An Economic Assessment of the Cost of Cancer in Texas and the Benefits of the Cancer Prevention and Research Institute of Texas (CPRIT) and its Programs:

2020 Update

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Summary of Study Results

- The direct **cost of cancer** in Texas, as traditionally measured, is estimated to be **$44.7 billion** in 2020 (compared to about $42.5 billion in 2019), with total economic losses (including multiplier effects) of an estimated **$115.6 billion** in output and **1,125,833** jobs.
- The **current total annual impact of all CPRIT operations, prevention/screening, and research programs** (including initial outlays and multiplier effects) includes **$637.8 million** in output (real gross product) in 2020 as well as **8,558** jobs. When all secondary and downstream benefits are considered, these values rise to just over **$15.6 billion** in output and **151,587** jobs.
- This incremental business activity generates **taxes for the State and local governments**.
    - In 2020, annual tax receipts associated with CPRIT grants and programs (including downstream effects) total **$815.0 million** to Texas, a significant increase over last year's **$704.1 million**; local public entities receive **$363.4 million**.
    - Since the inception of CPRIT, these gross incremental taxes total almost **$10.6 billion** for the State and almost **$4.8 billion** for local governments.
    - The net incremental taxes (which nets out the potential benefits of other typical uses of State funds over the ten-year period) include **$10.2 billion** to the State and almost **$4.5 billion** to local governments.
    - These amounts are well in excess of the total commitment of State resources. Notable gains in benefits in recent years reflect factors such as the compounding effects over time and the substantial matching funds that are being leveraged by CPRIT activities.

Every Dollar Invested Through CPRIT Returns: (Including Initial Outlays and Secondary (Downstream) Effects)	
$25.96	**In Treatment Cost Savings and Resulting Economic Benefits through Earlier Detection from Prevention/Screening Activity in 2020**
$110.62	**In Economic Activity (Total Expenditures) in 2020**
$54.04	**In Output (Real Gross Product) in 2020**
$32.36	**In Personal Income in 2020**
$14.94	**In Retail Sales in 2020**
$2.94	**In State Tax Receipts as of 2020**
$1.31	**In Local Government Tax Receipts as of 2020**
Source: The Perryman Group	

- **With the decision to extend funding for CPRIT**, the net cumulative economic benefits over another 10 years of these initiatives include an estimated **$172.9 billion in gross product and some 1,649,870 job-years of employment, as well as billions in tax receipts to the State and local governments.**
- **Basic medical research is also a part of society's essential infrastructure, and CPRIT has demonstrated the capacity to enhance the health of Texans and the economy at a pace that far exceeds the direct investment.**
- These results are explained more fully in subsequent sections and the Appendices of this report.

Introduction

The Cancer Prevention and Research Institute of Texas (CPRIT) has been working to reduce the tragically high human and financial cost of cancer since 2010. CPRIT has helped attract 213 leading cancer research scientists and their labs to Texas (including members of the prestigious National Academy of Sciences) as well as recruit 14 companies. **CPRIT scholar Dr. James Allison, who was recruited to MD Anderson Cancer Center as part of a $10 million CPRIT grant in 2011, was awarded the 2018 Nobel Prize in physiology or medicine,** along with Tasuku Honjo, for his work in cancer immunotherapy. In September 2020, multiple CPRIT award recipient Dr. Zhijian "James" Chen received the 2020 William B. Coley Award for Distinguished Research in Basic and Tumor Immunology from the Cancer Research Institute. Many other CPRIT scholars have received prestigious awards as well.

Reducing the burden of cancer provides benefits to individuals, families, hospitals, state and local governments, insurance providers, and society as a whole.

During fiscal year 2020, CPRIT funded projects resulted in over 900 published articles, and 42 new patent filings. Over the last ten years, CPRIT has funded research projects which have resulted in over 3,400 publications and more than 600 new patents and patent applications. CPRIT funding has led to 160 clinical trials or studies with over 26,213 patients enrolled. In addition, CPRIT grants for screening and related education have provided 6.6 million prevention services to Texans from all 254 counties and are improving access to lifesaving testing for some of the state's most vulnerable populations.

Reducing the burden of cancer provides benefits to individuals, families, hospitals, state and local governments, insurance providers, and society as a whole. Through research and prevention/screening, cancer incidence and severity can be notably reduced, providing relief in terms of health outcomes and quality of life, as well as notable

In addition to their positive effect on health and wellbeing, CPRIT activities generate sizable economic benefits.

benefits to the economy. Medical outlays can be decreased through earlier detection, and improving results benefit both patients and society as a whole through enhancing the productivity and lifespan of those affected by cancer. In addition, research activity, apart from its primary mission to drive fundamental breakthroughs, can serve as a catalyst for business development in related industries (such as biomedicine).

In addition to their positive effect on health and wellbeing, CPRIT activities generate sizable economic benefits. The Perryman Group (TPG) has quantified the cost of cancer in Texas and the economic benefits of CPRIT for several years. This report updates the findings from TPG's analysis utilizing the most recent data regarding cancer incidence and results to date from CPRIT grants, following the same general methodology and report structure to aid in comparisons of results across years.

