fields over the period.
- Number of Ph.D. graduates in STEM fields over the period.

Data for the first five metrics, plus each institution's total research spending, comes from the Association of University Technology Managers dataset. Paper and patent citation figures come from Google Scholar and Google Patent searches, respectively. Graduate numbers come from U.S. Department of Education data on the postsecondary sector.

We standardize scores on each metric by dividing by the standard deviation of the distribution of scores across universities, use weightings from principal component analysis to combine each institution's nine scores into a raw composite score, then recalibrate so that the top-ranking institution (the University of California System) has a score of 100. Our analysis replicates the method we employed in our 2020 report with data from 2013 to 2017, allowing comparisons across time. See Appendix 1 for a detailed explanation of data sources and methods and the online Data Appendix to this report for all underlying data.

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* J.H. Cullum Clark et al., *The Innovation Impact of U.S. Universities* (Dallas, Texas: George W. Bush Institute–SMU Economic Growth Initiative and Opus Faveo Innovation Development, June 2020), https://www.bushcenter.org/publications/the-innovation-impact-of-u-s-universities.

** See Appendix 2, Table A for a complete ranking of all 177 institutions in our dataset and the online Data Appendix to this report for all underlying data.

Our nine metrics represent a wider conception of “innovation impact” than most other groups[134] have used in similar analyses, reflecting the premise that influencing other innovators and producing STEM graduates are important channels through which university innovation affects the wider world, alongside technology commercialization and new firms.

In some cases, we list statewide public university systems rather than individual campuses because these institutions report data only at the system level to the Association of University Technology Managers (AUTM), on which we rely for several metrics. This includes the **University of California** and **University of Texas** systems – which rank first and second for innovation impact as well as research spending – plus the **University of Massachusetts**, **University of Maryland**, **State University of New York**, and **University of Colorado** systems.

Table 1
Best Performing Eds and Meds Institutions for Overall Innovation Impact
(Top 15 of 177 ranked institutions)

	Institution	Innovation Impact	Research Spending ($m)	Innovation Impact Productivity
1	University of California System	100.0	$ 5,611	1.78
2	University of Texas System	57.6	$ 3,010	1.91
3	Massachusetts Institute of Technology	32.9	$ 1,782	1.84
4	University of Michigan	27.6	$ 1,546	1.78
5	University of Washington	27.2	$ 1,300	2.09
6	Harvard University	25.1	$ 882	2.85
7	University of Pennsylvania	24.9	$ 986	2.53
8	University of Minnesota	24.8	$ 997	2.49
9	University of Florida	22.9	$ 668	3.43
10	University of Massachusetts System	21.8	$ 685	3.18
11	Stanford University	21.6	$ 1,388	1.55
12	Purdue University	20.8	$ 659	3.16
13	Arizona State University	20.3	$ 599	3.39
14	Johns Hopkins University	19.9	$ 1,778	1.12
15	University System of Maryland	19.3	$ 1,112	1.73
	Average for All Institutions	**7.7**	**$405**	**2.86**

Source: Author’s calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See full summary of sources and methods in Appendix 1; full ranking of 177 institutions in Appendix 2, Table A; and underlying data in online data appendix.

Johns Hopkins University (JHU) and the JHU Applied Physics Laboratory report data to AUTM separately, so we break them out. Likewise, Harvard, Massachusetts General Brigham, and Brigham and Women's Hospital report separately, despite close ties among them. If we combined associated institutions in both cases, JHU would rank second for research spending and ninth for innovation impact. Harvard plus affiliated medical centers would rank fourth for spending and third for innovation impact.

One of the most striking facts about our rankings is how concentrated both research spending and innovation impact are among several dozen universities. **The 30 institutions that rank highest for research spending in our dataset account for 46% of all eds and meds research spending and about 44% of the sector's aggregate innovation impact as we measure it**.[*] The institutions in our rankings account for approximately 90% of all research spending by U.S. eds and meds institutions.[**]

Improving over time: Roughly two out of three institutions in our dataset increased their innovation impact over the levels we reported in our 2020 report.[***] **Among the institutions for which we have comparable data for both periods, collective output rose almost 30%, adjusted for inflation**.[****]

The following are the 15 institutions with research spending over $300 million that increased their innovation impact most since the 2013–2017 period covered in our 2020 rankings.[*****]

- Arizona State University
- California Institute of Technology (Caltech)
- Children's Hospital of Cincinnati
- Dana-Farber Cancer Institute
- Fred Hutchinson Cancer Research Center
- Harvard University
- Massachusetts Institute of Technology (MIT)
- Mayo Clinic
- Memorial Sloan Kettering Cancer Center
- Northwestern University
- Purdue University

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[*] We must estimate the share of total innovation impact of the 30 institutions that rank highest for research spending in our dataset since we don't have innovation output data for institutions comprising about 10% of total U.S. eds and meds research spending.

[**] Two institutions – Yale University and Columbia University – would likely make the top 50 in our ranking for innovation impact, but they don't report data to AUTM, so we can't include them.

[***] Only 161 of the 177 institutions in our dataset also reported sufficient data to AUTM for us to calculate scores in our 2020 report. In addition, we have to make estimates to achieve comparability across new and old scores, including for inflation factors in license income. See Appendix 1 for summary of our across-time comparisons.

[****] How can we reconcile this recent increase in output with the long-term downtrend in transformative science we discussed in Section III? Eds and meds institutions can increase the number of patents, licenses, spinout companies, and paper citations they produce even while reducing their emphasis on transformative science if the patents, licenses, and spinout firms focus on narrow, incremental innovation and the total number of academic papers rises.

[*****] Seventy-two institutions in our dataset had average annual research spending over $300 million between 2016 and 2020. Note also that innovation impact scores in this report are based on 2016–2020 data while the scores in our 2020 report are based on the overlapping years 2013–2017, which means we're really comparing 2018–2020 innovation output to 2013–2015 output when we estimate changes since our 2020 report.

- St. Jude Children's Research Hospital
- University of Massachusetts System
- University of Pennsylvania
- Washington University of St. Louis

Smaller institutions that achieved especially strong improvements in their innovation impact include **Brigham Young University**, **Carnegie Mellon University**, **Case Western University**, **Cedars-Sinai Medical Center**, **Colorado State University**, **Nationwide Children's Hospital**, **Princeton**, the **University of Akron**, and the **University of Notre Dame**.

Innovation impact productivity rankings: Table 2 shows the top 10 performing institutions for innovation impact productivity, or turning research spending dollars into innovation impact, in five different groups.[*] We divide the institutions in our dataset into five groups because we think it makes sense to compare institutions with peers of similar scale and mission when evaluating productivity.

Institutions ranking high for innovation impact productivity are not necessarily ones that are especially large in research spending or overall innovation impact. **Arizona State** and **Purdue**, for instance, have smaller research budgets than most of our "large universities" group but perform better than most of the group's members for productivity. Institutions at the top of the "midsized" and "smaller university" groups achieve productivity well above the best performing universities in the "large" group. The University of California and Texas systems, meanwhile, perform below average for productivity.

Rising productivity: Some institutions that have achieved especially strong innovation impact growth since the mid-2010s – **Caltech**, **Carnegie Mellon**, **MIT**, and **Purdue** for instance – owe most of their improvement to rising productivity. **Princeton**, by contrast, grew primarily because of increased research spending. **Arizona State**, **MIT**, the **Mayo Clinic**, and **Memorial Sloan Kettering** strongly outperformed most other institutions for increasing both research investment and productivity.[**]

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[*] These are our five groups:

- Large research universities: operate undergraduate and graduate degree programs and spent more than $515 million on research on average between 2016 and 2020.
- Midsized research universities: operate undergraduate and graduate degree programs and spent between $205 million and $515 million on research on average between 2016 and 2020.
- Smaller universities: operate undergraduate and graduate degree programs and spent less than $205 million on research on average between 2016 and 2020.
- Medical centers: operate patient care as well as research facilities; no undergraduate degree programs.
- Pure research institutes: operate no degree programs or patient care facilities.

We've chosen the research budget thresholds to arrive at three equal-sized groups of research universities. Note: Even most of our "smaller" universities are relatively large institutions. Colleges and universities smaller than these generally don't report data to AUTM and thus aren't in our rankings. We compute innovation impact productivity for each institution as its innovation impact score divided by research spending, multiplied by 10.[8] See Appendix 2, Tables B, C, D, E, and F for full innovation impact productivity rankings for each group.

[**] See data on individual institutions in the online Data Appendix to this report.

Table 2

Best Performing Eds and Meds Institutions for Innovation Impact Productivity

(Top 10 in each of five groups)

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)		Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)
	Large Universities:					**Medical Centers:**			
1	California Inst of Technology	4.91	19.1	$ 389	1	Univ of Arkansas for Med Sci	4.17	2.3	$ 56
2	University of Florida	3.41	22.8	$ 668	2	U of North Texas Health Sci Ctr	3.02	1.4	$ 45
3	Arizona State University	3.39	20.3	$ 599	3	Massachusetts General Hospital	2.02	19.0	$ 941
4	Northwestern University	3.27	19.6	$ 601	4	Cedars-Sinai Medical Center	1.91	3.4	$ 176
5	Purdue University	3.20	21.1	$ 659	5	Dana-Farber Cancer Institute	1.82	5.7	$ 314
6	North Carolina State Univ	3.19	16.5	$ 517	6	Nationwide Childrens Hospital	1.70	3.0	$ 179
7	Univ of Massachusetts System	2.95	20.2	$ 685	7	Cleveland Clinic	1.63	4.8	$ 292
8	Harvard University	2.91	25.6	$ 882	8	Mayo Clinic	1.55	12.7	$ 821
9	University of Pennsylvania	2.58	25.4	$ 986	9	Hackensack Univ Med Center	1.39	0.1	$ 7
10	New York University	2.46	16.6	$ 674	10	Univ of Nebraska Med Center	1.34	6.1	$ 456
	Average of Group	**1.93**	**18.0**	**$ 971**		**Average of Group**			
	Midsized Universities:					**Pure Research Institutes:**			
1	Carnegie Mellon University	5.48	14.6	$ 266	1	Whitehead Inst for Biomed Res	5.70	2.5	$ 44
2	University of New Mexico	5.43	13.3	$ 244	2	Cold Spring Harbor Laboratory	4.82	6.7	$ 139
3	Princeton University	4.53	13.3	$ 293	3	Wistar Institute	2.86	1.9	$ 68
4	Washington State University	3.57	7.2	$ 201	4	Zucker Inst for Innov Comm	1.72	4.5	$ 264
5	University of Chicago	3.51	12.4	$ 355	5	Salk Inst for Biological Studies	1.02	1.1	$ 109
6	University of Houston	3.41	5.8	$ 170	6	Johns Hopkins U Appld Phys Lab	0.22	3.4	$ 1,522
7	University of Central Florida	3.06	7.1	$ 230					
8	Case Western Reserve Univ	3.06	10.2	$ 334					
9	Rice University	3.04	4.1	$ 135					
10	Texas Tech University System	2.92	7.0	$ 239					
	Average of Group	**2.29**	**5.4**	**$ 233**		**Average of Group**	**2.72**	**3.4**	**$ 358**
	Smaller Universities:								
1	Brigham Young University	30.75	10.6	$ 35					
2	WiSys Technol Foundation	18.82	3.4	$ 18					
3	Worcester Polytechnic Inst	11.62	3.7	$ 32					
4	University of Akron	11.56	4.3	$ 37					
5	U of North Carolina Charlotte	7.94	3.3	$ 41					
6	Northern Illinois University	7.75	1.3	$ 17					
7	Univ of North Texas Denton	7.70	2.2	$ 29					
8	U of N Carolina Wilmington	6.71	1.1	$ 17					
9	University of South Dakota	6.37	1.0	$ 15					
10	Ros Franklin U of Med/Sci	6.34	1.0	$ 16					
	Average of Group	**5.13**	**2.2**	**52**					

No tradeoffs across different kinds of productivity: Institutions that perform strongly for innovation impact productivity tend to outperform for turning research dollars into each of our nine innovation outputs, countering worries that investing in technology commercialization detracts from basic research.[*]

[*] Calculating nine productivity variables as each of our nine innovation output metrics divided by research spending, 28 of the 36 pairwise correlations among these variables are positive, and none of the eight negative correlations exceeds -0.10. See correlation table in Appendix 1.

In particular, **above-average productivity in generating patents, spinout companies, and licenses to spinouts is associated with outperformance in earning citations in other people's academic papers and producing doctoral, master's, and bachelor's graduates in STEM fields**.

What explains differences across universities in innovation impact?

- **Research spending:** Total spending is highly predictive of innovation impact, based on our regression analysis. Notably, other measures of university size, like endowments, *aren't* predictive of innovation impact after controlling for research spending. This means **large size leads to high innovation impact only insofar as it translates to large research budgets**.

  What accounts for differences in research spending? Older universities, institutions with a medical school, institutions with numerous members of the National Academies,* and institutions with relatively large endowments tend to have larger research budgets.** But the correlation between endowment values and research spending is only 0.43—which means **universities of all sizes have consequential decisions to make about how much to emphasize research**.

- **Faculty quality:** Institutions with more members of the National Academies tend to produce greater innovation impact, even after controlling for research spending. **Top-tier researchers achieve more with the resources available to them than other faculty do, the data show**.

- **Technology commercialization policies:** The number of staff in an institution's technology transfer office (TTO) and the size of its patenting budget are predictive of innovation impact. So is the professional background of the TTO head: Institutions with engineers as the TTO head outperform other institutions for innovation impact, all else equal.***

- **Entrepreneurship programs:** Having a teaching entrepreneurship program predicts greater innovation impact.

- **Metro area demographics:** Institutions in metros with relatively high immigrant population shares tend to generate greater innovation impact, all else equal.****

Being private as opposed to public makes no significant difference, our data show.

As for innovation impact productivity, factors that influence university performance include the following:

- **Scale:** Eds and meds institutions experience diseconomies of scale in generating innovation impact, our data shows. **Higher research spending predicts greater innovation impact, but this effect weakens as spending grows very large. This is because larger spending is**

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* National Academies of Sciences, Engineering, Medicine, and Inventors. Election to one of the National Academies by one's peers is a highly prestigious honor for researchers, and the number of members of the National Academies at a university is a widely cited measure of the university's faculty quality.
** See regression results in online Data Appendix.
*** Institutions that rank in the top third of our "large universities" group for innovation impact productivity mostly have between 17 and 46 people in their TTOs, with the University of Pennsylvania as an outlier at 67. Universities in the top third of our dataset for productivity have patenting budgets equal to 0.9% of research spending, on average – well above the overall average of 0.6%.
**** See regression results in online Data Appendix.

associated with lower productivity in turning research dollars into innovation outputs. This may be because large institutions are able to pursue marginal projects that smaller institutions cannot, potentially generating societal benefits but reducing productivity as we measure it. Also, research activities at the largest institutions may be more subject to waste and bureaucratic inefficiencies than those at smaller universities.

- **Patenting budget:** Institutions with large patent budgets relative to total research spending tend to achieve better-than-average innovation impact productivity.

- **Medical schools:** Institutions with a medical school tend to have modestly lower productivity than institutions without one.[*]

- **Entrepreneurship programs:** Having an entrepreneurship program predicts higher productivity.

- **Industry funding as share of research budget:** Institutions that receive above-average industry funding as a share of research spending tend to realize lower innovation impact productivity, all else equal. This metric also predicts lower performance on each of our nine output metrics. Industry funding may push researchers toward firm-specific projects that lead to fewer papers, patents, licenses, and spinout companies than projects focused on transformational basic research.

  Universities with high industry funding ratios disproportionately lose faculty researchers to companies that have funded their work, where the researchers tend to become less productive.[135] Also, industry funding ratios are uncorrelated with research spending, so institutions that receive large industry funding don't seem to have more resources as a result.[**]

All these results are consistent with the findings in our 2020 report, so the main relationships we describe here have been stable over at least the last 10 years.

Which metro areas are performing best for eds and meds innovation impact?

Metro-area innovation impact (BushEds) scores: Table 3 shows the 15 best-performing metro areas in the United States for total university innovation impact, which we refer to as "BushEds" scores. A metro's BushEds score is simply the sum of the innovation impact scores for each of the individual institutions located there.[***]

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[*] Institutions with medical schools outperform for productivity in producing spinout companies as well as bachelor's, master's, and Ph.D. students, but modestly underperform for overall innovation impact productivity. This may be because academic medical centers devote significant research resources to clinical trials, which don't tend to generate innovation impact as we measure it here.
[**] The average share of research spending funded by industry between 2016 and 2020 among 177 institutions was 7.4%, while the median industry funding share was 5.6%. Just 16 institutions covered more than 15% of research spending from industry grants. These include several major academic medical centers but mostly consist of regional universities with smaller research budgets. See data on individual institutions and regression results in online Data Appendix.
[***] We apportion the innovation scores for seven university system – the University of California, University of Texas, University of Maryland, University of Colorado, University of Massachusetts, and State University of New York systems plus that part of the University of Wisconsin System not accounted for by

Table 3
Best Performing Metros for BushEds: Metro-Area Innovation Impact

	Metro Areas	Aggregate BushEds	BushEds per Capita
1	Boston-Cambridge-Newton, MA-NH	113.8	23.2
2	New York-Newark-Jersey City, NY-NJ-PA	79.4	4.0
3	Los Angeles-Long Beach-Anaheim, CA	57.1	4.4
4	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	43.8	7.0
5	Houston-The Woodlands-Sugar Land, TX	39.9	5.5
6	San Francisco-Oakland-Berkeley, CA	39.5	8.5
7	Chicago-Naperville-Elgin, IL-IN-WI	34.0	3.6
8	Pittsburgh, PA	32.1	13.6
9	Baltimore-Columbia-Towson, MD	30.8	10.8
10	Seattle-Tacoma-Bellevue, WA	29.9	7.4
11	Durham-Chapel Hill, NC	28.4	43.4
12	Ann Arbor, MI	27.6	74.6
13	Minneapolis-St. Paul-Bloomington, MN-WI	24.8	6.7
14	Gainesville, FL	22.9	67.1
15	San Diego-Chula Vista-Carlsbad, CA	22.6	6.9
	Average for all Metros > 0	**10.8**	**15.1**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. Metros have BushEds scores above zero if and only if they have at least one institution which reports sufficient data to AUTM to allow us to calculate institution-level innovation impact scores. See summary of sources and methods in Appendix 1; full ranking of all metros with aggregate innovation scores above zero in Appendix 2, Table G; and underlying data in online Data Appendix.

The **Boston** metro, for instance, ranks first among U.S. metro areas with a total innovation impact score of 113.8, representing the sum of our scores for **Harvard University**, **MIT**, **Mass General Brigham**, **Dana-Farber Cancer Institute**, and the area's other knowledge-generating institutions. We arrive at the Boston metro's BushEds per capita score by dividing this total score by the metro's population, then multiplying by 10^8 to generate scores at intuitive scale.

We calculate per capita scores for each metro area because larger metros generally have more academic research activities than smaller ones, but smaller metros in some cases perform ahead of larger peers in innovation output per resident. Our BushEds and BushEds per capita scores measure different things, and both turn out to be relevant predictors of many economic outcomes. The Boston metro's advantage over second-ranked **New York** is much larger on a per capita basis than in overall terms, reflecting

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its Madison and Milwaukee campuses – across metros according to each campus's research spending, which is publicly available for each system. We estimate innovation impact scores for Yale and Columbia universities by assuming they achieve average innovation impact productivity and include these estimates in our aggregate scores for the New Haven and New York metros, respectively. See full rankings of all 126 metros with scores above zero in Appendix 2, Table G and underlying data in the online Data Appendix.

Boston's smaller population. The **Durham-Chapel Hill** metro, meanwhile, generates higher innovation impact per capita than Boston but only about one-quarter the total innovation impact, reflecting its far smaller population.

College towns in some cases have stronger portfolios of innovative eds and meds institutions than larger cities. **Durham-Chapel Hill**, **Madison**, **New Haven**, and **Provo** score high in the rankings. Twelve of the 50 top performers on our aggregate BushEds measure are smaller college or hospital towns that aren't among America's 100 largest metros.[*]

Metro-area BushEds scores are strongly predictive of how metros perform for associate degree and bachelor's degree attainment levels, incomes, upward mobility, social capital, and innovation, as we show in Sections II and VI.[**]

<u>BushEds per capita:</u> Table 4 shows the 15 best performing of America's 100 largest metros for total innovation impact per capita on the left side and the top 15 performers among smaller metros – between 101st and 250th in population rank – on the right.[***] We separate the two groups because high-performing college towns score far ahead of almost all larger metros, and we aim to highlight differences across large cities in this report.

Eds and meds activities are far larger in top-performing metros than low-performing ones. The **Boston** metro's institutions produce more than four times as much innovation output per capita as those of any large metro in the bottom half of the rankings. **Pittsburgh** and **Raleigh** produce four and three times as much as the median metro, respectively.

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[*] Ann Arbor, Michigan; Gainesville, Florida; Lafayette–West Lafayette, Indiana; Champaign-Urbana, Illinois; Ithaca, New York; College Station, Texas; Trenton-Princeton, New Jersey; Charlotteville, Virginia; State College, Pennsylvania; Rochester, Minnesota; Athens, Georgia; and Lansing, Michigan.
[**] See Appendix 2, Table M for a ranking of metros for innovation and additional related data.
[***] See full rankings for each group on our BushEds per capita measure in Appendix 2, Tables H and I and underlying data in the online Data Appendix.

Table 4

Best Performing Metros for BushEds Innovation Impact Per Capita

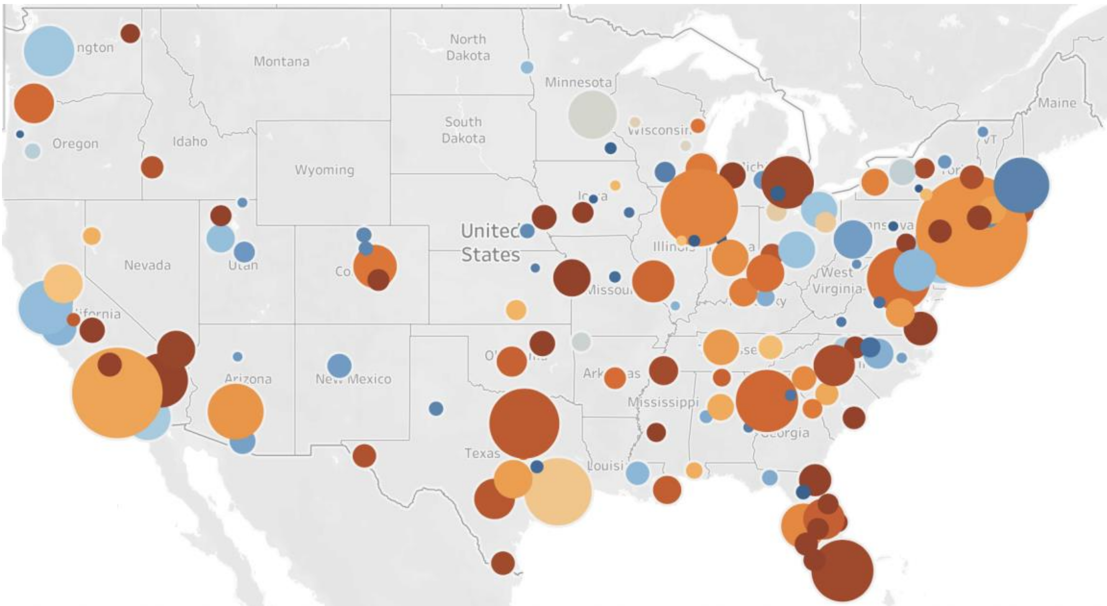
(Top 100 metros on left side; all others on right side)

Top 100 Metros				Smaller Metros			
	Metro Areas	**BushEds per Capita**	**Aggregate BushEds**		**Metro Areas**	**BushEds per Capita**	**Aggregate BushEds**
1	Durham-Chapel Hill, NC	43.4	28.4	1	Ithaca, NY	164.5	17.3
2	Madison, WI	24.1	16.5	2	Lafayette-West Lafayette, IN	92.6	20.8
3	Boston-Cambridge-Newton, MA-NH	23.2	113.8	3	Champaign-Urbana, IL	86.4	19.2
4	New Haven-Milford, CT	17.7	15.3	4	Ann Arbor, MI	74.6	27.6
5	Provo-Orem, UT	15.0	10.5	5	Gainesville, FL	67.1	22.9
6	Albuquerque, NM	14.2	13.0	6	State College, PA	61.2	9.6
7	Worcester, MA-CT	14.0	13.7	7	Ames, IA	54.2	6.8
8	Pittsburgh, PA	13.6	32.1	8	Rochester, MN	54.0	12.3
9	Tucson, AZ	13.4	14.1	9	Corvallis, OR	53.2	5.1
10	Baton Rouge, LA	12.5	10.9	10	College Station-Bryan, TX	51.5	14.0
11	Raleigh-Cary, NC	11.3	16.3	11	Lawrence, KS	47.6	5.7
12	San Jose-Sunnyvale-Santa Clara, CA	11.0	21.6	12	Columbia, MO	47.5	10.1
13	Baltimore-Columbia-Towson, MD	10.8	30.8	13	Iowa City, IA	42.1	7.5
14	Springfield, MA	9.0	6.2	14	Charlottesville, VA	42.0	9.4
15	San Francisco-Oakland-Berkeley, CA	8.5	39.5	15	Blacksburg-Christiansburg, VA	41.7	6.9
	Average for Top 100 Metros (> 0)	**6.2**	**14.0**		**Average for Smaller Metros (> 0)**	**27.9**	**6.3**

See Appendix 2, Tables H and I for full rankings of all metro areas with aggregate scores above 0.

Figure 2 shows how the 126 metros with BushEds per capita scores above zero rank. Circle size indicates metro-area population, while color represents ranks for BushEds per capita. Blue indicates high BushEds per capita scores, and orange indicates relatively low scores.

Figure 2
BushEds Per Capita: Metro-Area Innovation Impact
(126 metros with scores above zero; blue and orange indicate
above- and below-average total innovation impact, respectively)



<u>BushMeds scores</u>: Table 5 shows the best performing 15 metros in the United States on our "BushMeds" measure of innovative medical activities. Our BushMeds scores are based on total hospital activities of all medical centers in each metro, adjusted for the "quality" of each institution. **Rochester, Minnesota,** illustrates why it makes sense to quality-adjust our hospital scale figures. The Rochester-based **Mayo Clinic** – often ranked as America's top medical center – has at least three times more economic impact per bed or procedure than other Minnesota hospitals.[136] Virtually all high-ranking institutions are academic medical centers as we define them in this report.[*]

Larger metros generally have larger portfolios of innovative medical activities than smaller ones. Even so, some metros – **Baltimore**, **St. Louis**, **Pittsburgh**, **Durham-Chapel Hill**, and **Ann Arbor** for instance – perform much better than their size would predict.

Metros that outperform on our BushMeds measure are ones that excel at research and "export" their services to other places – that is, attract patients from elsewhere for specialty care.

[*] We calculate BushMeds scores for each metro by computing a composite measure of the scale of each hospital in the metro area, drawing on American Hospital Association 2014–2018 data on budgets, beds, and discharges; quality-adjusting the composite scale measure for each hospital using *U.S. News & World Report* rankings across 16 specialties; summing up the quality-adjusted scale figures for all the hospitals in the metro area; and recalibrating scores so that the top-ranking metro (New York) has a score of 100. See Appendix 1 for an explanation of sources and methods and Appendix 2, Table J for full rankings of America's 250 largest metros.

Table 5

Best Performing Metros for BushMeds: Quality-Adjusted Medical Center Activities

(Top 250 Metros)

	Metro Areas	Aggregate BushMeds	BushMeds per Capita
1	New York-Newark-Jersey City, NY-NJ-PA	100.0	12.9
2	Chicago-Naperville-Elgin, IL-IN-WI	40.7	10.6
3	Los Angeles-Long Beach-Anaheim, CA	37.5	7.1
4	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	30.7	12.4
5	Houston-The Woodlands-Sugar Land, TX	27.3	9.4
6	Boston-Cambridge-Newton, MA-NH	26.6	13.4
7	Dallas-Fort Worth-Arlington, TX	25.7	8.2
8	Detroit-Warren-Dearborn, MI	23.8	13.6
9	San Francisco-Oakland-Berkeley, CA	17.4	9.2
10	Baltimore-Columbia-Towson, MD	17.3	15.2
11	St. Louis, MO-IL	16.6	14.6
12	Miami-Fort Lauderdale-Pompano Beach, FL	15.4	6.2
13	Atlanta-Sandy Springs-Alpharetta, GA	15.2	6.2
14	Pittsburgh, PA	14.6	15.6
15	Washington-Arlington-Alexandria, DC-VA-MD-WV	14.5	5.6
	Average for 250 Metros	**4.5**	**11.6**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods; Appendix 2, Table J for a full ranking of all of the 250 largest metro areas; and all underlying data in online Data Appendix.

BushMeds per capita: Table 6 shows the best performing 15 of America's 100 largest metros for innovative medical activities per capita on the left side and the top 15 among metros ranked 101st through 150st in population terms on the right. Again, we separate the two groups because high-performing college towns with an academic medical center score so far ahead of large metros on this measure.*

On this measure too, top-performing metros score far ahead of lower-performing ones. **Durham-Chapel Hill** does three times more innovative medical activity per capita than the median large metro and at least five times more than metros in the bottom tenth of the ranking.

* We calculate BushMeds per capita scores by dividing aggregate BushMeds scores for each metro by metro-area population and recalibrating to set the top-performing metro (Rochester, Minnesota) to 100. See Appendix 2, Tables K and L for full rankings of each group.

Table 6

Best Performing Metros for BushMeds Medical Center Activities Per Capita

(Top 100 metros on the left side; next 250 on the right side)

	Top 100 Metros				Smaller Metros		
	Metro Areas	BushMeds per Capita	Aggregate BushMeds		Metro Areas	BushMeds per Capita	Aggregate BushMeds
1	Durham-Chapel Hill, NC	31.5	8.4		Rochester, MN	100.0	9.1
2	Charleston-North Charleston, SC	30.5	10.2		Ann Arbor, MI	62.9	9.4
3	New Haven-Milford, CT	19.0	6.6		Iowa City, IA	48.6	3.5
4	Albany-Schenectady-Troy, NY	18.7	6.7		Charlottesville, VA	38.3	3.4
5	Toledo, OH	18.6	4.9		Columbia, MO	31.0	2.6
6	Birmingham-Hoover, AL	18.6	8.2		Binghamton, NY	24.7	2.4
7	Jackson, MS	18.2	4.4		Saginaw, MI	24.0	1.9
8	Madison, WI	18.2	5.0		Gainesville, FL	23.8	3.2
9	Little Rock, AR	17.5	5.3		Tyler, TX	23.0	2.2
10	Harrisburg-Carlisle, PA	16.5	3.9		Lexington-Fayette, KY	22.5	4.8
11	Scranton--Wilkes-Barre, PA	15.9	3.6		Sioux Falls, SD	22.4	2.5
12	Rochester, NY	15.8	6.8		Florence, SC	22.0	1.8
13	Pittsburgh, PA	15.6	14.6		Duluth, MN-WI	20.8	2.4
14	Syracuse, NY	15.5	4.1		Springfield, IL	20.4	1.7
15	Baltimore-Columbia-Towson, MD	15.2	17.3		Billings, MT	19.9	1.5
	Average for Top 100 Metros	**10.8**	**8.9**		**Average for Smaller Metros**	**12.2**	**1.5**

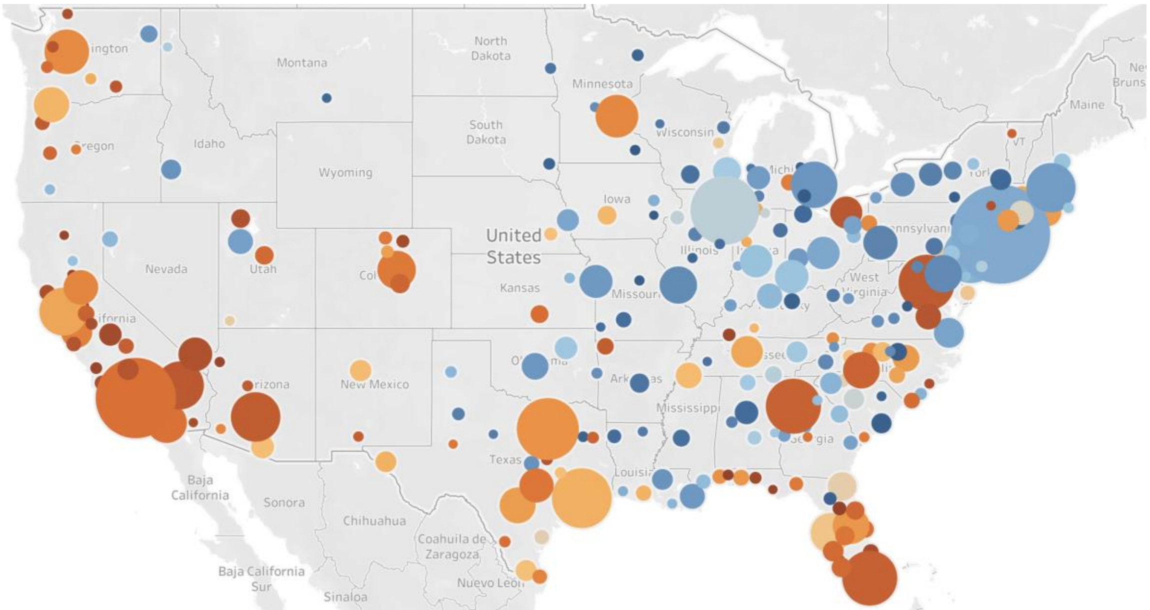
See Appendix 2, Tables K and L for full rankings of the 250 largest U.S. metros.

Figure 3 shows how America's 250 largest metros rank for BushMeds per capita scores. Again, circle size signifies metro-area population, while color indicates BushMeds per capita ranks. Blue indicates high BushMeds per capita scores, while orange indicates below-average scores.

Figure 3

BushMeds Per Capita: Quality-Adjusted Medical Center Activities

(250 largest metros; blue and orange indicate above- and below-average total innovation impact, respectively)



<u>What explains differences across metros in eds and meds innovation?</u> These factors influence how metro areas perform on our BushEds and BushMeds scores:

- **Research spending:** Total research spending by local universities and academic medical centers is strongly predictive of eds and meds outcomes as measured by our BushEds and BushMeds metrics. Likewise, metros with high eds and meds research spending as a share of local GDP outperform on our BushEds and BushMeds per capita measures.

- **University age:** The age of a metro area's leading university is strongly associated with total university research spending and is also predictive of BushEds and BushMeds scores.[*]

- **State spending:** Per capita state spending on hospitals is predictive of how metros perform in our BushMeds per capita rankings. However, **state spending on higher education does not influence metro-area BushEds scores – probably because most state appropriations to colleges and universities go to teaching activities rather than research**.

- **Foreign-born population share:** Metros with above-average immigrant population shares tend to outperform other metros for university innovation, reflecting the disproportionate role immigrants play in innovation and entrepreneurship in 21st century America.

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[*] We define the "leading university" in each metro area for the purpose of calculating university age as the university that ranks first for research spending. We make one exception: Boston, where Harvard is older than MIT but spends less on research. We use Harvard as Boston's leading university because of its overall eminence and because Harvard plus affiliated medical centers spend more than MIT on research.

State spending on higher education notably influences metro-area community college and bachelor's degree outcomes but not university innovation impact. This result – together with the close association among university age, research spending, and innovation impact – suggests that it takes considerably longer to build great research universities and academic medical centers than to build teaching institutions that produce good student outcomes.

How eds and meds institutions are evolving to promote innovation impact

Blue-sky research on big challenges

Eds and meds institutions that outperform for innovation impact are generally ones that choose to do so. Some are working to push the collective work of their institution toward research that is potentially transformational and aimed at society's greatest real-world problems – and away from narrow, incremental projects with little connection to social needs.

A 2019 report from the Association of Public and Land-Grant Universities and a broad consortium of institutions called for America's universities to step up their commitment to "public impact research" addressing society's "grand challenges."[137] Former Stanford President John Hennessy echoed this call in a speech at Stanford's "Entrepreneur's Corner": **"If universities don't work on the world's biggest problems, who will?"**[138]

Eds and meds institutions are pursuing several strategies to promote ambitious "blue-sky" research by their faculty and students – taking on profound and socially significant questions with limited hypotheses on where the work will lead.

- **Change incentives:** Universities can broaden promotion and tenure criteria and other incentives to encourage researchers to take on high-risk, high-return projects – recognizing that academic reward systems typically incentivize low-risk incremental research, particularly for junior faculty in what can often be the most creative time in their career.

- **Offer fast grants for ambitious projects:** Relatively small grant facilities can make a large difference for researchers who have no other ready source of funding.[*]

- **Invest in expensive research equipment and facilities:** Equipment bottlenecks have significantly constrained recent eds and meds innovation, a 2023 Federal Reserve Bank of Kansas City study showed.[139]

- **Organize for transformative science and innovation:** Former University of North Carolina Chancellor Holden Thorp and entrepreneur Buck Goldstein call for research universities to center

[*] An example: George Mason University economist Tyler Cowen, University of California at Berkeley bioengineering professor Patrick Hsu, and Stripe founder Patrick Collison created a fast-grant program to fight the COVID-19 pandemic in April 2020. Their program distributed more than 260 grants, each approved in less than 14 days, including a saliva test developed by Yale researchers who couldn't get funding from internal Yale sources (Greg Ip, "To Boost Growth, Rethink Science Funding," *Wall Street Journal*, November 18, 2022).

innovative activities that address big challenges in interdisciplinary units outside traditional academic departments and closely connected with the private sector in their book *Engines of Innovation: The Entrepreneurial University in the Twenty-First Century*.[140] Steven Currall of the University of South Florida and colleagues concur, arguing that "organized innovation" requires "radical dismantling of traditional research and academic silos" and "orchestration" of academic public-private collaboration.[141]

A leading example of how to organize research units for blue-sky innovation is the lab led by legendary inventor Robert Langer, now within the Koch Institute for Integrative Cancer Research at **MIT**. The subject of a Harvard Business School case study, Langer's lab pursues high-risk, high impact health care technology projects, employs an interdisciplinary team of more than 100 researchers, interacts closely with seasoned entrepreneurs and venture capital investors, and creates spinout companies to commercialize inventions. The Langer Lab has helped launch more than 40 companies – including Moderna – and developed over 35 products now on the market.[142]

- **Hold down dependence on industry funding:** Corporate partners generally steer researchers away from blue-sky science. High-performing researchers and institutions collaborate closely with private-sector partners without becoming contract researchers for private firms.

- **Define innovation broadly:** Some transformational innovations are not well suited to patenting, licensing, or venture capital startup investing. Eds and meds leaders should recognize that innovation in many cities doesn't follow the Silicon Valley script but rather occurs in non-glamorous homegrown industries, University of Toronto scholar Dan Breznitz writes in *Innovation in Real Places: Strategies for Prosperity in an Unforgiving World*.[143]

Below are some recent initiatives by high-performing eds and meds institutions:

- **University of Arizona:** The university changed its promotion and tenure policies to take into consideration "integrative and applied forms of scholarship that include cross-cutting collaborations with business and community partners, including translational research, commercialization activities, and patents."[144]

- **MIT:** MIT's Deshpande Center for Technological Innovation, launched in 2002, makes two-year grants to faculty and students to advance potentially transformative projects. The Center has made over $200 million in grants to some 400 researchers. Its grants have helped create 49 companies, addressing challenges like wastewater cleaning, biological sensing, and space propulsion.[145] MIT launched another unit, The Engine, in 2016 as a Cambridge-based fund and incubator to support breakthrough "tough tech" projects that are too complex to attract venture capital investors demanding fast profits. The Engine has raised over $430 million to date, with $60 million in seed funding from the university. Startups backed by The Engine to date include companies developing a commercially viable fusion reactor, a commercial quantum computer, and an instrument that allows a patient's cells to be loaded with a cancer drug and injected back.[146]

- **Caltech:** Caltech's Rothenberg Innovation Initiative, started in 2007, offers two-year grants of up to $250,000 to faculty researchers for high-risk, high-reward research projects.[147]

- **North Carolina State University:** NC State's Chancellor's Innovation Fund, started in 2010, makes fast grants of up to $50,000 for short-term, potentially transformational faculty or student projects. The Fund has made $4m in grants to more than 60 projects, which have attracted $75 million in follow-on funding from other sources, leading to 32 startups and $2.5 million in license income.[148]

- **The Broad Institute of MIT and Harvard:** MIT and Harvard partnered to launch the Broad Institute, which pursues large-scale collaborative science centered on systems biology and genomic medicine. The Broad Institute employs almost 3,000 researchers. It has identified more than 100 cancer-causing genes and is now the world's largest producer of genomic data.[149]

- **Harvard's Wyss Institute:** The Wyss Institute, launched in 2009 with $350 million in gifts from Harvard alumnus Hansjörg Wyss and now employing 250 researchers, pursues transformational blue-sky research focused on the new field of biologically inspired engineering, with applications in health care, robotics, manufacturing, and more. In its first 14 years, the Institute has given rise to 56 startup businesses and developed such products as vascularized tissue for breast reconstruction and plastic-degrading microbes that can decompose plastic waste at large scale.[150]

- **Kansas State University:** K-State has launched large-scale interdisciplinary research programs focused on biodefense, food and agriculture systems, and digital agriculture.

- **Vanderbilt University:** Vanderbilt has initiated large-scale centers focused on cyber and physical national security, regional infrastructure, and the science of reading.

- **The University of Texas at San Antonio:** UTSA launched a cybersecurity center in 2001.

- **Arizona State:** ASU's website lists 174 interdisciplinary research centers, including units focused on advanced electronics, drylands stewardship, medical imaging, nanotechnology, policing, and urban innovation.

Instilling institutionwide cultures of innovation and entrepreneurship

One of the factors that distinguishes eds and meds institutions with outsized economic impact is the "breadth of involvement" of the whole university in innovation activities – including research, teaching, student activities, and industry collaboration – according to a Carnegie Mellon University Center for Economic Development report. "The most engaged universities demonstrate … diverse, integrated commitments across administrative and academic units," the report's authors conclude.[151]

University initiatives to build institutionwide cultures of innovation and entrepreneurship include:

- Makerspaces to support product development by campus inventors.
- Entrepreneurship programs, including for students outside traditional business schools.
- Entrepreneurship training for faculty and graduate/post-graduate researchers.
- Business plan competitions.
- Business mentoring programs.

- Accelerators and incubators.*
- Networking opportunities with local startup/venture ecosystems.
- Celebration of campus innovation and entrepreneurship achievements.

Universities with deep innovation and entrepreneurship cultures generally outperform for basic research as well, countering fears that commercial work might undermine traditional university missions. Two studies have debunked the idea of a tradeoff between patenting and research quality.[152] A series of studies have further shown evidence for positive relationships between patenting and publication quantity at the whole-university level that are consistent with the findings in our report.[153]

Universities with institution-wide innovation and entrepreneurship cultures include:

- **MIT:** This top performer is widely recognized for its innovation-minded cultures. MIT has more than 80 innovation and entrepreneurship organizations on campus, centered in the MITInnovationHQ.

- **Stanford:** Stanford students confirm the entrepreneurial culture that pervades their campus. "Here in Silicon Valley, you never really hear [negative stories] of failure," one student says on Stanford's website. "It's survivor bias. I think Stanford does this well." Another said: "People here can fail without being ridiculed."

- **Brigham Young:** BYU operates America's largest student-run venture fund, a startup incubator in its business school, at least nine Innovation Lab spaces, an undergraduate minor in design thinking, classes on starting a biotech company, and thriving student clubs for entrepreneurship and venture investing. It benefits from an exceptional degree of cohesion and common purpose among its faculty, reflecting the university's unique position as an institution of The Church of Jesus Christ of Latter-day Saints, and from tight connections with the wider Silicon Slopes ecosystem stretching from Provo through Salt Lake City to Park City.

- **Purdue:** Purdue's leaders have made innovation impact and entrepreneurship core priorities of the university over the last decade. Faculty across the university are working to turn more of their research into real-world products. The Purdue Foundry incubator, started in 2013, has helped launch 370 companies with almost $900 million in external funding.

- **Drexel University:** Drexel's culture became extremely innovation-minded under Constantine "Taki" Papadakis, president from 1995 to 2009. On his watch, Philadelphia-based Drexel created one of America's top interdisciplinary degree-granting entrepreneurship schools, assigned assistant deans for research and innovation to every school, and partnered with the University of Pennsylvania to build the University City District and the uCity Square innovation district. Today, Drexel operates an accelerator program, a seed fund, and a substantial incubator space. Drexel

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* An accelerator is a program supporting early-stage innovative companies, typically for a short duration such as 12 weeks, through education, mentorship, financing, and sometimes office space. Prominent examples include Y Combinator in the San Francisco Bay area and Techstars in Boulder, Colorado. An incubator is a workspace aimed at offering startups a range of needed services, including expert advisors, training, and office equipment.

also generously supports innovative researchers with funding and lab space and offers unusually favorable financial terms to inventors.

Optimizing technology commercialization operations

Well-run technology transfer and commercialization offices help drive university-wide innovation impact, as our data confirms.

Institutions that have built effective tech transfer offices (TTOs) recognize that technology commercialization doesn't come naturally to most academic cultures and requires sustained commitment from university leadership. Even at **MIT**, faculty researchers mostly looked down on commercialization before the mid-1980s. The university's TTO was a "bureaucratic quagmire" with a bad reputation among entrepreneurs and investors before the appointment of Lita Nelsen, who built one of the world's greatest commercialization operations during her 1986–2016 tenure.[154]

High-performing eds and meds institutions generally share several common elements in their technology commercialization activities:

- **Goals: Effective TTOs aim to advance three goals, many experts agree: (1) Strengthen their institution's whole research and teaching ecosystem; (2) attract, retain, and incentivize faculty researchers; and (3) improve the world through transformative research and innovation**.[155]

  Earning profits for the institution is an occasional side benefit of effective technology commercialization, but high-performing institutions rarely aim to maximize profits as such. One reason is that few universities ever earn enough in license income or equity returns to cover TTO costs, as MIT's Lita Nelsen has pointed out. Another is that focusing on profits, even when rational in a narrow sense, can slow the time to market for innovative products, antagonize star faculty, and undermine broader cultural goals.[156]

- **Experienced leadership, professional staff, adequate funding:** TTOs are typically "overcommitted, understaffed, and burdened with expectations that they will pay for themselves," according to Thorp and Goldstein. Inexperienced leadership or inadequate staffing often leads to dysfunctional interactions between administrators and researchers and poor marketing of university inventions.[157] TTO staff size and patenting budgets significantly influence universitywide innovation outcomes, our data show.

- **Focus on external relationship building and product time-to-market:** Many TTOs wait for potential licensees to come to them and then focus excessively on minimizing their university's risks when negotiating terms. They also err by empowering inexperienced researchers as CEOs of university-backed spinouts. Effective TTOs, by contrast, relentlessly network with seasoned entrepreneurs and investors, market their most promising technologies, recruit experienced business leaders to head their startup companies, and focus on the shortest path to market for innovative products.[158]

- **Offer attractive, market-rate terms to university inventors:** Effective TTOs recognize that below-market terms can lead innovation-minded researchers to bypass the TTO and strike their own external deals, or simply work elsewhere.[159] High-performing institutions also limit the share of earned revenues that go to the TTO. MIT's TTO takes 15%.[160]

- **Monitor, quantify, and transparently disclose innovation impact results:** Some high-performing institutions publish brief but transparent annual reports on how they are doing, including data they report to the Association of University Technology Managers.[*]

Consider the technology commercialization activities of several top performers for innovation impact productivity:

- **Caltech:** At Caltech, the top-ranking large university in our productivity rankings, the TTO engages constantly with industry, files provisional patent applications on virtually every invention disclosure it receives, and focuses on being "as user friendly as possible" for researchers and external partners.

- **The University of Florida:** UF operates one of America's largest and most respected TTOs. UF's TTO functions as a "high-volume shop" with numerous process management tools borrowed from the business world, its head told us in an interview. The university's "UF Innovate" initiative aims to build tight linkages among the TTO, faculty inventors, UF's incubators and seed funds, and external entrepreneurs and investors. UF, second among large universities for productivity in our rankings, produces 23% as much innovative output as the University of California System while spending only 12% as much on research.

- **Arizona State:** ASU has dramatically stepped up its technology commercialization efforts over the last two decades under President Michael Crow's leadership. The university, which did virtually no funded research as recently as 1980, increased research spending more than sixfold from 2002 to 2022 and outperformed almost all other large universities in raising productivity over the past 10 years. In our new rankings, ASU ranks third among large universities for productivity. The Department of Defense awarded ASU a grant in 2014 for a Center of Excellence in Technology Transfer from which other institutions can learn.[161]

- **Mass General Brigham:** Mass General Brigham Innovation operates one of America's premiere academic medical center TTOs, representing not just Mass General Brigham's hospital system but also several other Harvard-affiliated medical centers. It employs 140 people and has helped commercialize numerous medical devices and therapeutic drugs, including the hemophilia B drug Alprolix, rheumatoid arthritis drug Enbrel, and diabetes drug Victoza. Mass General Brigham ranks third among medical centers for innovation impact productivity in our rankings.

Supporting local innovation and entrepreneurship ecosystems

One of the most notable trends of the last two decades has been a shift among universities toward promoting local and regional business ecosystems – including launching local startups – and away from licensing technologies to faraway corporations.[162]

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[*] See, for instance, disclosures on the Carnegie Mellon (https://www.cmu.edu/cttec/) and ASU (https://skysonginnovations.com) websites.

Successful eds and meds fuel local economic development by producing graduates who stay in town, attracting research funding and employing large workforces, as we discuss in Section II. But **high-performing institutions are becoming more intentional about startup creation and local economic engagement,** including the following initiatives:

- Licensing technologies to local entrepreneurs and investors.
- Launching spinout companies that operate locally, including student-led firms.[163]
- Operating seed funds to invest in faculty and student startups.
- Partnering with local industry on R&D projects.
- Participating in business attraction and growth initiatives with public and private sector partners.
- Purchasing goods and services from locally owned and operated businesses.

Here are some examples of effective engagement in local startup and economic development activities:

- **Caltech:** Caltech, which ranks first among large universities in our rankings for turning research dollars into spinout companies as well as for overall innovation impact productivity, operates an exceptionally robust startup ecosystem. Its TTO employs two entrepreneurs-in-residence who help university-affiliated company founders develop business plans, coach them on investor pitches, introduce them to local subject-matter experts, and provide ongoing mentoring. Caltech operates a well-located Innovation Center for spinout companies adjacent to campus. The university also runs a substantial seed fund and in 2023 launched a partnership with local firm Wilson Hill Ventures to foster Caltech spinouts.[164]

- **Purdue:** Purdue ranks second among large universities for spinout creation per dollar of research spending and fifth for total spinouts, ahead of many much larger institutions.[165] Like Caltech, the university has a comprehensive startup ecosystem that includes the Purdue Foundry incubator as well as a venture fund focused on Purdue-connected startups and close connections with supportive outside partners like the Silicon Valley Boilermaker Innovation Group. In 2023, the university formed "Purdue Innovates" to coordinate among its startup ecosystem, its entrepreneurship teaching programs, and its technology commercialization office[166]

- **Arizona State:** ASU, which ranks fourth among large universities for productivity in creating spinouts, is a global innovator in combining a broad range of economic development-focused activities – corporate relations, technology transfer, management of seven innovation districts and a core lab space, and engagement in public-private-university economic development activities for the Phoenix metro area and beyond – in an integrated organizational structure, ASU Knowledge Enterprise. ASU is also a leader in fostering student entrepreneurship programs through teaching programs and its Luminosity Lab, founded in 2017, which provides a skunkworks plus modest funding for student innovators.[167]

- **Carnegie Mellon University:** Carnegie Mellon, the top performer among midsized universities in our ranking for innovation impact productivity, has partnered with many technology and advanced manufacturing companies and played an instrumental role in inducing them to build facilities in Pittsburgh. Its Robotics Institute – the world's leading robotics research and teaching organization with more than 1,000 faculty, staff, and students – has worked with Tesla, Google, and Uber on autonomous vehicle technology. Carnegie Mellon also operates widely respected accelerator programs with its partner Innovation Works and incubator programs through its Swartz Center for Entrepreneurship.

- **Kansas State University:** K-State has emerged as a national thought leader in how universities can become stronger engines of local economic development. The university, like ASU, is among the few that combine technology transfer, corporate engagement, and local economic development initiatives in an integrated unit, K-State Innovation Partners (KSU-IP). KSU-IP plays a central role in K-State's "K-BED" (knowledge-based economic development) partnership with local government and economic development authorities in Manhattan, Kansas. KSU-IP and its external partners effectively function as a single unit in pursuing economic development opportunities for the region. K-State's close engagement helped Manhattan become the site of the National Bio and Agro-Defense Facility – a joint venture of the U.S. Departments of Agriculture and Homeland Security – and to win a 2022 contest for a Scorpius BioManufacturing plant.[168]

- **The Ohio State University and Ohio University:** OSU, Ohio University, and partner institutions launched a $40 million-plus venture fund to promote Ohio startups. The fund, which started investing in 2016, has backed 20 companies and earned a 30% gross rate of return. The universities are currently planning a second fund.[169]

- **Yale University:** Yale, which had a strained relationship with New Haven leaders and residents for decades, assumed a leading role in the city's economic revival starting in the 1990s. Yale has thoroughly renovated several walkable neighborhoods near the campus, built a new Science Park in and around long-abandoned industrial buildings, and helped launch more than 25 local biotech companies drawing on Yale research.[170]

- **University of Pennsylvania:** The university's West Philadelphia Initiatives, launched in the 1990s, have long included a commitment to substantial procurement of goods and services from locally owned and operated businesses.[171] The university's purchases from West and Southwest Philadelphia suppliers amounted to $104 million in 2022, including $23 million from Black-owned businesses.

