Private Funding for Pancreatic Cancer Research: More Than a Chip Shot

Cancer is the second leading cause of death in the United States and is projected to soon overcome heart disease as the world's largest health problem.[1] In contrast with improving outcomes for most common malignancies, mortality rates of pancreatic cancer and liver cancer are worsening for both men and women[2,3]; they are projected to be the second and third most common cause of cancer-related deaths before 2030, respectively (Figure 1). The 5-year survival is only 8% for pancreatic cancer and 17.5% for liver cancer.[2,4] In addition to generally poor prognoses and shortened survival, the economic burden of these cancers is substantial.[5,6]

Despite its impact on public health and economics, pancreatic and liver cancer research is underfunded by the federal government,[7] receiving approximately 2.1% and 1.4% (2013), respectively, of federal dollars distributed by the National Cancer Institute (NCI; Figure 2). Other malignancies, including breast, prostate, and colon, have generally received better support. Funding for cancer has depended on the NCI since the National Cancer Act of 1971 broadened the scope and responsibilities of the NCI and created the National Cancer Program. Despite best efforts for an equitable disbursement of monies, there are gaps in cancer research funding. Disparities in the funding and the survival rates between the nation's deadliest cancers and other major cancers led to the recent passing of the "Recalcitrant Cancer Research Act of 2012". This bill defines recalcitrant cancers as those with a five-year relative survival below 50% and requires the NCI to develop scientific frameworks for two of the recalcitrant cancers. NCI has since developed frameworks for pancreatic adenocarcinoma and small cell lung cancer.

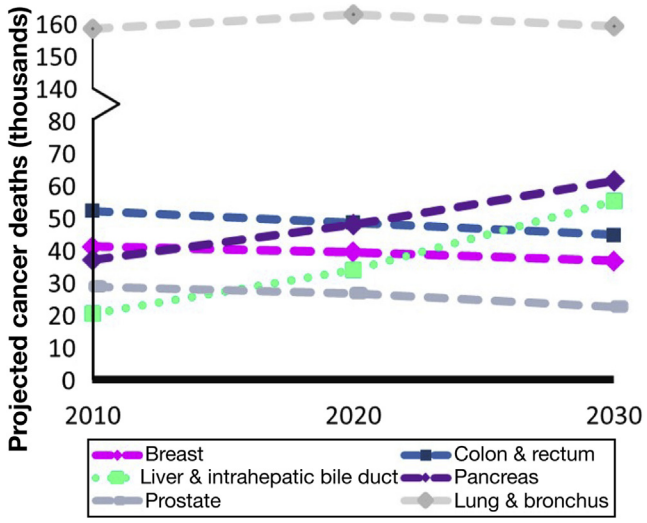

Figure 1. Projected cancer deaths using the delay-adjusted average annual percentage change.

In addition to funding disparities, governmental funding of cancer research has experienced inconsistent growth. The sequestration, a poor economy, and difficult political climate have all contributed to a decline in research funding.[8] For example, from 1994 to 2004 the National Institutes of Health (NIH) budget increased 254%, from $11 billion to $28 billion. However, From 2005 to 2015 the NIH budget only increased 6%, from $28.5 billion to $30.3 billion.[9] Accounting for inflation, this represents a funding deficit of 25% over this time period despite rising research costs and funding requests (NCI budget facts). In 2013, a difficult funding environment was worsened when, as required by statute, President Obama signed an order initiating sequestration. This resulted in a NIH funding cut of 5% or $1.55 billion of its fiscal year 2013 budget. The dearth in research funding has led to a crisis in support and job satisfaction for young investigators.[10,11]

Recognizing the need for additional research support, patient advocacy groups, philanthropic organizations, and private organizations are contributing cancer research funding to supplement declining government funds. With the transformation of the American Cancer Society by Mary Lasker in the 1940s, private and philanthropic organizations have played a growing role in cancer research.[12] For example, In the United States, during a period of stagnant federal research funding, there was an 11% increase in overall spending by nonprofit organizations between 2003 and 2008.[13] Globally, of the 10 largest nonindustry funders of health research in 2016,[14] 2 are philanthropic foundations. These groups also expend substantial resources lobbying congress for cancer research support. According to a STAT analysis of the Center for Responsive Politics' database of lobbying reports, cancer centers, patient advocacy groups, and foundations spent nearly $10 million lobbying congress and federal agencies in 2015. The scope and influence of these organizations are growing and changing the funding landscape.

