

State of Oklahoma

Incentive Evaluation Commission

Oklahoma Health Research Program Evaluation

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Key Findings & Recommendations



Incentive Overview

The Oklahoma Health Research Program, administered by the Oklahoma Center for the Advancement of Science and Technology (OCAST), provides funding to investigators to pursue their ideas for increased scientific understanding of important problems in human health and lays the foundation for driving economically significant future innovations. The program funds qualified basic research projects conducted by Oklahoma-based investigators for the multiple purposes of (1) enhancing the competitiveness of Oklahoma health researchers in their pursuit of additional research funds; (2) recruiting and retaining outstanding health research scientists for the state; (3) improving health care for Oklahoma citizens; and (4) strengthening the state's health care industry.

Award amounts range from \$10,000 to \$45,000 per year for up to three years (for a maximum of \$135,000 over three years). No matching funds are required. Eligible entities include Oklahoma public or private colleges or universities, nonprofit research institutions and private enterprises with the principal place of business in Oklahoma.

Retain, Reconfigure or Repeal: Retain, with modifications.

Key Findings

- **Value and number of awards made over time:** Between 2011 and 2021, OCAST issued Health Research grant awards totaling \$37.9 million (an average of \$3.4 million per year). On a year-over-year basis, total grants awarded have declined, decreasing by a compound annual growth rate (CAGR) of -5.3 percent over that time period. In 2021, Health Research award payments totaled \$2.5 million, representing a decrease of approximately \$1.8 million from a decade prior.
- **Value of additional funding leveraged as a result of program funding:** For many years, the total number of federal National Institutes of Health (NIH) awards funded annually in Oklahoma remained relatively stable: between 1992 and 2017, total awards increased by a CAGR of 0.5 percent. In more recent years, however, the state has seen a significant increase: between 2017 and 2021, growth was a CAGR of 10.6 percent. Total NIH funding in the State available under these awards has grown relatively steadily over time, increasing from \$21.7 million in 1992 to \$128.3 million in 2021, CAGR of 6.3 percent.

Based on information self-reported annually by grant recipients as a condition of receiving an award, between 2016 and 2021, Health Research Program grant recipients attracted approximately \$84.3 million in follow-on funds, representing a significant benefit of the program.

- **Number and value of health care products and services developed as a result of program funding:** Recent Health Research Program grant recipients reported having 10 patent applications granted; the value of the patents is estimated to be \$2.0 million.
- **Case studies or other longitudinal tracking of program recipient growth outcomes:** Based on information collected by OCAST, in 2020 and 2021, prior Health Research Program grant recipients formed 6 new companies, developed 32 new products or innovations, and filed 8 patents.
- **Economic activity associated with program funding:** In the aggregate, OCAST awarded approximately \$18.5 million in Health Research Program grants between 2016 and 2021. OCAST reported a total financial impact of \$183.4 million during the time period, as follows:

Total Payroll: \$3,859,512



Follow-on Funds Attracted:	\$ 84,281,513
Impact on Capital Investment:	\$ 79,241,232
<u>Impact on Gross Sales:</u>	<u>\$ 16,060,353</u>
Total Financial Impact:	\$183,442,610

- **State return on investment (ROI):** Based on the information outlined in the preceding bullet, OCAST estimates that the direct effect of its investments during this time period generated a return of 10 to 1 (Total Financial Impact of \$183.4 million / \$18.5 million in grant funds awarded = state ROI of 10.1).

Notably, however, OCAST's analysis is not an assessment of the economic impacts of the program relative to the tax revenue foregone by the State. When accounting for the direct, indirect and induced impacts of the Health Research funds awarded – as compared to the state tax revenue generated by these impacts, PFM finds that the Health Research program generated approximately \$5.9 million in state tax revenue between 2016 and 2021, well less than the \$18.5 million in awards granted over the time period.

- **An assessment of whether adequate protections are in place to ensure the fiscal impact of the incentive does not increase substantially beyond the state's expectations in future years:** OCAST has adequate projections in place to ensure the fiscal impact of the Health Research program does not increase substantially beyond the state's expectations in future years.
- **Interaction or coordination with other programs or service offerings in the economic development or entrepreneurial support ecosystem:** OCAST does not currently track the Health Research program's interaction or coordination with other programs or service offerings in the economic development or entrepreneurial support ecosystem outside of OCAST.

Recommendations

- **Further refine and improve data collection and reporting processes:** Data collection for any incentive program is indisputably a best practice, and this process is undoubtedly beneficial to OCAST and its stakeholders.

While OCAST has begun collecting additional data points from its Health Research grantees in recent years, it remains difficult to effectively evaluate the effectiveness of the program due to data collection and reporting process issues.

To allow the program to be more easily or conclusively evaluated in the future, OCAST should consider collecting additional information from grant recipients as part of its already-established data collection and reporting processes and/or modifying its current practices.

At present, the OCAST data 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 grant recipients dropping in and out of the survey. This often leads to significant fluctuations in the aggregate program data over time. Additionally, recipients self-report the data, which can lead to variances in the way information is reported and is subject to error. Finally, it is not clear when revenue is reported or where it is generated (i.e., in Oklahoma or another state).

To more 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.

Additionally, OCAST should consider conducting longitudinal case studies over a meaningful period of time for select companies. This would track the advance and development of the effects and benefits of health research, showing the synergy between grants, follow-on funding and capital investment.

Finally, for follow-on funding attained, OCAST should obtain data on when funds are spent; and the purpose for fund expenditures.



Introduction



Oklahoma Incentive Evaluation Commission Overview

The Oklahoma Incentive Evaluation Commission (Commission) was created by House Bill (HB) 2182 of 2015 to produce objective evaluations of the State of Oklahoma's wide array of economic development incentives. The Commission is made up of five members appointed by the Governor, President Pro Tempore of the Senate and Speaker of the House of Representatives, along with representatives of the Department of Commerce, Office of Management and Enterprise Services and the Tax Commission.

Under the enabling legislation, each of the State's economic incentives must be evaluated once every four years according to a formal set of general criteria, including (but not limited to) economic output, fiscal impact, return on incentive and effectiveness of administration, as well as criteria specific to each incentive.

Since the Commission's inception, it has contracted with PFM Group Consulting LLC (PFM) to serve as the independent evaluator of each incentive scheduled for review in that year. PFM issues a final draft evaluation on each incentive with recommendations as to how Oklahoma can most effectively achieve the incentive's goals, including recommendations on whether the incentive should be retained, reconfigured or repealed; as well as recommendations for any changes to State policy, rules or statutes that would allow the incentive to be more easily or conclusively evaluated in the future.

The Commission is charged with considering the independent evaluator's facts and findings – as well as all public comments – before voting to retain, repeal or modify each incentive under review. It then submits a final report to the Governor and Legislature. This incentive was last evaluated in 2018.