Report Components

An approach consistent to prior years was used where possible in this 2020 update. At present, the initial CPRIT grants have been in place for about 11 years. Recipients have reported progress, hiring, matching funds, and other key performance metrics. Firms have also located to Texas or expanded as a result of CPRIT efforts. This information was used in assessing the economic impacts related to research to the extent possible and, as in last year's update, were used to validate model results. The major components of The Perryman Group's analysis include the following:

The **economic cost of cancer** in terms of Texas business activity including losses stemming from treatment, morbidity, and mortality as well as the associated spillover effects are initially estimated. Data regarding the numbers of Texans with cancer and the associated costs for direct medical expenses, morbidity costs, and mortality are the subject of reports by entities such as the National Institutes of Health, the American Cancer Society, the National Cancer Institute (Centers for Disease Control (CDC)), and the Texas Cancer Registry (Texas Department of State Health Services). The projected costs of cancer treatment in 2020 and 2030 and an estimated breakout of cancer expenditures by payer in 2019 are also given. An analysis of the losses associated with the top four cancer sites for annual deaths in Texas for 2020 (lung and bronchus, colorectal, breast, and pancreas) are also provided.

The **overall effect of CPRIT operations** on business activity in Texas (including multiplier effects) is estimated using input data regarding direct expenditures and operations employment at the Institute.

The **positive economic benefits of CPRIT-supported cancer prevention and screening programs** are also assessed, including both the increase in business activity due to the screenings themselves and the associated benefits from improved health. The effects of matching funds generated by CPRIT programs were also included. As of the 2015 report, this aspect of the analysis made use of extensive updates of prior underlying research on the rates of return to prevention and screening efforts, thus resulting in somewhat greater measured effects than in earlier years.

Economic returns on research supported by the Institute (including the effects related to the specific outlays, actual and anticipated recruitment efforts for high quality scholars in relevant areas, typical returns on medical research investments, and spinoff companies that surface from such endeavors) were also evaluated. Again, associated matching funds are incorporated into the analysis.

Some illustrative scenarios related to **potential economic development and social gains** (a recently added feature) stemming from the Institute's role as a catalyst for incremental business activity are provided, as well as others demonstrating the economic value of increased quality of life, longevity, and productivity from improved outcomes.

The economic impact of extending CPRIT operations and initiatives beyond its original ten-year period is also evaluated. This projection reveals notable potential gains expected from CPRIT and its programs being extended. When examined on a dynamic basis, CPRIT generates State revenues well in excess of its costs, thus providing a strong fiscal rationale for its continuation. The Appendices provide a detailed discussion of all aspects of the report, including methodology and disaggregated results.

The Economic Cost of Cancer in Texas

Cancer affects the longevity, quality of life, and finances of individuals suffering with the illness. Costs associated with cancer include direct medical outlays for treatment and care as well as indirect costs such as disease-related work disability or premature mortality. Prevention, early detection, effective treatment, and medical advances to minimize the consequences of the disease are vital national and, indeed, global priorities.

Despite advances in many aspects of cancer prevention and treatment, the number of Americans diagnosed with the disease remains very high. One factor in the recent upward trend in new cases is the aging of the US population, as cancer incidence increases among older age groups. The COVID-19 pandemic during 2020 and the resulting shutdowns led to many appointments being missed, cancelled, or delayed and will likely lead to increased cancer cases and deaths over time.

Cancer Incidence

The American Cancer Society estimates that there will be about 1,806,590 new cases of cancer (893,660 male and 912,930 female) and 606,520 deaths from cancer (321,160 male and 285,360 female) in the US in 2020. The number of new cases expected in 2020 is about 44,000 higher than the projected number for 2019 as cases for both males and females are expected to increase. The estimated cancer deaths shows a slight decrease overall with male deaths slightly lower and female deaths slightly higher compared to 2019.[1]

In Texas, a total of 129,770 new cases of cancer are anticipated in 2020, with 41,810 cancer deaths projected according to the American Cancer Society.[2] Compared to the estimates for 2019, about 4,880 more cases and about 510 more deaths are expected in 2020. The Texas Cancer Registry projects slightly different numbers for Texas in 2020 than the American Cancer Society with 127,131 new cases (65,310 male and 61,821 female), as well as 45,858 deaths

[1] American Cancer Society, *Cancer Facts & Figures 2020*, Atlanta, American Cancer Society; 2020.
[2] American Cancer Society, *Cancer Facts & Figures 2020*, Atlanta, American Cancer Society; 2020.

(24,818 male and 21,041 female).[3] As with the nation, cancer remains the second leading cause of death in the state, after cardiovascular disease.[4]

Cancer Costs

Apart from the extremely high human cost, cancer causes economic harms to affected individuals, businesses, and society as a whole through shortened life spans, lost productivity, increased health care expenditures, and premature mortality.