Herein, we attempt to further define and characterize the research funding landscape for pancreatic and liver cancers by quantifying research support offered through private organizations. Additionally, we report on the content of these grants by comparing common scientific outline (CSO) codes between publicly and privately funded projects.

Enumerating Funding Sources: The International Cancer Research Partnership

The International Cancer Research Partnership (ICRP) is an alliance of

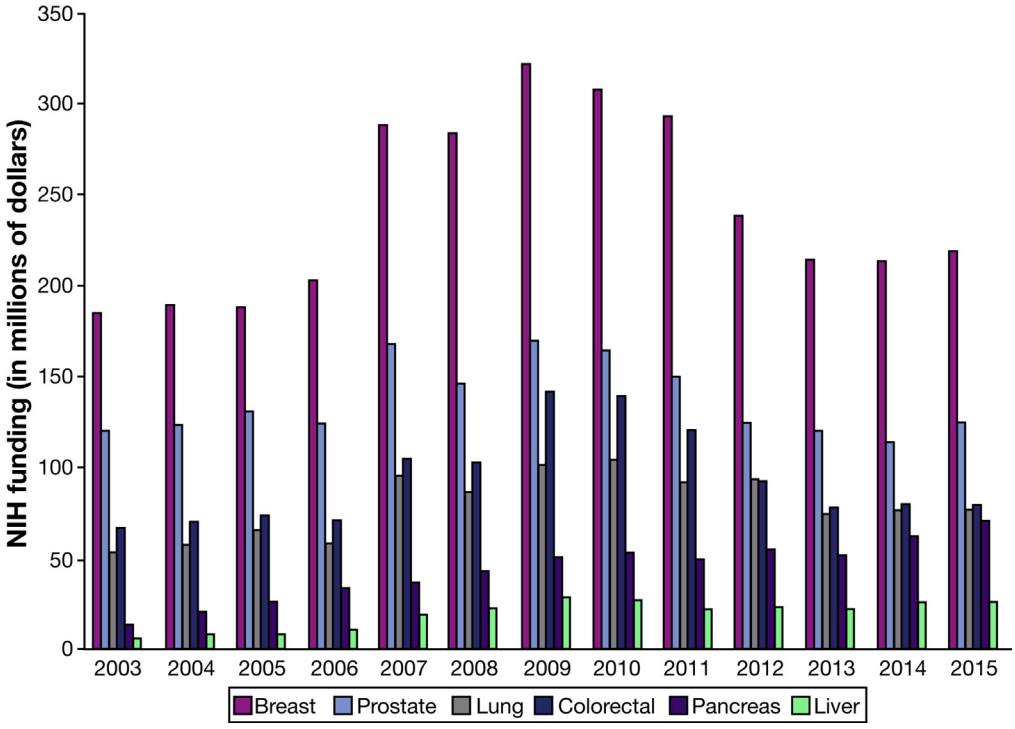

Figure 2. National Institutes of Health (NIH) funding, 2003 to 2015, for pancreas and liver cancers. NIH funding for common malignancies were compared with funding for pancreas and liver cancers.

governmental and charitable organizations funding regional, national, and international cancer research grants and awards, which provides key information about ongoing and historical research funding. Established in 2000, the ICRP includes organizations from Australia, Canada, France, Japan, the Netherlands, United Kingdom, and the United States, both private and public.

The ICRP maintains a database of grants, awards, and their associated CSO codes that its members have provided. All partners, public and private, have access to the database and can use it to identify gap areas, or areas where interagency collaboration may be required. Using the ICRP database, the number of grants and their monetary value for pancreatic cancer and liver cancers awarded from 2003 to 2013 in the United States was analyzed. Grants were included if >50% were dedicated to either liver or pancreatic cancer. In addition, private funding data from the Pancreatic Cancer Action Network, Lustgarten Foundation, and the American Association for Cancer Research were provided and private and public funding for pancreatic cancer was compared with the funding for liver cancer. Generally, public funding was comprised of governmental institutions including the NIH, the US Department of Defense, and the Canadian Institutes of Health Research.

Private Versus Public Cancer Research Funding: Pancreatic and Liver Cancer

Between 2003 and 2013, total funding for pancreatic cancer has increased >4-fold from $21 million to $86 million (Supplementary Figure 1). The total number of private and public grants also increased over this time period from 129 to 534 grants. Private and charitable funding made up 17% of the total funding in 2013, which is an improvement over the 13% in 2003 ($P < .001$). In addition, private funding for pancreatic cancer research increased by greater than 6-fold over the 11 years of data collection from $2.3 million to $14.8 million dollars.