Summary of 2018 Evaluation Findings and Recommendations

Based on the preceding framework, significant findings and recommendations from the 2018 evaluation of the Oklahoma Health Research Program are summarized in the following table:

Table 1: Summary of 2018 Evaluation Key Findings and Recommendations

Evaluation Category	Key Finding(s)
Overall Findings	<ul style="list-style-type: none">- Total NIH funding in Oklahoma has increased steadily over the past 25 years but lags other states on a per capita basis- OK's direct investment in health-related R&D is significant- OK's employment in R&D in health-related fields has decreased, but average industry pay has increased- Medical patents awarded in OK peaked in 1998
Fiscal and Economic Impact	<ul style="list-style-type: none">- Since inception, the program has provided more than \$85 million in awards; recipients are primarily public colleges and universities- Nearly 300 jobs are attributable to the program, and other economic impacts appear to be significant
Administrative Effectiveness	<ul style="list-style-type: none">- Grantee surveys are beneficial but may lead to inconsistencies in data reporting
Retain, Reconfigure or Repeal	<ul style="list-style-type: none">- Retain, with modifications (see the following)
Recommendations	<ul style="list-style-type: none">- Collect more detailed information from current and former grant recipients to allow for consistent analysis- 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



Evaluation Category	Key Finding(s)
	<ul style="list-style-type: none">- If a successful product or company is developed, the location where the product is sold, supported, and manufactured should be identified- In order to correctly and accurately perform an economic impact analysis, additional information should be collected

Source: *State of Oklahoma Incentive Evaluation Commission, Tax Incentive Evaluation Report 2018*

Based on PFM's analysis and consideration of other factors, the Commission voted 5-0 to approve the recommendation to retain the program with the suggested modifications. Since the Incentive Evaluation Commission completed its review of this program in 2018, there have been no statutory changes.

2022 Criteria and Evaluation Approach

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 and, as noted previously, the provisions of HB 2182 require that criteria specific to each incentive be used for the evaluation.

The stated purposes of the Oklahoma Health Research Program include (1) enhancing the competitiveness of Oklahoma health researchers in their pursuit of additional research funds; (2) recruiting and retaining outstanding health research scientists for the state; (3) improving health care for Oklahoma residents; and (4) strengthening the state's health care industry.

In addition to these goals and the general evaluation factors previously described, the Commission has adopted the following criteria to assist in a determination of program effectiveness:

- Value and number of awards made over time
- Value of additional funding leveraged as a result of program funding
- Number and value of health care products and services developed as a result of program funding
- Interaction or coordination with other programs or service offerings in the economic development or entrepreneurial support ecosystem
- Case studies or other longitudinal tracking of program recipient growth outcomes
- Economic activity associated with program funding
- State return on investment

To conduct its 2022 review of the Oklahoma Health Research Program, the PFM project team conducted the following activities:

- Submitted a data request to OCAST
- Reviewed and analyzed internal and external data and information
- Completed subject matter expert/internal stakeholder interviews with representatives from OCAST
- In collaboration with the Oklahoma City, Tulsa and State Chambers of Commerce, conducted external stakeholder interviews with industry representatives
- Benchmarked Oklahoma to other states



Background



Health Research Background and History

The term “health research,” also 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.

As it also aims to find better ways to prevent and treat disease, health research is an important way to help improve the care and treatment of people worldwide and 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 a “remarkable improvement” in health care and public health. Economists have found that medical research can have an enormous impact on human health and longevity, and that the resulting increased productivity of the population contributes greatly to the national economy (in addition to the individual benefits of improved health).¹

Health Research Funding

The key funder of health-related research and development (R&D) in the U.S. is the industry sector (primarily biopharmaceutical and medical technology R&D firms, and companies in the health care services arena), which accounted for approximately two-thirds of the \$194 billion spent in 2018. The federal government – principally the NIH – is also a key funder of health research R&D activities, accounting for approximately \$43 billion (22.2 percent) of the U.S. total. Together, the industry sector and the federal government provided nearly 90 percent of all medical and health research support in the country between 2013 and 2018, as shown in the following table.²

Investment in medical and health research in the U.S. grew by more than \$51 billion (35.6 percent) between 2013 and 2018, for a CAGR of 6.3 percent. The largest increase is attributable to private industry, which increased its funding by nearly \$37 billion (39.3 percent); federal government funding increased by over \$9 billion (26.9 percent) during the time period.

Table 2: Estimated U.S. Medical and Health R&D Expenditures by Segment (\$ in Millions), 2013-2018

	2013	% of 2013 Total	2018 (est.)	% of 2018 Total	% Change 2013-2018	CAGR
Industry	\$92,970	64.9%	\$129,488	66.7%	39.3%	6.9%
Federal Government	\$33,906	23.7%	\$43,016	22.2%	26.9%	4.9%
Academic & Research Institutions	\$11,324	7.9%	\$15,705	8.1%	38.7%	6.8%
Foundations, Voluntary Health Associations & Professional Societies	\$3,217	2.2%	\$3,825	2.0%	18.9%	3.5%
State & Local Government	\$1,729	1.2%	\$2,142	1.1%	23.9%	4.4%
Total	\$143,146	100.0%	\$194,176	100.0%	35.6%	6.3%

Source: Research America, *U.S. Investments in Medical and Health Research and Development, 2013-2018* (Table 2)

¹ Institute of Medicine Committee on Health Research and the Privacy of Health Information, “The Value, Importance and Oversight of Health Research.” Accessed electronically at <https://www.ncbi.nlm.nih.gov/books/NBK9571/#.~:text=It%20can%20provide%20important%20information,to%20research%20provide%20complementary%20insights>.

² Research America, “U.S. Investments in Medical and Health Research and Development, 2013-2018,” (Fall 2019). Accessed electronically at https://www.researchamerica.org/sites/default/files/Publications/InvestmentReport2019_Fnl.pdf



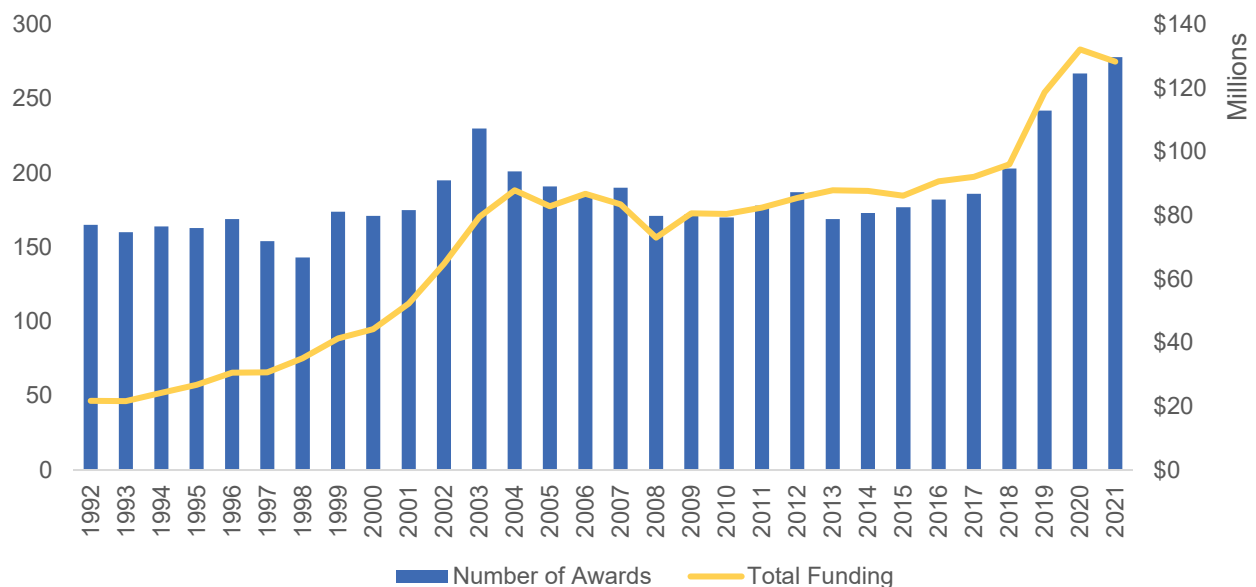
Federal Government Health Research Funding

As previously stated, the NIH is the primary source of federal health research funding – and is a meaningful proxy for overall federal health research dollars obtained on a state-by-state basis.