Partnering with local organizations on research for social good

Universities are also investing in local economic development alongside local partners through policy research institutes.

- **Rice University:** Rice's Kinder Institute for Urban Research helps address Houston-area social and economic challenges through policy research, an annual population survey, regular housing market studies, and close engagement with Houston-area school districts and local governments.

- **Arizona State:** ASU's Center for Smart Cities and Regions develops evidence-based strategies for the Greater Phoenix area, while its Center for Urban Innovation has partnered with 13 local municipalities to improve local government performance.

- **University of Minnesota:** The university's Urban Research and Outreach-Engagement Center, established in 2005, works alongside Minneapolis-area neighborhoods to promote economic and community development through evidence-based solutions to local challenges. The center operates computer classes, a program on maternal health, and research on the opioid epidemic.

- **University of Wisconsin–Oshkosh:** The university's Center for Customized Research and Services coordinates faculty engagement in local and regional challenges. Its contract research work has included a study of how the COVID-19 pandemic affected Wisconsin small businesses and a project to support a struggling northern Wisconsin town's placemaking initiatives. The university's Whitburn Center, meanwhile, partners with Wisconsin municipalities to improve government performance.

- **HBCUs:** HBCUs have a long history of engaging on local racial justice issues. **Texas Southern University** launched its Center of Excellence for Housing and Community Development Policy Research, focused on the Houston area and the Texas Gulf Coast, in 2023. **North Carolina A&T University** is creating a similar Center of Excellence on affordable housing and sustainable communities focused on North Carolina's Triad region. The U.S. Department of Housing and Urban Development is supporting both initiatives.

- **Dallas College:** Dallas College's Research Institute, launched in 2022, produces research on educational attainment, postsecondary success, and the value of college. Modeled after institutes like the Belk Center for Community College Leadership and Research at NC State University and the Community College Research Center at Teachers College, Columbia University, the group embeds a greater research presence within a community college while collaborating with K–12, four-year, and other partners throughout the region, state, and nation.

Ensuring freedom of inquiry and expression

The American Association of University Professors and the Association of American Colleges, in their famous 1940 "Statement of Principles on Academic Freedom and Tenure," held that "**Institutions of higher education are conducted for the common good … [and] the common good depends upon the free search for truth and its free exposition … Freedom of research is fundamental to the advancement of truth**."[172] **These principles have been the bedrock of teaching, research, and innovation at America's universities ever since.**

Restoring the core values of free inquiry, free expression, and objective research at America's universities is a vital element in strengthening university innovation impact. Institutions that welcome unorthodox views and prevent intimidation of researchers and students doing unpopular research will almost surely outperform less free, more ideologically driven institutions as centers of research and innovation over the long term.

- **University of Chicago:** The University of Chicago has been a thought leader on free expression since former President Robert Zimmer articulated the "Chicago Principles" in 2014, asserting that universities must not suppress debate or deliberation just because "the ideas put forth are thought by some or even most members of the university community to be offensive, unwise, immoral, or wrong-headed."[173] Just over 100 universities have adopted the "Chicago statement" or a similar policy since then, including many high-performing institutions for innovation impact productivity like Arizona State, Case Western, MIT, Princeton, the University of Akron, the University of Arizona, and Vanderbilt.[174]

- **Vanderbilt University:** Vanderbilt Chancellor Daniel Diermeier reaffirmed the university's commitment to "principled neutrality" on contentious topics and launched the Vanderbilt Project on Unity and American Democracy, led by former Tennessee Governor Bill Haslam, historian Jon Meacham, and faculty member Samar Ali, to promote research and discussion of evidence-based approaches to mediating differences among Americans.[175]

While total research spending is highly predictive of the innovation impact of individual eds and meds institutions, some universities and academic medical centers significantly outperform others in turning research dollars into innovation outputs. Faculty quality, institutional culture, and technology commercialization policies help explain differences in innovation impact productivity.

High-performing eds and meds institutions are pursuing several proven strategies to increase the impact of their research, support local innovation ecosystems, and promote hometown economic development, including the following:

- **Create incentives, funding, and effective organizational units to support potentially transformative research addressing society's greatest challenges.**
- **Instill institutionwide cultures of innovation and entrepreneurship.**
- **Optimize technology commercialization activities: Appropriate goals, adequate funding and staff, aggressive external engagement, transparent monitoring of results.**
- **Support local innovation and entrepreneurship ecosystems.**
- **Partner with local organizations on research for social good.**

V. PLACE

Eds and meds institutions influence economic outcomes in their cities in part by how they shape the built environment.* We look at several kinds of intentional placemaking initiatives in this section, but we devote most of its space to the fastest-growing placemaking strategy that universities and medical centers are pursuing today: innovation districts.

Innovation districts

Innovation districts are dense, physically compact urban areas where knowledge-generating institutions and leading-edge companies of diverse size and industry, including startups and supportive organizations like accelerators, cluster together to stimulate creativity, collaboration, innovation, and entrepreneurship. In most cases, innovation district leaders aspire to create attractive, walkable environments, including substantial housing options.** Successful innovation districts generally involve close cooperation among a variety of players: one or more eds and meds anchor institutions, specialized real estate developers, entrepreneurs, investors, incubators, established companies, philanthropists, community nonprofits, and local (and sometimes state) governments.[176]

Eds and meds institutions sometimes own the land – and in some cases buildings, too – where innovation districts are located. But an innovation district, by definition, engages nonacademic tenants in multi-tenant space rather than hosting traditional single-use academic buildings. Eds and meds institutions often ground-lease space to private-sector developers to speed up development and manage financial risk, but they invariably occupy some of the district's space as anchor tenants and sometimes play leading roles in curating the tenants and activities that come to the district.[177]

In some cases, a university or medical center is the prime mover in building an innovation district, such as the **Ion district** launched by **Rice University** near downtown Houston. In others, districts come about through multistakeholder initiatives from the start, like Philadelphia's **uCity Square** and St. Louis's **Cortex Innovation Community**.

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* The author Yi-Fu Tuan defined "places" as "centers of felt value … or humanized space, where unbounded space is transformed into place *via the bonds humans make with particular spaces by imprinting of values and meaning upon them*." As quoted in Daniel H. Olsen, Review of Yi-Fu Tuan, *Space and Place*, *Material Culture* 38, No. 1 (Spring 2006): 128–30, https://www.jstor.org/stable/29764328.

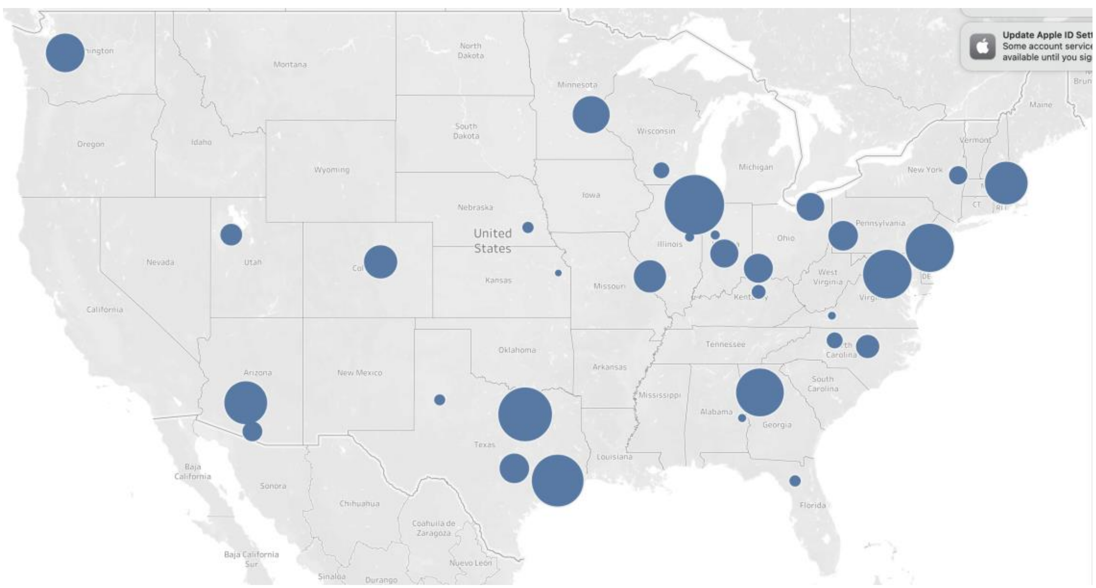
** We draw this definition from the leading authors on the topic: Julie Wagner, president of the Global Institute on Innovation Districts (GIID) and Bruce Katz, director of the Nowak Metro Finance Lab at the Lindy Institute for Urban Innovation at Drexel University (Bruce Katz and Julie Wagner, *The Rise of Innovation Districts: A New Geography of Innovation in America* [Brookings Metropolitan Policy Program, May 2014], https://www.giid.org/wp-content/uploads/2019/01/innovationdistricts1.pdf; Global Institute on Innovation Districts, https://www.giid.org). Katz and Wagner define innovation districts in *The Rise of Innovation Districts* as "geographic areas where leading-edge anchor institutions and companies cluster and connect with startups, business incubators, and accelerators. They are also physically compact, transit-accessible, and technology wired and offer mixed-use housing, office, and retail." We slightly rework this definition because, based on the definition, most of the 36 self-identified innovation districts in our dataset would not fully qualify under GIID's strict definition – primarily because of lack of housing and/or transit-based access. We fully agree that GIID's wording captures the common aspirations of most innovation district founders and leaders.

Rapid growth: There are more than 100 innovation districts in the world today, up from a handful before 2000, according to the Global Institute on Innovation Districts (GIID). American cities host more than 50—and considerably more if one loosens the definition. Twenty-one of the 36 innovation districts in a first-of-its-kind dataset we've assembled for this report came into being after 2000, and 10 have started since 2013.

Innovation districts are also spreading geographically. Leading specialist developers generally didn't build wet lab-ready life science space outside the Boston, Philadelphia, San Francisco, and San Diego metros until the past decade, industry experts told us.[178] Today they're building in more than a dozen additional metros.[179]

Figure 4 shows the locations of the 36 innovation districts in our dataset graphically, while Table 7 lists them.[*]

Figure 4
Innovation Districts in the Bush Institute-SMU Dataset



[*] We've selected our 36 innovation districts with the goal of creating a broadly representative sample, not of building a comprehensive list. All innovation districts in our dataset satisfy at least one of three criteria. They are: (1) members of the GIID network; (2) members of the Association of University Research Parks; or (3) frequently mentioned in published work on the subject. Entries for innovation district founding years reflect selective judgments in some cases, where establishment of a management entity took place after innovation district-type activities were already underway. U.S. innovation districts listed in a GIID report but not included in our dataset include: Innovate ABQ (Albuquerque), University of Maryland BioPark (Baltimore), Birmingham Innovation District, Buffalo Niagara Medical Campus, Innovation District of Chattanooga, Illinois Medical District (Chicago), Durham Innovation District, Erie Innovation District, Brooklyn Navy Yard, OKC Innovation District (Oklahoma City), Portland Innovation Quadrant (Portland, Oregon), Providence Innovation and Design District, and SFO Mission Bay (San Francisco). See Julie Wagner, Bruce Katz, and Thomas Osha, *The Evolution of Innovation Districts: The New Geography of Global Innovation* (The Global Institute on Innovation Districts, 2019), https://www.giid.org/wp-content/uploads/2019/05/the-evolution-of-innovation-districts.pdf.

Table 7
Innovation Districts in the Bush Institute-SMU Dataset

Metro Areas	Innovation Districts	Year Founded	Metro Areas	Innovation Districts	Year Founded
Albany, NY	Rensselaer Technology Park	1981	Lawrence, KS	KU Innovation Park	2009
Atlanta, GA	Atlanta Tech Sq	2000	Lexington, KY	Coldstream Res Campus	1992
Auburn, AL	Auburn Research & Tech Fdn	2004	Lincoln, NE	Lincoln Neb Innov Campus	2014
Austin, TX	Capitol City Innovation	2017	Lubbock, TX	Innov Hub at Research Park	2014
Blackbsburg, VA	Virginia Tech Corp Res Ctr	1985	Madison, WI	University Research Park	1984
Boston, MA	Longwood Medical Area	1972	Minn.-St. Paul, MN	Towerside Innov District	2013
Boston, MA	Kendall Square	1960	Philadelphia, PA	uCity Square	1963
Champaign-Urbana, IL	Research Park	1999	Phoenix, AZ	ASU Research Park	1984
Chicago, IL	Uni Tech Park at IIT	2006	Phoenix, AZ	PHX Core	2017
Cincinnati, OH	Cincinnati Innov District	2020	Pittsburgh, PA	Pittsburgh Innov District	2000
Cleveland, OH	Cleveland Health-Tech Corr	2010	Raleigh, NC	Centennial Campus NC State	1984
Dallas-Fort Worth, TX	Pegasus Park	2015	Raleigh, NC	Research Triangle Park	1960
Denver, CO	Fitzsimons Innov Community	2004	Salt Lake City, UT	Univ of Utah Research Park	1968
Gainesville, FL	Gainesville Innov District	2010	Seattle, WA	South Lake Union	1990
Houston, TX	UH Tech	1953	St. Louis, MO	Cortex Innov Community	2002
Houston, TX	Houston Innovation Corridor	2021	Tucson, AZ	Tech Parks AZ	1994
Indianapolis, IN	16 Tech	2015	Washington, DC	Discovery District	2017
Lafayette, IN	Purdue Discovery District	2001	Winston-Salem, NC	Innovation Quarter	2002

Why innovation districts

The economic rationale for innovation districts is the premise that agglomeration economies – the productivity and innovation benefits arising from talented people and cutting-edge firms working in proximity to one another[180] – function best when innovators are very close together.

The benefits of clustering R&D labs are most powerful when they're within a quarter mile of each other, a 2012 Federal Reserve Bank of Philadelphia study found.[181] And successful product development tends to occur in places even more geographically concentrated than the underlying research on which it's based, Stanford's Nicholas Bloom and colleagues show in a 2023 paper.[182] The benefits of close proximity explain why great innovation leaders like Mervin Kelly of Bell Labs and Steve Jobs of Apple designed office layouts to maximize serendipitous "collisions" among R&D professionals.[183]

Anne Heatherington, a senior R&D executive at a pharmaceutical firm with offices in the **Kendall Square** district adjacent to **MIT** in Cambridge, Massachusetts, said, "To benefit from Kendall Square, you have to leave your office and get out into it…. It wasn't until I joined a small biotech where collaboration outside the company was essential – so-called competitors, data consortia, potential hires, others seeking to learn – that I realized the true power of Kendall Square. It is all there. You have many points of intersection. The proximity to peers, to some of the startups, and then the proximity to the academics as well makes a big difference."[184]

Innovation also occurs best in an environment with firms of differing size interacting with each other in locations close to research universities, further studies show.[185]

An additional rationale is that many people seem to like working in innovation districts, so they help eds and meds institutions, innovative firms, and other employers attract talent. “It’s actually really fun to work with other smart people around you,” Johannes Freuhauf, founder of life science coworking space and launchpad firms BioLabs and LabCentral, has said.[186]

Eds and meds institutions create or participate in innovation districts for two reasons: (1) to build great urban places that will help attract and retain faculty researchers and students and enhance their value to the wider community, and (2) to accelerate innovation and external partnerships based on their research, which also benefit students through a more vibrant learning environment and work opportunities nearby. Private sector firms locate R&D operations in innovation districts for these reasons too—and to recruit talented students from adjacent universities.

And city and state governments support the development of local innovation districts because having a significant concentration of business R&D activities is an economic “game changer” for cities, in the words of Doug Edgerton of the North Carolina Biotechnology Center.[187] **Research Triangle Park**, started in 1960 between Raleigh and Durham, has played a pivotal role in the emergence of its region as one of the most innovative, high-income, fast-growing areas in the United States.[188]

Cities also benefit from the tax base associated with thriving innovation districts, particularly in places where tax-exempt eds and meds real estate takes up substantial local land.

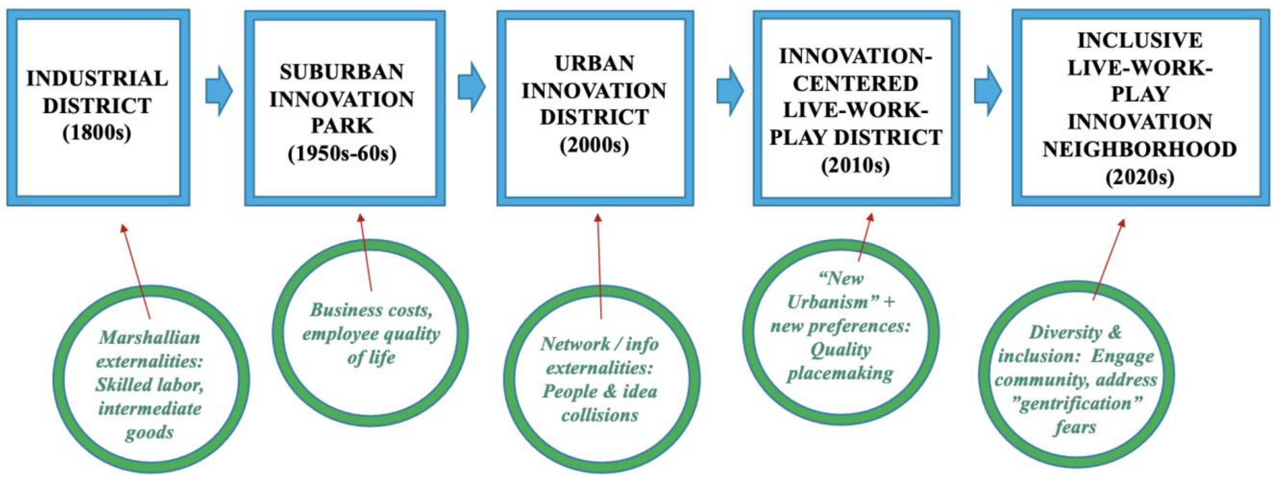
Evolution of an idea

Ideas on what an innovation district should aim to be have evolved rapidly, even as the number of innovation districts has soared. Figure 5 presents a schematic of this evolution: Each rectangle represents a stage in state-of-the-art thinking about innovation districts, and each circle represents forces that caused this thinking to shift to a new stage.

Industrial districts: Nineteenth century manufacturing operations tended to congregate in close proximity to one another in urban industrial districts like Midtown in Manhattan, Bedford-Stuyvesant in Brooklyn, Milwaukee Avenue in Chicago, and the Strip district in Pittsburgh. This pattern reflected the benefits of locating facilities within walking distance of dense pools of skilled labor and intermediate good suppliers. Once there was a critical mass of manufacturers in one location, it was in the interest of new entrants to locate there as well.

Suburban innovation parks: Improved transportation made it possible for firms to move manufacturing and R&D operations to suburban locations, including research/innovation parks, starting in the 1950s. Many took advantage of this opportunity to reduce costs and give employees higher quality of life in less crowded conditions. North Carolina’s **Research Triangle Park (RTP)**, an emblematic suburban research park, rose to prominence due to the opening of an IBM R&D facility in 1965 and the relocation of British pharmaceutical giant Glaxo’s U.S. headquarters in 1983. **The University of North Carolina at Chapel Hill**, **NC State University**, and **Duke University** were all engaged from the start.

Figure 5
Innovation Districts: Evolution of an Idea



Urban innovation districts: Leading-edge firms increasingly came to favor locating R&D facilities in dense urban locations near research universities rather than suburban office parks in the 2000s. The chief consideration driving this shift was growing recognition of the benefits of proximity, including "collisions" with talented researchers at eds and meds institutions and other firms.

Silicon Valley pulled far ahead of Massachusetts' suburban Route 128 as a tech hub in the 1980s and 1990s in part because of its greater density and social connectedness, according to economist AnnaLee Saxenian.[189] But then urban **Kendall Square** started to outshine Silicon Valley in biotechnology starting in the 2010s due to still greater density.[190] **RTP** has shifted emphasis as well, launching ambitious plans to develop a dense, urbanized live-work-play hub in the heart of its sprawling suburban property.

The emergence of successful urban innovation districts has typically followed one of three patterns.

Some districts emerged organically over decades and only developed coordinated governance later. **Kendall Square**, the paradigmatic example of this pattern, has been an industrial district since the 1830s, home to MIT since 1916, and site of the U.S. government's Radiation Laboratory during World War II. But the district suffered repeated setbacks from the 1960s to the 1990s – corporate exits for the suburbs, NASA's cancellation of a planned R&D facility, the decline of anchor tenant Polaroid, and the collapse of an early "AI Alley" in the 1990s. Kendall Square's emergence as the world's leading biotechnology hub was unplanned and uncertain until Swiss pharmaceutical company Novartis announced its Institute for Biomedical Research in 2002. Coordinated governance, MIT engagement, and the square's brand as "the most innovative square mile on the planet" only developed gradually.[191]

Second are areas that started as traditional academic real estate expansions but subsequently evolved into modern innovation districts. **Atlanta's Tech Square** came into being because landlocked Georgia Tech jumped over Interstate 75/85 to build traditional academic buildings in a disinvested neighborhood near downtown Atlanta, leading to unanticipated interest in the location on the part of private sector firms. Coordinated efforts to develop an innovation district emerged only later. **Wake Forest University** set out to build traditional space for its medical school in an underused industrial area adjacent to downtown Winston-Salem, then shifted plans to a multi-tenant innovation district during the planning process.[192]

A third group comprises districts whose founders set out to build innovation districts from the start. This group includes Philadelphia's **uCity Square**, planned by the **University of Pennsylvania**, **Drexel**, and partners in the 1990s; St Louis's **Cortex Innovation Community**, planned by **Washington University of St. Louis** and partners in the early 2000s; Dallas's **Pegasus Park**, launched by a private sector group led by a leading local philanthropist but now hosting facilities for the **University of Texas Southwestern Medical Center**, **SMU**, and other Dallas-area institutions; and most districts launched over the past two decades. We note these patterns because it's not obvious that planners can replicate assets that emerged organically through trial and error over many years.

Innovation-centered live-work-play districts: Innovation districts shifted toward incorporating residential and recreational elements in the 2010s, driven by growing public enthusiasm for quality placemaking. This change also reflected recognition that agglomeration economies work best in places with heavy mixing of land uses and that the 20th century practice of separating office real estate from other activities was a key reason most American downtowns declined between 1950 and 2000.

Kendall Square saw virtually no housing development between 1960 and 2018 and had an infamously limited restaurant scene as recently as the late 2010s. Most people working in the square got there each day via long commutes on the frequently unreliable MBTA Red Line.[193] In **RTP**, land-use rules entirely prohibited residential development, despite vast available land.[194] In these and other places, innovation district leaders changed course in the 2010s. **Virtually all innovation districts launched since 2010 have incorporated "live" and "play" elements in their plans from inception**.

Inclusive live-work-play innovation neighborhoods: The 2020s have seen rising concerns that successful innovation districts might stimulate explosive increases in land and housing prices in nearby neighborhoods and lead to displacement of low- to moderate-income people living there. **Many innovation district leaders now pay much closer attention than in the past to building districts in ways that will benefit people in surrounding neighborhoods and mitigate displacement.**[*] Issues of ecological sustainability are also rising as priorities for some district leaders.

How eds and meds institutions are working with partners to build successful innovation districts

Physical space: Innovation districts must ensure, first of all, that their workspaces meet the needs of leading-edge companies as well as academic tenants, that they are accessible, and that physical space keeps up with demand, including from startup firms with limited resources.

Fulfilling these requirements is a complex undertaking. Potential tenants have come to expect amenity-rich Class A office space. Labs and clean rooms add considerably to construction costs. Startups and academic users want large makerspaces.

Some innovation districts face significant accessibility challenges. A Cornell University-sponsored initiative on Roosevelt Island in New York City has struggled because of difficulties most New Yorkers

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[*] A handful of longstanding innovation districts – notably **Cortex Innovation Community** in St. Louis and **uCity Square** in Philadelphia – included equitable growth among their objectives from the start (Global Institute on Innovation Districts, https://www.giid.org).

face in getting there. Some districts, like **RTP**, are easily accessible by car but nearly impossible to access via public transit.[195] **Kendall Square**, in the heart of bustling Cambridge, is confronting what local business leaders call a "transportation crisis" that threatens a "breaking point" for the district's growth.

Building adequate supply, often in constrained locations, is another challenge. Many biotechnology companies have left Los Angeles over the last decade because the market lacked sufficient lab space.[196]

Successful innovation districts are working to meet demand.

- **MIT** and partners are building multiple buildings in already-dense **Kendall Square**.

- The **Winston-Salem Innovation Quarter**, blessed with greenspace into which it can grow, is planning an additional 2 million square feet to house Wake Forest's renowned regenerative medicine lab along with private-sector tenants.

- **Rice** is planning multiple buildings adjacent to its **Ion** facility.

- **Arizona State** is building five science and technology centers in its multiple innovation districts, specifically aiming to expand collaboration between ASU researchers, private-sector firms, and the new **Mayo Clinic** academic medical center in north Phoenix.[197]

- **Tech Square** stakeholders – including **Georgia Tech** and **Emory University** – are collaborating to build a companion innovation area called **Rowen** in suburban Gwinnett County outside Atlanta, which can more affordably house land-intensive activities like biomanufacturing.[198]

Creating and preserving space for startups is a particular challenge. Most startups can't afford to pay the premium rents required to make the economics work for well equipped, amenity-rich office and lab buildings. Deep-pocketed large companies further drive up rents, squeezing startups out. One prominent Kendall Square venture firm moved to less expensive space in Boston because its portfolio companies can't afford space in the square.[199]

But startups are an essential element in innovation district ecosystems. "Startups are rejuvenating because they're always attracting new talent, new people," a Kendall Square entrepreneur says. "That rejuvenative capacity of an ecosystem, which has been missed in my view by people, is a key, key component of what drives it." **Preserving startup space in growing innovation districts generally requires subsidy from university, government, or philanthropic sources, or from a tax on full-pay tenants**.

Curation and programming: Successful innovation districts generally seek to curate the kinds of tenants the district hosts and to develop programming and shared systems that amplify the benefits of being there. **Goals include attracting researchers and companies from a range of fields to promote interdisciplinary convergence of ideas, having firms of all sizes, providing support for startups, promoting heavy mixing of activities and space uses, and fostering connection and collaboration**.[200]

Here are some of the strategies:

- **Value-added coworking spaces:** Successful districts create diverse spaces that allow tenants to stay in the district as they grow and needs change. **Rice University's Ion district** offers gradations from coworking spaces to areas with dedicated private offices alongside shared assets to private suites and whole floors. **Kansas State** is creating a workplace ecosystem adjacent to campus, including its new "Garage" for startups. Some districts host life science-focused coworking space with shared lab equipment and services, reducing fixed costs for startups.

  Cambridge-based BioLabs, which operates coworking spaces in more than a dozen metro areas, has facilities in **Kendall Square**, **RTP**, Dallas's **Pegasus Park**, and other innovation districts.[201] The Cambridge Innovation Center (CIC), founded in 1999 in an MIT-owned building in **Kendall Square**, now houses more than 1,000 startups in buildings across multiple Boston-area innovation districts. CIC has played a pivotal role in the emergence of Kendall Square as one of the world's premiere innovation districts, many experts confirm.[202]

- **Programming:** Many innovation districts host startup activities like the MassChallenge competition and accelerator program, which operates in innovation districts in the Boston, Dallas, Houston, and Austin metros and elsewhere.[203] **Atlanta Tech Square** and **Cortex** offer frequent networking and speaker events for members.[204] At **RTP**, the state-funded North Carolina Biotechnology Center and the nonprofit Council for Entrepreneurial Development have long offered entrepreneurship programming and networking opportunities. The Triangle Universities Center for Advanced Studies Inc. (TUCASI) a "park within the park" that local leaders call "the secret sauce" of RTP, operates a rich variety of programming centered on the Park's three founding universities: **UNC Chapel Hill**, **NC State**, and **Duke**.[205]

- **Heavy eds and meds engagement in local innovation ecosystems:** A growing number of eds and meds institutions are stepping up their focus on local startups and economic development, often centered in nearby innovation districts and shifting away from licensing technologies to faraway firms that contribute nothing to the local economy. (See Section VI.)

These activities are core elements attracting companies to innovation districts, which is why districts that are little more than real estate plays don't work.[206] Successful innovation districts typically have a management entity separate from participating academic institutions or developers that coordinates the district's curation and programming activities.

Design and quality of life: Fulfilling the many goals of an innovation district requires careful design and substantial investment in quality-of-life amenities.

Like spaces that optimize student learning, physical spaces that are well designed for innovative work support group ideation, individual focus time, collaboration, social mingling, and quiet "brain breaks," according to a report by architecture firm HKS.[207]

In addition, **successful districts typically include design elements to promote social interaction among people from different organizations, like well-located "hot spots," as well as transparent building "skins" to showcase innovative work**. They aim to ensure walkable access to restaurants, coffee shops, bars, green spaces, and other amenities.[208] And they often include public art to energize their gathering places, as Greg Wright of Spark Towns has highlighted.

Many innovation districts have nonetheless struggled to create an authentic sense of place, according to GIID founder and president Julie Wagner. Some have needlessly demolished "gritty" historic buildings and replaced them with generic steel structures. Others have built excessively large, unwelcoming campuses with no attractive "nodes" acting as natural gathering places. Some are simply too large and dispersed to accomplish what they're trying to do, Wagner argues.[209]

As the innovation district concept has evolved to incorporate "live" and "play" elements, district leaders are focusing on improved placemaking.

- **Atlanta Tech Square**, **University College District**, and the **Pittsburgh Innovation District** are investing in restaurant offerings, public event spaces, and "parklets."[210]

- **Oklahoma City** is investing in walkability and nearby quality of life in its medical center–focused innovation district.[211]

- The **Winston-Salem Innovation Quarter** is adaptively repurposing old tobacco industry buildings that give the district its distinctive sense of place.[212]

- **Kendall Square** is adding greenspace designed by architect Maya Lin, restaurant locations, and a long-awaited pharmacy.[213]

- Seattle's **South Lake Union** has seen significant adaptive reuse of historic industrial buildings and heavy investment in amenities along its Lake Union waterfront. The district's redevelopment has attracted major investments by the **University of Washington School of Medicine**, the **Fred Hutchinson Cancer Research Center**, **Seattle Children's Hospital**, and **Amazon**.

Housing: Building housing in or near innovation district workplaces has become a high priority for district leaders over the last decade. People who live relatively close to significant "activity centers" have much shorter commutes than people who don't, but fewer than 40% of people in large metro areas live within three miles of a center, according to Brookings Institution research.[214] Shortages of nearby housing are becoming a large recruitment problem for employers in numerous innovation districts.[215]

Some innovation districts are planning multifamily residential development in centrally located district sites, including on university-owned land. **Kendall Square** has plans to add more than 1,700 units in the heart of the district. **RTP** will develop 1,200 housing units in its new Hub RTP, while the **Winston-Salem Innovation Quarter**'s expansion plans call for a multifamily structure alongside lab space.[216] **South Lake Union** has added almost 2,000 units since the start of a city-led redevelopment initiative in 2003.[217]

Inclusion: Innovation district initiatives to become more inclusive and expand opportunity in surrounding neighborhoods mostly center on K-12 education, jobs and workforce development, and inclusive placemaking. They also include affordable housing, which we discuss later in this section.

- **K-12 initiatives: Drexel** and the **University of Pennsylvania** are helping develop a K-8 STEM-focused school near **uCity Square**, while **Arizona State** and the **University of Arizona** are working on a biomedical magnet high school near an innovation district in Phoenix. **Cortex** stakeholders have established the Collegiate School of Medicine and Bioscience for high school students. **Wake Forest** has launched popular on-campus summer immersion and paid internship programs for high school students living near the **Innovation Quarter**.[218]

- **Jobs and workforce development:** Eds and meds institutions associated with **Cortex**, **uCity Square**, and a new innovation district in **Columbus, Ohio,** operate workforce training programs for neighborhood adults and job platforms to help them find work with district employers. **Cleveland Health-Tech Corridor** stakeholders established the Evergreen Cooperative Initiative to create living-wage jobs in locally owned companies serving the area's hospitals and other enterprises. **RTP** institutions are supporting an initiative by area community colleges to develop a shared curriculum aimed at preparing people for RTP biotechnology jobs.[219]

- **Inclusive placemaking: Wake Forest** and partner **Atrium Health** are working alongside a historic Black church to create a "Metropolitan Village" just across a highway from the Innovation Quarter, with affordable housing, workforce development initiatives, and programming to connect neighborhood residents with the Innovation Quarter.[220]

Governance: Successful innovation districts recognize that **effective collaboration and organization among district stakeholders is essential**. Stakeholders typically include disparate institutions with different goals and decision-making styles and little record of working closely with one another, as Julie Wagner points out in a new Global Institute on Innovation Districts report.[221] "Without some way of governing, separate ideas and strategies will fail to 'add up,'" she argues.

Participating eds and meds institutions and other stakeholders generally need to develop a shared vision for the district addressing issues such as the following:

- Building a master plan for physical development of the district.
- Working out goals and practices for the district's programming and curation.
- Determining what's allowed for district stakeholders in terms of physical space and activities.
- Constructing shared research agreements among institutions.
- Marketing the district.
- Resolving disputes.

Stakeholders, moreover, need to build governance processes to sustain collaboration as conditions and plans evolve. The **Winston-Salem Innovation Quarter**, for instance, has had to navigate a significant change in the governance structure of the district's dominant institution, **Wake Forest University Health Sciences**, and the departure of a key private-sector tenant during the pandemic. Building the innovation district has been "a game of continuous innovation and setbacks, and staying true to [our] principles," according to Graydon Pleasants, one of the Innovation Quarter's chief planners.

Most successful innovation districts have a management entity separate from participating institutions and developers to coordinate efforts and address these challenges. Some management entities – including the entities managing **RTP**, **Cortex**, **uCity Square**, the **Pittsburgh Innovation District**, and the **Helix** district at Houston's **Texas Medical Center** – operate with multistakeholder models. The **MaRS Discover District** in Toronto has an exceptionally effective multistakeholder governance structure. Other districts, like the **Innovation Quarter** and the **Ion** district, have a single dominant institution. But even the latter typically find it helpful to establish management entities that can move more nimbly than their parent institutions.[222]

To be effective, innovation district management entities must have sustainable financing streams. In some cases like **RTP**, sustainable funding comes from large land ownership in the district. In other cases like the **University City District**, stakeholders empower the management entity to levy fees on tenants.[223]

Public-sector roles: Local governments have played essential roles in building virtually all successful innovation districts. Districts that offer significant public gathering spots and affordable space for startups are typically not viable without some kind of public-sector or philanthropic subsidy. Local government contributions have consisted mostly of assistance based on taxing and land-use powers rather than active management of districts.

- **Taxing powers:** The City of Boston approved tax abatements to promote the **Longwood Medical Area** and **Seaport** districts, while Raleigh and Durham have supported **RTP** through special tax treatment. Winston-Salem created a Tax Increment Financing (TIF) district to promote the **Innovation Quarter**. **Tech Square** has benefited from being in Atlanta's Midtown Improvement District. Many districts have benefited from tax abatements to restore historic buildings, build sidewalks, and make other vital investments.

- **Land-use powers:** The City of Philadelphia has granted specific land-use powers to the **University City District** management entity, while St. Louis has supported **Cortex** with both land-use authorities and tax abatements. Houston contributed much of the land on which the vast **Texas Medical Center**, including its **Helix** district, sits. Cambridge, Massachusetts, created a unique zoning status for **Kendall Square** in 2015, requiring all new office or lab structures over 100,000 square feet to set aside "Innovation Space" either in the building or elsewhere in the square for coworking or incubator space. The city's goal was to keep Kendall Square accessible for startups.[224]

In some districts, state authorities have also played key roles. The North Carolina state government helped finance the redevelopment of a former RJ Reynolds tobacco plant to launch the **Winston-Salem Innovation Quarter**. The state-backed Massachusetts Life Science Center provided initial funding for the prototype for what became the BioLabs coworking space and other dedicated research real estate in **Kendall Square**. Michigan established a health care-focused venture fund that helped develop **Ann Arbor's Life Science Corridor**. The Georgia Department of Transportation built the 5th Street Bridge across Interstate 75/85, allowing Georgia Tech to start what became **Tech Square**.

Federal agencies have also contributed to the success of some innovation districts by becoming anchor tenants. The Environmental Protection Agency opened a large research facility in **RTP** in 1970. The U.S. Department of Transportation launched a research center in **Kendall Square** the same year. In June 2023, the U.S. Department of Agriculture opened its National Bio and Agro-Defense Facility in the heart of a nascent innovation district adjacent to Kansas State University in Manhattan, Kansas. And in September 2023, the federal government's new Advanced Research Projects Agency for Health (ARPA-H) announced it would locate two of its three headquarters facilities in **Kendall Square** and Dallas's **Pegasus Park**, with the third in downtown Washington.

How America's innovation districts are performing: New Bush Institute data

Placemaking: We assess the placemaking performance of innovation districts based on two questions. First, are districts creating prosperous, high-opportunity neighborhoods that are attractive to high-skilled people and innovation-focused businesses? Second, is housing supply keeping up with demand in these neighborhoods? Places that experience strong demand growth but not a commensurate supply response tend to see rapid housing price appreciation and displacement of lower-income people living there.

***Innovation districts are succeeding in their placemaking goals*, based on our data quantifying the performance of neighborhoods surrounding innovation districts.**

Table 8 shows how the 36 innovation districts in our dataset are performing relative to metropolitan America as a whole in creating prosperous neighborhoods nearby. Our approach is to estimate the extent to which innovation districts and surrounding areas are seeing population increases, above-average income growth, and growth in highly educated people working in what urbanist Richard Florida calls “creative” sectors.* Our approach makes several assumptions:

- **People vote with their feet:** If an area is growing faster than other areas, most likely it is an attractive place to live, with better-than-average job opportunities within commuting range.
- **Rising educational attainment:** If the education level of people living in a neighborhood rises faster than in other places, most likely it’s because people of high attainment levels are moving in. Attainment levels of individual adults living in a place don’t change quickly.
- **Nearby job opportunities:** If average commuting times among people living in a neighborhood are relatively low and stable, most likely the composition of sectors in which people work reflects the mix of opportunities close by. Low commuting times and high population shares working in “creative” sectors means there are many creative-sector jobs nearby.
- **Above-average income growth can mean two things, both good:** Strong income growth can mean people with relatively high incomes are moving in, or it can mean people already there are experiencing faster-than-average income growth. In successful places, both are true.

The performance of individual districts in our dataset is consistent with these assumptions. **Innovation district neighborhoods experiencing above-average population growth have also experienced greater increases in educational attainment levels, better income growth, larger concentrations of creative-sector jobs, and shorter commutes than other innovation district neighborhoods.**

* We base our analysis on data for all census tracts as defined by the U.S. Census Bureau that either (1) contain part or all of one of our innovation districts or (2) are physically adjacent to the tracts that contain the innovation district. We draw tract-level data from the Census Bureau’s American Community Survey and aggregate across the tracts surrounding each innovation district. We calculate a second set of figures covering only tracts that contain part or all of an innovation district, but we regard this data as less informative because the population living within the same census tract as an innovation district in some cases consists heavily of college students. To get a sense of how large these neighborhoods are, consider: The neighborhood surrounding Kendall Square consists of 10 census tracts, comprising approximately 1% of the land area of the Boston metro area. The neighborhood surrounding RTP consists of five census tracts, comprising a little more than 1% of the land area of the combined Raleigh and Durham-Chapel Hill metros. The neighborhood surrounding Pegasus Park in Dallas consists of seven census tracts, comprising approximately 0.5% of the land area of the Dallas–Fort Worth metro area and about 1.5% of the land area of the city of Dallas. See full explanation of sources and methods in Appendix 1, summary data for all 36 innovation districts in Appendix 2, Tables X and Y, and complete data including for our narrower “core” version of each neighborhood in the online Data Appendix to this report.

To be clear: Our data measures performance of specific neighborhoods relative to county, metro area, and national benchmarks. It doesn't measure performance of neighborhoods near an innovation district *and* a university relative to neighborhoods near universities *without* an innovation district.* This means we're really looking at the effects of being near both an innovation district and an associated university compared with being near neither.

Table 8
Innovation Districts: Neighborhood Prosperity and Opportunity

		Educational Attainment					Commute	
Groups	Pop. Growth 2010-20	% Adj Assoc/ Some College	% Bachelors+ 2020	Chg in % Bach+ 2010-20	% Creative Sectors	% Chg Median Household Income 2010-20	Average Commuting Time (mins)	Chg in Avg Commuting Time (mins) 2010-20
All 36 Innovation Districts	9.8%	48.5%	49.0%	6.5%	63.9%	46.0%	20.4	0.6
Metropolitan America	8.3%	43.6%	33.6%	4.8%	51.6%	31.7%	27.5	2.1
Average by Age Quartile:								
Oldest	10.2%	52.5%	57.9%	8.5%	72.1%	48.0%	18.8	1.6
2nd	1.9%	43.3%	39.6%	3.8%	59.3%	51.8%	20.3	0.7
3rd	9.6%	51.1%	46.4%	7.1%	61.7%	39.3%	19.7	0.3
Newest	18.3%	48.1%	51.8%	6.6%	62.8%	43.4%	23.1	(0.1)
Average by Size Tier:								
1st	8.6%	50.2%	60.2%	8.6%	71.4%	47.5%	19.7	1.0
2nd	10.6%	47.5%	41.5%	5.0%	59.0%	45.0%	20.9	0.4
Average by Metro Size Tercile:								
1st	12.4%	47.3%	50.9%	7.7%	63.7%	49.2%	22.0	1.6
2nd	11.5%	43.8%	37.7%	5.8%	57.0%	34.1%	20.5	(3.8)
3rd	2.9%	53.9%	48.9%	3.5%	66.9%	43.0%	16.3	0.2
Avg by Metro Housing Policy Tier:								
Least restrictive	7.9%	49.7%	52.5%	6.0%	61.9%	41.1%	18.8	0.5
2nd	9.6%	47.9%	45.9%	3.2%	60.4%	49.9%	19.4	(1.0)
3rd	9.4%	45.8%	39.0%	6.4%	64.1%	52.5%	19.3	0.4
Most restrictive	12.3%	50.1%	56.3%	9.9%	68.3%	42.5%	23.5	2.3
Average by Metro Location Type:								
Urban Downtown	17.0%	48.1%	51.3%	8.2%	65.4%	47.2%	21.4	1.6
Urban peripheral	11.1%	45.9%	45.2%	8.0%	63.0%	57.2%	20.4	1.6
Suburban research park	22.0%	48.3%	49.4%	0.1%	54.5%	23.9%	25.8	2.6
Smaller college town	12.4%	53.4%	52.1%	4.1%	68.1%	37.1%	16.3	1.1

Source: Author calculations based on U.S. Census Bureau, American Community Survey data.

* Comparing to neighborhoods near universities without innovation districts would be problematic, since the definition of innovation districts is subjective. It wouldn't be clear which institutions don't have a district.

As the shaded section at the top of Table 8 shows, the innovation district neighborhoods in our dataset have performed significantly better than metropolitan America as a whole in these areas:

- Population growth (2010-20).
- Two measures of educational attainment.
- Growth in population shares with a bachelor's degree or higher (2010-20)
- Population shares working in creative sectors.
- Median household income growth (2010-20).
- Average commuting times.
- Changes in average commuting times (2010-20).

Our 36 innovation district neighborhoods have also strongly outperformed their own metro areas and metropolitan America as a whole for income growth among Black, Hispanic, Asian American, and White populations. Their edge in Black and Hispanic incomes compared with metro-area and national Black and Hispanic averages is even larger than their edge among Asian and White populations.

Table 9 shows 15 innovation districts that have performed better than average among districts in our dataset on a composite score we've calculated based on these metrics.[*] Among relatively large districts, top performers include the following:

- Tech Square (Atlanta)
- South Lake Union (Seattle)
- uCity Square (Philadelphia)
- Cortex Innovation Community (St. Louis)
- Kendall Square (Cambridge, MA)
- University of Utah Research Park (Salt Lake City)

Performance on our composite score is positively associated with how an innovation district's metro area performs for overall innovation.[*]

[*] We base our composite score on 16 metrics, including relative performance against a district's own county, its own metro, and metropolitan America as a whole for several variables. See Appendix 1 for a summary of sources and methods; Appendix 2, Tables N and O for summary data on all 36 innovation districts; and the online Data Appendix for all underlying data.

Table 9

High-Performing Innovation Districts for Neighborhood Prosperity and Opportunity

	Innovation Districts	Composite Score	Pop. Growth 2010-20	Educational Attainment: % Adj Assoc/ Some College	Educational Attainment: % Bachelors + 2020	Educational Attainment: Chg in % Bach+ 2010-20	% Creative Sectors	% Chg Median Household Income 2010-20	Commute: Average Commuting Time (mins)	Commute: Chg in Avg Commuting Time (mins) 2010-20
			vs. USA							
1	Virginia Tech Corp Research Ctr	**0.81**	0.96	1.20	1.91	1.15	1.48	1.39	0.56	0.95
2	Atlanta Tech Square	**0.69**	0.89	1.49	2.50	1.11	1.49	1.18	0.73	0.94
3	Capitol City Innovation (Austin)	**0.60**	1.19	1.22	2.03	1.01	1.32	1.52	0.51	1.03
4	South Lake Union (Seattle)	**0.50**	1.25	1.67	2.26	1.03	1.29	1.34	0.89	1.06
5	uCity Square (Philadelphia)	**0.45**	0.97	1.04	1.87	1.09	1.51	1.22	0.80	0.93
6	Cortex Innov Community (St. Louis)	**0.38**	0.94	1.05	1.81	1.05	1.35	1.16	0.70	0.94
7	Auburn Res & Tech Fdn	**0.34**	1.26	1.42	1.35	0.97	1.36	0.93	0.63	0.89
8	Cincinnati Innovation District	**0.33**	1.02	1.06	1.44	1.04	1.27	1.24	0.70	0.94
9	Kendall Square (Cambridge)	**0.31**	1.18	1.14	2.20	1.02	1.55	1.23	0.86	1.05
10	Lincoln Nebraska Innov Campus	**0.21**	0.98	1.32	0.81	0.99	1.12	1.44	0.58	0.88
11	Houston Innov Corridor	**0.15**	1.02	1.24	1.81	1.01	1.26	1.04	0.84	0.94
12	Longwood Medical Area (Boston)	**0.11**	0.98	0.91	1.18	1.03	1.54	1.07	0.47	1.07
13	University of Utah Research Park	**0.10**	0.97	1.63	2.12	0.98	1.38	1.03	0.65	1.05
14	Towerside Innov Dist (Minneapolis)	**0.09**	1.05	1.13	1.96	1.06	1.32	1.13	0.82	1.01
15	Research Park (Champaign)	**0.03**	0.68	1.45	2.17	0.96	1.55	0.87	0.51	0.89
	Average for 36 Districts	**-0.02**	**1.01**	**1.11**	**1.46**	**1.01**	**1.24**	**1.11**	**0.74**	**0.98**

Source: Author's calculation based on U.S. Census Bureau, American Community Survey data. All figures represent underlying metrics divided by averages for metropolitan America as a whole. See data for all 36 innovation districts in Appendix 2, Table N.

Why some innovation districts outperform for prosperity and innovation: These factors are predictive of how innovation districts perform, based on data in the bottom panel of Table 8 and additional analysis:*

- **Innovation district age and size:** Districts that are older or larger than average in terms of employers and working population are outperforming other districts for creating prosperity and opportunity in surrounding neighborhoods. The more established the innovation district, the stronger its benefits.

- **BushEds and BushMeds metro-area scores:** Innovation districts in metros with stronger-than-average portfolios of eds and meds institutions outperform other districts for creative-sector jobs and increases in education levels in surrounding neighborhoods.

- **Metro-area housing policy:** Districts in metros with less restrictive policies have mostly outperformed those in more restrictive metros for housing development, which predicts better growth in population, education levels, and creative-sector jobs. On the other hand, some innovation districts in highly restrictive metro areas are well established and very successful – like the districts in the Boston, Philadelphia, and Seattle metros – which makes the relationship between housing policy and our neighborhood prosperity metrics in Table 8 look ambiguous.

* See correlation data in online Data Appendix to this report.

- **Innovation district location in its metro area:** Districts located in core-city downtown locations in large metros are generally outperforming districts located in peripheral core-city locations – often repurposed industrial areas – as well as suburban research parks.[*]

Metro-area size is not predictive of how innovation districts are performing on these metrics. **Districts in smaller college towns are performing roughly in line with those in large metros.**

Table 10 shows how the 36 innovation districts in our dataset are performing relative to metropolitan America for housing development and stability in surrounding neighborhoods. **America's innovation districts and nearby neighborhoods are outperforming other places in creating new housing supply. Rents are rising faster than elsewhere due to strong demand growth, but there is little evidence of displacement in most of these neighborhoods, our data show.**

Cities and neighborhoods vary considerably in how difficult it is to build new housing and thus the degree to which rising housing demand elicits new supply. Building sufficient housing of all kinds is an essential element of successful placemaking. Here too, our approach relies on several assumptions:

- **Housing supply and rising rents:** If rents in a neighborhood increase faster than average, it means supply growth isn't keeping up with demand.

- **Housing supply, rents, and displacement:** Weak supply growth and resulting rent increases are the main driver of displacement in urban neighborhoods.

- **Combined Black and Hispanic population as a proxy:** It's difficult to measure displacement in specific neighborhoods directly. Since there is frequently a racial overlay to displacement in U.S. cities,[225] we've used changes in combined Black and Hispanic population shares as an imperfect proxy for displacement.

The 36 innovation districts in our dataset have higher combined Black and Hispanic population shares than metropolitan America as a whole, and they've experienced greater increases in combined shares since 2010 on average, as the shaded top panel in Table 10 shows. **Our analysis counters the common narrative that successful innovation districts have caused significant displacement**.[226]

[*] Innovation districts located in downtowns do start with some advantages relative to those built in repurposed industrial areas and other peripheral locations: they typically don't have to engage in the same degree of investment in land reclamation, road improvements, and other infrastructure; and they don't have to create density from scratch. The author thanks Julie Wagner for this important insight.

Table 10

Innovation Districts: Housing and Neighborhood Stability

Groups	Housing						Black + Hispanic Pop Share	
	% Chg in Units	% Built since 2010	% Built since 2000	Median Home Value	Median Rent	% Chg Rent	B+H Pop Share 2020	% chg B+H Pop Share 2010-20
All 36 Innovation Districts	14.0%	15.6%	27.3%	$276,290	$1,012	39.8%	34.7%	1.4%
Metropolitan America	6.5%	6.3%	19.6%	$292,536	$1,096	30.3%	32.2%	1.1%
Average by Age Quartile:								
Oldest	22.7%	20.7%	37.7%	$345,009	$1,131	36.7%	27.2%	-0.8%
2nd	12.3%	13.5%	21.1%	$228,584	$1,000	36.7%	47.1%	3.0%
3rd	10.1%	14.4%	28.5%	$261,293	$1,060	33.5%	30.0%	1.0%
Newest	9.2%	12.1%	22.2%	$268,398	$ 864	52.0%	32.5%	2.1%
Average by Size Tier:								
1st	16.8%	17.8%	24.9%	$312,198	$1,091	42.0%	25.9%	-0.2%
2nd	12.4%	14.5%	29.0%	$253,611	$ 961	38.4%	40.2%	2.4%
Average by Metro Size Tercile:								
1st	14.7%	15.4%	23.7%	$343,476	$1,076	47.5%	38.5%	1.4%
2nd	1.8%	22.0%	41.3%	$139,385	$ 981	31.9%	39.9%	-1.4%
3rd	16.5%	13.2%	30.2%	$157,410	$ 862	23.6%	22.7%	2.7%
Avg by Metro Housing Policy Tier:								
Least restrictive	11.8%	17.5%	33.6%	$305,999	$1,080	40.0%	33.2%	2.4%
2nd	16.4%	17.9%	27.6%	$196,114	$ 973	25.3%	30.2%	4.7%
3rd	8.8%	11.9%	29.2%	$238,243	$ 894	32.1%	44.0%	-2.0%
Most restrictive	18.2%	15.1%	18.5%	$327,260	$1,070	57.5%	32.2%	0.4%
Average by Metro Location Type:								
Urban Downtown	23.3%	18.3%	28.5%	$375,157	$1,114	52.3%	42.6%	-0.4%
Urban peripheral	14.9%	12.3%	21.9%	$283,549	$ 999	42.8%	37.7%	0.8%
Suburban research park	2.8%	27.4%	38.9%	$279,041	$1,018	33.1%	26.1%	6.8%
Smaller college town	17.0%	13.5%	30.2%	$165,502	$ 890	32.7%	23.1%	2.2%

Source: Author calculations based on U.S. Census Bureau, American Community Survey data.