Private funding, as compared with public funding, has seen a steeper increase from 2010 to 2013, when a 42% increase in private funding is observed. Public funding decreased during this time period, likely related to sequestration budget cuts. Notably, mean award amounts increased significantly for private grants over the time period reviewed. The mean annual award distribution for private institutions was $94,000 per grant in 2003 as compared with $181,000 for public institutions. By 2013, the mean annual distribution for private institutions had surpassed their private counterparts ($203,000 vs $154,000).

Similar metrics for liver cancer were reviewed. Funding for liver cancer has also increased over this time period; however, the percentage contribution from private and charitable organizations was significantly less as compared with pancreatic cancer ($P < .001$; Supplementary Figure 2). For example, in 2013, private funding for liver cancer was close to 5% versus nearly 20% for pancreatic cancer.

CSO Codes and Research Funding

We also reviewed the CSO reporting for pancreatic cancer research

funding, benchmarked against the NCI research portfolio from 2003 to 2013. We found the intent of pancreatic ductal adenocarcinoma research has changed over time, with more studies directed at developing treatments being funded. There has also been a decreased emphasis on etiology and very few grants directed at prevention.

In 2003, the 3 most commonly assigned codes were "etiology," "treatment," and "biology." In 2013, the 3 most commonly assigned codes were "treatment," "biology," and "early detection, diagnosis, prognosis". There has been a substantial decrease in funding for "etiology" (CSO code 2), which accounted for 39% of funding in 2003 and only 9% in 2013. Funding for "biology" (CSO code 1) and "treatment" (CSO code 5) have increased over the same time period (Supplementary Table 1).

When we stratified grant content by public or private institutions we found that although there were no private grants funding "treatment" in 2003, by 2013 the portfolios had similar emphases on "treatment" and "biology" (Supplementary Table 2). Over the 10 years reviewed, the grant content of public and private institutions is converging. One exception is there are almost no private grants focused on "early detection, diagnosis and prognosis" (CSO code 2).

We performed a similar review for liver cancer (Supplementary Table 2). Across public and private institutions, funding emphasized "biology" and "etiology." Unlike pancreatic cancer, there was decreased emphasis on "treatment." Both private and public liver cancer grants were more likely to focus on etiology as compared with pancreatic cancer. Unlike pancreatic cancer, liver cancer has several well-defined etiologies, including viral hepatitis and cirrhosis. Grant content differences seem to correlate with our understanding of the pathogenic differences between these diseases and our desperation for new pancreatic cancer therapies

These results are provocative; one could imagine public and private funding institutions addressing different aspects of cancer research. Perhaps philanthropic funding requires more tangible results and is less likely to focus on prevention and etiology, whereas the NCI may find these areas of study more important and aligned with their goals. As private funding continues to grow, coordination with NCI may help to organize efforts to provide the appropriate breadth and extent of research support for specific malignancies.

Private cancer research funding for pancreatic cancer is growing. Over the last 10 years, the number of private grants and the total amount has increased significantly. The mean grant award difference between public and private funding has decreased as well. But the intent of this research has also changed, with more studies directed at developing treatments. There has also been a decreased emphasis on etiology and very few grants directed at prevention.

The Moonshot Program: Bridging the Funding Gap

Our analysis suggests that private cancer research funding, similar to public funding, is not distributed equally. Despite a heavy disease burden and poor public funding, pancreatic and liver cancers have not received comparable levels of philanthropic and private support. The cause for this discrepancy is unclear, but suggests that more work needs to be done to ensure appropriate levels of funding for malignancies with a high societal burden.

As with any movement, our "war" on cancer requires defined principles and clear objectives. Our review suggests that *nemo resideo* or *no man left behind* should become a guiding ethos. Our first obligation is to ensure that the NCI is appropriately funded now and in the future. We must continue to identify areas of need and support the Recalcitrant Cancer Research Act of 2012. Finally, we need to ask the general public, philanthropic groups, and other private agencies to follow their conscience and help provide supplemental support. The improving arc of pancreatic cancer funding could be a model for other diseases.

The tide of stagnant medical research funding is turning. On January 12, 2016, President Obama announced a "moonshot proposal" that will considerably increase governmental cancer research.[15] The recent passage of the of the 21st Century Cures Act by the senate almost guarantees funding for the Moonshot program, including $4.8 billion over the next 10 years to the NIH for medical research into cancer and other diseases. These investments in cancer research infrastructure are providing great opportunities to bring together the NIH, academic cancer institutes, and philanthropic and patient advocacy groups to develop comprehensive strategies for malignancies that have been previously overlooked. The recent creation of the FDA Center of Excellence is leveraging collective expertise to support oncologic drug development. We encourage an expansion of this mandate to include research and development for recalcitrant malignancies.