*The direct medical costs of cancer and morbidity and mortality losses (as traditionally measured) in the state totaled an estimated **$44.7 billion** in 2020, increasing over the past few years.*

The **direct medical costs and morbidity and mortality losses (as traditionally measured) in the state totaled an estimated $44.7 billion in 2020**, up from $42.5 billion in 2019 and $40.3 billion two years ago (according to TPG's update of existing information from the National Institutes of Health[5] and a study of costs in Texas).[6] In 2010, cancer treatment costs in Texas were about $11.5 billion in current dollars and $13.6 billion in constant 2020 dollars. In 2020, treatment costs are estimated to be almost $19.6 billion in current and constant 2020 dollars (a 70.6% and 43.9% rise respectively). By 2030, the projected costs are expected to be $30.8 billion in current dollars, 57.5% higher than in 2020. In constant 2020 dollars, the costs are

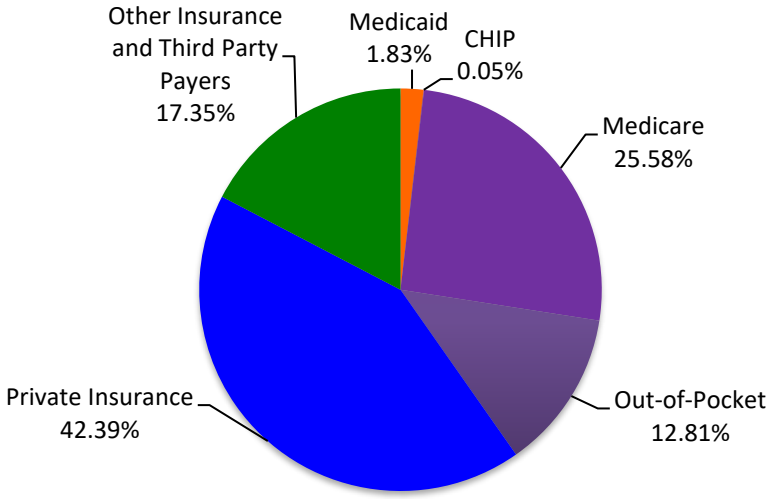
[3] "Expected New Cancer Cases and Deaths by Primary Site, Texas, 2020," Texas Cancer Registry, Cancer Epidemiology and Surveillance Branch, Texas Department of State Health Service, January 2020. Because of the additional detail provided in these estimates, they are used in much of the current analysis.
[4] American Cancer Society, *Cancer Facts & Figures 2020*, Atlanta, American Cancer Society; 2020.
[5] The National Institutes of Health (NIH) estimated the total overall cost of cancer in 2010 (the latest year for which such information is available) to be $263.8 billion including direct medical costs of $102.8 billion (including the total of all health expenditures), indirect morbidity costs (the cost of lost productivity due to illness) of $20.9 billion, and indirect mortality costs (the cost of lost productivity due to premature death) of $140.1 billion. See Cancer facts & figures 2011. (2011). American Cancer Society.
[6] A study directed by the Texas Department of State Health Services (DSHS) and conducted by scholars at the University of Texas Medical Branch (UTMB) found that the total cost of cancer in the state was roughly $21.9 billion in 2007, with $10.0 billion in direct medical costs and $11.8 billion in indirect costs from lost productivity due to cancer morbidity and mortality. See Philips, B.U., et al. (2009, March). The cost of cancer in Texas 2007. Department of Preventive Medicine and Community Health; Texas Medical Branch at Galveston.

projected to be $25.2 billion by 2030, a 43.9% increase over 2020. The projected rates of increase at the national level are even higher.

Costs of cancer treatment are covered by private insurance companies, social programs such as Medicare and Medicaid, and by the patients themselves.

- The Perryman Group estimates that the cost of cancer treatment to private insurance companies in Texas in 2019 was about $8.3 billion.
- The cost of treating cancer in Texas paid through Medicaid in 2019 was $357.4 million.
- The CHIP program spent some $9.2 million treating cancer in 2019.
- Costs of cancer treatment to Medicare in Texas in 2019 totaled an estimated $5.0 billion.
- The cost of treating cancer to other third-party payers in 2019 was determined to be almost $3.4 billion.
- The out-of-pocket cost to cancer patients in Texas in 2019 was approximately $2.5 billion.[7]

[7] Medicaid and CHIP cancer expenditure data from AHQP Claims Universe, Texas Medicaid and Healthcare Partnership (TMHP); Enc_Best Picture Universe, TMHP; prepared by Data Dissemination, Center for Analytics and Decision Support, Texas Health and Human Services Commission, December 2020. All other expenditures are approximations by The Perryman Group based on best available data.



Sources: Medicaid and CHIP cancer expenditure data from AHQP Claims Universe, Texas Medicaid and Healthcare Partnership (TMHP); Enc_Best Picture Universe, TMHP; prepared by Data Dissemination, Center for Analytics and Decisions Support, HHSC, December 2020. All other expenditures are approximations by The Perryman Group based on

The cost of cancer goes well beyond initial effects. Several studies have clearly portrayed the very large economic losses associated with cancer. While many of these are excellent analyses, they fail to capture numerous "multiplier" effects associated with the disease and, thus, represent only a portion of the overall toll on business activity (only the initial effect of the various categories of cost).

The cost of cancer goes well beyond initial impacts. It also includes associated foregone spillover effects.

Most studies of cancer costs reflect only the initial effect of direct medical outlays for treatment and care and indirect costs such as disease-related work disability or premature mortality are not included. However, these losses, in turn, generate further reductions in business activity.