Table 11 shows 15 innovation districts that have performed better than average on a composite score based on these housing and demographic metrics.* Among relatively large districts, top performers include the following:

- Tech Square (Atlanta)
- Centennial Campus (Raleigh)
- Cleveland Health-Tech Corridor
- 16 Tech (Indianapolis)

Table 11
High-Performing Innovation Districts for Housing and Neighborhood Stability

	Innovation Districts	Composite Score	Housing						Black + Hispanic Pop Share	
			% Incr in Units	% Built since 2010	% Built since 2000	Median Home Val	Median Rent	% Chg Rent	B+H Pop Share 2020	% chg B+H Pop Share 2010-20
			vs. MSA							
1	Rensselaer Tech Park (Albany)	**1.56**	0.87	8.17	4.49	na	1.57	0.90	1.05	1.02
2	Atlanta Tech Square	**1.41**	1.55	6.09	1.53	1.67	0.76	1.08	0.91	1.02
3	Pegasus Park (Dallas)	**1.22**	1.38	1.86	0.79	1.15	0.87	1.01	1.51	1.40
4	Auburn Res & Tech Fdn	**0.80**	1.10	2.07	1.54	1.02	0.94	0.70	1.08	0.92
5	University Research Park (Madison)	**0.49**	0.82	3.66	2.40	na	1.00	0.95	1.57	1.01
6	Coldstream Res Campus (Lexington)	**0.47**	0.98	2.47	2.33	1.02	1.11	1.00	3.00	1.01
7	Lincoln Nebraska Innov Campus	**0.45**	0.96	1.16	1.33	0.49	0.73	0.70	1.84	1.05
8	Centennial Campus NC State	**0.21**	0.77	2.39	1.41	na	0.89	1.05	0.74	1.10
9	Virginia Tech Corp Res Ctr	**0.18**	1.01	2.21	2.01	1.08	0.74	1.07	1.14	1.02
10	Fitzsimons Innov Commty (Denver)	**0.15**	0.88	1.69	1.20	0.61	0.81	0.82	2.53	1.03
11	Cleveland Health-Tech Corridor	**0.14**	1.00	3.13	2.09	0.91	1.05	1.16	2.06	0.93
12	16 Tech (Indianapolis)	**0.07**	0.82	2.01	1.38	na	0.97	0.98	3.15	0.96
13	Capitol City Innov (Austin)	**0.04**	0.86	0.96	1.25	2.10	0.98	0.97	0.75	1.00
14	Innov Hub at Res Park (Lubbock)	**0.02**	0.90	0.95	1.54	1.20	1.06	1.05	0.94	1.05
15	Purdue Discovery District	**0.01**	0.99	1.84	0.63	0.73	0.99	1.14	0.63	1.03
	Average for 36 Districts		**0.93**	**2.01**	**1.21**	**1.17**	**0.98**	**1.06**	**1.34**	**1.00**

Source: Author's calculation based on U.S. Census Bureau, American Community Survey data. All figures represent underlying metrics for each innovation district divided by comparable metrics for each district's metro area as a whole. See data for all 36 innovation districts in Appendix 2, Table O.

A handful of innovation districts in smaller college towns have performed strongly both for neighborhood prosperity and for housing supply and neighborhood stability. These include districts in **Auburn,**

* We base our composite score on 14 metrics, including relative performance against a district's own county, own metro, and metropolitan America as a whole for several variables. See Appendix 1 for a summary of sources and methods; Appendix 2, Tables N and O for summary data on all 36 innovation districts; and the online Data Appendix for all underlying data.

Alabama; **Blacksburg, Virginia**; and **Lincoln, Nebraska**. Of the larger innovation districts, only **Atlanta Tech Square** ranks above average in both respects.*

Why some innovation districts outperform for housing and neighborhood stability: The following factors are predictive of how innovation districts perform, based on data in the bottom panel of Table 11 and additional analysis:*

- **Innovation district age and size:** Districts that are older or larger than average have mostly outperformed other districts for housing supply growth. However, they are also experiencing faster rent increases, reflecting stronger-than-average housing demand growth, and they are showing some evidence of displacement.

- **Growth, education levels, creative-sector employment:** Districts with above-average population growth, educational attainment increases, and creative-sector job shares have seen more housing supply growth, independent of whether they're especially large or well established. Above-average housing demand growth is inducing above-average supply growth.

- **BushEds and BushMeds metro-area scores:** Being in a metro with a stronger-than-average portfolio of eds and meds institutions predicts faster-than-average rent increases but isn't predictive of housing supply growth, further validating that districts in these metros have seen especially robust prosperity and thus demand growth.

- **Metro-area housing policy:** Districts in metros with highly restrictive housing policies have seen above-average rent appreciation and more evidence of displacement than districts in metros with less restrictive policies.

- **Innovation district location in its metro area:** Districts in downtown locations in large metros have experienced better housing supply growth than those in peripheral areas of core cities but also faster rent increases, reflecting greater demand growth. Districts in large metro suburban locations or smaller college towns have been more successful than core-city districts in keeping housing relatively affordable and avoiding displacement.

Metro-area size doesn't predict housing supply growth in innovation districts. But districts in large metros have seen faster rent increases than those in smaller metros over the last decade, probably reflecting general housing market challenges in large cities.

Performance of innovation district real estate: Another measure of innovation district placemaking success is how office and lab space in innovation districts is performing in financial terms. Strong financial performance signals that tenants want to be there.

Office and lab space in innovation districts is performing very well by most metrics, though interest rate increases since early 2022 have dented demand in the near term.

- **Anecdotal evidence points to strong demand:** Developers and leasing experts we've spoken with universally agree that demand for Class A space – the highest quality office space in a local

* We recognize that urban housing markets have seen considerable home price and rent increases since 2020, so it is possible that our conclusions on displacement will change with new data in the future.
* See correlation data in the online Data Appendix to this report.

market – in innovation districts is strong and growing, especially among life science companies. **Large cutting-edge firms, startups, investors, and businesses that serve them in fields like banking, accounting, and law want to be present in growing innovation districts near leading eds and meds institutions.** Many university faculty members also prefer lab space in mixed-tenant innovation district settings to traditional academic facilities.

Dallas's **Pegasus Park**, which opened near UT Southwestern Medical Center in 2021, reached 80%-plus occupancy in less than two years, far ahead of plan. Developers associated with **Kendall Square**, **RTP**, the **NC State Centennial Campus**, the **Innovation Quarter**, **Tech Square**, the **Ion**, the **University of Utah Research Park**, and **ASU**'s Phoenix-area districts are all planning new buildings to keep up with demand.[227]

- **Premium rents:** We've collected financial data for representative Class A office/lab buildings in 24 of the 36 innovation districts in our dataset. Innovation district properties command rents 10% to 50% higher than comparable buildings in the same submarket within their metro area but outside the innovation district in virtually every case.*

- **CBRE data on commercial life science real estate (not necessarily in innovation districts):** Vacancy rates in dedicated life science properties fell to 5% in 2022 from an average of 8% between 2017 and 2021 – below office real estate averages for both periods, according to a 2023 CBRE report. Property values for buildings that changed hands remained at record high levels relative to net operating income as of April 2023, reflecting investor confidence in future demand.

  On the other hand, interest rate hikes and a temporary decline in venture capital fundraising have led potential tenants to back away from taking new space since early 2023. Total commercial life science R&D space in U.S. cities will rise some 20% from 2023 to 2025, CBRE predicts, so there will likely be excess supply in some markets until demand grows enough to absorb it.

  Metros where vacancy rates are especially low and demand remains robust include Philadelphia, Washington, Raleigh-Durham, Atlanta, Nashville, and Dallas, CBRE reports. The New York, Chicago, San Francisco, Los Angeles, and San Diego markets are experiencing higher vacancies and weaker demand growth. Large increases in available space over the next two years will likely put pressure on the Boston-Cambridge life science market, the nation's largest, as well.[228]

- **More innovation districts:** Developers are planning additional innovation districts in metros that already host large districts. Longfellow Real Estate Partners, for instance, is developing **Durham Innovation District** near **Duke**'s East Campus and planning a new district adjacent to **UNC Chapel Hill**. **Harvard University** is developing a new multi-tenant **Enterprise Research Campus**, including residential and hotel properties, adjacent to its business school in Boston/Allston.

  Many other cities are focused on building new innovation districts. Fort Worth, Texas, has established a **Medical Innovation District** that hosts **Texas Christian University**'s new medical school in its Near Southside area, close to a new innovation-centered campus Texas A&M University is building on the edge of downtown Fort Worth. Oklahoma City is developing the

* Data from CoStar. Data is not available from CoStar for representative buildings in the other 12 districts. See data in the online Data Appendix to this report.

Oklahoma City Innovation District adjacent to the **University of Oklahoma College of Medicine**’s campus near downtown as part of the city’s ambitious MAPS 4 investment program.

Accelerating innovation: While America’s innovation districts are clearly succeeding as placemaking initiatives, it’s much harder to measure the extent to which they’re achieving their second goal, accelerating innovation.

All the innovation districts in our dataset point to significant startup activity taking place on their grounds. St. Louis’s **Cortex**, for instance, has helped create more than 415 startups and 4,000-plus jobs. But it’s difficult to compare these figures to what would have happened if stakeholder institutions hadn’t created their innovation districts in the first place. Perhaps the same companies would have come into being and advanced the same technologies, just across town or elsewhere in the United States.

Some tentative conclusions:

- **Innovation districts that have proved successful as placemaking ventures have *probably* caused an acceleration in local innovation, based on strong evidence confirming the innovation benefits of innovative people working in close proximity to eds and meds institutions.**

- **The existence of nearby innovation districts has influenced student choices.** The number of Wake Forest students choosing to major in computer science, for instance, increased sharply after the opening of the Innovation Quarter and its student-focused classroom and lab spaces.[229]

- **The presence of innovation districts is influencing location choices by companies of all sizes.** More than one biotech company has relocated to Dallas because of affordable lab space in the BioLabs facility at **Pegasus Park**. Leading tech firms have established R&D locations in Atlanta because of the attractions of **Tech Square**. Apple likely based its decision to locate a large R&D facility in North Carolina on the presence of **RTP**, where the unit will operate.

- **If concentrations of R&D talent had not emerged in metros outside the Northeast and Pacific coasts, it’s likely that fewer innovative companies would have come into being. Some prospective companies and their employees would not have been able to afford sky-high commercial real estate and housing prices in places like Cambridge and San Francisco or to recruit staff to less expensive locations.**

Revitalizing downtowns

While innovation districts represent the fastest growing form of placemaking investment by eds and meds institutions beyond traditional campuses, more and more institutions are engaging with surrounding communities in other kinds of placemaking.

One promising strategy is to help transform and revitalize struggling downtowns by establishing satellite campuses or other facilities.

- **The University of California at San Diego:** UCSD, based in oceanfront La Jolla, opened its large “Park & Market” facility in downtown San Diego in 2022. Park & Market aims to build stronger connections between the university and the San Diego community. It offers accessible for-credit and noncredit workforce training programs, provides affordable office space to numerous civic and social venture organizations, and runs community events and convenings in its ample atrium and theater.[230] Downtown San Diego has seen a stronger-than-average foot-traffic recovery from the pandemic, in large part because it has more academic and other nonoffice activities than most other downtowns, based on University of Toronto data.[231]

- **Arizona State** and the **University of Arizona**: ASU has played a pivotal role in reinvigorating downtown Phoenix. Based in suburban Tempe, ASU has moved its nursing, journalism, communications, and law schools to a new downtown Phoenix campus. ASU also launched a new Media and Immersive eXperience Center at its downtown Mesa campus, which opened in 2022. The University of Arizona, meanwhile, announced plans in 2023 to build a health science center focused on precision immunotherapies in downtown Phoenix.[232] Downtown Phoenix has outperformed most others for its post-pandemic recovery.[233]

- **University of Colorado in Denver:** The University of Colorado, which has its main campuses in Boulder and suburban Aurora, operates a rapidly growing satellite campus adjacent to downtown Denver, alongside the Community College of Denver and other institutions. The university and its partners have launched a master-planning exercise aimed at building greater connectivity with Denver's downtown, promoting multifamily residential development, and building a "complete" live-work-play neighborhood within walking distance of downtown.[234]

- **Texas A&M University in Fort Worth:** Texas A&M, with no previous Fort Worth presence, is building a four-block campus in downtown Fort Worth. The facility will house law and advanced-practice nursing programs as well as a future multi-tenant innovation building. The initiative is the result of a push by former Mayor Betsy Price to attract a Tier 1 university to help propel what is already one of America's most celebrated downtown revitalizations.[235]

- **The University of Texas at San Antonio:** UTSA is building a satellite campus downtown that will house the university's new cybersecurity program, a Data Science Center, arts programs, and general curriculum. The university anticipates the new campus will increase transfer rates from San Antonio's community colleges by improving physical access for many students.[236]

- **Wake Forest:** Wake Forest moved its Engineering, Biochemistry, and Medicinal Chemistry programs as well as its medical school to its Wake Downtown campus, which opened in the Innovation Quarter adjacent to downtown Winston-Salem in 2017. Wake Downtown, along with the whole Innovation Quarter, has greatly reinvigorated street life in downtown Winston-Salem and sparked the development of hundreds of downtown apartments.[237]

- **Johns Hopkins University:** JHU has helped revitalize a previously decaying downtown area facing Baltimore's Inner Harbor by moving its business school and other university activities into a new satellite campus in the neighborhood.

- **University of Louisville:** The university announced a new downtown campus, funded by the largest private gift in its history, which will host an institute focused on environmental determinants of health and other programs.[238]

- **Michigan State University in Grand Rapids:** Michigan State moved its medical school to downtown Grand Rapids in 2011. This initiative transformed a struggling downtown area into what is now called the "Medical Mile" – including a multi-tenant "Innovation Building."[239]

- **Yale:** Yale has led major redevelopment projects that have transformed several streetscapes in and around downtown New Haven.[240]

- **ProMedica in Toledo:** Health care system ProMedica moved its headquarters from a suburban area to downtown Toledo in 2017, investing $100 million to transform a former steam plant that had been vacant for 30 years into a modern office complex and a former Toledo Edison office building next door into apartments for employees and other residents.[241]

Engaging in underinvested neighborhoods

One way eds and meds institutions can help revitalize underinvested neighborhoods is to provide their core services to neighborhood residents.

Academic medical centers, for instance, **can make a significant difference by opening clinics in "health care desert" neighborhoods**. More than one in five people without access to a vehicle or public transit – amounting to 5% of U.S. adults – skipped a medical appointment in 2022 because of difficulties getting there, an Urban Institute study found.[242] Physical access to health care facilities substantially affects the probability that pregnant women will receive adequate prenatal care.[243]

- **Cincinnati Children's Hospital** launched a school-based initiative to improve children's health in 2015 in two low-income neighborhoods where child hospital-days are 10 times higher than in affluent Cincinnati neighborhoods. The program – focused on preventative care, school-home connections, and transitions after hospitalizations – significantly reduced total child hospital-days, while comparable baseline neighborhoods experienced no change over the same period.[244]

- **ProMedica** established a Family Health and Wellness Center on the grounds of a Stellantis automobile plant in Toledo in 2022, aiming to support almost 10,000 employees and their families – many of whom live in health care deserts.[245]

Universities, meanwhile, can offer educational enrichment opportunities for K–12 students living in disadvantaged neighborhoods. Kansas State runs intensive STEM programs for high school and middle school girls in Manhattan, Kansas. **Yale** and **Wake Forest** are among the many institutions stepping up summer immersion programs for local high school-age students.[246]

A handful of universities have engaged in comprehensive placemaking initiatives in underinvested neighborhoods near their campuses.

- **University of Pennsylvania** and **Drexel**: Penn and a group of community partners launched their West Philadelphia Initiative in the early 1990s. The Initiative has focused on K–12 education, workforce development, job placements, housing rehabilitation, and purchasing by participating institutions from locally owned vendors. Drexel's Dornsife Center for Neighborhood Partnerships has also played a leading role in the neighborhood. The West Philadelphia Initiative has helped create over 5,000 jobs and 1,000-plus housing units. It has also catalyzed significant improvements in neighborhood schools, reduced crime, and brought new quality-of-life amenities to the neighborhood.[247]

- **Case Western University and the Cleveland Clinic:** CWU, the Cleveland Clinic, and community partners launched the Greater University Circle Initiative in 2005. The Initiative has focused on physical redevelopment of neighborhoods in the University Circle area, affordable housing, attracting small businesses, and purchasing by participating institutions. The Initiative has brought several hundred employees of CWU or the Cleveland Clinic to the neighborhood and helped launch numerous locally owned businesses.[248]

- **Johns Hopkins University:** JHU and local partners launched East Baltimore Development, Inc. (EBDI) in 2001 to promote economic vitality and opportunity in an underinvested neighborhood near JHU's campus. EBDI has focused on housing, educational opportunities, workforce development, job placements, and green space. The Initiative has resulted in greater employment rates for local residents, improved public safety, increased educational attainment, and stabilization of what had been a declining population in the neighborhood. It has also been relatively successful at mitigating displacement that might have occurred as JHU built substantial lab and office space nearby.[249]

- **The University of Texas at El Paso:** UTEP and local partners started the Nonprofit Enterprise Center to support social services-focused nonprofits in El Paso as well as a family literacy program supporting low-income residents.[250]

- **ProMedica:** ProMedica launched the Ebeid Institute[*] in 2014 to lead a place-based initiative focused on Toledo's underinvested UpTown neighborhood. The Ebeid initiative includes a center offering subsidized fresh food, nutrition classes, financial counseling, and computer facilities. Since 2018, it has also included the Ebeid Neighborhood Promise, a comprehensive $50 million program aimed at social determinants of health and engaging the national community development organization LISC and local partners.[251]

- **Kaiser Permanente:** Health care system Kaiser Permanente has built a new campus in the underserved Baldwin Hills neighborhood in Los Angeles, including not only much-needed hospital and pharmacy facilities but also fitness centers, workspace with internet connections and job counseling, and greenspace.

Developing housing

Eds and meds institutions are also investing in attainable housing in underinvested places. These initiatives include rental or downpayment assistance programs for employees as well as new housing development for neighborhood residents.

- **Yale**, the **University of Pennsylvania**, **Johns Hopkins**, **Case Western**, the **Cleveland Clinic**, and the **University of Southern California** are among the institutions that have launched downpayment or rental assistance programs for moderate-income employees.[252]

[*] Named for Toledo philanthropist Russell J. Ebeid.

- **Michigan State** and **ProMedica**: Michigan State and its partners have included new mixed-income housing in their redevelopment of the "Medical Mile" in Grand Rapids. ProMedica has helped finance the redevelopment of a former Toledo Wonder Bread factory into a 33-unit apartment building.[253]

- The **Mayo Clinic** has committed $7 million to a new community land trust in its hometown of Rochester, Minnesota, that will generate 875 affordable housing units – and has already catalyzed more than $350 million in private-sector investments downtown.[254]

Strengthening physical connections between campuses and surrounding cities

A simple but useful way for eds and meds institutions to invest in quality placemaking and engage with surrounding communities is to strengthen the physical connections between campuses and adjacent neighborhoods. This means redesigning the boundary spaces between campus and "town" to make them less of a barrier to outsiders and more porous and welcoming.

Jane Jacobs noted in her classic *The Death and Life of Great American Cities* that most universities "have given no thought or imagination to the unique establishments they are." They "either pretend to be cloistered or countrified places nostalgically denying their transplantation, or else they pretend to be office buildings," Jacobs wrote. Eds and meds institutions should place parks, theaters, and other areas open to the public at "strategic points" along campus perimeters, Jacobs advised.

A few universities are becoming more intentional about these boundary spaces:

- **UNC Chapel Hill:** The university launched a large project in 2022 to reimagine its front "entrance" and create more seamless connections between the campus and Chapel Hill's Franklin Street thoroughfare.[255]

- **Kansas State:** K-State, which is separated from its surrounding city by wide avenues, is redeveloping its entire boundary to become more welcoming and build engagement with the Manhattan community.

- **Atlanta Tech Square:** The new Coda building in Tech Square includes an atrium with a food court featuring local restaurant options that opens onto a well-designed outdoor "living room" open to the public.

- **Wake Forest:** Wake Downtown's front door opens onto Bailey Park, a heavily programmed one-block public greenspace with adjacent restaurants and coffee shops.

High-performing eds and meds institutions are investing in innovative placemaking strategies to support local prosperity and opportunity, attract talent, and increase their innovation impact.

- **Innovation districts: Many eds and eds institutions are working with developers, entrepreneurs, investors, local governments, and other partners to build innovation districts – physically compact urban areas where eds and meds researchers can cluster with leading-edge companies of diverse size and industry to stimulate creativity, collaboration, innovation, and entrepreneurship. Current thinking on innovation districts is evolving and increasingly calls for mixed-use live-work-play spaces that deliver benefits for surrounding neighborhoods.**

  Building innovation districts is a complex undertaking that requires –

  - **Physical spaces that meet current tenant needs and keep up with demand.**
  - **Thoughtful curation and programming, especially to support startups.**
  - **Careful design and attractive quality-of-life amenities.**
  - **Ample housing within walking distance.**
  - **Inclusive approaches to surrounding neighborhoods.**
  - **Effective governance to coordinate disparate district stakeholders.**
  - **Support from local and sometimes state governments.**

  America's innovation districts are succeeding as placemaking ventures, new Bush Institute data show.

- **Revitalizing traditional downtowns.**
- **Investing in underinvested neighborhoods.**
- **Supporting access to housing and new residential development.**
- **Strengthening connections between campuses and surrounding cities.**

VI. TALENT

Talent in America's metropolitan areas: Which metros are performing best?

Community and technical colleges

Rankings: The top-performing 15 of America's 100 largest metro areas for community and technical college outcomes include first-ranked **Provo** plus **Salt Lake City**; seven California metros including **Los Angeles**, **San Diego**, **San Francisco**, and **San Jose**; and **Des Moines**, **Greensboro**, **Phoenix**, **Madison**, **San Antonio**, and **El Paso,** based on our composite outcomes score* for 2021. (See Table 12.)
Among the nation's largest metros, **Chicago**, **Dallas-Fort-Worth**, **Houston**, **Washington**, and **Philadelphia** rank in the middle third of the ranking, while **New York City**, **Boston**, **Atlanta**, and **Miami** are in the bottom third.

The performance of metros on our community college outcomes score is predictive of how they perform for overall educational attainment levels, incomes, and upward mobility, as we show in Section II.

America's 100 largest metros vary dramatically in their performance on specific metrics we include in our composite score. Consider 2021 enrollment rates, measured as a share of metro-area population. The top five metros on this metric – **Fresno, California**; **Sacramento**; **Oxnard-Thousand Oaks, California**; **Provo**; and **San Jose** – have enrollment rates fully five times higher than the bottom five metros in the

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* Our composite scores combine eight measures focused on enrollment rates, retention rates, graduation rates, transfer rates, incomes, and overall associate degree attainment rates in the population:

- Total enrollment in all community and technical colleges in the metro area as a share of population.
- Retention: Total returning students as a share of population.
- Graduation: Total number of students graduating with an associate degree or certificate within 150% of normal time as a share of population.
- Transfer: Total number of students enrolling in another postsecondary institution within eight years of completing a community college program as a share of population.
- Median income of graduates 10 years after graduation.
- Median income of graduates 10 years after graduation as share of metro-area median income.
- Residents ages 18–24 who've completed an associate degree, certificate, or some college as a share of all residents ages 18–24 who haven't completed a bachelor's degree or higher.
- Residents age 25 and over who've completed an associate degree as a share of all residents aged 25 and over who haven't completed a bachelor's degree or higher.

For each metro area, we aggregate data for all community and technical colleges, computing sums or weighted averages depending on the metric, then calculate z-scores for each metric based on the distribution of the measure across America's 100 largest metros. We calculate composite scores as the unweighted mean of the eight z-scores. We include full rankings for the 100 largest metros in Appendix 2, Table P, as well as full rankings for total enrollment rates (Table Q) and residents age 25 and over who've completed an associate degree as a share of all residents age 25 and over who have not completed a bachelor's degree or higher (Table R). Our online data appendix provides all underlying data and additional related data for America's 100 largest metro areas.

ranking.[*] Metros that outperform for overall enrollment rates also tend to outperform for attainment rates within their White, Black, Hispanic, and Asian American populations.[**]

Table 12
Best Performing Metros for Community College Outcomes: Top 15 Large Metros
(out of America's 100 largest metro areas)

	Metro Area	Avg z-score
1	Provo-Orem, UT	2.37
2	Oxnard-Thousand Oaks-Ventura, CA	1.90
3	San Jose-Sunnyvale-Santa Clara, CA	1.55
4	Sacramento-Roseville-Folsom, CA	1.51
5	San Francisco-Oakland-Berkeley, CA	1.08
6	Los Angeles-Long Beach-Anaheim, CA	1.04
7	San Diego-Chula Vista-Carlsbad, CA	1.04
8	Des Moines-West Des Moines, IA	1.02
9	Greensboro-High Point, NC	0.74
10	Fresno, CA	0.72
11	Phoenix-Mesa-Chandler, AZ	0.64
12	Madison, WI	0.53
13	San Antonio-New Braunfels, TX	0.51
14	Salt Lake City, UT	0.51
15	El Paso, TX	0.50
	Average, Top 100 Metros	**0.00**

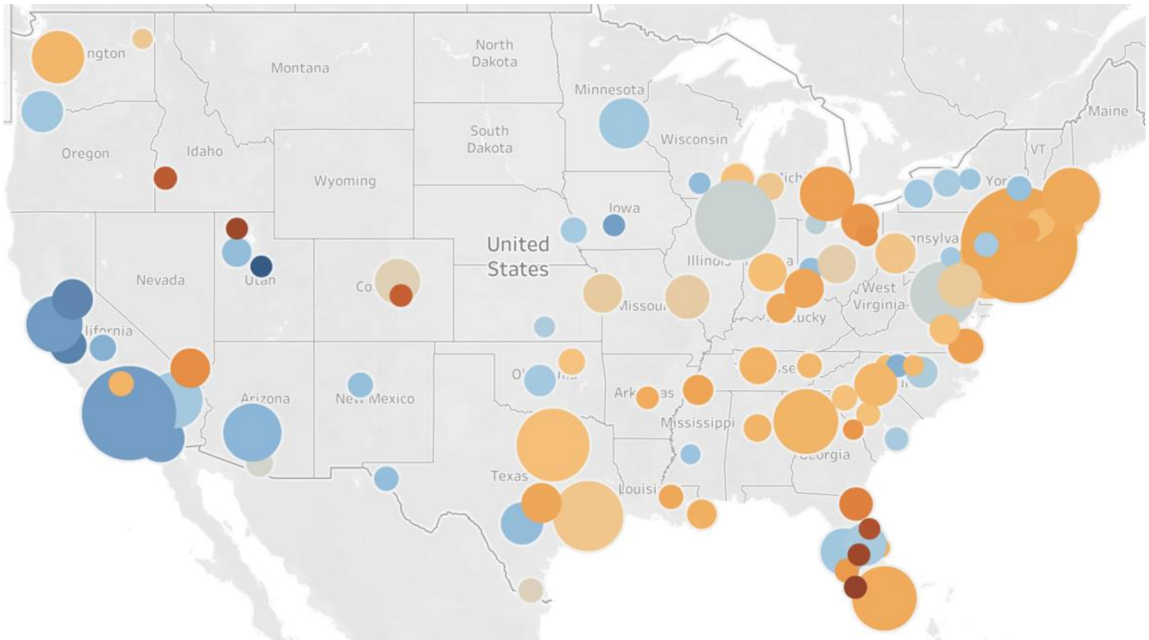
Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates) and the National Center for Education Statistics (IPEDS data). See full ranking of America's 100 largest metros in Appendix 2, Table P, and all underlying data in the online data appendix to this report.

Another metric that differs widely across metros is associate degree attainment, which we measure as residents over age 24 who've earned an associate degree as a share of residents who don't have a bachelor's degree (to avoid "punishing" metros that would otherwise perform poorly because they have high bachelor's instead of associate degree attainment). The top five performers for this measure – **Albany, New York**; **Madison**; **Rochester, New York**; **Syracuse, New York**; and **Buffalo, New York** – have attainment rates between 18.5% and 20%, compared with an average of 13.7% for the nation's largest 100 metros and less than 11% for the bottom seven metros in the ranking.[***]

The map in Figure 6 illustrates composite scores for all Top 100 metros. The size of circles indicates metro-area population, while color indicates community college outcome scores: Blue connotes high scores and orange connotes low scores.

[*] See Appendix 2, Table Q.
[**] See racially disaggregated data in the online Data Appendix to this report.
[***] See Appendix 2, Table R.

Figure 6
Community College Outcomes, 100 Largest Metros
(Composite scores based on enrollment, retention, graduation, and post-graduation wage rates – Circle size indicates metro area; blue and orange indicate above- and below-average outcomes, respectively)



Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates) and the National Center for Education Statistics (IPEDS data). See full ranking of America's 100 largest metros in Appendix 2, Table P, and all underlying data in the online data appendix to this report.

Metros also vary significantly in year-to-year student retention rates, graduation rates, and graduate incomes, even after accounting for large differences across metros in overall income levels.*

What accounts for outcome differences across metros? The following factors significantly influence how metros perform on our composite outcomes score, based on simple regression analysis:**

- **Commuting:** Metros with longer average commutes have significantly worse outcomes than other metros, holding metro-area size and other factors constant. Commuting times influence our outcomes measure primarily through their effects on enrollment rates, which suggests physical access to campuses affects enrollment decisions.

- **Race:** Higher Asian American population share and to a lesser degree Hispanic population share predict better community college outcomes.

- **State spending on eds and meds:** Higher spending per capita on higher education and hospitals predicts better performance on our composite outcomes score. Notably, overall higher education spending is a better predictor of outcomes than community college spending as such,

* See online Data Appendix.
** See regression results in online Data Appendix.

suggesting that linkages across different kinds of postsecondary institutions affect outcomes. Metros with high state investment in medical centers create above-average opportunities for health care professionals, increasing the appeal of health care-focused community college programs.[*] The policy takeaways from this relationship aren't clear in the absence of further information on the specific types of investment that generate improved outcomes, which we explore in Section VI of this report.

Digging further into the data, these metrics each significantly influence one or more outcome measures.[**]

- **BushEds and BushMeds per capita:** Our measures of innovative university research and medical center activities are positively correlated with associate degree attainment levels. This suggests that the spillover effects of eds and meds research and patient care on local economies influence people's *incentives* to earn an associate degree, since higher scores on our BushEds and BushMeds measures don't directly affect community colleges.

- **Social capital:** Stronger local social capital, as reflected in the U.S. Congress Joint Economic Committee's (JEC) index score, predicts higher associate degree attainment levels.

- **Community college enrollment rates:** Higher enrollment rates as a share of the population predict higher retention rates, higher graduation rates, higher likelihood that community college students enroll in another postsecondary institutions within eight years, and smaller population shares who've participated in some college but earned no degree – sometimes referred to as the "some college / no degree" (SCND) population. These notable results imply that metros which outperform on enrollment rates aren't just attracting marginal students who are less likely than others to complete a degree or credential. They're delivering better outcomes across the board.

- **Transfer rates:** Both our "transfer" measures – immediate transfer-out rates for current community college students and enrollment in another postsecondary institution within eight years – significantly affect metro-area associate degree attainment levels. As with our BushEds and BushMeds measures, this suggests metros with better pathways for transferring to four-year institutions have stronger incentives to start and complete associate degrees in the first place.

- **In-demand fields:** Metros with higher shares of their associate degree-seeking students majoring in one of 11 groups of in-demand fields[***] tend to have smaller "some college / no degree" population shares, all else equal. This implies that metros with higher shares choosing an in-demand field have better completion rates than other metros.

- **State spending:** Both overall state higher education spending and state community college spending influence multiple outcome measures, including enrollment, retention, graduation, and transfer rates.

[*] For quantitative analysis supporting this point, see discussion of metro-area rankings for preparing people for in-demand occupations later in Section VI.
[**] See regression results and correlation tables in online Data Appendix.
[***] We include the following groups of fields as defined in the National Center for Education Statistics IPEDS dataset: information technology and computers, education, engineering, engineering-related technician programs, biology and biomedical, science technician programs, construction trades, mechanical and repair programs, precision manufacturing, health and nursing, and business. See data in online Data Appendix.

Improving outcomes over time: Metros that have outperformed for increasing community college enrollment since 2010 or at least for limiting enrollment declines include **Provo**; **Salt Lake City**; **Boise, Idaho**; **Raleigh, North Carolina**; **Charleston, South Carolina**; **Nashville, Tennessee**; and the four Texas Triangle metros of **Dallas-Fort Worth**, **Houston**, **San Antonio**, and **Austin**.[256]

Four-year institutions

Rankings: **New York**, **Chicago**, **Washington**, **Philadelphia**, **Atlanta**, and **Boston** rank in the top third of America's 100 largest metros for population share with a bachelor's degree or higher, while **Los Angeles**, **Houston**, **Dallas-Fort Worth**, **Miami**, and **Phoenix** rank in the middle third. Table 13 shows the best-performing 15 of America's 100 largest metros on this metric.*

Table 13
Best Performing Metros for Bachelor's Degree Attainment: Top 15 Metros
(out of America's 100 largest metro areas, population age 25 and over)

	Metro Areas	Attain Rate
1	San Jose-Sunnyvale-Santa Clara, CA	52.5%
2	Washington-Arlington-Alexandria, DC-VA-MD-WV	51.7%
3	San Francisco-Oakland-Berkeley, CA	50.7%
4	Boston-Cambridge-Newton, MA-NH	48.9%
5	Bridgeport-Stamford-Norwalk, CT	48.9%
6	Raleigh-Cary, NC	47.8%
7	Madison, WI	47.1%
8	Durham-Chapel Hill, NC	46.4%
9	Austin-Round Rock-Georgetown, TX	46.0%
10	Denver-Aurora-Lakewood, CO	44.7%
11	Seattle-Tacoma-Bellevue, WA	43.6%
12	Minneapolis-St. Paul-Bloomington, MN-WI	42.7%
13	New York-Newark-Jersey City, NY-NJ-PA	41.4%
14	Baltimore-Columbia-Towson, MD	41.0%
15	Provo-Orem, UT	40.7%
	Average, Top 100 Metros	**34.3%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See full ranking of America's 100 largest metros in Appendix 2, Table S, and related data in the online data appendix to this report.

Metro-area rankings for bachelor's attainment levels look similar disaggregated by race, with a handful of exceptions:*

* See Appendix 2, Table S, for a full ranking of America's largest 100 metros.
* See Appendix 2, Tables T, U, V, W, X, and Y for metro-area rankings for population shares with a bachelor's degree or higher among White, Black, Hispanic, Asian American, Native American, and foreign-born populations.

- The leading technology centers of the West and East Coasts – **San Francisco**, **San Jose**, **Seattle**, **Boston**, and **Washington** – rank even higher for population shares with a bachelor's degree or higher among their White and Asian American populations than they do overall.

- Large Southeast metros like **Atlanta**, **Charlotte**, and **Raleigh** rank higher for Hispanic and Asian American bachelor's attainment than for overall attainment.

- Western metros like **Phoenix**, **Tucson**, **Denver**, and **Colorado Springs** rank higher for Black attainment than they do overall.

- Southwestern metros like **Oklahoma City**, **San Antonio**, and **El Paso** rank higher for Native American attainment levels than overall.

- Smaller metros with a large university presence like **Madison** and **Durham-Chapel Hill, North Carolina,** rank higher for bachelor's attainment in their foreign-born population than overall.

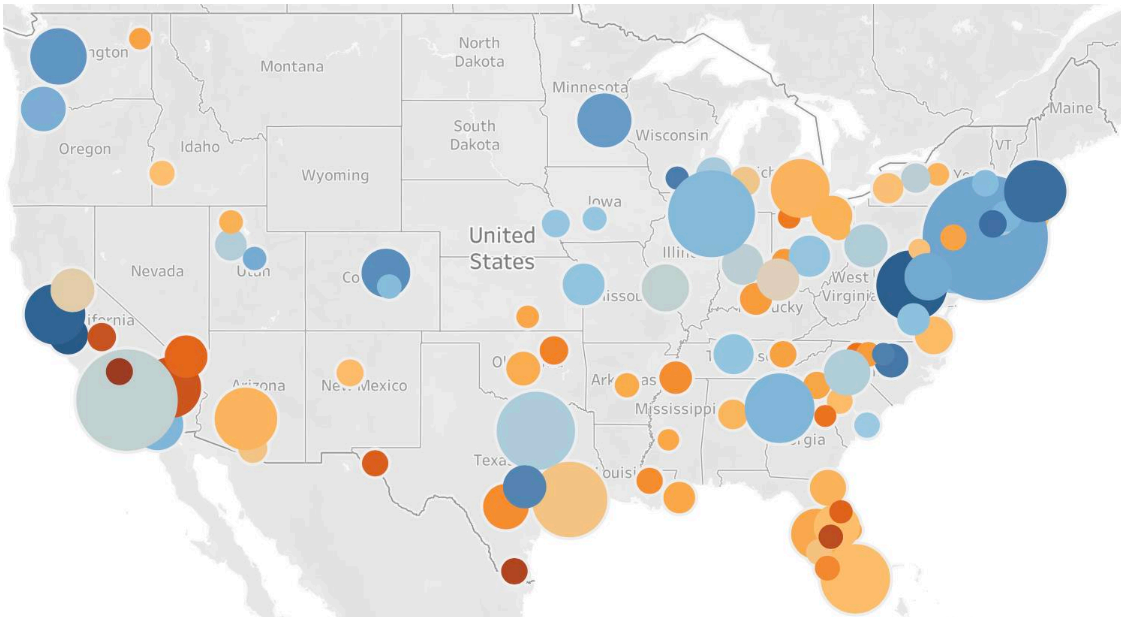
America's metros vary significantly in their bachelor's degree attainment rates, just as they do in community college outcomes. The five top-performing metros have bachelor's attainment rates about twice as high as those of metros in the bottom 10.[257]

Figure 7 shows population shares with a bachelor's degree or higher for all Top 100 metros. Again, circle size represents metro-area population, while color depicts educational attainment. Blue indicates high attainment, while orange means below-average attainment.

Figure 7

Population Shares with a Bachelor's Degree or Higher, 100 Largest Metros

(Circle size indicates metro area; blue and orange indicate above- and below-average attainment rates, respectively)



Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See full ranking of America's 100 largest metros in Appendix 2, Table S, and related data in the online data appendix to this report.

What accounts for outcome differences across metros? These factors influence how metros perform for bachelor's degree attainment levels, our regression analysis shows:*

- **BushEds and BushMeds per capita:** Our measures of innovative research and medical activity are strongly predictive of metro-area population shares with a bachelor's degree or higher.
- **Community college outcomes:** Our composite outcomes score as well as community college retention and transfer rates are positively associated with bachelor's degree attainment levels. It's likely that causality runs in both directions: Metros with strong community college systems produce more transfer students and thus more bachelor's graduates, and those with high bachelor's attainment levels enjoy greater prosperity and opportunity than other places, creating incentives for people to enter and complete community college programs.
- **Black community college enrollment:** Metros with higher enrollment in community colleges among Black people tend to have higher Black bachelor's degree attainment – a relationship that

* See regression results in online Data Appendix. These relationships hold for bachelor's degree attainment levels within every age cohort in the Census data: 18–24, 25–34, 35–44, and 45–64.

is more pronounced than with other racial groups. This suggests that **community college is a particularly important stepstone toward bachelor's degrees for Black Americans**.[*]

- **State spending per capita on higher education and on hospitals:** Both state measures are predictive of bachelor's degree attainment. Just as with community college programs, metros with high investment in medical centers attract people into health care-focused college programs.[**]

- **Population:** Larger metros tend to have higher bachelor's degree attainment levels, all else equal.

- **Social Capital:** The social capital index developed by the U.S. Congress Joint Economic Committee (JEC) is strongly predictive of bachelor's degree attainment levels.

- **Race and foreign-born status:** Metros with larger Hispanic population shares tend to have lower population shares with a bachelor's degree or higher, while those with higher foreign-born population shares have higher bachelor's degree attainment levels, all else equal.

While bachelor's degree attainment levels rose between 2010 and 2020 in almost all large metros, those experiencing the strongest increases mostly fall into three groups:

- **Major technology centers:** San Francisco, San Jose, Seattle, and Boston.
- **Booming Sun Belt and Mountain State metros:** Raleigh, Nashville, Austin, Denver, and Salt Lake City.
- **Mid-Atlantic and Midwestern metros experiencing eds and meds-based turnarounds:** Baltimore, Philadelphia, Pittsburgh, Grand Rapids, and Dayton, Ohio.

Filling in-demand occupations

Rankings: Table 14 shows the best performing 15 of America's 100 largest metros on a composite measure of success in filling seven growing, in-demand occupations: IT security professionals, computer network specialists, secondary school teachers, nurses, electricians, HVAC installers, and welders:[***]

Metro-area performance varies across the seven occupations:

- **IT security:** Top performers include tech centers like Washington, San Jose, San Francisco, and Seattle but also Durham-Chapel Hill, Denver, Colorado Springs, and Albuquerque, New Mexico.

[*] Successful transfer rates are approximately the same across racial and ethnic groups, according to data from *Transfer and Mobility—2018* (Herndon, VA: National Student Clearinghouse Research Center, August 7, 2018), https://nscresearchcenter.org/signaturereport15/). However, Black and Hispanic transfer students are less likely to transfer from two-year to four-year colleges than White or Asian students and more likely to transfer to other two-year institutions, so this result only partially explains our quantitative finding.

[**] For quantitative analysis supporting this point, see discussion of metro-area rankings for preparing people for in-demand occupations later in Section VI.

[***] Method: For each occupation, we take total numbers of people working in the occupation in each metro as a share of total population and convert to z-scores. We compute our composite score as the unweighted average of the z-scores for each occupation.

- **Computer networks:** Durham-Chapel Hill, Washington, Baltimore, Madison, Minneapolis-St. Paul, and Columbus, Ohio.
- **High school teachers:** Honolulu; Columbus; Dayton; Akron, Ohio; Toledo, Ohio; Cleveland, Ohio; and McAllen, Texas.
- **Nurses:** Boston; Cleveland; Madison; Little Rock, Arkansas; Birmingham, Alabama; Jackson, Mississippi; and Harrisburg-Carlisle, Pennsylvania.
- **Electricians:** Salt Lake City; Denver; Greensboro; Little Rock; Baton Rouge, Louisiana; Knoxville, Tennessee; and Des Moines, Iowa.
- **HVAC installers:** Salt Lake City; Boise; Raleigh; Greensboro; Richmond, Virginia; Tampa, Florida; North Port-Sarasota, Florida; and Omaha, Nebraska.
- **Welders:** Baton Rouge; Knoxville; Houston; Tulsa, Oklahoma; Wichita, Kansas; and Milwaukee, Wisconsin.

Table 14

Best Performing Metros for Filling Select In-Demand Occupations: Top 15 Metros

(out of America's 100 largest metro areas)

	Metro Area	Avg z-score
1	Little Rock-North Little Rock-Conway, AR	0.80
2	Madison, WI	0.77
3	Baton Rouge, LA	0.75
4	Salt Lake City, UT	0.73
5	Tulsa, OK	0.72
6	Des Moines-West Des Moines, IA	0.71
7	Durham-Chapel Hill, NC	0.70
8	Oklahoma City, OK	0.70
9	Baltimore-Columbia-Towson, MD	0.64
10	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.63
11	Omaha-Council Bluffs, NE-IA	0.59
12	Denver-Aurora-Lakewood, CO	0.58
13	Louisville/Jefferson County, KY-IN	0.58
14	Virginia Beach-Norfolk-Newport News, VA-NC	0.57
15	Nashville-Davidson--Murfreesboro--Franklin, TN	0.56
	Average, Top 100 Metros	**0.00**

Source: Author's calculations based on occupational data from the U.S. Bureau of Labor Statistics, 2021 data ("Occupational Employment and Wage Statistics," https://www.bls.gov/oes/tables.htm). See full ranking of America's 100 largest metros in Appendix 2, Table Z, and related data in the online data appendix to this report.

On the whole, America's largest metros as well as its lowest-income metros underperform in filling these in-demand occupations, with the exception of IT jobs in the major tech centers.

When metros outperform for filling in-demand jobs, the people filling the jobs as well as the wider economy benefit. First, many people who've become IT professionals or welders in these cities would likely have completed less training and would be earning less if they lived in underperforming places. Second, people working in these occupations generally earn more (IT professionals and construction/mechanical tradespeople) or the same (teachers) than their counterparts in underperforming metros. (The one exception: Nurses earn less in metros with a greater supply of RNs, probably because this enables market-dominant hospitals to pay less at the margin.[*]) **Cities that succeed in creating a good supply of trained professionals generally also succeed in creating demand for their services as well.**

What accounts for outcome differences across metros? Metros that outperform on the following measures tend to outperform on our composite measure of filling in-demand occupations:[**]

- **BushEds and BushMeds per capita:** Metro-area eds and meds portfolios influence overall outcomes but most strongly affect the performance of metros in filling IT and nursing jobs.

- **Degree attainment levels:** Both associate degree and bachelor's degree attainment levels are predictive of overall metro-area performance. They most strongly influence how well metros fill IT, nursing, electrician, and HVAC jobs.

- **Social capital:** Metros that outperform on the JEC's social capital index tend to see above-average success in filling in-demand occupations, all else equal.

Salt Lake City, for instance, ranks well above average on each of these metrics, which helps to explain why it outperforms in filling jobs in skilled construction and mechanical trades.[***]

Several additional factors predict metro-area performance in filling specific occupations on our list:

- **Health care pipeline:** Metro-areas with above-average community college health and nursing graduates per capita tend to outperform in filling nursing jobs. And metros in states with above-average state spending on hospitals tend to outperform both in producing bachelor's degree graduates in nursing and in filling nursing positions. **Cleveland**, for instance, benefits from the presence of the respected **Cleveland Clinic** and from above-average state spending on hospitals—and outperforms most other metros for nursing bachelor's and filled positions.

- **Teacher pipeline:** Metros that produce more community college education and biology graduates tend to outperform in filling high school teacher jobs. Outperformers on these metrics include **Provo**, **El Paso**, **Dayton**, and **Toledo**.

- **Building and mechanical trades:** Metros that produce more community college engineering-related technical graduates as well as those with higher state postsecondary spending perform ahead of others in filling electrician and welder positions. **Provo** and **Indianapolis** rank high for producing skilled community college graduates and for state higher education spending—and for filling electrician jobs.

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[*] Metros with higher hospital market concentration see lower incomes for nurses, our analysis shows. See regression results in online Data Appendix.
[**] See correlation tables and regression results in online Data Appendix.
[***] See data on Salt Lake City and all Top 100 metros in online Data Appendix.

How eds and meds institutions are evolving to improve postsecondary outcomes

Increasing opportunity and economic mobility in the United States necessarily means raising the education and skill levels of its people. This in turn requires creating more diverse pathways to thriving, living-wage careers as well as strengthening existing pathways to improve student outcomes. America should commit to an "opportunity pluralism" agenda, former Assistant Secretary of Education and Walton Family Foundation official Bruno Manno convincingly argues in a 2023 essay.[258] Manno and others call for abandoning what they see as a misguided national message of "college for all" and for embracing the proposition that America's complex 21st century should offer numerous distinctive pathways to skill development and living-wage careers.

But eds and meds as we define them in this report will almost surely play a central role in virtually all pathways such a pluralistic opportunity agenda might envision. If Manno and other critics of "college for all" mean policymakers should deemphasize support for full-time, four-year campus experiences with lavish amenities and increase support for innovative alternatives with proven results, they make a compelling case. America has never really had a policy of promoting this version of college "for everyone" anyway—as evidenced by the small proportion of high school students receiving Pell grants in the program's early years and the declining share of tuition covered by Pell Grants today.

Eds and meds institutions, however, figure prominently in almost every innovative pathway Manno and other reformers call for:

- Education focused more on marketable skills than degree credentials.
- Career and technical education (CTE).
- Dual enrollment high school-postsecondary programs.
- Career academies.
- Industry-recognized certifications (IRCs) that stack toward degrees.
- Intensive advising and mentoring.

Meanwhile, labor markets leave no doubt that young people with only a high school diploma or less face dismal career prospects. **If we reimagine "college" as a vast array of well-designed, interconnected postsecondary learning experiences aimed at preparing people to flourish in 21st century workplaces and lead thriving lives, then *America should aspire to give almost all young people some version of college*.**

For a new opportunity agenda to succeed, **America needs a higher education sector prepared to offer a fast-changing, kaleidoscopic range of programs that are responsive to labor markets, informed by data, stackable and transferable across institutions, and focused on preparing students of all backgrounds and life stages for countless evolving occupations. More and more innovative, high-performing colleges and universities are working toward this future today.**

Improved pathways from high school through college to living-wage careers

Building new and better pathways from high school through postsecondary experiences to thriving careers demands sustained commitment from institutions throughout the talent development ecosystem –

high schools, employers, community nonprofits, and all levels of government in addition to existing postsecondary institutions and disruptive new entrants to the postsecondary marketplace.

Better college and career advising in high school and before: Students, first of all, need to understand how choices during their middle and high school years will influence their opportunities later. For instance, one of the best predictors of whether a student will complete a two- or four-year college program is whether they've taken and performed well in Algebra II and possibly higher-level math classes in high school.[259] More generally, taking more rigorous high school classes increases the odds of college completion, especially among Black and Hispanic students.[260]

High school students also need more counseling resources, better information tools, and more exposure to workplaces as early as possible.

In particular, students need more and better help choosing postsecondary programs suited to their preparation level and goals. A heated debate today concerns whether high schools are pushing students toward prestigious selective colleges too much or too little. On one side, Stanford University economist Caroline Hoxby and colleagues have shown that many students who've performed well in high school weaken their career prospects by "undermatching" in their college choices, in some cases because they don't have accurate information on the actual cost of attending a more selective institution.[261] Enrolling in "high-quality" colleges, as measured by selectivity and test scores, gives students access to more support and resources and increases their probability of graduating, abundant evidence shows.[262]

On the other side, economist Thomas Sowell and others have shown that students sometimes hurt themselves by *overmatching* – for instance, enrolling in highly selective universities where they will be among the least-prepared students, perhaps as a result of affirmative action programs – and would improve their likely outcomes by choosing a less expensive program closer to home.[263]

Most likely, both kinds of mistakes occur far more frequently than they should. Students, especially young people from disadvantaged backgrounds, need intensive, realistic advising supported by far better information on possible pathways, including required coursework, completion rates, labor market data, and program costs.[*]

Dual enrollment programs: Classes that give high school students opportunities to earn credit at both their high school and a postsecondary institution – typically taught by community college instructors in high school facilities – help young people get an early start on college and potentially reduce subsequent postsecondary time and costs. Some dual enrollment programs give high school students hands-on career-related experience, such as a **Texas** program that sends mobile labs to schools where students interested in health care can "treat" dummies in a realistic setting.[264]

Dual-credit enrollment has grown explosively over the last three decades. Today, more than 88% of public high schools offer dual-enrollment classes, and 34% of students complete at least one.[265]

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[*] Even brief information packets on college-to-career pathways and related costs can significantly increase enrollment by low-income students, studies show. (Caroline M. Hoxby and Sarah Turner, "Expanding College Opportunities for High-Achieving, Low Income Students," Stanford Institute for Economic Policy Research Discussion Paper 12-014 (2013): 7, https://siepr.stanford.edu/publications/working-paper/expanding-college-opportunities-high-achieving-low-income-students; Andrew Barr and Sarah Turner, "A Letter and Encouragement: Does Information Increase Post-Secondary Enrollment of UI Recipients?" NBER Working Paper no. 23374, April 2017, https://www.nber.org/papers/w23374).

Enrollment among lower-income students is lower than among high-income students, but it's growing faster, based on 2023 Arizona state data.[266]

High school students who take dual-credit classes are more likely than other students to identify interests early, make good postsecondary choices, enroll in college, and graduate.[267] **Arizona** students who took dual-enrollment classes were 2.2 times as likely as other students with similar characteristics to attend college – 60% attendance compared with 26% for students who didn't take dual enrollment classes – a 2023 "matched-pair" analysis found. Fully 76% of students who took a dual enrollment math class went on to attend college, compared with 34% of closely matched peers who didn't.[268]

Dual enrollment programs pose challenges for institutions which operate them and for some participating students. First, community colleges tend to lose money offering dual enrollment programs, based on typical funding mechanisms. Colleges hope to make up their losses by increasing full-time enrollment by participating students.[269] Second, many students take dual enrollment classes in subjects they don't intend to pursue later and thus save no time or money in college. Dual enrollment programs need to become more closely connected to explicit career pathways.[270]

States and localities are rapidly stepping up their commitment to dual enrollment programs.

- The Arizona legislature passed legislation in June 2023 creating a new funding facility for dual enrollment tuition. **Arizona State University** has launched a program to certify high school teachers for dual enrollment classes.[271]

- California's new community college chancellor says she aims to enroll every ninth grader in a dual enrollment class. **California community colleges** are starting to place counselors in high schools to help students navigate dual enrollment classes and pathways to college.[272]

- The Dallas Independent School District and **Dallas College** (Dallas County's community college) have partnered to build leading "Early College" and "Pathways in Technology" (P-Tech) programs. **Alvin Community College** near Houston has created pathways for students to graduate with high school diplomas and associate degrees simultaneously. The Texas Legislature approved legislation in June 2023 shifting the state's community college funding to an outcomes-based model and increasing tuition support for dual enrollment students.[273]

Enabling transfers from community colleges to four-year institutions: Building streamlined systems to support transfers is an essential component of widening postsecondary pathways. Most community college students indicate that they hope to earn a bachelor's degree. Enabling transfers has been an aspiration of America's postsecondary system since California's higher education reforms in the 1960s. California's long record of strong community colleges and high transfer rates helps explain why most California metros achieve greater-than-average enrollment.

