Longwood collective

To: Our Esteemed Leaders in Local, State, and Federal Government

Re: Significance of NIH Funding in Boston's Longwood Medical and Academic Area

From: Longwood Collective

Date: February 12, 2025

The recently announced restrictions of National Institutes of Health (NIH) funding that set a 15% cap on reimbursements for indirect costs associated with research activities will be highly consequential to funding levels dedicated to medical research and public health. For decades, NIH funding has been a major source of revenue fueling initiatives dedicated to scientific discovery, and has led to medical advancements and innovations that are improving patient outcomes in the global fights against cancer, heart disease, diabetes, and more. This funding has enabled researchers to develop life-saving vaccines, pioneering therapies, and cutting-edge technologies that have not only improved but also saved millions of people's lives. The effects of the funding extend far beyond laboratories and hospitals.

Nowhere is this more evident than in Boston's Longwood Medical and Academic Area (LMA), a global hub for medical research, innovation, and education that is also one of the densest clusters of research activity in the nation, with more NIH awards for its research endeavors than other similar academic biomedical cluster in the United States.

For context, the Longwood Collective is a non-profit organization that provides essential programs and services in Boston's LMA in service to our 22 member institutions in the medical, academic and cultural sectors, including many of Massachusetts' largest NIH funding recipients. Enclosed in this memo is information about the impact this new policy will have on the core research function that makes the LMA a healthcare epicenter and a leading contributor to our nation's position as a global leader in medical research.

The hospital research labs in the LMA are a vital part of the overall nonprofit, mission-driven organizations to which they are part and are drivers of world-renowned global research and medical breakthroughs. Medical innovations from Longwood are too numerous to list in full, but include the first heart valve repair, first artificial kidney machine for clinical use, first heart, full face, and multiple organ transplants, the first administration of insulin, the pioneering use of chemotherapy to treat cancer, gene therapies to treat diseases such as sickle cell, and more recently using genomics to create targeted therapies to treat breast and lung cancer, as well as other diseases.

Recently, in response to the COVID-19 pandemic, as a part of Operation Warp Speed, Longwood institutions performed clinical trials to test new vaccines to protect against the disease, and tested therapies to lessen patients' symptoms, saving and prolonging countless lives. Longwood institutions have been at the forefront of defining, researching, and treating 'multi-system inflammatory syndrome' in children and researching the causes of long-Covid.

The ability of researchers to respond to new challenges is contingent upon a combination of federal and public funding sources, together with philanthropic donations, to support their mission-driven work. The research labs are focused on advancing scientific breakthroughs through research to address long-term illnesses for which there is no immediate cure such as diabetes, cancer, and neurological conditions, while the hospital operations provide acute, life-saving care to patients.

In addition to supporting the LMA's medical and educational institutions in their global research and medical breakthroughs that have saved countless lives, NIH funding plays a major role in supporting the innovation ecosystem in the Commonwealth of Massachusetts and its associated reputational, workforce, and economic benefits.

Fast Facts:

1. **NIH funding heavily supports LMA institutions in their world-renowned global research and medical breakthroughs that have saved countless lives.**

   Analysis of the FY24 Funding Levels:

   - Boston's independent hospitals received over $1.65 billion in NIH funding in FY24 - just over 50% of the nationwide total for independent hospitals.
     - Of that, $902 million went to LMA institutions; representing 54.6% of the funding Boston's independent hospitals received. LMA institutions account for over a quarter of all NIH awarded funding for independent hospitals nationwide (27.5% of funding, or 30% of awards).
   - If the LMA were its own state, it would rank 9 nationally in total NIH funding, behind Illinois and ahead of Washington *(see chart below).*
   - LMA institutions received approximately $1.2 billion of NIH funding from over 2,100 awards, representing over a third of the state's totals.
   - Of every dollar the NIH awards to Massachusetts, 37 cents goes to the LMA.
   - Within Boston, the LMA attracts 51% of all NIH awards and funding.

