



State of Oklahoma

Incentive Evaluation Commission

Draft Health Research Program Evaluation

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Key Findings and Recommendations



Overview

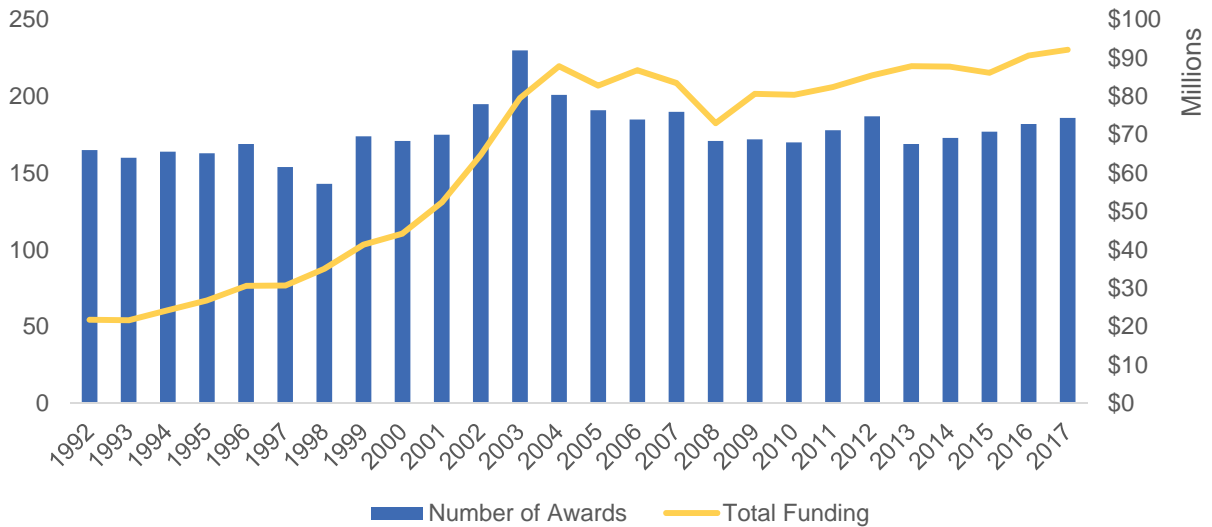
Administered by the Oklahoma Center for the Advancement of Science and Technology (OCAST), the Oklahoma Health Research Program funds basic research projects related to human health for one to three years at a maximum level of \$45,000 per year. The awards (which are funded by an appropriation of \$2.5 million in FY2018) enable researchers to gain the expertise and produce the data needed to obtain larger grants from federal agencies and other national funding organizations. Research funded by this program investigates the causes, diagnosis, treatment and prevention of human diseases and disabilities and facilitates the development of health care products and services.

Recommendation: Based on its analysis of available data, the project team recommends retaining the Oklahoma Health Research Program.

Key Findings Related to Established Criteria for Evaluation

- Total National Institutes of Health (NIH) funding in Oklahoma has increased steadily over the past 25 years.** In 1992, NIH funding totaled \$21.7 million; by 2017, that total was \$92.1 million (a compound annual growth rate of 5.9 percent). Data for the years prior to the program's inception was not available.

Figure 1: NIH Award Activity in Oklahoma, 1992-2017



Source: NIH Reporting Portfolio – Awards by Location and Organization

- Relative to other states, Oklahoma's per capita NIH funding is lagging.** Oklahoma ranked 39th in 1992 (at \$7) among the 50 states and Washington, D.C. Despite the state's per capita amount increasing to \$23 by 2017, its rank had fallen to 44th. Among Oklahoma's six surrounding states, (none of which were found to have comparable programs), Oklahoma's per capita NIH funding in 1992 ranked higher only than Arkansas (\$6 per capita), and this was also the case in 2017.
- While trailing other states in NIH funding rankings, the State's direct investment in health-related research and development (R&D) is significant.** Of the \$15.7 million the State spent on health-related R&D in 2016, \$11.7 million was attributable to the Tobacco Settlement Endowment Trust, \$4.0 million to OCAST and approximately \$10,000 to the Department of Human Services. The State's



2016 investment in health-related R&D ranked 10th among 35 states for which data was provided. Further, among immediately surrounding states, Oklahoma's investment was smaller only than Texas (\$212 million) and, at \$4.04 per capita, Oklahoma was second only to Texas (\$7.87 per capita).¹

- **Statewide employment in R&D in the Physical, Engineering and Life Sciences industry decreased between 2001 and 2016 while average industry pay has increased.**² Further, the average industry pay (\$70,000 in 2016) is significantly higher than the average wage for all industries in Oklahoma (\$44,000) – and the average industry pay is increasing more rapidly than the average wage across all industries.
- **Medical patents awarded in Oklahoma peaked in 1998 at 42.**³ In 2012, the most recent year for which detailed data is available, 26 medical patents were issued in the state. Oklahoma's patent activity is comparable to surrounding states and those states with incentives comparable to the Health Research program.
- **Since the program's inception, OCAST has provided more than \$85 million in Health Research awards.** While there has been some variance in the value of contracts awarded annually over the past several decades, awards have remained relatively stable. Between 1988 (the first year a grant was funded) and 2017, annual grant disbursements averaged \$2.8 million.
- **The program's recipients are primarily public colleges and universities; these entities have accounted for between 70 and 89 percent of annual program funding since its inception.** With a total of \$67 million in awards received, these colleges and universities comprise 79 percent of total funding over the life of the program. Non-profit research institutions are the second largest recipients, receiving \$16 million since 1987. Private colleges and universities have received nearly \$2 million.
- **A total of 277.5 new or retained jobs are attributable to 128 Health Research awards made between 2010 and 2016.** The average pay associated with those jobs is estimated to be approximately \$45,000, equal to the average annual wage across all private industries (\$45,169 in 2017). Including benefits, total compensation is estimated to be \$9.1 million.⁴
- **Other economic impacts appear to be significant.** Among 151 Health Research award recipients responding to OCAST's annual survey, representatives of 81 projects (53.6 percent) indicated that a total of \$51.1 million in additional funding was obtained as a result of the initial Health Research funding. In addition, 12 reported developing new products and five reported that patents have been granted.

Other Findings

- **Few states have programs similar to the Health Research Program.** Only Connecticut, Pennsylvania and Virginia were found to have state-level grant programs geared toward health-related research. With an appropriation of \$2.5 million in FY2018, Oklahoma's program investment was comparable to that of Virginia, which awarded \$3.4 million. While both Oklahoma and Virginia fund their programs through an annual appropriation, Virginia's program also receives contributions from six

¹ National Science Foundation, National Center for Science and Engineering Statistics – Survey of State Government Research and Development. Accessed electronically at <https://ncesdata.nsf.gov/sgrd/2016/>

² Data based on North American Industry Classification System (NAICS) code 54171 – Research and Development in the Physical, Engineering and Life Sciences

³ Data per U.S. Patent and Trademark Office. Two major industry subcategories – pharmaceuticals and medicines (NAICS code 3254) and medical equipment and supplies (NAICS code 3391) are used to serve as a proxy for health research patents.

⁴ Based on PFM analysis of OCAST annual survey data. It is possible that survey responses may contain errors. Figures do not include data for award recipients that did not respond to the survey.



partnering universities. Virginia also has a matching requirement that ranges from one-to-one to six-to-one.

- **Grantees are required by contract to respond to a program survey for a period of five years.** While it is beneficial for OCAST to collect program information, certain issues exist. For instance, the fact that respondents are required to reply for five years and then can drop off can lead to fluctuations in the data over time as one grantee's impact data is removed from totals (despite the project still being in existence). Additionally, the fact that recipients self-report the data can lead to variances in the way information is reported. The 2017 OCAST Impact Survey is provided in **Appendix A**.