Several years ago, The Perryman Group developed a more comprehensive measure of the cost of cancer which includes losses stemming from treatment, morbidity, and mortality as well as the associated foregone spillover effects. This more comprehensive measure is quantified in the approach utilized by The Perryman Group in the current analysis.

Measuring Economic Impacts

Any economic stimulus, whether positive (such as direct spending, investments, or corporate activity) or negative (such as lost productivity due to disease) generates multiplier effects throughout the economy. In this instance, economic costs of cancer include not only the initial incidence of costs, but also the subsequent rounds of economic activity which are forgone. Economic benefits of cancer research and prevention/screening activities include, among others, increased research spending, commercialization of discoveries, enhanced screening programs, and higher productivity stemming from better health outcomes. (These channels of benefits are described within the report and the accompanying Appendices.) Once the direct stimulus was quantified, the associated multiplier effects were measured.

The Perryman Group's dynamic input-output assessment model (the US Multi-Regional Impact Assessment System, which is described in further detail in the Appendices to this report) was developed by The Perryman Group about 40 years ago and has been consistently maintained and updated since that time; it has been used in hundreds of analyses for clients ranging from major corporations to government agencies. The system uses a variety of data (from surveys, industry information, and other sources) to describe the various goods and services (known as resources or inputs) required to produce another good/service. This process allows for estimation of the total economic impact (including multiplier effects) of CPRIT programs and related activity. An associated fiscal model allows for estimation of tax receipts to state and local entities. The submodels used in the current analysis reflect the specific industrial composition and characteristics of the Texas economy and its various counties, metropolitan areas, regions, and legislative districts.

These total economic effects are quantified for key measures of business activity:

- **Total expenditures** (or total spending) measure the dollars changing hands as a result of the economic stimulus.
- **Gross product** (or output) is production of goods and services that will come about in each area as a result of the activity. This measure is parallel to the gross domestic product numbers commonly reported by various media outlets and is a subset of total expenditures.
- **Personal income** is dollars that end up in the hands of people in the area; the vast majority of this aggregate derives from the earnings of employees, but payments such as interest and rents are also included.
- **Job gains** are expressed as (1) job-years of employment (equivalent to one person working for one year but it could be multiple people working part of a year) for temporary projects (such as construction of a facility) or cumulative assessments over time or (2) jobs when evaluating ongoing annual effects.

Dynamic State and local government revenues reflect tax receipts stemming from the increase in total economic activity. Monetary values were quantified on a constant (2020) basis, which eliminates inflationary effects and allows comparison across various time periods. See the Appendices to this report for more detailed information regarding the methods and assumptions used in this analysis.

Total Economic Cost of Cancer

Using The Perryman Group's more comprehensive measure, the total cost of cancer to the Texas economy is estimated to be almost **$234.5 billion** in reduced annual spending, **$115.6 billion** in output losses per annum, and **1,125,833** lost jobs from cancer treatment, morbidity, and mortality and the associated spillover effects. These amounts represent a slight increase over last year's estimated total cost of $224.1 billion in spending, $110.5 billion in output, and 1,094,965 jobs. **These totals represent approximately 6.37% of the total output of the Texas economy, 6.29% of earnings, and 8.85% of employment.**

Using The Perryman Group's more comprehensive measure, the total cost of cancer to the Texas economy is estimated to be more than $115.6 billion in output losses per annum and more than 1.1 million lost jobs.

The yearly loss in State fiscal revenues (including Medicaid and CHIP and uncompensated care) is some **$8.9 billion**, while losses to local governments include about **$3.9 billion** per annum.

The yearly loss in State fiscal revenues (including Medicaid and CHIP and uncompensated care) is some $8.9 billion, while losses to local governments include about $3.9 billion per annum.

Losses are spread across all regions of Texas and are concentrated in the state's most populous areas. Details of these losses from cancer treatment, morbidity, and mortality and the associated spillover effects are shown in the following table.

The Total Annual Impact of Losses (Treatment, Morbidity, and Mortality) Associated with the Incidence of Cancer on Business Activity in Texas

(Monetary Values in Billions of Constant 2020 Dollars)

	Treatment	Morbidity	Mortality	TOTAL
Total Expenditures	($64.4)	($47.0)	($123.0)	($234.47)
Gross Product	($32.4)	($23.0)	($60.2)	($115.63)
Personal Income	($21.3)	($13.3)	($34.9)	($69.54)
Retail Sales	($8.3)	($6.8)	($17.9)	($33.08)
Employment (Permanent Jobs)	(347,258.8)	(209,732.9)	(568,840.8)	(1,125,833)

Note: Components may not sum to total due to rounding.
Source: The Perryman Group