Fully 70% of transfer students complete their bachelor's program, which is equivalent to graduation rates among students who start out at four-year colleges.[274] Metros with higher transfer rates have higher associate degree attainment rates, bachelor's attainment rates, and incomes, our data show.

But **transferring is more difficult than it needs to be – which is why only 22% of community college students manage to do it**. Many community college students have inadequate access to information tools and advising on transfer pathways. Students also lose 40% or more of community college course credit when transferring. Difficulties transferring credits are both a deterrent to transferring in the first place and a large risk factor for dropping out for students who do transfer. Many four-year institutions don't have well defined pathways for prospective transfer students, and some don't permit transfers at all.[275]

Building better transfer pathways is a complex undertaking requiring change in the "collective mindset" and whole-of-the-institution commitment at four-year institutions, according to Lisa Vollendorf, President of Empire State University, New York's only public online-only four-year institution.[276]

Colleges and universities across the United States are working to address these challenges:

- Philadelphia-based **Drexel University** and nearby **Montgomery County Community College (MCCC)** were early leaders in building better transfer pathways. The two institutions have worked together for the past decade to create seamless transfer experiences, including offering Drexel classes in MCCC facilities.

- Orlando-based **Valencia College** and the **University of Central Florida** now offer a streamlined "DirectConnect" pathway.[277]

- **Texas A&M University**'s Engineering Academy program lets students at **Dallas College** and other participating community colleges take two years of basic classes, some taught by TAMU faculty, then transfer seamlessly into TAMU's engineering bachelor's program. Transfer students in this program have an average GPA equivalent to traditional students.[278]

- **Empire State** guarantees admission to community college graduates and accepts 100% of lower-division credits. It also grants credit for specified work experiences and credentials, including military training.[279]

- **MIT**, **Yale**, and 11 other highly selective universities have joined the Aspen Institute's Transfer Scholars Network, launched in 2021 and aimed at standardizing transfer pathways.[280]

Bachelor's degree programs at community colleges: More and more community colleges are offering bachelor's degrees in fields they're positioned to provide, creating an efficient alternative to transferring. These programs typically serve a different demographic than traditional four-year institutions: Students on average are older, employed full-time, and more dependent on need-based aid.[281]

State legislatures have only recently started to permit community colleges to offer bachelor's programs, since four-year universities haven't wanted to face competition for scarce students and have staunchly opposed them almost everywhere. Just 24 states allow community college bachelor's programs at all, and most of these heavily restrict what community colleges can offer, regardless of demand. Ohio first allowed bachelor's programs in 2019, Arizona and California in 2021, and Oregon in 2023 – with strict limits in every case. Texas only allows community colleges to offer programs if their real estate holdings are worth more than $6 billion, which ruled out 20 of the state's 50 community colleges as of 2019.[282]

Consider the case of nursing programs. Nursing is in some respects the ideal field to start with. Many community colleges already have nursing programs, associate degree-seekers in the field often wish to proceed to a Bachelor of Science in Nursing (BSN) degree, and most hospitals are working to increase the share of their nursing workforce with bachelor's degrees. Yet only 12 states permit community college bachelor's degrees in the field.[283]

But the model is working. In Florida, the first state to permit community college bachelor's programs in 2002 and probably the least restrictive in its rules today, more than 45,000 community college students are currently enrolled in bachelor's programs. Bachelor's completion rates are equal to those of traditional students at four-year universities. And employers respect the degree: BSN graduates of Florida community colleges earn an average of $66,000 immediately after completing the degree, 25% more than RNs with associate degrees from the same colleges.[284]

Many institutions are launching innovative bachelor's programs in this nascent space:

- **Utah Valley University (UVU)** in Provo, with 41,000 students, represents an especially innovative model – and its success helps explain why Provo ranks first among America's metros for community college outcomes. UVU's "dual mission" model means it offers all the typical programming of a community college but also a full array of bachelor's programs. Students mostly take first-year classes together, whether they're enrolled in a bachelor's, associate, or certificate program. Pathways for advancing from an associate degree to a bachelor's program are straightforward to navigate. Associate degree-seeking students receive intensive advising and have extensive exposure to bachelor's programs, both of which seem to contribute to exceptional student outcomes. UVU achieves higher retention rates than other community colleges (66% vs. an average of 57% for America's 100 largest metros), higher graduation rates* (38% vs. 26% on average), and far higher median incomes 10 years after graduation ($49,000 vs. $36,000). It's also defying the odds by growing enrollment significantly over the last decade.[285]

- **Solano College** in Fairfield, California, created an industrial biomanufacturing program in 2017, including dual enrollment classes for high school students, stackable credentials, and both associate and bachelor's degree programs in a single, integrated curriculum. Among students who've entered the bachelor's track, graduation and job placement rates are essentially 100%.

- Three Florida community colleges – **Valencia College**, **Lake Sumter College**, and **Seminole State College** – launched a nursing consortium in 2018 aimed at making electives available, sharing costs, and building streamlined pathways to BSN degrees. Each college provisionally admits all students entering its nursing associate degree program to an RN-to-BSN path. More than 500 BSN-certified RNs have graduated during the program's first four years.[286]

- **Dallas College** in 2021 became the first Texas community college to offer a four-year bachelor's program in early childhood education. Students have opportunities to earn more than $30,000 a year as apprentice teachers during their fourth year and have averaged almost $60,000 a year immediately after graduating. Dallas College plans to launch a bachelor's program in nursing in 2024.

- **Austin Community College** launched a bachelor's degree in cybersecurity in fall 2023 with heavy engagement from employers.[287]

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* The graduation rates we report here are the industry-standard of graduating within 150% of "normal" time.

Additional innovative pathways:

- ***From noncredit credentials to degrees:*** Community colleges are working to align noncredit and associate degree pathways and allow efficient stacking of noncredit credentials toward degrees. **Florida**, **Ohio**, and **Michigan** have launched statewide systems to standardize how community colleges award degree credit for industry-recognized credentials (IRCs) in fields like nursing, IT, and advanced manufacturing.[288]

- ***From the military to college*: Collin College** (the community college in Collin County, Texas) and the **University of Texas at San Antonio** have initiated programs to ease the path from the military to college, including credit for skills credentials earned in the Armed Forces.

- ***Return to college for students who've dropped out:*** The California State Legislature passed a bill in 2022 creating a simplified statewide process for people who've dropped out of the **University of California** or **California State University** systems to return and complete their degrees.[289]

- ***Upskilling opportunities for adults in the workforce:*** California community colleges started a program in 2020 with Kaiser Permanente's Futuro Health initiative, Google, and other industry partners to design IRCs, develop programs, recruit students, provide intensive advising, and help with job placement for adults interested in becoming medical assistants, care coordinators, telehealth coordinators, health IT specialists, phlebotomists, and other health care roles. The program supported more than 5,000 students in 2022, 90% of them non-White.[290]

- ***Upskilling pathways within specific fields:*** A blue-ribbon commission called for nursing schools and employers to develop more streamlined pathways from Licensed Practical Nurse and Licensed Vocational Nurse roles to associate, BSN, Master in Nursing (MN), and Master of Science in Nursing (MSN) degrees in the landmark 2010 report *The Future of Nursing*.[291]

- ***Pathways for immigrants with degrees and credentials earned in origin countries:*** Fully 25% of immigrants who earned a bachelor's degree before coming to the United States are working in jobs that don't use their skills or are unemployed, according to a 2016 study by the Migration Policy Institute, the American Immigration Council, and other partners.[292] America's cities have more than 165,000 immigrants with degrees in health care-related fields who are not using these skills.[293] One early step: Boston's Bunker Hill Community College has initiated a program to help some 50 foreign-educated nurses gain Massachusetts licensure each year.[294]

More employer-responsive technical programs leading to specific occupations

Innovative colleges are stepping up their commitment to career and technical education (CTE) programs for the simple reasons that students want them and employers demand them.

Asked what the highest priorities of the higher education sector should be in a 2023 survey, Americans ranked teaching useful skills to help students get a good-paying job as one of their top three, alongside affordability and helping students graduate without debt.[295] Enrollment in community college CTE programs has grown significantly over the last decade, even as overall enrollment has fallen off.[296*]

Building employer-responsive CTE programs is a complex undertaking. Collaboration between colleges and employers is often "superficial at best," one expert said. Colleges often find that employers are vague about what they want to see in new CTE programs, and employers often think the programs colleges develop are too removed from workplace realities. Colleges need to engage more closely with employers. They also need far better data on real-world occupations, including earnings levels and skills required, to align curriculum with workplace demands, according to Georgetown's Anthony Carnevale.[297]

The last five years have seen tremendous innovation in CTE offerings.

- **Evergreen Valley College**, **Alameda College**, and other Northern California community colleges have launched numerous IT-focused IRC and associate degree programs in close cooperation with Google, Amazon's AWS unit, and other Bay Area tech giants. Evergreen has also partnered with Tesla to build an intensive training program for careers at Tesla, including workplace learning experiences and stackable certifications.[298] Strong connections between community colleges and tech employers helps explain the outperformance of California metros for enrollment and overall community college outcomes.

- **AWS** launched a "Skills to Jobs Tech Alliance" in 2023 engaging colleges and other employers nationwide to develop standardized IRCs and programs in cloud computing, software engineering, and data integration. The City College of New York is playing a lead role.[299]

- **The Ohio State University** and **central Ohio community colleges** are working with Intel, which has announced a $100 million investment in the initiative, to develop CTE programs supporting Intel's new fabrication facility in Licking County, near Columbus.[300]

- **Arizona State University (ASU)** announced a partnership with semiconductor equipment manufacturer Applied Materials in 2023 to build a $270 million Materials-to-Fab Center in Tempe, Arizona, for R&D and job training in support of the new Taiwan Semiconductor fab under development east of Phoenix as well as other chip companies.[301]

- **Wake Technical Community College**, which has long played a key role in building workforce programs in collaboration with biotechnology employers in North Carolina's Research Triangle area, announced a new STEM facility with a heavy biomanufacturing focus in 2022.[302]

- The **Tennessee College of Applied Technology** – Tennessee's main provider of CTE programming – announced a new campus near Memphis that will work closely with Ford Motor Company's new plant in the area on electric vehicle and battery manufacturing technologies.[303]

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[*] To say the pendulum in higher education should swing, and is swinging, toward better balance between career-connected skills and the humanities is not to oppose teaching liberal arts in America's colleges and universities. It's simply to recognize the overwhelming demand from employers and potential students for more CTE. There is still ample demand for humanities content – even if it's declining at the margin – and many universities and liberal arts colleges will continue to thrive in part by addressing this demand.

- San Antonio-based **St. Philip's College**, a two-year HBCU,* launched a cybersecurity certification program in partnership with local employers in 2022.[304]

- The **University of North Texas at Dallas** is building a new police academy it will operate for the Dallas Police Department and other regional police forces. UNT Dallas is also incorporating explicit "workplace competencies" throughout its programs, with employer advice.

- **UNT Frisco**, a new branch campus of the **University of North Texas at Denton**, has built processes that allow it to launch employer-responsive academic programs within six months of identifying industry needs.

More employer-recognized credentials embedded in programs

Alternative credentials like college-issued certificates and industry-recognized certifications (IRCs) are a hot topic today in discussions about how to increase opportunity in America. One reason: They're growing fast. The number of noncredit credentials awarded by colleges more than doubled between 2000 and 2020, while the number of degrees awarded rose much more slowly.[305] Fully 45% of the workforce now has at least one alternative credential. More than 90% of human resources professionals believe IRCs can convey as much information about a job applicant's skills as a degree, one survey showed.[306]

One obvious reason for the appeal of alternative credentials is that people can earn them at lower cost in time and money than they can a degree. More important, though, is that **certificates and IRCs can potentially bridge a growing gap between what college degrees signify in terms of workplace-relevant cognitive skills and what employers demand**. College coursework has in many cases moved in a more esoteric, ideologically driven direction, as we discuss in Section III. But **workplace demands have grown more technologically sophisticated and specialized** as well, **and employers are looking for credible information sources on what job applicants know how to do**.

Alternative credentials in their present form are an imperfect solution to this problem. There are more than 5,000 credential issuers and some 46,000 distinct credentials in the market, but little quality control or regulation. Many are time- rather than competency-based with no rigorous assessment of skills learned – that is, people "earn" them just by showing up. This means most credentials convey no credible information to employers, which explains why few credentials provide any earnings benefit.[307]

Many colleges are working to address these shortcomings. **First, they're shifting toward industry-recognized certifications and away from certificates developed entirely in-house**, aiming to make credentials more responsive to specific employer needs. **Utah** is a leader in developing IRCs in close collaboration with industry – another reason why Provo and Salt Lake City rank so high for community college outcomes. The State of Utah encourages IRCs and requires institutions to incorporate extensive feedback from at least five relevant employers for each IRC-focused program they start. The **University of Utah** and **Utah Valley University** both offer wide varieties of IRC programs.[308]

Second, colleges are working with employers and nonprofit partners to standardize what students learn in credential programs and what IRCs signify. **North Carolina** institutions developed a standardized "BioWork" IRC that's played a key role in the state's success in biotechnology. **Wisconsin**'s

* Historically Black college or university.

statewide Technical College System has launched standardized IRCs in advanced manufacturing and other fields, including streamlined approval processes and pathways to stack IRCs toward an associate degree. Students in these programs have certification completion rates 19 percentage points higher than similar students in other programs, and one third go on to earn an associate degree.[309]

Third, colleges are embedding IRCs in two- and four-year degree programs and moving away from operating them as a separate track. More than 45% of people earning an IRC today earn them while in a bachelor's degree program or after earning a bachelor's degree.[310] **Ohio** and **Washington** have launched statewide systems to standardize how IRCs stack toward degrees. In Washington, a new program that combines basic math and English skills with stackable IRCs increased degree completion rates by 32 percentage points in a randomized study.[311] The **University of California at Davis** is considering breaking up its MBA program into a set of stackable credentials that would lead to a traditional degree but also convey standardized information about student skills.[312]

Fourth, college and universities are launching new IRCs to keep up with fast-changing employer needs. The **University of South Florida** started an AI certificate in fall 2023, while three Phoenix-area community colleges started a short-term "QuickStart" IRC in semiconductor manufacturing aimed entirely at jobs in the area's new Taiwan Semiconductor facility.[313]

Increasing capacity, especially in high demand fields

One of the best ways for America to widen its talent pipeline and increase opportunity is for colleges and universities that are especially good at producing well-prepared graduates to grow.

High-performing flagship public institutions: Many prestigious public universities largely stopped growing enrollment after the 1970s. **Growth in nationwide college enrollment** therefore **took place in a way unlike virtually any other industry: The highest quality programs (by some measures) served an ever-shrinking share of students, while institutions with fewer resources absorbed almost all the incremental growth**. This pattern has reinforced steep but dysfunctional prestige hierarchies that are increasingly hard to reconcile with mainstream 21st century thinking about how education and opportunity should work.

Concerns about diluting academic standards don't explain why so many have chosen not to grow. Admissions deans routinely say large numbers of rejected students could readily do the work at their college. The experience of other countries also belies this concern. The University of Toronto, for instance, has grown to more than 60,000 undergraduates and 16,000 graduates and remains arguably Canada's top-ranked university, as ASU President Michael Crow has pointed out.[314]

Rather, **the fact that so many institutions made the same choice at roughly the same time suggests that choosing not to grow is a rational decision for top players in a competitive arena in which low admissions rates and a reputation for exclusivity lead to high prestige and strong performance in national rankings**.[315] Former Harvard President Larry Summers recently agreed that this choice is increasingly hard to defend.[316]

Arizona State stands as a powerful counterexample. ASU, which in Crow's words focuses not on "how many people it can exclude but how many it can include," has increased enrollment of first-year students more than 120% since he became president in 2002. During these years the university has improved on multiple measures of "quality." ASU's first- to second-year retention rate rose to 84% from 75% during Crow's first 10 years. Research spending has quadrupled and grown more productive (as we show in Section V). ASU now ranks first in the nation for Ph.D. degrees earned by Native Americans and math Ph.D.s earned by Hispanics.[317] ASU's commitment to inclusion also helps explain why Phoenix ranks first among large metros for transfers from community colleges to bachelor's programs that take place within eight years.

Upward mobility stars: Economic mobility in America would also benefit from greater enrollment in less resource-rich colleges that nonetheless outperform for promoting upward mobility among at-risk students. These include, for instance, the **University of Texas at El Paso**, the **University of Texas-Rio Grande Valley**, the **State University of New York at Stonybrook**, and the **California State University System**, according to detailed data from Harvard's Raj Chetty and colleagues.[318] They include numerous HBCUs like Baltimore-based **Morgan State University** and urban commuter universities like **UNT Dallas** that, fortunately, are committed to significant future growth.[319] And they include community colleges like **Utah Valley University**.[320]

In-demand fields: Colleges and universities should also expand slots in capacity-constrained programs that lead to in-demand occupations. An obvious case is nursing. America's nursing schools turn away about 80,000 qualified candidates a year because of insufficient faculty and physical space, despite the large and growing shortage of nurses in the nation's health care system.[321] Nursing schools in Houston in some cases have at least four times more qualified applicants than slots, a recent report found.[322]

Some universities are working to expand capacity. The **University of Central Florida** announced plans in 2022 to double its nursing school's physical capacity, while **Columbus State Community College** is using a grant from provider OhioHealth – the largest grant in its history – to double the size of its school.[323]

More generally, expanding capacity for in-demand fields is a much better way to cope with high demand than rationing slots and excluding interested students, as many colleges currently do through restricted access majors.[324]

Restructuring programs for student success

Changing student demographics mean one of the most significant steps colleges can take to increase access and completion is to increase flexibility around when and where students take classes.

Approximately one third of community college students are over 24 years old and working full time, while two thirds attend college part-time.[325] The share of "nontraditional" students at four-year institutions is rising as well.[326] Distance and busy schedules are high obstacles to college attendance for many of these students.

New locations: One measure colleges and universities can take is creating branch campuses or satellite facilities near underserved populations. **Opening new two- or four-year branch campuses leads to substantially higher college enrollment and completion among people living within 25 miles or in the same county**, several studies in California and elsewhere have shown.[327] Urban satellite facilities have also proven successful in increasing enrollment, academic and industry studies have shown. **UT**

San Antonio has recently opened a facility in downtown San Antonio aimed partly at increasing access for transfer students from the area's community colleges.[328]

Time flexibility: Another strategy is to restructure programs to give students greater time flexibility. **Ivy Tech**, Indiana's statewide community college system, has shortened many courses by half to reduce drop-out rates, adopted more flexible course sequencing so students can take developmental education (remedial) classes simultaneously with CTE coursework rather than as a prerequisite, and expanded online offerings. The result: Completion rates have increased by 9 percentage points over the past decade.[329] **Tennessee's community college system** is also planning to introduce more accelerated, half-length classes to increase flexibility for students.[330] Time flexibility is particularly significant for adult learners who frequently have to manage work and family responsibilities while completing their studies.

More innovative formats: Online, shorter degree programs, and apprenticeships

Innovative formats aimed at promoting student success extend beyond new locations and schedules.

Online: One important new format, of course, is fully online degrees. Evidence on the effectiveness of online programs during the pandemic paints a mixed picture. On the one hand, many traditional students seeking a four-year campus experience away from home were frustrated by remote college. On the other hand, actual class engagement was relatively high, despite the on-the-fly improvisation that typically characterized sudden moves to virtual class. Community college students were more likely to attend class and come prepared but less likely to engage with fellow students, a 2023 study by the Center for Community College Student Engagement found.[331] Some students found they preferred online class.[332]

In any case, **many colleges are stepping up their fully online offerings to increase enrollment and provide students more flexibility**. **Georgia Tech**'s fully online master's program in computer science, launched in 2014, operates entirely asynchronously – meaning students proceed at their own pace – and charges students just $7,000 for the equivalent of one year of courses. Students have an average age of 32, universally work full-time, and mostly indicate they wouldn't be able to do a master's degree if it wasn't fully online. With no space constraints, the program accepts every applicant they believe can do the work, which amounts to an acceptance rate of 74%. The program currently has 11,000 enrolled students logging in from 124 countries and has produced 5,000 graduates.[333]

Purdue University acquired education provider Kaplan University in 2018 for its online capabilities and is working to integrate in-person and online classes into a single "Purdue Global" institution. **MIT** has launched a series of fully online "MicroMasters Programs" in data science, finance, supply chain management, and other fields, with more than 5,000 people earning IRCs since 2015. **ASU** aims to enroll 100 million people by 2030 in its new online Global Management, Entrepreneurship, and Innovation certificate program.[334]

As for institutions that operate fully or primarily online, **Southern New Hampshire University (SNHU)** and **Western Governors University (WGU)** have grown tremendously in recent years. Today SNHU has 170,000 students enrolled in online programs. WGU has 150,000.

Some leaders of four-year institutions express skepticism about online formats, citing robust demand for slots at premiere universities. But excessive focus on students aiming for Harvard or Stanford can mislead observers about the vast changes at the margin in America's student population. Most students attend college close to home and are focused on degrees that will help them get a good job at the best possible price. For most of them, the stereotypical four-year experience is increasingly becoming an out-of-reach luxury good. In the survey cited earlier on higher education priorities, respondents ranked having an "active social scene," "competitive varsity sports," and "a reputation for being elite" as the last three of 66 choices. More than 75% of students at four-year institutions have never attended a varsity game.[335]

New in-person formats: While there are too many promising experiments underway to address here, consider one that has earned substantial attention. The University of Austin plans to open a small, asset-light campus and offer a four-year program in an atmosphere committed to free inquiry and "the fearless pursuit of truth."[336]

Shorter degree programs: A simple way to let students earn a bachelor's degree at less cost in time and money is to offer programs that students can complete in fewer than four years. Colleges are working to make this opportunity more widely available by easing the path to transfer credits and count some IRCs, adding summer classes, and reducing required coursework outside the major.[337]

One helpful innovation: Seventeen of America's 155 medical schools now offer a seven-year combined bachelor's-M.D. degree, and four offer a six-year program. The United States and Canada are the only countries in the world where it takes eight years of postsecondary work to complete a medical education for most aspiring physicians. This reflects the range of courses students are required to take as undergraduates rather than a higher amount of medical school training than is required in wealthy European and East Asian countries.[338]

Some colleges are recognizing that a full four-year experience with a diverse range of classes and extracurriculars should be one version of college, but not the only one. As more colleges experiment with shorter formats while more community colleges offer bachelor's programs, the traditional distinction between two and four-year institutions is likely to blur.

Apprenticeships: German-style apprenticeships have been slow to take off in the United States, since Americans workers don't stay in the same job as long, so employers don't have confidence that an investment in training will pay off. Colleges, however, are realizing that a more viable apprenticeship model in the United States is to offer associate degree programs with stackable IRCs and substantial apprenticeship-like experience in a single workplace – with no obligation on the part of the employer to pay for training. The number of young people engaged in apprenticeships has grown more than 50% since 2010, with a rising share leading to an associate degree.[339]

Better advising and holistic student support

High-performing colleges are learning more about obstacles that stand in the way of degree completion for many of their students. These include:[340]

- Insufficient information about academic and career pathways and campus resources.
- Complex (and sometimes irrational) rules governing course prerequisites.
- Complex rules on financial aid, including unexplained changes in aid packages.
- Anxiety, depression, and feeling of not belonging.
- Challenges involving necessities: food, transportation, child care.
- Challenges involving jobs and income.

- Insufficient access to academic, career, and mental health counselors.

Colleges are working to address these obstacles through new models of intensive advising and holistic support.

- **Understanding student needs:** Effective advising starts with understanding how things are going for students. **ASU**, **UNT Dallas**, and many other institutions participate in the Beginning College Survey of Student Engagement, also known as the "Bessie."[341] Good data systems are essential for tracking student engagement and well-being.

- **Intensive advising and mentoring:** Colleges committed to an intensive advising model typically assign at-risk students multiple advisors and mentors, including academic advisors, pathway and career counselors, tutors, mental well-being counselors, and fellow student mentors. Check-ins are far more frequent than most American undergraduates generally experience. **UNT Dallas** is aiming for a model of one lead advisor for every 250 students – a much higher ratio than most colleges have.[342] **ASU**, **Purdue**, **Utah Valley University**, and HBCUs in general are also among the leaders in running intensive advising models.[343]

- **Good technology tools: ASU**, **Purdue**, and **Virginia's community colleges** provide students state-of-the-art dashboards to help them understand majors and career pathways and make good choices, stay on track, and communicate with counselors. High-performing colleges are also investing in predictive analytics tools to identify students who are at risk of dropping out.[344]

- **Incentives for good decisions: Evergreen Valley College**, **Temple University**, and the **University of Indiana** provide financial incentives to take a full course load each term, based on strong evidence that students who don't are far more likely to drop out.[345]

- **Intensive onboarding:** Indiana's **Ivy Tech** launched its "Ivy Achieves" orientation program statewide in 2022. It focused on 10 "habits" associated with college success, including registering for classes early, using course management software daily, and meeting frequently with advisors. The program increased first-to-second year retention in its first year, evidence indicates.[346] Brigham Young University is expanding its mentoring program for first-year students to increase their sense of belonging on campus.

- **Tutoring: Virginia Tech** has long offered high-quality math tutoring through its "Math Emporium" program. Participating students improve results more than other students, data shows.[347]

- **Promoting engagement, well-being, and a sense of belonging:** How connected students feel with faculty, fellow students, and their college community is highly predictive of success rates. Fostering a sense that students belong on campus is especially important for Black and Hispanic students. And a small amount of personal connectedness can make a big difference in increasing retention, data from the Community College Research Center shows. Colleges are coaching faculty and staff to make student interactions friendly and supportive. Engaging at-risk students early with mental health services also increases retention, studies cited in an American Council on Education report show.[348]

- **Holistic support addressing basic needs: Luzerne County Community College** in Pennsylvania offers students and their families a subsidized food market. **Niagara County**

Community College in New York has long hosted quality on-campus child care facilities. **Dallas College** helps students with bus passes and is expanding on-campus child care.

Intensive advising and holistic support services work. The most effective way to increase community college completion rates is to increase instructional spending and provide extensive advising and wraparound services, a 2019 Brookings Institution study concluded.[349] In a controlled experiment at three Ohio community colleges between 2012 and 2018, students receiving intensive advising and a suite of holistic services had a 40% associate degree completion rate after three years, compared with 22% in the control group.[350] **Florida State University** reported a 16 percentage point increase in bachelor's degree completion rates within six years after implementation of an intensive advising system.[351] **Dallas College**'s intensive "Learner Care Model" has increased Fall-to-Fall retention rates to almost 60% for participating students, compared with 35% for comparable students before the program's launch.

Surveys show that Black HBCU students, who have significantly higher completion rates than Black students at comparable non-HBCUs, are more likely than non-HBCU Black students to say that their professors care about them (58% to 25%) and that they have mentors encouraging them to pursue their goals (42% to 23%).[352]

Guided Pathways, a program developed at Columbia University combining intensive advising and holistic support with explicit college-to-workplace pathways for each student, has shown particularly strong results for first-generation Black and Hispanic students. At **Bluegrass Community and Technical College** in Kentucky, the program raised graduation rates to 27% from 16% for underrepresented minority students between 2017 and 2022. More than 400 community colleges have adopted Guided Pathways nationwide, even though it requires significant investment in case management resources.[353]

Better physical and natural spaces

The spaces people occupy and the built environment that defines these spaces influence people's ability to learn and work productively, considerable evidence shows. Spending time in green settings outdoors also generates significant health benefits, according to abundant research.

Drawing on new brain science findings, architecture firm HKS makes a case in a 2023 report on "brain-healthy workplaces" that study and work spaces should encourage people to move through areas specifically designed for exploration and ideation, individual focus, collaboration, social connection, and rest over the course of their day. Additionally, well-designed "live-learn" environments can improve health, well-being, learning, and ecological sustainability by promoting healthy choices by design, HKS researchers and their collaborators have shown.

Based on HKS's study, colleges can improve student mental well-being, learning, and completion rates by creating accessible spaces that afford opportunities for each of these activities, including the following:

- Co-location of living and learning spaces.
- Prioritizing multimodal mobility: walking, biking, public transit where feasible.
- Providing a range of ideation/exploration spaces with whiteboards and other supporting technologies both inside buildings and in more open public spaces.
- Enhanced acoustics and configurations to enable individual focus as well as large group learning.
- Meeting spaces with substantial work surfaces and technology integration for collaboration.

- Spaces for gathering, mingling, and having fun.
- Designated quiet spaces with adjustable lighting for “brain breaks.”
- Access to nature at multiple scales: Plants, trees, trails, parks, pocket parks, community gardens, terraces, and more for individual or group brain breaks.
- Arts facilities and visible public art
- Good access to affordable healthy eating options to make healthy choices the easy choice.
- Healthy materials, lower energy use, and lower embodied carbon for long-term resilience.[354*]

Reducing operating costs and prices

Money isn’t the main factor holding back college enrollment and completion, but it’s a significant factor. People who’ve never enrolled in college or dropped out cite financial considerations as an important reason for their decision, a 2023 Gallup/Lumina Foundation survey showed.[355] Affordability ranked first in the poll we previously noted on what Americans believe should be higher education’s top priorities.[356]

Evidence from scholarship programs illustrates possible effects from policies to loosen financial constraints on college attendance. Georgia’s merit-based HOPE program, launched in 1993, led to a 3 to 5 percentage-point increase in enrollment rates for each $1,000 of grant aid.[357] “Promise” programs offering free community college have also delivered higher enrollment rates. The Kalamazoo Promise, started in 2005, resulted in a 14 percentage point increase in enrollment rates for eligible students and a 10 percentage point increase in the share of Kalamazoo young people earning a postsecondary credential within six years, with especially large benefits for Hispanic and Black students.[358]

Additional evidence comes from four-year institutions that have avoided or limited tuition increases in recent years. **Purdue University**, which hasn’t raised tuition in 12 years under a policy initiated by former president Mitch Daniels, has seen undergraduate enrollment at its main West Lafayette campus rise more than 25% since 2012.[359] The **University of Illinois at Urbana-Champaign** has raised tuition more slowly than most institutions – 16% since 2016 – and has realized enrollment growth of 15% since 2016, despite difficult demographics in its state.[360]

Why do we say money isn’t the main factor constraining enrollment and completion? A host of other challenges – poor information on postsecondary pathways, inadequate K-12 preparation, lack of available programs nearby, work-related scheduling conflicts, food insecurity, child care issues, mental health and “belonging” obstacles, and growing perceptions that the returns to college aren’t worth it – collectively explain much of America’s disappointing enrollment and completion trends, as we show throughout this report. Making college free doesn’t solve these challenges. In Kalamazoo, 45% of eligible students enrolled but never earned a postsecondary credential, while 4% never enrolled in a program.[361]

Limiting tuition increases means containing costs, unless institutions are able to cover spiraling costs from other sources. Some colleges and universities are finding ways to hold expenses down.

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[*] The author is grateful to student participants in the 2023 cohort of the Dallas-based Center for BrainHealth’s Todd Platt BrainHealth Scholars program, who gave a brilliant presentation on brain-healthy college spaces at the end of their program.

- **Tackle administrative bloat and increase productivity: Purdue** has managed to remain financially strong – it's one of only a handful of public universities with the highest-possible credit rating – despite its long freeze on tuition hikes.[362] It has also managed to perform well by any metric, climbing in media rankings[*] and scoring very high on our innovation impact index (see rankings in Section V). The university's measures to contain costs have included cutting some low-enrollment programs, marginally increasing student-to-faculty ratios, changing employee health plans, and eliminating unnecessary administrative positions.[363**]

- **Specialize:** Colleges don't have to offer programs in every in-demand field, much less low-enrollment fields. An alternative strategy is to do some things very well and attract students interested in those pathways. New Jersey-based **Fairleigh-Dickinson University** announced in 2022 that it would stop offering many major programs at both of its two New Jersey campuses and focus on strengthening each campus's specialties.[364]

- **Use land more efficiently or reduce the physical footprint:** Many colleges are land-rich but use land inefficiently. Colleges offering four-year residential experiences on beautiful campuses would be unwise to fill in popular quads, of course, but many of these institutions could consolidate vast surface parking lots into compact multilevel garages. They could also promote off-campus housing nearby so fewer students and staff need to drive to campus every day. **UT Dallas**, located on a sprawling property that was once remote from built-up areas but is now surrounded by high-value suburban real estate, has shifted to building three-story academic structures and is working with developers to construct multifamily housing adjacent to campus. **Shaw University**, a Raleigh-based HBCU, is selling down some of its extremely valuable excess property in downtown Raleigh, where it's the largest nongovernment landowner.[365]

- **Merge: Drexel University** announced in 2023 that it's absorbing Salus University in Elkins Park, Pennsylvania, in a transaction that will bring it more than $50 million in incremental revenues but less in operating costs.[366] Oakland, California-based **Mills College** merged into **Northeastern University** in 2022, creating an integrated bicoastal institution.[367]

- **Improve retention rates:** The least expensive students to recruit are the ones who are already there. Colleges have many relatively low-cost options with proven records of increasing year-to-year student retention, as this report shows.

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[*] Purdue has improved its position in the *U.S. News & World Report* rankings to 51st in 2023 from 65th in 2013 ("Best National University Rankings," 2023, https://www.usnews.com/best-colleges/rankings/national-universities; "U.S. News National University Rankings, 2008–2015," Public University Honors, https://publicuniversityhonors.com/2015/06/13/u-s-news-national-university-rankings-2008-present/).

[**] Purdue notably hasn't increased reliance on inexpensive contingent faculty, raised its proportion of full-pay international students, held faculty pay levels at noncompetitive levels, or received above-average increases in state funding (Andrew Ferguson, "The College President Who Simply Won't Raise Tuition," *The Atlantic*, April 2020, https://www.theatlantic.com/magazine/archive/2020/04/mitch-daniels-purdue/606772/).

Innovative research and medical institutions as well as state spending on higher education and health care strongly affect community college outcomes. Innovative institutions, state spending, and community college outcomes in turn influence how metros perform in bachelor's degree attainment rates and filling in-demand jobs.

High-performing two- and four-year colleges are pursuing many avenues with proven track records to build a stronger value proposition, create programs relevant to today's students, increase enrollment, and improve completion rates. These include the following:

- **Better education-to-career pathways: Dual enrollment programs, streamlined paths for transferring from two- to four-year institutions, bachelor's programs at community colleges, employer-responsive career and technical education programs, industry-recognized credentials embedded in degree programs, and more.**
- **More capacity at institutions that outperform for student upward mobility and in in-demand fields.**
- **New locations, better physical spaces, more flexible schedules, and innovative formats: fully online degrees, shorter duration bachelor's programs, apprenticeships.**
- **Intensive advising and holistic student support.**
- **Cost containment and tuition freezes.**

VII. HOW POLICYMAKERS AND PHILANTHROPISTS CAN AMPLIFY THE ECONOMIC IMPACT OF EDS AND MEDS INSTITUTIONS ON AMERICA'S CITIES:

RECOMMENDATIONS

High-performing eds and meds institutions are investing in countless initiatives to become more powerful engines of local prosperity, as this report shows. They're strengthening talent pipelines, promoting local innovation ecosystems, and joining with local partners to create innovation districts and other environments that expand opportunity for residents. **Federal, state, and local governments as well as philanthropic funders all have vital roles to play in supporting these initiatives and amplifying the impact of eds and meds institutions on local economies**.

This report points to three general objectives that should inform policy and funding decisions associated with eds and meds institutions.

General policy objectives

First, policymakers and philanthropic funders should adequately fund proven talent, innovation, and place initiatives. This report highlights many areas in which funding significantly constrains promising avenues for progress:

- **Degree pathways:** Funding constraints limit dual-enrollment programs since community colleges offering them typically don't have incremental revenue sources to cover program costs.

- **Advising and student support:** Holistic student support and good advising for college and high school students work, but they're labor intensive and generally underfunded.

- **Cost to students:** Cost is a significant obstacle to enrollment and completion. Initiatives to reduce or contain prices clearly increase enrollment rates. Colleges have many ways to reduce costs—and they should do so.

- **Research spending:** The very strong relationship between research spending and measurable innovation impact at the level of individual eds and meds institutions suggests many could increase innovation outputs considerably if they had more research funding.

- **Innovation districts:** Building innovation districts with space for startups and other entities with thin resources requires subsidies, since innovation district real estate is inherently expensive.

- **Underinvested neighborhoods:** Investing in clinics, teaching facilities, job centers, and affordable housing in underinvested neighborhoods is costly for eds and meds institutions. It would be good news if more could afford to do it at scale.

Second, decision-makers should focus on how existing funding streams and regulations influence incentives for eds and meds institutions—and reform them to incentivize better outcomes.

- **Insufficient incentives to improve student outcomes:** Federal loan programs that impose no constraints on college cost inflation or administrative bloat and leave colleges off the hook for poor student outcomes create strong incentives for institutions to make choices that aren't in the public interest. Likewise, state funding streams that reimburse colleges for credit-hours rather than outcomes incentivize institutions to grow "inputs" rather than focus on student success.

- **Narrow, incremental research:** Federal R&D grantmaking agencies structure most grant programs in ways that incentivize researchers to choose narrow, low-risk projects.

- **Cross-subsidizing other operations with patient services:** Long-term declines in federal funding as a share of medical research budgets have drastically increased pressure on academic medical centers to cross-subsidize research from patient care revenues, arguably transforming institutional cultures and priorities in unproductive ways. Federal and state regulators have reinforced these tendencies by setting reimbursement rates for Medicare and Medicaid patients at levels that require massive cross-subsidy from private-payer care.

Third, increased funding should go hand in hand with much greater accountability and competition for colleges, universities, and medical centers.

- **Public outcomes data:** Accountability starts with far better publicly available data on how eds and meds institutions are performing on metrics that matter most to the public – student outcomes, innovation, and quality patient care.

- **Consequences for failure:** Accountability demands consequences for failure. **Policymakers should put less emphasis on keeping individual institutions in business and more on the results generated by the eds and meds sector as a whole.**

- **Competition:** The ultimate guarantor of accountability is robust competition. In general, **there is too little competition in the eds and meds sector**. In higher education, lack of competition stems primarily from America's inputs-oriented accreditation system and its link to federal student finance programs. In health care, it stems partly from lax antitrust enforcement.[368]

Federal policy

Increase basic research funding and promote blue-sky, transformational science

Consider some key facts on federal funding for research at eds and meds institutions:

- **Total spending:** Federal agencies spent $43.5 billion in 2021 on research conducted by eds and meds institutions. Federal funds cover about 49% of eds and meds research and constitute 28%

of total federal R&D spending.[*] Sixty-four percent of federal research grants to eds and meds institutions go to what the federal government defines as basic (as opposed to applied) research.[369]

- **Medical centers:** $24 billion of the total $43.5 billion in eds and meds spending funds research at accredited medical schools and associated academic medical centers. **Federal grants cover 14% of total expenses for these institutions, down from 22% in 2004 and 24% in 1977. Patient care revenues cover 63% of expenses, up from 21% in 1977**.[370**]

- **Success: America's system of funding scientific research – federal funding allocated by a competitive process adjudicated by peer review panels and going to decentralized, autonomous institutions that do most of the actual work – has been a resounding success. This strategy, together with federal support for technology commercialization under the Bayh-Dole Act of 1980, cemented U.S. preeminence in science and technology during the first four decades after World War II. U.S. universities came to constitute 46 of the top 100 universities in the world and eight of the top 10 for the quality and quantity of patenting activity, according to an international ranking published by Thomson Reuters.[371] America continues to lead the world in science by virtually any metric.** U.S.-based researchers, for instance, account for 30% of citations in the most cited top 1% of scientific journals, according to National Science (NSF) data. European researchers have a 21% share on this metric, Chinese researchers have 20%, and Japanese researchers have 15%.[372]

- **Declining federal commitment:** Federal R&D funding, however, has steadily fallen to 0.66% of GDP in 2021, from a high of 1.86% in 1964. R&D investment by private firms has increased sufficiently to keep total R&D spending about constant as a share of GDP over the last two decades, but **basic research investment has receded since eds and meds institutions funded by federal grants account for a majority of basic research**.[373] One culprit: Fast-growing federal spending on Social Security, Medicare, and other entitlement programs has increasingly "crowded out" vital investments in research and education.

- **Changing incentives:** The federal peer review process has evolved to become less supportive of bold, high-risk, interdisciplinary proposals and more focused on narrow, incremental research aimed at confirming reigning theories – or worse, validating "politically correct" views – many scientists believe. University of California at Santa Barbara physicist James Langer wrote in a widely cited article in *Science* that "one less-than-'excellent' review, no matter how misguided, is usually enough to doom a proposal. Any proposal that is truly innovative, interdisciplinary or otherwise unusual is almost certain to be sent to at least one reviewer who will be less than enthusiastic about it."[374] University of Pennsylvania physician Ezekiel Emmanuel argues that the National Institute of Health (NIH) process has become "sclerotic, cautious, [and] focused on doing

[*] State governments cover 5% of the $84 billion invested by eds and meds institutions in R&D, while private industry covers 6%. Other sources – notably patient care revenues at academic medical centers – cover the other 37%. For the 45% of federal R&D spending that doesn't go to eds and meds institutions, the main destinations are federal research facilities (like the National Institutes of Health and federal labs like the Los Alamos and Lawrence Livermore National Labs), agencies (like the Department of Defense and NASA), and private sector contractors.

[**] Patient care also constitutes a much larger share of academic medical center expenses than in the 1970s, as academic medical centers have become considerably larger heath care providers. But academic medical centers nonetheless increasingly rely on profits from patient care to subsidize losses in research and medical education (confirmed through multiple author interviews).

what it has always done."[375*] Harvard Medical School researcher Charlotte Blease writes that federal grant systems today reward preordained "correct" findings and discourage pursuing contrarian approaches.[376]

- **Losing ground to other countries:** The United States devotes 2.7% of GDP to R&D today (economywide, not just public sector spending), compared to 4.3% in South Korea, 4.1% in Israel, 3.6% in Japan, 3.2% in Finland and Sweden, 2.9% in Germany, and 2.1% in China.[377] America's share of citations in Top 1% journals, while still the world's largest, has declined to 30% from 39% in 2010, while China's has risen to 20% from 12% and India's to 14% from 12% over the same period.[378]

Congress should:

- **Increase federal R&D funding by at least 50% as a share of GDP:** A blue-ribbon panel of top technology executives, retired military leaders, and other experts recommended in a landmark 2005 report, "Rising Above the Gathering Storm," that the U.S. government double its R&D budget as a share of GDP, to about 1.4%.[379] A 2018 task force convened by the Council on Foreign Relations proposed 1.0% of GDP, or 50% larger than at present.[380]

  Skeptics might contend that the low-hanging scientific "fruit" has been picked and that a larger research budget wouldn't produce a significant reacceleration in innovation and economic growth. Data we present in this report points to a more optimistic view. First, very strong relationships between research spending and innovation outputs at the level of individual institutions suggest that more spending would generate more or less commensurate increases in output. Second, there's no evidence of poor marginal returns on research investment in South Korea, Israel, and other innovation-minded countries. Third, classic work by the economist Edwin Mansfield found that U.S. academic R&D investment has generated a long-term return of more than 20% to society.[381] And fourth, simple arithmetic based on the more recent data we present in this report points to a marginal return of at least 8% to 16%.[**]

- **Redesign federal research spending to promote blue-sky research addressing society's biggest challenges:** Congress should mandate that grantmaking agencies increase their funding of high-risk, potentially high-return science and report regularly on progress. Agencies should set aside a substantial share of funds for grants that one or two members of a peer review panel can approve to reduce the negative effects of groupthink. Grant terms should allow greater flexibility

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[*] Consider also that 78% of scientists would make midcourse changes in their federally funded research projects if they weren't constrained by inflexible grant terms, according to a survey conducted by Stripe founder Patrick Collison, economist Tyler Cowen, and bioengineer Patrick Hsu (Ip, "Rethink Science Funding").

[**] The 178 eds and meds institutions in our dataset earned a total of $2.4 billion in license income a year on average between 2016 and 2020, relative to average annual spending of $71.7 billion – a "return" of 3.4%. Universities typically earn royalties of 3% to 4% of gross product revenues associated with their IP licenses, which means the products represented in our data generated revenue equal 85% to 113% of total university R&D spending. Some of this revenue comes from sales at government-mandated prices well below people's willingness to pay. If we assume these products generate "consumer surplus" – value to consumers in excess of the total price they pay – equal to 50% of revenues and further that these products generate consumer surplus 20% to 30% above those of older products they're replacing, then the return to consumers from forgoing $1 of current consumption to fund eds and meds R&D is some 8 to 16 cents per annum, or 8 to 16%.

for researchers to adapt to new data and should give more weight to plans for disseminating or commercializing findings.

Grantmaking agencies have pursued strategies like these before. The NSF's "Engineering Research Centers" program, which funded $1 billion in grants to roughly 50 institutions between 1985 and 2009, required interdisciplinary collaboration, industry advisors, and student engagement and allowed a longer-than-typical timeline for projects. The program led to 142 spinout companies, better collaboration across universities, and more emphasis on cutting-edge science, surveys showed.[382] The NSF also experimented with fast grants that a single program officer could approve in a 2009 program, with good results.[383]

New legislation creating the Advanced Research Projects Agency for Health within the NIH in 2022 is a step toward more federal funding for blue-sky science. Congress should seek changes in the rest of NIH and in non-health care funding programs as well.

- **Fund the true cost of medical research directly and eliminate distortions arising from cross-subsidization by patient care:** Congress should fund the vast majority of health care research at academic medical centers, up from 50% to 75% today, reducing pressure on medical centers to make large profits on patient care. Today's system creates an undesirable tradeoff between funding medical research on the one hand and injecting more competition into hospital markets on the other. It also loads excessive medical costs on private-sector employers and their employees – who pay up to cross-subsidize both Medicare/Medicaid-insured patients and America's health care research establishment – and adds significant costs to the health care system.

- **Mandate commitment to free inquiry and objective research as a condition for federal research grants:** The growing shift on campuses away from free inquiry and objective research strikes at the heart of the research and teaching missions for which taxpayers support eds and meds institutions. Congress should not subsidize it.

Require more college outcomes data, including for nondegree programs

Helping students make better decisions and holding colleges accountable for outcomes demand better data than is typically available today. The federal government imposes limited reporting requirements on colleges for degree programs and virtually no requirements for nondegree credential programs.[384]

Congress should:

- **Broaden required data reporting:** Require all colleges, universities, and other institutions that benefit from federal financial aid or research funding to collect and report nationally consistent outcomes data on all degree and nondegree credential programs. Require disaggregation by predictive student attributes like race, gender, age, part-time vs. full-time status, parents' income, and occupation after graduation plus all-in costs and completion rates for all programs.

- **Improve data tools:** Direct the Department of Education to improve tools for students and counselors like the College Scorecard and College Navigator, which provide some degree of outcomes data on specific institutions and programs, to make all data available in easily searchable form.

- **Create consequences for sustained failure:** Declare institutions or specific programs ineligible for federal financial aid if they repeatedly fail to meet defined minimum outcome thresholds.

- **Require consistent innovation impact reporting:** One possibility: Require institutions receiving federal research funding to report standard annual data to a third-party data aggregator like the Association of University Technology Managers, provided the aggregator makes the data publicly available and easily searchable.

A bipartisan group of members of Congress introduced a bill in 2023 that aimed to modernize outcome and cost reporting. Despite wide support from higher education leaders, the bill didn't advance.[385]

Step up investment in regional talent and innovation ecosystems

America should aim to build strong talent and innovation ecosystems in cities and regions across the country.

The federal government is currently conducting several experiments with competitive programs promising large grants to a handful of multistakeholder consortia to support local innovation ecosystems, including the Economic Development Administration's $1 billion Build Back Better Regional Challenge and $500 million Tech Hubs initiatives as well as the NSF's $800 million Engines program.[386] These novel initiatives appropriately recognize the central role of eds and meds institutions, the opportunity to promote innovation ecosystems beyond traditional Northeastern and West Coast technology centers, and the interconnected, multistakeholder realities of successful local economies.

Congress should launch programs making these kinds of approaches evergreen rather than one-off. Future programs should incorporate lessons from current experiments but should consider adjustments:

- **Shift to a model emphasizing many small grants backing proven strategies rather than a handful attempting grand transformations of local economies:** Small grants to support strategies like dual enrollment CTE programs or startup space in innovation districts can make a big difference.

- **Emphasize grants that are flexible with respect to which industries will succeed in particular locations rather than backing top-down efforts to build a single pre-selected industry:** Federal and local planners just don't know what will happen.

- **Delegate grant selection to peer review evaluation committees with academic leaders, business executives, investors, and state and local officials rather than agency civil servants:** Bring more real-world knowledge to the table, as federal agencies do to award research grants.

This report points to several strategies for building talent and innovation ecosystems that have proven track records but would benefit from public-sector funding:

- **Create more training slots for occupations essential to eds and meds-centered innovation ecosystems:** Academic medical centers, for instance, need physicians and nurses, but many localities face growing shortages in both occupations. The federal government funds graduate medical education for specified numbers of students at each accredited medical school. But 70% of schools, trying to keep up with demand, enroll more students than the federal program pays for under its antiquated caps.[387] Likewise, Congress currently subsidizes nursing education at levels amounting to just under $2,000 per nurse, or about 3% to 4% of the all-in cost of training RNs, but U.S. nursing schools turn away more than 80,000 qualified applicants each year due to shortages of instructors, facilities, and clinical rotation opportunities.[388] Congress should fund significant capacity expansion at schools of medicine, nursing, and other health care occupations.

- **Support technology transfer operations and other enablers of innovation impact:** Congress should consider supporting expansion of TTOs and other innovation-promoting activities. Successful programs include the NSF Innovation Corps (I-Corps™) and NIH's Research Evaluation and Commercialization Hubs (REACH) program.

- **Subsidize innovation district elements that are essential but hard to fund without subsidy:** These include dedicated startup space, programming for district researchers and entrepreneurs, and inclusion initiatives for surrounding neighborhoods. One possibility: Experts from the Global Institute on Innovation Districts, HR&A Advisors, and New Localism Advisors have proposed a federal "Innovation Zone" program to support physical construction, talent development for residents, seed funds, TTOs, and other innovation district elements.[389]

- **Locate federal research facilities near eds and meds institutions with vibrant innovation ecosystems around the country:** The Department of Agriculture's National Bio and Agro-Defense Facility is likely to transform the innovation ecosystem surrounding **Kansas State University** in Manhattan, Kansas. The new ARPA-H facility in Dallas will likewise have transformative impact on **Pegasus Park** and the wider region's innovation ecosystem.

- **Promote mixed-income housing near eds and meds institutions and innovation districts:** Housing development might target institution employees as well as low- to moderate-income residents. One possibility: a federal tax-credit or matching program to support development or renovation of well-located mixed-income housing.[390]

- **Support education-to-career pathways:** Dual enrollment programs, intensive advisement, holistic student support, and paid internships and apprenticeships linked to a degree or IRC program all improve student outcomes, but they are resource intensive with no accompanying revenue streams.[391]

Reform immigration law: More visas and reformed work rules for foreign STEM students

Highly skilled immigrants have long played a supersized role in the success of America's eds and meds institutions as students, postdocs, faculty, and in other roles. Many foreign-born graduate students remain in U.S. cities for good after graduation, enriching their communities. Immigrants disproportionately earn patents, launch companies, and build R&D-intensive firms.[392]

Immigrants also disproportionately become scientists and academics, strengthening eds and meds institutions to the benefit of surrounding communities. **Metros with high immigrant population shares tend to host universities with larger than average innovation impact, our analysis shows.**[*]

America is engaged in a ferocious competition for talent against other countries. Congress should enact common-sense immigration reforms to strengthen the nation's position in this competition.

Specifically, Congress should:

- **Ease the path for student visas to help U.S. eds and meds institutions regain their edge in attracting students from outside the United States:** America's share of all college and graduate students studying abroad declined to 21% in 2019 from 28% in 2001, while Canada, Australia, and northern European countries enjoyed large market share gains, according to a report by the organization NAFSA: Association of International Educators. The main reasons for America's declining share in this critically important industry are visa problems, obstacles to working after graduation, physical safety worries, and growing fears of not feeling welcome, university administrators indicate.[393] **Sustaining America's premier position as a magnet for student talent is vital for ensuring the nation's leadership in science and technology. Also, universities that succeed in boosting enrollment by foreign-born students should increase total enrollment rather than shrink capacity for native-born applicants.**

- **Create better paths for immigrant STEM workers to put their skills to use in America:** Congress should allow more foreign-born STEM graduates to work in America's cities by making it easier for foreign-national STEM students studying at U.S. universities to stay in the United States after graduation and expanding the number of H-1B temporary work visas for skilled people to meet demand. A bipartisan group of 49 former high-ranking federal officials wrote a public letter in May 2022 urging Congress to exempt foreign-born holders of U.S. graduate and professional STEM degrees from current green card caps. **"Stapling a green card" to advanced degrees earned at U.S. universities is an obvious way for America to strengthen its position in the worldwide competition for STEM talent.** Canada offers an equivalent pathway to working after graduation. Almost half of foreign-national STEM graduate and professional degree-holders who graduated before 2004 had become U.S. citizens by 2017, the Center for Security and Emerging Technology found.[394]

- **Expand the Conrad-30 program, which incentivizes qualified foreign doctors to practice in underserved communities**: Each year, each state may obtain up to 30 waivers to recruit foreign medical graduates who were trained in the United States under a visa program to work in medically underserved, often rural, areas. Without the waiver, these doctors would be forced to leave the United States. In 2021, a bill was introduced in Congress to expand the program to 35 waivers per year. Congress should expand the program further to encompass more medical graduates and cover other underserved health care professions including nursing, as well as teachers and engineers.