Recommended Program Modifications

- **OCAST should collect more detailed information from current and former grant recipients to allow for consistent analysis.** The collection of additional information, such as the NAICS code associated with each project and a more detailed accounting of the jobs created or retained (e.g. position titles) will likely enable supplemental analysis of the Health Research program's impacts. Additionally, each respondent should fill out a separate survey for each project, rather than aggregating the impact into a single response.
- **For programs that invest in early stage firms or research activities, it is critical to track business activity and funding sources prior to obtaining the state financial support and after the state monies have been spent to measure the long-term effect of the program.** In addition, if a business has multiple products being sold and developed, the data collection should detail these different functional activities to isolate the program receiving state funds.
- **If a successful product or company is developed, the location for where the product is sold, supported, and manufactured should be identified.** Given the failure rate of early stage companies and associated research, evaluations for these types of incentive programs tend to focus on a few highly successful companies, rather than individual recipients. These success stories can often generate enough economic activity and tax revenue to justify a program.
- **In order to correctly and accurately perform an economic impact analysis, the following information would be required on an annual basis.** It is preferable that this information be collected by project funding year cohort, since the awards most often last for multiple years. This would enable the analysis of impact from year to year (which is not currently possible).
 - Jobs data (including how many jobs existed prior to OCAST funding and how much other funding has been raised);
 - Payroll data;
 - Economic activity data (including gross sales and additional funding raised as a direct result of OARS funding);
 - Success or failure rate of each recipient; and
 - Industry sector information.



Introduction



Incentive Evaluation Commission Overview

In 2015, HB2182 established the Oklahoma Incentive Evaluation Commission (the Commission). It requires the Commission to conduct evaluations of all qualified state incentives over a four-year timeframe. The law also provides that criteria specific to each incentive be used for the evaluation. The first set of 11 evaluations were conducted in 2016, and an additional 12 were conducted in 2017.

The Oklahoma Health Research Program is one of 11 incentives scheduled for review by the Commission in 2018. Based on this evaluation and their collective judgment, the Commission will make recommendations to the Governor and the State Legislature related to this incentive.

Industry and Incentive Background

Citing Oklahoma's "need for an institution which combines the resources of public and private sectors to encourage the development of new products, new processes and whole new industries," the Economic Development Act of 1987 authorized the creation of OCAST. The Economic Development Act both created and incorporated a variety of mechanisms to increase the quantity and quality of research in Oklahoma in order to increase the rate of knowledge transfer and technological innovation and, thereby, improve economic competitiveness and spur economic growth. Originally created by the Oklahoma Health Research Act, the Oklahoma Health Research Program administered by OCAST is one of these mechanisms.

The Oklahoma Health Research Program funds basic research projects related to human health for one to three years at a maximum level of \$45,000 per year. The awards enable researchers to gain the expertise and produce the data needed to obtain larger grants from federal agencies and other national funding organizations. Research funded under this program investigates the causes, diagnosis, treatment and prevention of human diseases and disabilities and facilitates the development of health care products and services.

Criteria for Evaluation

A key factor in evaluating the effectiveness of incentive programs is to determine whether they are meeting the stated goals as established in state statute or legislation. In the case of this program, the goals are to help recruit and retain well-qualified health research scientists for the State, improve the competitiveness of Oklahoma-based investigators for national research funds, improve health care for the citizens of Oklahoma, and strengthen the State's health care industry.

In some respects, the goals of this program do not readily align with the legislative definition of incentives subject to review by the Commission. The enabling statute indicates that these incentives are "a tax credit, tax exemption, tax deduction, tax expenditure, rebate, grant, or loan that is intended to encourage businesses to locate, expand, invest, or remain in Oklahoma, or to hire or retain employees in Oklahoma." While it could be argued that improving research scientist competitiveness and strengthening the health care industry may encourage businesses to locate, expand, invest, or remain in Oklahoma, or to hire or retain employees in Oklahoma, these appear to be secondary or spin-off benefits rather than the primary purpose of the program.

To assist in a determination of program effectiveness, the Commission adopted the following criteria:

- Number of health research scientists recruited/retained through the program;
- National research funding obtained as a result of the program;
- Comparison of national research funding before/after program initiation;
- Comparison of national research funding for state without similar programs;
- Health care products and services developed as a result of funding; and
- Return on investment.



The criteria, particularly around health care products and services developed as a result of the funding, seek to focus on what are generally considered key goals of incentive programs, such as job recruitment and retention. Ultimately, incentive programs have to weigh both the benefits (outcomes related to achieving policy goals and objectives) and the costs, and that is also a criterion for evaluation (State return on investment). These will be discussed throughout the balance of the evaluation.



Health Research Background



Health Research Background

The term “health research,” sometimes called “medical research” or “clinical research,” refers to research that is conducted to learn more about human health. The broad definition includes biomedical research, epidemiological studies and health services research, as well as studies of behavioral, social and economic factors that affect health. Health research often aims to find better ways to prevent and treat disease and as such, it has a high value to society. It can provide important information about disease trends and risk factors, outcomes of treatment or public health interventions, functional abilities, patterns of care and health care costs and use.

Health research has led to significant discoveries, the development of new therapies, and improvements in health care and public health. Economists have found that medical research can have a significant impact on human health and longevity, and that the resulting increase productivity of the population contributes greatly to the national economy (Hatfield et al, 2001; Murphy and Topel, 1999).⁵

Today, the key funders of health-related R&D in the United States are private industry (primarily consisting of biopharmaceutical, medical technology and health care services companies) and the federal government (principally the National Institutes of Health [NIH]). Together, these entities provide nearly 90 percent of all health research support in the country, as shown in the following table. Investment in medical and health research in the U.S. grew by nearly \$30 billion (20.6 percent) between 2013 and 2016. The largest increase is attributable to private industry, which increased its funding by nearly \$23 billion (24.6 percent). Federal government funding increased by over \$4 billion (12.8 percent) during the time period.

Table 1: Estimated U.S. Medical and Health Research Expenditures 2013-2016 (in millions)

Research Segment	2013	% of 2013 Total	2016	% of 2016 Total	Change 2013-2016	CAGR*
Private Industry*	\$92,970	65.2%	\$115,862	67.4%	24.6%	7.6%
Federal Government	\$33,382	23.4%	\$37,646	21.9%	12.8%	4.1%
Academic & Research Institutions	\$10,742	7.5%	\$12,520	7.3%	16.6%	5.2%
Non-Research Conducting Grant-Giving Entities	\$3,903	2.7%	\$4,088	2.4%	4.7%	1.6%
State & Local Government	\$1,506	1.1%	\$1,686	1.0%	12.0%	3.8%
Total	\$142,503	100.0%	\$171,802	100.0%	20.6%	6.4%

Source: Research America – U.S. Investments in Medical and Health Research and Development, 2013-2016

* Industry segment includes biopharmaceutical, medical technology and health care services companies

* Compound Annual Growth Rate

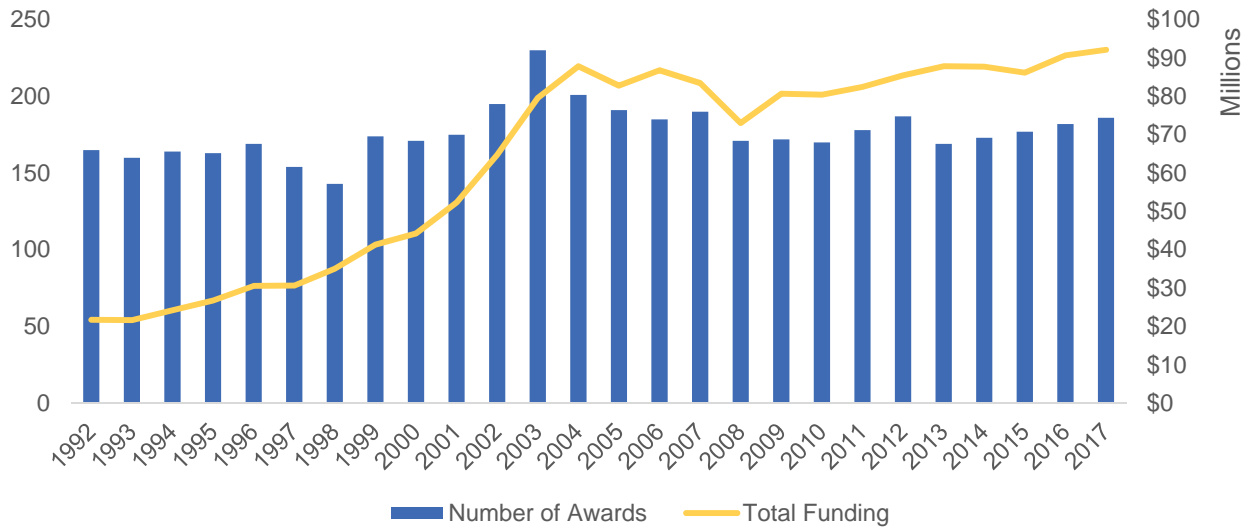
Federal Government Health Research Funding

Because the NIH is the primary source of federally-funded health research, analyzing NIH grant activity by state can serve as a meaningful proxy for overall federal research dollars obtained on a state-by-state basis. Since 1992, the total number of NIH awards funded annually in Oklahoma has remained relatively stable; excluding 2003, when 230 awards were funded, annual awards average 175. Total NIH funding in the State has grown steadily over time (with the exception of 2001 to 2004, when funding grew more rapidly), increasing from \$21.7 million in 1992 to \$92.1 million in 2017, a compound annual growth rate (CAGR) of 5.9 percent. The rate of increase in NIH funding has slowed in recent years, with a CAGR of 2.6 percent over the last 10 years.