COST OF CANCER BY COUNCIL OF GOVERNMENTS REGION

ECONOMIC COST OF CANCER INCLUDING DIRECT MEDICAL EXPENSES AND PREMATURE MORBIDITY AND MORTALITY

ANNUAL EFFECT ON BUSINESS ACTIVITY		
	GROSS PRODUCT	EMPLOYMENT
	(Billions of 2020 Dollars)	*(Jobs)*
Panhandle	($2.1)	(20,943)
South Plains	($2.0)	(20,365)
Nortex	($1.6)	(15,491)
North Central Texas	($28.4)	(269,608)
Ark-Tex	($1.7)	(18,479)
East Texas	($5.7)	(56,853)
West Central Texas	($2.2)	(22,012)
Rio Grande	($3.6)	(36,334)
Permian Basin	($2.0)	(18,986)
Concho Valley	($0.9)	(9,143)
Heart of Texas	($2.2)	(23,115)
Capital Area	($6.0)	(61,012)
Brazos Valley	($1.3)	(13,803)
Deep East Texas	($2.5)	(26,826)
South East Texas	($2.5)	(26,143)
Houston-Galveston Area	($27.4)	(242,681)
Golden Crescent	($1.1)	(11,503)
Alamo Area	($11.0)	(112,110)
South Texas	($0.8)	(8,603)
Coastal Bend	($3.2)	(31,407)
Lower Rio Grande Valley	($3.6)	(39,026)
Texoma	($1.3)	(13,679)
Central Texas	($1.9)	(20,520)
Middle Rio Grande	($0.7)	(7,189)
Border Region	($8.7)	(91,191)
TOTAL STATE	**($115.6)**	**(1,125,833)**

Note: Border Region includes Rio Grande, Terrell County, Middle Rio Grande, South Texas, and Lower Rio Grande Valley
Source: The Perryman Group

Cost of Top Death Causing Cancers

As a new component beginning with the 2017 analysis, The Perryman Group analyzed the losses associated with the top four cancer sites for annual deaths in Texas, which include lung and bronchus, colorectal, breast, and pancreas. The Perryman Group determined the total direct annual medical cost of these cancers in Texas for 2020 is **$3.7 billion**. The analysis also indicates a total cost to the Texas economy of almost **$45.0 billion** in reduced annual spending, **$22.2 billion** in reduced output per year, and **216,430** lost jobs from cancer treatment, morbidity, and mortality and the associated spillover effects.

The top four cancer sites for annual deaths in Texas cost the state economy $22.2 billion in reduced output per year and 216,430 lost jobs.

The following table illustrates total lifetime losses associated with the deaths in 2020 and other effects resulting from these four sites.

The Total Impact of Losses (Treatment, Morbidity, and Mortality) Associated with Lung and Bronchus, Colorectal, Breast, and Pancreatic Cancer Deaths in 2020 and Other Effects on Texas Business Activity

(Monetary Values in Billions of Constant 2020 Dollars)

	Lung and Bronchus	Colorectal	Breast	Pancreatic	TOTAL
Total Expenditures	($23.0)	($9.9)	($5.3)	($6.8)	($45.0)
Gross Product	($11.3)	($4.9)	($2.6)	($3.4)	($22.2)
Personal Income	($6.8)	($2.9)	($1.6)	($2.0)	($13.3)
Retail Sales	($3.2)	($1.4)	($0.8)	($1.0)	($6.2)
Employment (Jobs)	(110,754)	(47,182)	(25,585)	(32,909)	(216,430)

Note: Medical costs based on (1) estimated costs per site for cancer cases over the diagnosis period as estimated by the National Institutes of Health (adjusted to reflect current dollars based on the Medical Services CPI for Texas areas as maintained by the US Bureau of Labor Statistics), (2) estimated incidence and deaths by cancer site in Texas for 2020 as compiled by the Texas Cancer Registry, and (3) estimated patterns following diagnosis based on patterns of incidence and death by site. Morbidity and mortality effects are estimated based on patterns relative to medical costs in Texas and approximate cost allocations over the disease cycle (which provides a reasonable proxy for morbidity and mortality patterns). Components may not sum to total due to rounding.
Source: The Perryman Group

Details of losses from treatment, morbidity, and mortality for each of these cancers can be found in the Appendices.

Benefits of Screening and Prevention

It is far less expensive to screen for cancer and treat it in its early stages. Not only are treatment expenses likely to be lower for early-stage diagnoses, but also morbidity and mortality losses are reduced. The Perryman Group's analysis indicates that **every $1 spent through CPRIT for screening/prevention leads to $25.96 in treatment cost savings and resulting economic benefits through earlier detection.**[8] The Perryman Group's analysis also estimates that every $1 spent on screening/prevention saves $1.86 in direct health spending (these savings are included in the $25.96 listed above).

Every $1 spent through CPRIT for screening/prevention saves $1.86 in direct health spending and leads to a total of $25.96 in treatment cost savings and resulting economic benefits through earlier detection.

[8] The reported benefits from screening and prevention are significantly higher than in some earlier years based on recent and more comprehensive research which illustrates greater rates of return on prevention and screening than prior evidence. See, for example, Boland, Mairin and Joan Murphy, The Economic Argument for Prevention of Ill-health at Population Level, For Working Group on Public Health Policy Framework, May 2012.

The Economic Impact of CPRIT and its Programs

The overall effects of CPRIT and its various initiatives extend well beyond the initial stimulus and impacts business activity throughout the supply chain. Even beyond the potentially life-changing influence of spending to reduce the incidence and severity of the disease, this investment in research, screening, and related activities generates substantial economic impacts. Moreover, the investment has the potential to reduce the cost of cancer through improving outcomes.

Returns on investments in medical research include jobs created in the private sector, health care costs saved, the value of increased longevity, the value of reduced morbidity and disability, and the benefits of newer medicines and therapies. Job creation occurs not only directly through the scientists and staff in the research facilities, but also indirectly through the provision of business services needed by those institutions and other multiplier effects.

