

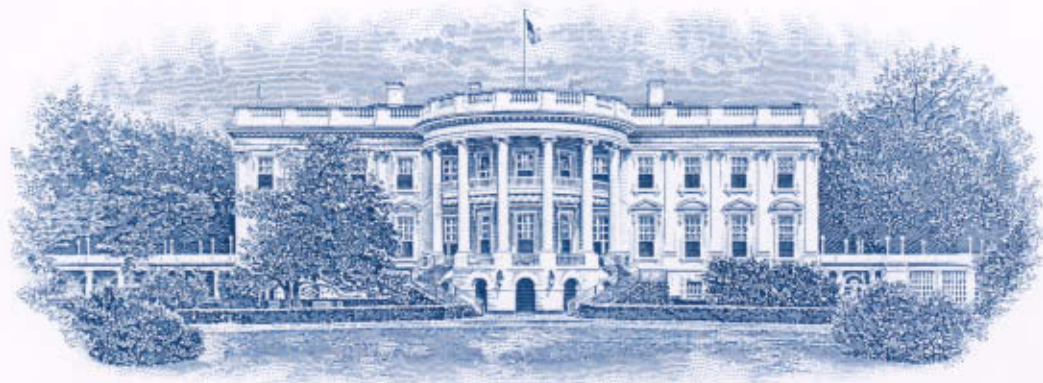
# Putting Aging On Hold:

Delaying  
the diseases  
of old age



**An official report to the White House Conference on Aging**

Prepared by the  
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# Putting Aging On Hold:

## Delaying the Diseases of Old Age

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# Putting Aging on Hold: Delaying the Diseases of Old Age

## Executive Summary

"We have not directed enough serious attention to the concept of postponement and the enormous benefits to be accrued. Most of the fatal diseases and all of the nonfatal diseases . . . increase exponentially with age. Postponing, therefore, has a magnified effect since delaying a process by one doubling will reduce by half the future incidence. We are living too long not to direct more of our efforts toward diseases which make aging a burdensome process."

—Jacob A. Brody, M.D.  
Professor of Epidemiology and Research Medicine  
School of Public Health, University of Illinois at Chicago<sup>1</sup>

"Let's say we could develop a way to delay the need for nursing home care for one month. That delay would save \$3,000 for a single patient. And if we can delay institutionalization by just one month for 100,000 people a year, that represents savings equal to all the money the government invests each year in basic research for Alzheimer's disease."

—Carl Cotman, Ph.D.  
Psychobiologist  
University of California at Irvine<sup>2</sup>

Americans are living longer and healthier than ever. This should come as welcome news. Unfortunately, even with improved health and longevity, the longer people live the greater the chances they will experience a geriatric problem — incontinence, immobility, memory loss, and other chronic disabilities — which could strip away their independence.

The common response by health care systems both public and private is to spend more money on nursing homes and other forms of "sick care." However, a more humane and cost-effective option is to invest more in research which could cure, prevent, or especially delay dysfunctions in later life. This research option — an investment in improving health and enhancing independence for millions of Americans — could remove much of the pressure from an already overtaxed U.S. health care system.

It is a central and powerful fact of life that from youth to old age, a person's chances of surviving 12

additional months steadily decline with the passing of years. In the sense of being biologically fit, a ten year old is practically indestructible. The statistical odds are that for every 10,000 ten year olds, only two will not live to see 11. Beyond age ten, however, mortality rates double at regular intervals until even the oldest of the old succumb.<sup>3</sup> In all the world there is only one known human, Jeanne Marie Calment of France, who is still alive after 120 years. Demographers and insurance actuaries call this doubling trend the force of mortality.

Health experts in aging research see another force at work, which might be called the *force of morbidity*. It is the clock-like regularity by which risks of chronic aging-related disease also double approximately every five years after middle age. Except for the rare and pitiable exceptions, including the accelerated progeric conditions such as Down's syndrome and Werner's disease, occurrences of Alzheimer's-like dementias, osteo-

porosis and stroke are nearly unheard of in people younger than 40. But beginning in middle age, the risks double every five to seven years for a wide variety of incurable and chronic afflictions. While most of these infirmities, such as arthritis, frailty and memory loss, are not directly life-threatening, the consequences of a mounting *force of morbidity* are aging-related health problems on a mass scale. These conditions rob individuals of quality of life in their later years, and they present an aging society with a daunting financial, social and ethical challenge.

The generals in a would-be war on aging-related disability now see a determined strategy of delay against the rising risks to chronic disease as both plausible and highly effective. Delaying the diseases of aging is a relatively new idea, but one with great potential.

Either by delaying the onset by five years or by effecting a five-year "time out" in the progression of these aging related diseases, the exponential portion of the curve

<sup>1</sup>Strategies to Delay Dysfunction in Later Life, Springer Publishing Company, New York, New York, 1995, J.A. Brody and R.N. Butler, editors.

<sup>2</sup>AARP Bulletin, January 1995.

<sup>3</sup>LIFESPAN: Who Lives Longer - And Why. Thomas J. Moore. Simon & Schuster, New York, New York, 1993.

would have one less doubling near the end of life. This would eliminate half of all cases of the disease and half of the attendant costs and misery.

Even a brief delay can translate into dramatic savings. For example, it is estimated that postponing physical dependency for older Americans in the aggregate by just one month would save the nation \$5 billion in health care and custodial costs. Postponing the onset of Alzheimer's disease by five years would, in the course of time, reduce incidence by half, thus saving half the cost of this terrible, terminal illness, currently estimated at \$100 billion annually. Similarly, if hip fractures could be delayed five years, the exponential increases would have one less doubling. Ultimately, we would achieve a 50 percent reduction in the number of hip fractures and their costs. Hip fracture is one of the leading causes of hospitalization and one hip fracture alone costs an estimated \$40,000 in medical and long-term care costs. Clearly, postponement could cut these high costs and dramatically extend older Americans' active and independent later years.

The best way to postpone the diseases and conditions of aging is to nurture research that will demonstrate who is most vulnerable to these problems and how their risk can be reduced.

This report describes the "Longevity Revolution" and its implications for America. It looks at current and projected health care spending and how these amounts might be trimmed by making a greater investment in aging research. The report examines the critical role of research in delaying, preventing and treating

the diseases and conditions of aging. It analyzes trends in research funding for aging, both public and private. It puts the leading illnesses and conditions of aging "under the microscope," discussing the number of cases, the total overall costs of the illness, recent breakthroughs in treatments and therapies, and promising directions for future research. The findings of this report include the following:

- The number of Americans 65 and over, currently 33.6 million, will more than double, reaching 70.2 million by 2030;
- The "oldest old," age 85 and older, is the fastest growing segment of the population and will rise from 3.3 million (1994) to 9 million (2030) and possibly as high as 48 million by some estimates (2050). This is the age group most likely to need long-term care;
- In 1992, older Americans over the age of 65 accounted for nearly 38 percent of the national health care bill of \$800 billion;
- The National Institutes of Health will spend only 7 percent of its 1995 budget on aging-related research, although older Americans account for more than one-third of health care spending;
- Under the President's proposed budget for fiscal year 1996, spending at the National Institute on Aging will actually decrease by \$4.4 million from 1995 after adjusting for inflation;
- The growing gap between basic research sponsored by the feder-

al government and applied research and development by private industry could produce diminishing opportunities for the development of new therapeutic agents for older patients;

- Postponing the diseases and conditions of aging can result in dramatic cost savings:
  - a five-year delay in onset of Alzheimer's disease could ultimately cut the number estimated \$50 billion dollars annually.
  - a five-year delay in occurrence of hip fracture annually could cut the number of events by 140,000 annually and save an estimated \$5 billion annually;
  - a five-year delay in onset of urinary incontinence could save an estimated \$8 billion annually; and
  - a five-year delay in onset of cardiovascular disease could save an estimated \$69 billion annually.

