The Case for Increased Funding for Research in Pulmonary and Critical Care

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Abstract

The current economic and political climate places future funding of the NIH and other federal biomedical research programs in jeopardy. This Perspective seeks to arm the diverse membership of the ATS with the information necessary to understand and articulate the value of biomedical research in their respective communities. We provide an historical overview of NIH funding in general and of allocations directed at respiratory-related research in particular. We argue that this is in fact an opportune time to expand investments in biomedical research and that doing so makes sense from the perspectives of improving health, curtailing health care expenditures, and job creation and economic growth. We further argue that current levels of allocation towards respiratory research are incommensurate with the medical, economic, and societal burden of respiratory disease in the United States. Respiratory disease currently is the only leading cause of death that has risen, rather than fallen, in recent decades. Declines in the burden of cardiovascular disease and cancer followed substantial increases in research funding, and slowing the rising burden of respiratory disease will likewise require a greatly expanded investment in pulmonary, critical care, and sleep research.

“If you think research is expensive, try disease.”
- *Mary Lasker, 1901-1994*

Deep concerns about the lingering economic downturn and the federal deficit underscore the current national debate on government spending, and healthcare expenditures are pivotal to that discussion. In this climate, future funding of the National Institutes of Health (NIH)and other federal programs in biomedical research are in jeopardy. As health care providers, biomedical researchers, educators, and community leaders, members of the ATS must not only be informed about these issues but must vigorously defend and articulate the value of biomedical research in their communities. Instead of cutting investmentsin biomedical research, this is an opportune moment to expand such investments, and doing so makes sense from the perspectives of health, economics, and business.

The U.S. biomedical research enterprise has been the envy of the world for the last half century, withits government- and industry-funded research fueling the development of most of the world’s new drugs, vaccines, and medical devices, and its academic institutions considered premier sites for research training. Biomedical research expenditures currently total ~$100 billion annually, with approximately 65% supported by industry, 30% by government (most by the NIH), and 5% by foundations, charities, and private funds (1). This total research investment represents ~4% of the ~$2.5 trillion expended on health annually in the U.S.

Although its origins can be traced back to the 1880s, the NIH as an institution providing public funding for medical research was established by the U.S. Congress in 1930. The National Heart Institute was created in 1948, and incorporation of lung diseases (1969) and blood disorders (1972) resulted in the modern NHLBI. Today NIH comprises 27 institutes and centers with an annual budget of just over $31 billion. 10% of this (the intramural program) supports projects conducted by about 6,000 scientists within its own laboratories, mostly on the NIH campus in Bethesda, Maryland. More than 80% of the NIH's annual budget (the extramural program)is allocated through nearly 50,000 competitive grant awards to more than 330,000 researchers at over 3,000 universities, medical schools, and other research institutions (2).

The importance of basic research to improvements in human health – a fundamental mission of the NIH – cannot be overstated. The mechanistic underpinning for many of the treatments in current use, such as -adrenergic agonists for asthma and endothelin receptor antagonists for pulmonary arterial hypertension, were discovered through NIH-funded research. In an effort to fulfill its obligation to demonstrate practical deliverables from its Congressional allocations, the NIH has increasingly embraced earmarks targeting “translational” research. All researchers ultimately wish to translate their observations into diagnostic or therapeutic interventions, but there are real limitations and costs to this funding trend. Translational endeavors are in many instances premature because the basic scientific knowledge needed to accomplish this effectively is lacking. Moreover, experience has shown that the practical applications of fundamental investigation often cannot be predicted. Finally, this funding trend places

significant pressure on investigator-initiated research – traditionally the foundation of the NIH funding scheme.

The NIH budget enjoyed healthy growth from the 1950s through the 1990s, doubling approximately every 10 years. In 1998, Congress committed to double the NIH budget over a 5-year interval, which was accomplished at a funding level of $27 billion in 2003. Subsequent growth in the budget has been a far more modest 1-2% annually, and adjusting for inflation, the NIH budget actually decreased by 8.6% from 2003-2007. The 2009 American Reinvestment and Recovery Act (ARRA) provided a welcome infusion of $9 billion in additional NIH funds to support new 2-year projects. Although both the doubling and ARRA represented extraordinary and unprecedented investments in biomedical research that unquestionably pushed science forward, they also expanded the pool of researchers who would compete for NIH support in the future. Moroever, the enduring value of these two efforts may be undermined by the lack of a long-term plan to sustain growth in research funding. Reflecting the failure of funding to keep pace with the growth in the pool of investigators, the success rate for NIH grants has plummeted towards 10%, an untenably low rate for sustaining and expanding the pace of U.S. biomedical research

Among NIH institutes, the National Cancer Institute (NCI) has long received the greatest proportion of total funding. In 2003, NHLBI was overtaken by the National Institute of Allergy and Infectious Disease (NIAID) as the second-ranked institute by funding. Although it has remained in third position since that time, NHLBI's slice of the total NIH pie has declined slightlyfrom ~11% in 2003 to ~10% in 2010. Within the NHLBI portfolio, what is the "market share" for lung disease relative to cardiovascular and hematologic disease? Since 2005, ~20% of the NHLBI budget has been allocated to lung disease; a slight increase to 22% was recorded in 2010. This amounts to about $675 million total for lung disease research.