The impact of NIH funding on Oklahoma's economy is significant. According to United for Medical Research (UMR), the \$128.3 million invested by the NIH in Oklahoma in 2021 supported 2,927 jobs, resulting in economic activity totaling an estimated \$403 million.³ In 2021, the top NIH-funded research institutions in the state were the University of Oklahoma Health Sciences Center; the Oklahoma Medical Research Foundation; the University of Oklahoma, Norman; Oklahoma State University, Stillwater; and the Laureate Institute for Brain Research.⁴

For many years, the total number of NIH awards funded annually in Oklahoma remained relatively stable: between 1992 and 2017, total awards increased by a CAGR of just 0.5 percent. In more recent years, however, the state has seen a significant increase: between 2017 and 2021, growth was equal to a CAGR of 10.6 percent. Total NIH funding in the State available under these awards has grown relatively steadily over time, increasing from \$21.7 million in 1992 to \$128.3 million in 2021, a compound annual growth rate (CAGR) of 6.3 percent.

Figure 1: NIH Award Activity in Oklahoma, 1992-2021



Source: NIH Reporting Portfolio – Awards by Location and Organization

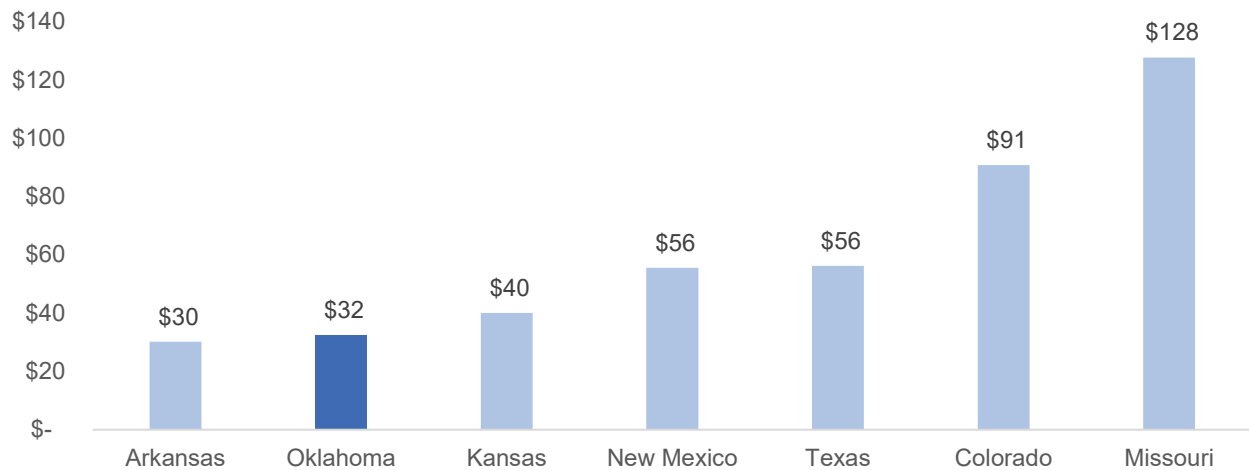
When comparing total NIH award funding in Oklahoma to other states and Washington, D.C., Oklahoma ranked 37th of 51 in 1992, improving slightly to 34th in 2021. On a per capita basis, Oklahoma ranked 39th in 1992 (at \$7). Despite the State's per capita amount increasing to \$32 by 2021, it ranked 43rd (a slight improvement from 44th in 2017). Among the six states neighboring 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 that was also the case in 2021 (Arkansas' NIH funding was \$30 per capita).

³ United for Medical Research, "NIH in Your State: Oklahoma." Accessed electronically at <https://unitedformedicalresearch.org/nih-in-your-state/>

⁴ NIH, "NIH Awards by Location and Organization, U.S. FY2021." Accessed electronically at <https://report.nih.gov/award/index.cfm#tab1>



Figure 2: Per Capita NIH Funding, Select States (2021)



Source: NIH Reporting Portfolio – Awards by Location and Organization

State and Local Government Health Research Funding

While state and local government support comprises approximately one percent of total U.S. investment in medical and health research (see Table 2), they are an important part of the overall funding makeup. State and local governments increased their investment in medical and health research by \$413.0 million (23.9 percent) between 2013 and 2018 – equal to a CAGR of 4.4 percent. State and local governments fund medical and health research primarily through support to universities (79.5 percent); an additional 14.1 percent is via support to other research institutions, and the remaining 6.4 percent is to support intramural research conducted by public sector agencies, such as health departments.⁵

State Health Research Expenditures

According to the National Science Foundation (NSF), Oklahoma's health-related R&D expenditures increased from \$5.8 million in 2009 to \$17.4 million in 2020, a CAGR of 10.5 percent. Of the 2020 total, most (\$12.3 million) was attributable to the Tobacco Settlement Endowment Trust⁶; an additional \$4.6 million was attributable to OCAST and approximately \$0.5 million to the Department of Health.

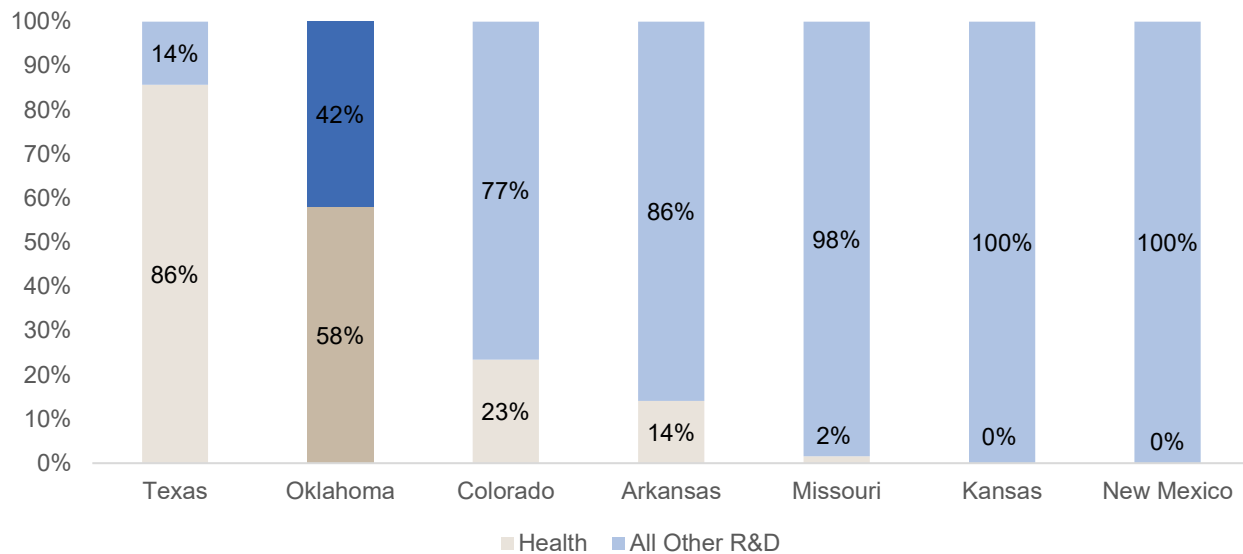
Health research comprised 58.0 percent of the State's total spending on R&D in 2020 (higher than the national average of 42.0 percent). Further, when compared to the six neighboring states, Oklahoma's investment in health research as a share of total expenditures is relatively high, as only Texas has a larger share (86.0 percent).

