

Federal Funding for Kidney Disease Research: A Missed Opportunity

Kidney disease is an under-recognized but common public health issue that is expensive to treat and disproportionately affects vulnerable populations. As physicians and public policy professionals involved in the treatment and research of kidney disease, we explain here why increased research investments are a critical step to reduce the public health burden of kidney disease.

GROWING BURDEN OF KIDNEY DISEASE

Chronic kidney disease is a growing public health problem in the United States.¹ Ten percent of US adults—more than 20 million Americans—have chronic kidney disease.² The prevalence of chronic kidney disease increased by 30% in the decade between 1994 and 2004, largely because of an increased prevalence of diabetes, hypertension, and obesity.³ Chronic kidney disease generally progresses over time, and can cause cardiovascular disease, anemia, bone disease, fluid overload, and eventually end-stage renal disease. Patients with end-stage renal disease need renal replacement therapy, either from dialysis or a kidney transplant, to live. The risk of death for patients receiving dialysis is nearly eight times higher than the non-end-stage renal disease population, leading to a 20% annual probability of death.¹ In 2008, the average

three-year survival of patients receiving dialysis was a dismal 56%.¹ While patients who receive kidney transplants survive longer, a shortage of organs prevents transplantation for many patients.

Kidney disease is frequently associated with complications that impair quality of life. Patients with end-stage renal disease rarely regain full health, and are often unable to return to work. The percentage of Americans with end-stage renal disease classified as disabled was 92% in 2011.⁴ Kidney disease disproportionately affects minorities and vulnerable populations. For instance, chronic kidney disease is more common among African Americans compared with other races, and is more common in older Americans.² Among patients with chronic kidney disease, African Americans, Mexican Americans, patients with lower socioeconomic status, and other disadvantaged and vulnerable patients are more likely to progress to end-stage renal disease.¹ Because kidney disease can reduce a person's productivity, these disparities amplify ongoing racial and socioeconomic inequalities.

FEDERAL EXPENDITURES FOR KIDNEY DISEASE TREATMENT

Kidney disease treatment is expensive and uniquely tied to federal expenditures through the

Medicare entitlement program. Because of a law passed in 1972, nearly all patients with end-stage renal disease are eligible for and receive Medicare coverage.⁵ As of 2013, approximately 616 000 patients are receiving dialysis or have had a kidney transplant, costing the federal government nearly \$35 billion annually.¹ Patients with end-stage renal disease require renal replacement therapy, expensive medications, and are hospitalized frequently, leading to high treatment costs. Despite growth in the end-stage renal disease population over the past 30 years, patients with end-stage renal disease still represent only one percent of the Medicare population. Yet, costs associated with the condition accounted for more than six percent of Medicare's budget in 2013. The combined annual cost to Medicare for treating all health conditions faced by patients with chronic kidney disease and end-stage renal disease has reached

\$80 billion, nearly 25% of Medicare's budget.¹

IMPORTANCE OF FEDERAL INVESTMENTS IN KIDNEY RESEARCH

The federal government plays a vital role in financing health care-related research. Federal investment in research for a variety of specific conditions—including cerebrovascular disease, cancer, and HIV/AIDS—has fostered important scientific advances, leading to therapies that improve patient outcomes. Stroke mortality improved with National Institutes of Health (NIH)-funded innovations such as platelet coagulation inhibitors and tissue plasminogen activators. Cancer-related mortality has improved with the discovery of adjuvant therapies, cell signaling targets, and human papillomavirus vaccination. Substantial declines in heart disease occurred following innovations in angioplasty. Increased federal research investment in kidney disease could generate similar advancements. In

ABOUT THE AUTHORS

Mallika L. Mendu is with the Division of Renal Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston MA. Kevin F. Erickson is with the Section of Nephrology, Baylor College of Medicine, Houston, TX. Thomas H. Hostetter is with the Division of Nephrology, UH Case Medical Center, Case Western Reserve School of Medicine, Cleveland OH. Wolfgang Winkelmayr is with the Section of Nephrology, Baylor College of Medicine, Houston, TX. Grant Olan and Rachel N. Meyer are with the American Society of Nephrology, Washington, DC. Raymond Hakim is with the Division of Nephrology, Vanderbilt University Medical Center, Nashville, TN. John R. Sedor is with the Division of Nephrology, Metro Health Medical Center, Case Western Reserve School of Medicine.