⁵ Institute of Medicine Committee on Health Research and the Privacy of Health Information – The Value, Importance and Oversight of Health Research (2009). Accessed electronically at <https://www.ncbi.nlm.nih.gov/books/NBK9571/>



Figure 2: NIH Award Activity in Oklahoma, 1992-2017



Source: NIH Reporting Portfolio – Awards by Location and Organization

When comparing total NIH award funding in Oklahoma to other states and Washington, D.C., Oklahoma's rank in 1992 (37 of 51) was unchanged in 2017. On a per capita basis, Oklahoma ranked 39th in 1992 (at \$7). Despite the State's per capita amount increasing to \$23 by 2017, its rank had fallen to 44th. Among the six states immediately surrounding Oklahoma (Arkansas, Colorado, Kansas, Missouri, New Mexico and Texas), Oklahoma's per capita NIH funding in 1992 ranked sixth, higher only than Arkansas (\$6 per capita), and it remained sixth in 2017. A detailed list of each state's NIH funding and rank between 1992 and 2017 is provided in **Appendix B**.

The impact of NIH funding on a state's economy is significant. The \$92.1 million invested in Oklahoma in 2017 supported 2,126 jobs, resulting in economic activity totaling an estimated \$292.6 million. The top NIH-funded research institutions in the state were the University of Oklahoma Health Sciences Center, Oklahoma Medical Research Foundation, the University of Oklahoma – Norman, Oklahoma State University – Stillwater and VADovations, Inc.⁶

State and Local Health Research Funding

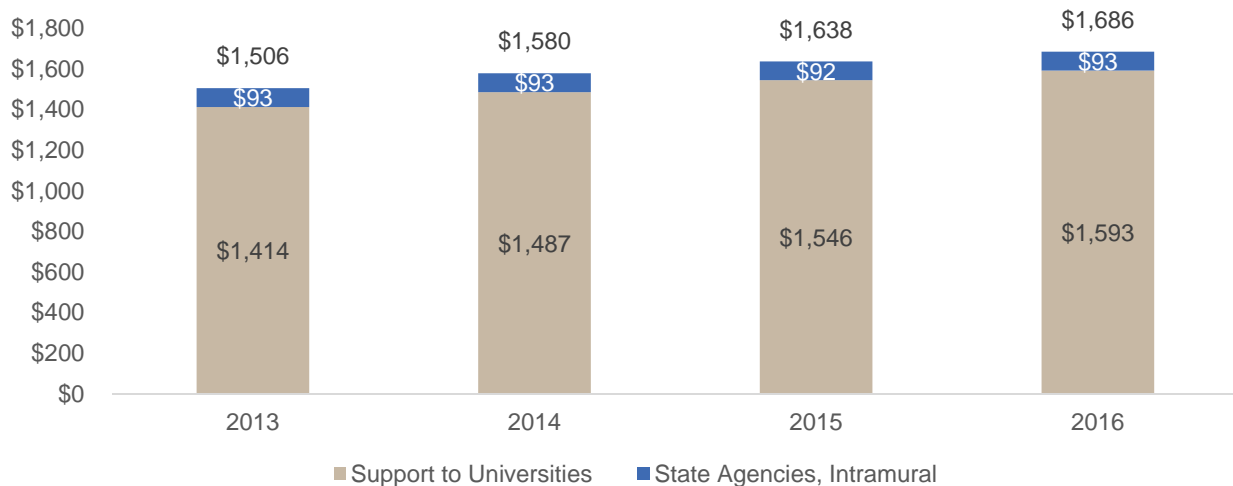
Nationally, state and local government support accounts for one percent of total U.S. investment in medical and health research. While not the primary financial contributors to health-related R&D, these governments are an important part of overall funding. State and local governments increased their investment in medical and health research by \$180 million (12.0 percent) between 2013 and 2016 – equal to a CAGR of nearly four percent (similar to that of the federal government over the same time period). As shown in the following figure, state and local governments support medical and health research primarily through grants to universities, though a smaller portion (around six percent) is used to support intramural research conducted by public local agencies such as state health departments.⁷

⁶ United for Medical Research – NIH by State 2017. Accessed electronically at <http://www.unitedformedicalresearch.com/state-by-state/#state/oklahoma>

⁷ Research America – U.S. Investments in Medical and Health Research and Development, 2013-2016. Accessed electronically at https://www.researchamerica.org/sites/default/files/RA-2017_InvestmentReport.pdf.



Figure 3: Estimated State and Local Government Medical and Health Research Expenditures, 2013-2016 (in millions)



Source: Research America – U.S. Investments in Medical and Health Research and Development, 2013-2016

According to the NSF, in 2016, expenditures for health-related R&D accounted for 46.8 percent of total State spending on R&D. Those health-related R&D expenditures increased from \$5.8 million in 2009 to \$15.7 million in 2016, a CAGR of 15.3 percent. Of the 2016 total, most (\$11.7 million) was attributable to the Tobacco Settlement Endowment Trust; an additional \$4.0 million was attributable to OCAST and approximately \$10,000 to the Department of Human Services. The State's 2016 investment in health-related R&D ranked 10th among 35 states for which data was provided. Further, among immediately surrounding states, Oklahoma's total investment was smaller only than Texas (\$212 million) and, at \$4.04 per capita, Oklahoma was second only to Texas (\$7.87 per capita).⁸

Health Research Industry Employment and Payroll

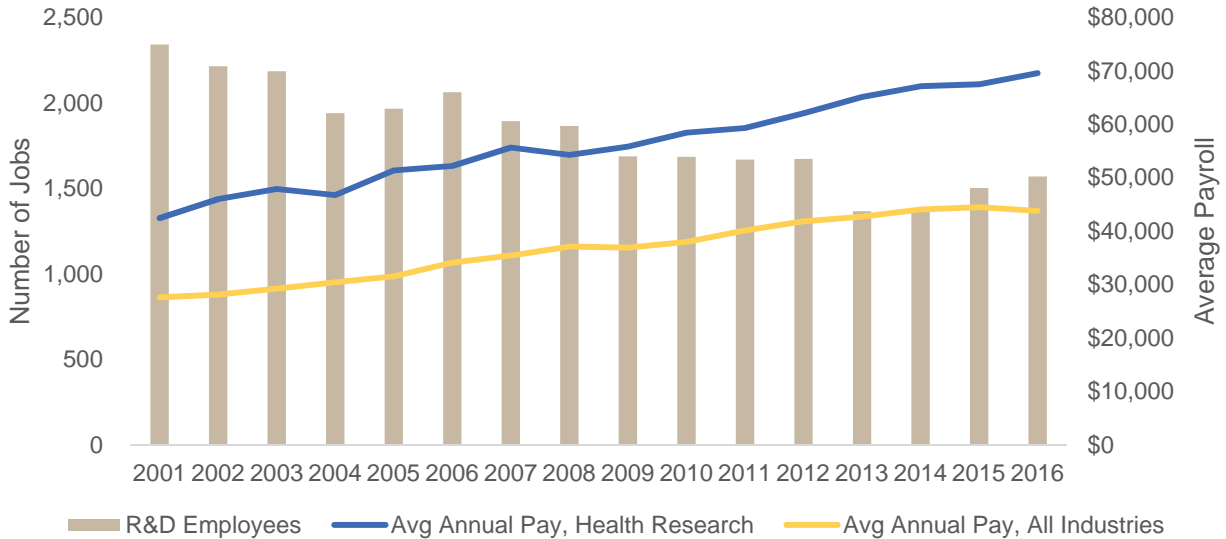
In Oklahoma, overall employment in R&D in the Physical, Engineering and Life Sciences industry decreased between 2001 and 2016, while average industry pay has increased.⁹ Further, the average industry pay (\$70,000 in 2016) is significantly higher than the average wage for all industries in Oklahoma (\$44,000), as shown in the following table. Additionally, with a CAGR of 3.3 percent between 2001 and 2016, the average industry pay is increasing more rapidly than the average wage across all industries (3.1 percent).