⁵ Research America, "U.S. Investments in Medical and Health Research and Development, 2013-2018," (Fall 2019). Accessed electronically at https://www.researchamerica.org/sites/default/files/Publications/InvestmentReport2019_Fnl.pdf

⁶ In 1998 four of the largest tobacco companies agreed to negotiate a national settlement with the 46 states (including Oklahoma) who had sued them related to illegal practices. As part of the Master Settlement Agreement, states receive an annual payment from the tobacco industry as long as cigarettes are sold nationally. After bipartisan support for legislation to create a state question to amend the Oklahoma Constitution, voters in 2000 approved the creation of the Oklahoma Tobacco Settlement Endowment Trust. Seventy-five percent of each annual payment is deposited in the trust. Only the earnings are used each year. Trust expenditures are devoted to preventing cancer and cardiovascular disease, Oklahoma's leading causes of death. It awards grants to schools, communities, state agencies and partner organizations and funds research and emerging opportunities in the public and private sectors. See <https://oklahoma.gov/tset.html> for more information.



Figure 3: State R&D Expenditures by Function, Select States (2020)



Source: National Science Foundation

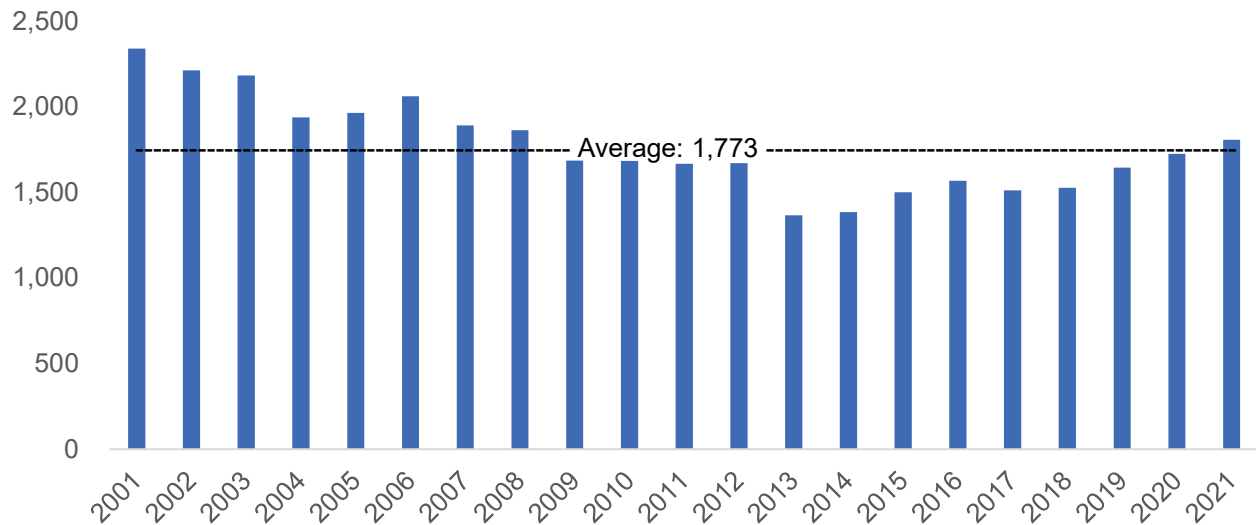
Industry Employment and Payroll

According to the U.S. Bureau of Labor Statistics (BLS) data, in 2021, an estimated 1,810 Oklahomans were employed in the 'physical, engineering and life sciences R&D' industry (equal to 0.1 percent of total private industry employment in the state).⁷ As shown in the following figure, between 2001 and 2013, industry employment declined from 2,342 to 1,367 – a CAGR of -4.4 percent. Since 2013, however, employment has generally grown year-over-year, increasing by a CAGR of 3.6 percent between 2013 and 2021. Over the full time period, employment has averaged 1,773 and has decreased by a CAGR of -1.3 percent.

⁷ North American Industry Classification System (NAICS) code 541715, R&D in the Physical, Engineering, and Life Sciences. This U.S. industry comprises establishments primarily engaged in conducting research and experimental development (except nanotechnology and biotechnology research and experimental development) in the physical, engineering, and life sciences, such as agriculture, electronics, environmental, biology, botany, computers, chemistry, food, fisheries, forests, geology, health, mathematics, medicine, oceanography, pharmacy, physics, veterinary and other allied subjects.



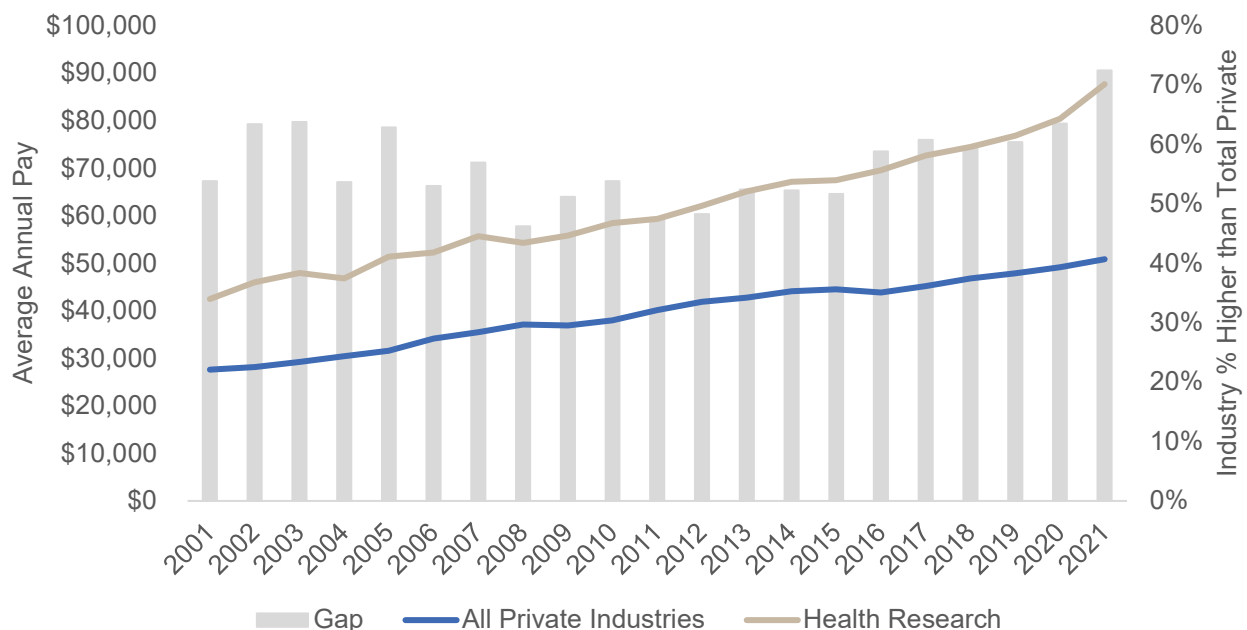
Figure 4: Oklahoma Employment, R&D in Physical, Engineering and Life Sciences, 2001-2021



Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

In 2021, the average health research industry pay in Oklahoma was \$87,670, which is significantly higher than the average across all private industries in the state (\$50,842). Average industry pay has consistently surpassed the average pay across all private industries in Oklahoma, and the size of that variance has widened in recent years. In 2008, for example, industry pay was 46.2 percent higher than the private industry average (the smallest gap for the 2001-2021 period); in 2021, industry pay was 72.4 percent higher. In addition, average pay for the industry increased by a CAGR of 3.7 percent between 2001 and 2021, faster than the rate of growth across all private industries in the state (3.1 percent).