To suggest how a greater investment in aging research can help put aging on hold, this report contains a series of policy recommendations. Foremost among these is a call for a stronger national commitment to accelerate research in human aging and to alleviate aging-related diseases. This effort would go well beyond the traditional single-disease focus that drives Congressional appropriations for national biomedical research. It calls instead for a national research effort aimed at a whole class of diseases of aging, which, if left unsolved, will be the main driver of U.S. health care costs for at least the next 100

costs for at least the next 100 years. It also calls for implementing a comprehensive agenda for aging research that would range from understanding the basic biologic mechanisms of aging to clinical studies, studies of the behavioral, social and psychological aspects of aging, health services research and bioethics research.

What would such an all-out effort for aging research cost? About 1 billion annually. This was the figure cited by the U.S. Bipartisan Commission on Comprehensive Health Care ("The Pepper Commission") in 1990, the Institute of Medicine's National Research Agenda on Aging in 1991 and, annually since 1989, by the Task Force for Aging Research Funding, an ad hoc committee of over 70 nonprofit aging and health groups. The federal Task Force on Aging Research (TFAR) recently released its blue-

print for aging research in America, calling for \$1.1 billion in funding over the next five years to augment the \$841 million currently being spent annually by the U.S. Department of Health and Human Services and the Department of Veterans' Affairs. This sum is needed to adequately address all forms of research on aging issues, including biologic, medical, health services, psychological, social, economic, and demographic research. Information from the TFAR report, *Threshold of Discovery: Future Directions for Aging Research*, is cited in Chapter 2 of this report.

Knowledge gained from such a strategic aging research effort would benefit the nation's economy and bolster productivity. Increasing the health and activity of older Americans is both socially desirable and economically neces-

sary. The United States will save billions of dollars by keeping older people out of hospitals, out of operating rooms and out of nursing homes. Just as importantly, a coordinated and well-funded aging research effort would hold out hope to current and future generations that long life can be healthy and productive to the end, with the *force of morbidity* compressed to an irreducible minimum.

# Chapter 1

## The Longevity Revolution and Its Impact

*"We need a massive effort to reduce and, for many of the elderly, eliminate the chief threats to their independence. . . The more independent the elderly are, the less expensive nursing home and institutional care they require. Independence is what the elderly want most."*

—Former Health, Education and Welfare Secretary  
Joseph A. Califano, Jr.

The United States is in the midst of an unprecedented demographic revolution. This "Longevity Revolution" is dramatically changing the fabric of American society. For a growing number of seniors, growing older is not an idle time of rest and looking backward, but a productive period where new careers, interests and activities are pursued with vitality. Signs of this cultural shift are everywhere. Mandatory retirement is a thing of the past. Travel plans are aggressively marketed to older consumers. Movies and television shows, as well as commercials, portray older people in active, vital roles. With increasing health, vigor and independence among the older population comes a natural human desire to enjoy all of these commodities for as long as possible. This chapter examines the demographics of the Longevity Revolution, the costs of caring for America's elderly today and in the future, and how scientific research in human aging is essential to increasing the health and independence of older Americans.

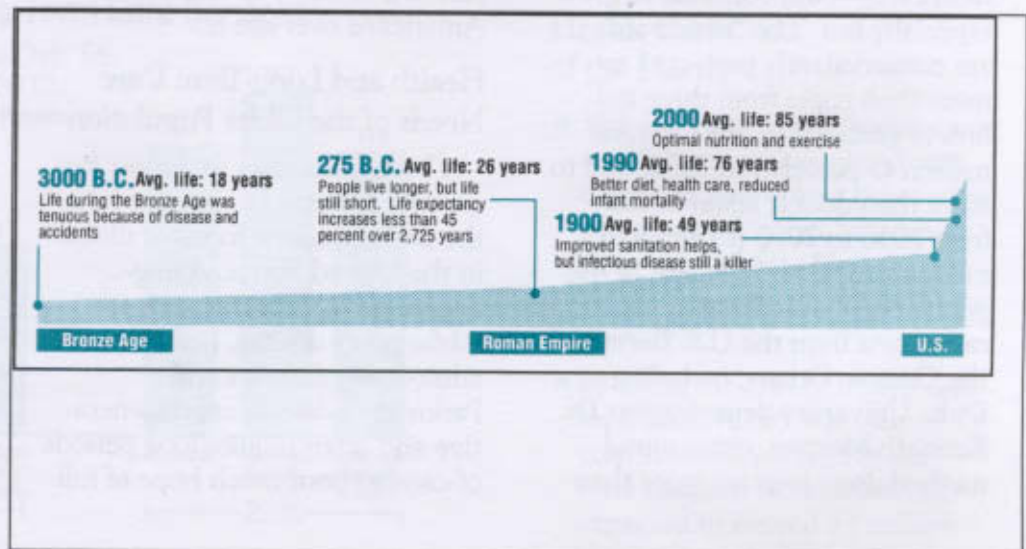
### The Older Population

Longevity has increased at an astonishing rate in the 20th century. Dr. Robert N. Butler, chairman of geriatric medicine at Mount Sinai Medical School in New York, notes that there has been a greater increase in average life expectancy at birth during this century than there was from the

time of ancient Rome to the year 1900. Medical and scientific breakthroughs, improved health habits and rising standards of living have combined to raise the average life expectancy from 47 years in 1900 to 72.3 for men and 79.1 for women in 1992.

### Future Growth

But this Longevity Revolution is still in its infancy. The next major factor contributing to the growth in older Americans will be the aging of the post-World War II "Baby Boom," defined by demographers as those born from 1946 to

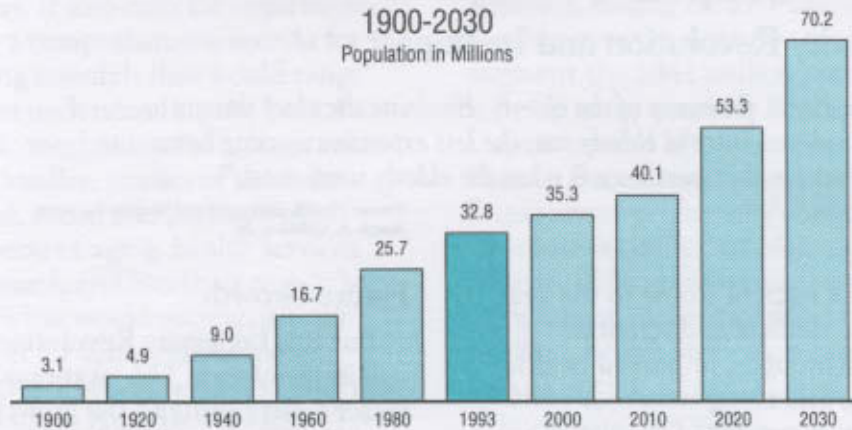


Currently, Americans age 65 and older constitute 13 percent of the population, or 33.6 million persons. Because of longer life expectancy and the large number of people reaching the oldest ages, Americans age 85 and older represent the fastest growing segment of the population.