[*] See regression results in the online Data Appendix.

State policy

Redirect funding: Research excellence, technology commercialization, and student outcomes

Consider these key facts on state funding for eds and meds institutions:

- **Share of expenses:** State governments cover 39% of expenses at community colleges, 17% at public research universities, and 5% at medical schools on average.[395] Approximately 76% of state appropriations to eds and meds institutions consist of unrestricted budget support, unlike federal support which primarily funds student financial aid and specific research projects.[396]

- **Declining share:** State appropriations to the higher education sector per resident declined 35% on average from 1990 to 2019, adjusted for inflation, with much of the drop occurring after the global financial crisis of 2007-2009.[397] State funding of community colleges has held up better than other higher education spending, falling slightly on a per-student basis since 2000 in the average state.[398] **As a share of expenses, today's 17% state share of expenses at research universities compares with 31% at the start of the century. At medical schools, state shares have fallen to 5% today from 30% in 1977**.[399]

- **Hospitals:** State appropriations to hospitals have increased 59% on a per capita basis on average since 2000, primarily reflecting tremendous growth in Medicaid spending. Medical centers generally lose money on Medicaid patients, so these appropriations do little to help support medical research budgets.

- **Variation across states:** Some states invest far more in their eds and meds institutions than other states do. **Utah** spends 83% more per capita than the average state on higher education. **North Dakota** spends 81% more than average, **Virginia** spends 28% more, **Colorado** spends 25% more, and **California** spends 17% more. **Illinois**, **Missouri**, and **New York** each spend at least 30% less than the average state on a per capita basis. **Texas** invests fully nine times more per capita than **Illinois** in research at eds and meds institutions.

  As for medical centers, **Iowa**, **Kansas**, **Utah**, and **Virginia** appropriate more than twice as much per resident as the average state, while **Florida**, **Illinois**, **Louisiana**, and **West Virginia** appropriate less than half as much as average.

  And as for rates of change over time, **Connecticut**, **Montana**, and **Pennsylvania** have held higher education spending per resident roughly steady since 1990, while **Arizona**, **California**, and **Maine** have reduced investment per capita by more than 50%.[400]

State legislatures should:

- **Support innovative research: Texas** has long been a leader in supporting innovative research and medical science at its public eds and meds institutions. The Texas Legislature helped build **MD Anderson Cancer Center** into one of the world's leading medical institutions through consistent support starting during World War II.[401] In 2009, the legislature passed a bill allocating up to $500 million to public universities meeting specified research criteria to make more of its institutions into Carnegie "Tier One" national research universities. The number of Tier One institutions has since risen to 10 from three.[402] In 2010, the state launched the Cancer Prevention and Research Institute of Texas (CPRIT), which has since made almost 1,900 grants to medical researchers amounting to $3.3 billion. Texas voters approved renewing CPRIT with an additional $3 billion in 2019.

North Carolina also supports life science innovation and entrepreneurship. The North Carolina Biotechnology Center, which receives 80% of its funding from the state and 20% from private sources, makes grants to academic researchers to help them reach "proof-of-concept" for new drugs and technologies.[403] The North Carolina legislature is considering an appropriation of more than $1 billion to NCInnovation, a new nonprofit with numerous business and academic leaders on its board that aims to make research and commercialization grants.[404]

- **Support technology dissemination and commercialization:** The **Colorado** Legislature passed legislation in 2005 creating a funding stream to support university tech transfer programs and accelerate commercialization of new technologies. The program has made $46 million in grants and helped launch 56 startups.[405]

- **Support the development of eds and meds-linked innovation districts:** The governments of **North Carolina**, **Michigan**, and **Georgia** made investments pivotal to the subsequent success of innovation districts in Winston-Salem, Ann Arbor, and Atlanta, as we discuss in Section V. The **North Carolina** legislature helped finance the renovation of former RJ Reynolds tobacco facilities to create the **Innovation Quarter**, while a **Michigan** state venture fund helped fund Ann Arbor's **Life Science Corridor**. **Georgia's Department of Transportation** built a key bridge across Interstate 75/85, making **Tech Square** possible.

- **Support innovative education-to-career pathways:** Legislatures are pursuing numerous avenues to promote innovative pathways. Some – like **Utah**, **Texas**, and **California** – are stepping up funding for initiatives like dual enrollment programs, intensive advisement models, and new career-connected leaning programs.[406] **Texas** and **California** have passed bills to create consistent, streamlined statewide processes for dual enrollment and transfer credits, while **Florida** has created a statewide system for articulation agreements governing credit for industry-recognized credentials (IRCs).[407] **Tennessee**, **Washington**, and other states have helped fund implementations of Guided Pathways and other intensive advising models.[408] **Georgia** and **Indiana** have passed legislation extending existing scholarship programs to adult learners.[409]

- **Shift toward outcomes-based funding models:** Approximately 30 states have adopted community college funding systems that base funding amounts for specific colleges on student degree and credential completion rates, transfer rates, and labor market outcomes rather than "input" measures like credit-hours, at least to some degree. These states vary significantly, however, in the share of total funding that depends on outcomes, from 100% in **Ohio** to 3% in **Arkansas**.[410] **Texas** passed a new outcomes-based funding formula in 2023 that links 90% of state community college appropriations to outcome measures.[411]

  All states should link most community college funding to student outcomes. They should also consider incorporating student outcomes more fully into state funding of four-year institutions.

- **Support expansion of college capacity for in-demand occupations: Kansas** passed the "Kansas Promise Scholarship Act" in 2021 to create new funding streams to increase capacity in associate degree and technical certification programs for in-demand fields like cybersecurity, advanced manufacturing, early childhood education, and building trades.[412] **Arizona** and **Florida** appropriated funds to increase nursing school capacity in their states in 2022.[413]

Strengthen state data systems to document student outcomes and support better advising

States have a vital role to play in creating outcomes-focused data systems and putting them to use through better student advising, in concert with more detailed, nationally consistent data collection and reporting by the federal government.

State legislatures should:

- **Prioritize building and maintaining state longitudinal data systems (SLDS)** that capture student outcomes from pre-K-12 through postsecondary programs to careers to deepen policymakers' and leaders' understanding of who is accessing opportunity, what programs and initiatives are most successful, and what credentials provide the best value to students over time. The George W. Bush Institute ranks each SLDS across four metrics: governance for system vision, governance for capacity and resources, accessibility and data driven policy, and transparency and reporting.

- **Build credential libraries** to help students and families understand the options and likely value of credentials and degrees.

Allow existing and new institutions easier entry into postsecondary markets

States should promote more competition in their postsecondary education markets. This includes liberalizing restrictions that prevent existing institutions as well as disruptive entrants from offering innovative programs.

State legislatures should:

- **Liberalize restrictions on new programs:** Most states maintain restrictions preventing even established public colleges and universities from offering in-demand academic programs. These restrictions typically serve only to protect the interests of incumbent institutions. In **Texas**, for instance, rules block community colleges from offering bachelor of science in nursing (BSN) programs if a college's total property value is below a specified level, excluding 20 of the state's 50 community college systems. Another rule prohibits new BSN programs within a 50-mile radius of an existing program, regardless of local supply and demand for slots. The state, meanwhile, prohibits four-year institutions from participating in the Texas Workforce Commission's community college-focused Skills Development Fund – which has prevented Texas A&M from launching a program it's well positioned to run in biomanufacturing. The legislature actually tightened restrictions on new professional degree programs still further in 2021.[414] States should loosen or eliminate such rules.

- **Create streamlined paths to market entry and exit for nontraditional program operators:** States should have clear outcomes-based rules eliminating eligibility for state funding for chronically failing programs, whether offered by traditional or nontraditional operators.

Require eds and meds institutions to uphold free inquiry and expressions

States should require colleges, universities, and academic medical centers receiving state funding to uphold free inquiry and expression as a condition for state funding: States should establish clear rules defining terms and impose accountability through regular reporting and third-party audits. The **Florida**, **Ohio**, and **Tennessee** legislatures have each established protections for free inquiry and speech over the last six years.[415]

Local policy

Use land-use authority to advance the productive evolution of eds and meds institutions

The physical footprint of eds and meds institutions should evolve dynamically as a function of their teaching, research, and placemaking activities rather than remaining static based on historical land purchases. Some institutions need to grow traditional campuses to make room for initiatives like expanded patient care. Others aim to transform university-owned land into innovation districts and other multitenant mixed uses. Many institutions would benefit from shrinking their footprints to reduce expenses and opening up space for alternative uses like housing. **Local governments influence the options available to eds and meds institutions through their land-use policies**.

Local governments should:

- **Enable the physical expansion of growing institutions:** This generally means rezoning adjacent real estate and overcoming resistance from "not-in-my-back-yard" (NIMBY) forces that fear neighborhood change, including gentrification. Work with eds and meds institutions to develop community benefit packages that will make campus expansion a win-win for neighbors as well as growing institutions.

- **Support development of innovation districts with land-use and property tax measures:** Tax and zoning measures by local governments played vital roles in the emergence of successful innovation districts in **Cambridge**, **Boston**, **Philadelphia**, **Raleigh-Durham**, **Winston-Salem**, **Atlanta**, **St. Louis**, and **Houston**. This has typically taken the form of Tax Increment Financing and related structures. Several of these cities have granted special authorities to innovation district management entities that have been instrumental to their districts' growth. Cities can also enact land-use rules conducive to innovation district success like requiring district developers to include outward-facing activities like restaurants, coffee shops, and job centers on ground floors of multistory buildings, building wide sidewalks and green spaces, and keeping cars away from building entrances.[416]

- **Support development of housing – including employee, student, and mixed-income housing – on or near eds and meds campuses:** Most U.S. cities need more housing supply. **Developing housing near university or medical center campuses is especially helpful because it increases education and job opportunities for residents who have the opportunity to live there and because it helps institutions attract talent**. **Innovation districts that have seen better-than-average housing development in surrounding neighborhoods have also experienced greater success on other placemaking measures**, as we show in Section V. Also, large-scale mixed-use development near institutions in underinvested neighborhoods – as the **University of North Texas at Dallas** is currently planning – is one of the most promising paths for creating nodes of prosperity in struggling places.

- **Enable shrinkage of campuses, more intensive land use, and adaptive reuse of underutilized academic properties where it makes sense to do so:** Many colleges will likely go out of business in coming years, and many more will see declining enrollment. Sprawling, underused campuses are a poor use of increasingly scarce land in metropolitan areas. Cities should aim to convert underused academic real estate to residential and mixed-use development and encourage institutions to use land more intensively.

Invest in quality-of-life amenities to support innovative placemaking initiatives

Cities can also support eds and meds-sponsored placemaking initiatives by investing in quality-of-life amenities. Building trails, pocket parks, arts facilities, and public gathering spaces helps make innovation districts and other physical places near campuses more appealing. They also make a large difference in eds and meds-led initiatives to revitalize underinvested neighborhoods. Local governments play a particularly vital role in ensuring public safety in innovation districts, recovering downtowns, and areas adjacent to eds and meds campuses.

Initiatives to revive traditional downtowns as safe, interesting, walkable, mixed-use places also support the success of local eds and meds institutions by helping attract talented faculty and students.

Act as a convener for local initiatives involving eds and meds institutions

Mayors and other local leaders are often well positioned to act as conveners. In many cities mayors have brought together eds and meds officials and other local players, who don't always have a record of working closely with one another, to develop shared visions and strategies for strengthening local talent pipelines and innovation ecosystems.[417] **Fort Worth** Mayor Mattie Parker recently launched a citywide effort to improve education-to-career pathways with heavy engagement from private-sector employers.[418] Former **Boston** Mayor Thomas Menino was the chief convener of a public-private group that came together to build Boston's Seaport innovation district.

Mayors can also become their city's leading champion for talent, innovation, and place initiatives. Mayors, for instance, should help articulate the idea that career and technical education can be a good choice for many young people and dispel the narrative that it's a path to second-class citizenship. They should additionally help persuade residents that the success of their local eds and meds institutions advances the interests of all residents.

Philanthropy

Local philanthropic funders can also make a large difference to talent, innovation, and place initiatives sponsored by eds and meds institutions. Virtually all of America's leading eds and meds institutions owe much of their present position to long-time support by local private-sector and philanthropic funders.

Philanthropic funders should:

- **Support the growth and success of local eds and meds institutions, including community colleges, four-year research universities, and academic medical centers:** Strong eds and meds institutions are powerful drivers of economic development, as we've shown throughout this report.

- **Support eds and meds innovation initiatives:** Private-sector and philanthropic funders are sometimes positioned to support more sophisticated technology transfer and commercialization offices than universities and medical centers could otherwise afford. They can also play key roles in launching new research-intensive academic initiatives, as **Pittsburgh** foundations did in helping Carnegie Mellon University start its robotics and machine-learning programs.[419] And they are positioned to support blue-sky research activities that federal funders sometimes eschew.

- **Support the growth and success of eds and meds-sponsored innovation districts:** Private-sector and philanthropic funders are arguably the best positioned local players to fund innovation district elements like startup coworking spaces, workforce readiness and job connector programs for local residents, and outreach efforts supporting surrounding neighborhoods.

- **Support initiatives by eds and meds institutions to engage with underinvested neighborhoods:** Opportunities include clinics operated by medical centers in health care deserts, summer STEM immersion programs on university campuses for local high school students, and mixed-income housing developments near campuses.

- **Support development of innovative education-to-career pathways and other proven initiatives to improve student outcomes:** Some proven pathway programs need philanthropic support or government subsidies to function at scale. These include dual enrollment programs, intensive advising models, holistic student support like food distribution to disadvantaged students,[*] workforce readiness programs like Year Up, and paid internships and apprenticeships. Philanthropic funders might also support alternative nongovernment aggregators of student outcome data, like Third Way's 2022 ranking of colleges for economic mobility.[420]

[*] The North Texas Food Bank, for instance, has used philanthropic resources to create mobile pantry operations on all seven campuses of **Dallas College**, Dallas County's community college system, addressing the challenge that 63% of students have missed a class because of food insecurity and 25% have dropped a for-credit class for this reason.

- **Require eds and meds institutions to uphold free inquiry and expression as a condition for support:** Philanthropic funders collectively have a powerful voice. They should use it to push as many eds and meds institutions back toward commitment to the principles of free inquiry and free expression. Institutions that continue down the path of ideological conformity and restrictiveness are likely to prove poor investments for funders aiming to promote opportunity for students, innovation, and quality patient care.

Recommendations:

Federal, state, and local governments as well as philanthropic funders all have vital roles to play in amplifying the impact of eds and meds institutions on local economies.

Congress should:

- **Increase federal basic research funding and promote blue-sky, transformative science.**
- **Require more college outcomes data, including for nondegree programs.**
- **Step up investment in regional talent and innovation ecosystems.**
- **Reform immigration law: More visas and looser work rules for foreign STEM students.**

State legislatures should:

- **Redirect funding: Research excellence, technology commercialization, and student outcomes.**
- **Strengthen state data systems to document student outcomes and support better advising.**
- **Allow existing and new institutions easier entry into postsecondary markets.**
- **Require eds and meds institutions to uphold free inquiry and expression.**

Local governments should:

- **Use land-use authority to advance productive evolution of local eds and meds institutions.**
- **Invest in quality-of-life amenities to support innovative placemaking initiatives.**
- **Act as a convener for local initiatives involving eds and meds institutions.**

Philanthropic funders should strongly support the growth and success of local eds and meds institutions, including support for innovative education-to-career pathways, technology commercialization initiatives, innovation districts, and engagement in underinvested neighborhoods. Funders like policymakers should insist on commitment to free inquiry and free expression.

VIII. CONCLUSION

Virtually all cities have available avenues to promote local prosperity and opportunity through eds and meds initiatives focusing on innovation, place, and talent.

- **Innovation:** Approximately 65% of Americans live in the 126 metro areas hosting universities and academic medical centers with positive innovation impact as we measure it in this report. All these institutions have opportunities to promote transformational blue-sky science, instill deeper institutionwide cultures of innovation and entrepreneurship, strengthen technology commercialization operations, increase engagement with local technology and business ecosystems, and invest more in evidence-based initiatives to promote local prosperity. Hundreds of additional institutions in smaller metros have opportunities to promote local innovation through better connections between internal research assets and external firms.

- **Place:** Just under half of all Americans live in a metro that already has at least one identifiable eds and meds-linked innovation district. Virtually all these districts are growing strongly and have opportunities to become more powerful engines of opportunity in the future. Many cities host universities or academic medical centers with sufficient critical mass to justify an innovation district but don't yet have one. All cities have opportunities to incorporate eds and meds institutions into downtown revitalizations and place-based initiatives, using evidence-based strategies to spur vitality in underinvested neighborhoods. And all cities would benefit from new housing supply close to eds and meds institutions.

- **Talent:** Almost every American city hosts at least one college or university. All postsecondary institutions have opportunities to build more effective education-to-career pathways, stronger career and technical education (CTE) programs leading to living-wage jobs, improved student advising and support, more flexible and affordable postsecondary access, and better outcomes. Flagship state universities can increase local opportunity by choosing to grow. Colleges with low or average completion rates have many proven options for improving outcomes. All cities also have medical centers that can contribute to talent pipelines by stepping up training for nurses and other health care professionals.

Table 15 summarizes this report's recommendations for eds and meds leaders; for federal, state, and local policymakers; and for philanthropic funders.

In the long term, cities which perform well for educational attainment, workplace skills development, and innovation will perform well as engines of prosperity and opportunity for people living there. If some cities continue to perform far ahead of others in building strong eds and meds institutions, disparities across cities are likely to increase as cities most focused on education and innovation leave others behind.

But if eds and meds institutions in cities across the country succeed in becoming even more powerful engines of local prosperity than they are today, they can help spark faster innovation and economic growth for the nation as a whole—and a vast expansion of opportunity for all Americans.

Table 15

Summary of Recommendations

For federal policymakers:

- Innovation:
    - Increase and reform federal funding of basic science.
        - Increase total investment at least 50% to 1% of GDP.
        - Promote blue-sky, transformational research.
        - Fund true cost of medical research and reduce cross-subsidy from patient care revenues.
        - Mandate commitment to free inquiry and objective research as condition for funding.
    - Support technology commercialization initiatives.
        - Require consistent public reporting of innovation impact outcomes.
    - Invest in local innovation and talent ecosystems.
        - Create evergreen versions of recent one-off initiatives, adjusted to emphasize frequent grants supporting proven strategies, selected by peer-review committees.
- Place:
    - Invest in local innovation and talent ecosystems.
        - Create evergreen versions of recent one-off initiatives, adjusted to emphasize frequent grants supporting proven strategies, selected by peer-review committees.
        - Support innovation district elements: startup space, programming, inclusion.
    - Support eds and meds-sponsored downtown revitalizations.
    - Support eds and meds-sponsored neighborhood initiatives.
        - Support creation of clinics in health care deserts.
        - Support enrichment programs for local K–12 students.
        - Support comprehensive placemaking initiatives.
    - Promote mixed-income housing near eds and meds campuses and innovation districts.
- Talent:
    - Require and publish more student outcomes data.
        - Include certification and other nondegree programs.
        - Develop better data tools for students and advisors.
        - Ensure consequences for sustained failure.
    - Invest in local innovation and talent ecosystems.
        - Create evergreen versions of recent one-off initiatives, adjusted to emphasize frequent grants supporting proven strategies, selected by peer-review committees.
        - Fund innovative education-to-career pathways.
        - Fund more training slots for occupations essential to ecosystem success (e.g. doctors and nurses).
    - Reform immigration law
        - Ease path for international student visas.
        - Broaden pathways for immigrant STEM workers.
        - Expand the Conrad-30 program.

For state policymakers:

- Innovation:
    - Redirect higher education funding:
        - Support innovative eds and meds basic research.
    - Support technology commercialization and other innovation initiatives.
        - Require consistent reporting of innovation impact outcomes for public universities and academic medical centers.
    - Work with eds and meds institutions on research for social good.
    - Mandate commitment to free inquiry and objective research as condition for funding.
- Place:
    - Redirect higher education funding:
        - Increase support for innovation districts: infrastructure, housing, etc.
        - Fund more training slots for occupations essential to ecosystem success (e.g. doctors and nurses).
    - Support eds and meds-sponsored downtown revitalizations.
    - Support eds and meds-sponsored neighborhood initiatives.
        - Support creation of clinics in health care deserts.
        - Support enrichment programs for local K–12 students.
        - Support comprehensive placemaking initiatives.
- Talent:
    - Redirect higher education funding:
        - Support innovative education-to-career pathways.
        - Shift to outcome-based funding models for community colleges and four-year universities.
        - Support expansion of capacity for programs in high-demand fields.
    - Strengthen state data systems.
        - Require more reporting of outcomes data.
        - Develop state longitudinal data systems (SLDS).
        - Build consistent credential libraries.
    - Promote market entry by innovative new providers.
        - Liberalize program restrictions on existing institutions.
        - Streamline pathways to market entry and exit.

For local policymakers:

- Innovation:
    - Act as a convener on eds and meds innovation initiatives.
    - Work with eds and meds institutions on research for social good.
- Place:
    - Use land-use and tax authority to support eds and meds initiatives.
        - Support development of innovation districts: infrastructure, housing, etc.
        - Enable campus shrinkage, more intensive land use, and adaptive reuse.
    - Support development and preservation of housing near eds and meds campuses and innovation districts.
    - Invest in quality-of-life amenities near eds and meds campuses and innovation districts.

- Act as a convener to promote innovation districts, including good governance structures; downtown revitalizations; and eds and meds-sponsored neighborhood initiatives.
- Talent:
  - Support growth of successful local eds and meds institutions.
    - Support innovative education-to-career pathways.
    - Support physical expansion of growing institutions where appropriate.

For philanthropic funders:

- Innovation:
  - Support research activities of successful eds and meds institutions.
  - Support technology commercialization and other innovation initiatives.
  - Work with eds and meds institutions on research for social good.
  - Mandate commitment to free inquiry and objective research as condition for funding.
- Place:
  - Support growth of innovation districts.
    - Fund programming, coworking spaces.
  - Invest in quality-of-life amenities near eds and meds campuses and innovation districts.
  - Act as a convener to promote innovation districts, including good governance structures; downtown revitalizations; and eds and meds-sponsored neighborhood initiatives.
- Talent:
  - Support growth of successful local eds and meds institutions.
    - Support innovative education-to-career pathways.
    - Support physical expansion of growing institutions where appropriate.

For eds and meds leaders:

- Innovation:
  - Create more incentives for blue-sky, transformational research addressing big challenges.
    - Change workplace incentives for researchers.
    - Create fast grant programs for bold projects.
    - Invest in research equipment and facilities.
    - Organize units to promote transformational science.
    - Hold down dependence on industry funding.
  - Promote institutionwide cultures of innovation and entrepreneurship.
  - Optimize technology commercialization.
    - Set appropriate goals: building innovation ecosystems, attracting and retaining talent, generating impact—not maximizing revenues as such.
    - Ensure experienced leadership and adequate staff and funding.
    - Focus on external relationship building.
    - Ensure market-rate terms for inventors.
    - Monitor and disclose innovation impact outcomes annually.
  - Support local innovation and entrepreneurship ecosystems outside the institution.
  - Work with local partners on research for social good.
  - Commit to free inquiry and objective research.
- Place:

- Invest in innovation districts.
    - Plan for adequate, accessible physical space that promotes network effects, good design, outdoor space, and walkability.
    - Emphasize good curation and programming.
    - Work with local partners to develop and preserve mixed-income housing nearby.
    - Emphasize inclusion: opportunities for K–12 students, jobs, workforce development, inclusive placemaking.
    - Ensure effective governance across district stakeholders.
- Participate in revitalization of traditional downtowns as vibrant live/work/play neighborhoods.
- Engage in underinvested neighborhoods.
    - Support creation of clinics in health care deserts.
    - Support enrichment programs for local K–12 students.
    - Support comprehensive placemaking initiatives.
- Work with partners to promote development of nearby housing, including for staff.
- Build porous campus-town borders and connections.

- Talent:
    - Invest in innovative education-to-career pathways.
        - Dual enrollment programs.
        - Better community college-to-bachelors transfer pathways.
        - More bachelors programs in community colleges.
        - More industry-recognized certifications and other credentials that stack towards or are earned in conjunction with degrees.
        - Better military-to-college pathways.
        - Better pathways for dropped-out students to return to college.
        - More streamlined upskilling pathways within specific fields (e.g. nursing).
        - Better pathways to help skilled immigrants use their skills in America.
    - Develop high-quality, employer-responsive career and technical education (CTE) programs.
    - Build more capacity for programs in high-demand fields.
    - Restructure programs to allow more time and space flexibility.
    - Develop innovative formats: online programs, degree programs with shorter timelines, apprenticeships embedded in CTE programs.
    - Provide intensive advising and holistic student support to at-risk students.
    - Create more brain-healthy physical spaces.
    - Reduce operating costs and net prices.
        - Cut administrative bloat.
        - Shrink campuses and aim for more intense land use, in many cases.

Appendix 1
SOURCES AND METHODS

Section II: Eds and Meds Institutions Today

General benefits

Metrics:

- **Median household income:** We draw median household income from the U.S. Census Bureau's American Community Survey (ACS) 2010 five-year estimates and 2020 five-year estimates.

- **Upward mobility:** Data come from the Opportunity Insights dataset compiled by Harvard University economist Raj Chetty and colleagues. Data for each metro area represents adult income earned by people who grew up in that metro independent of where they live in adulthood. We use the default setting of Opportunity Insights data: income of people who grew up in families earning at the 25th percentile of the national income distribution (25% of the way up from the bottom), all races. The Opportunity Insights team shared aggregated metro-area level data with the author.

- **Social capital:** The U.S. Congress Joint Economic Committee (JEC) Republican staff published composite social capital scores for most U.S. counties (as well as all states) in 2019, based on a wide variety of metrics relating to social trust, interconnectedness, civic engagement, and family life. The JEC staff shared aggregated metro-area-level data with the author.

- **BushEds, BushMeds, and community college outcome scores:** See description of how we've calculated BushEds and BushMeds scores under "Section V: Innovation" below. Our BushEds scores for each metro represent add-ups of our "innovation impact" scores for each university or research institution included in our dataset that's located in that metro. Our method for compiling innovation impact scores replicates and updates the method we used in our 2020 report "The Innovation Impact of U.S. Universities," which we wrote with collaborators from Opus Faveo Innovation Development and SMU. We use our 2020 rather than 2023 scores wherever BushEds or BushEds per capita scores appear as an explanatory variable in this report, since university characteristics for 2013-2017 are intuitively more likely to influence subsequent metro-area economic performance than university characteristics for 2016-2020.

- **University age:** For each metro we calculate "university age" based on the founding date of the university located in that metro that ranks highest on our measure of overall innovation impact. We make one exception: We use Harvard University (founded 1636) instead of MIT (founded 1861) for the Boston metro, reflecting Harvard's stature. Moreover, Harvard and affiliated medical centers would rank ahead of MIT for overall innovation impact if they reported consolidated data to the Association of University Technology Managers rather than reporting separately. Founding dates come from university websites.

Innovation

Metrics:

- **Metro-area innovation rank:** We generate a composite ranking of America's 122 most innovative metros by combining five rankings from external media and research organizations:

  - 2ThinkNow "Innovation Cities Index" 2021
  - Inc. "Most Innovative Cities in America" index, 2014
  - Qad "What Are America's Most Inventive Cities?" 2020
  - 24/7WallSt "America's Most Innovative Cities" 2018
  - Forbes' "America's Most Innovative Cities" 2010

  Each of these organizations base their rankings on composite scores incorporating various quantitative indicators related to patents and innovative companies. The first three primarily use aggregate measures of innovation, which means it helps a metro area to be large, while the last two primarily rely on per capita measures.

  We combine the five rankings as follows: We start with all metros that appear on all five lists, compute each metro's average rank across the five rankings, assign the top rank in our composite list to the metro with the best average rank, and rank the remaining metros that make all five lists accordingly. Then we take up all metros that appear on four of the five lists, calculate each of these metros' average rank, and add these to our composite ranking accordingly. Then we add metros that appear on three lists, then metros that appear on two lists, and finally metros that appear on just one list.

- **Private sector R&D investment:** We draw data on private-sector R&D investment as a share of local GDP from the National Center for Science and Engineering Statistics 2018 data.[421]

- **Venture capital investment:** Venture capital investment per resident comes from 2021 Pitchbook data, as reported by Bloomberg City Lab.

- **Life science jobs:** Data on total life science jobs per metro area come from CBRE's "2023 U.S. Life Sciences Outlook."

- **Shares of employment in the information sector and the professional, scientific, and management sector:** Sector employment shares at the metro area come from the ACS, 2020 five-year estimates.

Talent

Metrics:

- **Educational attainment levels:** We draw data for the share of residents age 25 or older with a bachelor's degree or higher for each metro from the ACS 2010 and 2020 five-year estimates.

- **Filling in-demand occupations:** We draw data on the number of people working full-time or part-time in specific occupations in each metro from the U.S. Bureau of Labor Statistics' (BLS) "Employment by Detailed Occupation" reports, 2021 data. We use data on seven detailed occupations: (1) information security analysts, (2) computer network support specialists, (3) secondary school teachers, (4) registered nurses, (5) electricians, (6) heating, air conditioning, and refrigeration mechanics and installers, and (7) welding, soldering, and brazing workers. We make the simplifying assumption that a metro is more successful than others in filling these in-demand occupations if it has a relatively large number of people in the occupation as a share of population. We base this assumption on the premises that (1) all metros have roughly similar demand per capita for people doing these jobs, and (2) cities throughout the United States face widely reported shortages in each of these areas,[422] meaning we implicitly rule out the possibility that a metro area is oversupplied with professionals in these occupations.

- **Community college outcomes:** See discussion of how we've calculated composite community college outcome scores for each metro area under "Section IV: Talent" below.

Calculations on spillovers of greater eds and meds institution presence to local residents: Based on our regression analysis, a sustained 10% increase in state higher education spending would predict a 0.69 percentage point increase in metro-area population share with a bachelor's degree or higher – more than twice the 0.32 percentage point increase estimated in the Brookings Institution report we cite on p. 24. This increase in turn predicts an increase of $1,093 in annual median household income, or 1.6% – more than three times larger than the 0.5% increase estimated in the Brookings report.

The Brookings analysis differs from ours in that it estimates effects via a bottom-up add-up of specific effects. The two effects the report estimates quantitatively are (1) increased economic activity associated with a larger higher education sector that "exports" more of its services to students from elsewhere, grossed up by a multiplier effect, and (2) increased bachelor's degree attainment of local residents. Our top-down approach based on marginal effects from regression analyses captures at least two channels that Brookings' approach doesn't capture: (1) R&D / innovation spillovers to the domestic economy (which Brookings notes but doesn't quantify in its report), and (2) increased population share with a bachelor's degree or higher due to highly educated people who move from elsewhere because of greater economic opportunity induced by a larger higher education sector. We acknowledge that if all metros raised their higher education spending simultaneously, individual metros would not realize this "market share" effect. We conclude that out quantitative analysis largely agrees with the analysis in the Brookings report.

Section IV: Innovation

University and research institution innovation impact

Metrics:

- **Patents issued per year:** Association of University Technology Managers (AUTM) dataset, data for 2016, 2017, 2018, 2019, and 2020.

- **Intellectual property (IP) licenses signed per year:** AUTM dataset, data for 2016-2020.

- **IP license income earned per year:** AUTM dataset, data for 2016-2020.

- **Spinout companies formed around university IP per year:** AUTM dataset, data for 2016-2020.

- **IP licenses signed with spinout companies per year:** AUTM dataset, data for 2016-2020.

- **Citations of papers by university researchers in other academic papers over the period:** We rely on citation counts estimated by Google Scholar from 2016 through 2020. Specifically, we enter the official name of the university in quotation marks into the Google Scholar search box and set the date range. Google then gives an estimated citation count. In a small number of cases, we had to make minor adjustments to the university title to capture how the university refers to itself in academic literature and patents. Note that Google Scholar doesn't permit us to restrict our count to papers in STEM fields. In practice, however, STEM papers constitute a large majority of papers identified by our method.

- **Citations of papers by university researchers in issued patents over the period:** We follow the same method as for paper citations, but using Google Patents instead of Google Scholar. Specifically, we enter the official name of the university in quotation marks into the Google Patents search box, set the date range, and include all patent offices covered by Google's search system. Again, we had to make minor adjustments to the university title to capture how the university refers to itself in academic literature and patents.

- **Number of bachelor's and master's degree graduates in STEM fields over the period:** U.S. Department of Education data for graduates by field and degree from each institution, as reported on the NSF's National Center for Science and Engineering Statistics website.

- **Number of Ph.D. graduates in STEM fields over the period:** U.S. Department of Education data for graduates by field and degree from each institution, as reported on the NSF's National Center for Science and Engineering Statistics website.

- **Research spending:** AUTM dataset, data for 2016-2020.

- **Share of research spending funded by industry:** Research spending funded by industry, based on the AUTM dataset, 2016-2020, divided by total research spending.

- **Faculty quality:** Number of members of the National Academies of Sciences, Engineering, Medicine, and Inventors, based on data on the National Academies website.

- **TTO staff:** AUTM dataset, data for 2016-2020.

- **Patenting budget:** AUTM dataset, data for 2016-2020.

- **Entrepreneurship program:** Binary variable. We determined whether institutions have entrepreneurship teaching programs based on thorough searches of each institution's website.

- **Public vs. private:** Determined by search of each institution's website.

Inclusion rules: We include institutions in our innovation impact rankings if and only if the AUTM dataset contains data for them covering at least two of the years 2016, 2017, 2018, 2019, and 2020 for all five AUTM output variables (patents issued, licenses signed, license income received, spinouts formed, and licenses to spinouts) and for total research spending. We construct our scores using up to five years of data for each institution to smooth out fluctuations in the data, since the performance of universities on individual output metrics is sometimes lumpy.

Calculation of composite scores:

- **Standardized scores for each metric:** We standardize scores by dividing each university's raw figure on each of our nine innovation output variables by the standard deviation of the distribution of outcomes for that variable.

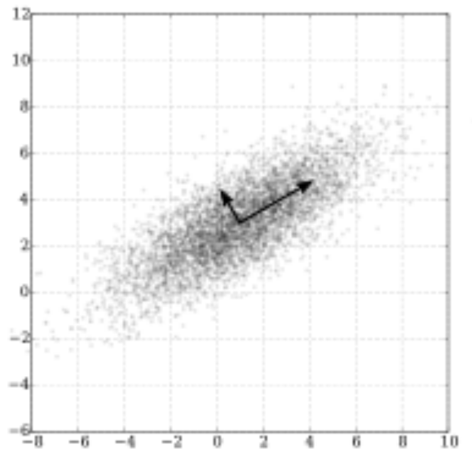
- **PCA to aggregate:** We aggregate our nine standardized variables into a composite score using principal component analysis (PCA). PCA, a method widely used in academic studies in economics and statistics, involves transforming a dataset of multiple *correlated* variables into a set of linearly *uncorrelated* variables ("principal components"). PCA transforms the data in such a way that one transformed variable, the first principal component, captures in one dimension as much of the variation in the data as possible; the second transformed variable captures as much of the remaining variation as possible, after controlling for variation in the first principal component, and so on.[*]

  Figure 8 illustrates graphically how PCA works, using a two-variable dataset that's easy to visualize. The PCA method fits the longer, upward-sloping line through the scatterplot of points such that variation along this line accounts for as much as possible of the variation in the data. The shorter, downward-sloping line then accounts for all remaining variation in the data after controlling for variation along the first line. Likewise, PCA needs nine transformed variables to capture all the variation across universities in our nine-variable dataset. But in some cases, as with our data, variation in the first principal component accounts for most of the underlying variation.

[*] For a detailed explanation of the method, see the 1901 paper in which PCA's inventor Karl Pearson first describes it ("On Lines and Planes of Closest Fit to Systems of Points in Space," *Philosophical Magazine*, Vol. 2, No. 11 [1901]: 559-72) and a variety of more recent "textbook" explanations, such as I. T. Jolliffe, *Principal Component Analysis*, 2nd ed. (New York: Springer, 2002), xxix, 487.

Figure 8

Graphical Illustration of Principal Component Analysis (PCA)*



The benefits of combining our nine output variables using PCA, relative to combining them through a simple unweighted average or a weighted average using arbitrarily selected weighing factors, are, first, that the first principal component necessarily captures more of the variation across universities in the nine-variable dataset than a weighted average with other weighting factors would, and, second, that PCA essentially allows the data to tell us what the implicit weighing factor on each of the nine variables should be.

Suppose we start from the premise that each of our nine impact variables is correlated with an unobservable variable that intrinsically sums up the innovation impact of each institution. If eight of our observable variables are highly correlated with one another but the ninth has a relatively low correlation with each of the other eight, PCA will implicitly assign a lower weight to the ninth factor than to the other eight in generating the first principal component. In effect, the method assumes the ninth variable is a weaker approximation than the others of the unobservable "innovation impact" variable. We use PCA to compute our innovation impact scores but unweighted averages elsewhere in this report—for instance, for our composite community college outcome scores—because in this instance, we believe it makes sense to think of an unobserved "innovation impact" variable that is imperfectly proxied by each of our nine output variables. In the case of our innovation impact scores, we have no prior hypothesis as to which output variables proxy this unobserved variables better than others. By contrast, we think of each of our community college outcome measures as the actual quantities we aim to capture rather than proxies for an unobserved variable.

To calculate the composite score for each university, we take the first principal component of the nine-variable dataset consisting of our transformed innovation output variables, which accounts for approximately 64% of the variation in the dataset. Using Stata, we arrive at loadings (weighting factors) for our nine variables as follows:

* The graph, from the Wikipedia entry for PCA, shows the PCA of a two-variable Gaussian distribution centered at (1,3) with a standard deviation of 3 in roughly the (0.866, 0.5) direction and of 1 in the orthogonal direction. The diagonal vectors depicted in the figure are the eigenvectors of the covariance matrix scaled by the square root of the corresponding eigenvalue, and shifted so their tails are at the mean.

- Issued patents: 0.1495
- Licenses signed: 0.1118
- License income: 0.0666
- Spinouts formed: 0.1602
- Licenses to spinouts: 0.1515
- Paper citations: 0.1053
- Patent citations: 0.0302
- STEM Bach/Master's: 0.1087
- STEM Ph.D.s/MDs: 0.1162

We compute a weighted average standardized score for each institution using these loadings.

- **Recalibrate scores to a zero to 100 range:** We recalibrate the PCA-based weighted average score for each institution to a zero to 100 range to make the numbers more intuitive. We set the first-ranked institution for innovation impact, the University of California System, at 100. We generate recalibrated scores for each university by multiplying each weighted-average score by 12.367.

Change over time: We estimate change in innovation impact from our 2013–2017 scores to our new 2016-2020 scores by estimating the change in overall innovation impact of the University of California System, then looking at how each institution's overall innovation impact scores have changed relative to those of the UC System. We estimate the change for the University of California System by calculating the ratio of the UC System's score for each output variable for 2016–2020 to its score for that variable for 2013-2017, then calculating the weighted average of the nine ratios using our 2016-2020 PCA loadings as weighting factors. This means we implicitly ignore the PCA loadings from our 2016-2020 dataset, which were of course slightly different. We estimate the real, inflation-adjusted change in the UC System's license income by adjusting the nominal change for changes in the U.S. headline CPI index from 2015 to 2018. By this method, the UC System's overall innovation impact grew approximately 43%.

Innovation impact productivity scores: We calculate innovation impact productivity scores by dividing the overall innovation impact score for each institution by that institution's total research spending, then multiplying by 10^8 to arrive at scores with more intuitive scale.

Correlation across nine productivity scores: For each institution, we calculate productivity in turning research resources into each of our nine innovation impact outputs, measured as raw output on each output metric divided by total research spending. The following table shows all pairwise correlations among these productivity scores:

Table 16
Correlations Across Single-Variable Productivity Scores

	Issued U.S. Patents	Licenses Signed	Gross License Income	Startups Formed	Licenses to Startups	Paper Citations	Patent Citations	STEM Bachelor's and Master's	STEM Doctoral Degrees
Issued U.S. Patents	1								
Licenses Signed	0.63	1							
Gross License Income	0.08	0.21	1						
Startups Formed	0.79	0.78	0.06	1					
Licenses to Startups	0.77	0.78	0.07	0.93	1				
Paper Citations	0.18	0.08	0.06	0.17	0.13	1			
Patent Citations	-0.04	-0.03	0.26	-0.03	-0.03	0.06	1		
STEM Bachelor's and Master's	0.38	0.21	-0.10	0.37	0.39	0.17	-0.04	1	
STEM Doctoral Degrees	0.29	0.12	-0.10	0.24	0.23	0.10	-0.06	0.31	1

Metro-area BushEds scores

Calculating total scores at the metro-area level: We calculate BushEds innovation impact scores for each metro area by adding the overall innovation impact scores for each institution located in that metro. Summing scores across institutions makes sense because our recalibrated innovation impact scores preserve scale relationships across institutions. If institution 1 has twice as much output on each output score as institution 2, then institution 1's innovation impact score will be twice as high as that of institution 2. (See proof at the end of Appendix 1.)

University systems: Seven statewide systems report data to AUTM at the system rather than individual campus level, which means their innovation impact-producing work takes place in more than one metro area. We apportion the innovation scores for these systems – the University of California, University of Texas, University of Maryland, University of Colorado, University of Massachusetts, and State University of New York systems plus that part of the University of Wisconsin System not accounted for by its Madison and Milwaukee campuses – across metros according to each campus's research spending, which is publicly available for each system.

College towns: We define "college towns" for purposes of this report as metro areas where college or graduate students constitute 42% or more of all students of any age. We select this cutoff point somewhat arbitrarily because it does a good job of generating a list of metros that are commonly thought of as college towns without leaving out many such metros. By this method, 30 metro areas qualify as college towns. None of these is large enough to make the list of America's 100 largest metros.

BushEds per capita scores: We divide overall BushEds innovation impact scores for each metro by metro-area population.

Metro-area BushMeds scores

Metrics:

- **Scale variables: Hospital beds.** American Hospital Association dataset, 2018.
- **Scale variables: Patient discharges.** American Hospital Association dataset, 2018.
- **Scale variables: Annual budget.** American Hospital Association dataset, 2018.
- **Quality adjustments:** *U.S. News & World Report* hospital rankings for 16 medical specialties, 2018.

Calculating quality-adjusted scale scores at the individual hospital level: We calculate quality-adjusted scale scores for every hospital in the American Hospital Association's dataset for 2014-2018 (provided by AHA to the author) by standardizing three raw measures of hospital scale to z-scores, computing unadjusted composite scale scores for each hospital, and quality-adjusting our composite scale measure using 2018 *U.S. News & World Report* rankings across 16 specialties. The AHA dataset covers more than 4,000 U.S. hospitals.

Our premises are (1) that the scale of a metro area's hospital portfolio probably matters from an economic point of view, and (2) that "quality" likely matters as well. As we note in the text of this report, the Rochester-based **Mayo Clinic** – often ranked as America's top medical center – illustrates why it makes sense to quality-adjust a hospital's scale when evaluating its economic impact. Mayo has at least three times more economic impact per bed or procedure than other Minnesota hospitals.[423]

Specifically, we compute annual averages over 2014–2018 for three measures of hospital scale – total beds, total patient discharges, and total expenses – for every hospital in the dataset which has data for at least two of the years 2014, 2015, 2016, 2017, and 2018 for each of our three scale variables. We convert annual averages on each scale metric to z-scores, then compute unadjusted composite scale scores for each hospital as the unweighted average of our three z-scores. We recalibrate unadjusted composite scores to a zero to 100 range, with the largest hospital in the dataset getting a score of 100, to ensure all hospitals have scores above zero. We construct quality-adjusted measures for each hospital by adjusting its unadjusted composite scale measure by a factor between 1 and 3.05, where the *U.S. News* top-ranked Mayo Clinic gets a factor of 3.05 and all other institutions get a factor scaled between 1 and 3.05 based on *U.S. News* 2018 rankings. *U.S. News* provides 17 rankings (16 rankings for medical specialties and one overall, with 50 or fewer hospitals in each of the 17 rankings). For each ranking we subtract a hospital's rank from 51 or assign a score of zero for each ranking in which it does not appear, then sum these 17 numbers, for a maximum possible score of (17)x(50) = 850. The maximum adjustment factor of 3.05 reflects an analysis of the economic impact of the Mayo Clinic vs. that of unranked Minnesota hospitals (calculation based on several economic impact metrics and available on request).

Metro-area BushMeds scores: We calculate overall BushMeds scores for metro areas as the sum of the quality-adjusted scale scores for all hospitals in each metro. We recalibrate metro-area BushMeds scores so that the top-ranking metro (New York) has a score of 100.

Metro-area BushMeds per capita scores: We divide overall BushMeds innovation impact scores for each metro by metro-area population.

Section V: Place

Innovation district dataset

Defining innovation district neighborhoods: We define "core" innovation district neighborhoods as the U.S. Census tract(s) where the 36 innovation districts in our dataset are located. We define "extended" innovation district neighborhoods as Census tracts in core neighborhoods plus all Census tracts adjacent to these Census tracts. In practice, core neighborhoods generally consist of one or at most two Census tracts, while extended neighborhoods generally consist of approximately five to 20 Census tracts.

All data we show in this report is for "extended innovation district neighborhoods," our preferred measure of demographic and economic conditions surrounding eds and meds institutions and associated innovation districts. We prefer to focus on extended neighborhoods because the residents of core Census tracts in some cases consist primarily of college students, who are not representative of larger neighborhood realities on any metric. Focusing on extended neighborhoods dilutes the effect of student data considerably. We include all data for core as well as extended neighborhoods in the online Data Appendix to this report.

Metrics:

- **Population growth, educational attainment, creative sector employment, incomes, and commuting times:** ACS, 2020 five-year estimates and 2010, five-year estimates.

- **Housing and racial composition:** ACS, 2020 five-year estimates and 2010, five-year estimates.

- **Innovation district age:** We determine to the best of our ability the year in which each innovation district or its management entity was officially established, based on innovation district websites.

- **Innovation district size:** We assign districts into four size groups based on a variety of variables, drawn mostly from innovation district websites: physical size of the district, number of companies operating there, number of people working there, and others. Our assignments are inescapably somewhat subjective, since there is no obvious basis for determining how to weight different scale metrics, and we've been unable to determine values of some scale metrics for certain districts.

- **Metro-area housing policy:** In the absence of geographically comprehensive data on housing and land-use policies in core cities as well as suburban municipalities in each metro area, we assign the 32 metros where our 36 innovation districts are located into four groups according to composite scores based on three housing outcome metrics that are each closely associated with policy environments: the number of new housing permits, 2015-2019; absolute scores for housing underproduction as of 2019 from the think tank Up for Growth's 2022 report on housing underproduction in the United States; and changes in the extent of housing underproduction from 2012 to 2019, based on the Up for Growth report. We calculate composite scores as the unweighted average of each metro's performance on the three metrics, standardized to z-scores.

- **Innovation district location in metro area:** We assign districts into four location groups – large metro-area downtowns, large metro-area core city peripheral locations, large metro-area suburban locations, and smaller metros – somewhat subjectively, based on metro-area maps, personal experience, and conversations with innovation district leaders and experts. The author thanks Julie Wagner of the Global Institute on Innovation Districts for the insight that metro-area location likely has significant effects on outcomes, which turns out to be true.

- **Innovation district office rents:** We identify one significant office/lab property within each district (not possible in a few cases) and draw current asking rents from CoStar data.

Assessing how variation in district age, size, and location and metro-area size and housing policy influence innovation district outcomes: We break the 36 innovation districts in our dataset into four size groups, four age groups, and four metro-area location groups, and we break the 32 metros in which our 36 districts are located into three size groups (which makes for a cleaner division that any four we could devise) and four housing policy groups. For each outcome metric of interest, we compare unweighted average scores for that metric across each group of districts or metros. All data, including group assignments, is available in the online Data Appendix.

Calculating innovation district neighborhood scores:

For prosperity and opportunity composite scores, we standardize innovation district neighborhood performance on 16 metrics to z-scores and compute unweighted averages of each neighborhood's 16 z-scores. These are the 16 metrics we include:

- Population growth relative to the neighborhood's own MSA, 2010-2020; calculated as [1 + 2010-2020 growth rate] / [1 + own MSA's overall 2010-2020 growth rate] (ACS data, 2010 five-year estimates and 2020 five-year estimates).
- Population growth relative to the growth rate of metropolitan America as a whole, 2010–2020; calculated as [1 + 2010-2020 growth rate] / [1 + overall 2010-2020 growth rate for metro America as a whole] (ACS, 2020 five-year estimates).
- Population share of people age 25 and older in the neighborhood with an associate degree or some college as a share of population 25 and older without a bachelor's degree, relative to own MSA, 2020 (ACS, 2020 five-year estimates).
- Population share of people age 25 and older with a bachelor's degree or higher, relative to own MSA, 2020 (ACS, 2020 five-year estimates).
- Increase in population share with a bachelor's degree or higher, relative to own MSA, 2010–2020; defined as [1+ 2020 population share with bachelor's degree or higher for neighborhood – 2010 population share with bachelor's degree or higher for neighborhood] / [1 + 2020 population share with a bachelor's degree or higher for own MSA as a whole – 2010 population share with a bachelor's degree or higher for own MSA as a whole] (ACS, 2020 five-year estimates, 2010 five-year estimates, and 2020 five-year estimates).
- Population share of people age 25 and older with an associate degree or some college as a share of population 25 and older without a bachelor's degree, relative to metropolitan American as a whole, 2020 (ACS, 2020 five-year estimates).
- Population share of people age 25 and older with a bachelor's degree or higher, relative to metropolitan American as a whole, 2020 (ACS, 2020 five-year estimates).
- Increase in neighborhood population share with a bachelor's degree or higher, relative to metropolitan American as a whole 2010–2020; defined as [1+ 2020 population share with bachelor's degree or higher for neighborhood – 2010 population share with bachelor's degree or higher for neighborhood] / [1 + 2020 population share with a bachelor's degree or higher for

metro America as a whole – 2010 population share with a bachelor's degree or higher for metro America as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).

- Total share of neighborhood working population who work in one of five "creative" sectors, following the methods of urbanist Richard Florida, relative to own MSA, 2020 (ACS, 2020 five-year estimates; five sectors are information; professional, scientific, and management; education and health; finance; and arts and recreation).
- Total share of working population who work in one of the five "creative" sectors, relative to metropolitan American as a whole, 2020 (ACS, 2020 five-year estimates).
- Growth in neighborhood median household income, relative to own MSA, 2010–2020; defined as [1+ growth rate in median household income for neighborhood] / [1 + growth rate in median household income for own MSA as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Growth in median household income, relative to metropolitan America as a whole, 2010–2020; defined as [1+ growth rate in median household income for neighborhood] / [1 + growth rate in median household income for metro America as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Average commuting time, relative to own MSA, 2020 (ACS, 2020 five-year estimates).
- Average commuting time, relative to metropolitan America as a whole, 2020 (ACS, 2020 five-year estimates).
- Change in average commuting time, relative to own MSA, 2010–2020; defined as [1 + (2020 neighborhood average commuting time less 2010 neighborhood average commuting time) / 2010 neighborhood average commuting time] / [1 + (2020 average commuting time for own MSA less 2010 average commuting time for own MSA) / 2010 average commuting time for own MSA] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Change in average commuting time, metropolitan America as a whole, 2010-2020; defined as [1 + (2020 neighborhood average commuting time less 2010 neighborhood average commuting time) / 2010 neighborhood average commuting time] / [1 + (2020 average commuting time for metro America less 2010 average commuting time for metro America) / 2010 average commuting time for metro America] (ACS, 2010 five-year estimates and 2020 five-year estimates).

For housing and neighborhood stability composite scores, we standardize innovation district neighborhood performance on 14 metrics to z-scores and compute unweighted averages of each neighborhood's 14 z-scores. These are the 14 metrics we include:

- Increase in total housing units, relative to own MSA, 2010-2020; defined as [1 + 2020-2010 growth rate in neighborhood stock of units] / [1 + growth rate in total stock of units for own MSA as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Share of housing units built since 2010, relative to own MSA, 2020 (ACS, 2020 five-year estimates).
- Share of housing units built since 2000, relative to own MSA, 2020 (ACS, 2020 five-year estimates).
- Increase in median rent, relative to own MSA, 2010-2020; defined as [1 + growth rate in neighborhood median rent paid by renters] / [1 + growth rate in median rent paid by renters for own MSA as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Increase in total housing units, relative to own county, 2010-2020; defined as [1 + 2020-2010 growth rate in neighborhood stock of units] / [1 + growth rate in total stock of units for own county as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).