Figure 5: Oklahoma Average Annual Pay, Health Research and Total Private Industry, 2001-2021



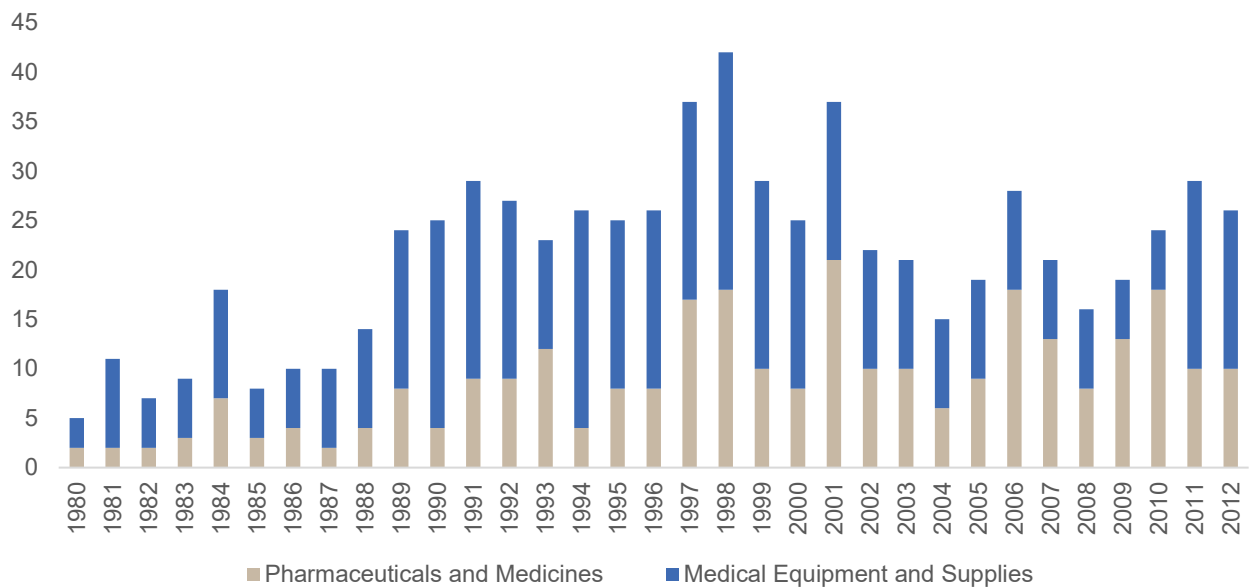
Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages



Health Research Patent Activity

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 a 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 6: Oklahoma Medical Patents by Industry, 1980-2012*



Source: U.S. Patent and Trademark Office – Utility Patent Grants Organized by Industry, 1980-2012 (the most recent dataset available)
 * 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

With a CAGR of 5.4 percent, Oklahoma's patent activity between 1980 and 2010 is comparable to surrounding states.⁸ 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 Issued, Select States, 1980-2010

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%
New Mexico	3	9	22	13	5.0%	1.9%	-5.1%

⁸ Data cited is most recent available from the U.S. Patent and Trademark Office with sufficient level of detail for analysis.



State	1980	1990	2000	2010	CAGR 1980-2010	CAGR 1990-2010	CAGR 2000-2010
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



Program Usage & Administration



Program Characteristics

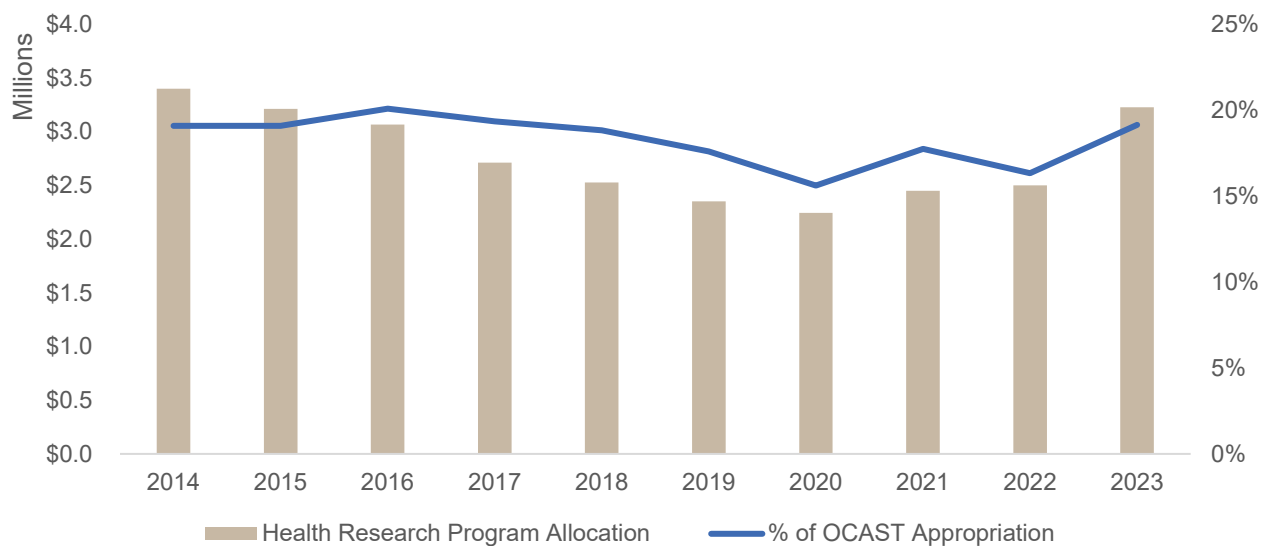
The Oklahoma Health Research Program, administered by OCAST, provides funding to investigators to pursue their ideas for increased scientific understanding of important problems in human health and lays the foundation for driving economically significant future innovations. The program funds qualified basic research projects conducted by Oklahoma-based investigators for the multiple purposes of (1) enhancing the competitiveness of Oklahoma health researchers in their pursuit of additional research funds; (2) recruiting and retaining outstanding health research scientists for the state; (3) improving health care for Oklahoma citizens; and (4) strengthening the state's health care industry. 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.⁹

Awards are between \$10,000 and \$45,000 per year for up to three years (a maximum of \$135,000 over three years). No matching funds are required. Eligible entities include Oklahoma public or private colleges or universities, nonprofit research institutions and private enterprises with the principal place of business in Oklahoma.

OCAST Health Research Program Appropriation

Between 2014 and 2023, OCAST has allocated between 15 and 20 percent of its total appropriation to the Health Research program, equal to between \$2.2 million and \$3.4 million per year. During that time frame, funds designated for the program have been effectively flat, declining by a CAGR of -0.6 percent.