NIH Funding Levels for the LMA (compared to statewide levels): Source

FY2024		
Rank	**State**	**Amount**
1	CA	$4,997,040,165
2	NY	$3,477,047,975
3	MA	$2,167,974,705
4	PA	$2,167,974,705
5	TX	$1,875,252,729
6	NC	$1,802,372,165
7	MD	$1,403,635,588
8	IL	$1,244,490,665
9	**LMA**	$1,243,090,591
10	WA	$1,192,973,909

FY2024		
LMA	**Boston**	**MA**
$1,243,090,591	$2,439,601,065	$3,340,117,905

2. **NIH funding also supports the LMA as a powerful jobs and economic engine for the City of Boston, Massachusetts, and New England.**

In April 2021, the Longwood Collective published an Economic Impact Report together with the UMass Donahue Institute that details Longwood's economic and health contributions to Boston and MA, including its ability to attract NIH funding. Key findings include:

- Together, institutions in the LMA employ 73,000 workers including more than 11,000 researchers alone, educators, clinicians, administrators, and more. Research and medical positions drive employment in the LMA as both the foundational occupations and the growth leaders.
- The LMA is the densest concentration of employment outside of the downtown core of Boston, containing more workers, students, and research funding than at any other time in its history, having added more than 1,200 jobs per year over the past 10 years. The LMA contributed one of every 11 new jobs in Boston over that time.
- Longwood's hospitals are an integrated clinical, teaching and research center that are focused on advancing scientific breakthroughs through research to address long-term illnesses for which there is no immediate cure such as diabetes, cancer, and neurological conditions, while the hospital operations provide acute, life-saving care to patients.

- The medical breakthroughs that result from close coordination among education, research, and healthcare are significant and global in impact, and include the first heart valve repair, first artificial kidney machine for clinical use, first heart, full face, and multiple organ transplants, the first administration of insulin, the pioneering use of chemotherapy to treat cancer, gene therapies to treat diseases such as sickle cell, and more recently using genomics to create targeted therapies to treat breast and lung cancer as well as other diseases.

Sampling of Current LMA-Based Research Activities with >15% Indirect Costs

- **Understanding the Functional Causes of Epilepsy[1]:**
  - Epilepsy is a debilitating disease affecting 1 in 26 people (3-4% lifetime risk), making it the third most common neurological disorder in the United States. The goal of this project is to acquire and use information about epilepsy-causing mutations that occur in localized regions of the brain, and within a subset of the brain cells within that region, to better understand the functional causes of epilepsy. The researchers will use newly-developed single-cell sequencing methods to identify which specific types of brain cells harbor the causative mutations and determine how these mutations change the expression of genes within these cells, and in neighboring cells.
    - FY25 NIH Funding: $910,212 total, including $307,935 indirect costs
- **Advancing Leukemia Vaccines[2]:**
  - Researchers have shown positive results in adult acute myeloid leukemia patients who receive personalized vaccines once in remission following chemotherapy treatments. Of patients in a clinical trial, 71% remained free of disease with a median follow up of 5 years. In order to enhance the possibility of long-term protection, the researchers are targeting "transforming growth factor beta" (TGF-β), which has been proven to suppress tumor growth, to further improve upon outcomes for patients who receive this vaccine.
    - FY25 NIH Funding: $622,526 total, including $155,379 indirect costs

[1] This research is supported by the National Institute of Neurological Disorders and Stroke under Project no. 2R37NS035129-26 (*Human Epilepsy Genetics – Mosaic Mutations in Focal Epilepsy*, Principal Investigator: C. Walsh). Retrieved from https://reporter.nih.gov/project-details/11049264

[2] This research is supported by the National Cancer Institute under Project no. 5R01CA262629-04 (*Personalized Adoptive T-cell Therapy for AML*, Principal Investigator: D. Avigan). Retrieved from https://reporter.nih.gov/project-details/11001441