Is this level of appropriation commensurate with the medical, economic, and societal burden of lung disease in the U.S.? A number of perspectives argue that it is not. First, the total direct and indirect economic cost of lung disease in the U.S. in 2010 is estimated at $186 billion. This means thatU.S. expenditures on health care and lost productivity for lung disease exceed NIH expenditures on lung disease research by approximately 275-fold. Second, several lung diseases are among those determined to be "underfunded." One analysis (3) compared NIH funding allocations in 1996 for 29 distinct diseases for which data existed to several validated estimates of societal burden for those diseases. By this analysis, HIV infection was by far the most overfunded disease relative to its societal burden, and breast cancer was second. Notably, of the 7 most underfunded diseases, 3 of them – COPD, pneumonia, and lung cancer – were lung diseases. A follow-up analysis of 2006 allocations (4) revealed little improvement in the alignment between NIH funding and lung disease burdens over that decade. Third, while the death rate from COPD has doubled within the last 30 years, rates for the other leading causes of death (heart disease, cancer, and stroke) have decreased by over 50%; as a result of these divergent trends, COPD is now the third leading cause of death in the U.S and a major contributor to morbidity, lost work, and hospitalizations.

Although the NHLBI investment in COPD research has commendably increased over the last several years, the 2010 funding allocation for COPD ($118 million) was only 30% of that for stroke, 6% of that for heart disease, and 2% of that for cancer (5).

The dimensions of the impact of respiratory and critical care diseases can be further appreciated by a glance at some facts and figures regarding specific disorders other than COPD: 1) Asthma is the most common chronic disease and the leading cause for hospitalization in children. 2) Pneumonia is the leading reason for hospitalization (other than delivering a baby) in the U.S., and worldwide, respiratory infections exact a greater health burden (defined as disability-adjusted life-years lost) than any other single category of disease (6). 3) Lung cancer is now the leading cause of cancer death in men and woman in the U.S. 4) Even though most people have never heard of it, as many Americans die annually of pulmonary fibrosis as die of breast cancer. 5) A variety of medical and societal forces have driven a surge in utilization of critical care medicine services; in 2005, critical care accounted for 13.4% of all U.S. hospital costs and 0.66% of the gross domestic product (7), and it is surely growing. 6) Acute lung injury, which occurs in response to diverse insults such as sepsis, aspiration, and trauma, kills as many Americans annually as do breast, colon, and prostate cancer combined. 7) The prevalence of sleep disordered breathing is currently estimated at approximately 10%, and its deleterious systemic effects are only beginning to be appreciated. One final perspective on the inadequacy of research funding for key lung diseases is provided by the fact that estimated 2012 NIH funding levels for research in COPD ($120 million), ARDS ($112 million), and pneumonia ($95 million) are each less than those for anthrax ($121 million) and sexually-transmitted diseases ($255 million) (5).

The last quarter of the twentieth century saw pulmonary and critical care medicine move beyond the whole organ physiologic level and towards an understanding of the cells and molecules that participate in lung homeostasis and disease. The last decade has seen basic researchers employ sophisticated new methods in cell and molecular biology, engineering of transgenic animals, large-scale molecular profiling, bioinformatics analyses, cell therapies, and organ regeneration. In parallel, we are gaining insight into how to transform these discoveries into meaningful therapeutic advances. Expertise has been gained in clinical research design and execution, and the recognition of the importance of disease heterogeneity is revolutionizing how we conceptualize both research and clinical care. Yet today's challenging climate for biomedical research funding raises the ominous concern that many of these hard-won scientific gains will of necessity be left unharvested to "spoil in the field." Indeed, the Director of the Division of Lung Diseases of NHLBI, Dr. James Kiley, recently stated on the pages of the *Journal* that "Now, more than ever, the pulmonary community needs to combat this rising epidemic [of lung diseases] by accelerating research to further advance our understanding of complex respiratory diseases" (8).

Proposed changes in how health care is organized, delivered, and reimbursed are prominently featured in current discussions about health care reform. While such changes have obvious potential to improve quality of care, their economic benefits are incremental in nature, and these may be overwhelmed by a populace that is aging and

that has an ever-increasing thirst to implement expensive health care technologies. By contrast, biomedical and health services research offers an opportunity – perhaps the only opportunity – for advances in diagnosis, treatment, and disease management that are not merely incremental but truly reshape the landscape as measured by dramatic improvements in health and reductions in health care costs. NIH-funded research has been estimated to provide a 50-fold return to the economy by improving health (9). In addition, it is an economic engine which creates jobs and spurs innovation. It is now more important than ever for all members of the ATS to embrace the challenge issued by Dr. Kiley (8); this demands that they become better informed about how research is funded and advocate for much-deserved increases in funding for the research necessary to advance lung health. ATS members are urged to educate the public, including their patients, about the importance of biomedical research and to vigorously champion research funding in their local communities and at state and national levels. They should contact their members of Congress to educate them about the vital importance of increasing funding for NIH. If we fail to engage in advocacy, NIH will face stagnant and even reduced funding in 2013 and beyond. The ATS advocacy website contains sample letters and all of the information you need to contact your members of Congress. Go to http://www.thoracic.org/advocacy/take-action-now.php.

Recommendations

We offer the following recommendations intended to promote biomedical research in general as well as research specifically in lung health and in respiratory and critical care medicine:

1. A steady expansion of federal funding for biomedical research is a critical priority, and the medical research community must embrace and articulate this message to the public. Biomedical research is highly valued by a large majority of Americans (9) and it has enjoyed bipartisan support in Congress for many years; this should, therefore, be a politically feasible national goal.
2. It is a central tenet of research that the practical applications of fundamental investigation often cannot be predicted. It is therefore important that support for investigator-initiated basic research remain vigorous.
3. NIH-funded research at academic medical centers continues to play a crucial role in identifying the targets for drug development by the pharmaceutical industry. The symbiotic partnership between these key stakeholders must be protected and permitted to flourish.
4. Death rates for lung diseases have increased while those for cancer and cardiovascular diseases have diminished. The latter successes clearly reflect substantial infusions in NIH funding during the preceding thirty years. It is appropriate that a similar degree of funding urgency now be directed towards respiratory and critical illness.

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