1964. This is the largest single generation in American history, and its oldest members will begin turning 65 in 2011, ushering in a "Senior Boom." Their numbers will skyrocket, from 40.1 million elderly persons in 2011 to at least 70.2 million by 2030.

## Number of Persons 65+

1900-2030  
Population in Millions



Based on data from US Bureau of the Census

The over-85 population — those most likely to need long-term care — will continue to grow especially fast. The “oldest old” are conservatively projected to more than triple from three million (1 percent) in 1993 to nine million (3 percent) in 2030, and to more than double again in size from 2030 to 2050 (to almost 19 million people or 5 percent of the population), according to mid-range data from the U.S. Bureau of the Census. Others, including Duke University demographer Dr. Kenneth Manton, using sound methodology, forecast more than

twice the Census Bureau’s estimated numbers of oldest old: by mid-century, as many as 48 million Americans over age 85.

### Health and Long-Term Care Needs of the Older Population

Chronic illnesses that most frequently strike in late life are now the most common forms of illness in the United States. Aging-dependent conditions such as Alzheimer’s disease, heart disease, adult-onset diabetes and Parkinson’s disease are degenerative and often require long periods of care without much hope of full

recovery. Many older people are afflicted with numerous other chronic illnesses and debilitating conditions for which we currently lack the ability to effectively prevent or cure. These include arthritis, osteoporosis, urinary incontinence and aging-related losses of sight and hearing. While seldom a cause of death, these problems are the cause of much dependent care and a greatly diminished quality of life for millions of Americans.

From 2010 forward, as the over-85 population expands rapidly, the incidence of illness and dependency could prove crippling to the American health care system. For example, Alzheimer’s disease is predicted to afflict some 14 million Americans by 2050 — a number equivalent to the total population of Texas.

Understandably, long-term care needs will grow as the population ages. In 1990, there were approximately seven million older people needing long-term care. By 2005, that number is projected to rise to nine million, and to 12 million by 2020.

## U.S. Population Projections:2050

Age 85 and Older  
Population in Millions



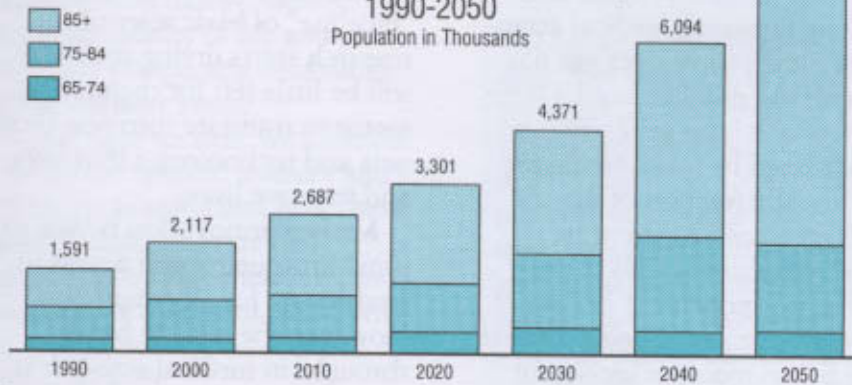
\*Research results supported by the National Institute on Aging



## Projections of the Nursing Home Population

65 Years and Older by Age Group  
1990-2050

Population in Thousands

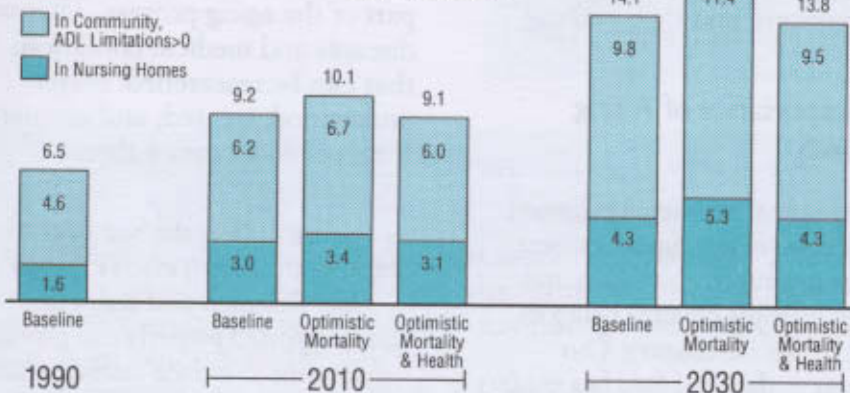


Source: Based on nursing home utilization rates from the 1990 census (press release CB93-117) and projections of the population by age (Current Population Reports, P25-1104)

## Potential Need for Long-Term Care Services

For Persons Over 65  
1990-2030

Millions of Persons



Source: DYNASIM projections  
Prepared by the Urban Institute

In sum, longer life expectancy across the population carries the high risk of more people suffering from chronic diseases. These problems will accelerate the demand for long-term care, particularly after 2010. In the absence of research breakthroughs, a sixfold increase in health care costs among our oldest citizens, not counting inflation, is expected with the aging of the Baby Boom.<sup>4</sup>

## The High Cost of Health Care

This year, health care spending in the U.S. will pass the trillion dollar mark for the first time, with public and private health care expenditures expected to total \$1.007 trillion. More than one-third of this amount will be spent on Americans 65 and over, a rate expected to rise with the growth of that age group unless we find bet-

ter ways to cure, prevent or postpone the diseases of aging.

Each year the nation devotes more of its resources to health care. In 1960, health care expenditures were 5.2 percent of the gross national product (GNP); by 1990, health care expenditures had reached 12.2 percent of the GNP or \$696.6 billion. If current trends continue, the Health Care Financing Administration projects that health care could consume 31.5 percent of the GNP in 2020. If expenditures actually reach this level, they would place an unacceptable strain on us as individuals and on society.

## Health Care Costs of the Elderly

- The 1992 per capita health care expenditure for people 65 and older was nearly four times what was spent for individuals under 65 — \$9,125 for older Americans and \$2,349 for those under 65;
- By 2004, the cost of health care for those over 65 is projected to constitute 50 percent of the total national health care bill, expected to exceed \$2 trillion;
- Unless cures, better means of prevention or effective means to delay the diseases of aging are discovered, Medicare costs for the oldest old could increase sixfold by 2040.

The price of medical and custodial care, coupled with indirect costs such as the burden on caregivers, is a hardship borne by individuals, families, private insurers and the federal government.

<sup>4</sup>Journal of the American Medical Association, Volume 263, Number 17, May 2, 1990, pp. 2335-2340.

