

# Diabetes Research in the Department of Veterans Affairs

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**OBJECTIVE** — To provide an overview of the Department of Veterans Affairs (VA) research activities, highlighting diabetes-related research.

**RESEARCH DESIGN AND METHODS** — Diabetes is an important component of the VA research portfolio. All four VA research services support aspects of diabetes research. VA diabetes research projects and funding were examined from 1998 to 2003.

**RESULTS** — VA scientists are conducting research on diabetes genetics, etiology, diagnosis, therapy, epidemiology, health services, and rehabilitation. VA research funding is available to answer important veteran-relevant questions through peer review, Center of Excellence activities, and multisite trial mechanisms. Many VA scientists also receive research support from nonfederal sources, including private corporations and nonprofit foundations. The VA Office of Research and Development actively supports training the next generation of researchers through their career development awards and the VA health profession training programs.

**CONCLUSIONS** — The VA's diabetes research portfolio is extensive and includes many investigators, trainees, and fellows. There is substantial leveraging of VA diabetes research with support from other federal and nonfederal funding agencies, foundations, and private corporations. VA diabetes research findings benefit the global diabetes care community.

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A high priority of the Department of Veterans Affairs (VA) is research. The VA Office of Research and Development is dedicated to discovering new knowledge, creating innovations that translate into advances in health care for veterans and the nation, and developing VA researchers and health care leaders. This article provides an overview of diabetes research within the VA.

The VA research program began after World War II. In affiliated hospitals, physicians cared for patients, taught medical students and residents, and engaged in their own research. In 2003, the VA re-

search program received \$394 million in VA funds, with an additional \$400 million in indirect research support from VA medical appropriations. An additional \$565 million in direct support come from other non-VA research funds for a total annual budget of nearly \$1.4 billion (Table 1). The funding available to VA researchers has increased considerably from FY1997 to the projected budget for FY2004. Collaboration with nongovernment agencies, private foundations, and private industry leverages VA research resources and contributes to productive interagency working relationships. The VA

research program currently supports >15,000 research projects and 3,800 investigators in 115 different VA medical centers. This research involves >15,000 patients and is designed to improve the health of both veterans and nonveterans.

Diabetes is the third most common diagnosis among veterans who receive medical care from VA. Given the significant burden and opportunities for primary and secondary prevention for veterans with diabetes, the VA research program makes a substantial investment in diabetes research, spanning the continuum from basic genetics research to clinical trials on diabetes prevention and treatment (1).

The VA offers several types of research awards. The merit review mechanism is used to fund investigator-initiated research and is similar to the National Institutes of Health R-01 funding mechanism. Career Development and Research Scientist Awards are available to support the development of promising junior and established senior investigators. The VA supports multiple centers of excellence in each of its research services. They target specific diseases, particular research methods, or areas of emphasis, such as multiple sclerosis, epidemiology research, and quality of care and utilization studies. In 2002, VA research support was allocated as follows: 70% to investigator-initiated projects, 14% to multisite trials, 8% to Centers of Excellence ( $n = 41$ ), 7% to career development awardees ( $n = 188$ ), and 1% to service-directed research.

In 2003, VA research was reorganized into four areas: Clinical Science Research and Development, Biomedical Laboratory Research and Development, Health Services Research and Development, and Rehabilitation Research and Development. A brief summary of the research priorities and diabetes portfolios of each area follows.

## Clinical Science Research and Development

The focus of Clinical Science Research and Development is to support clinical research that is relevant to veterans. The most visible component is the Coopera-

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**Abbreviations:** QUERI, Quality Enhancement Research Initiative; VA, Department of Veterans Affairs.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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Table 1 —VA research budget, FY1997–FY2004\*

	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004 (projected)
Research and development appropriation	262	272	315.7	321	351	371	394	408
Medical care	319.7	310.7	326	344.8	376.2	377	400	414
NIH and other sources	381.4	414.7	480.6	504.1	498.7	624	565	689
Total	963.1	997.4	1,122.3	1,169.9	1,225.9	1,372	1,359	1,511

\*Dollars in millions. NIH, National Institutes of Health.

tive Studies Program. The VA conducts population-based research through clinical trials on health issues that are vital to our nation's veterans. Through multisite randomized trials, VA researchers are investigating strategies to improve the effectiveness of treatment provided to persons with diabetes. Some current examples in the diabetes portfolio include studies of innovative models for diabetes care, evaluating the short-term consequences of screening for diabetes, and investigating the use of fluorescent scatter on the lens of the eye as a possible tool for diagnosing diabetes. A cooperative study is now underway using intensive versus conventional insulin treatment to manage glycemia in veterans with type 2 diabetes. This study examines the issues of expected benefits and costs and cardiovascular disease outcomes.