- Share of housing units built since 2010, relative to own county, 2020 (ACS, 2020 five-year estimates).
- Share of housing units built since 2000, relative to own county, 2020 (ACS, 2020 five-year estimates).
- Increase in median rent, relative to own county, 2010-2020; defined as [1 + growth rate in neighborhood median rent paid by renters] / [1 + growth rate in median rent paid by renters for own county as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Increase in total housing units, relative to metropolitan America as a whole, 2010-2020; defined as [1 + 2020-2010 growth rate in neighborhood stock of units] / [1 + growth rate in total stock of units for metro America as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Share of housing units built since 2010, relative to metropolitan America as a whole, 2020 (ACS, 2020 five-year estimates).
- Share of housing units built since 2000, relative to metropolitan America as a whole, 2020 (ACS, 2020 five-year estimates).
- Increase in median rent, relative to metropolitan America as a whole, 2010-2020; defined as [1 + growth rate in neighborhood median rent paid by renters] / [1 + growth rate in median rent paid by renters for metro America as a whole] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Change in combined Black + Hispanic population share, relative to own MSA, 2010-2020; defined as [1 + (2020 neighborhood Black population share + 2020 neighborhood Hispanic population share – 2010 neighborhood Black population share – 2010 neighborhood Hispanic population share)] / [1+ (2020 Black population share for own MSA + 2020 Hispanic population share for own MSA – 2010 Black population share for own MSA – 2010 Hispanic population share)] (ACS, 2010 five-year estimates and 2020 five-year estimates).
- Change in combined Black + Hispanic population share, relative to metropolitan America as a whole, 2010–2020; defined as [1 + (2020 neighborhood Black population share + 2020 neighborhood Hispanic population share – 2010 neighborhood Black population share – 2010 neighborhood Hispanic population share)] / [1+ (2020 Black population share for metro America + 2020 Hispanic population share for metro America – 2010 Black population share for metro America – 2010 Hispanic population share for metro America)] (ACS, 2010 five-year estimates and 2020 five-year estimates).

We include measures of housing stock growth and rent increases relative to own counties as well as own MSAs because many people likely make choices about where to live *within* counties, so performance of innovation district neighborhoods relative to nearby neighborhoods in the same county is highly relevant as an indicator of neighborhood placemaking success in our view.

Section VI: Talent

Community college outcomes

Metrics:

- **Total enrollment in all community and technical colleges in the metro area as a share of population:** Enrollment figures for each metro area are a bottom-up add-up of total enrollment in each community or technical college in the metro, based on 2021 data from the U.S. Department of Education's IPEDS dataset.

- **Retention: Total returning students as a share of population.** Retention rates come from the IPEDS dataset, 2021.

- **Graduation: Total number of students graduating with an associate degree or certificate within 150% of normal time as a share of population.** IPEDS dataset, 2021.

- **Transfer: Total number of students enrolling in another postsecondary institution within eight years of completing a community college program as a share of population.** IPEDS dataset, 2021.

- **Median income of graduates 10 years after graduation:** IPEDS dataset, 2021.

- **Median income of graduates 10 years after graduation as share of metro-area median income:** Graduate data from IPEDS dataset, 2021; metro-area median household incomes come from the ACS, 2020 five-year estimates.

- **Residents ages 18–24 who've completed an associate degree, certificate, or some college as a share of all residents aged 18–24 who haven't completed a bachelor's degree or higher:** Author's calculations based on ACS educational attainment data, 2020 five-year estimates.

- **Residents ages 25 and over who've completed an associate degree as a share of all residents aged 25 and over who haven't completed a bachelor's degree or higher:** Author's calculations based on ACS educational attainment data, 2020 five-year estimates.

- **State spending on higher education and hospitals:** U.S. Census Bureau Annual Survey of State and Local Government Finances, 1977-2000.[424]

- **Average commuting time and change in average commuting time:** ACS, 2010 and 2020 five-year estimates.

- **Race:** ACS, 2020 five-year estimates. We use the Census category "White, not Hispanic" as the definition of "White" for purposes of this report's analysis, so that the two categories "White" and "Hispanic" don't overlap.

Calculation of composite scores: For each metro area, we aggregate data for all community and technical colleges located in the metro, computing sums or weighted averages depending on the metric, then calculate z-scores—the metro's score minus the mean score for America's 100 largest metros, divided by the standard deviation of the distribution across the 100 largest metros—for each metric. We calculate composite scores as the unweighted mean of the eight z-scores.

Filling in-demand occupations

Metrics:

- **Number of workers by occupation and metro area:** We divide the number of workers in each of our seven BLS occupational categories (see discussion of sources and methods for Section II above) by total metro-area population for purposes of the analysis in this section. We use total population as the denominator rather than total working population since metros vary in their ratios of working to total population but the demand for each occupation's services is probably about the same on a per capita basis across metros. We make the simplifying assumption that a metro is more successful than others in filling these in-demand occupations if it has a relatively large number of people in the occupation as a share of population. We base this assumption on the premises that (1) all metros have roughly similar demand per capita for people doing these jobs, and (2) cities throughout the United States face widely reported shortages in each of these areas,[425] meaning we implicitly rule out the possibility that a metro area is oversupplied with professionals in these occupations.

- **Community college graduates by field:** We include the following groups of fields as defined in the National Center for Education Statistics IPEDS dataset: information technology and computers, education, engineering, engineering-related technician programs, biology and biomedical, science technician programs, construction trades, mechanical and repair programs, precision manufacturing, health and nursing, and business. We calculate the sum of 2021 associate degree graduates from all the community and technical colleges in each metro for each field (based on IPEDS data). We divide metro-area associate degree graduates in each field by total metro-area population for purposes of the analysis in this section.

Calculation of composite scores: To arrive at composite scores for filling in-demand occupations at the metro-area level, we convert each metro's number of workers in each of our seven occupations to a z-score, then calculate the unweighted mean of the seven occupation-specific z-scores for each metro.

**

We estimate all regression models that we discuss in this report by ordinary least squares. We report all regression results in the online Data Appendix to this report.

**

An institution with twice the output of another institution on each of our nine innovation impact output metrics will have an innovation impact score twice as high under our method (Proof):

To simplify, consider a case with two institutions—I and II—and three output metrics: 1, 2, and 3.

Let x_i^j be institutions i's score on output metric j, and let Y_i be institution i's overall innovation impact score.

Let A be a recalibration parameter for converting average z-scores to a zero to 100 scale, such that institution i's recalibrated innovation impact score is given by

$$Y_i = A * [\text{average standardized score for institution i}]$$

Let σ^j be the standard deviation of the distribution of scores on metric j, x_i^j, across institutions.

Assume institution I has twice the output of institution II on each output metric 1, 2, and 3. Then:

$x_I^1 = 2 * x_{II}^1$
$x_I^2 = 2 * x_{II}^2$
$x_I^3 = 2 * x_{II}^3$

Institution I's innovation impact score is given by:

$$Y_I = A * \left[\frac{1}{3} * \left(\frac{x_I^1}{\sigma^1} + \frac{x_I^2}{\sigma^2} + \frac{x_I^3}{\sigma^3}\right)\right]$$

$$Y_I = A * \left[\frac{1}{3} * \left(\frac{2x_{II}^1}{\sigma^1} + \frac{2x_{II}^2}{\sigma^2} + \frac{2x_{II}^3}{\sigma^3}\right)\right]$$

$$Y_I = 2 * \frac{A}{3}\left[\left(\frac{x_{II}^1}{\sigma^1} + \frac{x_{II}^2}{\sigma^2} + \frac{x_{II}^3}{\sigma^3}\right)\right]$$

$$Y_I = 2 * A * \left[\frac{1}{3}\left(\frac{x_{II}^1}{\sigma^1} + \frac{x_{II}^2}{\sigma^2} + \frac{x_{II}^3}{\sigma^3}\right)\right]$$

$$Y_I = 2 * Y_{II}$$

Appendix 2

DETAILED TABLES

Table A

Innovation Impact of U.S. Eds And Meds Institutions

	Institution	Innovation Impact	Research Spending ($m)	Innovation Impact Productivity
1	University of California System	100.0	$ 5,611	1.78
2	University of Texas System	57.6	$ 3,010	1.91
3	Massachusetts Institute of Technology	32.9	$ 1,782	1.84
4	University of Michigan	27.6	$ 1,546	1.78
5	University of Washington	27.2	$ 1,300	2.09
6	Harvard University	25.1	$ 882	2.85
7	University of Pennsylvania	24.9	$ 986	2.53
8	University of Minnesota	24.8	$ 997	2.49
9	University of Florida	22.9	$ 668	3.43
10	University of Massachusetts System	21.8	$ 685	3.18
11	Stanford University	21.6	$ 1,388	1.55
12	Purdue University	20.8	$ 659	3.16
13	Arizona State University	20.3	$ 599	3.39
14	Johns Hopkins University	19.9	$ 1,778	1.12
15	University System of Maryland	19.3	$ 1,112	1.73
16	Northwestern University	19.2	$ 601	3.21
17	University of Illinois Urbana-Champaign	19.2	$ 1,035	1.86
18	California Institute of Technology	18.5	$ 389	4.75
19	Massachusetts General Brigham	18.2	$ 941	1.94
20	University of Pittsburgh	17.9	$ 811	2.21
21	Cornell University	17.3	$ 1,011	1.71
22	Duke University	16.9	$ 1,003	1.68
23	New York University	16.5	$ 674	2.46
24	University of Wisconsin-Madison	16.5	$ 1,331	1.24
25	North Carolina State University	16.3	$ 517	3.15
26	Ohio State University	15.3	$ 897	1.71
27	State University of New York	14.3	$ 978	1.46
28	University of Colorado System	14.2	$ 761	1.86
29	Carnegie Mellon University	14.2	$ 266	5.34
30	University of Arizona	14.1	$ 682	2.07
31	Texas A&M University System	14.0	$ 963	1.46
32	University of Southern California	13.5	$ 842	1.60
33	University of New Mexico	13.0	$ 244	5.33
34	Princeton University	12.9	$ 293	4.40
35	Mayo Clinic	12.3	$ 821	1.49
36	University of South Florida	12.2	$ 558	2.19
37	University of Chicago	12.2	$ 355	3.43
38	University of North Carolina Chapel Hill	11.5	$ 841	1.37
39	Rutgers The State University of New Jersey	11.5	$ 661	1.74
40	Louisiana State University System	10.9	$ 352	3.10
41	University of Utah	10.7	$ 535	2.01
42	Brigham Young University	10.5	$ 35	30.36
43	Case Western Reserve University	10.1	$ 334	3.04
44	University of Missouri System	10.1	$ 357	2.84
45	Penn State University	9.6	$ 920	1.05
46	University of Virginia	9.4	$ 537	1.74
47	University of Georgia	9.0	$ 458	1.95
48	Michigan State University	8.9	$ 692	1.29
49	Vanderbilt University	8.6	$ 728	1.18
50	Georgia Institution of Technology	8.4	$ 858	0.98
			$ 512	
	Average for All Institutions	**7.7**	**$ 405**	**2.86**

Source: Author’s calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See full summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table A (cont.)

Innovation Impact of U.S. Eds And Meds Institutions

	Institution	Innovation Impact	Research Spending ($m)	Innovation Impact Productivity
51	Indiana University	8.1	$ 512	1.58
52	Washington University of St. Louis	7.9	$ 770	1.03
53	Colorado State University	7.7	$ 370	2.08
54	Memorial Sloan Kettering Cancer Center	7.5	$ 694	1.08
55	University of Iowa	7.5	$ 463	1.61
56	Texas Tech University System	7.2	$ 239	3.03
57	Washington State University	7.2	$ 201	3.60
58	Brigham & Women's Hospital	7.2	$ 678	1.06
59	University of Central Florida	7.1	$ 230	3.07
60	Emory University	7.0	$ 590	1.19
61	Virginia Tech	6.9	$ 539	1.28
62	Iowa State University	6.8	$ 388	1.76
63	Drexel University	6.8	$ 119	5.70
64	Cold Spring Harbor Laboratory	6.3	$ 139	4.55
65	University of Kentucky	6.3	$ 312	2.01
66	University of Nebraska Medical Center	6.1	$ 456	1.34
67	Boston University	6.0	$ 487	1.23
68	University of Houston	5.9	$ 170	3.46
69	Mount Sinai School of Medicine	5.8	$ 535	1.08
70	Virginia Commonwealth University	5.7	$ 252	2.27
71	University of Miami	5.7	$ 346	1.65
72	University of Kansas	5.7	$ 252	2.25
73	Temple University System	5.5	$ 217	2.54
74	University of Connecticut	5.5	$ 222	2.47
75	Dana-Farber Cancer Institute	5.5	$ 314	1.74
76	University of Alabama at Birmingham	5.4	$ 574	0.94
77	Oregon Health & Science University	5.1	$ 387	1.32
78	Oregon State University	5.1	$ 266	1.92
79	University of Rochester	5.1	$ 381	1.33
80	Auburn University	5.1	$ 209	2.44
81	University of Cincinnati	4.8	$ 237	2.03
82	Tufts University	4.8	$ 188	2.55
83	Florida State University	4.8	$ 186	2.56
84	George Washington University	4.7	$ 262	1.80
85	Zucker Inst. for Inno. Commercialization	4.7	$ 264	1.76
86	University of Louisville	4.7	$ 182	2.56
87	Cleveland Clinic	4.5	$ 292	1.56
88	University of Tennessee	4.5	$ 392	1.16
89	Baylor College of Medicine	4.3	$ 458	0.94
90	University of Akron	4.2	$ 37	11.35
91	Wayne State University	4.2	$ 235	1.77
92	Children's Hospital Boston	4.1	$ 359	1.15
93	University of Notre Dame	4.1	$ 220	1.86
94	University of South Carolina	4.1	$ 216	1.90
95	University of Oklahoma	4.1	$ 237	1.73
96	Rice University	4.0	$ 135	2.99
97	University of Arkansas Fayetteville	3.7	$ 147	2.49
98	Clemson University	3.6	$ 149	2.42
99	Worcester Polytechnic Institute	3.6	$ 32	11.22
100	University of Toledo	3.4	$ 52	6.53
			$ 176	
	Average for All Institutions	**7.7**	**$ 405**	**2.86**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See full summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table A (cont.)

Innovation Impact of U.S. Eds And Meds Institutions

	Institution	Innovation Impact	Research Spending ($m)	Innovation Impact Productivity
101	Kansas State University	3.4	$ 208	1.62
102	WiSys Technology Foundation	3.4	$ 18	18.71
103	University of Delaware	3.3	$ 152	2.18
104	Dartmouth College	3.3	$ 189	1.74
105	University of Alabama	3.2	$ 66	4.92
106	Brown University	3.2	$ 189	1.72
107	University of North Carolina Charlotte	3.2	$ 41	7.79
108	Cedars-Sinai Medical Center	3.2	$ 176	1.81
109	Johns Hopkins Univ. Applied Physics Lab.	3.2	$ 1,522	0.21
110	Ohio University	3.1	$ 56	5.61
111	Tulane University	3.0	$ 148	2.05
112	Oklahoma State University	3.0	$ 165	1.81
113	Beth Israel Deaconess Medical Center	2.9	$ 234	1.25
114	Nationwide Childrens Hospital	2.9	$ 179	1.61
115	University of Hawaii	2.9	$ 292	0.98
116	University of Vermont	2.8	$ 132	2.12
117	Georgetown University	2.8	$ 165	1.68
118	Fred Hutchinson Cancer Research Center	2.7	$ 483	0.55
119	University Wisconsin-Milwaukee	2.6	$ 56	4.62
120	Montana State University	2.6	$ 133	1.94
121	Georgia State University	2.6	$ 200	1.28
122	West Virginia University	2.5	$ 103	2.48
123	University of Oregon	2.5	$ 80	3.11
124	University of Arkansas for Medical Sciences	2.4	$ 56	4.35
125	East Carolina University	2.4	$ 40	5.99
126	Mississippi State University	2.4	$ 251	0.96
127	Utah State University	2.4	$ 256	0.93
128	University of Nevada at Reno	2.4	$ 106	2.23
129	Whitehead Institute for Biomedical Research	2.4	$ 44	5.40
130	Augusta University	2.3	$ 94	2.49
131	H. Lee Moffitt Cancer Ctr. & Research Inst.	2.3	$ 185	1.26
132	Children's Hospital Cincinnati	2.3	$ 473	0.48
133	Portland State University	2.2	$ 62	3.61
134	North Dakota State University	2.2	$ 153	1.45
135	University of North Texas Denton	2.2	$ 29	7.66
136	University of Mississippi	2.2	$ 77	2.83
137	Colorado School of Mines	2.2	$ 53	4.08
138	University of South Alabama	2.1	$ 61	3.51
139	South Dakota State University	2.1	$ 62	3.42
140	Northern Arizona University	2.1	$ 52	3.99
141	University of Nevada at Las Vegas	2.0	$ 73	2.75
142	Rochester Institute of Technology	2.0	$ 50	4.04
143	Michigan Technological University	2.0	$ 76	2.60
144	Stevens Institute of Technology	1.9	$ 41	4.56
145	Wistar Institute	1.8	$ 68	2.69
146	Medical College of Wisconsin	1.8	$ 279	0.65
147	Wright State University	1.7	$ 57	3.02
148	New Jersey Institute of Technology	1.7	$ 145	1.18
149	Rowan University	1.6	$ 30	5.53
150	Southern Illinois University	1.5	$ 65	2.37
	Average for All Institutions	**7.7**	**$ 405**	**2.86**

Source: Author’s calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See full summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table A (cont.)

Innovation Impact of U.S. Eds And Meds Institutions

	Institution	Innovation Impact	Research Spending ($m)	Innovation Impact Productivity
151	University of New Hampshire	1.5	$ 124	1.23
152	Univ. of North Texas Health Science Center	1.5	$ 45	3.35
153	Boise State University	1.4	$ 35	4.15
154	Cleveland State University	1.4	$ 81	1.68
155	Brandeis University	1.4	$ 59	2.29
156	University of Alabama in Huntsville	1.4	$ 90	1.50
157	Loyola University of Chicago	1.3	$ 40	3.30
158	Northern Illinois University	1.3	$ 17	7.68
159	Marquette University	1.3	$ 33	3.80
160	Children's Hospital of Philadelphia	1.3	$ 394	0.32
161	St. Jude Children's Research Hospital	1.2	$ 410	0.30
162	Rosalind Franklin Univ. of Med. and Science	1.2	$ 16	7.55
163	University of Idaho	1.1	$ 110	0.98
164	University of North Carolina Wilmington	1.1	$ 17	6.33
165	Salk Institute for Biological Studies	1.0	$ 109	0.94
166	University of Denver	1.0	$ 33	3.03
167	University of South Dakota	1.0	$ 15	6.56
168	Louisiana Tech University	0.9	$ 25	3.44
169	Illinois State University	0.8	$ 18	4.59
170	Catholic University of America	0.8	$ 22	3.70
171	University of Northern Iowa	0.7	$ 41	1.83
172	Bowling Green State University	0.7	$ 17	4.19
173	University of Alaska Anchorage	0.7	$ 16	4.15
174	Tufts Medical Center	0.6	$ 73	0.85
175	North Carolina A&T State University	0.6	$ 37	1.66
176	Fox Chase Cancer Center	0.3	$ 43	0.79
177	Hackensack University Medical Center	0.0	$ 7	0.66
	Average for All Institutions	**7.7**	**$405**	**2.86**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See full summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table B

Innovation Impact Productivity: Large Universities

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)
1	California Institute of Technology	4.75	18.5	$ 389
2	University of Florida	3.43	22.9	$ 668
3	Arizona State University	3.39	20.3	$ 599
4	Northwestern University	3.21	19.2	$ 601
5	University of Mass. System	3.18	21.8	$ 685
6	Purdue University	3.16	20.8	$ 659
7	North Carolina State University	3.15	16.3	$ 517
8	Harvard University	2.85	25.1	$ 882
9	University of Pennsylvania	2.53	24.9	$ 986
10	University of Minnesota	2.49	24.8	$ 997
11	New York University	2.46	16.5	$ 674
12	University of Pittsburgh	2.21	17.9	$ 811
13	University of South Florida	2.19	12.2	$ 558
14	University of Washington	2.09	27.2	$ 1,300
15	University of Arizona	2.07	14.1	$ 682
16	University of Utah	2.01	10.7	$ 535
17	University of Georgia	1.95	9.0	$ 458
18	University of Texas System	1.91	57.6	$ 3,010
19	University of Colorado System	1.86	14.2	$ 761
20	Univ. of Illi. Urbana-Champaign	1.86	19.2	$ 1,035
21	Mass. Institute of Technology	1.84	32.9	$ 1,782
22	University of Michigan	1.78	27.6	$ 1,546
23	University of California System	1.78	100.0	$ 5,611
24	University of Virginia	1.74	9.4	$ 537
25	Rutgers/State Univ. of New Jersey	1.74	11.5	$ 661
26	University System of Maryland	1.73	19.3	$ 1,112
27	Cornell University	1.71	17.3	$ 1,011
28	Ohio State University	1.71	15.3	$ 897
29	Duke University	1.68	16.9	$ 1,003
30	University of Iowa	1.61	7.5	$ 463
31	University of Southern California	1.60	13.5	$ 842
32	Indiana University	1.58	8.1	$ 512
33	Stanford University	1.55	21.6	$ 1,388
34	State University of New York	1.46	14.3	$ 978
35	Texas A&M University System	1.46	14.0	$ 963
36	Univ. of N. Carolina Chapel Hill	1.37	11.5	$ 841
37	Michigan State University	1.29	8.9	$ 692
38	Virginia Tech	1.28	6.9	$ 539
39	University of Wisconsin-Madison	1.24	16.5	$ 1,331
40	Boston University	1.23	6.0	$ 487
41	Emory University	1.19	7.0	$ 590
42	Vanderbilt University	1.18	8.6	$ 728
43	University of Tennessee	1.16	4.5	$ 392
44	Johns Hopkins University	1.12	19.9	$ 1,778
45	Penn State University	1.05	9.6	$ 920
46	Washington University of St. Louis	1.03	7.9	$ 770
47	Georgia Institution of Technology	0.98	8.4	$ 858
48	Univ. of Alabama at Birmingham	0.94	5.4	$ 574
	Average of Group	**1.93**	**18.0**	**$ 971**

See Appendix 1 for explanation of sources and methods.

Table C

Innovation Impact Productivity: Midsized Universities

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)
1	Carnegie Mellon University	5.48	14.6	$ 266
2	University of New Mexico	5.43	13.3	$ 244
3	Princeton University	4.53	13.3	$ 293
4	Washington State University	3.57	7.2	$ 201
5	University of Chicago	3.51	12.4	$ 355
6	University of Houston	3.41	5.8	$ 170
7	University of Central Florida	3.06	7.1	$ 230
8	Case Western Reserve Universit	3.06	10.2	$ 334
9	Rice University	3.04	4.1	$ 135
10	Texas Tech University System	2.92	7.0	$ 239
11	Louisiana State University Syste	2.75	9.7	$ 352
12	University of Missouri System	2.69	9.6	$ 357
13	University of Arkansas Fayettev	2.53	3.7	$ 147
14	Florida State University	2.52	4.7	$ 186
15	University of Louisville	2.52	4.6	$ 182
16	Tufts University	2.44	4.6	$ 188
17	Clemson University	2.43	3.6	$ 149
18	University of Connecticut	2.40	5.3	$ 222
19	Temple University System	2.39	5.2	$ 217
20	Auburn University	2.37	5.0	$ 209
21	University of Kansas	2.17	5.5	$ 252
22	University of Delaware	2.16	3.3	$ 152
23	Virginia Commonwealth Univer	2.16	5.4	$ 252
24	University of Vermont	2.10	2.8	$ 132
25	Tulane University	2.01	3.0	$ 148
26	Montana State University	1.99	2.6	$ 133
27	Colorado State University	1.99	7.4	$ 370
28	University of Cincinnati	1.95	4.6	$ 237
29	University of Kentucky	1.94	6.1	$ 312
30	Oregon State University	1.91	5.1	$ 266
31	University of Notre Dame	1.89	4.2	$ 220
32	University of South Carolina	1.82	3.9	$ 216
33	Oklahoma State University	1.79	2.9	$ 165
34	Dartmouth College	1.77	3.3	$ 189
35	Iowa State University	1.76	6.8	$ 388
36	George Washington University	1.75	4.6	$ 262
37	Brown University	1.70	3.2	$ 189
38	Wayne State University	1.67	3.9	$ 235
39	Georgetown University	1.66	2.7	$ 165
40	University of Oklahoma	1.63	3.9	$ 237
41	University of Miami	1.63	5.6	$ 346
42	Kansas State University	1.61	3.4	$ 208
43	North Dakota State University	1.45	2.2	$ 153
44	University of Rochester	1.34	5.1	$ 381
45	Georgia State University	1.28	2.6	$ 200
46	New Jersey Institute of Technol	1.20	1.7	$ 145
47	Utah State University	0.95	2.4	$ 256
48	University of Hawaii	0.95	2.8	$ 292
49	Mississippi State University	0.95	2.4	$ 251
	Average of Group	**2.29**	**5.4**	**$ 233**

See Appendix 1 for explanation of sources and methods.

Table D

Innovation Impact Productivity: Smaller Universities

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)
1	Brigham Young University	30.36	10.5	$ 35
2	WiSys Technology Foundation	18.71	3.4	$ 18
3	University of Akron	11.35	4.2	$ 37
4	Worcester Polytechnic Institute	11.22	3.6	$ 32
5	Univ. of North Carolina Charlotte	7.79	3.2	$ 41
6	Northern Illinois University	7.68	1.3	$ 17
7	University of North Texas Denton	7.66	2.2	$ 29
8	Ros. Franklin Univ. of Med. and Sci.	7.55	1.2	$ 16
9	University of South Dakota	6.56	1.0	$ 15
10	University of Toledo	6.53	3.4	$ 52
11	Univ. of N. Carolina Wilmington	6.33	1.1	$ 17
12	East Carolina University	5.99	2.4	$ 40
13	Drexel University	5.70	6.8	$ 119
14	Ohio University	5.61	3.1	$ 56
15	Rowan University	5.53	1.6	$ 30
16	University of Alabama	4.92	3.2	$ 66
17	University Wisconsin-Milwaukee	4.62	2.6	$ 56
18	Illinois State University	4.59	0.8	$ 18
19	Stevens Institute of Technology	4.56	1.9	$ 41
20	Bowling Green State University	4.19	0.7	$ 17
21	Boise State University	4.15	1.4	$ 35
22	University of Alaska Anchorage	4.15	0.7	$ 16
23	Colorado School of Mines	4.08	2.2	$ 53
24	Rochester Institute of Technology	4.04	2.0	$ 50
25	Northern Arizona University	3.99	2.1	$ 52
26	Marquette University	3.80	1.3	$ 33
27	Catholic University of America	3.70	0.8	$ 22
28	Portland State University	3.61	2.2	$ 62
29	University of South Alabama	3.51	2.1	$ 61
30	Louisiana Tech University	3.44	0.9	$ 25
31	South Dakota State University	3.42	2.1	$ 62
32	Loyola University of Chicago	3.30	1.3	$ 40
33	University of Oregon	3.11	2.5	$ 80
34	University of Denver	3.03	1.0	$ 33
35	Wright State University	3.02	1.7	$ 57
36	University of Mississippi	2.83	2.2	$ 77
37	University of Nevada at Las Vegas	2.75	2.0	$ 73
38	Michigan Technological University	2.60	2.0	$ 76
39	Augusta University	2.49	2.3	$ 94
40	West Virginia University	2.48	2.5	$ 103
41	Southern Illinois University	2.37	1.5	$ 65
42	Brandeis University	2.29	1.4	$ 59
43	University of Nevada at Reno	2.23	2.4	$ 106
44	University of Northern Iowa	1.83	0.7	$ 41
45	Cleveland State University	1.68	1.4	$ 81
46	North Carolina A&T State Univ.	1.66	0.6	$ 37
47	Univ.of Alabama in Huntsville	1.50	1.4	$ 90
48	University of New Hampshire	1.23	1.5	$ 124
49	University of Idaho	0.98	1.1	$ 110
	Average of Group	**5.12**	**2.2**	**$ 52**

See Appendix 1 for explanation of sources and methods.

Table E

Innovation Impact Productivity: Medical Centers

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)
1	Univ. of Arkansas for Med. Sci.	4.35	2.4	$ 56
2	Univ. of N.Texas Health Science Ctr.	3.35	1.5	$ 45
3	Massachusetts General Brigham	1.94	18.2	$ 941
4	Cedars-Sinai Medical Center	1.81	3.2	$ 176
5	Dana-Farber Cancer Institute	1.74	5.5	$ 314
6	Nationwide Childrens Hospital	1.61	2.9	$ 179
7	Cleveland Clinic	1.56	4.5	$ 292
8	Mayo Clinic	1.49	12.3	$ 821
9	University of Nebraska Med. Cr.	1.34	6.1	$ 456
10	Oregon Health & Science University	1.32	5.1	$ 387
11	H. Lee Moffitt Cancer Ctr. & Res. Ins	1.26	2.3	$ 185
12	Beth Israel Deaconess Medical Ctr.	1.25	2.9	$ 234
13	Children's Hospital Boston	1.15	4.1	$ 359
14	Memorial Sloan Kettering Cancer Ctr	1.08	7.5	$ 694
15	Mount Sinai School of Medicine	1.08	5.8	$ 535
16	Brigham & Women's Hospital	1.06	7.2	$ 678
17	Baylor College of Medicine	0.94	4.3	$ 458
18	Tufts Medical Center	0.85	0.6	$ 73
19	Fox Chase Cancer Center	0.79	0.3	$ 43
20	Hackensack Univ. Medical Center	0.66	0.0	$ 7
21	Medical College of Wisconsin	0.65	1.8	$ 279
22	Fred Hutchinson Cancer Research Ctr	0.55	2.7	$ 483
23	Children's Hospital Cincinnati	0.48	2.3	$ 473
24	Children's Hospital of Philadelphia	0.32	1.3	$ 394
25	St. Jude Children's Research Hospital	0.30	1.2	$ 410
	Average of Group	**1.32**	**4.2**	**$ 359**

See Appendix 1 for explanation of sources and methods.

Table F

Innovation Impact Productivity: Pure Research Institutes

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending ($m)
1	Whitehead Inst. for Biomed. Research	5.40	2.4	$ 44
2	Cold Spring Harbor Laboratory	4.55	6.3	$ 139
3	Wistar Institute	2.69	1.8	$ 68
4	Zucker Inst. for Innov. Commercializ	1.76	4.7	$ 264
5	Salk Institute for Biological Studies	0.94	1.0	$ 109
6	Johns Hopkins Univ. Appd. Phys. La	0.21	3.2	$ 1,522
	Average of Group	**2.59**	**3.2**	**$ 358**

See Appendix 1 for explanation of sources and methods.

Table G

BushEds: Aggregate Innovation Impact

	Metro Areas	Aggregate BushEds	BushEds per Capita		Metro Areas	Aggregate BushEds	BushEds per Capita
1	Boston-Cambridge-Newton, MA-NH	113.8	23.2	51	Iowa City, IA	7.5	42.1
2	New York-Newark-Jersey City, NY-NJ-PA	79.4	4.0	52	Lubbock, TX	7.2	22.3
3	Los Angeles-Long Beach-Anaheim, CA	57.1	4.4	53	Cincinnati, OH-KY-IN	7.1	3.1
4	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	43.8	7.0	54	Rochester, NY	7.1	6.5
5	Houston-The Woodlands-Sugar Land, TX	39.9	5.5	55	Orlando-Kissimmee-Sanford, FL	7.1	2.6
6	San Francisco-Oakland-Berkeley, CA	39.5	8.5	56	Boulder, CO	7.0	21.1
7	Chicago-Naperville-Elgin, IL-IN-WI	34.0	3.6	57	Blacksburg-Christiansburg, VA	6.9	41.7
8	Pittsburgh, PA	32.1	13.6	58	Ames, IA	6.8	54.2
9	Baltimore-Columbia-Towson, MD	30.8	10.8	59	Lexington-Fayette, KY	6.3	12.1
10	Seattle-Tacoma-Bellevue, WA	29.9	7.4	60	Springfield, MA	6.2	9.0
11	Durham-Chapel Hill, NC	28.4	43.4	61	Lincoln, NE	6.1	17.9
12	Ann Arbor, MI	27.6	74.6	62	Richmond, VA	5.7	4.3
13	Minneapolis-St. Paul-Bloomington, MN-WI	24.8	6.7	63	Miami-Fort Lauderdale-Pompano Beach, FL	5.7	0.9
14	Gainesville, FL	22.9	67.1	64	Lawrence, KS	5.7	47.6
15	San Diego-Chula Vista-Carlsbad, CA	22.6	6.9	65	Milwaukee-Waukesha, WI	5.7	3.6
16	San Jose-Sunnyvale-Santa Clara, CA	21.6	11.0	66	San Antonio-New Braunfels, TX	5.5	2.1
17	Lafayette-West Lafayette, IN	20.8	92.6	67	Hartford-East Hartford-Middletown, CT	5.5	4.5
18	Phoenix-Mesa-Chandler, AZ	20.3	4.1	68	Birmingham-Hoover, AL	5.3	4.7
19	Washington-Arlington-Alexandria, DC-VA-MD-WV	19.9	3.1	69	Corvallis, OR	5.1	53.2
20	Champaign-Urbana, IL	19.2	86.4	70	Auburn-Opelika, AL	5.1	28.7
21	Columbus, OH	18.2	8.5	71	Tallahassee, FL	4.8	12.3
22	Dallas-Fort Worth-Arlington, TX	17.5	2.3	72	Louisville/Jefferson County, KY-IN	4.7	3.6
23	Ithaca, NY	17.3	164.5	73	Winston-Salem, NC	4.6	6.8
24	Madison, WI	16.5	24.1	74	Knoxville, TN	4.5	5.1
25	Raleigh-Cary, NC	16.3	11.3	75	Utica-Rome, NY	4.5	15.5
26	Cleveland-Elyria, OH	16.0	7.7	76	Akron, OH	4.2	6.0
27	Atlanta-Sandy Springs-Alpharetta, GA	15.4	2.5	77	Detroit-Warren-Dearborn, MI	4.2	1.0
28	New Haven-Milford, CT	15.3	17.7	78	Buffalo-Cheektowaga, NY	4.1	3.5
29	Tampa-St. Petersburg-Clearwater, FL	14.5	4.5	79	South Bend-Mishawaka, IN-MI	4.1	12.7
30	Tucson, AZ	14.1	13.4	80	Columbia, SC	4.1	4.9
31	College Station-Bryan, TX	14.0	51.5	81	Oklahoma City, OK	4.1	2.8
32	Worcester, MA-CT	13.7	14.0	82	Fayetteville-Springdale-Rogers, AR	3.7	6.5
33	Albuquerque, NM	13.0	14.2	83	Greenville-Anderson, SC	3.6	3.8
34	Trenton-Princeton, NJ	12.9	33.5	84	Greenville, NC	3.6	21.0
35	Sacramento-Roseville-Folsom, CA	12.8	5.3	85	Riverside-San Bernardino-Ontario, CA	3.6	0.8
36	Rochester, MN	12.3	54.0	86	Santa Maria-Santa Barbara, CA	3.6	8.0
37	Baton Rouge, LA	10.9	12.5	87	Toledo, OH	3.4	5.3
38	Salt Lake City, UT	10.7	8.5	88	Manhattan, KS	3.4	25.2
39	Provo-Orem, UT	10.5	15.0	89	Tuscaloosa, AL	3.2	12.1
40	Denver-Aurora-Lakewood, CO	10.4	3.5	90	Providence-Warwick, RI-MA	3.2	1.9
41	Austin-Round Rock-Georgetown, TX	10.3	4.4	91	Charlotte-Concord-Gastonia, NC-SC	3.2	1.2
42	Columbia, MO	10.1	47.5	92	New Orleans-Metairie, LA	3.0	2.4
43	State College, PA	9.6	61.2	93	Honolulu	2.9	2.9
44	Charlottesville, VA	9.4	42.0	94	Burlington-South Burlington, VT	2.8	16.0
45	Athens-Clarke County, GA	9.0	41.1	95	Morgantown, WV	2.5	18.1
46	Lansing-East Lansing, MI	8.9	16.6	96	Eugene-Springfield, OR	2.5	6.5
47	Nashville-Davidson--Murfreesboro--Franklin, TN	8.6	4.3	97	Little Rock-North Little Rock-Conway, AR	2.4	3.2
48	Indianapolis-Carmel-Anderson, IN	8.1	3.8	98	Logan, UT-ID	2.4	15.6
49	St. Louis, MO-IL	7.9	2.8	99	Reno, NV	2.4	4.8
50	Fort Collins, CO	7.7	21.2	100	Augusta-Richmond County, GA-SC	2.3	3.8
					Average for all Metros > 0	**10.8**	**15.1**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table G (cont.)

BushEds: Aggregate Innovation Impact

	Metro Areas	Aggregate BushEds	BushEds per Capita
101	Portland-Vancouver-Hillsboro, OR-WA	2.2	0.9
102	Fargo, ND-MN	2.2	8.8
103	Mobile, AL	2.1	5.0
104	Flagstaff, AZ	2.1	14.4
105	Las Vegas-Henderson-Paradise, NV	2.0	0.9
106	Wichita, KS	2.0	3.1
107	Dayton-Kettering, OH	1.7	2.1
108	Carbondale-Marion, IL	1.5	11.5
109	El Paso, TX	1.4	1.7
110	Boise City, ID	1.4	1.8
111	Huntsville, AL	1.4	2.7
112	Memphis, TN-MS-AR	1.2	0.9
113	Binghamton, NY	1.2	4.9
114	Eau Claire, WI	1.1	6.4
115	Green Bay, WI	1.1	3.4
116	Oshkosh-Neenah, WI	1.1	6.5
117	Albany-Schenectady-Troy, NY	1.1	1.2
118	Wilmington, NC	1.1	0.0
119	Waco, TX	0.9	3.2
120	McAllen-Edinburg-Mission, TX	0.9	1.0
121	Bloomington, IL	0.8	4.8
122	Waterloo-Cedar Falls, IA	0.7	4.5
123	Syracuse, NY	0.7	1.1
124	Anchorage, AK	0.7	1.6
125	Merced, CA	0.6	2.3
126	Greensboro-High Point, NC	0.6	0.8
	Average for all Metros > 0	**10.8**	**15.1**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table H

BushEds Innovation Impact per Capita

(100 largest metros)

	Metro Areas	BushEds per Capita	Aggregate BushEds		Metro Areas	BushEds per Capita	Aggregate BushEds
1	Durham-Chapel Hill, NC	43.4	28.4	51	Wichita, KS	3.1	2.0
2	Madison, WI	24.1	16.5	52	Honolulu	2.9	2.9
3	Boston-Cambridge-Newton, MA-NH	23.2	113.8	53	Oklahoma City, OK	2.8	4.1
4	New Haven-Milford, CT	17.7	15.3	54	St. Louis, MO-IL	2.8	7.9
5	Provo-Orem, UT	15.0	10.5	55	Orlando-Kissimmee-Sanford, FL	2.6	7.1
6	Albuquerque, NM	14.2	13.0	56	Atlanta-Sandy Springs-Alpharetta, GA	2.5	15.4
7	Worcester, MA-CT	14.0	13.7	57	New Orleans-Metairie, LA	2.4	3.0
8	Pittsburgh, PA	13.6	32.1	58	Dallas-Fort Worth-Arlington, TX	2.3	17.5
9	Tucson, AZ	13.4	14.1	59	Dayton-Kettering, OH	2.1	1.7
10	Baton Rouge, LA	12.5	10.9	60	San Antonio-New Braunfels, TX	2.1	5.5
11	Raleigh-Cary, NC	11.3	16.3	61	Providence-Warwick, RI-MA	1.9	3.2
12	San Jose-Sunnyvale-Santa Clara, CA	11.0	21.6	62	Boise City, ID	1.8	1.4
13	Baltimore-Columbia-Towson, MD	10.8	30.8	63	El Paso, TX	1.7	1.4
14	Springfield, MA	9.0	6.2	64	Albany-Schenectady-Troy, NY	1.2	1.1
15	San Francisco-Oakland-Berkeley, CA	8.5	39.5	65	Charlotte-Concord-Gastonia, NC-SC	1.2	3.2
16	Salt Lake City, UT	8.5	10.7	66	Syracuse, NY	1.1	0.7
17	Columbus, OH	8.5	18.2	67	McAllen-Edinburg-Mission, TX	1.0	0.9
18	Cleveland-Elyria, OH	7.7	16.0	68	Detroit-Warren-Dearborn, MI	1.0	4.2
19	Seattle-Tacoma-Bellevue, WA	7.4	29.9	69	Miami-Fort Lauderdale-Pompano Beach, FL	0.9	5.7
20	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	7.0	43.8	70	Memphis, TN-MS-AR	0.9	1.2
21	San Diego-Chula Vista-Carlsbad, CA	6.9	22.6	71	Portland-Vancouver-Hillsboro, OR-WA	0.9	2.2
22	Winston-Salem, NC	6.8	4.6	72	Las Vegas-Henderson-Paradise, NV	0.9	2.0
23	Minneapolis-St. Paul-Bloomington, MN-WI	6.7	24.8	73	Greensboro-High Point, NC	0.8	0.6
24	Rochester, NY	6.5	7.1	74	Riverside-San Bernardino-Ontario, CA	0.8	3.6
25	Akron, OH	6.0	4.2	75	Allentown-Bethlehem-Easton, PA-NJ	0	0
26	Houston-The Woodlands-Sugar Land, TX	5.5	39.9	76	Bakersfield, CA	0	0
27	Sacramento-Roseville-Folsom, CA	5.3	12.8	77	Bridgeport-Stamford-Norwalk, CT	0	0
28	Toledo, OH	5.3	3.4	78	Cape Coral-Fort Myers, FL	0	0
29	Knoxville, TN	5.1	4.5	79	Charleston-North Charleston, SC	0	0
30	Columbia, SC	4.9	4.1	80	Colorado Springs, CO	0	0
31	Birmingham-Hoover, AL	4.7	5.3	81	Deltona-Daytona Beach-Ormond Beach, FL	0	0
32	Hartford-East Hartford-Middletown, CT	4.5	5.5	82	Des Moines-West Des Moines, IA	0	0
33	Tampa-St. Petersburg-Clearwater, FL	4.5	14.5	83	Fresno, CA	0	0
34	Austin-Round Rock-Georgetown, TX	4.4	10.3	84	Grand Rapids-Kentwood, MI	0	0
35	Los Angeles-Long Beach-Anaheim, CA	4.4	57.1	85	Harrisburg-Carlisle, PA	0	0
36	Richmond, VA	4.3	5.7	86	Jackson, MS	0	0
37	Nashville-Davidson--Murfreesboro--Franklin, TN	4.3	8.6	87	Jacksonville, FL	0	0
38	Phoenix-Mesa-Chandler, AZ	4.1	20.3	88	Kansas City, MO-KS	0	0
39	New York-Newark-Jersey City, NY-NJ-PA	4.0	79.4	89	Lakeland-Winter Haven, FL	0	0
40	Greenville-Anderson, SC	3.8	3.6	90	North Port-Sarasota-Bradenton, FL	0	0
41	Indianapolis-Carmel-Anderson, IN	3.8	8.1	91	Ogden-Clearfield, UT	0	0
42	Augusta-Richmond County, GA-SC	3.8	2.3	92	Omaha-Council Bluffs, NE-IA	0	0
43	Louisville/Jefferson County, KY-IN	3.6	4.7	93	Oxnard-Thousand Oaks-Ventura, CA	0	0
44	Milwaukee-Waukesha, WI	3.6	5.7	94	Palm Bay-Melbourne-Titusville, FL	0	0
45	Chicago-Naperville-Elgin, IL-IN-WI	3.6	34.0	95	Poughkeepsie-Newburgh-Middletown, NY	0	0
46	Buffalo-Cheektowaga, NY	3.5	4.1	96	Scranton--Wilkes-Barre, PA	0	0
47	Denver-Aurora-Lakewood, CO	3.5	10.4	97	Spokane-Spokane Valley, WA	0	0
48	Little Rock-North Little Rock-Conway, AR	3.2	2.4	98	Stockton, CA	0	0
49	Cincinnati, OH-KY-IN	3.1	7.1	99	Tulsa, OK	0	0
50	Washington-Arlington-Alexandria, DC-VA-MD-WV	3.1	19.9	100	Virginia Beach-Norfolk-Newport News, VA-NC	0	0
					Average for Top 100 Metros	**6.2**	**14.0**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table I

BushEds Innovation Impact per Capita

(Smaller metros)

	Metro Areas	BushEds per Capita	Aggregate BushEds
1	Ithaca, NY	164.5	17.3
2	Lafayette-West Lafayette, IN	92.6	20.8
3	Champaign-Urbana, IL	86.4	19.2
4	Ann Arbor, MI	74.6	27.6
5	Gainesville, FL	67.1	22.9
6	State College, PA	61.2	9.6
7	Ames, IA	54.2	6.8
8	Rochester, MN	54.0	12.3
9	Corvallis, OR	53.2	5.1
10	College Station-Bryan, TX	51.5	14.0
11	Lawrence, KS	47.6	5.7
12	Columbia, MO	47.5	10.1
13	Iowa City, IA	42.1	7.5
14	Charlottesville, VA	42.0	9.4
15	Blacksburg-Christiansburg, VA	41.7	6.9
16	Athens-Clarke County, GA	41.1	9.0
17	Trenton-Princeton, NJ	33.5	12.9
18	Auburn-Opelika, AL	28.7	5.1
19	Manhattan, KS	25.2	3.4
20	Lubbock, TX	22.3	7.2
21	Fort Collins, CO	21.2	7.7
22	Boulder, CO	21.1	7.0
23	Greenville, NC	21.0	3.6
24	Morgantown, WV	18.1	2.5
25	Lincoln, NE	17.9	6.1
26	Lansing-East Lansing, MI	16.6	8.9
27	Burlington-South Burlington, VT	16.0	2.8
28	Logan, UT-ID	15.6	2.4
29	Utica-Rome, NY	15.5	4.5
30	Flagstaff, AZ	14.4	2.1
31	South Bend-Mishawaka, IN-MI	12.7	4.1
32	Tallahassee, FL	12.3	4.8
33	Lexington-Fayette, KY	12.1	6.3
34	Tuscaloosa, AL	12.1	3.2
35	Carbondale-Marion, IL	11.5	1.5
36	Fargo, ND-MN	8.8	2.2
37	Santa Maria-Santa Barbara, CA	8.0	3.6
38	Eugene-Springfield, OR	6.5	2.5
39	Fayetteville-Springdale-Rogers, AR	6.5	3.7
40	Oshkosh-Neenah, WI	6.5	1.1
41	Eau Claire, WI	6.4	1.1
42	Mobile, AL	5.0	2.1
43	Binghamton, NY	4.9	1.2
44	Bloomington, IL	4.8	0.8
45	Reno, NV	4.8	2.4
46	Waterloo-Cedar Falls, IA	4.5	0.7
47	Green Bay, WI	3.4	1.1
48	Waco, TX	3.2	0.9
49	Huntsville, AL	2.7	1.4
50	Merced, CA	2.3	0.6
51	Anchorage, AK	1.6	0.7
	Average for Smaller Metros	**27.9**	**6.3**

Source: Author's calculations based on technology commercialization data from the Association of University Technology Managers; paper and patent citations data from Google Scholar and Google Patents; and graduate data from the National Science Foundation. See summary of sources and methods in Appendix 1 and underlying data in online data appendix.

Table J

BushMeds: Total Quality-Adjusted Medical Center Activities

(250 largest metros)

	Metro Areas	Aggregate BushMeds	BushMeds per Capita		Metro Areas	Aggregate BushMeds	BushMeds per Capita
1	New York-Newark-Jersey City, NY-NJ-PA	100.0	12.9	51	Grand Rapids-Kentwood, MI	5.9	13.5
2	Chicago-Naperville-Elgin, IL-IN-WI	40.7	10.6	52	Providence-Warwick, RI-MA	5.7	8.6
3	Los Angeles-Long Beach-Anaheim, CA	37.5	7.1	53	Memphis, TN-MS-AR	5.3	9.7
4	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	30.7	12.4	54	Little Rock-North Little Rock-Conway, AR	5.3	17.5
5	Houston-The Woodlands-Sugar Land, TX	27.3	9.4	55	Omaha-Council Bluffs, NE-IA	5.0	13.0
6	Boston-Cambridge-Newton, MA-NH	26.6	13.4	56	Hartford-East Hartford-Middletown, CT	5.0	10.3
7	Dallas-Fort Worth-Arlington, TX	25.7	8.2	57	Madison, WI	5.0	18.2
8	Detroit-Warren-Dearborn, MI	23.8	13.6	58	Raleigh-Cary, NC	4.9	8.5
9	San Francisco-Oakland-Berkeley, CA	17.4	9.2	59	Toledo, OH	4.9	18.6
10	Baltimore-Columbia-Towson, MD	17.3	15.2	60	Baton Rouge, LA	4.8	13.9
11	St. Louis, MO-IL	16.6	14.6	61	Lexington-Fayette, KY	4.8	22.5
12	Miami-Fort Lauderdale-Pompano Beach, FL	15.4	6.2	62	Greenville-Anderson, SC	4.7	12.3
13	Atlanta-Sandy Springs-Alpharetta, GA	15.2	6.2	63	Tulsa, OK	4.6	11.1
14	Pittsburgh, PA	14.6	15.6	64	Dayton-Kettering, OH	4.4	13.5
15	Washington-Arlington-Alexandria, DC-VA-MD-WV	14.5	5.6	65	Jackson, MS	4.4	18.2
16	Seattle-Tacoma-Bellevue, WA	13.3	8.1	66	Boise City, ID	4.3	13.9
17	Tampa-St. Petersburg-Clearwater, FL	13.0	9.9	67	Allentown-Bethlehem-Easton, PA-NJ	4.3	12.6
18	Kansas City, MO-KS	11.9	13.5	68	Tucson, AZ	4.2	9.7
19	Minneapolis-St. Paul-Bloomington, MN-WI	11.9	8.0	69	Cleveland-Elyria, OH	4.1	5.0
20	Phoenix-Mesa-Chandler, AZ	11.8	5.7	70	Syracuse, NY	4.1	15.5
21	Columbus, OH	11.3	13.0	71	Knoxville, TN	3.9	11.1
22	Riverside-San Bernardino-Ontario, CA	10.6	5.6	72	Worcester, MA-CT	3.9	10.3
23	Cincinnati, OH-KY-IN	10.3	11.4	73	Harrisburg-Carlisle, PA	3.9	16.5
24	Charleston-North Charleston, SC	10.2	30.5	74	Akron, OH	3.7	13.1
25	Indianapolis-Carmel-Anderson, IN	9.8	11.5	75	Albuquerque, NM	3.7	9.7
26	Portland-Vancouver-Hillsboro, OR-WA	9.7	9.5	76	Columbia, SC	3.6	10.6
27	San Diego-Chula Vista-Carlsbad, CA	9.6	7.1	77	Scranton--Wilkes-Barre, PA	3.6	15.9
28	Virginia Beach-Norfolk-Newport News, VA-NC	9.5	13.1	78	Springfield, MO	3.5	18.3
29	Ann Arbor, MI	9.4	62.9	79	McAllen-Edinburg-Mission, TX	3.5	9.8
30	San Antonio-New Braunfels, TX	9.1	8.7	80	Iowa City, IA	3.5	48.6
31	Rochester, MN	9.1	100.0	81	Charlottesville, VA	3.4	38.3
32	Orlando-Kissimmee-Sanford, FL	9.0	8.4	82	El Paso, TX	3.3	9.5
33	Denver-Aurora-Lakewood, CO	9.0	7.4	83	Bridgeport-Stamford-Norwalk, CT	3.2	8.5
34	Durham-Chapel Hill, NC	8.4	31.5	84	Honolulu	3.2	8.2
35	Birmingham-Hoover, AL	8.2	18.6	85	Gainesville, FL	3.2	23.8
36	Oklahoma City, OK	7.9	13.6	86	Spokane-Spokane Valley, WA	3.2	13.7
37	Sacramento-Roseville-Folsom, CA	7.5	7.8	87	Las Vegas-Henderson-Paradise, NV	3.1	3.3
38	Nashville-Davidson--Murfreesboro--Franklin, TN	7.3	9.2	88	Greensboro-High Point, NC	3.0	9.7
39	Milwaukee-Waukesha, WI	7.1	11.0	89	Fort Wayne, IN	3.0	18.0
40	New Orleans-Metairie, LA	7.0	13.6	90	Augusta-Richmond County, GA-SC	3.0	11.8
41	Rochester, NY	6.8	15.8	91	Shreveport-Bossier City, LA	2.9	18.3
42	Charlotte-Concord-Gastonia, NC-SC	6.8	6.2	92	Asheville, NC	2.9	15.3
43	Austin-Round Rock-Georgetown, TX	6.7	7.2	93	Des Moines-West Des Moines, IA	2.8	9.6
44	Albany-Schenectady-Troy, NY	6.7	18.7	94	Killeen-Temple, TX	2.7	14.0
45	Salt Lake City, UT	6.6	13.2	95	Columbia, MO	2.6	31.0
46	New Haven-Milford, CT	6.6	19.0	96	Springfield, MA	2.6	9.2
47	Buffalo-Cheektowaga, NY	6.5	14.3	97	Peoria, IL	2.5	15.6
48	Jacksonville, FL	6.5	10.1	98	Portland-South Portland, ME	2.5	11.4
49	Louisville/Jefferson County, KY-IN	6.3	12.2	99	Lancaster, PA	2.5	11.3
50	San Jose-Sunnyvale-Santa Clara, CA	6.2	7.7	100	Sioux Falls, SD	2.5	22.4
					Average for Top 100 Metros	**8.9**	**10.8**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods and all underlying data in online Data Appendix.