Figure 7: OCAST Health Research Program Allocation, 2014-2023



Source: OCAST 2018 and 2023 Business Plans

⁹ Specifically, according to statute, a "health research project" is defined for purposes of the program as "a specific examination, experimentation or investigation, or initiative to provide research resources oriented principally toward basic, applied, and developmental scientific inquiry related to the causes, diagnosis, prevention, and treatment of human diseases and disabilities and mental health and emotional disorders, and the rehabilitation of persons afflicted 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 this state; and the development of new products and services which shall form the basis of new high-technology health research and care industry for this state."



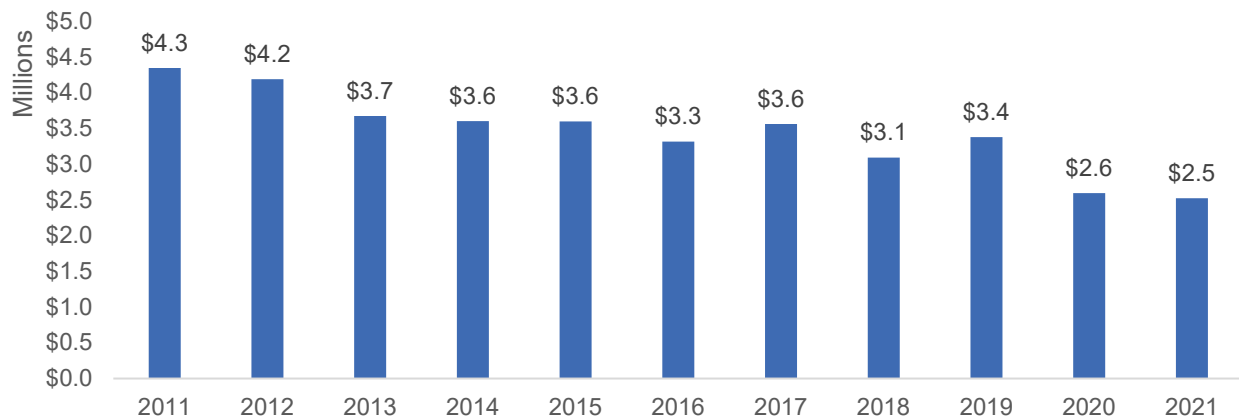
Historic Use of the Program

Health Research Program grantees are predominantly public colleges and universities. According to OCAST data, they comprise 90.9 percent of final, total award amounts between 2018 and 2021. Private education institutions comprise 4.5 percent of the total, and nonprofits account for the remaining 4.6 percent.¹⁰ The primary categories of health research funded by the program include:¹¹

- Biomedical engineering
- Cancer research
- Cell and molecular biology
- Chemistry and biochemistry
- Genomics and gene expression
- Immunology
- Infectious disease
- Instrumentation, data sciences and clinical evaluations
- Neurobiology
- Nutrition, psychology and public health
- Physiology and pharmacology

Between 2011 and 2021, OCAST issued an average of \$3.4 million in grant payments annually, equal to \$37.9 million in the aggregate. Total payments issued annually have declined over time, decreasing by a CAGR of -5.3 percent. The following figure summarizes Health Research grant payments issued by year.

Figure 8: Health Research Program Award Payments Issued, FY2011-FY2021



Source: OCAST data

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

¹⁰ Per OCAST data, "AR-HR 2018-2022."

¹¹ OCAST, "2020 Health Research Projects." Accessed electronically at <https://oklahoma.gov/content/dam/ok/en/oCAST/documents/programs/2020-hrc-program.pdf>



merits of proposed health research projects, the qualifications of investigators, and the facilities where proposed health research projects will be performed and advises OCAST of its findings.¹²

Application Review Process

All proposals are reviewed and ranked for funding by experienced health researchers who reside outside the State of Oklahoma. 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.

Progress Reports and Performance Evaluation

Grantees 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 (the experienced health researchers referenced previously) 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
- 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
- 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, including Health Research:

- Number of new companies formed
- Number of jobs created or retained
- Total payroll
- Patents granted
- Value of annual licenses and royalties
- Gross sales
- Capital investments
- Cost avoidance
- Total financial impact and leverage

To collect and report on this information, OCAST requires Health Research program grantees to respond to an annual survey during the project funding period and for five years after the funding period ends. In fact,

¹² 74 O.S., § 5060.17



grant applications specifically state that grantees are required to provide OCAST with the requested information during and after the funding period. This information may include but is not limited to (1) impact survey information; (2) site visits; and (3) reverse site visits, during which the grantee may be required to present his or her project-related information to OCAST staff, the OCAST Board of Directors, members of the Oklahoma Legislature and other interested parties.

Grantees' self-reported information and data is aggregated and reported on a six-year rolling basis in OCAST's annual Impact Reports. This effectively means, for example, that the impacts reported in the 2022 Impact Report reflect activity associated with projects funded between 2016 and 2021, including activity occurring in the years after funding for past projects has ended.

OCAST policy stipulates that a prior Health Research program grantee with a delinquent progress report – or a grantee that has not responded to other OCAST requests for information (including impact survey data) may not be eligible to submit an application for new project funding. Further, any grantee who has a delinquent progress report at the time of review will not be eligible for review, and any grantee with a delinquent progress report at the time of award notification will not receive a contract until the progress report has been submitted. In the latter case, if the delinquent report has not been submitted within 60 days of the award date, OCAST will void the award and return the money to the Health Research program.



Economic & Fiscal Impact



Economic and Fiscal Impacts

The economic and fiscal impact analysis is based on a review of data provided by OCAST. It reflects the activity self-reported by grant recipients while they are receiving Health Research funds, as well as the years immediately following the end of their respective funding periods. The economic impacts associated with new jobs were estimated using the IMPLAN economic impact software. The methodology for using the IMPLAN model is explained in **Appendix A**.

During the most recent six-year period (2016-2021) the Health Research program has provided \$18,460,878 in grants.

As mentioned previously, OCAST conducts an annual survey of grant recipients collecting economic evaluation and company status data over this period, which represents the active grants. Once awarded, most grants are annually recurring during this period. As a result of the ongoing nature of grants and the ramp up of economic activity associated with companies over the award period, a cumulative, multi-year measurement of the economic impacts of the Health Research program should most appropriately take place, rather than measuring program activity in a single year. The results of the OCAST survey data for 2021, covering the most recent award period is shown in the following table.

Table 4: Health Research Program Participant Survey Results, 2021

Measure	Result
Survey Response Rate	97.96%
Jobs Created or Retained	192
Total Payroll	\$3,859,512
Average Annual Wage*	44,200
Follow-on Funds Attracted	\$84,281,513
Patent Applications	31
Patents Granted	10
Value of Patents	\$2,000,000
Impact on Capital Investments	\$79,241,232
Impact on Gross Sales	\$16,060,353
Companies Formed	6
Total Financial Impact (Direct Effect)	\$183,442,610
Program Grants 2016-2021	\$18,460,878
Direct Effect of Investment	10:1

Source: PFM analysis of OCAST program participant survey, 2021

** Annual wage data is not consistent with the number of jobs created and reflects only the summary of OCAST survey response data.*

Through the Survey data, OCAST has measured the “Total Financial Impact” of the program by adding together reported Total Payroll, Follow-on Funds Attracted, Capital Investments and Gross Sales. The sum of these four elements is \$183.4 million, which OCAST has labeled Total Financial Impact. In measuring the impacts of economic activity associated with the initial investment of the Health Research grant program, the Total Financial Impact can be renamed the Direct Effect of economic activity. OCAST then compares the Direct Effect with the initial grant investment which results in a 10:1 ratio. OCAST has named this ratio the “Return on Investment”. PFM has renamed this ratio as the Direct Effect of Investment for consistency within the context of measuring economic impacts. The 10:1 ratio remains unchanged, reflecting substantial economic activity associated with the Health Research grant program.