Other funding mechanisms are used to support peer-reviewed research, specialized centers of excellence, and training. The Epidemiologic Research and Information Centers (ERICs) conduct diabetes and other research, education, and technical assistance and disseminate relevant findings to research and clinical communities.

Between 1998 and 2002, the VA with cofunding from the Juvenile Diabetes Foundation International, created three VA diabetes research centers located in Iowa City, Nashville, and San Diego. The Iowa City focus was the identification of potential causes of early vascular defects and design of preventive or palliative therapies. The Nashville center emphasized the cellular and molecular processes by which intensive therapy reduced insulin resistance and the role of exercise in

modulating therapeutic effectiveness. The San Diego center concentrated on insulin resistance mechanisms and causes of diabetic vascular and renal complications.

### Biomedical Laboratory Research and Development

Biomedical Laboratory Research and Development supports investigator-initiated research to study basic biological or physiological principles related to disorders and diseases of importance to veterans. Funded programs may use human tissues, blood, or other biological specimens or animal models, but not intact human subjects. Research in Biomedical Laboratory Research and Development emphasizes projects that will ultimately lead to improvements in clinical practice. Examples of relevant diabetes research include studies on prevalence and clinical signifi-

Table 2 —VA investigator diabetes-related research summary FY1988–FY2003

FY	VA funded		Non-VA funded		No funding		Total (distinct projects)	
	No. of projects	Funding	No. of projects	Funding	No. of projects	Funding	No. of distinct projects	Total funding
2003	93	\$12,942,154	395	\$35,816,012	635	\$0	1,049	\$48,758,166
2002	92	\$13,396,960	366	\$31,072,163	586	\$0	975	\$44,469,123
2001	97	\$12,339,799	361	\$28,204,321	517	\$0	911	\$40,544,120
2000	100	\$11,355,346	318	\$23,366,684	444	\$0	802	\$34,722,030
1999	90	\$11,008,557	323	\$20,587,936	356	\$0	756	\$31,596,493
1998	87	\$10,455,207	321	\$15,277,709	321	\$0	721	\$25,732,916
1997	72	\$8,302,705	306	\$15,914,023	298	\$0	658	\$24,216,728
1996	59	\$6,698,625	246	\$11,946,380	286	\$0	575	\$18,645,005
1995	75	\$7,693,592	210	\$9,448,956	273	\$0	537	\$17,142,548
1994	77	\$7,638,009	184	\$9,908,388	284	\$0	525	\$17,546,397
1993	71	\$6,923,551	209	\$9,047,460	230	\$0	490	\$15,971,011
1992	72	\$5,769,753	212	\$8,344,070	201	\$0	469	\$14,113,823
1991	71	\$6,198,081	178	\$7,681,992	198	\$0	435	\$13,880,073
1990	74	\$5,866,933	181	\$8,452,681	202	\$0	441	\$14,319,614
1989	70	\$5,124,224	140	\$5,193,968	181	\$0	376	\$10,318,192
1988	63	\$4,890,114	108	\$3,383,711	158	\$0	319	\$8,273,825
Total	1,263	\$136,603,610	4,058	\$243,646,454	5,170	\$0	10,039	\$380,250,064

**Table 3 —Diabetes-related research conducted by VA investigators using non-VA funds, FY2003**

Source	Percent funding *	Dollar amount
Federal (NIH)		
National Institute of Diabetes and Digestive and Kidney Diseases		14,204,820
National Heart, Lung, and Blood Institute		5,357,595
National Institute on Aging		1,133,353
Other NIH		3,916,885
Subtotal	69	24,612,653
Federal (other)		
Centers for Disease Control and Prevention		837,859
Department of Defense		796,072
Other federal		1,252,578
Subtotal	8	2,886,509
Nonfederal sources		
State and university		194,902
Private corporation		4,162,948
Subtotal	12	4,357,850
Nonprofit foundations		
American Diabetes Association		1,667,754
Juvenile Diabetes Foundation		1,030,533
VA research foundation		284,652
Other		906,061
Subtotal	11	3,959,000
Total, all categories	100*	35,816,012

\*Projects with multiple funding sources are counted in each funding category. However, "Total, all categories" reflects unique projects only. NIH, National Institutes of Health.

cance of antibodies in patients with recently diagnosed type 2 diabetes, genetics, weight loss, and glucose metabolism in older men.