Chapter 2 examines in detail the diseases and conditions of aging. However, a few figures are listed here to suggest the magnitude of their costs, today and in the future:

(All numbers refer to direct and indirect costs)

- Cardiovascular diseases cost \$138 billion annually;
- Cancer alone accounts for 10 percent of the total cost of disease in the U.S., coming in at \$104 billion annually. While all types of cancer do not follow the exponential growth patterns exhibited by other diseases of aging, some types, such as breast and prostate cancer, are much more common in elderly patients, and the risk increases dramatically with age;
- Alzheimer's disease costs are estimated at \$100 billion annually;
- Strokes among older people result in health care costs of almost \$30 billion annually;
- By conservative estimates, managing urinary incontinence costs more than \$16 billion annually. As the population ages, the annual price tag may rise as high as \$30 billion;
- The cost to the nation of osteoporosis was estimated in 1988 to be \$10 billion annually. Without intervention, these costs may rise during the next 25 years to between \$30 and \$60 billion. Hip fractures alone account for more than \$7 billion annually.

The health care costs associated with our demographic future are staggering. How can America meet the health care cost challenge of our aging population?

The options are to: 1) pay the bills — over \$300 billion a year and rising; 2) ration health care and deny lifesaving medical attention to some people over age 65; 3) ignore the problem until a later Congress or a later generation is overwhelmed by these problems; or 4) invest a fraction of the health care costs in scientific research that could lead to prevention, postponement or cure of the major diseases of aging. Unless the U.S. can mount a successful effort to slow or stop the incidence of these debilitating problems, older Americans will soon represent as much as one-half of a growing national health care bill. Aging research plays a pivotal role in improving the health and enhancing the independence of older persons, and thus curbing costs.

### The Importance of Aging Research

*"Biomedical research has proven to be one of our nation's wisest investments. It saves lives and money, while creating new jobs across the country. Our success in this vital field has made the United States a world leader in promoting health and in preventing disease and disability."*

—President Bill Clinton<sup>1</sup>

Americans are proud of their health care system. They demand and expect the best health care in the world. They believe the United States' scientific community will continue to lead the world in biomedical innovation and will provide the cures and interventions that they need.

But a crisis is brewing. Dwindling financial support for

medical research threatens the nation's ability to remain a leader in medical innovation. Once the "pipeline" of basic scientific research starts drying up, there will be little left for the private sector to translate into new products and technologies that save and improve lives.

Medical innovation is vital to providing quality and access to health care for all Americans. However, the road to breakthroughs in medical research is not always short or smooth. It can require a significant investment of time and resources.

In the field of aging research in particular, the investment is well worth it. Alzheimer's disease, osteoporosis, urinary incontinence and others are not an inevitable part of the aging process. They are diseases and medical conditions that can be researched, better understood, treated, and ultimately reduced as a major threat.

*"Science offers the best hope to improve the older person's quality of life. Research that is directed and supported properly can provide the means to reduce disability and dependence in old age, and can decrease the burdens on a health care system strained to its limits."*

—The Institute of Medicine<sup>2</sup>

<sup>1</sup>In a letter to the National Health Council

<sup>2</sup>*Extending Life, Enhancing Life: A National Research Agenda on Aging*, National Academy Press, Washington, DC, 1991.

At its core, aging research emphasizes strategies for maintaining health and independence, improving quality of life and preventing or postponing disabilities during the later years.

In the next section, we examine in detail the specific diseases and conditions of aging and how these might be delayed or treated. Current preventive measures and therapies are discussed, along with the most promising directions for future research.

## The Benefits of Strength Training: Margaret L., age 87, Quincy, Massachusetts

The last thing Margaret L. thought she'd become at age 86 was a weight lifter. But when she enrolled in a study conducted by Tufts University, the grandmother from Quincy, Massachusetts started lifting weights three times a week with amazing results.

This and other studies under the direction of Dr. Maria Fiatarone have put male and female subjects aged 75 to 99 in up to one-year strength training regimens. Participants have seen their strength double and for some even triple in two months. Muscle fibers expanded, increasing both aerobic capacity and overall physical activity levels.

There were other benefits. "I've been diabetic for 25 years, but now I take less insulin," Mrs. L. reported. One 91-year-old participant reported, "I have high blood pressure and the program lowered my rates. I have angina and that's under control now, too."

What was especially surprising about these studies, according to Dr. Fiatarone, was that they showed that the aging body retains remarkable and unexpected ability to rejuvenate neural and muscular tissues.

Margaret L. finished her one-year experimental period in March of 1995 but will keep attending fitness classes. "I don't feel as old when I'm doing the program," she says. "When I started, I couldn't get out of the bathtub. I was having a hard time getting out of bed — now I do it like I was 40."

## Telomere Research — Unlocking the Secrets of Cell Senescence

Scientists looking for the trigger that causes cells to cease dividing with advanced age may just find out why many cancer cells can divide indefinitely — and the payoff could be a stunningly effective new way to shut down cancer's wild proliferation.

Chromosomes are paired strands of DNA coiled at the center of all cells that make up humans and other living organisms. Researchers now think a clue to aging lies in the tips of chromosomes: a string of molecular sequences called telomeres.

It is believed that, at the very least, telomeres may serve the cell as a kind of "aging clock," because telomeres grow shorter every time a cell divides. Still other scientists believe that preserving telomere length might be a strategy for staving off debilitating diseases that accumulate with aging.

Meanwhile, academic and industry biologists know that cancer cells manage to halt the shrinkage of their own telomeres, thus overriding the normal aging program and allowing cancer cells to divide out of control and spread throughout the body.

These scientists suspect that an enzyme called telomerase, which appears in most cancer cells but not healthy somatic cells, is the culprit. Now they are fast in pursuit of ways to block telomerase, hoping to force aging and cell death on so-called immortal cancer cells without affecting normal healthy cells.

*"We should try to reduce the need for care by devoting significant research attention to the prevention and cure of debilitating illnesses — illnesses like Alzheimer's, arthritis, and osteoporosis — that can keep us from caring for ourselves."*

— Former President  
George Bush

## Chapter 2

### Delaying the Onset of Chronic Illnesses and Its Impact

*"Recognizing that most illness at present is chronic rather than acute and that the overwhelming portion of the illness burden falls upon the elderly, a Compression of Morbidity strategy seeks to compress this period of ill health between an increasing age at onset of disability or illness and a stable or slowly advancing average age at death."*

—James F. Fries, M.D.  
Stanford University School of Medicine  
Stanford, California<sup>1</sup>

*"If we don't do something soon, Alzheimer's disease is going to consume us."*

—Zaven S. Khachaturian, Ph.D.  
Associate Director for Neuroscience,  
National Institute on Aging<sup>2</sup>

#### The Delay Strategy

Aging itself is not a disease, but does set the stage for a series of risk factors which provide fertile soil for numerous events, such as memory loss, incontinence and immobility. In other words, the accumulation of normal aging characteristics creates a threshold beyond which there is increased susceptibility for an array of outcomes, many negative. If that susceptibility to the diseases and conditions of aging could be delayed to an appreciable degree, older Americans might live healthier, longer lives and avoid losing their independence. Through this delay of dysfunction, the nation could save money that otherwise would go toward the cost of their health care and custodial care.

There is emerging consensus in the aging research community that the goal of research efforts should be to delay the onset of symptoms of aging-dependent diseases and conditions. This strategy will prevent millions of cases of these dysfunctions and shorten the time in which they take their toll on individuals and their families. While

we continue to seek cures, we should also pursue this delay strategy as a means of preventing disease among the elderly population. Given the rising costs of health care, the disability and frailty of our growing senior population, and the exponential fashion in which the diseases and conditions of aging progress, a five-year or more delay in the incidence of these diseases and conditions would have tremendous social and economic benefits for the nation.