PFM then uses IMPLAN economic impact software to determine the economic output activity associated with the program, by calculating the indirect and induced economic impacts associated with the Program direct effects. The Direct Effect survey data of \$183.4 million is converted to Direct Impact through the use of IMPLAN resulting in \$191.4 million in Direct Economic Impacts of the program.



The economic impact analysis then calculates the indirect and induced economic effects and reveals total economic activity associated with the Health Research grant program reaches \$358.1 million, over the survey period and is associated with 368 new and retained jobs.

Table 5: Economic Impact of Health Research Program, 2016-2021

Impact Type	Employment	Labor Income	Value Added	Economic Output	State Tax
Direct	192	\$67,357,442	\$86,662,333	\$191,394,115	\$2,223,141
Indirect	99	\$29,914,466	\$45,286,284	\$95,739,253	\$1,545,435
Induced	77	\$20,867,918	\$37,941,131	\$70,930,885	\$2,137,963
Total	368	\$118,139,825	\$169,889,747	\$358,064,253	\$5,906,539

Source: PFM; IMPLAN 2022

Note: Employment reflects permanent jobs; All other measures are cumulative over the survey period

What is unclear from the survey data is how much of the Direct Effect activity would have occurred without or “but for” the program. The participant survey data does not ask a question such as, “How much of the follow-on funds attracted would have occurred without the Health Research grant?” This question could be asked for all of the direct effect measures including employment, payroll, follow-on funds, capital investments and gross sales. The additional information gained from these questions would answer how much of the total economic activity is directly caused by the Health Research program, rather than simply associated with it.

The total state tax revenue from all economic activity associated with the program is \$5.9 million. Despite the inability to know what portions of activity are directly caused by the program, all state tax generated by activity associated with the program of \$5.9 million is less than the total state grant expenditure of \$18.5 million over the survey period. The Health Research grant program costs more in State grant expenditures than is generated in state tax revenues. Total economic activity associated with the program is significantly greater, by a factor of 19:1, than state grant costs for the program.

It is important to discuss in the context of the Health Research program that basic scientific research is not and does not always have direct product and market output results. Some basic scientific research can take decades to produce actionable or otherwise economically meaningful results. It is for this reason other measures are associated with the program such as patents granted and patent applications, which can be a reflection of the potential to accrue longer term benefits. Over the survey period 31 patents were applied for and 10 patents were granted.

Additionally, to more accurately evaluate the effects of the Health Research grant program longer period longitudinal case studies for some selected companies could be conducted. This would track the advance and development of the effects and benefits of scientific research showing the synergy between grants, follow on funding, and capital investment. Anecdotally some companies describe how the Health Research grants became an effective financial bridge for the company before larger federal or private grants were received, thereby allowing survival of the company. Or, grants may fund the final component of a research project allowing decades of prior work to come to fruition. This type of information is important to gauging the effect and value of the Health Research grant program. The examples cited are known conditions. It would be useful to collect this information in a more formal fashion so it may be communicated as part of the economic impact evaluation.



Program Benchmarking



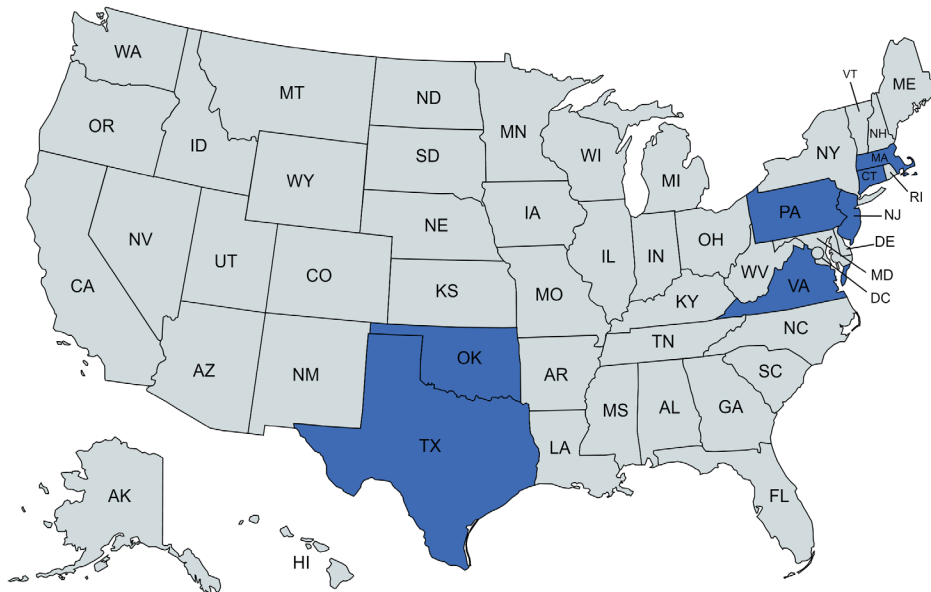
Benchmarking Introduction

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.¹³ 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.

Peer State Programs: Key Findings¹⁴

In addition to Oklahoma, six states (highlighted in the map) were identified that provide grants for health-related research. These grant programs are described in the following discussion; a detailed comparison of key characteristics is provided in **Appendix B**.

Figure 9: States with Health Research Grant Programs



- **Connecticut:** The 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. The Fund targets organizations working in bioscience, biomedical engineering, health information management, medical care, medical devices, medical diagnostics, pharmaceuticals, personalized medicine or other related disciplines intended to impact human health.¹⁵
- **Massachusetts:** The Seed Fund’s mission is to advance innovative and promising life sciences companies in targeted geographies throughout the Commonwealth by working with partners to

¹³ The primary instances of exactly alike state incentive programs occur when states choose to ‘piggyback’ onto federal programs.

¹⁴ This report focuses on state health research programs. For information about state R&D programs, broadly, see PFM’s Oklahoma Applied Research Support Program Evaluation (2022).