⁸ National Science Foundation, National Center for Science and Engineering Statistics – Survey of State Government Research and Development. Accessed electronically at <https://ncesdata.nsf.gov/sgrd/2016/>

⁹ Data based on North American Industry Classification System (NAICS) code 54171 – Research and Development in the Physical, Engineering and Life Sciences



Figure 4: Oklahoma Employment and Pay, R&D in the Physical, Engineering and Life Sciences Industry, 2001-2016



Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages
NAICS 54171 – Research and Development in the Physical, Engineering and Life Sciences

While the average annual pay is higher for the industry than for overall private employment, when compared to immediately surrounding states, the variance in Oklahoma is not as significant as that observed in other states (excluding Arkansas). It should be noted that other economic factors, such as cost of living, can influence these statistics.

Table 2: Comparison of Average Annual Pay, 2016

State	Avg. Annual Pay, All Industries	Avg. Annual Pay, Health Research	\$ Variance	% Variance
Oklahoma	\$43,809	\$69,575	\$25,766	58.8%
Arkansas	\$41,270	\$58,120	\$16,850	40.8%
Colorado	\$54,873	\$112,243	\$57,370	104.6%
Kansas	\$44,771	\$78,776	\$34,005	76.0%
Missouri	\$46,562	\$98,561	\$51,999	111.7%
New Mexico	\$41,063	\$98,226	\$57,163	139.2%
Texas	\$55,085	\$107,811	\$52,726	95.7%

Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages
NAICS 54171 – Research and Development in the Physical, Engineering and Life Sciences

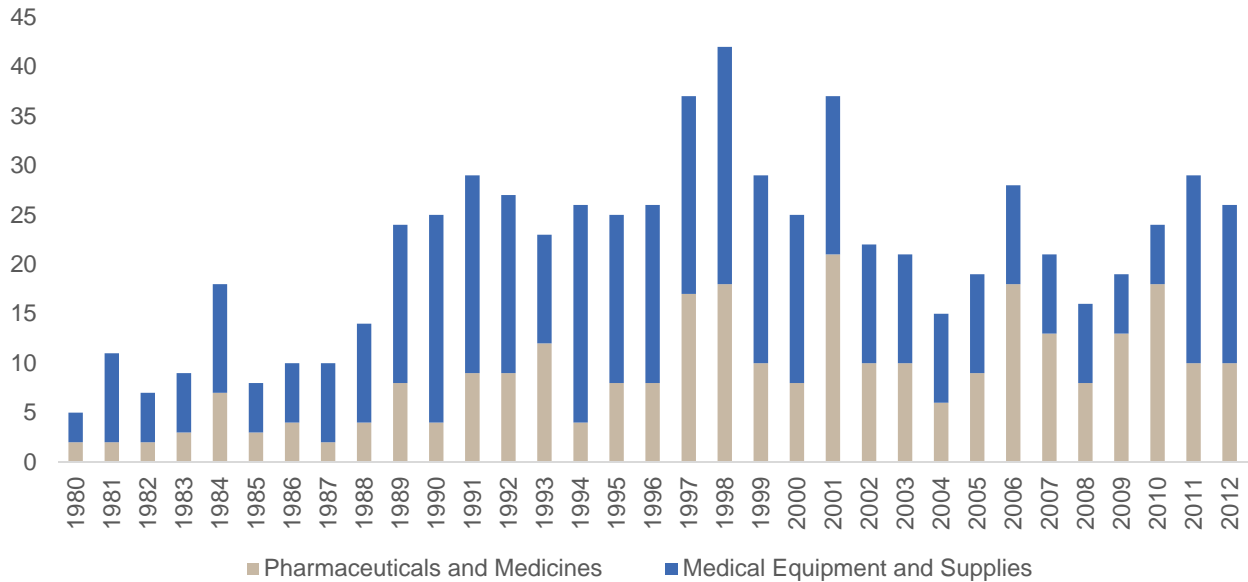
Health Research Patents

It can be useful to analyze patent data made available by the U.S. Patent and Trademark Office as an indicator of health research productivity. Utility patents are granted to anyone who invents or discovers any new and useful process, machine, article of manufacture, or composition of matter, or any new and useful improvement. Within the broad umbrella of utility patents, the project team identified two major industry subcategories – pharmaceuticals and medicines (NAICS code 3254) and medical equipment and supplies (NAICS code 3391) – to serve as a proxy for health research patents. As shown in the following table, medical patents awarded in



Oklahoma peaked in 1998 at 42. Patents are relatively evenly split between pharmaceuticals and medicines and medical equipment and supplies.

Figure 5: Oklahoma Medical Patents by Industry, 1980-2012¹⁰



Source: U.S. Patent and Trademark Office – Utility Patent Grants Organized by Industry, 1980-2012

With a CAGR of 5.4 percent, Oklahoma’s patent activity between 1980 and 2010 is comparable to surrounding states and states with comparable programs. Between 1990 and 2010, Oklahoma’s activity (-0.2 percent) was essentially flat, while all other states grew by between 1.9 percent (New Mexico) and 8.6 percent (Arkansas). Between 2000 and 2010, Oklahoma’s patent activity (-0.4 percent) was again nearly flat – as were many other states. The exception was Arkansas, which increased by a CAGR of 4.1 percent over the time period.

Table 3: Medical Patents, Selected States

State	1980	1990	2000	2010	CAGR 1980-2010	CAGR 1990-2010	CAGR 2000-2010
Oklahoma	5	25	25	24	5.4%	-0.2%	-0.4%
Arkansas	3	4	14	21	6.7%	8.6%	4.1%
Colorado	15	34	105	102	6.6%	5.6%	-0.3%
Texas	43	118	303	259	6.2%	4.0%	-1.6%
Virginia*	17	42	96	90	5.7%	3.9%	-0.6%
Connecticut*	47	88	201	222	5.3%	4.7%	1.0%
New Mexico	3	9	22	13	5.0%	1.9%	-5.1%
Pennsylvania*	103	143	415	430	4.9%	5.7%	0.4%
Kansas	10	17	41	37	4.5%	4.0%	-1.0%
Missouri	32	50	104	83	3.2%	2.6%	-2.2%

Source: U.S. Patent and Trademark Office – Utility Patent Grants Organized by Industry, 1980-2012

* Denotes state with comparable program

¹⁰ Pharmaceuticals and Medicines patent data includes patents registered under the same NAICS 3254; Medical Equipment and Supplies patent data includes patents registered under NAICS 3391.



Program Usage and Administration



Program Characteristics

Citing Oklahoma's "need for an institution which combines the resources of public and private sectors to encourage the development of new products, new processes and whole new industries," the Economic Development Act of 1987 authorized the creation of OCAST. The Economic Development Act both created and incorporated a variety of mechanisms to increase the quantity and quality of research in Oklahoma in order to increase the rate of knowledge transfer and technological innovation and, thereby, improve economic competitiveness and spur economic growth. Originally created by the Oklahoma Health Research Act, the Oklahoma Health Research Program administered by OCAST is one of these mechanisms.

The Health Research Program addresses OCAST's statutory mandate of supporting basic human health-related research by allocating resources according to scientific merit and the potential to leverage private and federal resources while fostering public and private sector collaboration.

The Oklahoma Health Research Program funds basic health research projects related to human health for one to three years at a maximum level of \$45,000 per year. The awards enable researchers to gain the expertise and produce the data needed to obtain larger grants from federal agencies and other national funding organizations and to develop patents which in the long term can lead to commercialization. Research funded under this program investigates the causes, diagnosis, treatment and prevention of human diseases and disabilities and facilitates the development of health care products and services.