The direct outlays and related "multiplier" effects emanating from CPRIT operations and programs generate a sizable increase in business activity in Texas including $637.8 million in output (gross product) and 8,558 jobs.

Many studies over an extended period of time support the conclusion that investing in medical and cancer research can yield returns far in excess of initial outlays. Texas is already beginning to see tangible job gains and other benefits such as attracting top-tier research talent (including the CPRIT scholar, Dr. James Allison, who was awarded the 2018 Nobel Prize in physiology or medicine, along with Tasuku Honjo, for his work in cancer immunotherapy), external research funding, and commercialization of findings.

Benefits of CPRIT Operations and Spending

The direct outlays and related "multiplier" effects emanating from CPRIT operations and programs generate a sizable increase in business activity in Texas

including **$637.8 million** in output (gross product) and **8,558** jobs during fiscal year 2020.

These economic benefits stem from operations, prevention and screening, and research programs. They are consistent with the results reported by grant recipients and other data available regarding CPRIT initiatives. Fiscal benefits are also significant, as noted in the table below.

The Current Impact of CPRIT Direct Operations, Prevention and Screening, and Research Programs on Texas Business Activity and Tax Receipts

(Monetary Values in Millions of Constant 2020 Dollars)

	Operations	Prevention & Screening	Research	TOTAL
ECONOMIC BENEFITS				
Total Expenditures	$32.1	$119.4	$1,071.6	**$1,223.1**
Gross Product	$16.3	$65.0	$556.4	**$637.8**
Personal Income	$11.2	$45.5	$385.5	**$442.1**
Retail Sales	$4.2	$17.0	$146.6	**$167.9**
Employment (Permanent Jobs)	139	775	7,645	**8,558**
FISCAL BENEFITS				
State (Texas)	$0.8	$3.2	$28.4	$32.5
Local Governmental Entities Throughout the State	$0.4	$1.7	$16.3	$18.4

Note: Components may not sum to total due to rounding.
Source: The Perryman Group

Secondary Benefits

Even beyond these substantial gains in business activity, CPRIT programs lead to secondary (downstream) benefits such as improved outcomes stemming from screening and prevention and research. Screening can help reduce cancer

incidence and severity. TPG estimates the total annual net outcomes-related benefits from screening and prevention supported by CPRIT to be **$359.0 million** in output (gross product) and **3,496** jobs in 2020 (on a net present value basis assuming typical outcomes from available academic studies[9]). Effects since the inception of CPRIT programs are included in the Appendices to this report.

The economic benefits of CPRIT-funded research activity compound over time. Current estimates of these secondary effects stemming from research include almost **$14.6 billion** in output and **139,533** jobs in 2020. These gains are expected to grow substantially in future years as programs continue and benefits cumulate (as indicated in the Appendices).[10]

The cancer research supported by CPRIT also generates substantial social returns. The estimated cumulative social returns from the cancer research supported by CPRIT from 2010-2020 include almost **$332.5 billion** in gross product in the United States and **$408.9** globally. The impact on employment in the US is **3,120,980** job-years of employment and globally is **3,838,806** job years.[11]

Overall Total Current Impact of CPRIT Operations (including Secondary Effects)

Adding the economic benefits of CPRIT operations, prevention/screening programs, research, outcomes-based prevention/screening, and secondary research effects yield a total gross impact of the Institute's operations. The current total annual gross impact of CPRIT on Texas business activity was found to include almost **$31.9 billion** in annual spending, **$15.6 billion** in output each year, and **151,587** jobs in 2020. Fiscal benefits are also substantial, as noted in the following table.

[9] As noted above, these estimates are notably higher than in some prior years as a result of more specific recent research. See, for example, Boland, Mairin and Joan Murphy, The Economic Argument for Prevention of Ill-health at Population Level, For Working Group on Public Health Policy Framework, May 2012.
[10] Association of University Technology Managers®, *AUTM U.S. Licensing Activity Survey: FY2016*, editors Shawn Hawkins, Yiorgos Kostoulas, Alice Li, Nichole R. Mercier, Matthew A. Mroz, Olivia Novac, Ragan Robertson, Nate Ruey, Ashley J. Stevens, April Turley and Karen White, with research assistance by Chrys Gwellem.
[11] Social returns have been included in the last few years based on recent academic research. See, in particular, Hall Bronwyn, Jacques Mairesse, and Pierre Mohnen; *Measuring the Returns to R&D*; chapter prepared for the *Handbook of the Economics of Innovation*, editors B.H. Hall and N. Rosenberg. December 2009. Frontier Economics, Rates of return to investment in science and innovation, report prepared for the Department for Business Innovation and Skills, July 2014.

Because of the cumulative nature of research gains, these benefits increase over time. Even when other potential uses for State funding of CPRIT are considered, the net economic benefits remain substantial (as indicated in the Appendices). Over an extended time horizon, CPRIT and the research funding it provides will likely generate fiscal receipts totaling a multiple of the commitment of public resources (in addition to the notable economic and health benefits).