¹⁵ Connecticut Department of Economic and Community Development, “Bioscience Innovation Fund Overview.” Accessed electronically at https://portal.ct.gov/DECD/Content/Business-Development/05_Funding_Opportunities/Bioscience-Innovation-Fund



leverage resources and promote economic development. Individual investments of up to \$250,000 in a convertible note are awarded to life sciences start-ups, and up to \$1 million of capital investment is available. The fund targets life sciences companies broadly, including therapeutics, medical devices, diagnostics, and bioinformatics/digital health technologies.¹⁶

- **New Jersey:** The State of New Jersey has multiple grant programs targeting health research, including:¹⁷

Table 6: State of New Jersey Health Research Grant Programs

Agency	Grant Program(s)
Governor's Council for Medical Research and Treatment of Autism	Autism Basic Research Pilot Program
	Autism Fellowship Research Program
New Jersey Commission on Brain Injury Research	Individual Research Grant
	Pilot Research Grant
New Jersey Commission on Cancer Research	Pediatric Bridge Research Grant
	Pediatric Pilot Research Grant
	Pediatric Research Grant
	Pilot Program Research Grant
	Research Bridge Grant
New Jersey Commission on Spinal Cord Research	Exploratory Research Grant
	Individual Research Grant

Source: State of New Jersey Department of Health

- **Pennsylvania:** In 2001, Act 77 directed the Pennsylvania Department of Health to establish a health research program. Under the Commonwealth Universal Research Enhancement (CURE) Program, research grants are awarded for clinical, health services, and biomedical research. Two types of health research grants are awarded under the program: formula grants are awarded non-competitively to institutions that receive funding from the National Cancer Institute or the National Institutes of Health; non-formula funds are awarded by competitive bid. All entities receiving funds must follow certain reporting, monitoring and evaluation procedures.¹⁸
- **Texas:** On November 6, 2007, Texas voters approved Proposition 15, a constitutional amendment which allowed the State to establish the Cancer Prevention and Research Institute of Texas and permitted the Institute to issue \$3 billion in general obligation bonds over ten years to fund grants for cancer research and prevention.¹⁹ The Institute offers several targeted grants, including:²⁰

Table 7: Cancer Prevention and Research Institute of Texas Research Grants

Grant Program	Description
Seed Company Awards for Product Development Research	Funding available to Texas-based companies and companies willing to relocate to Texas that will support company formation, as well as early research and development of novel oncology therapeutics, devices, treatment-oriented information technology products, diagnostics, or tools. The objective of the SEED Award program is to start with an interesting

¹⁶ Massachusetts Life Sciences Center, "Seed Fund." Accessed electronically at <https://www.masslifesciences.com/programs/seedfund/>

¹⁷ State of New Jersey Department of Health, "Directory of Grant Programs." Accessed electronically at <https://healthapps.state.nj.us/noticeofgrant/noticegrants.aspx>

¹⁸ Pennsylvania Department of Health, "CURE Awarded Grants." Accessed electronically at <https://www.health.pa.gov/topics/Research/CURE/Pages/Grants.aspx>

¹⁹ Livestrong, "Texas Takes on Cancer: The Cancer Prevention and Research Institute – A Case Study of Proposition 15." Accessed electronically at <https://www.livestrong.org/sites/default/files/what-we-do/reports/texas-takes-on-cancer.pdf>

²⁰ Texas eGrants Application Portal, "Cancer Prevention and Research Institute of Texas Grants." Accessed electronically at <https://txapps.texas.gov/tolapp/egrants/search.htm>



Grant Program	Description
	technology and to progress it toward a commercially viable business opportunity, i.e., make it more attractive to private funding agents.
Texas Diagnostics and Devices Company Awards for Product Development Research	Funding available to Texas-based companies and companies willing to relocate to Texas that will support the ongoing research and development of diagnostic tests and devices to treat, detect, diagnose, monitor, and assist in the treatment of cancer. The applicant should be working toward submitting an Investigational Device Exemption (IDE) or a 501(k) or Premarketing Approval (PMA) and is typically within one year from filing an IDE (or later stage work.)
New Technologies Company Awards for Product Development Research	Funding available to Texas-based companies and companies willing to relocate to Texas that will support the ongoing research and development of new and emerging technologies for the detection, diagnosis, prognosis, monitoring, or treatment of cancer. CPRIT created this RFA to fund new and emerging technology projects that do not easily fit into any of the three other CPRIT Product Development Research RFAs.
Texas Therapeutics Company Awards for Product Development Research	Funding available to Texas-based companies and companies willing to relocate to Texas that will support the ongoing research and development of innovative therapeutics with a significant impact on the treatment of cancer. The applicant is typically within one year from filing an IND/IDE or already in Phase 1.

Source: Texas eGrants Application Portal

- **Virginia:** 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. There is a minimum of 1:1 matching funds for the program, and matching funds may only be in cash form (not in-kind services or waiver of indirect overhead charges). The program also requires that proposals demonstrate projects would result in increased revenues and job creation in Virginia.²¹

Benchmarking Program Evaluations

While no evaluations of the preceding programs were identified, one recent study examined the effects of NIH funding on researchers and output. This analysis found that NIH funding stimulates research by supporting the teams that conduct it. While faculty and their productivity are heavily affected by funding, so are trainees and staff. The largest effects of funding on research output are ripple effects on publications that do not include principal investigators. According to the study's authors, while funders focus on research output from projects, they would be well advised to consider how funding ripples through the wide range of people – including trainees and staff – employed on projects.²²

²¹ VBHRC, "Grant Funding Program Funding Criteria," (December 2021). Accessed electronically at https://www.virginiacatalyst.org/uploads/7/3/8/73883877/virginia_catalyst_grant_funding_criteria_dec2021.pdf

²² Science Advances, "The Ripple Effects of Funding on Researchers and Output," (April 22, 2022). Accessed electronically at <https://www.science.org/doi/10.1126/sciadv.abb7348?cookieSet=1>



Appendices



Appendix A: IMPLAN Economic Impact Methodology

The economic impact methodology utilized to determine the multiplier effects is IMPLAN (Impact Analysis for PLANning), a proprietary model; PFM has obtained a license for use of the IMPLAN model for these evaluations.

IMPLAN's Social Accounting Matrices (SAMs) capture the actual dollar amounts of all business transactions taking place in a regional economy as reported each year by businesses and governmental agencies. SAM accounts are a better measure of economic flow than traditional input-output accounts because they include "non-market" transactions. Examples of these transactions would be taxes and unemployment benefits.

Multipliers

SAMs can be constructed to show the effects of a given change on the economy of interest. These are called Multiplier Models. Multiplier Models study the impacts of a user-specified change in the chosen economy for 440 different industries. Because the Multiplier Models are built directly from the region-specific SAMs, they will reflect the region's unique structure and trade situation.

Multiplier Models are the framework for building impact analysis questions. Derived mathematically, these models estimate the magnitude and distribution of economic impacts, and measure three types of effects which are displayed in the final report. These are the direct, indirect, and induced changes within the economy. Direct effects are determined by the Event as defined by the user (i.e., a \$10 million order is a \$10 million direct effect). The indirect effects are determined by the amount of the direct effect spent within the study region on supplies, services, labor, and taxes. Finally, the induced effect measures the money that is re-spent in the study area as a result of spending from the indirect effect. Each of these steps recognizes an important leakage from the economic study region spent on purchases outside of the defined area. Eventually, these leakages will stop the cycle.



Appendix B: Comparison of Peer State Programs

State	Program	Incentive Type(s)	Award Amounts	Program Size	Eligible Entities
Oklahoma	Health Research Grants	Grants	\$10,000-\$45,000 per year for up to 3 years	\$2.5m in 2021	Oklahoma public or private colleges or universities, nonprofit research institutions and private enterprises with the principal place of business in Oklahoma
Connecticut	Bioscience Innovation Fund	Grants, equity investments and loans	Royalty-bearing grants up to \$500,000 over 3 years	\$200 million over 10 years	Startups, early-stage businesses, non-profits and accredited colleges and universities
Massachusetts	Seed Fund	Convertible Notes	Up to \$250,000	N/A	Early-stage life sciences companies, broadly
Pennsylvania	Commonwealth Universal Research Enhancement Program	Grants	Maximum of \$4 million	\$11.6 million in 2021	Research universities
Virginia	Virginia Biosciences Health Research Corporation Grants	Grants	\$200,000-\$800,000	N/A	Research universities