#### Aging-Dependent Diseases: What Are They? How Do They Advance With Age?

Aging-dependent diseases and conditions are those that rise steadily with age, accumulating as we live longer. They include Alzheimer's disease and related dementias, cerebrovascular disease, vision and hearing loss, type II diabetes and altered glucose metabolism, hip fracture, osteoporosis, Parkinson's disease, specific infections such as pneumococcal pneumonia, constipation, incontinence, depression, social isolation and living alone,

widowhood and nursing home admission.

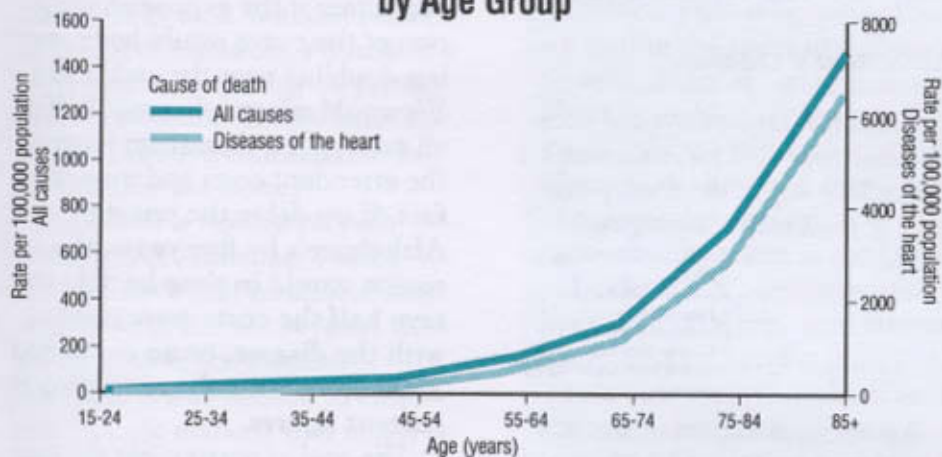
These conditions follow the basic Gompertz logarithmic curve of steadily rising risk of disease and death with advancing age. They seldom occur before middle age, then the incidence doubles exponentially every five years or more at some time prior to age 65.

For example, when we look at diseases of the heart, indeed when we look at mortality from all causes, we witness a similar pattern related to age. This is demonstrated clearly in the chart on the next page.

<sup>1</sup>Facts and Research in Gerontology, Volume 7, 1993.

<sup>2</sup>AARP Bulletin, January 1995.

## Mortality Rates for Selected Causes by Age Group



Source: *Vital Statistics of the United States, Volume 11—Mortality, Part A, 1988*

To illustrate the benefit of strategy of delaying chronic disease, if one's risks of the disease at age 70 were only 2 percent instead of 4 percent, that person's chances at 80 would be closer to 15 percent than 32 percent, which is the likely incidence rate at present. Either by delaying the onset of risk by five years or by effecting a five-year "time out" in the progression of an illness like Alzheimer's disease, the exponential portion of the curve would have one less doubling near the end of life. Thus, we could effectively avoid half of all cases of the disease and half of the attendant costs and misery.

Given the growth in the rate of incidence of these aging-dependent conditions, many top scientists and policy experts believe a "strategy of delay" by just a few years in this escalation of risk could have huge payoffs. Moreover, they believe delaying the onset of the escalation — or a "time out" in its progression — is not only feasible with current technology, but also probably a more realistic goal than finding

either a total cure or developing a set of global preventive measures.

Postponing chronic illnesses and disabilities means that older people will die, but of the postponed illness or of some other cause at a later point in life. Delaying the incidence of aging-dependent conditions is important because, from age 70 upwards, individuals are more likely to experience several different health problems at once. Multiple health problems usually mean much higher rates of frailty and dependency. If one or more diseases and conditions of aging can be eliminated or delayed in a person's 60s, this phenomenon of multiple problems or "comorbidity" may also be eliminated. The key is to start the delay as early as possible, although experts such as Dr. Jacob A. Brody of the University of Illinois-Chicago contend that "any delaying, at any age, certainly helps."

Dr. Kenneth G. Manton, Acting Director of Demographic Studies at Duke University and Medical Research Professor at Duke Medical Center's Department of Community and Family Medicine,

has done extensive study on the future size and health status of the U.S. elderly population, and on strategies for reducing frailty, disability and mortality among that age group. He notes that several illnesses or conditions may be linked by common risk factors, so that delaying one means reduction in incidence of another. For example, diabetes increases incidence of stroke, heart disease, renal disease and macular degeneration. Loss of estrogen with menopause may increase the risk of both osteoporosis and atherogenesis, the process of atherosclerotic change. While recent studies have shown that inheritance of the E4 form of apolipoprotein may increase the risk of Alzheimer's disease, it may also increase the incidence of heart disease. Thus, to delay or eliminate one cause of health problems is to delay other health problems to some degree.

In addition, illnesses can be part of the same pathologic process manifested at different ages. For example, osteoporosis increases the risk of hip fracture. Immobility due to hip fractures increases risk for pneumonia.

Conversely, a single intervention may improve the outcome of more than one aging-related disease. For example, administering Angiotensin-Converting Enzyme (ACE) II inhibitors, which are drugs that reduce hypertension, stroke, and congestive heart failure, also appears to reduce diabetes and lessen kidney problems. There is a multiple effect and therefore a multiple benefit across diseases.

The potential for benefits like these is strong throughout the field. The goal of putting aging on hold is well-defined. There are many promising new insights and

leads emerging from the frontiers of genetics and cell biology for many of these specific illnesses and the process of aging in general. The human capital to mount such a challenge to the diseases of aging is available and, to a large extent, the scientific infrastructure is in place, thanks to adequate federal funding in many of the diseases and conditions of aging over the past decade. There are already promising methods for detecting those persons most vulnerable to aging-dependent conditions and interventions for reducing risk.

*"This delaying strategy can work well with the aging population because you prevent the diseases and problems that are preventable and then you invest the savings into finding cures and therapies for the diseases that so far can't be prevented. It's similar to the way we got rid of polio and now we can invest the money that would have gone to its victims into finding out about cystic fibrosis and taking care of young people who have it and other incurable diseases."*

*[Note: the annual cost of treating polio if a vaccine had not been found is estimated at \$30 billion per year.]*

—Lewis Kuller, M.D., Dr.P.H.  
Professor and Chairperson  
Department of Epidemiology  
Graduate School of Public  
Health  
University of Pittsburgh

The following section examines in depth the major causes and indicators of lost independence among the elderly — their incidence and symptoms, existing strategies for prevention, detection and treatment, and the most promising areas for future research. Each represents an important front in the aging-delay strategy.

## The Causes and Indicators of Lost Independence:

### Alzheimer's Disease

*"The search for an early and accurate diagnostic tool for Alzheimer's is a critical step in the development of preventative strategies."*

—Zaven S. Khachaturian,  
Ph.D.  
Associate Director for  
Neuroscience  
Director of Alzheimer's  
Disease Research  
National Institute on Aging

An estimated four million Americans suffer from Alzheimer's disease, a degenerative disorder that destroys the brain, robs its victims of memory and judgment and leaves patients unable to function on their own. Unless a cure or treatment is found, 14 million people will be stricken by the middle of the next century.