The total economic benefits of CPRIT operations, prevention/screening programs, research, outcomes-based prevention/screening, and secondary research effects was found to include almost $31.9 billion in annual spending, $15.6 billion in output each year, and 151,587 jobs.

The Overall Total Gross Annual Impact of CPRIT Operations, Prevention/Screening, and Research Programs on Texas Business Activity and Tax Receipts (Including Direct Outlays with Multiplier Effects as Well as Secondary Effects)
(Monetary Values in Millions of Constant 2020 Dollars)

ECONOMIC BENEFITS*	
Total Expenditures	$31,886.7
Gross Product	$15,616.5
Personal Income	$9,412.7
Retail Sales	$4,309.8
Employment (Permanent Jobs)	151,587
FISCAL BENEFITS	
State (Texas)	$815.0
Local Governmental Entities Throughout the State	$363.4

*Based on budgeted operations and reported awards in fiscal year 2020.
Source: The Perryman Group

Further CPRIT Benefits

The ultimate goal of CPRIT is reducing cancer incidence and the associated high human and economic costs, and a major reduction in incidence/severity would yield substantial economic benefits. In addition, the research activity supported by CPRIT can serve as a catalyst for economic development.

If CPRIT's screening/prevention programs, research advances, and other initiatives **reduce the incidence of cancer** over time to equal the average of current levels observed in the five states with the lowest incidence and death rates, notable economic benefits would be realized. The Perryman Group estimates that the gains in Texas stemming from a substantial reduction in **cancer incidence by 2045 would include more than $15.7 billion in gross product and about 153,339 permanent jobs. Fiscal benefits of such a reduction in cancer incidence include an estimated $884.3 million to the State each year and $392.0 million to local government entities (in constant 2020 dollars).** Moreover, these benefits do not include the obvious gains in quality of life and would not be restricted to Texas; they would bring better outcomes throughout the country and, indeed, the entire world.

If CPRIT's screening/prevention programs, research advances, and other initiatives reduce the incidence of cancer over time to equal the average of current levels observed in the five states with the lowest incidence and death rates, gains in Texas by 2045 would include more than $15.7 billion in gross product and about 153,339 permanent jobs as well as an estimated $884.3 million to the State each year and $392.0 million to local government entities (in constant 2020 dollars).

Research activity associated with CPRIT is enhancing Texas' position in a number of related industries. Since 2010, CPRIT has funded 1,576 awards for cancer research, product development, and prevention with the awards totaling $2,641,125,485.[12] CPRIT has enjoyed a number of successes and its programs and

[12] Grants Funded, Cancer Prevention & Research Institute of Texas website, https://www.cprit.state.tx.us/grants-funded, accessed December 4, 2020.

grants are helping attract key researchers and companies to Texas. CPRIT scholars have received numerous prestigious awards including the 2018 Nobel Prize in physiology or medicine awarded to Dr. James Allison, (along with Tasuku Honjo) for his work in cancer immunotherapy. In September 2020, multiple CPRIT award recipient Dr. Zhijian "James" Chen received the 2020 William B. Coley Award for Distinguished Research in Basic and Tumor Immunology from the Cancer Research Institute.

Research activity associated with CPRIT is enhancing Texas' position in a number of related industries.

CPRIT's investments have played a critical role in connecting universities, researchers, private companies, hospitals, clinics, and physicians across Texas in the battle against cancer. CPRIT has recruited 213 cancer researchers and their labs to Texas. CPRIT's efforts have resulted in 160 new clinical studies with more than 26,213 patients enrolled through CPRIT programs. CPRIT has delivered 6.6 million prevention services to Texans from every county in the state. CPRIT funded academic grantees and companies have raised $4.96 billion in non-state follow-on funding above contract award. In addition to helping save lives, these grants have the potential to generate significant returns to CPRIT as well. CPRIT has funded research projects which have resulted in over 3,400 publications and more than 600 new patents and patent applications.[13]

If Texas achieves a concentration in the biomedical industry (pharmaceuticals and medical equipment) by 2045 equivalent to that of the US, incremental gains would include $17.8 billion in annual gross product and 151,270 jobs.

The Institute's role as a potential catalyst for development of Texas' biomedical industries is helping to establish the Lone Star State as a center for such development. The economic gains from such economic development have been and will continue to be significant. The Perryman Group estimates that **if Texas achieves a concentration in the biomedical industry (pharmaceuticals and medical equipment) by 2045 equivalent to that of the US, incremental gains would include $17.8 billion in annual gross product**

[13] CPRIT Real Momentum Measurable Results, August 19, 2020, Cancer Prevention & Research Institute of Texas website, https://www.cprit.state.tx.us/media/2341/report_momentum_08192020.pdf, accessed December 4, 2020.

and 151,270 jobs. If the state's concentration in the biomedical industry in 2045 reached a level equivalent to California, the incremental economic benefits would include $24.3 billion in gross product each year and about 203,553 jobs. (It is worth noting Texas continues to gain biotech jobs relative to the US and California resulting in lower impact numbers than last year.)

Economic Effects of Extending CPRIT and Its Programs an Additional Ten Years

As has been illustrated, CPRIT plays a vital role in fighting cancer and generates substantial economic benefits to the state. The impact of the decision to continue CPRIT's programs after Texas voters overwhelmingly approved the passage of Proposition 6 in November 2019 with sustainable levels of funding for another 10 years beyond its initial mission is significant. The additional $3 billion in funding to CPRIT, along with the initial $3 billion makes the $6 billion, 20-year initiative, the largest state funded research program in US history and the second largest source of funding for cancer research in the world.