Table J (cont.)

BushMeds: Total Quality-Adjusted Medical Center Activities

(250 largest metros)

	Metro Areas	Aggregate BushMeds	BushMeds per Capita		Metro Areas	Aggregate BushMeds	BushMeds per Capita
101	Chattanooga, TN-GA	2.5	10.7	151	Rockford, IL	1.5	11.0
102	Duluth, MN-WI	2.4	20.8	152	Billings, MT	1.5	19.9
103	Binghamton, NY	2.4	24.7	153	Beaumont-Port Arthur, TX	1.5	9.3
104	Reno, NV	2.4	12.2	154	Anchorage, AK	1.5	9.1
105	Huntington-Ashland, WV-KY-OH	2.3	16.3	155	Hickory-Lenoir-Morganton, NC	1.5	9.8
106	North Port-Sarasota-Bradenton, FL	2.3	6.7	156	Fort Smith, AR-OK	1.4	14.2
107	Richmond, VA	2.3	4.3	157	Erie, PA	1.4	13.2
108	Winston-Salem, NC	2.3	8.2	158	Mobile, AL	1.4	8.2
109	Tyler, TX	2.2	23.0	159	Myrtle Beach-, SC-NC	1.4	6.8
110	Reading, PA	2.2	12.7	160	Charleston, WV	1.4	13.5
111	Lakeland-Winter Haven, FL	2.2	7.2	161	Cedar Rapids, IA	1.4	12.5
112	Huntsville, AL	2.2	11.1	162	Modesto, CA	1.4	6.2
113	Flint, MI	2.2	13.1	163	Spartanburg, SC	1.3	10.2
114	Green Bay, WI	2.1	16.1	164	Lincoln, NE	1.3	9.8
115	Savannah, GA	2.1	13.2	165	Brownsville-Harlingen, TX	1.3	7.8
116	Cape Coral-Fort Myers, FL	2.1	6.6	166	Joplin, MO	1.3	18.2
117	Lubbock, TX	2.1	15.8	167	Utica-Rome, NY	1.3	11.4
118	Gulfport-Biloxi, MS	2.1	12.1	168	Amarillo, TX	1.3	12.3
119	Fayetteville, NC	2.0	9.1	169	Jackson, TN	1.3	18.1
120	Canton-Massillon, OH	1.9	12.0	170	Fayetteville-Springdale-Rogers, AR	1.3	5.9
121	Colorado Springs, CO	1.9	6.3	171	Monroe, LA	1.3	16.2
122	Lafayette, LA	1.9	9.5	172	Gainesville, GA	1.3	15.5
123	Vallejo, CA	1.9	10.4	173	South Bend-Mishawaka, IN-MI	1.2	9.2
124	Saginaw, MI	1.9	24.0	174	Macon-Bibb County, GA	1.2	12.9
125	York-Hanover, PA	1.8	10.0	175	Boulder, CO	1.2	9.0
126	Florence, SC	1.8	22.0	176	Muskegon, MI	1.2	17.0
127	Hagerstown-Martinsburg, MD-WV	1.8	15.3	177	St. Cloud, MN	1.2	14.3
128	Roanoke, VA	1.8	14.1	178	Trenton-Princeton, NJ	1.2	7.8
129	Wichita, KS	1.8	6.8	179	Tallahassee, FL	1.2	7.3
130	Manchester-Nashua, NH	1.8	10.5	180	Topeka, KS	1.2	12.3
131	Deltona-Daytona Beach-Ormond Beach, FL	1.8	6.5	181	Eau Claire, WI	1.1	16.6
132	Corpus Christi, TX	1.8	10.2	182	Atlantic City-Hammonton, NJ	1.1	10.7
133	Provo-Orem, UT	1.8	6.5	183	Johnson City, TN	1.1	13.7
134	Fargo, ND-MN	1.7	17.3	184	Abilene, TX	1.1	16.0
135	Youngstown-Warren-Boardman, OH-PA	1.7	8.1	185	Visalia, CA	1.1	5.9
136	Columbus, GA-AL	1.7	13.2	186	Medford, OR	1.1	12.1
137	Palm Bay-Melbourne-Titusville, FL	1.7	7.0	187	Fort Collins, CO	1.1	7.4
138	Pensacola-Ferry Pass-Brent, FL	1.7	8.3	188	Lake Charles, LA	1.1	12.7
139	Salisbury, MD-DE	1.7	9.9	189	Fresno, CA	1.1	2.6
140	Evansville, IN-KY	1.7	13.3	190	College Station-Bryan, TX	1.1	9.8
141	Springfield, IL	1.7	20.4	191	Houma-Thibodaux, LA	1.0	12.3
142	Kalamazoo-Portage, MI	1.7	15.7	192	Athens-Clarke County, GA	1.0	11.7
143	Lansing-East Lansing, MI	1.7	7.6	193	Kingsport-Bristol, TN-VA	1.0	8.1
144	Champaign-Urbana, IL	1.7	18.3	194	Salem, OR	1.0	5.7
145	Montgomery, AL	1.7	11.0	195	Naples-Marco Island, FL	1.0	6.3
146	Bakersfield, CA	1.6	4.5	196	Ogden-Clearfield, UT	1.0	3.6
147	Lynchburg, VA	1.6	15.2	197	Chico, CA	1.0	11.6
148	Davenport-Moline-Rock Island, IA-IL	1.6	10.6	198	Burlington, NC	1.0	14.4
149	Tuscaloosa, AL	1.6	15.8	199	Eugene-Springfield, OR	1.0	6.4
150	Wilmington, NC	1.5	12.4	200	Barnstable Town, MA	1.0	11.3
					Average for Smaller Metros	**1.5**	**12.2**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods and all underlying data in online Data Appendix.

Table J (cont.)

BushMeds: Total Quality-Adjusted Medical Center Activities

(250 largest metros)

	Metro Areas	Aggregate BushMeds	BushMeds per Capita
201	Norwich-New London, CT	1.0	9.1
202	Terre Haute, IN	1.0	12.8
203	Appleton, WI	1.0	9.9
204	Yakima, WA	1.0	9.3
205	Elkhart-Goshen, IN	0.9	10.6
206	Lafayette-West Lafayette, IN	0.9	9.3
207	Dover, DE	0.9	11.6
208	Racine, WI	0.8	10.3
209	Olympia-Lacey-Tumwater, WA	0.8	6.8
210	Oxnard-Thousand Oaks-Ventura, CA	0.8	2.4
211	Laredo, TX	0.8	7.0
212	Auburn-Opelika, AL	0.8	11.1
213	St. George, UT	0.7	10.0
214	Salinas, CA	0.7	4.3
215	Coeur d'Alene, ID	0.7	10.7
216	Longview, TX	0.7	6.2
217	Bowling Green, KY	0.7	9.6
218	Yuma, AZ	0.7	7.9
219	Hilton Head Island-Bluffton, SC	0.7	7.5
220	Kennewick-Richland, WA	0.7	5.4
221	Bend, OR	0.6	7.6
222	Santa Rosa-Petaluma, CA	0.6	3.1
223	Port St. Lucie, FL	0.6	2.9
224	Stockton, CA	0.6	1.9
225	Prescott Valley-Prescott, AZ	0.6	5.7
226	Burlington-South Burlington, VT	0.6	6.2
227	Santa Maria-Santa Barbara, CA	0.6	3.1
228	Warner Robins, GA	0.5	7.1
229	Midland, TX	0.5	7.2
230	Las Cruces, NM	0.5	5.9
231	Bremerton-Silverdale-Port Orchard, WA	0.5	4.7
232	Waco, TX	0.5	4.1
233	Greeley, CO	0.4	2.9
234	Punta Gorda, FL	0.4	4.7
235	Merced, CA	0.3	3.0
236	Bellingham, WA	0.3	3.1
237	Kingston, NY	0.3	4.1
238	Crestview-Fort Walton Beach-Destin, FL	0.3	2.5
239	Jacksonville, NC	0.3	3.3
240	Santa Cruz-Watsonville, CA	0.2	2.2
241	Clarksville, TN-KY	0.2	1.8
242	El Centro, CA	0.2	2.9
243	Lake Havasu City-Kingman, AZ	0.1	1.4
244	San Luis Obispo-Paso Robles, CA	0.1	0.8
245	Redding, CA	0.1	1.1
246	Ocala, FL	0.0	0.2
247	Panama City, FL	0.0	0.3
248	Yuba City, CA	0.0	0.3
249	Daphne-Fairhope-Foley, AL		
250	Poughkeepsie-Newburgh-Middletown, NY		
	Average for Smaller Metros	**1.5**	**12.2**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods and all underlying data in online Data Appendix.

Table K

BushMeds Medical Center Activities per Capita

(100 largest metros)

	Metro Areas	BushMeds per Capita	Aggregate BushMeds		Metro Areas	BushMeds per Capita	Aggregate BushMeds
1	Durham-Chapel Hill, NC	31.5	8.4	51	Tucson, AZ	9.7	4.2
2	Charleston-North Charleston, SC	30.5	10.2	52	Albuquerque, NM	9.7	3.7
3	New Haven-Milford, CT	19.0	6.6	53	Memphis, TN-MS-AR	9.7	5.3
4	Albany-Schenectady-Troy, NY	18.7	6.7	54	Greensboro-High Point, NC	9.7	3.0
5	Toledo, OH	18.6	4.9	55	Des Moines-West Des Moines, IA	9.6	2.8
6	Birmingham-Hoover, AL	18.6	8.2	56	Portland-Vancouver, OR-WA	9.5	9.7
7	Jackson, MS	18.2	4.4	57	El Paso, TX	9.5	3.3
8	Madison, WI	18.2	5.0	58	Houston, TX	9.4	27.3
9	Little Rock, AR	17.5	5.3	59	Springfield, MA	9.2	2.6
10	Harrisburg-Carlisle, PA	16.5	3.9	60	Nashville, TN	9.2	7.3
11	Scranton--Wilkes-Barre, PA	15.9	3.6	61	San Francisco-Oakland-Berkeley, CA	9.2	17.4
12	Rochester, NY	15.8	6.8	62	San Antonio-New Braunfels, TX	8.7	9.1
13	Pittsburgh, PA	15.6	14.6	63	Providence-Warwick, RI-MA	8.6	5.7
14	Syracuse, NY	15.5	4.1	64	Raleigh-Cary, NC	8.5	4.9
15	Baltimore-Columbia-Towson, MD	15.2	17.3	65	Bridgeport-Stamford-Norwalk, CT	8.5	3.2
16	St. Louis, MO-IL	14.6	16.6	66	Orlando-Kissimmee-Sanford, FL	8.4	9.0
17	Buffalo-Cheektowaga, NY	14.3	6.5	67	Honolulu	8.2	3.2
18	Boise City, ID	13.9	4.3	68	Dallas-Fort Worth-Arlington, TX	8.2	25.7
19	Baton Rouge, LA	13.9	4.8	69	Winston-Salem, NC	8.2	2.3
20	Spokane-Spokane Valley, WA	13.7	3.2	70	Seattle-Tacoma-Bellevue, WA	8.1	13.3
21	Detroit-Warren-Dearborn, MI	13.6	23.8	71	Minneapolis-St. Paul, MN-WI	8.0	11.9
22	Oklahoma City, OK	13.6	7.9	72	Sacramento-Roseville-Folsom, CA	7.8	7.5
23	New Orleans-Metairie, LA	13.6	7.0	73	San Jose-Sunnyvale-Santa Clara, CA	7.7	6.2
24	Kansas City, MO-KS	13.5	11.9	74	Denver-Aurora-Lakewood, CO	7.4	9.0
25	Dayton-Kettering, OH	13.5	4.4	75	Austin-Round Rock-Georgetown, TX	7.2	6.7
26	Grand Rapids-Kentwood, MI	13.5	5.9	76	Lakeland-Winter Haven, FL	7.2	2.2
27	Boston-Cambridge-Newton, MA-NH	13.4	26.6	77	San Diego-Chula Vista-Carlsbad, CA	7.1	9.6
28	Salt Lake City, UT	13.2	6.6	78	Los Angeles-Long Beach-Anaheim, CA	7.1	37.5
29	Akron, OH	13.1	3.7	79	Palm Bay-Melbourne-Titusville, FL	7.0	1.7
30	Virginia Beach-Norfolk, VA-NC	13.1	9.5	80	Wichita, KS	6.8	1.8
31	Omaha-Council Bluffs, NE-IA	13.0	5.0	81	North Port-Sarasota-Bradenton, FL	6.7	2.3
32	Columbus, OH	13.0	11.3	82	Cape Coral-Fort Myers, FL	6.6	2.1
33	New York, NY-NJ-CT-PA	12.9	100.0	83	Provo-Orem, UT	6.5	1.8
34	Allentown-Bethlehem-Easton, PA-NJ	12.6	4.3	84	Deltona-Daytona Beach, FL	6.5	1.8
35	Philadelphia, PA-NJ-DE-MD	12.4	30.7	85	Colorado Springs, CO	6.3	1.9
36	Greenville-Anderson, SC	12.3	4.7	86	Charlotte-Concord-Gastonia, NC-SC	6.2	6.8
37	Louisville/Jefferson County, KY-IN	12.2	6.3	87	Atlanta-Sandy Springs-Alpharetta, GA	6.2	15.2
38	Augusta-Richmond County, GA-SC	11.8	3.0	88	Miami-Fort Lauderdale, FL	6.2	15.4
39	Indianapolis-Carmel-Anderson, IN	11.5	9.8	89	Phoenix-Mesa-Chandler, AZ	5.7	11.8
40	Cincinnati, OH-KY-IN	11.4	10.3	90	Washington, DC-VA-MD-WV	5.6	14.5
41	Tulsa, OK	11.1	4.6	91	Riverside-San Bernardino-Ontario, CA	5.6	10.6
42	Knoxville, TN	11.1	3.9	92	Cleveland-Elyria, OH	5.0	4.1
43	Milwaukee-Waukesha, WI	11.0	7.1	93	Bakersfield, CA	4.5	1.6
44	Chicago-Naperville-Elgin, IL-IN-WI	10.6	40.7	94	Richmond, VA	4.3	2.3
45	Columbia, SC	10.6	3.6	95	Ogden-Clearfield, UT	3.6	1.0
46	Hartford, CT	10.3	5.0	96	Las Vegas-Henderson-Paradise, NV	3.3	3.1
47	Worcester, MA-CT	10.3	3.9	97	Fresno, CA	2.6	1.1
48	Jacksonville, FL	10.1	6.5	98	Oxnard-Thousand Oaks-Ventura, CA	2.4	0.8
49	Tampa-St. Petersburg-Clearwater, FL	9.9	13.0	99	Stockton, CA	1.9	0.6
50	McAllen-Edinburg-Mission, TX	9.8	3.5	100	Poughkeepsie-Newburgh, NY		
					Average for Top 100 Metros	**10.8**	**8.9**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods and all underlying data in online Data Appendix.

Table L

BushMeds Medical Center Activities per Capita

(Smaller metros)

	Metro Areas	BushMeds per Capita	Aggregate BushMeds		Metro Areas	BushMeds per Capita	Aggregate BushMeds
1	Rochester, MN	100.0	9.1	51	Reading, PA	12.7	2.2
2	Ann Arbor, MI	62.9	9.4	52	Lake Charles, LA	12.7	1.1
3	Iowa City, IA	48.6	3.5	53	Cedar Rapids, IA	12.5	1.4
4	Charlottesville, VA	38.3	3.4	54	Wilmington, NC	12.4	1.5
5	Columbia, MO	31.0	2.6	55	Houma-Thibodaux, LA	12.3	1.0
6	Binghamton, NY	24.7	2.4	56	Amarillo, TX	12.3	1.3
7	Saginaw, MI	24.0	1.9	57	Topeka, KS	12.3	1.2
8	Gainesville, FL	23.8	3.2	58	Reno, NV	12.2	2.4
9	Tyler, TX	23.0	2.2	59	Medford, OR	12.1	1.1
10	Lexington-Fayette, KY	22.5	4.8	60	Gulfport-Biloxi, MS	12.1	2.1
11	Sioux Falls, SD	22.4	2.5	61	Canton-Massillon, OH	12.0	1.9
12	Florence, SC	22.0	1.8	62	Athens-Clarke County, GA	11.7	1.0
13	Duluth, MN-WI	20.8	2.4	63	Dover, DE	11.6	0.9
14	Springfield, IL	20.4	1.7	64	Chico, CA	11.6	1.0
15	Billings, MT	19.9	1.5	65	Utica-Rome, NY	11.4	1.3
16	Shreveport-Bossier City, LA	18.3	2.9	66	Portland-South Portland, ME	11.4	2.5
17	Champaign-Urbana, IL	18.3	1.7	67	Barnstable Town, MA	11.3	1.0
18	Springfield, MO	18.3	3.5	68	Lancaster, PA	11.3	2.5
19	Joplin, MO	18.2	1.3	69	Auburn-Opelika, AL	11.1	0.8
20	Jackson, TN	18.1	1.3	70	Huntsville, AL	11.1	2.2
21	Fort Wayne, IN	18.0	3.0	71	Rockford, IL	11.0	1.5
22	Fargo, ND-MN	17.3	1.7	72	Montgomery, AL	11.0	1.7
23	Muskegon, MI	17.0	1.2	73	Coeur d'Alene, ID	10.7	0.7
24	Eau Claire, WI	16.6	1.1	74	Atlantic City-Hammonton, NJ	10.7	1.1
25	Huntington-Ashland, WV-KY-OH	16.3	2.3	75	Chattanooga, TN-GA	10.7	2.5
26	Monroe, LA	16.2	1.3	76	Davenport-Moline-Rock Island, IA-IL	10.6	1.6
27	Green Bay, WI	16.1	2.1	77	Elkhart-Goshen, IN	10.6	0.9
28	Abilene, TX	16.0	1.1	78	Manchester-Nashua, NH	10.5	1.8
29	Lubbock, TX	15.8	2.1	79	Vallejo, CA	10.4	1.9
30	Tuscaloosa, AL	15.8	1.6	80	Racine, WI	10.3	0.8
31	Kalamazoo-Portage, MI	15.7	1.7	81	Spartanburg, SC	10.2	1.3
32	Peoria, IL	15.6	2.5	82	Corpus Christi, TX	10.2	1.8
33	Gainesville, GA	15.5	1.3	83	St. George, UT	10.0	0.7
34	Hagerstown-Martinsburg, MD-WV	15.3	1.8	84	York-Hanover, PA	10.0	1.8
35	Asheville, NC	15.3	2.9	85	Appleton, WI	9.9	1.0
36	Lynchburg, VA	15.2	1.6	86	Salisbury, MD-DE	9.9	1.7
37	Burlington, NC	14.4	1.0	87	Hickory-Lenoir-Morganton, NC	9.8	1.5
38	St. Cloud, MN	14.3	1.2	88	Lincoln, NE	9.8	1.3
39	Fort Smith, AR-OK	14.2	1.4	89	College Station-Bryan, TX	9.8	1.1
40	Roanoke, VA	14.1	1.8	90	Bowling Green, KY	9.6	0.7
41	Killeen-Temple, TX	14.0	2.7	91	Lafayette, LA	9.5	1.9
42	Johnson City, TN	13.7	1.1	92	Beaumont-Port Arthur, TX	9.3	1.5
43	Charleston, WV	13.5	1.4	93	Yakima, WA	9.3	1.0
44	Evansville, IN-KY	13.3	1.7	94	Lafayette-West Lafayette, IN	9.3	0.9
45	Erie, PA	13.2	1.4	95	South Bend-Mishawaka, IN-MI	9.2	1.2
46	Columbus, GA-AL	13.2	1.7	96	Fayetteville, NC	9.1	2.0
47	Savannah, GA	13.2	2.1	97	Anchorage, AK	9.1	1.5
48	Flint, MI	13.1	2.2	98	Norwich-New London, CT	9.1	1.0
49	Macon-Bibb County, GA	12.9	1.2	99	Boulder, CO	9.0	1.2
50	Terre Haute, IN	12.8	1.0	100	Pensacola-Ferry Pass-Brent, FL	8.3	1.7
					Average for Smaller Metros	**12.2**	**1.5**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods and all underlying data in online Data Appendix.

Table L (cont.)

BushMeds Quality-Adjusted Medical Center Activities per Capita

(Smaller metros)

	Metro Areas	BushMeds per Capita	Aggregate BushMeds
101	Mobile, AL	8.2	1.4
102	Kingsport-Bristol, TN-VA	8.1	1.0
103	Youngstown-Warren, OH-PA	8.1	1.7
104	Yuma, AZ	7.9	0.7
105	Brownsville-Harlingen, TX	7.8	1.3
106	Trenton-Princeton, NJ	7.8	1.2
107	Lansing-East Lansing, MI	7.6	1.7
108	Bend, OR	7.6	0.6
109	Hilton Head Island-Bluffton, SC	7.5	0.7
110	Fort Collins, CO	7.4	1.1
111	Tallahassee, FL	7.3	1.2
112	Midland, TX	7.2	0.5
113	Warner Robins, GA	7.1	0.5
114	Laredo, TX	7.0	0.8
115	Olympia-Lacey-Tumwater, WA	6.8	0.8
116	Myrtle Beach, SC-NC	6.8	1.4
117	Eugene-Springfield, OR	6.4	1.0
118	Naples-Marco Island, FL	6.3	1.0
119	Longview, TX	6.2	0.7
120	Burlington-South Burlington, VT	6.2	0.6
121	Modesto, CA	6.2	1.4
122	Visalia, CA	5.9	1.1
123	Las Cruces, NM	5.9	0.5
124	Fayetteville-Springdale-Rogers, AR	5.9	1.3
125	Prescott Valley-Prescott, AZ	5.7	0.6
126	Salem, OR	5.7	1.0
127	Kennewick-Richland, WA	5.4	0.7
128	Punta Gorda, FL	4.7	0.4
129	Bremerton-Silverdale, WA	4.7	0.5
130	Salinas, CA	4.3	0.7
131	Waco, TX	4.1	0.5
132	Kingston, NY	4.1	0.3
133	Jacksonville, NC	3.3	0.3
134	Bellingham, WA	3.1	0.3
135	Santa Rosa-Petaluma, CA	3.1	0.6
136	Santa Maria-Santa Barbara, CA	3.1	0.6
137	Merced, CA	3.0	0.3
138	El Centro, CA	2.9	0.2
139	Port St. Lucie, FL	2.9	0.6
140	Greeley, CO	2.9	0.4
141	Crestview-Fort Walton Beach, FL	2.5	0.3
142	Santa Cruz-Watsonville, CA	2.2	0.2
143	Clarksville, TN-KY	1.8	0.2
144	Lake Havasu City-Kingman, AZ	1.4	0.1
145	Redding, CA	1.1	0.1
146	San Luis Obispo-Paso Robles, CA	0.8	0.1
147	Panama City, FL	0.3	0.0
148	Yuba City, CA	0.3	0.0
149	Ocala, FL	0.2	0.0
150	Daphne-Fairhope-Foley, AL		
	Average for Smaller Metros	**12.2**	**1.5**

Source: Author's calculations based on medical center data from the American Hospital Association and *U.S. News & World Report* hospital rankings by specialty. See Appendix 1 for explanation of sources and methods and all underlying data in online Data Appendix.

Table M

Ranking of 100 Largest Metros for Innovation and Related Data

Innov Rank	Metro Areas	BushEds	BushEds per Capita	BushMeds	BushMeds per Capita	Univ Research Spend (% GDP)	Business R&D Spending (% GDP)	VC Invest per Capita	Life Sci Jobs per Capita
1	San Jose, CA	21.9	11.2	6.2	7.7	0.29%	20.4%	$ 13.7	35.9
2	New York, NY	79.9	4.0	100.0	12.9	0.20%	1.7%	$ 2.7	7.1
3	San Francisco, CA	39.5	8.5	17.4	9.2	0.36%	7.4%	$ 20.3	17.3
4	Boston, MA	115.5	23.6	26.6	13.4	0.87%	5.5%	$ 7.2	26.5
5	Seattle, WA	30.3	7.6	13.3	8.1	0.40%	7.5%	$ 2.0	7.5
6	Chicago, IL	35.6	3.7	40.7	10.6	0.14%	1.5%	$ 0.8	6.3
7	Dallas-Fort Worth, TX	17.1	2.2	25.7	8.2	0.14%	1.4%	$ 0.2	3.2
8	Houston, TX	39.4	5.5	27.3	9.4	0.37%	0.9%	$ 0.3	4.9
9	Austin, TX	10.1	4.3	6.7	7.2	0.33%	5.3%	$ 2.1	
10	San Diego, CA	22.7	6.9	9.6	7.1	0.51%	5.1%	$ 3.0	21.3
11	Los Angeles, CA	57.5	4.4	37.5	7.1	0.26%	1.6%	$ 1.8	6.9
12	Portland, OR	7.4	3.0	9.7	9.5	0.24%	5.1%		
13	Washington, DC	19.6	3.1	14.5	5.6	0.23%	1.3%	$ 0.8	12.6
14	Minneapolis-St. Paul, MN	24.4	6.6	11.9	8.0	0.35%	2.6%		12.2
15	Philadelphia, PA	45.9	7.4	30.7	12.4	0.42%	2.7%	$ 1.2	9.6
16	Atlanta, GA	18.0	2.9	15.2	6.2	0.34%	1.1%	$ 0.7	3.3
17	Denver, CO	10.4	3.5	9.0	7.4	0.22%	1.0%	$ 1.5	10.1
18	Detroit, MI	3.9	0.9	23.8	13.6	0.08%	6.7%		
19	Phoenix, AZ	20.3	4.1	11.8	5.7	0.18%	1.7%	$ 0.4	5.1
20	Boise City, ID	1.5	1.9	4.3	13.9	0.09%	7.0%		
21	Rochester, NY	7.2	6.6	6.8	15.8	0.62%	1.5%		
22	Albany, NY	1.1	1.2	6.7	18.7				
23	Pittsburgh, PA	32.6	13.9	14.6	15.6	0.66%	1.0%		8.5
24	Baltimore, MD	31.2	11.0	17.3	15.2	1.40%	1.3%		
25	St. Louis, MO-IL	7.9	2.8	16.6	14.6	0.35%	3.5%		
26	Milwaukee, WI	5.5	3.5	7.1	11.0	0.28%	2.1%		
27	Raleigh, NC	16.5	11.4	4.9	8.5	0.55%	4.1%	$ 1.1	17.3
28	Tucson, AZ	14.1	13.4	4.2	9.7	1.37%	3.2%		
29	Bridgeport-Stamford, CT	-	0.0	3.2	8.5		1.8%		
30	Cincinnati, OH-KY-IN	7.0	3.1	10.3	11.4	0.44%	2.6%		
31	Madison, WI	16.4	24.0	5.0	18.2	2.19%	3.4%		
32	Durham-Chapel Hill, NC	28.5	43.5	8.4	31.5	3.07%	8.1%		22.9
33	Oxnard-Thousand Oaks, CA	-	0.0	0.8	2.4		3.7%		
34	Miami, FL	5.6	0.9	15.4	6.2	0.10%	0.5%	$ 0.8	3.3
35	Provo, UT	10.6	15.2	1.8	6.5	0.12%	2.8%		
36	Palm Bay-Melbourne, FL	-	0.0	1.7	7.0		4.1%		
37	Las Vegas, NV	2.0	0.9	3.1	3.3	0.20%	0.5%		
38	Nashville, TN	8.7	4.3	7.3	9.2	0.38%			
39	Charlotte, NC-SC	3.3	1.2	6.8	6.2	0.02%	0.8%		
40	Kansas City, MO-KS	-	0.0	11.9	13.5	0.25%	1.9%		
41	San Antonio, TX	5.4	2.1	9.1	8.7	0.18%	0.4%		
42	Des Moines, IA	-	0.0	2.8	9.6		1.6%		
43	Charleston, SC	-	0.0	10.1	30.5	0.58%	1.3%		
44	Springfield, MA	5.8	8.3	2.6	9.2	2.07%			
45	Orlando, FL	7.1	2.6	9.0	8.4	0.14%	0.7%		
46	Salt Lake City, UT	10.7	8.5	6.6	13.2	0.41%	1.6%	$ 2.0	19.8
47	Indianapolis, IN	8.2	3.9	9.8	11.5		3.4%		9.4
48	Albuquerque, NM	13.3	14.4	3.7	9.7	0.53%	1.4%		
49	Providence, RI-MA	3.2	1.9	5.7	8.6	0.23%	1.7%		
50	Oklahoma City, OK	3.9	2.7	7.9	13.6	0.25%	0.4%		
	Average for Top 100 Metros	**10.5**	**4.6**	**8.9**	**10.8**	**0.47%**	**2.4%**	**$3.3**	**12.3**

See Appendix 1 for explanation of sources and methods.

Table M (cont.)

Ranking of 100 Largest Metros for Innovation and Related Data

Innov Rank	Metro Areas	BushEds	BushEds per Capita	BushMeds	BushMeds per Capita	Univ Research Spend (% GDP)	Business R&D Spending (% GDP)	VC Invest per Capita	Life Sci Jobs per Capita
51	Richmond, VA	5.4	4.1	2.3	4.3	0.24%	0.8%		
52	Honolulu, HI	2.8	2.8	3.2	8.2	0.53%			
53	Tulsa, OK	-	0.0	4.6	11.1				
54	Louisville/Jefferson County, KY-IN	4.6	3.6	6.3	12.2	0.24%			
55	Augusta, GA-SC	2.2	3.5	3.0	11.8				
56	Omaha-Council Bluffs, NE-IA	-	0.0	5.0	13.0	0.03%	0.6%		
57	Virginia Beach-Norfolk, VA-NC	-	0.0	9.5	13.1		0.5%		
58	Jacksonville, FL	-	0.0	6.5	10.1	0.31%	0.8%		
59	New Orleans, LA	3.0	2.4	7.0	13.6	0.19%			
60	Cleveland, OH	16.4	7.9	4.1	5.0	0.49%	1.2%		
61	Birmingham, AL	5.3	4.7	8.2	18.6	0.70%			
62	Greensboro-High Point, NC	0.6	0.8	3.0	9.7	0.07%	1.8%		
63	Columbia, SC	3.9	4.7	3.6	10.6	0.53%			
64	Little Rock, AR	2.3	3.1	5.3	17.5	0.40%			
65	Knoxville, TN	4.5	5.0	3.9	11.1	1.39%			
66	Jackson, MS	-	0.0	4.4	18.2				
67	Winston-Salem, NC	4.6	6.8	2.3	8.2	0.41%	1.2%		
68	Memphis, TN-MS-AR	1.3	1.0	5.3	9.7	0.50%	0.5%		
69	Baton Rouge, LA	9.7	11.1	4.8	13.9	0.72%			
70	Columbus, OH	17.8	8.3	11.2	13.0	0.83%	1.4%		
71	Colorado Springs, CO	-	0.0	1.9	6.3		1.1%		
72	Dayton, OH	1.7	2.1	4.4	13.5	0.35%	1.4%		
73	Grand Rapids, MI	-	0.0	5.9	13.5		1.2%		
74	Tampa-St. Petersburg, FL	12.2	3.8	13.0	9.9	0.38%	0.9%		
75	Wichita, KS	3.1	4.8	1.8	6.8	0.18%	1.5%		
76	Toledo, OH	4.0	6.2	4.9	18.6	0.14%			
77	Akron, OH	4.3	6.1	3.7	13.1	0.16%	1.9%		
78	Sacramento, CA	12.8	5.3	7.5	7.8	0.45%	1.7%		
79	El Paso, TX	1.4	1.6	3.2	9.5	0.22%			
80	Riverside-San Bernardino, CA	3.6	0.8	10.6	5.6		0.4%		
81	Buffalo, NY	4.1	3.6	6.5	14.3		1.0%		
82	Allentown-Bethlehem, PA-NJ	-	0.0	4.3	12.6	0.09%	1.2%		
83	Spokane, WA	-	0.0	3.2	13.7		1.1%		
84	Greenville-Anderson, SC	3.6	3.9	4.7	12.3	0.17%	1.1%		
85	Hartford, CT	5.3	4.4	5.0	10.3	0.25%	0.8%		
86	Syracuse, NY	0.7	1.1	4.1	15.5		1.6%		
87	Fresno, CA	-	0.0	1.1	2.6				
88	Bakersfield, CA	-	0.0	1.6	4.5		0.6%		
89	Stockton, CA	-	0.0	0.6	1.9				
90	Cape Coral-Fort Myers, FL	-	0.0	2.1	6.6				
91	Deltona-Daytona Beach, FL	-	0.0	1.8	6.5	0.07%			
92	Harrisburg-Carlisle, PA	-	0.0	3.9	16.5				
93	Lakeland-Winter Haven, FL	-	0.0	2.2	7.2				
94	McAllen-Edinburg, TX	0.8	1.0	3.5	9.8	0.19%			
95	New Haven, CT	15.3	17.7	6.6	19.0	2.03%	1.9%		
96	North Port-Sarasota, FL	-	0.0	2.3	6.7				
97	Ogden, UT	-	0.0	1.0	3.6		2.1%		
98	Poughkeepsie, NY	-	0.0		0.0				
99	Scranton--Wilkes-Barre, PA	-	0.0	3.6	15.9				
100	Worcester, MA-CT	13.1	13.3	3.9	10.3		2.3%		
	Average for Top 100 Metros	**10.5**	**4.6**	**8.9**	**10.8**	**0.47%**	**2.4%**	**$3.3**	**12.3**

See Appendix 1 for explanation of sources and methods.

Table N

Innovation Districts: Neighborhood Prosperity and Opportunity

	Innovation Districts	Composite Score	Pop. Growth 2010-20	Educational Attainment: % Adj Assoc/ Some College	Educational Attainment: % Bachelors + 2020	Educational Attainment: Chg in % Bach+ 2010-20	% Creative Sectors	% Chg Median Household Income 2010-20	Commute: Average Commuting Time (mins)	Commute: Chg in Avg Commuting Time (mins) 2010-20
			vs. USA							
1	Virginia Tech Corp Research Ctr	**0.81**	0.96	1.20	1.91	1.15	1.48	1.39	0.56	0.95
2	Atlanta Tech Square	**0.69**	0.89	1.49	2.50	1.11	1.49	1.18	0.73	0.94
3	Capitol City Innovation (Austin)	**0.60**	1.19	1.22	2.03	1.01	1.32	1.52	0.51	1.03
4	South Lake Union (Seattle)	**0.50**	1.25	1.67	2.26	1.03	1.29	1.34	0.89	1.06
5	uCity Square (Philadelphia)	**0.45**	0.97	1.04	1.87	1.09	1.51	1.22	0.80	0.93
6	Cortex Innov Community (St. Louis)	**0.38**	0.94	1.05	1.81	1.05	1.35	1.16	0.70	0.94
7	Auburn Res & Tech Fdn	**0.34**	1.26	1.42	1.35	0.97	1.36	0.93	0.63	0.89
8	Cincinnati Innovation District	**0.33**	1.02	1.06	1.44	1.04	1.27	1.24	0.70	0.94
9	Kendall Square (Cambridge)	**0.31**	1.18	1.14	2.20	1.02	1.55	1.23	0.86	1.05
10	Lincoln Nebraska Innov Campus	**0.21**	0.98	1.32	0.81	0.99	1.12	1.44	0.58	0.88
11	Houston Innov Corridor	**0.15**	1.02	1.24	1.81	1.01	1.26	1.04	0.84	0.94
12	Longwood Medical Area (Boston)	**0.11**	0.98	0.91	1.18	1.03	1.54	1.07	0.47	1.07
13	University of Utah Research Park	**0.10**	0.97	1.63	2.12	0.98	1.38	1.03	0.65	1.05
14	Towerside Innov Dist (Minneapolis)	**0.09**	1.05	1.13	1.96	1.06	1.32	1.13	0.82	1.01
15	Research Park (Champaign)	**0.03**	0.68	1.45	2.17	0.96	1.55	0.87	0.51	0.89
16	Pittsburgh Innovation District	**0.03**	0.92	1.11	1.72	1.02	1.44	1.07	0.75	1.08
17	Innov Hub at Res Park (Lubbock)	**0.02**	1.03	1.07	1.12	1.01	1.15	1.05	0.51	0.91
18	Cleveland Health-Tech Corridor	**0.01**	0.99	0.96	1.11	1.00	1.39	1.06	0.77	0.94
19	Centennial Campus NC State	**-0.03**	1.04	1.08	1.40	1.04	1.21	1.06	0.81	0.91
20	Purdue Discovery District	**-0.04**	0.65	1.11	1.97	1.06	1.35	1.08	0.63	1.00
21	PHX Core (Phoenix)	**-0.04**	1.05	0.89	1.16	1.12	1.12	1.00	0.80	0.93
22	University Research Park (Madison)	**-0.05**	0.96	1.42	1.86	0.97	1.26	0.92	0.67	0.94
23	Research Triangle Park (NC)	**-0.07**	1.45	1.08	1.98	0.98	1.01	1.09	0.86	1.06
24	Fitzsimons Innov Commty (Denver)	**-0.13**	1.02	0.64	0.43	1.00	0.98	1.71	0.74	0.97
25	Innovation Quarter (Wake Forest)	**-0.13**	1.34	0.82	1.02	1.04	0.00	1.27	na	na
26	KU Innovation Park	**-0.21**	0.93	1.41	0.00	0.95	1.29	1.25	0.64	0.96
27	Coldstream Res Campus (Lexington)	**-0.23**	1.12	1.01	0.77	0.99	0.95	0.88	0.69	0.88
28	Rensselaer Tech Park (Albany)	**-0.31**	0.99	1.06	1.22	1.04	1.04	0.98	0.78	1.00
29	16 Tech (Indianapolis)	**-0.33**	1.05	0.78	0.54	0.99	1.06	1.01	0.77	0.91
30	ASU Research Park	**-0.38**	0.94	1.52	1.51	0.94	1.14	0.82	0.84	0.98
31	Gainesville Innovation District	**-0.46**	0.93	1.15	1.57	0.77	1.43	0.89	0.58	1.06
32	UH Tech (Houston)	**-0.52**	0.85	0.73	0.82	1.04	0.92	0.87	0.85	0.91
33	Pegasus Park (Dallas)	**-0.53**	0.92	0.87	0.94	1.01	0.55	1.38	0.88	1.01
34	Tech Parks Arizona (Tucson)	**-0.65**	0.82	0.72	0.40	0.99	1.01	0.91	0.78	0.92
35	Uni Tech Park at IIT (Chicago)	**-0.81**	1.02	0.94	0.94	1.03	1.25	0.95	1.09	1.22
36	Discovery Dist (College Park MD)	**-1.08**	0.92	0.77	1.17	0.95	1.04	0.87	1.26	1.06
	Average for 36 Districts	**-0.02**	**1.01**	**1.11**	**1.46**	**1.01**	**1.24**	**1.11**	**0.74**	**0.98**

Table O
Innovation Districts: Housing and Neighborhood Stability

	Innovation Districts	Composite Score	Housing: % Incr in Units	Housing: % Built since 2010	Housing: % Built since 2000	Housing: Median Home Val	Housing: Median Rent	Housing: % Chg Rent	Black + Hispanic Pop Share: B+H Pop Share 2020	Black + Hispanic Pop Share: % chg B+H Pop Share 2010-20
			vs. MSA							
1	Rensselaer Tech Park (Albany)	**1.56**	0.87	8.17	4.49	na	1.57	0.90	1.05	1.02
2	Atlanta Tech Square	**1.41**	1.55	6.09	1.53	1.67	0.76	1.08	0.91	1.02
3	Pegasus Park (Dallas)	**1.22**	1.38	1.86	0.79	1.15	0.87	1.01	1.51	1.40
4	Auburn Res & Tech Fdn	**0.80**	1.10	2.07	1.54	1.02	0.94	0.70	1.08	0.92
5	University Research Park (Madison)	**0.49**	0.82	3.66	2.40	na	1.00	0.95	1.57	1.01
6	Coldstream Res Campus (Lexington)	**0.47**	0.98	2.47	2.33	1.02	1.11	1.00	3.00	1.01
7	Lincoln Nebraska Innov Campus	**0.45**	0.96	1.16	1.33	0.49	0.73	0.70	1.84	1.05
8	Centennial Campus NC State	**0.21**	0.77	2.39	1.41	na	0.89	1.05	0.74	1.10
9	Virginia Tech Corp Res Ctr	**0.18**	1.01	2.21	2.01	1.08	0.74	1.07	1.14	1.02
10	Fitzsimons Innov Commty (Denver)	**0.15**	0.88	1.69	1.20	0.61	0.81	0.82	2.53	1.03
11	Cleveland Health-Tech Corridor	**0.14**	1.00	3.13	2.09	0.91	1.05	1.16	2.06	0.93
12	16 Tech (Indianapolis)	**0.07**	0.82	2.01	1.38	na	0.97	0.98	3.15	0.96
13	Capitol City Innov (Austin)	**0.04**	0.86	0.96	1.25	2.10	0.98	0.97	0.75	1.00
14	Innov Hub at Res Park (Lubbock)	**0.02**	0.90	0.95	1.54	1.20	1.06	1.05	0.94	1.05
15	Purdue Discovery District	**0.01**	0.99	1.84	0.63	0.73	0.99	1.14	0.63	1.03
16	Discovery Dist (College Park MD)	**-0.11**	0.85	na	na	na	na	na	1.23	1.20
17	Pittsburgh Innovation District	**-0.15**	0.92	1.71	1.32	1.49	1.30	1.01	1.65	0.96
18	Longwood Medical Area (Boston)	**-0.16**	0.90	1.91	1.64	0.71	0.68	0.95	1.28	0.89
19	Research Park (Champaign)	**-0.16**	1.02	0.96	0.56	0.75	1.03	1.02	0.79	1.03
20	UH Tech (Houston)	**-0.20**	0.75	1.65	1.11	na	0.81	1.03	1.48	0.95
21	Uni Tech Park at IIT (Chicago)	**-0.24**	0.88	1.78	2.40	0.90	0.82	1.23	1.60	0.91
22	ASU Research Park	**-0.25**	0.76	1.26	0.66	1.36	1.23	0.97	0.49	1.01
23	Cincinnati Innovation District	**-0.30**	0.80	1.88	0.86	1.02	0.96	1.07	2.41	0.94
24	Towerside Innov Dist (Minneapolis)	**-0.41**	0.97	0.00	0.55	1.07	0.98	1.05	0.90	1.01
25	University of Utah Research Park	**-0.43**	0.88	0.22	0.74	1.83	0.97	1.02	0.36	1.02
26	Cortex Dinnov Commty (St. Louis)	**-0.44**	1.03	0.00	0.31	1.65	1.05	1.06	1.63	0.96
27	Tech Parks Arizona (Tucson)	**-0.48**	0.83	0.52	0.96	0.57	0.87	1.08	1.83	0.95
28	Gainesville Innovation District	**-0.52**	0.71	0.19	0.26	0.62	0.96	0.98	0.70	0.98
29	Research Triangle Park (NC)	**-0.52**	0.77	na	0.85	1.64	1.11	1.03	0.73	0.98
30	KU Innovation Park	**-0.56**	0.94	1.40	0.69	1.05	1.00	1.38	1.28	1.04
31	Houston Innovation Corridor	**-0.59**	0.83	1.01	0.41	2.59	1.38	1.12	0.89	0.92
32	Kendall Square (Cambridge)	**-0.30**	1.23	1.90	0.97	1.47	1.53	1.32	1.15	1.02
33	Innovation Quarter (Wake Forest)	**-0.62**	0.62	2.21	1.19	1.05	1.03	1.26	1.93	0.92
34	PHX Core (Phoenix)	**-0.74**	0.93	1.07	0.33	1.00	0.90	1.20	1.20	0.83
35	uCity Square (Philadelphia)	**-0.74**	0.97	0.00	0.36	1.69	0.98	1.27	1.24	0.99
36	South Lake Union (Seattle)	**-0.94**	1.08	na	0.14	0.56	0.33	1.40	0.56	1.00
	Average for 36 Districts		**0.93**	**2.01**	**1.21**	**1.17**	**0.98**	**1.06**	**1.34**	**1.00**

Table P

Community & Technical College Outcomes: 100 Largest Metros

	Metro Area	Avg z-score		Metro Area	Avg z-score
1	Provo-Orem, UT	2.37	51	Grand Rapids-Kentwood, MI	-0.19
2	Oxnard-Thousand Oaks-Ventura, CA	1.90	52	Houston-The Woodlands-Sugar Land, TX	-0.20
3	San Jose-Sunnyvale-Santa Clara, CA	1.55	53	Pittsburgh, PA	-0.20
4	Sacramento-Roseville-Folsom, CA	1.51	54	Scranton--Wilkes-Barre, PA	-0.22
5	San Francisco-Oakland-Berkeley, CA	1.08	55	Tulsa, OK	-0.24
6	Los Angeles-Long Beach-Anaheim, CA	1.04	56	Milwaukee-Waukesha, WI	-0.26
7	San Diego-Chula Vista-Carlsbad, CA	1.04	57	Greenville-Anderson, SC	-0.26
8	Des Moines-West Des Moines, IA	1.02	58	Columbia, SC	-0.28
9	Greensboro-High Point, NC	0.74	59	Dallas-Fort Worth-Arlington, TX	-0.28
10	Fresno, CA	0.72	60	Indianapolis-Carmel-Anderson, IN	-0.29
11	Phoenix-Mesa-Chandler, AZ	0.64	61	Richmond, VA	-0.29
12	Madison, WI	0.53	62	New Haven-Milford, CT	-0.33
13	San Antonio-New Braunfels, TX	0.51	63	Winston-Salem, NC	-0.33
14	Salt Lake City, UT	0.51	64	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	-0.35
15	El Paso, TX	0.50	65	Hartford-East Hartford-Middletown, CT	-0.36
16	Albuquerque, NM	0.47	66	Durham-Chapel Hill, NC	-0.39
17	Dayton-Kettering, OH	0.47	67	Knoxville, TN	-0.40
18	Honolulu, HI	0.45	68	Charlotte-Concord-Gastonia, NC-SC	-0.41
19	Albany-Schenectady-Troy, NY	0.45	69	Providence-Warwick, RI-MA	-0.41
20	Jackson, MS	0.37	70	Seattle-Tacoma-Bellevue, WA	-0.42
21	Syracuse, NY	0.35	71	Birmingham-Hoover, AL	-0.44
22	Portland-Vancouver-Hillsboro, OR-WA	0.29	72	Bakersfield, CA	-0.46
23	Minneapolis-St. Paul-Bloomington, MN-WI	0.28	73	Atlanta-Sandy Springs-Alpharetta, GA	-0.46
24	Tampa-St. Petersburg-Clearwater, FL	0.27	74	Nashville-Davidson--Murfreesboro--Franklin, TN	-0.47
25	Harrisburg-Carlisle, PA	0.27	75	New Orleans-Metairie, LA	-0.51
26	Riverside-San Bernardino-Ontario, CA	0.27	76	Palm Bay-Melbourne-Titusville, FL	-0.52
27	Buffalo-Cheektowaga, NY	0.26	77	Little Rock-North Little Rock-Conway, AR	-0.57
28	Oklahoma City, OK	0.25	78	Miami-Fort Lauderdale-Pompano Beach, FL	-0.59
29	Poughkeepsie-Newburgh-Middletown, NY	0.23	79	Boston-Cambridge-Newton, MA-NH	-0.60
30	Allentown-Bethlehem-Easton, PA-NJ	0.23	80	Louisville/Jefferson County, KY-IN	-0.61
31	Omaha-Council Bluffs, NE-IA	0.22	81	Baton Rouge, LA	-0.64
32	Springfield, MA	0.21	82	Austin-Round Rock-Georgetown, TX	-0.67
33	Orlando-Kissimmee-Sanford, FL	0.21	83	New York-Newark-Jersey City, NY-NJ-PA	-0.67
34	Rochester, NY	0.20	84	Cincinnati, OH-KY-IN	-0.68
35	Charleston-North Charleston, SC	0.20	85	Memphis, TN-MS-AR	-0.69
36	Wichita, KS	0.18	86	Bridgeport-Stamford-Norwalk, CT	-0.72
37	Raleigh-Cary, NC	0.18	87	Detroit-Warren-Dearborn, MI	-0.74
38	Toledo, OH	0.12	88	Virginia Beach-Norfolk-Newport News, VA-NC	-0.74
39	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.07	89	North Port-Sarasota-Bradenton, FL	-0.84
40	Chicago-Naperville-Elgin, IL-IN-WI	0.07	90	Augusta-Richmond County, GA-SC	-0.87
41	Tucson, AZ	0.02	91	Cleveland-Elyria, OH	-0.89
42	Worcester, MA-CT	0.00	92	Akron, OH	-0.99
43	Stockton, CA	-0.01	93	Las Vegas-Henderson-Paradise, NV	-0.99
44	McAllen-Edinburg-Mission, TX	-0.04	94	Jacksonville, FL	-1.19
45	Denver-Aurora-Lakewood, CO	-0.06	95	Colorado Springs, CO	-1.85
46	Columbus, OH	-0.09	96	Boise City, ID	-2.00
47	St. Louis, MO-IL	-0.11	97	Deltona-Daytona Beach-Ormond Beach, FL	-2.25
48	Kansas City, MO-KS	-0.13	98	Lakeland-Winter Haven, FL	-2.53
49	Baltimore-Columbia-Towson, MD	-0.15	99	Ogden-Clearfield, UT	-2.54
50	Spokane-Spokane Valley, WA	-0.17	100	Cape Coral-Fort Myers, FL	-2.74
				Average, Top 100 Metros	**0.00**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2021 five-year estimates) and the National Center for Education Statistics (IPEDS data). See all underlying data in the online data appendix.

Table Q

Community & Technical College Enrollment Rates: 100 Largest Metros

(% of total metro-area population)

	Metro Area	Enroll Rate		Metro Area	Enroll Rate
1	Fresno, CA	6.9%	51	Winston-Salem, NC	2.3%
2	Sacramento-Roseville-Folsom, CA	6.3%	52	Buffalo-Cheektowaga, NY	2.3%
3	Oxnard-Thousand Oaks-Ventura, CA	6.0%	53	Albany-Schenectady-Troy, NY	2.3%
4	Provo-Orem, UT	5.9%	54	Minneapolis-St. Paul-Bloomington, MN-WI	2.2%
5	San Jose-Sunnyvale-Santa Clara, CA	5.1%	55	Washington-Arlington-Alexandria, DC-VA-MD-WV	2.2%
6	San Diego-Chula Vista-Carlsbad, CA	5.1%	56	Raleigh-Cary, NC	2.2%
7	Los Angeles-Long Beach-Anaheim, CA	5.1%	57	Richmond, VA	2.2%
8	Jackson, MS	4.7%	58	Orlando-Kissimmee-Sanford, FL	2.1%
9	San Francisco-Oakland-Berkeley, CA	4.7%	59	Detroit-Warren-Dearborn, MI	2.1%
10	Des Moines-West Des Moines, IA	4.7%	60	New York-Newark-Jersey City, NY-NJ-PA	2.1%
11	Bakersfield, CA	4.4%	61	Palm Bay-Melbourne-Titusville, FL	2.1%
12	Indianapolis-Carmel-Anderson, IN	4.2%	62	Charlotte-Concord-Gastonia, NC-SC	2.0%
13	San Antonio-New Braunfels, TX	4.2%	63	Hartford-East Hartford-Middletown, CT	2.0%
14	Albuquerque, NM	4.0%	64	Rochester, NY	1.9%
15	El Paso, TX	4.0%	65	Miami-Fort Lauderdale-Pompano Beach, FL	1.9%
16	Riverside-San Bernardino-Ontario, CA	3.9%	66	Memphis, TN-MS-AR	1.9%
17	Harrisburg-Carlisle, PA	3.8%	67	New Haven-Milford, CT	1.9%
18	Phoenix-Mesa-Chandler, AZ	3.7%	68	Grand Rapids-Kentwood, MI	1.9%
19	Honolulu, HI	3.6%	69	Colorado Springs, CO	1.8%
20	Charleston-North Charleston, SC	3.5%	70	Greenville-Anderson, SC	1.8%
21	McAllen-Edinburg-Mission, TX	3.5%	71	Syracuse, NY	1.8%
22	Tucson, AZ	3.4%	72	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.8%
23	Oklahoma City, OK	3.2%	73	Milwaukee-Waukesha, WI	1.8%
24	Dayton-Kettering, OH	3.2%	74	Las Vegas-Henderson-Paradise, NV	1.7%
25	Stockton, CA	3.2%	75	Pittsburgh, PA	1.7%
26	Salt Lake City, UT	3.2%	76	Boston-Cambridge-Newton, MA-NH	1.7%
27	Wichita, KS	3.1%	77	Deltona-Daytona Beach-Ormond Beach, FL	1.7%
28	Houston-The Woodlands-Sugar Land, TX	3.1%	78	Austin-Round Rock-Georgetown, TX	1.7%
29	Chicago-Naperville-Elgin, IL-IN-WI	3.1%	79	Nashville-Davidson--Murfreesboro--Franklin, TN	1.7%
30	Omaha-Council Bluffs, NE-IA	3.1%	80	Atlanta-Sandy Springs-Alpharetta, GA	1.7%
31	Allentown-Bethlehem-Easton, PA-NJ	3.0%	81	Providence-Warwick, RI-MA	1.6%
32	Denver-Aurora-Lakewood, CO	3.0%	82	Birmingham-Hoover, AL	1.6%
33	Columbus, OH	2.9%	83	Columbia, SC	1.6%
34	Tampa-St. Petersburg-Clearwater, FL	2.9%	84	Baton Rouge, LA	1.5%
35	Worcester, MA-CT	2.8%	85	Bridgeport-Stamford-Norwalk, CT	1.5%
36	Portland-Vancouver-Hillsboro, OR-WA	2.8%	86	Knoxville, TN	1.5%
37	Boise City, ID	2.7%	87	Jacksonville, FL	1.5%
38	Springfield, MA	2.7%	88	Durham-Chapel Hill, NC	1.4%
39	Greensboro-High Point, NC	2.6%	89	Louisville/Jefferson County, KY-IN	1.4%
40	Baltimore-Columbia-Towson, MD	2.6%	90	Scranton--Wilkes-Barre, PA	1.3%
41	Seattle-Tacoma-Bellevue, WA	2.6%	91	Lakeland-Winter Haven, FL	1.2%
42	Poughkeepsie-Newburgh-Middletown, NY	2.5%	92	Little Rock-North Little Rock-Conway, AR	1.2%
43	Virginia Beach-Norfolk-Newport News, VA-NC	2.5%	93	Spokane-Spokane Valley, WA	1.2%
44	Madison, WI	2.5%	94	Augusta-Richmond County, GA-SC	1.1%
45	Tulsa, OK	2.5%	95	Cincinnati, OH-KY-IN	0.9%
46	St. Louis, MO-IL	2.4%	96	Cleveland-Elyria, OH	0.5%
47	New Orleans-Metairie, LA	2.4%	97	Akron, OH	0.1%
48	Toledo, OH	2.4%	98	North Port-Sarasota-Bradenton, FL	0.1%
49	Dallas-Fort Worth-Arlington, TX	2.4%	99	Ogden-Clearfield, UT	na
50	Kansas City, MO-KS	2.4%	100	Cape Coral-Fort Myers, FL	na
				Average, Top 100 Metros	**2.7%**

Source: Author’s calculations based on data from the National Center for Education Statistics (IPEDS data). See all underlying data in the online data appendix.