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Supplementary Material

Note: To access the supplementary material accompanying this article, visit the online version of *Gastroenterology* at www.gastrojournal.org, and at http://dx.doi.org/10.1053/j.gastro.2017.02.034.

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Conflicts of interest
The authors disclose no conflicts.

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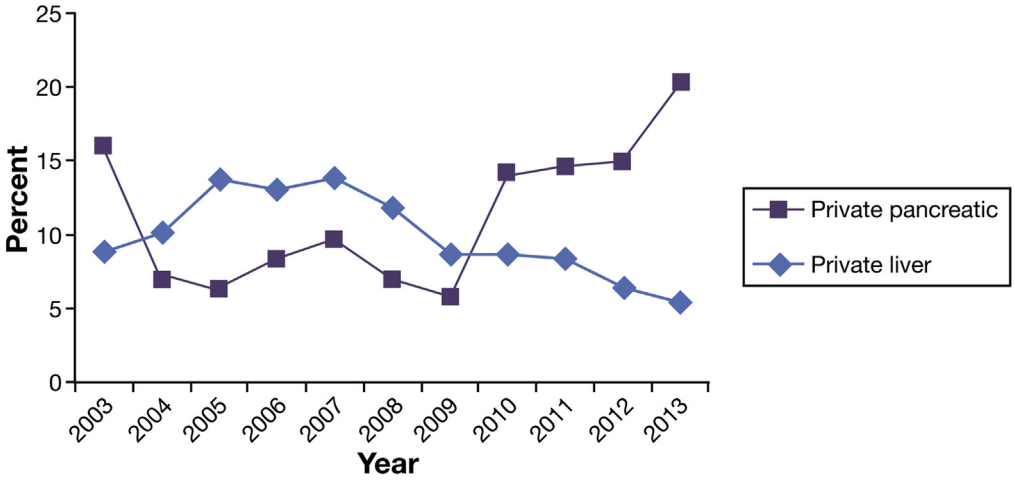
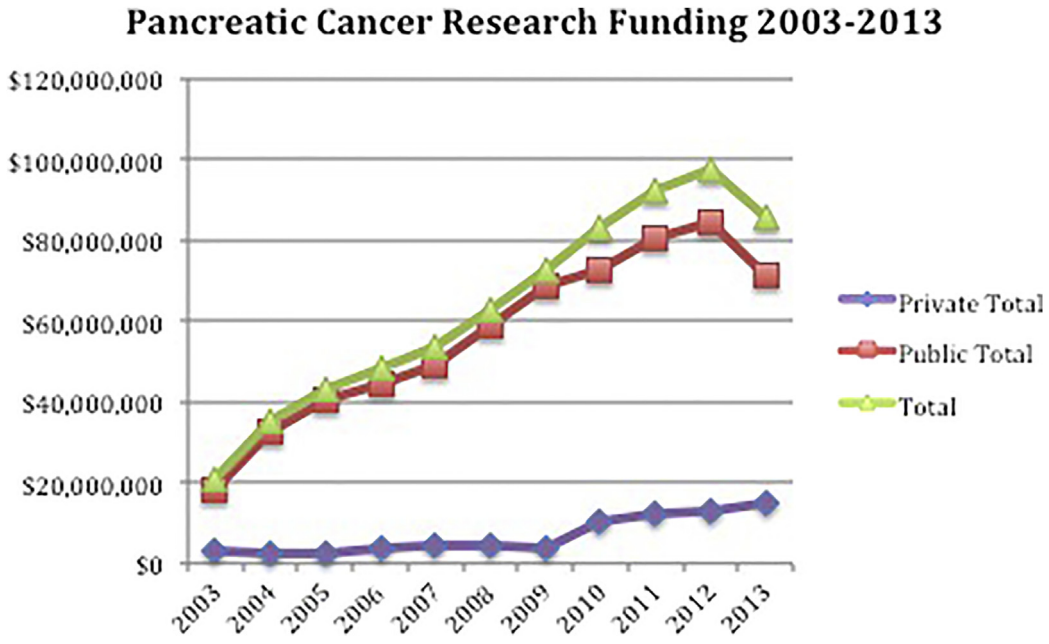


Supplementary Figure 1. Pancreatic cancer research funding landscape, 2003 to 2013. Private, public, and total pancreatic research funding from 2003 to 2013 was evaluated. The data were derived from the International Cancer Research Partnership database and disclosures from private organizations.