The Perryman Group estimates the anticipated gross cumulative ten-year impacts of extending CPRIT operations and all of its programs include **$180.3 billion in gross product and some 1,751,127 job-years of employment**. (A job-year is equivalent to one person working full-time for one year but could be multiple persons working for part of a year.) The **gross fiscal gains** over ten years of extending CPRIT and its programs include almost **$9.8 billion to the State and $4.4 billion to local governments**. Note that these gains do not include any offset for the residual effects of the initial decade of activity, as those would have been enjoyed even if the program had not been extended.

Even when other potential uses for State funding of CPRIT are considered, the net cumulative economic gains over the additional 10 years of funding remain substantial. These net gains include **$172.9 billion in gross product and some 1,649,870 job-years of employment.** The net fiscal gains are noted in the table.

It should be noted that, while commercialization of discoveries is clearly a viable and important aspect of the overall initiative and can at times generate near-term returns, support of basic research brings greater long-term gains and should continue to be the major focus of CPRIT efforts. Attempts to substantially alter the priorities of the program would diminish its value in terms of human health, economic impact, and fiscal benefits.

The gross cumulative ten-year impacts of extending CPRIT and all of its programs include $180.3 billion in gross product, more than 1.75 million job-years of employment, almost $9.8 billion in revenue to the State and $4.4 billion in additional tax receipts to local governments.

Scientific research, as is facilitated by CPRIT, is valuable to society in large part due to what it facilitates downstream and how it produces further research leading to additional advances.[14] In traditional infrastructure such as roads, highways, water systems, and schools, the government typically plays a major role as provider, coordinator, or regulator. Scientific research, specifically cancer research, is much like traditional infrastructure because it creates benefits or value primarily from downstream uses and "contributes significantly to economic growth and social welfare."[15]

Scientific research, as is facilitated by CPRIT, is valuable to society in large part due to what it facilitates downstream.

Because of its inherent nature as infrastructure, cancer research and prevention should be funded and supported in a manner similar to that of traditional infrastructure. It is in essence a public good that benefits everyone in society although some of the specific benefits might not occur until well in the future. Thus, it is highly impactful to Texas in multiple contexts that CPRIT and its many initiatives have been continued.

[14] See for example, Frischman, Brett, "An Economic Theory of Infrastructure and Commons Management," American Law & Economics Association Annual Meetings, 2006.
[15] Frischman, Brett, "An Economic Theory of Infrastructure and Commons Management," American Law & Economics Association Annual Meetings, 2006 p. 993.

The Anticipated Net Cumulative Ten-Year Impacts of Extending CPRIT and All of Its Programs at Sustainable Levels of Funding for Another Ten Years on Texas Business Activity and Tax Receipts (Including Direct Outlays with Multiplier Effects as Well as Secondary Effects) **(Monetary Values in Billions of Constant 2020 Dollars)**	
ECONOMIC GAINS*	
Total Expenditures	$354.0
Gross Product	$172.9
Personal Income	$103.5
Retail Sales	$47.8
Employment (Job Years)	1,649,870
FISCAL GAINS	
State (Texas)	$9.4
Local Governmental Entities Throughout the State	$4.2
Source: The Perryman Group; A job-year is equivalent to one person working full-time for one year.	

Conclusion

The Cancer Prevention and Research Institute of Texas plays a crucial role in the war on cancer. Through its operations, screening/prevention efforts, and research programs, CPRIT is helping reduce the extremely high human and economic costs of cancer. CPRIT is also generating a sizable economic stimulus from all of its efforts including more than **$15.6 billion** in output (gross product) and **151,587** jobs in 2020 (when multiplier and secondary effects are included). Moreover, the Institute's efforts to improve outcomes related to cancer prevention and treatment can lead to a significant reduction in cancer incidence and severity over time and be a catalyst to biomedical development in Texas.

CPRIT efforts improve outcomes related to cancer prevention and treatment, leading to a significant reduction in cancer incidence and severity over time. The Institute is also a catalyst to biomedical development in Texas.

The Institute's positive impact represents an excellent return on fiscal resources. Research enabled by grants funded through CPRIT is already bearing fruit, with leading researchers as well as companies coming to the state, matching funds being attracted, and findings being published in leading journals. Empirical evidence shows that medical research and prevention programs can reduce cancer incidence and enhance outcomes. Reductions in treatment expenses, morbidity, and mortality stand to bring notable economic benefits.

Basic medical research is part of society's essential infrastructure, and CPRIT has demonstrated capacity to enhance the health of Texans and the economy at a pace that far exceeds the direct investment.

The economic activity stemming from CPRIT operations and programs generates tax receipts and reduced State expenditures for health care over time which exceed the investment of resources. The significance of CPRIT activities continues to expand and will only accelerate in the future now that its mission has been extended. **Basic medical research is a part of society's essential infrastructure, and**

CPRIT has demonstrated capacity to enhance the health of Texans and the economy at a pace that far exceeds the direct investment.