- **Determining Genetic Risk for Developing Alzheimer's and Related Dementias Following Inflammation From Surgery or Infection[3]:`**
    - Delirium is a common geriatric syndrome associated with Alzheimer's and Alzheimer's Disease-Related Dementias, though the relationship between the two is not well understood. There is evidence to support a relationship between genetic risk for Alzheimer's and risk for delirium following brain inflammation, for example as the result of a brain surgery or infection. Researchers will investigate datasets of older adults undergoing major elective surgery to inform possible interventions that can prevent delirium and reduce Alzheimer's.
        - FY25 NIH Funding: $746,750 total, including $155,379 indirect costs
- **Improving Cell Based Therapies for Brain Tumors[4]:**
    - Standard treatments have shown little to no efficacy in highly malignant and glioblastoma brain tumors. There is a great need for new solutions, and researchers have identified a possible treatment through engineered mesenchymal stem cells (MSCs) and T cells. These engineered cells should have an impact beyond brain tumors and contribute to the breadth of cancer therapies available.
        - FY25 NIH Funding: $417,858 total, including $176,626 indirect costs
- **Understandings Antibiotic Resistance Evolution to Address the Current Crisis of Bacterial Antibiotic Resistance[5]**:
    - Antibiotic resistance in bacteria is a public health crisis, with many easy-to-treat infections now nearly incurable due to evolutionary mutations. The classical model of resistance evolution where a bacterium mutates in the presence of antibiotic use has fallen short and cannot explain all evolutionary factors. This research will work to understand more completely how antibiotic resistance takes hold, to develop new therapies for patients with long-term infections.
        - FY25 NIH Funding: $483,990 total, including $221,553 indirect costs

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[3] This research is supported by the National Institute on Aging under Project no. 5R01AG079864-03 (*Brain Vulnerability in Delirium and Alzheimer's Disease and Related Dementias: Intersection of Polygenic Risk and Inflammation*, Principal Investigator: S. Vasunilashorn). Retrieved from https://reporter.nih.gov/project-details/10987037

[4] This research is supported by the National Cancer Institute under Project no. 1R01CA288535-01A1 (*Cell Surface Receptor Targeted Therapies for Brain Tumors,* Principal Investigator K. Shah). Retrieved from https://reporter.nih.gov/project-details/11047965

[5] This research is supported by the National Institute of General Medical Sciences under Project no. 1R35GM156320-01 (*Evolutionary Tradeoffs in Antibiotic Resistance*, Principal Investigator M. Baym). Retrieved from https://reporter.nih.gov/project-details/11011835

- **Investigating the Impact of Air Pollution on Risk and Progression of Alzheimer's Disease and Related Dementias[6]**:
    - Alzheimer's Disease is the sixth leading cause of death in the United States, yet little is understood in terms of vulnerability, prevention, and mitigation of disease progression. Studies have proven a relationship between neurodegeneration and air pollution, highlighting particular biological pathways that are impacted by poor air quality. This study will work to understand the complex interactions of individual, environmental, and societal factors that lead to increased vulnerability to Alzheimer's.
        - FY25 NIH Funding: $638,167 total, including $219,305 indirect costs
- **Improving Diabetes Therapy by Examining How Exercise Training Impacts Adipose Tissue[7]**
    - Diabetes is a major public health problem and exercise plays an essential role in the management and prevention of the disease. The goal of this research is to find out how exercise training causes fundamental changes to adipose tissue, which signal the body to improve overall metabolism including lowering blood sugar and lipid levels and enhancing function of other tissues such as liver, muscle, and kidney. These studies will lead to a better fundamental understanding of the beneficial effects of exercise on health and help to identify therapies for diabetes.
        - FY25 NIH Funding: $657,554 total, including $273,019 indirect costs

Historical Critical Research that has Advanced in the LMA with Support of NIH Funding with >15% Indirect Costs:

- **Blood test predicts 30-year cardiovascular disease risks for women[8] (September 2024)**
    - *NIH funding total:* $71,103,799, including $15,482,171 indirect costs
    - *Context:* Cardiovascular disease is the term for diseases that affect the heart or blood vessels. These include coronary heart disease, heart attacks, stroke, heart failure, and peripheral artery disease. More than 800,000 people nationwide die of such diseases every year.
    - *Outcome:* Researchers found that a blood test to measure levels of three compounds could predict a woman's risk for cardiovascular disease decades