The rate of Alzheimer's rises steeply with age. Alzheimer's seldom occurs before middle age, then the likelihood doubles exponentially every five years after about age 60. Alzheimer's strikes 2 percent of people aged 65, 4 percent by age 70, 8 percent by 75, 16 percent of those age 80, 32 percent by age 85, and an astonishing 47 percent of people over 85.

Alzheimer's disease is a major contributor to skyrocketing health care costs, bankrupting families and draining more than \$100 billion annually from the nation's economy. There is emerging consensus in the Alzheimer's and aging research community that the goal of research efforts should be to delay the onset of Alzheimer's symptoms. Many leading scientists and policy experts in this field believe a strategy of delay by just a few years in this escalation of risk could have huge payoffs. Either by delaying the onset of risk by five

years, or by affecting a five-year "time out" in the progression of Alzheimer's, the exponential portion of the curve would have one less doubling near the end of life. We would effectively avoid half of all cases of the disease and half of the attendant costs and misery. In fact, if we delay the onset of Alzheimer's by five years, the nation would in time be able to save half the costs associated with the disease, or an estimated \$50 billion annually according to current figures.

The goal of postponing the rising risk of Alzheimer's disease by five years within the next five years, and ten years within the next ten years is becoming a legitimate strategy and goal for the world's leading teams of Alzheimer's researchers.

The March 22, 1995 issue of the *Journal of the American Medical Association (JAMA)* reported that scientists comparing brain positron-emission tomography (PET) scans and genetic tests from relatives of Alzheimer's disease patients have seen a possible relationship between the two test results that suggests a method for predicting Alzheimer's up to 20 years before any outward symptoms of the disease appear. The researchers hope that by using PET scans, which are sensitive to mild, early changes in the brain, they will have an effective method for monitoring possible drug therapies that could prevent, at early or presymptomatic stages, the severe neuron damage and memory loss that occurs in Alzheimer's patients.

Because Alzheimer's is a progressive disease, patients' needs change over time. The identification of services that are effective for individual patients at particular

stages of their illness will allow better targeting of limited financial resources as well. Without better targeting of resources, Alzheimer's patients can frequently be prematurely institutionalized when their care could have continued to be rendered in the home.

Research is needed on early detection of Alzheimer's since many believe that treatment may slow or stop, but not reverse, the progression of the disease. Research is also needed to establish biologic markers that might be part of a blood or urine analysis to detect the disease in its earliest stages, well before any cognitive decline is apparent. Screening methods such as cognitive function tests for use in physicians' offices need to be developed further. A national initiative can then be implemented to discover treatments that will allow Alzheimer's patients to continue to function independently.

Basic research is also needed on the causes of and risk factors for all the dementias, including Alzheimer's disease. Population-based studies can identify risk factors for Alzheimer's. While federal funding for Alzheimer's disease has increased in recent years, continued support must be given to the underlying causes so that improved methods of treatment and prevention will be possible.

Lastly, research is needed to determine which types of health care and long-term care services for persons with dementia are most beneficial for patients, and which will reduce the burdens and stress on family caregivers.

### **Osteoporosis**

Osteoporosis, or porous bone, is a disease characterized by low bone mass and structural deteriora-

## **An Animal Model for Alzheimer's Disease**

Inducing the symptoms of Alzheimer's disease in animals is essential for testing the safety and efficacy of drugs to treat the illness. Only with an animal model can researchers ensure that a substance will cross the blood brain barrier, that it will not be toxic or cause side effects, and that it will inhibit symptoms of the disease. Because laboratory animals' lifespans are short and they age relatively quickly, there are no examples of rodents developing Alzheimer's naturally, with age. Therefore, special steps must be taken in the laboratory to induce symptoms of the illness.

Under the procedure known as "transgenics," a number of researchers have planted a gene that creates Alzheimer's symptoms — usually amyloid precursor protein (APP) or apolipoprotein E4 (apoE4) — directly into mouse embryos, which are reimplanted into female adult mice. The scientists then look for mice in which the gene is expressed in the egg or sperm, and mate two such animals in order to have one or two copies of the gene. They retest the offspring of these animals to ensure that the gene has been propagated and is still there. Recently, this strategy with APP has resulted in mice that develop Alzheimer-like amyloid lesions in the brain.

Drs. Sally Frautschy and Gregory Cole of the Sepulveda VA Medical Center (California) have a different approach, infusing the Alzheimer's-producing protein directly into laboratory rats with a pump. This process allows scientists to introduce one or more Alzheimer's-producing substances, so that more variables can be tested.

Both strategies should help develop systems where new Alzheimer's disease drugs can be discovered.

ration of bone tissue, leading to bone fragility and an increased susceptibility to fractures of the hip, spine, and wrist.

Osteoporosis affects 20 million women and 5 million men, and leads to 1.5 million fractures each year — more than 250,000 of which are hip fractures. One out of every two women and one in eight men will have an osteoporosis-related fracture in their lifetime. By age 75, one third of all men will be affected by osteoporosis.

The direct and indirect costs of osteoporosis are estimated to be as much as \$20 billion annually. Delaying the onset of osteoporosis by five years could save up to \$10 billion annually.

The good news is that osteoporosis is also one of the leading areas for the further identification and application of preventive steps, including the importance of calcium and vitamin D and lifelong exercise, and for the development of new therapies. Several promising new drugs expected to improve bone density and, it is to be hoped, decrease incidence of hip fractures in women over age 50, are currently under review. Scientists have noted that if we doubled our research efforts toward finding cures and preventions for osteoporosis, the U.S. would be well on its way to controlling this disease by 2010. As little as .3 percent of the costs associated with osteoporosis is being spent on osteoporosis research by the federal govern-

ment—between \$60 million. Nevertheless, scientists are making tremendous strides in understanding and developing treatments for this debilitating illness.

Basic research on the prevention and treatment of bone loss and osteoporosis, and other bone-related illnesses such as Paget's disease, should be expanded with specific consideration paid to identifying persons at risk; defining the role of aging versus specific bone pathology; identifying the structural, cellular, and biochemical factors that affect bone strength and the resistance to fracture; identifying the roles of nutrition, physical activity, disease, medication, and environmental factors in the development of osteoporosis and the impact of these factors in response to treatment; formulating new strategies for enhancing the cellular processes involved in bone repair; and identifying the causes and treatment of Paget's disease.

## Hip Fractures

*"Hip fracture rates in American females rise suddenly at about age 40, and there—after increase exponentially, doubling each five to six years.*

*If we could delay the sudden rise by six years, the exponential curve would have one less doubling hence we halve the number of hip fractures."*

—Jacob Brody, M.D.  
University of Illinois at Chicago

This year, more than 280,000 Americans will suffer hip fractures; half will be unable to walk again unassisted and 25 percent will end up in nursing homes permanently. Hip fractures are more serious than most of us think. Studies show that as many as one-quarter of those injured die within three months of the surgery neces-

sary to repair the fractured hip. Death can also result from complications related to the injury.