The Health Research Program funds health research projects defined as specific examination, experimentation or investigation oriented principally toward basic, applied and developmental scientific inquiry related to health research. They include the following:¹¹

- The causes, diagnosis, prevention and treatment of human diseases and disabilities and mental health and emotional disorders, and the rehabilitation of persons affected with such diseases, disabilities and disorders;
- New knowledge, better understanding and innovative methods to improve the processes by which health care services are made available and how they may be provided more efficiently, more effectively and at a lower cost, for all the citizens of the state; and
- The development of new products and services which shall form the basis of new high-technology health research and care industry for the state.

OCAST Appropriation

OCAST is required by statute to recommend an appropriate level of funding for its programs that will "make these programs nationally competitive with those of other states and to adopt...a threshold funding level for each of the programs...that is great enough to have a significant impact and carry out the intent" of the statute.¹² After the Governor and Legislature approve the OCAST annual appropriation, staff and board members develop a business plan for the application of available resources, abiding by the directives and constraints on the spending articulated in the signed appropriation bills.¹³

Over the past five years, the total OCAST appropriation has decreased by a CAGR of -6.8 percent. The Health Research program allocation decreased by a CAGR of -7.1 percent between FY2014 and FY2018 but consistently accounts for roughly 19 percent of the total OCAST appropriation, as shown in the following figure.

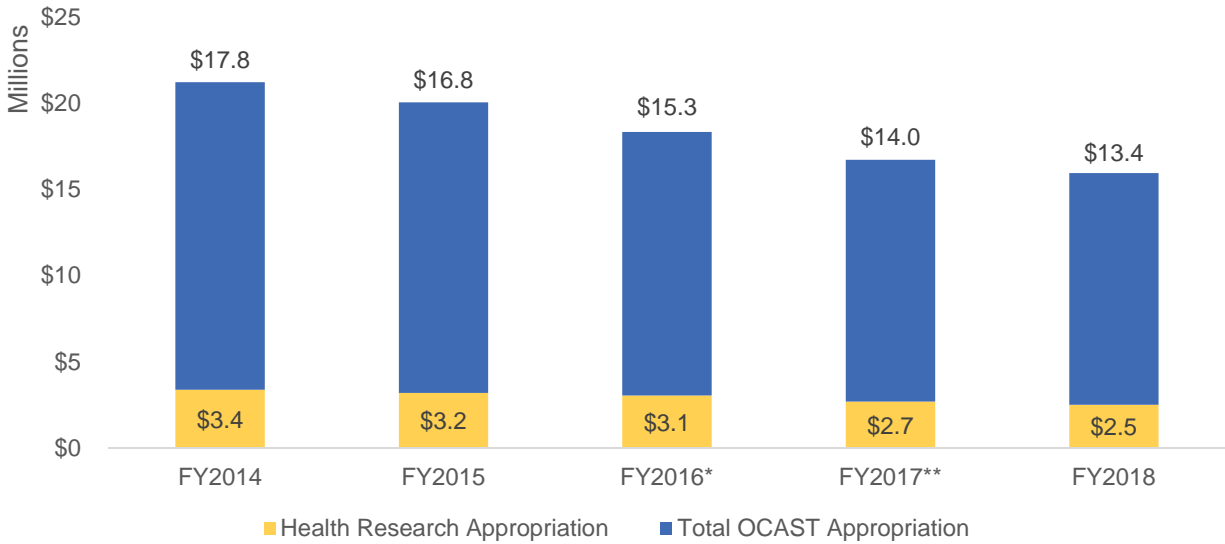
¹¹ 74 O.S., Section 5060.4

¹² 74 O.S., Section 5060.22

¹³ OCAST FY2018 Business Plan



Figure 6: OCAST Appropriation, FY2014-2018 (in Millions)



Source: OCAST 2018 Business Plan

* Initial OCAST appropriation in FY2016 was \$16.0 million; it was reduced to \$14.9 million due to budget cuts. The legislature returned \$0.4 million in September 2016, increasing the FY2016 appropriation to \$15.3 million.

** Initial OCAST appropriation in FY2017 was \$14.1 million; final appropriation \$14.0 million.

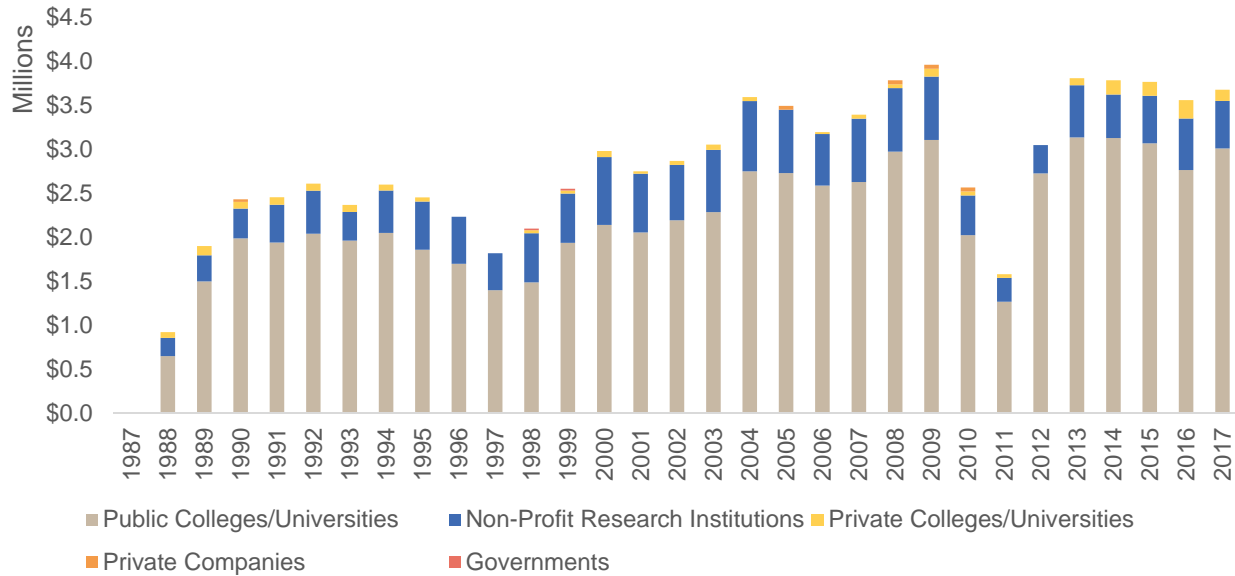
Historic Use of the Program

Since the program's inception, OCAST has provided more than \$85 million in Health Research awards. The program's recipients are primarily public colleges and universities; these entities have accounted for between 70 and 89 percent of annual funding since the program began and, with a total of \$67 million in awards received, comprise 79 percent of total funding over the life of the program. Non-profit research institutions are the second largest recipients, receiving \$16 million since 1987. Private colleges and universities have received nearly \$2 million.

While there has been some variance in the value of contracts awarded annually since the program's inception, awards have remained relatively stable. Between 1988 (the first year a grant was funded) and 2017, annual grant disbursements averaged \$2.8 million.



Figure 7: Health Research Program Funding by Organization Type, 1987-2017



Source: OCAST

The foremost beneficiary of the program has been the University of Oklahoma, which has received more than \$48.0 million in Health Research funds. Oklahoma State University has received \$18.4 million, while the Oklahoma Medical Research Foundation has received \$14.4 million. Combined, these three entities comprise nearly 95 percent of total funding over the lifetime of the Health Research Program

Table 4: Primary Health Research Grant Recipients, 1987-2017

Organization	Total Funding	% of Total Funding
University of Oklahoma	\$48,007,587	56.3%
Oklahoma State University	\$18,441,909	21.6%
Oklahoma Medical Research Foundation	\$14,362,153	16.9%
All Other Organizations	\$4,398,065	5.2%
Total Funding	\$85,209,714	100.0%

Source: OCAST

Health Research Program Administration

OCAST is responsible for administering the Health Research Program under the governance of the statutorily created Oklahoma Science and Technology Research and Development Board (OSTRaD). Also statutorily created, the nine member Oklahoma Health Research Committee (OHRC) acts in an advisory capacity to the OSTRaD Board and staff in the development of program specifications, organization and implementation of peer review, award of contracts and ongoing evaluation of contract performance. The OHRC evaluates the merits of proposed health research projects, the qualifications of investigators and the facilities in which proposed health research projects will be performed, and advises OCAST of its findings.¹⁴

¹⁴ 74 O.S., Section 5060.17



Program Eligibility

Eligible applicants for funding under the Health Research Program include private or public Oklahoma colleges or universities; nonprofit research foundations; and private enterprises of special importance to the Oklahoma economy. Investigators preparing applications must be employed by or affiliated with an eligible applicant organization, and must be residents of Oklahoma within 90 days of the award of a contract.¹⁵

Application Review Process

All proposals are reviewed and ranked for funding by research scientists residing outside the State who are nominated and approved by the OHRC. These peer reviewers evaluate applications for scientific merit based on the quality of the proposed research, qualifications of the principal investigator and appropriateness of the institutional facilities and use of the described project budget.