[6] This research is supported by the National Institute on Aging under Project no. 5R01AG066793-05 (*National Cohort Studies of Alzheimer's Disease, Related Dimensions, and Air Pollution*, Principal Investigator A. Zanobetti). Retrieved from https://reporter.nih.gov/project-details/10983783
[7] This research is supported by the National Institute of Diabetes and Digestive Kidney Diseases under Project no. 5R01DK099511-11 (*Novel Mechanisms of Exercise Training Effects on Glucose Homeostasis*, Principal Investigator L. Goodyear). Retrieved from https://reporter.nih.gov/project-details/11026384
[8] National Institutes of Health. (2024, August 31). *Single blood test predicts 30-year cardiovascular disease risks for women.* [Press release]. Retrieved from https://www.nih.gov/news-events/news-releases/single-blood-test-predicts-30-year-cardiovascular-disease-risks-women

later. The findings may lead to ways to detect and treat cardiovascular disease earlier.

- **Tiny, implanted devices give insights for treating brain tumors[9] (September 2023)**
  - *NIH funding total:* $16,829,492 including: $9,270,934 indirect costs
  - *Context:* Hard-to-treat tumors known as gliomas originate in the brain or spinal cord. The subtype known as glioblastoma is the most common type of primary brain cancer in adults and is especially aggressive. Affected patients usually have surgery to remove the tumor, followed by chemotherapy or radiation to eliminate any remaining cancer cells. Despite years of research, no biomarkers have been identified to help guide targeted treatment strategies. Unfortunately, survival rates for people with glioblastoma have not significantly improved over the past decades.
  - *Outcome:* The scientists created tiny drug-releasing microdevices—each about the size of a grain of rice—that can be inserted into a patient's tumor at the start of brain surgery. The device releases tiny "nano-doses" of anti-cancer drugs at separate locations within the tumor. The drugs then incubate in the patient's tumor as the brain surgery proceeds for another two to three hours. The microdevices are removed with the last piece of the tumor. The tissue can then be analyzed to assess the effects of various drugs. The findings from this small clinical trial hold promise for developing personalized post-surgery treatments for aggressive brain cancers.
- **Nanoparticles developed for traumatic brain injury[10] (January 2021)**
  - NIH funding total: $14,095,450, including $5,925,319 indirect costs
  - *Context:* A bump, blow, or jolt to the head can cause a traumatic brain injury (TBI). More than 2 million people in the U.S. sustain TBIs each year. A severe TBI can result in long-lasting problems with brain function, memory, and speech. TBIs may also increase the likelihood of developing diseases like Alzheimer's and Parkinson's disease, which cause brain cells to degenerate. Drugs that might help prevent Alzheimer's and other neurodegenerative diseases after TBI are hard to deliver to brain tissue. They're hampered by a dense barrier of cells protecting the brain called the blood brain barrier. This barrier prevents harmful materials that circulate in the blood from entering the brain, while allowing in oxygen, water, and other vital substances. As a result, doctors only have the short, unpredictable period when the blood brain barrier is breached after a head injury to deliver drugs to brain tissue.
  - *Outcome:* A research team set out to develop a system that would allow therapeutics to cross the blood brain barrier while intact. The team engineered

[9] National Institutes of Health. (2023, September 19). *Tiny implanted devices give insights for treating brain tumors.* [Press release]. Retrieved from https://www.nih.gov/news-events/nih-research-matters/tiny-implanted-devices-give-insights-treating-brain-tumors

[10] National Institutes of Health. (2021, January 12). *Nanoparticles developed for traumatic brain injury.* [Press release]. Retrieved from https://www.nih.gov/news-events/nih-research-matters/nanoparticles-developed-traumatic-brain-injury

nanoparticles to carry a promising TBI drug to the brain. They carried out studies in healthy mice to identify the most effective at delivering drugs to the brain. These findings suggest that the nanoparticle platform holds promise for treating TBI as well as other neurological disorders.