Because of aging-related changes and problems such as osteoporosis, arteriosclerosis, diabetes, and neurologic diseases, fall-related injuries are more prevalent and more severe in older persons. For example, each year about one-third of all people age 65 and older report a fall, and mortality resulting from falls in this population is more than six times higher than among younger people. The rate of hip fracture among the oldest old (age 85 and older) is considerably higher than that of other older people. Three-fourths are women, and 87 percent are 65 years of age or older. Men suffer fractures at later ages, too.

The injury is costly: about \$40,000 per fracture. Nationwide the cost is nearly \$10 billion a year in medical care and lost income. The cost of hip fractures is expected to double by the year 2020. The American Academy of Orthopedic Surgeons predicts that the nearly 350,000 hip fractures a year will double by the year 2050 unless something is done to prevent them.

Because hip fracture rates increase sharply with age, delaying the average age of hip fracture occurrence by five years could halve the number and cost of these fractures. **If we delay the occurrence of hip fracture by five years, the U.S. health care system could save \$5 billion annually.**

An estimated 20 percent of persons over age 65 who fall report they do so because of vertigo or dizziness. Falls are a major cause of morbidity, mortality and health care costs among older persons, with hip fracture being a prime example. Current studies need to

be expanded to address balance, upper-body motion, strength changes, and postural stability. Research strategies for frailty prevention should be developed and directed toward maximizing their impact on older persons. Interventions that affect multiple risk factors are especially attractive, e.g., strength training, which improves strength, muscle mass and balance.

## Vision Impairment

*"The estimated \$5 billion spent annually by the government could be reduced by one half if cataract development could be delayed by 10 years."*

—Carl Kupfer, M.D.  
Director  
National Eye Institute  
National Institutes of Health

More than 700,000 people over age 65 are legally blind, increasing each year by 25,000; more than 50 percent of new cases of blindness occur in this age group. The four leading causes of blindness in older Americans include cataract, macular degeneration, glaucoma, and diabetic retinopathy.

## Cataract

In the U.S., cataract accounts for over 6.3 million physician visits a year, and about 20 percent of individuals aged 65 to 74 years have clouding of the lens, causing a decrease in vision. Cataract surgery is now the most frequently performed operation in the United States among persons over age 60 — 1.5 million are performed annually — accounting for 12 percent of the Medicare Part B budget. (Part B is a voluntary medical insurance program paid in part from federal funds and in part from premiums paid by persons enrolled in the program. It generally covers goods and services



unrelated to inpatient hospital care.) The annual cost of lens extractions to the U.S. government is estimated at \$5 billion. If the rate of cataract development could be delayed by 10 years, approximately 50 percent of cataract operations could be avoided, and \$2.5 billion could be saved annually. Low intake of vitamin C and excess exposure to sunlight, both modifiable risk factors, have been identified.

### **Macular Degeneration**

Macular degeneration is one of the most common causes of vision loss in older adults. The most common type of macular degeneration is called aging-related macular degeneration (ARMD) because it usually occurs after the age of 60 and develops very slowly. With advancing age, degenerative changes may occur in the macula, the area of the retina responsible for sharp central vision. Such changes may occur any time after maturity, but they are by far most prevalent in old age. An estimated 1.7 million Americans over age 65 will have difficulty by 1995, and 100,000 are blind from ARMD. Because of aging-related macular degeneration, performing routine visual tasks such as driving, reading printed material or recognizing the faces of friends becomes difficult, thus compromising older persons' quality of life. Risk factors that may be modifiable include low intake of dark, leafy, green vegetables, (*Journal of the American Medical Association*, April 12, 1995).

By the year 2030, macular degeneration is expected to affect as many as 6.4 million older Americans.

### **Glaucoma**

Glaucoma is an insidious disease in which optic nerve damage leads to blindness. Typical glaucoma begins in mid-life, progresses slowly and impairs functional vision until its progression is slowed by medical or surgical intervention, or both. Glaucoma is a major public health problem that incurs a substantial economic burden. An estimated three million people in the United States have glaucoma and 120,000 of them are blind from it. Glaucoma is the cause of three million doctors' office visits annually. Blindness from glaucoma costs an estimated \$1.5 billion annually. **Research advances in determining its cause and identifying early risk factors may lead to early diagnosis of glaucoma and cost containment in its management.**

### **Diabetic Retinopathy**

Diabetic retinopathy occurs most often in patients with long-term, poorly controlled diabetes. Blood vessels in the eye break, resulting in repeated bleeding, which may bring partial or complete blindness. Previously, 50 percent of those with diabetic retinopathy with high-risk characteristics were blind within five years. National Eye Institute (NEI)-supported research has now demonstrated that currently recommended treatments are over 95 percent effective in preventing blindness. It has been estimated that these treatments could save \$1.2 billion to \$1.6 billion per year. And yet, only half of the people with high risk characteristics are receiving treatment. Through its National Eye Health Education Program, the NEI is attempting to get this information out.

• • •  
Research efforts to determine the normal course of retinal aging and to identify the underlying causes of macular degeneration can help to identify methods to prevent or slow the disease and lead to long-term protective measures that might reduce the risk of visual loss. In addition, expanded research is needed to determine the cause and risk factors of glaucoma as well as new approaches to the treatment and prevention of cataracts.

### **Urinary Incontinence**

Urinary incontinence, the physical inability to control urination, is a major clinical problem affecting as many as 20 million Americans. It is a significant cause of disability and dependency. Approximately 85 percent of those affected by incontinence are women. Incontinence is most prevalent among older Americans, affecting about 30 percent of women over the age of 60 and prompting more than 50 percent of nursing home admissions.

According to the Task Force on Aging Research, "the loss of female hormones after menopause and infection are among the factors that can cause changes in bladder function in women. In men, enlarged prostate gland and infection contribute to incontinence. With proper diagnosis and treatment, a significant percentage of incontinence in men and women can be cured, or their condition can be greatly improved."

Research funded by the National Institute on Aging showed that a simple program of pelvic muscle exercises and biofeedback reduced the number of incontinent episodes by over 60 percent and caused complete cure in 23 percent of patients.

This could translate into a savings of \$80 million per year from patients not needing surgical treatment.

The cost of managing urinary incontinence is estimated at about \$16 billion annually, a number that can be expected to grow as the U.S. population ages. **If we delay the onset of incontinence by five years, the U.S. could save \$8 billion annually.**

Even though progress has been made in reducing or eliminating urinary incontinence, a great need remains for research to discover new treatment methods, increase the effectiveness of present therapies, and develop more effective educational programs to direct attention to this problem. New and more effective treatments could normalize the lives of many otherwise healthy older patients who are incapacitated and socially isolated by the condition and, at the same time, reduce associated health care costs.

Further research into normal and abnormal bladder physiology is needed. Treatments such as pharmacologic therapy should be explored; behavioral interventions should be targeted toward persons at risk. Clinical trials should be conducted to examine the effective therapies for specific types of urinary incontinence.