Performance Evaluation

Investigators are required to submit an annual progress report 60 days prior to the ending date of each contract funding period, except at the end of the final contract period when a final report is submitted 30 days after the end of the contract. Reviewers evaluate annual project performance; continued funding is contingent upon a satisfactory annual performance evaluation and the availability of funds.

In general, the annual progress report provides:

- A summary of progress to date and plans for the subsequent contract period;
- A listing of submitted and/or published journal articles and publications that incorporate any portion of the work supported by the contract;
- A listing of all presently funded research grants or contracts; and
- A detailed budget for the subsequent year.

The final report incorporates:

- A summary of research completed on the project during the entire funding period;
- A listing of submitted and/or published journal articles and publications that incorporate any portion of the work supported by the contract; and
- A listing of all presently funded research grants or contracts.

Program Reporting

Annually, OCAST produces an 'Impact Report' detailing a summary of "success stories" and the following performance measures attributable to each of its programs:

- Number of new companies formed;
- Number of jobs created or retained;
- Total payroll;
- Patents granted;
- Annual licenses and royalties value;
- Gross sales;
- Capital investments;
- Cost avoidance; and

¹⁵ 74 O.S. Sections 5060.4, 5060.14 and 5060.17



- Total financial impact and leverage.

OCAST administers a survey of current and former award recipients in order to collect this information. Grantees are required by contract to respond to the survey for a period of five years from the time the first round of funding is received.

While data collection regarding any incentive program is a best practice, and this process is undoubtedly beneficial to OCAST and its stakeholders, the OCAST data currently collected is not presented in a manner conducive for accurately calculating economic impact. Of primary concern is that the surveys cover multiple award years in the aggregate, with Health Research recipients dropping in and out of the survey. This can often lead to significant fluctuations in the aggregate program data over time. Additionally, the fact that recipients self-report the data can lead to variances in the way information is reported and is inherently subject to error. In addition, it is not clear when revenue is reported or where it is generated (i.e. in Oklahoma or another state).

To correctly and accurately perform an economic impact analysis, the following information would be required on an annual basis – preferably for each class of recipients by group or cohort, since the awards most often last for multiple years.

- Jobs data (including how many jobs existed prior to OCAST funding and how much other funding has been raised);
- Payroll data;
- Economic activity data (including gross sales and additional funding raised as a direct result of Health Research funding);
- Success or failure rate of each recipient; and
- Industry sector information.



Economic and Fiscal Impact



Introduction

As discussed in the prior chapter, OCAST annually administers a survey of current and former award recipients in order to collect information for use in its yearly Impact Report. While the data currently collected as part of this process cannot be used to measure economic and fiscal impact in the traditional sense, it can provide insight into possible impacts of the program.

The following discusses the project team’s analysis of responses to the 2017 OCAST survey (administered to 2012-2016 award recipients). It should be noted that survey responses may be erroneous, and that figures do not include data for award recipients that did not respond to the survey. A list of the questions included in the 2017 OCAST Impact Survey is provided in **Appendix A**.

State Investment

One hundred fifty one awards totaling \$19.6 million were issued to respondents, as illustrated in the following table. It is also notable that the amounts listed below do not comprise all awards made in the years provided; instead, they represent the award amounts received by those grantees responding to the 2017 survey.

Table 5: 2017 OCAST Survey Health Research Recipient Responses, Award Summary¹⁶

Project Start Year	Project Count	Award Amount
2010	13	\$1,731,679
2011	19	\$2,564,279
2012	19	\$2,389,686
2013	24	\$2,985,258
2014	28	\$3,708,760
2015	22	\$2,865,846
2016	26	\$3,394,872
Total	151	\$19,640,380

Source: PFM analysis of 2017 Impact Report survey data

Employment and Payroll

As reported by survey respondents, a total of 277.5 jobs were created or retained as a result of 128 Health Research projects, resulting in an average of 2.2 jobs per project. Representatives of the remaining 23 projects did not report any jobs in response to the survey. The total annual payroll (plus benefits) was estimated at \$9.1 million, and the average annual wage among all companies in the aggregate was calculated to be \$45,240, equal to the average private industry annual wage (\$45,169 in 2017).

Additionally, nearly 220 interns were hired to support 90 Health Research projects, and representatives of 67 of those projects (74.4 percent) reported that they would hire their interns upon graduation if feasible.

Startup/Spin-Out Businesses and New Products

Among the 151 projects, one reported a startup/spin-out company attributable to the receipt of Health Research funding. According to publicly available records, the company (which is categorized under endoscopic and

¹⁶ Project start year is estimated based on naming convention of project number. For example, a project number of “AR16-001” is assumed to have started in 2016.



electro-medical equipment) was established in 2017 and incorporated in Oklahoma. Current estimates show the company has annual revenue of \$86,675 and employs a staff of two.

Of the 151 award recipients responding, 12 (7.9 percent) reported developing new products as a result of Health Research funding. These new products include (but are not limited to) dental adhesive resins with antibacterial and bioactive functionalities, photo-switching bio probes for super-resolution optical microscopy, a new protocol for cellular delivery of nanoparticles and a radioactive compound for use in evaluating kidney function. Several others reported the release of peer-reviewed publications.

Patents, Royalties and Licenses

A total of five patents have been awarded to five separate projects among the respondent group, though several indicated that patents were pending at the time of the survey. Only one respondent provided an estimated patent value (\$100,000). In addition, one respondent reported the receipt of \$7,500 in royalties or licensing fees as a result of Health Research funding.

Capital Investment

Twenty-five respondents (16.6 percent) indicated that capital investment resulted from Health Research funding – for a total investment of \$8.0 million. On average, this equates to more than \$0.3 million per project.

Gross Sales

Twelve respondents (7.9 percent) reported \$2.7 million in gross sales attributable to the receipt of Health Research funding – equal to more than \$0.2 million per project.

Additional Funding Obtained

Finally, representatives of 81 projects (53.6 percent) indicated that a total of \$51.1 million in additional funding was obtained as a result of the initial Health Research funding – equal to more than \$0.6 million per project.

Summary

While a traditional economic impact analysis cannot be performed due to the data collection issues described previously, the \$19.6 million OCAST investment in support of the Health Research projects summarized above indicate that the investment results in significant economic activity.



Incentive Benchmarking



Benchmarking

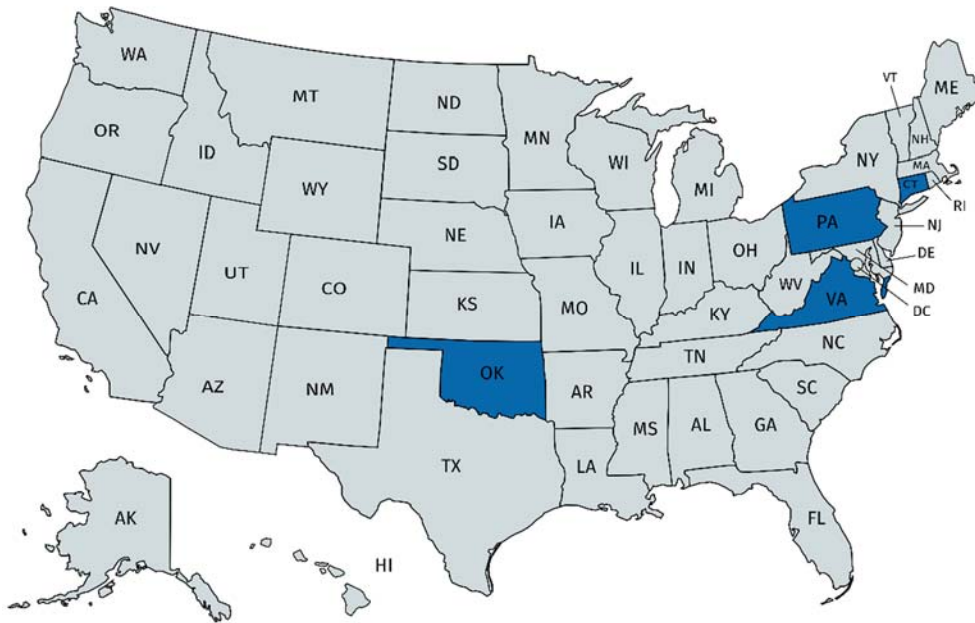
A detailed description of comparable state programs can be found in **Appendix C**.