Correspondence should be sent to Mallika L. Mendu, Attending Physician, Brigham and Women's Hospital, Division of Renal Medicine, 75 Francis Street, MRB-4, Boston, MA 02115. (e-mail: mmendu@partners.org). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

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TABLE 1—US National Institutes of Health (NIH) Research Funding by Disease

Disease	Prevalence, Millions	2014 Budget, ^a \$ Million	% of 2014 NIH Budget	NIH Spending per Patient, \$
HIV/AIDS	1.2 ^b	3677	12	3064
Cancer	14.0 ^c	7957	27	568
Heart disease	27.0 ^d	1645	5	61
Kidney disease	20.0 ^e	585	2	29

^aAccording to NIH at http://report.nih.gov/categorical_spending.aspx.

^bAccording to the Centers for Disease Control and Prevention (CDC) at <http://www.cdc.gov/hiv/basics/statistics.html>.

^cAccording to the American Cancer Society at <http://www.cancer.org/cancer/cancerbasics/cancer-prevalence>.

^dAccording to CDC at <http://www.cdc.gov/nchs/fastats/heart-disease.htm>.

^eAccording to CDC at http://www.cdc.gov/diabetes/pubs/pdf/kidney_factsheet.pdf.

particular, the discovery of new mechanisms of disease and new markers of disease progression could become a catalyst for much-needed private research investment into new therapies to treat chronic kidney disease.

When considering both the high cost of kidney disease treatment to the federal government and the immense toll it takes on population health, NIH funding for kidney disease research is inadequate. The NIH is the primary source of government supported research. Only two percent of NIH research funding in 2014 was allocated toward kidney disease—which totals less than one percent of federal expenditures to treat kidney disease. Moreover, NIH spends far less on kidney research per patient (approximately \$29/patient/year) than on heart disease (\$61/patient/year), cancer (\$568/patient/year), and HIV/AIDS (\$3064/patient/year; Table 1).⁶ The deficiency in federal kidney disease research funding is consistent with evidence that NIH's allocation of research funds often does not reflect disease burden. A comparison of disease-specific funding in 1996

found no relation between the amount of research funding and the incidence, prevalence, and number of hospital days attributed to a condition.⁷

KIDNEY RESEARCH ADVANCES AND OPPORTUNITIES

Although there has been less investment in kidney research and fewer trials for kidney disease therapies compared with many other common health conditions, a number of promising discoveries have emerged that, with the help of additional research funding, could lead to treatment advances. The discovery of apolipoprotein L1 gene variants as major causes of kidney disease in African Americans represents a potential target for novel therapies. Recent studies have elucidated mechanisms related to kidney embryogenesis, and the role of kidney fibrosis in kidney function decline. Research into the role of race, ethnicity, obesity, and hypertension in kidney disease progression could lead to better screening and novel therapies. Better biomarkers for use as

surrogate endpoints for clinical trials could facilitate research efforts.

An initiative of the National Institute of Diabetes and Digestive and Kidney Diseases, called the Kidney Research National Dialogue, solicited input from the scientific community on research objectives to improve understanding of kidney function and disease. The resulting work product, released in 2014, recommended six cross-cutting themes:

1. increase training and team science opportunities to expand the nephrology workforce,
2. develop novel technologies to assess kidney function,
3. promote human discovery research to better understand normal and diseased kidney function,
4. establish integrative models of kidney function to inform diagnostic and treatment strategies,
5. promote interventional studies that incorporate more responsive outcomes and improved trial designs, and
6. foster translation from clinical investigation to community implementation.

Together, these ideas generate a roadmap focused on investigation to improve prevention, diagnosis, and treatment of kidney disease. They can guide development of future research initiatives. **AJPH**

Mallika L. Mendu, MD, MBA
Kevin F. Erickson, MD, MS
Thomas H. Hostetter, MD
Wolfgang C. Winkelmayr, MD, ScD
Grant Olan, MA
Rachel N. Meyer
Raymond Hakim, MD
John R. Sedor, MD

CONTRIBUTORS

Mallika L. Mendu and Kevin F. Erickson are co-first authors. All of the authors had access to the data in this article and had a role in writing the article.

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