### Health Services Research and Development

The Health Services Research and Development program strives to advance knowledge, develop VA health services, researchers, and leaders, and promote innovations that translate into advances in health care for veterans and the nation. Health Services Research covers all areas of health care delivery. The diabetes-related portfolio includes screening for diabetes in veterans, a study of telephone-based disease management for patients with diabetes, stroke prevention in veterans with diabetes, and enhanced description, identification, classification, and treatment of foot ulcers in patients with diabetes. Eleven Health Services Research and Development (HSR&D) Centers of Excellence focus on linking research to patient care. The development of information through research does not neces-

sarily mean that that information is applied at the bedside. Therefore, the VA is expanding research designed to identify barriers to the rapid translation of research and to study new organizational structures with the potential to remove those barriers. The HSR&D Quality Enhancement Research Initiative (QUERI) is a comprehensive, data-driven, outcomes-based quality improvement program to translate research discoveries and innovations into better patient care and health care systems improvement through ongoing critical self-evaluation, learning, and measured change. The diabetes QUERI is described in a companion article in this supplement.

### Rehabilitation Research and Development

The Rehabilitation Research and Development Service (RR&D) addresses the prevention and minimization of disability and restoration of function in veterans with impairments. Each of 12 specialized centers of excellence is involved in research on a focused rehabilitation topic,

training, and outreach to veterans. A variety of other funding mechanisms is available to support rehabilitation research. RR&D actively supports investigation to prevent, treat, or rehabilitate persons at risk of limb loss. Rehabilitation researchers were responsible for the development of the Seattle Foot, a prosthesis that facilitates mobility and functioning in amputees with and without diabetes.

### Diabetes-related research portfolio

Diabetes-related research was broadly defined and investigated from FY1998 to FY2003. On an annual basis, VA investigators provide a research abstract on their research projects. We searched this research abstract system for research that included diabetes, diabetes complications, and the word "diabetes" in the title or text of the abstract or as a discrete MeSH term (c 18.452.297 and C 19.246).

Table 2 provides a summary of diabetes-related research broadly defined by year, number of projects, source, and amount of funds. Research funding was awarded for pilot funding, pre- and postdoctoral training, merit review applications, career development, career scientists, and center grants. Table 2 also shows sizeable increases in both the number of VA diabetes-related research projects and the funding resources. Over this 16-year interval, non-VA-funded research projects grew >3-fold, while the supporting research dollars increased 10-fold. The strong education and training mission of the VA explains the large number of projects initiated without funding. These diabetes-related projects were conducted with existing personnel and local support or as part of an existing, funded VA research program. For example, many pre- and postdoctoral fellows and physicians in training received local assistance to conduct thesis, dissertation, and other research and thus did not need to apply for peer-reviewed research support.

The VA was the leading source of funding for diabetes-related projects. The merit review mechanism accounted for the majority of funds spent by the VA on diabetes-related research during this interval. Table 3 shows non-VA-funded research in 2003; the National Institutes of Health provided 69% of the resources, followed by nonfederal sources at 12% (state, university, and private corporations), nonprofit foundations at 11%, and other federal sources at 8%.

Examples of VA- and non-VA-funded diabetes clinical trials during this interval included trials of hypoglycemic and lipid-lowering medication and special footwear for persons with diabetes. The VA also participated in large national collaborative trials, including the National Institutes of Health's Diabetes Prevention Program, the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial, and the National Center for Research Resources' Precose Resolution of Optimal Titration to Enhance Current Therapies Study (2–4).

VA investigators continue to play major roles in both VA- and non-VA-funded clinical trials relevant to diabetes. Given the liberal definition we used for “diabetes-related,” these findings may appear to inflate the agency's diabetes-related research. We were cognizant of the underlying mechanisms involved in diabetes pathogenesis, diagnosis, treatment, costs, and outcomes, and all were included in this search.

Other major qualitative changes that occurred during this interval were expanded collaborations between the Office of Research and Development and the Centers for Medicare and Medicaid Ser-

vices, National Institutes of Health, Centers for Disease Control, the American Diabetes Association, Juvenile Diabetes Foundation, and international and private corporations. In addition, the Diabetes QUERI has become a strong research center, now stimulating and supporting an increased number of diabetes-related research projects that address gaps in VA diabetes care.

In conclusion, this article summarizes diabetes activities and funding supported by the VA Office of Research and Development and other agencies. The VA was the major source of funds to support these activities, with the National Institutes of Health providing the second largest amount. Many research projects are conducted largely in support of trainees. Diabetes-related research is conducted across all VA research services and covers the full spectrum of investigative designs, from bench research to clinical trials. The VA, with its national distribution of health care facilities; advanced clinical information systems, resources, and researchers; and large population of patients with diabetes, can anticipate an even larger future role in diabetes research.

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