For evaluation purposes, benchmarking provides information related to how peer states use and evaluate similar incentives. At the outset, it should be understood that no states are ‘perfect peers’ – there will be multiple differences in economic, demographic and political factors that will have to be considered in any analysis; likewise, it is exceedingly rare that any two state incentive programs will be exactly the same.¹⁷ These benchmarking realities must be taken into consideration when making comparisons – and, for the sake of brevity, the report will not continually re-make this point throughout the discussion.

The process of creating a comparison group for incentives typically begins with bordering states. This is generally the starting point, because proximity often leads states to compete for the same regional businesses or business/industry investments. Second, neighboring states often (but not always) have similar economic, demographic or political structures that lend themselves to comparison.

Four states (Oklahoma, Connecticut, Pennsylvania and Virginia) were found to have programs geared toward health research. The following discusses some of the key characteristics of these programs.

Figure 8: States with Comparable Health Research Programs



Program Overviews

Connecticut’s Bioscience Innovation Fund (CBIF) provides focused financial assistance to startups, early stage businesses, non-profits and accredited colleges and universities. Connecticut Innovations makes investments from the \$200 million fund over 10 years in the form of grants, equity investments and loans to speed ‘commercializable’ bioscience breakthroughs toward the market. Royalty-bearing grants are made in the amount of up to \$500,000 over three years.

¹⁷ The primary instances of exactly alike state incentive programs occur when states choose to ‘piggyback’ onto federal programs.



Pennsylvania's Commonwealth Universal Research Enhancement (CURE) program supports broad-based health research for the purpose of discovering new scientific knowledge that can be applied toward improving the health of all residents.

The **Virginia** Biosciences Health Research Corporation (VBHRC) provides grants of \$200,000 to \$800,000 per project to accelerate transitional research and commercialization of breakthrough technologies in the life sciences that address large unmet medical needs with the goal of improving human health.

Program Funding

Despite allowing for grants of up to \$500,000, Connecticut allocated just \$30,000 in grants in 2015. Pennsylvania's CURE program is funded with Tobacco Settlement monies; while \$43 million was allocated in 2014, none was disbursed.

At \$3.7 million in 2017, Oklahoma's total program funding was comparable to Virginia, where the total amount awarded was \$3.4 million. Virginia's program is funded by the General Fund, the University of Virginia, Virginia Commonwealth University, Virginia Tech, Eastern Virginia Medical School, George Mason University and Old Dominion University.

Matching Requirements

Among states with comparable programs, only Virginia has a fund matching requirement. The program has a 6-times multiplier for large companies, though the Board of Directors can consider a smaller match for smaller companies (defined as those with under \$50 million in capitalization) but never less than a one-to-one dollar match.



Appendices



Appendix A: 2017 OCAST Impact Survey and Health Research Recipient Responses

1. Project Type.
 - a. Health Research
 - b. OARS
 - c. Intern
 - d. ONAP
 - e. SBIR/SBRA
 - f. Plant Science
2. Project Number.
3. Name.
4. Please list the number of jobs created or retained as a result of this project.
5. Please report the total annual payroll (including benefits) of jobs created or retained by this project.
6. List the total dollar amount of contracts, grants or additional follow-on funding awarded that can be attributed in whole or part to OCAST funding. Do not include any OCAST awards, OCAST-required matching funds or any state-appropriated funds.
7. What is the average annualized wage of the jobs created/retained by this project? Annualized wages can be determined by multiplying the hourly wage by 2,080.
8. Has a start-up or spin-out company formed that can be attributed to this OCAST-funded project?
9. Please list the nature of the spin-out company, the company name, approximate number of employees and the approximate annual payroll.
10. Have any new products or services resulted from your project?
11. Since you answered yes to the previous question, please name the type of product or service, the industries that will likely benefit from the product or service and the date/estimated date the product was/will be commercialized.
12. Have you submitted an application for, or been granted, a patent for a product or service resulting from this project?
13. Number of patent applications submitted.
14. Number of patents awarded.
15. Dollar value of patents awarded.
16. Have you received any royalties or licensing fees from a product or service resulting from this project?
17. Dollar amount of royalties or licensing fees received.
18. Please estimate the total dollar impact on capital investments this project has had.
19. Please estimate the total dollar impact on gross sales this project has had.
20. Were any student interns hired/retained as a part of this project?
21. How many students were hired/retained as a result of this project?
22. If the opportunity presents itself, do you intend to hire any of these interns full-time after the intern earns his or her degree?
23. As a result of this project, have there been any collaborations with a business or other academic entity? If so, please describe.
24. Please describe in lay terms the most significant impact of this project to date.
25. Please feel free to provide any other significant impacts, financial or otherwise, that were not covered in this survey.
26. Please feel free to provide any additional comments, including your thoughts on the ease of use of this survey.



Appendix B: NIH Funding by State, 1992-2017 (Funding Amounts in Millions of Dollars)