Supplementary Figure 2. Private funding proportion: liver versus pancreas. We reviewed the proportion of private funding (private funding/total funding) for cancer research for both liver and pancreatic cancer between 2003 and 2013.

Supplementary Table 1. CSO reporting for NCI Pancreatic Cancer Portfolio

CSO	CSO name	FY2003 ($)[a]	FY2003 (%)[a]	FY2008 ($)[b]	FY2008 (%)[b]	FY2013 ($)[c]	FY2013 (%)[c]
1	Biology	4,849,692	15	18,183,960	21	25,484,027	25
2	Etiology	13,083,971	39	14,358,840	16	9,174,250	9
3	Prevention	1,115,554	3	4,000,323	5	6,116,166	6
4	Early detection, diagnosis, prognosis	3,147,370	9	13,120,328	15	15,290,416	15
5	Treatment	10,377,213	31	29,790,661	34	37,716,360	37
6	Cancer control, survivorship, outcomes research	496,836	1	3,554,532	4	3,058,083	3
7	Scientific Model Systems	319,480	1	4,268,505	5	5,096,805	5
	Total	33,390,116	100	87,277,150	100	101,936,107	100

CSO, common scientific outline; FY, fiscal year; NCI, National Cancer Institute.
[a]FY2003 data sourced from NCI funded research portfolio online. Percent site and CSO funding data are not available on NCI portfolio for FY before 2007, so these were copied over from International Cancer Research Partnership (ICRP) data where possible. Awards without a correlate in ICRP were automatically assigned a percent (eg, if only pancreatic mentioned in site = 100%; if 2 sites mentioned, pancreatic = 50%). Similarly funds were apportioned equally between CSOs.
[b]FY2008 data sourced from NCI-funded research portfolio online and calculated using same methodology used for FY2013 calculations.
[c]FY2013 sourced from NCI-funded research portfolio online (http://fundedresearch.cancer.gov/nciportfolio/search/get?site=Pancreas&fy=PUB2013).

Supplementary Table 2. Private Versus Public CSO Reporting for Pancreatic and Liver Cancers[a]

CSO	CY2003	CY2008	CY2013
ICRP data: pancreatic cancer, 2003–2013, public (government) ICRP organizations			
CSO 1 Biology	20%	25%	35%
CSO 2 Etiology	32%	13%	11%
CSO 3 Prevention	4%	5%	6%
CSO 4 Early detection, diagnosis, prognosis	8%	18%	17%
CSO 5 Treatment	32%	34%	49%
CSO 6 Cancer control, survivorship, outcomes research	1%	4%	1%
CSO 7 Scientific model systems	4%	3%	5%
No. of awards	101	272	373
ICRP data: pancreatic cancer, 2003–2013, private (non-government) ICRP organizations (no. of awards)			
CSO 1 Biology	57%	42%	35%
CSO 2 Etiology	0%	3%	5%
CSO 3 Prevention	14%	1%	2%
CSO 4 Early detection, diagnosis, prognosis	14%	15%	1%
CSO 5 Treatment	0%	29%	23%
CSO 6 Cancer control, survivorship, outcomes research	0%	2%	2%
CSO 7 Scientific model systems	14%	8%	1%
No. of awards	7	50	57
ICRP data: Liver cancer, 2003–2013, public (government) ICRP organizations (no. of awards)			
CSO 1 Biology	23%	25%	26%
CSO 2 Etiology	41%	26%	25%
CSO 3 Prevention	6%	6%	7%
CSO 4 Early detection, diagnosis, prognosis	4%	13%	17%
CSO 5 Treatment	23%	21%	22%
CSO 6 Cancer control, survivorship, outcomes research	2%	3%	3%
CSO 7 Scientific model systems	2%	5%	2%
No. of awards	116	226	342
ICRP data: Liver cancer, 2003–2013, private (non-government) ICRP organizations (no. of awards)			
CSO 1 Biology	33%	20%	13%
CSO 2 Etiology	44%	36%	19%
CSO 3 Prevention	0%	9%	0%
CSO 4 Early detection, diagnosis, prognosis	0%	7%	2%
CSO 5 Treatment	0%	14%	8%
CSO 6 Cancer control, survivorship, outcomes research	11%	5%	3%
CSO 7 Scientific model systems	11%	9%	0%
No. of awards	9	22	31

CSO, common scientific outline; CY, calendar year; ICRP, International Cancer Research Partnership.
[a]Years 2003, 2008, 2013. Only awards with ≥50% relevance to each cancer type.