Table R

Associate Degree Attainment Rate: 100 Largest Metros

(% of residents 25+ without a bachelor's degree)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	Albany-Schenectady-Troy, NY	19.9%	51	Detroit-Warren-Dearborn, MI	13.5%
2	Madison, WI	19.4%	52	Allentown-Bethlehem-Easton, PA-NJ	13.5%
3	Rochester, NY	18.8%	53	Tucson, AZ	13.4%
4	Syracuse, NY	18.7%	54	Greensboro-High Point, NC	13.3%
5	Buffalo-Cheektowaga, NY	18.6%	55	Albuquerque, NM	13.3%
6	Minneapolis-St. Paul-Bloomington, MN-WI	18.5%	56	Harrisburg-Carlisle, PA	13.1%
7	Spokane-Spokane Valley, WA	18.5%	57	Winston-Salem, NC	13.0%
8	Colorado Springs, CO	18.4%	58	Phoenix-Mesa-Chandler, AZ	13.0%
9	Palm Bay-Melbourne-Titusville, FL	18.3%	59	Augusta-Richmond County, GA-SC	13.0%
10	Provo-Orem, UT	17.7%	60	Tulsa, OK	12.9%
11	Raleigh-Cary, NC	17.3%	61	Cincinnati, OH-KY-IN	12.9%
12	Orlando-Kissimmee-Sanford, FL	17.2%	62	Providence-Warwick, RI-MA	12.8%
13	Honolulu, HI	16.9%	63	Cleveland-Elyria, OH	12.8%
14	Seattle-Tacoma-Bellevue, WA	16.7%	64	Cape Coral-Fort Myers, FL	12.8%
15	Des Moines-West Des Moines, IA	16.6%	65	Atlanta-Sandy Springs-Alpharetta, GA	12.8%
16	Pittsburgh, PA	16.0%	66	Birmingham-Hoover, AL	12.7%
17	Poughkeepsie-Newburgh-Middletown, NY	15.9%	67	Wichita, KS	12.6%
18	Deltona-Daytona Beach-Ormond Beach, FL	15.4%	68	Kansas City, MO-KS	12.5%
19	Oxnard-Thousand Oaks-Ventura, CA	15.3%	69	Indianapolis-Carmel-Anderson, IN	12.4%
20	Sacramento-Roseville-Folsom, CA	15.2%	70	Louisville/Jefferson County, KY-IN	12.4%
21	Virginia Beach-Norfolk-Newport News, VA-NC	15.0%	71	Richmond, VA	12.3%
22	Portland-Vancouver-Hillsboro, OR-WA	15.0%	72	Washington-Arlington-Alexandria, DC-VA-MD-WV	12.3%
23	Charleston-North Charleston, SC	15.0%	73	Akron, OH	12.2%
24	Ogden-Clearfield, UT	15.0%	74	Lakeland-Winter Haven, FL	12.0%
25	Omaha-Council Bluffs, NE-IA	14.7%	75	Bridgeport-Stamford-Norwalk, CT	12.0%
26	Charlotte-Concord-Gastonia, NC-SC	14.7%	76	Columbus, OH	12.0%
27	Greenville-Anderson, SC	14.7%	77	Knoxville, TN	12.0%
28	Jacksonville, FL	14.7%	78	Chicago-Naperville-Elgin, IL-IN-WI	11.9%
29	Durham-Chapel Hill, NC	14.6%	79	Austin-Round Rock-Georgetown, TX	11.8%
30	Salt Lake City, UT	14.5%	80	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	11.8%
31	Hartford-East Hartford-Middletown, CT	14.4%	81	Little Rock-North Little Rock-Conway, AR	11.7%
32	San Jose-Sunnyvale-Santa Clara, CA	14.3%	82	El Paso, TX	11.7%
33	Tampa-St. Petersburg-Clearwater, FL	14.3%	83	Fresno, CA	11.7%
34	Grand Rapids-Kentwood, MI	14.3%	84	Nashville-Davidson--Murfreesboro--Franklin, TN	11.7%
35	Dayton-Kettering, OH	14.3%	85	Stockton, CA	11.6%
36	Springfield, MA	14.3%	86	Oklahoma City, OK	11.6%
37	Toledo, OH	14.2%	87	New York-Newark-Jersey City, NY-NJ-PA	11.6%
38	Miami-Fort Lauderdale-Pompano Beach, FL	14.2%	88	Baltimore-Columbia-Towson, MD	11.5%
39	Jackson, MS	14.2%	89	New Haven-Milford, CT	11.4%
40	St. Louis, MO-IL	14.1%	90	San Antonio-New Braunfels, TX	11.3%
41	Worcester, MA-CT	14.1%	91	Los Angeles-Long Beach-Anaheim, CA	11.2%
42	Boston-Cambridge-Newton, MA-NH	14.0%	92	Dallas-Fort Worth-Arlington, TX	11.2%
43	Denver-Aurora-Lakewood, CO	13.9%	93	Houston-The Woodlands-Sugar Land, TX	11.2%
44	San Diego-Chula Vista-Carlsbad, CA	13.8%	94	Riverside-San Bernardino-Ontario, CA	10.9%
45	Boise City, ID	13.8%	95	Las Vegas-Henderson-Paradise, NV	10.8%
46	Columbia, SC	13.7%	96	Memphis, TN-MS-AR	10.5%
47	North Port-Sarasota-Bradenton, FL	13.7%	97	Bakersfield, CA	9.4%
48	Scranton--Wilkes-Barre, PA	13.6%	98	New Orleans-Metairie, LA	9.2%
49	Milwaukee-Waukesha, WI	13.6%	99	Baton Rouge, LA	8.9%
50	San Francisco-Oakland-Berkeley, CA	13.6%	100	McAllen-Edinburg-Mission, TX	6.2%
				Average, Top 100 Metros	**13.7%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2021 five-year estimates). See all underlying data in the online data appendix.

Table S

Bachelor's Degree Attainment Rates: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	San Jose-Sunnyvale-Santa Clara, CA	52.5%	51	Poughkeepsie-Newburgh-Middletown, NY	33.4%
2	Washington-Arlington-Alexandria, DC-VA-MD-WV	51.7%	52	Buffalo-Cheektowaga, NY	33.3%
3	San Francisco-Oakland-Berkeley, CA	50.7%	53	Springfield, MA	33.2%
4	Boston-Cambridge-Newton, MA-NH	48.9%	54	Boise City, ID	33.2%
5	Bridgeport-Stamford-Norwalk, CT	48.9%	55	Orlando-Kissimmee-Sanford, FL	33.1%
6	Raleigh-Cary, NC	47.8%	56	Miami-Fort Lauderdale-Pompano Beach, FL	33.0%
7	Madison, WI	47.1%	57	Albuquerque, NM	33.0%
8	Durham-Chapel Hill, NC	46.4%	58	Providence-Warwick, RI-MA	33.0%
9	Austin-Round Rock-Georgetown, TX	46.0%	59	Columbia, SC	33.0%
10	Denver-Aurora-Lakewood, CO	44.7%	60	Virginia Beach-Norfolk-Newport News, VA-NC	32.9%
11	Seattle-Tacoma-Bellevue, WA	43.6%	61	Birmingham-Hoover, AL	32.3%
12	Minneapolis-St. Paul-Bloomington, MN-WI	42.7%	62	Detroit-Warren-Dearborn, MI	32.2%
13	New York-Newark-Jersey City, NY-NJ-PA	41.4%	63	Phoenix-Mesa-Chandler, AZ	32.2%
14	Baltimore-Columbia-Towson, MD	41.0%	64	Syracuse, NY	32.2%
15	Provo-Orem, UT	40.7%	65	Akron, OH	32.1%
16	Portland-Vancouver-Hillsboro, OR-WA	40.4%	66	Jacksonville, FL	32.1%
17	Hartford-East Hartford-Middletown, CT	39.6%	67	Cleveland-Elyria, OH	31.9%
18	Atlanta-Sandy Springs-Alpharetta, GA	39.5%	68	Ogden-Clearfield, UT	31.9%
19	San Diego-Chula Vista-Carlsbad, CA	39.5%	69	Oklahoma City, OK	31.5%
20	Chicago-Naperville-Elgin, IL-IN-WI	39.0%	70	Little Rock-North Little Rock-Conway, AR	31.4%
21	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	38.7%	71	Tampa-St. Petersburg-Clearwater, FL	31.2%
22	Albany-Schenectady-Troy, NY	38.6%	72	Jackson, MS	31.1%
23	Colorado Springs, CO	38.6%	73	New Orleans-Metairie, LA	31.1%
24	Richmond, VA	38.0%	74	Wichita, KS	31.0%
25	Kansas City, MO-KS	37.5%	75	Greenville-Anderson, SC	30.9%
26	Columbus, OH	37.3%	76	Palm Bay-Melbourne-Titusville, FL	30.9%
27	Nashville-Davidson--Murfreesboro--Franklin, TN	37.3%	77	Spokane-Spokane Valley, WA	30.7%
28	Des Moines-West Des Moines, IA	37.1%	78	Allentown-Bethlehem-Easton, PA-NJ	30.6%
29	Omaha-Council Bluffs, NE-IA	37.0%	79	Knoxville, TN	30.4%
30	Charleston-North Charleston, SC	36.5%	80	Louisville/Jefferson County, KY-IN	30.1%
31	Milwaukee-Waukesha, WI	36.1%	81	Greensboro-High Point, NC	30.0%
32	New Haven-Milford, CT	36.0%	82	Dayton-Kettering, OH	29.9%
33	Dallas-Fort Worth-Arlington, TX	36.0%	83	Memphis, TN-MS-AR	28.8%
34	Pittsburgh, PA	35.9%	84	Baton Rouge, LA	28.8%
35	Charlotte-Concord-Gastonia, NC-SC	35.9%	85	San Antonio-New Braunfels, TX	28.8%
36	Salt Lake City, UT	35.8%	86	Cape Coral-Fort Myers, FL	28.5%
37	Honolulu, HI	35.7%	87	Tulsa, OK	27.9%
38	Rochester, NY	35.6%	88	Toledo, OH	27.3%
39	Indianapolis-Carmel-Anderson, IN	35.6%	89	Winston-Salem, NC	26.8%
40	Los Angeles-Long Beach-Anaheim, CA	35.4%	90	Augusta-Richmond County, GA-SC	26.7%
41	St. Louis, MO-IL	35.4%	91	Scranton--Wilkes-Barre, PA	25.3%
42	Worcester, MA-CT	35.4%	92	Las Vegas-Henderson-Paradise, NV	25.2%
43	Cincinnati, OH-KY-IN	34.5%	93	Deltona-Daytona Beach-Ormond Beach, FL	24.6%
44	Sacramento-Roseville-Folsom, CA	34.3%	94	El Paso, TX	23.9%
45	Oxnard-Thousand Oaks-Ventura, CA	33.9%	95	Riverside-San Bernardino-Ontario, CA	22.4%
46	Grand Rapids-Kentwood, MI	33.7%	96	Fresno, CA	22.0%
47	Tucson, AZ	33.6%	97	Lakeland-Winter Haven, FL	20.6%
48	Houston-The Woodlands-Sugar Land, TX	33.6%	98	McAllen-Edinburg-Mission, TX	19.3%
49	North Port-Sarasota-Bradenton, FL	33.5%	99	Stockton, CA	19.2%
50	Harrisburg-Carlisle, PA	33.4%	100	Bakersfield, CA	17.1%
				Average, Top 100 Metros	**34.3%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table T

Bachelor's Degree Attainment Rates, White Population: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	Washington-Arlington-Alexandria, DC-VA-MD-WV	63.4%	51	Sacramento-Roseville-Folsom, CA	38.1%
2	San Francisco-Oakland-Berkeley, CA	62.0%	52	St. Louis, MO-IL	37.9%
3	San Jose-Sunnyvale-Santa Clara, CA	59.9%	53	Virginia Beach-Norfolk-Newport News, VA-NC	37.7%
4	Bridgeport-Stamford-Norwalk, CT	59.1%	54	Columbia, SC	37.6%
5	Austin-Round Rock-Georgetown, TX	55.1%	55	Birmingham-Hoover, AL	37.4%
6	Durham-Chapel Hill, NC	55.1%	56	Springfield, MA	37.2%
7	Raleigh-Cary, NC	53.3%	57	Memphis, TN-MS-AR	37.2%
8	Denver-Aurora-Lakewood, CO	52.9%	58	Worcester, MA-CT	36.5%
9	Boston-Cambridge-Newton, MA-NH	52.8%	59	Grand Rapids-Kentwood, MI	36.3%
10	New York-Newark-Jersey City, NY-NJ-PA	52.2%	60	Poughkeepsie-Newburgh-Middletown, NY	36.2%
11	Los Angeles-Long Beach-Anaheim, CA	51.0%	61	Pittsburgh, PA	36.2%
12	Honolulu, HI	50.2%	62	North Port-Sarasota-Bradenton, FL	35.9%
13	San Diego-Chula Vista-Carlsbad, CA	49.5%	63	Cleveland-Elyria, OH	35.7%
14	Madison, WI	47.8%	64	Cincinnati, OH-KY-IN	35.7%
15	Chicago-Naperville-Elgin, IL-IN-WI	47.0%	65	Buffalo-Cheektowaga, NY	35.4%
16	Baltimore-Columbia-Towson, MD	45.8%	66	Providence-Warwick, RI-MA	35.3%
17	Minneapolis-St. Paul-Bloomington, MN-WI	45.5%	67	Boise City, ID	35.2%
18	Albuquerque, NM	45.3%	68	Oklahoma City, OK	35.0%
19	Richmond, VA	45.1%	69	Jacksonville, FL	34.9%
20	Atlanta-Sandy Springs-Alpharetta, GA	45.1%	70	Detroit-Warren-Dearborn, MI	34.6%
21	Seattle-Tacoma-Bellevue, WA	45.0%	71	Harrisburg-Carlisle, PA	34.6%
22	Houston-The Woodlands-Sugar Land, TX	44.6%	72	Ogden-Clearfield, UT	34.4%
23	Miami-Fort Lauderdale-Pompano Beach, FL	44.2%	73	Greenville-Anderson, SC	34.3%
24	Charleston-North Charleston, SC	44.2%	74	Little Rock-North Little Rock-Conway, AR	34.1%
25	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	44.1%	75	Akron, OH	34.0%
26	Dallas-Fort Worth-Arlington, TX	44.1%	76	Wichita, KS	33.8%
27	Oxnard-Thousand Oaks-Ventura, CA	43.8%	77	Syracuse, NY	33.5%
28	Hartford-East Hartford-Middletown, CT	43.7%	78	Baton Rouge, LA	33.3%
29	Provo-Orem, UT	42.9%	79	Greensboro-High Point, NC	33.2%
30	Colorado Springs, CO	42.6%	80	Tampa-St. Petersburg-Clearwater, FL	33.1%
31	Portland-Vancouver-Hillsboro, OR-WA	42.2%	81	Fresno, CA	33.1%
32	Tucson, AZ	42.2%	82	McAllen-Edinburg-Mission, TX	32.9%
33	Milwaukee-Waukesha, WI	42.0%	83	Allentown-Bethlehem-Easton, PA-NJ	32.7%
34	El Paso, TX	41.6%	84	Cape Coral-Fort Myers, FL	32.6%
35	San Antonio-New Braunfels, TX	41.4%	85	Palm Bay-Melbourne-Titusville, FL	31.9%
36	New Haven-Milford, CT	41.1%	86	Louisville/Jefferson County, KY-IN	31.9%
37	Kansas City, MO-KS	41.1%	87	Spokane-Spokane Valley, WA	31.4%
38	Omaha-Council Bluffs, NE-IA	39.9%	88	Augusta-Richmond County, GA-SC	31.2%
39	Albany-Schenectady-Troy, NY	39.8%	89	Tulsa, OK	31.0%
40	Jackson, MS	39.7%	90	Dayton-Kettering, OH	30.8%
41	Salt Lake City, UT	39.5%	91	Knoxville, TN	30.7%
42	Charlotte-Concord-Gastonia, NC-SC	39.5%	92	Las Vegas-Henderson-Paradise, NV	30.6%
43	Nashville-Davidson--Murfreesboro--Franklin, TN	39.5%	93	Toledo, OH	29.4%
44	Columbus, OH	39.2%	94	Riverside-San Bernardino-Ontario, CA	28.9%
45	Des Moines-West Des Moines, IA	39.2%	95	Winston-Salem, NC	28.8%
46	Rochester, NY	38.9%	96	Scranton--Wilkes-Barre, PA	26.4%
47	Orlando-Kissimmee-Sanford, FL	38.8%	97	Deltona-Daytona Beach-Ormond Beach, FL	25.6%
48	New Orleans-Metairie, LA	38.7%	98	Bakersfield, CA	24.8%
49	Phoenix-Mesa-Chandler, AZ	38.5%	99	Stockton, CA	23.7%
50	Indianapolis-Carmel-Anderson, IN	38.5%	100	Lakeland-Winter Haven, FL	22.3%
				Average, Top 100 Metros	**39.3%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table U

Bachelor's Degree Attainment Rates, Black Population: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	San Jose-Sunnyvale-Santa Clara, CA	40.7%	51	Columbus, OH	21.9%
2	Oxnard-Thousand Oaks-Ventura, CA	39.0%	52	Jackson, MS	21.8%
3	Washington-Arlington-Alexandria, DC-VA-MD-WV	36.2%	53	Richmond, VA	21.7%
4	Albuquerque, NM	34.0%	54	Allentown-Bethlehem-Easton, PA-NJ	21.6%
5	Worcester, MA-CT	33.8%	55	Albany-Schenectady-Troy, NY	21.5%
6	Atlanta-Sandy Springs-Alpharetta, GA	31.6%	56	Dayton-Kettering, OH	21.5%
7	Raleigh-Cary, NC	31.4%	57	Springfield, MA	21.4%
8	Honolulu, HI	31.2%	58	Indianapolis-Carmel-Anderson, IN	21.3%
9	San Francisco-Oakland-Berkeley, CA	30.9%	59	Pittsburgh, PA	21.3%
10	Austin-Round Rock-Georgetown, TX	30.6%	60	Winston-Salem, NC	21.2%
11	Durham-Chapel Hill, NC	30.1%	61	Omaha-Council Bluffs, NE-IA	21.2%
12	El Paso, TX	29.8%	62	Birmingham-Hoover, AL	21.0%
13	Provo-Orem, UT	29.4%	63	Jacksonville, FL	20.9%
14	Nashville-Davidson--Murfreesboro--Franklin, TN	29.1%	64	Kansas City, MO-KS	20.5%
15	San Antonio-New Braunfels, TX	29.1%	65	Cincinnati, OH-KY-IN	20.5%
16	Los Angeles-Long Beach-Anaheim, CA	28.9%	66	Miami-Fort Lauderdale-Pompano Beach, FL	20.4%
17	Houston-The Woodlands-Sugar Land, TX	28.9%	67	Deltona-Daytona Beach-Ormond Beach, FL	20.3%
18	Portland-Vancouver-Hillsboro, OR-WA	28.8%	68	Knoxville, TN	20.1%
19	Dallas-Fort Worth-Arlington, TX	28.4%	69	Des Moines-West Des Moines, IA	19.8%
20	Denver-Aurora-Lakewood, CO	28.3%	70	Grand Rapids-Kentwood, MI	19.8%
21	Boston-Cambridge-Newton, MA-NH	27.9%	71	St. Louis, MO-IL	19.5%
22	Boise City, ID	27.6%	72	Memphis, TN-MS-AR	19.5%
23	Seattle-Tacoma-Bellevue, WA	27.6%	73	Baton Rouge, LA	19.5%
24	Baltimore-Columbia-Towson, MD	27.4%	74	Palm Bay-Melbourne-Titusville, FL	19.5%
25	Colorado Springs, CO	27.4%	75	Wichita, KS	19.5%
26	Tucson, AZ	27.3%	76	New Orleans-Metairie, LA	19.4%
27	San Diego-Chula Vista-Carlsbad, CA	26.6%	77	Tulsa, OK	19.1%
28	Charlotte-Concord-Gastonia, NC-SC	26.6%	78	Las Vegas-Henderson-Paradise, NV	18.8%
29	New York-Newark-Jersey City, NY-NJ-PA	26.5%	79	Fresno, CA	18.7%
30	Phoenix-Mesa-Chandler, AZ	26.2%	80	Harrisburg-Carlisle, PA	18.6%
31	Madison, WI	25.9%	81	Louisville/Jefferson County, KY-IN	18.2%
32	Sacramento-Roseville-Folsom, CA	25.4%	82	Detroit-Warren-Dearborn, MI	18.1%
33	Bridgeport-Stamford-Norwalk, CT	25.1%	83	Stockton, CA	17.8%
34	Providence-Warwick, RI-MA	24.7%	84	Augusta-Richmond County, GA-SC	17.5%
35	Little Rock-North Little Rock-Conway, AR	24.5%	85	Akron, OH	17.5%
36	Poughkeepsie-Newburgh-Middletown, NY	24.5%	86	Charleston-North Charleston, SC	17.4%
37	Columbia, SC	24.3%	87	Spokane-Spokane Valley, WA	17.4%
38	Riverside-San Bernardino-Ontario, CA	24.2%	88	Buffalo-Cheektowaga, NY	17.3%
39	Chicago-Naperville-Elgin, IL-IN-WI	24.0%	89	North Port-Sarasota-Bradenton, FL	16.3%
40	Tampa-St. Petersburg-Clearwater, FL	23.9%	90	Cleveland-Elyria, OH	16.2%
41	Orlando-Kissimmee-Sanford, FL	23.9%	91	Cape Coral-Fort Myers, FL	15.4%
42	Salt Lake City, UT	23.8%	92	Lakeland-Winter Haven, FL	15.4%
43	Oklahoma City, OK	23.8%	93	Rochester, NY	15.2%
44	Greensboro-High Point, NC	23.7%	94	Bakersfield, CA	15.1%
45	Minneapolis-St. Paul-Bloomington, MN-WI	23.2%	95	Greenville-Anderson, SC	14.9%
46	Ogden-Clearfield, UT	23.1%	96	Milwaukee-Waukesha, WI	14.1%
47	Virginia Beach-Norfolk-Newport News, VA-NC	22.9%	97	McAllen-Edinburg-Mission, TX	13.8%
48	Hartford-East Hartford-Middletown, CT	22.8%	98	Toledo, OH	13.7%
49	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	22.2%	99	Syracuse, NY	13.4%
50	New Haven-Milford, CT	22.2%	100	Scranton--Wilkes-Barre, PA	10.6%
				Average, Top 100 Metros	**23.1%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table V

Bachelor's Degree Attainment Rates, Hispanic Population: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	Pittsburgh, PA	36.5%	51	Baton Rouge, LA	19.2%
2	Baltimore-Columbia-Towson, MD	32.2%	52	Charlotte-Concord-Gastonia, NC-SC	19.1%
3	Madison, WI	31.0%	53	Durham-Chapel Hill, NC	19.1%
4	St. Louis, MO-IL	30.4%	54	San Diego-Chula Vista-Carlsbad, CA	18.8%
5	Cincinnati, OH-KY-IN	29.5%	55	Kansas City, MO-KS	18.7%
6	Miami-Fort Lauderdale-Pompano Beach, FL	28.8%	56	San Jose-Sunnyvale-Santa Clara, CA	18.5%
7	Palm Bay-Melbourne-Titusville, FL	28.7%	57	Deltona-Daytona Beach-Ormond Beach, FL	18.2%
8	Akron, OH	28.4%	58	Birmingham-Hoover, AL	18.1%
9	Columbus, OH	28.3%	59	Rochester, NY	17.9%
10	Jacksonville, FL	27.9%	60	Denver-Aurora-Lakewood, CO	17.9%
11	Albany-Schenectady-Troy, NY	27.8%	61	San Antonio-New Braunfels, TX	17.9%
12	Syracuse, NY	27.4%	62	Nashville-Davidson--Murfreesboro--Franklin, TN	17.9%
13	Washington-Arlington-Alexandria, DC-VA-MD-WV	27.2%	63	Toledo, OH	17.7%
14	Honolulu, HI	26.9%	64	McAllen-Edinburg-Mission, TX	17.5%
15	Virginia Beach-Norfolk-Newport News, VA-NC	26.8%	65	Tucson, AZ	17.4%
16	Austin-Round Rock-Georgetown, TX	25.0%	66	Hartford-East Hartford-Middletown, CT	17.2%
17	Orlando-Kissimmee-Sanford, FL	24.7%	67	Cleveland-Elyria, OH	16.9%
18	Spokane-Spokane Valley, WA	24.6%	68	Salt Lake City, UT	16.6%
19	Seattle-Tacoma-Bellevue, WA	24.5%	69	Omaha-Council Bluffs, NE-IA	16.4%
20	Detroit-Warren-Dearborn, MI	24.2%	70	Lakeland-Winter Haven, FL	16.2%
21	Boston-Cambridge-Newton, MA-NH	23.9%	71	Houston-The Woodlands-Sugar Land, TX	16.0%
22	Dayton-Kettering, OH	23.9%	72	Chicago-Naperville-Elgin, IL-IN-WI	16.0%
23	Tampa-St. Petersburg-Clearwater, FL	23.6%	73	Providence-Warwick, RI-MA	15.9%
24	Buffalo-Cheektowaga, NY	23.4%	74	Wichita, KS	15.9%
25	Knoxville, TN	23.3%	75	Memphis, TN-MS-AR	15.8%
26	San Francisco-Oakland-Berkeley, CA	23.0%	76	Dallas-Fort Worth-Arlington, TX	15.5%
27	Minneapolis-St. Paul-Bloomington, MN-WI	22.6%	77	Milwaukee-Waukesha, WI	15.4%
28	Louisville/Jefferson County, KY-IN	22.4%	78	New Haven-Milford, CT	15.4%
29	Columbia, SC	22.3%	79	Des Moines-West Des Moines, IA	15.1%
30	Augusta-Richmond County, GA-SC	22.2%	80	Allentown-Bethlehem-Easton, PA-NJ	15.1%
31	Atlanta-Sandy Springs-Alpharetta, GA	22.1%	81	Little Rock-North Little Rock-Conway, AR	15.0%
32	Provo-Orem, UT	22.0%	82	Grand Rapids-Kentwood, MI	15.0%
33	Poughkeepsie-Newburgh-Middletown, NY	22.0%	83	Worcester, MA-CT	15.0%
34	Richmond, VA	21.8%	84	Boise City, ID	14.8%
35	Raleigh-Cary, NC	21.8%	85	Springfield, MA	14.8%
36	Jackson, MS	21.4%	86	Cape Coral-Fort Myers, FL	14.8%
37	Colorado Springs, CO	20.8%	87	Los Angeles-Long Beach-Anaheim, CA	14.4%
38	New York-Newark-Jersey City, NY-NJ-PA	20.8%	88	Oxnard-Thousand Oaks-Ventura, CA	14.1%
39	North Port-Sarasota-Bradenton, FL	20.7%	89	Phoenix-Mesa-Chandler, AZ	14.0%
40	Charleston-North Charleston, SC	20.7%	90	Winston-Salem, NC	13.9%
41	Albuquerque, NM	20.7%	91	Ogden-Clearfield, UT	13.1%
42	New Orleans-Metairie, LA	20.7%	92	Scranton--Wilkes-Barre, PA	13.0%
43	Portland-Vancouver-Hillsboro, OR-WA	20.5%	93	Tulsa, OK	12.9%
44	Harrisburg-Carlisle, PA	20.3%	94	Oklahoma City, OK	12.8%
45	El Paso, TX	20.1%	95	Greensboro-High Point, NC	12.7%
46	Bridgeport-Stamford-Norwalk, CT	20.0%	96	Riverside-San Bernardino-Ontario, CA	11.7%
47	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	20.0%	97	Fresno, CA	11.3%
48	Greenville-Anderson, SC	19.5%	98	Las Vegas-Henderson-Paradise, NV	11.0%
49	Sacramento-Roseville-Folsom, CA	19.4%	99	Stockton, CA	8.3%
50	Indianapolis-Carmel-Anderson, IN	19.2%	100	Bakersfield, CA	8.1%
				Average, Top 100 Metros	#####

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table W

Bachelor's Degree Attainment Rates, Asian American Population: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	Durham-Chapel Hill, NC	75.1%	51	Los Angeles-Long Beach-Anaheim, CA	53.9%
2	Raleigh-Cary, NC	73.3%	52	Portland-Vancouver-Hillsboro, OR-WA	53.7%
3	Austin-Round Rock-Georgetown, TX	72.1%	53	Augusta-Richmond County, GA-SC	53.4%
4	Pittsburgh, PA	69.8%	54	Buffalo-Cheektowaga, NY	52.9%
5	Hartford-East Hartford-Middletown, CT	69.2%	55	Rochester, NY	52.8%
6	Madison, WI	68.9%	56	Miami-Fort Lauderdale-Pompano Beach, FL	52.8%
7	Bridgeport-Stamford-Norwalk, CT	67.9%	57	Providence-Warwick, RI-MA	52.4%
8	St. Louis, MO-IL	66.9%	58	Albuquerque, NM	52.3%
9	Detroit-Warren-Dearborn, MI	66.9%	59	San Antonio-New Braunfels, TX	52.3%
10	New Haven-Milford, CT	66.8%	60	Orlando-Kissimmee-Sanford, FL	52.1%
11	Chicago-Naperville-Elgin, IL-IN-WI	66.4%	61	Harrisburg-Carlisle, PA	52.1%
12	Knoxville, TN	66.4%	62	El Paso, TX	51.8%
13	San Jose-Sunnyvale-Santa Clara, CA	66.4%	63	San Diego-Chula Vista-Carlsbad, CA	51.7%
14	Richmond, VA	66.2%	64	Milwaukee-Waukesha, WI	51.5%
15	Cincinnati, OH-KY-IN	65.3%	65	Tampa-St. Petersburg-Clearwater, FL	51.3%
16	Washington-Arlington-Alexandria, DC-VA-MD-WV	65.1%	66	Denver-Aurora-Lakewood, CO	51.2%
17	McAllen-Edinburg-Mission, TX	64.2%	67	Salt Lake City, UT	51.0%
18	Boston-Cambridge-Newton, MA-NH	63.1%	68	Charleston-North Charleston, SC	51.0%
19	Baltimore-Columbia-Towson, MD	63.1%	69	Jacksonville, FL	49.3%
20	Cleveland-Elyria, OH	62.9%	70	Omaha-Council Bluffs, NE-IA	49.2%
21	Columbus, OH	62.8%	71	Riverside-San Bernardino-Ontario, CA	49.2%
22	Greenville-Anderson, SC	62.5%	72	Boise City, ID	49.2%
23	Jackson, MS	62.3%	73	Little Rock-North Little Rock-Conway, AR	48.5%
24	Dallas-Fort Worth-Arlington, TX	62.0%	74	Syracuse, NY	47.9%
25	Birmingham-Hoover, AL	60.9%	75	Cape Coral-Fort Myers, FL	47.5%
26	Charlotte-Concord-Gastonia, NC-SC	60.8%	76	Deltona-Daytona Beach-Ormond Beach, FL	46.9%
27	Dayton-Kettering, OH	60.0%	77	Minneapolis-St. Paul-Bloomington, MN-WI	46.5%
28	Oxnard-Thousand Oaks-Ventura, CA	59.6%	78	Greensboro-High Point, NC	45.5%
29	Memphis, TN-MS-AR	59.5%	79	North Port-Sarasota-Bradenton, FL	45.4%
30	Allentown-Bethlehem-Easton, PA-NJ	59.4%	80	Oklahoma City, OK	45.3%
31	Atlanta-Sandy Springs-Alpharetta, GA	59.1%	81	Scranton--Wilkes-Barre, PA	44.8%
32	Phoenix-Mesa-Chandler, AZ	58.9%	82	Sacramento-Roseville-Folsom, CA	43.9%
33	Albany-Schenectady-Troy, NY	58.7%	83	Virginia Beach-Norfolk-Newport News, VA-NC	43.5%
34	Worcester, MA-CT	58.5%	84	Palm Bay-Melbourne-Titusville, FL	42.7%
35	Baton Rouge, LA	58.3%	85	Akron, OH	42.1%
36	Columbia, SC	58.3%	86	Colorado Springs, CO	41.5%
37	Toledo, OH	57.6%	87	Lakeland-Winter Haven, FL	41.3%
38	Seattle-Tacoma-Bellevue, WA	56.9%	88	Des Moines-West Des Moines, IA	41.3%
39	Kansas City, MO-KS	56.9%	89	Springfield, MA	41.0%
40	Houston-The Woodlands-Sugar Land, TX	56.8%	90	Las Vegas-Henderson-Paradise, NV	40.7%
41	San Francisco-Oakland-Berkeley, CA	56.6%	91	Spokane-Spokane Valley, WA	40.5%
42	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	56.6%	92	New Orleans-Metairie, LA	40.4%
43	Nashville-Davidson--Murfreesboro--Franklin, TN	56.1%	93	Ogden-Clearfield, UT	38.7%
44	Indianapolis-Carmel-Anderson, IN	55.9%	94	Grand Rapids-Kentwood, MI	38.6%
45	Louisville/Jefferson County, KY-IN	55.9%	95	Honolulu, HI	37.2%
46	Winston-Salem, NC	55.8%	96	Wichita, KS	37.0%
47	New York-Newark-Jersey City, NY-NJ-PA	55.6%	97	Bakersfield, CA	36.7%
48	Poughkeepsie-Newburgh-Middletown, NY	55.0%	98	Tulsa, OK	35.7%
49	Tucson, AZ	54.7%	99	Fresno, CA	33.0%
50	Provo-Orem, UT	54.3%	100	Stockton, CA	32.3%
				Average, Top 100 Metros	**54.0%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table X

Bachelor's Degree Attainment Rates, Native American Population: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	Honolulu, HI	39.8%	51	Cleveland-Elyria, OH	19.5%
2	Palm Bay-Melbourne-Titusville, FL	36.0%	52	Tulsa, OK	19.5%
3	Austin-Round Rock-Georgetown, TX	31.7%	53	Buffalo-Cheektowaga, NY	19.3%
4	Cape Coral-Fort Myers, FL	30.9%	54	Atlanta-Sandy Springs-Alpharetta, GA	19.2%
5	Washington-Arlington-Alexandria, DC-VA-MD-WV	29.9%	55	Boise City, ID	18.9%
6	North Port-Sarasota-Bradenton, FL	27.3%	56	Cincinnati, OH-KY-IN	18.7%
7	Colorado Springs, CO	27.1%	57	Salt Lake City, UT	18.7%
8	Jacksonville, FL	26.5%	58	Nashville-Davidson--Murfreesboro--Franklin, TN	18.7%
9	Durham-Chapel Hill, NC	26.4%	59	Winston-Salem, NC	18.7%
10	Springfield, MA	26.2%	60	Miami-Fort Lauderdale-Pompano Beach, FL	18.6%
11	Albany-Schenectady-Troy, NY	26.0%	61	Louisville/Jefferson County, KY-IN	18.3%
12	Raleigh-Cary, NC	25.5%	62	Albuquerque, NM	17.9%
13	Kansas City, MO-KS	25.5%	63	San Diego-Chula Vista-Carlsbad, CA	17.9%
14	Virginia Beach-Norfolk-Newport News, VA-NC	25.2%	64	Provo-Orem, UT	17.2%
15	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	24.3%	65	Sacramento-Roseville-Folsom, CA	17.2%
16	Orlando-Kissimmee-Sanford, FL	23.6%	66	San Jose-Sunnyvale-Santa Clara, CA	17.2%
17	Madison, WI	23.6%	67	Seattle-Tacoma-Bellevue, WA	17.0%
18	Chicago-Naperville-Elgin, IL-IN-WI	23.3%	68	Los Angeles-Long Beach-Anaheim, CA	16.9%
19	Portland-Vancouver-Hillsboro, OR-WA	23.0%	69	Detroit-Warren-Dearborn, MI	16.5%
20	Boston-Cambridge-Newton, MA-NH	22.7%	70	Providence-Warwick, RI-MA	16.3%
21	Deltona-Daytona Beach-Ormond Beach, FL	22.6%	71	Dayton-Kettering, OH	16.3%
22	Bridgeport-Stamford-Norwalk, CT	22.5%	72	Pittsburgh, PA	16.2%
23	Little Rock-North Little Rock-Conway, AR	22.3%	73	Akron, OH	16.0%
24	Baltimore-Columbia-Towson, MD	22.3%	74	Ogden-Clearfield, UT	16.0%
25	Columbus, OH	22.2%	75	Wichita, KS	15.3%
26	Tampa-St. Petersburg-Clearwater, FL	22.1%	76	Greenville-Anderson, SC	15.3%
27	Milwaukee-Waukesha, WI	22.0%	77	Charlotte-Concord-Gastonia, NC-SC	15.0%
28	Syracuse, NY	21.6%	78	McAllen-Edinburg-Mission, TX	14.9%
29	Greensboro-High Point, NC	21.4%	79	Grand Rapids-Kentwood, MI	14.8%
30	Memphis, TN-MS-AR	21.3%	80	Phoenix-Mesa-Chandler, AZ	14.8%
31	Jackson, MS	21.3%	81	Knoxville, TN	14.6%
32	Toledo, OH	21.2%	82	Birmingham-Hoover, AL	14.5%
33	St. Louis, MO-IL	21.2%	83	Baton Rouge, LA	14.2%
34	Dallas-Fort Worth-Arlington, TX	21.2%	84	Charleston-North Charleston, SC	14.1%
35	Harrisburg-Carlisle, PA	21.1%	85	Hartford-East Hartford-Middletown, CT	14.1%
36	Rochester, NY	21.0%	86	Omaha-Council Bluffs, NE-IA	13.9%
37	Richmond, VA	21.0%	87	Las Vegas-Henderson-Paradise, NV	13.6%
38	Denver-Aurora-Lakewood, CO	21.0%	88	Spokane-Spokane Valley, WA	13.6%
39	Poughkeepsie-Newburgh-Middletown, NY	21.0%	89	Oxnard-Thousand Oaks-Ventura, CA	13.6%
40	Worcester, MA-CT	20.8%	90	Augusta-Richmond County, GA-SC	13.5%
41	New York-Newark-Jersey City, NY-NJ-PA	20.6%	91	Fresno, CA	13.5%
42	Houston-The Woodlands-Sugar Land, TX	20.6%	92	Lakeland-Winter Haven, FL	13.4%
43	Allentown-Bethlehem-Easton, PA-NJ	20.5%	93	Riverside-San Bernardino-Ontario, CA	13.4%
44	Oklahoma City, OK	20.4%	94	New Haven-Milford, CT	13.0%
45	Indianapolis-Carmel-Anderson, IN	20.1%	95	Tucson, AZ	12.0%
46	San Antonio-New Braunfels, TX	20.0%	96	Des Moines-West Des Moines, IA	11.8%
47	Minneapolis-St. Paul-Bloomington, MN-WI	19.9%	97	Stockton, CA	10.0%
48	El Paso, TX	19.8%	98	Scranton--Wilkes-Barre, PA	10.0%
49	New Orleans-Metairie, LA	19.7%	99	Bakersfield, CA	9.9%
50	San Francisco-Oakland-Berkeley, CA	19.6%	100	Columbia, SC	8.9%
				Average, Top 100 Metros	**19.5%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table Y

Bachelor's Degree Attainment Rates, Foreign-Born Population: 100 Largest Metros

(% of population age 25 and over with a bachelor's degree or higher)

	Metro Areas	Attain Rate		Metro Areas	Attain Rate
1	Pittsburgh, PA	58.6%	51	Milwaukee-Waukesha, WI	33.8%
2	San Jose-Sunnyvale-Santa Clara, CA	54.5%	52	Chicago-Naperville-Elgin, IL-IN-WI	33.1%
3	Madison, WI	54.0%	53	Allentown-Bethlehem-Easton, PA-NJ	33.1%
4	Baltimore-Columbia-Towson, MD	50.4%	54	Springfield, MA	33.0%
5	St. Louis, MO-IL	49.4%	55	Little Rock-North Little Rock-Conway, AR	32.8%
6	Cincinnati, OH-KY-IN	48.4%	56	Orlando-Kissimmee-Sanford, FL	32.6%
7	Raleigh-Cary, NC	47.8%	57	Palm Bay-Melbourne-Titusville, FL	32.2%
8	Seattle-Tacoma-Bellevue, WA	46.0%	58	San Diego-Chula Vista-Carlsbad, CA	32.1%
9	Albany-Schenectady-Troy, NY	45.4%	59	Tampa-St. Petersburg-Clearwater, FL	31.8%
10	Toledo, OH	45.4%	60	Poughkeepsie-Newburgh-Middletown, NY	31.4%
11	Washington-Arlington-Alexandria, DC-VA-MD-WV	44.9%	61	Colorado Springs, CO	31.2%
12	San Francisco-Oakland-Berkeley, CA	44.6%	62	Dallas-Fort Worth-Arlington, TX	31.2%
13	Durham-Chapel Hill, NC	44.3%	63	Sacramento-Roseville-Folsom, CA	30.8%
14	Detroit-Warren-Dearborn, MI	43.6%	64	North Port-Sarasota-Bradenton, FL	30.7%
15	Dayton-Kettering, OH	43.4%	65	Denver-Aurora-Lakewood, CO	30.7%
16	Columbus, OH	43.1%	66	Greensboro-High Point, NC	29.6%
17	Jackson, MS	42.5%	67	Houston-The Woodlands-Sugar Land, TX	29.6%
18	Boston-Cambridge-Newton, MA-NH	42.3%	68	Spokane-Spokane Valley, WA	29.5%
19	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	41.5%	69	Deltona-Daytona Beach-Ormond Beach, FL	29.2%
20	Cleveland-Elyria, OH	41.3%	70	Honolulu, HI	28.9%
21	Richmond, VA	41.1%	71	Provo-Orem, UT	28.9%
22	Knoxville, TN	40.6%	72	Miami-Fort Lauderdale-Pompano Beach, FL	28.8%
23	Harrisburg-Carlisle, PA	40.5%	73	Salt Lake City, UT	28.6%
24	Akron, OH	40.4%	74	Omaha-Council Bluffs, NE-IA	28.4%
25	Buffalo-Cheektowaga, NY	39.6%	75	Los Angeles-Long Beach-Anaheim, CA	28.2%
26	Atlanta-Sandy Springs-Alpharetta, GA	39.6%	76	New Orleans-Metairie, LA	26.8%
27	Austin-Round Rock-Georgetown, TX	39.2%	77	Grand Rapids-Kentwood, MI	26.7%
28	Worcester, MA-CT	39.0%	78	Des Moines-West Des Moines, IA	26.5%
29	Rochester, NY	38.7%	79	Albuquerque, NM	26.4%
30	Hartford-East Hartford-Middletown, CT	38.7%	80	Tucson, AZ	26.3%
31	Indianapolis-Carmel-Anderson, IN	37.3%	81	Boise City, ID	25.7%
32	Columbia, SC	37.3%	82	Phoenix-Mesa-Chandler, AZ	25.7%
33	Virginia Beach-Norfolk-Newport News, VA-NC	37.0%	83	Scranton--Wilkes-Barre, PA	25.7%
34	Jacksonville, FL	36.8%	84	Oxnard-Thousand Oaks-Ventura, CA	25.0%
35	Bridgeport-Stamford-Norwalk, CT	36.8%	85	Winston-Salem, NC	24.7%
36	Minneapolis-St. Paul-Bloomington, MN-WI	36.8%	86	Oklahoma City, OK	24.4%
37	Syracuse, NY	36.6%	87	Providence-Warwick, RI-MA	24.2%
38	Charlotte-Concord-Gastonia, NC-SC	36.2%	88	Wichita, KS	23.9%
39	Portland-Vancouver-Hillsboro, OR-WA	35.9%	89	San Antonio-New Braunfels, TX	23.0%
40	Baton Rouge, LA	35.9%	90	Las Vegas-Henderson-Paradise, NV	22.3%
41	Augusta-Richmond County, GA-SC	35.4%	91	Tulsa, OK	22.0%
42	Memphis, TN-MS-AR	35.2%	92	Cape Coral-Fort Myers, FL	21.8%
43	New Haven-Milford, CT	34.9%	93	Ogden-Clearfield, UT	20.4%
44	Kansas City, MO-KS	34.8%	94	Lakeland-Winter Haven, FL	20.4%
45	New York-Newark-Jersey City, NY-NJ-PA	34.6%	95	Riverside-San Bernardino-Ontario, CA	19.1%
46	Louisville/Jefferson County, KY-IN	34.6%	96	Stockton, CA	18.1%
47	Charleston-North Charleston, SC	34.5%	97	El Paso, TX	16.3%
48	Greenville-Anderson, SC	34.3%	98	Fresno, CA	15.3%
49	Nashville-Davidson--Murfreesboro--Franklin, TN	34.1%	99	McAllen-Edinburg-Mission, TX	13.8%
50	Birmingham-Hoover, AL	33.9%	100	Bakersfield, CA	12.1%
				Average, Top 100 Metros	**33.7%**

Source: Author's calculations based on data from the U.S. Census Bureau (American Community Survey, 2020 five-year estimates). See related data in the online data appendix to this report.

Table Z

Filling Select In-Demand Occupations: 100 Largest Metros

	Metro Area	Avg z-score		Metro Area	Avg z-score
1	Little Rock-North Little Rock-Conway, AR	0.80	51	Jacksonville, FL	0.03
2	Madison, WI	0.77	52	Pittsburgh, PA	(0.00)
3	Baton Rouge, LA	0.75	53	Hartford-East Hartford-Middletown, CT	(0.00)
4	Salt Lake City, UT	0.73	54	Colorado Springs, CO	(0.01)
5	Tulsa, OK	0.72	55	Seattle-Tacoma-Bellevue, WA	(0.03)
6	Des Moines-West Des Moines, IA	0.71	56	Syracuse, NY	(0.04)
7	Durham-Chapel Hill, NC	0.70	57	Houston-The Woodlands-Sugar Land, TX	(0.05)
8	Oklahoma City, OK	0.70	58	Orlando-Kissimmee-Sanford, FL	(0.05)
9	Baltimore-Columbia-Towson, MD	0.64	59	Columbia, SC	(0.09)
10	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.63	60	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	(0.10)
11	Omaha-Council Bluffs, NE-IA	0.59	61	Ogden-Clearfield, UT	(0.12)
12	Denver-Aurora-Lakewood, CO	0.58	62	Buffalo-Cheektowaga, NY	(0.13)
13	Louisville/Jefferson County, KY-IN	0.58	63	San Francisco-Oakland-Berkeley, CA	(0.16)
14	Virginia Beach-Norfolk-Newport News, VA-NC	0.57	64	Phoenix-Mesa-Chandler, AZ	(0.17)
15	Nashville-Davidson--Murfreesboro--Franklin, TN	0.56	65	Springfield, MA	(0.20)
16	Knoxville, TN	0.56	66	Augusta-Richmond County, GA-SC	(0.21)
17	Columbus, OH	0.54	67	Portland-Vancouver-Hillsboro, OR-WA	(0.21)
18	Richmond, VA	0.50	68	San Diego-Chula Vista-Carlsbad, CA	(0.23)
19	Cleveland-Elyria, OH	0.49	69	Atlanta-Sandy Springs-Alpharetta, GA	(0.24)
20	Cincinnati, OH-KY-IN	0.48	70	Miami-Fort Lauderdale-Pompano Beach, FL	(0.24)
21	Akron, OH	0.45	71	Chicago-Naperville-Elgin, IL-IN-WI	(0.24)
22	Milwaukee-Waukesha, WI	0.44	72	Greenville-Anderson, SC	(0.28)
23	Grand Rapids-Kentwood, MI	0.44	73	Detroit-Warren-Dearborn, MI	(0.28)
24	Birmingham-Hoover, AL	0.41	74	Sacramento-Roseville-Folsom, CA	(0.29)
25	St. Louis, MO-IL	0.41	75	North Port-Sarasota-Bradenton, FL	(0.29)
26	Dayton-Kettering, OH	0.38	76	New Orleans-Metairie, LA	(0.31)
27	San Jose-Sunnyvale-Santa Clara, CA	0.38	77	Provo-Orem, UT	(0.32)
28	Boston-Cambridge-Newton, MA-NH	0.37	78	New York-Newark-Jersey City, NY-NJ-PA	(0.34)
29	Honolulu, HI	0.36	79	Spokane-Spokane Valley, WA	(0.42)
30	Boise City, ID	0.35	80	Scranton--Wilkes-Barre, PA	(0.43)
31	Kansas City, MO-KS	0.34	81	Providence-Warwick, RI-MA	(0.45)
32	Harrisburg-Carlisle, PA	0.31	82	Cape Coral-Fort Myers, FL	(0.49)
33	Minneapolis-St. Paul-Bloomington, MN-WI	0.31	83	Allentown-Bethlehem-Easton, PA-NJ	(0.52)
34	Toledo, OH	0.27	84	Tucson, AZ	(0.53)
35	Charlotte-Concord-Gastonia, NC-SC	0.23	85	Fresno, CA	(0.57)
36	Dallas-Fort Worth-Arlington, TX	0.20	86	Bridgeport-Stamford-Norwalk, CT	(0.64)
37	Tampa-St. Petersburg-Clearwater, FL	0.18	87	Las Vegas-Henderson-Paradise, NV	(0.66)
38	Indianapolis-Carmel-Anderson, IN	0.17	88	Los Angeles-Long Beach-Anaheim, CA	(0.73)
39	Raleigh-Cary, NC	0.16	89	Riverside-San Bernardino-Ontario, CA	(0.76)
40	Memphis, TN-MS-AR	0.15	90	Bakersfield, CA	(0.78)
41	Greensboro-High Point, NC	0.13	91	Lakeland-Winter Haven, FL	(0.80)
42	Albuquerque, NM	0.12	92	El Paso, TX	(0.81)
43	Rochester, NY	0.12	93	San Antonio-New Braunfels, TX	(0.83)
44	Albany-Schenectady-Troy, NY	0.11	94	Deltona-Daytona Beach-Ormond Beach, FL	(0.89)
45	Charleston-North Charleston, SC	0.10	95	Oxnard-Thousand Oaks-Ventura, CA	(0.91)
46	Winston-Salem, NC	0.08	96	New Haven-Milford, CT	(0.96)
47	Austin-Round Rock-Georgetown, TX	0.08	97	McAllen-Edinburg-Mission, TX	(1.05)
48	Wichita, KS	0.06	98	Worcester, MA-CT	(1.08)
49	Palm Bay-Melbourne-Titusville, FL	0.04	99	Stockton, CA	(1.08)
50	Jackson, MS	0.03	100	Poughkeepsie-Newburgh-Middletown, NY	na
				Average, Top 100 Metros	**0.00**

Source: Author's calculations based on occupational data from the U.S. Bureau of Labor Statistics, 2021 data ("Occupational Employment and Wage Statistics," https://www.bls.gov/oes/tables.htm). See related data in the online data appendix.

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