State	1992		1997		2002		2007		2012		2017		Funding Rank		Funding per Capita			
	Awards	Funding	Awards	Funding	Awards	Funding	Awards	Funding	Awards	Funding	Awards	Funding	1992	2017	1992	Rank	2017	Rank
Alabama	588	\$111	610	\$149	667	\$242	619	\$270	570	\$253	644	\$298	20	22	\$28	22	\$61	24
Alaska	13	\$2	17	\$2	13	\$10	13	\$11	14	\$9	22	\$17	48	49	\$3	47	\$23	45
Arizona	359	\$69	344	\$77	453	\$135	488	\$175	423	\$174	419	\$189	26	27	\$19	28	\$27	41
Arkansas	100	\$15	107	\$21	146	\$53	161	\$61	135	\$62	99	\$57	40	39	\$6	40	\$19	47
California	5,186	\$1,159	5,523	\$1,449	7,001	\$2,490	7,487	\$3,681	7,768	\$3,475	8,013	\$3,946	1	1	\$39	14	\$100	11
Colorado	679	\$130	800	\$182	1,014	\$284	940	\$344	903	\$314	1,038	\$359	18	20	\$39	13	\$64	21
Connecticut	916	\$212	928	\$245	1,157	\$387	1,224	\$487	1,201	\$476	1,191	\$524	13	16	\$65	4	\$146	5
Delaware	27	\$5	37	\$7	75	\$25	73	\$29	67	\$33	83	\$43	45	43	\$7	38	\$45	29
DC	490	\$111	515	\$134	525	\$211	429	\$227	378	\$192	388	\$227	21	25	\$183	1	\$328	2
Florida	655	\$119	678	\$147	953	\$287	1,001	\$365	1,163	\$502	1,294	\$650	19	12	\$9	36	\$31	38
Georgia	602	\$108	683	\$147	966	\$308	1,040	\$386	1,092	\$466	1,237	\$537	22	15	\$17	29	\$52	27
Hawaii	82	\$17	58	\$20	88	\$49	117	\$71	101	\$57	75	\$50	39	41	\$15	30	\$35	35
Idaho	15	\$1	8	\$1	25	\$12	19	\$11	15	\$9	21	\$14	51	50	\$1	51	\$8	51
Illinois	1,377	\$247	1,442	\$320	1,859	\$555	2,027	\$769	1,983	\$798	2,009	\$806	9	9	\$22	24	\$63	23
Indiana	126	\$19	482	\$104	576	\$167	652	\$214	624	\$203	644	\$261	38	23	\$3	48	\$39	33
Iowa	395	\$81	387	\$94	517	\$170	505	\$206	440	\$195	436	\$177	25	30	\$29	20	\$56	25
Kansas	171	\$26	174	\$35	234	\$75	241	\$88	255	\$102	231	\$101	34	35	\$11	34	\$35	36
Kentucky	250	\$35	275	\$48	419	\$107	431	\$146	403	\$156	436	\$188	30	28	\$9	35	\$42	31
Louisiana	138	\$22	315	\$62	349	\$117	314	\$140	343	\$168	285	\$142	36	32	\$5	42	\$30	39
Maine	65	\$14	102	\$26	137	\$67	130	\$72	126	\$75	129	\$89	41	38	\$11	33	\$67	19
Maryland	2,165	\$512	2,082	\$606	2,266	\$848	2,538	\$1,349	2,416	\$1,598	2,368	\$1,612	4	5	\$107	3	\$266	3
Massachusetts	3,514	\$819	4,085	\$1,064	4,968	\$1,822	5,086	\$2,329	5,157	\$2,562	5,185	\$2,717	3	2	\$136	2	\$396	1
Michigan	1,234	\$242	1,243	\$299	1,475	\$457	1,460	\$624	1,581	\$633	1,598	\$708	11	11	\$26	23	\$71	18
Minnesota	824	\$173	847	\$201	1,039	\$348	1,054	\$468	1,083	\$497	1,121	\$557	15	13	\$39	12	\$100	10
Mississippi	75	\$9	82	\$15	85	\$26	79	\$45	78	\$34	89	\$53	42	40	\$4	46	\$18	48
Missouri	882	\$181	981	\$246	1,245	\$442	1,183	\$491	1,100	\$480	1,209	\$537	14	14	\$35	16	\$88	12
Montana	42	\$4	46	\$7	78	\$26	85	\$36	65	\$29	69	\$36	46	44	\$5	43	\$34	37
Nebraska	158	\$23	152	\$26	228	\$62	219	\$74	221	\$91	234	\$108	35	34	\$15	31	\$56	26
Nevada	52	\$7	43	\$9	53	\$18	53	\$22	44	\$21	56	\$32	44	45	\$6	41	\$11	50
New Hampshire	172	\$37	190	\$42	237	\$80	235	\$91	200	\$92	234	\$109	29	33	\$33	17	\$81	13
New Jersey	485	\$90	525	\$114	685	\$207	689	\$332	612	\$260	572	\$241	23	24	\$12	32	\$27	42
New Mexico	168	\$29	168	\$42	233	\$85	242	\$134	221	\$104	205	\$100	32	36	\$19	27	\$48	28
New York	3,976	\$933	3,995	\$1,039	5,050	\$1,678	4,848	\$2,004	4,851	\$2,042	5,056	\$2,386	2	3	\$52	7	\$120	9
North Carolina	1,458	\$315	1,610	\$409	1,947	\$680	2,184	\$1,140	2,292	\$1,061	2,330	\$1,246	7	6	\$48	8	\$121	8
North Dakota	17	\$2	27	\$3	44	\$14	36	\$17	35	\$15	31	\$18	47	48	\$3	49	\$24	43
Ohio	1,171	\$225	1,312	\$306	1,781	\$529	1,812	\$704	1,698	\$708	1,758	\$754	12	10	\$21	25	\$65	20
Oklahoma	165	\$22	154	\$31	195	\$65	190	\$83	187	\$85	186	\$92	37	37	\$7	39	\$23	44
Oregon	497	\$86	536	\$119	768	\$236	751	\$280	713	\$305	655	\$312	24	21	\$30	18	\$75	16
Pennsylvania	2,205	\$498	2,782	\$679	3,530	\$1,184	3,537	\$1,417	3,524	\$1,460	3,582	\$1,673	5	4	\$42	9	\$131	7
Rhode Island	226	\$40	274	\$53	389	\$108	482	\$145	466	\$150	486	\$171	28	31	\$40	11	\$161	4
South Carolina	181	\$28	188	\$39	347	\$102	389	\$133	392	\$136	441	\$183	33	29	\$8	37	\$37	34
South Dakota	13	\$2	16	\$3	25	\$13	30	\$17	36	\$22	34	\$24	50	47	\$2	50	\$27	40
Tennessee	669	\$135	718	\$163	968	\$327	1,092	\$458	1,112	\$476	1,100	\$511	17	17	\$28	21	\$76	15
Texas	1,827	\$343	2,163	\$500	2,803	\$981	2,801	\$1,123	2,641	\$1,077	2,764	\$1,161	6	7	\$20	26	\$41	32



State	1992		1997		2002		2007		2012		2017		Funding Rank		Funding per Capita			
	Awards	Funding	Awards	Funding	Awards	Funding	Awards	Funding	Awards	Funding	Awards	Funding	1992	2017	1992	Rank	2017	Rank
Utah	356	\$62	338	\$76	442	\$129	430	\$162	436	\$172	479	\$198	27	26	\$36	15	\$64	22
Vermont	157	\$33	117	\$26	174	\$62	164	\$67	128	\$52	111	\$49	31	42	\$58	6	\$79	14
Virginia	805	\$246	751	\$160	869	\$264	926	\$370	772	\$315	833	\$377	10	19	\$40	10	\$45	30
Washington	1,127	\$304	1,292	\$379	1,570	\$645	1,638	\$827	1,645	\$918	1,656	\$998	8	8	\$62	5	\$135	6
West Virginia	61	\$8	52	\$8	53	\$15	72	\$25	50	\$37	58	\$28	43	46	\$4	44	\$16	49
Wisconsin	765	\$144	815	\$178	984	\$321	1,014	\$389	929	\$376	915	\$425	16	18	\$29	19	\$73	17
Wyoming	16	\$2	9	\$1	21	\$7	16	\$7	12	\$7	19	\$12	49	51	\$4	45	\$21	46
Total	37,697	\$8,054	41,078	\$10,115	51,726	\$17,533	53,246	\$23,117	52,701	\$23,533	54,128	\$26,105						

Source: U.S. Department of Health and Human Services NIH Awards by Location and Organization



Appendix C: Comparable State Programs

Health Research							
State	Program Name	Program Type	Program Start Date	Program Provisions	Eligible Applicants	Annual Program Cost	Matching Req.
Oklahoma	Health Research Program	Grant	1987	<ul style="list-style-type: none"> - Funds basic research projects related to human health for one to three years; - Applicants may receive up to a minimum of \$10,000 and a maximum of \$45,000 per year (for a maximum of \$135,000 for three years). 	Oklahoma universities and colleges, nonprofit research organizations and commercial enterprises	\$3.7 million (2017)	None
Connecticut	Bioscience Innovation Fund (CBIF)	Grant	2013	<ul style="list-style-type: none"> - Provides royalty-bearing grants of up to \$500,000 (expended over a maximum of 3 years) - CBIF is a \$200 million, 10-year fund meant to speed bioscience breakthroughs toward the market 	Accredited colleges, universities and academic nonprofits	\$30,000 (2015)	None
Pennsylvania	Commonwealth Universal Research Enhancement Program (CURE)	Grant	2001	<ul style="list-style-type: none"> - CURE funds broad-based health research through tobacco settlement monies. There is no pre-determined amount of funding awarded; can vary from \$700 to over \$10 million. - Formula Funds: 13.6% of tobacco settlement funds are awarded non-competitively each year to institutions that received awards from the National Institute of Health (NIH) or the National Cancer Institute (NCI) during the preceding three years. - Nonformula Funds: 5.4% of funds are awarded by competitive peer review. 	Universities, hospitals or non-profit entities that conduct research and are located in Pennsylvania	\$43 million allocated; \$0 disbursed (2014)*	None



Health Research							
State	Program Name	Program Type	Program Start Date	Program Provisions	Eligible Applicants	Annual Program Cost	Matching Req.
Virginia	Virginia Biosciences Health Research Corporation (VBHRC) Grants	Grant	2013	- VBHRC grants fund translational research projects; - Grants are made in the range of \$200,000 to \$800,000 (usual project period of 12-18 months).	VBHRC universities in substantive collaboration with industry partners	\$3.4 million awarded (2017)	Yes, beginning with 1:1 and increasing to 6:1 for larger projects

* Funds were unavailable due to an unfavorable arbitration ruling in an ongoing dispute over Master Settlement Agreement payments between the state and tobacco product manufacturers