### Cardiovascular Diseases

*"It appears that acute myocardial infarction is a 20th century disease and disaster.*

*There is no mention in the literature of the classical heart attack before 1900."*

—Jacob Brody, M.D.  
University of Illinois at Chicago

Cardiovascular diseases (CVD's), including heart attack and stroke, remain the country's

No. 1 killer of men and women, causing 43 percent of all deaths in the U.S. Each year, more than 925,000 Americans die from CVD, and about one in four Americans suffer from CVD at an estimated cost of \$138 billion in 1994 including medical expenses and lost productivity. A large fraction of the U.S. population is at increased risk for these diseases because of their lifestyles or because they smoke, are obese, or have hypertension or high cholesterol levels. The most prevalent of all CVD risk factors is sedentari-ness, or low physical activity level, which affects 70 percent to 80 per-cent of American adults. As with smoking and a family history of CVD, sedentariness doubles the risk of CVD. Thus, if there were one thing that could be changed to have the most impact on CVD, it would be inactivity. (Only 25 percent of CVD patients smoke, 40 percent are obese, 10 percent have diabetes and 40 per-cent have hypertension, by com-parison.) About eight million

Americans have coronary heart disease or cerebrovascular disease, leaving them at increased risk for recurrent clinical episodes.

CVD deaths rise significantly with age — as does the number of Americans suffering from these diseases. CVD remains a main cause of disability and the leading cause of death of older Americans, killing about 50 percent of those age 65 and over. About 4 out of 5 people who die of heart attack are age 65 or over. If we delay the onset of cardiovascular disease by five years, the U.S. could save approximately \$69 billion annually.

There are good reasons to believe that this goal is within reach. For example, a recent National Heart, Lung, and Blood Institute study showed that an ACE inhibitor, enalapril, when used with other conventional heart-failure treatments, reduced deaths or hospitalizations due to congestive heart failure by 26 per-cent. Routine use of enalapril, it is estimated, could save about \$1 billion in hospital and other costs.

### A Case of Congestive Heart Failure: Julian Barber, Age 62

At age 62, Julian Barber, an active and busy communications execu-tive, suddenly had difficulty performing even the simplest of daily activi-ties. Just walking down the hall exhausted him. He was unable to sleep, and gained weight even though his diet was stable.

He soon made an appointment with his family doctor who diagnosed him with a common heart ailment and prescribed a drug for that condi-tion. However, Mr. Barber's symptoms grew worse.

Julian Barber then went to see a cardiologist, and was diagnosed with congestive heart failure (CHF), a serious life-threatening condition in which the heart gradually loses its ability to pump enough blood to sup-ply the body's needs.

He was immediately put on a course of ACE inhibitors and a diuretic, which proved so effective that his health improved dramatically in just three months. Today, Mr. Barber enjoys a normal, active life.

As a result of widespread dissemination efforts by the government and non-profit groups, the knowledge gap of the diagnosis and treatment of CHF with the ACE inhibitors is rapidly being filled, and primary care physicians are taking increasing advantage of these important medica-tions to prevent and treat CHF.

Recent research has also shown a link between a human gene and essential hypertension, the most pervasive form of high blood pressure, and revealed that even borderline systolic blood pressure is a key heart attack and stroke risk factor. Recently, research has also shown that exercise can prevent arterial stiffening, a primary cause of high blood pressure.

Much of the current research on the factors that affect risk of coronary heart disease has studied white middle-aged males. New directions for CVD research, in such areas as modifying lifestyle choices and using behavioral medicine techniques, need to be validated in women, racial and ethnic minorities and older persons. There may be an important link between cardiovascular disease in the elderly, including stroke, and vascular dementia. Treatment of vascular dementia in the elderly could potentially have a powerful effect in reducing risk of dementia.

In addition, research to define the causes and molecular mechanisms of aging-related vascular changes leading to heart failure and stroke is critical for the development of more effective prevention strategies and therapeutic interventions.

## Stroke

Stroke — America's third most common cause of death, the leading cause of serious disability and a major contributor to late-life dementia — strikes about 550,000 Americans each year, killing nearly one-third and permanently disabling most survivors, many of whom suffer brain damage.

About 72 percent of stroke victims are 65 years of age or older. For people over 55 years of age, the incidence of stroke more than

doubles in each successive decade. Stroke causes nursing home admissions of an estimated 180,000 older persons each year.

Stroke-related costs exceed \$30 billion each year. The majority of these costs are associated with expenses after the acute care phase — nursing care facilities, medical and social services, and loss of earnings. Although the stroke death rate is declining in this country, the number of Americans experiencing strokes and becoming severely disabled is on the rise. One-third of stroke survivors remain permanently disabled and need continued supportive health services. More than 2 million stroke survivors now endure crippling disabilities, including paralysis, loss of speech and memory lapses. As a result, far too many Americans face a great financial burden when they should be healthy and enjoying the fruits of their years of labor. **Thus, if we delay the onset of strokes by five years, the U.S. could save \$15 billion annually.**

Already progress has been made. An NIH multicenter clinical trial revealed that aspirin and warfarin can reduce the risk of stroke by up to 80 percent in victims of atrial fibrillation, a common condition in the elderly associated with about 70,000 strokes annually. General treatment could result in annual savings of \$200 million.

Recognizing that this important progress has been made, we nevertheless need a better understanding of the brain's ability to recover from stroke, and we must develop interventions to strengthen and enhance this recovery.

Recent stroke research shows that, although the major brain damage in stroke occurs within

the first few hours, injury to cells that control important areas such as memory and other cognitive functions continues to progress for as long as two days. The most important priority in stroke research in the next decade, therefore, is to identify and learn how to prevent the cellular and molecular mechanisms of ischemic nerve cell injury and death that occur during and after a stroke.

## Osteoarthritis

Of the more than 100 forms of arthritis, only osteoarthritis (OA), a progressive disease that includes cartilage degeneration among its changes, is related to aging. Half of all persons aged 65 and older and a higher proportion of those aged 75 and older report having symptoms of arthritis. The condition limits the ability of many older people to care for themselves. In 1990, osteoarthritis was the principal reason for more than 6 million physician office visits. The development of effective health care and health-related services for older people with OA would reduce the pain and disability associated with the condition and improve the quality of life for millions of older people.

Osteoarthritis costs American society in excess of \$8 billion annually. **By delaying the onset of this crippling disease by five years, the United States could save well over \$4 billion in direct and indirect costs.**

Research supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases has contributed substantially to improving our ability to diagnose and treat arthritis and related diseases. Exercise has been shown to improve function and decrease pain and medication use in

osteoarthritis. Also, research has revealed that ultrasound may have promise as a new useful method for early detection of osteoarthritis.

## Diabetes

Diabetes is the fourth leading cause of death by disease in the U.S. and a leading cause of heart disease, stroke, blindness, nerve and kidney damage and amputation. In 1992, there were 7.2 million diagnosed diabetic patients. Of the total, about half of all diabetic cases are in people over age 55.

Type II diabetes is characterized by abnormal insulin secretion from the pancreas and impaired sensitivity to insulin in peripheral tissues such as muscle and liver tissue. Type II is the major form of diabetes in older people — more than 2 million known cases have been reported in the 65 and over population; an additional 2 million could be diagnosed by testing; and 10 million others have some degree of glucose intolerance. Both genetic and lifestyle factors contribute to the risk of acquiring type II diabetes. The disease is much more prevalent in African Americans, Native Americans and Mexican Americans than in non-Hispanic caucasians.

Early recognition of impaired glucose tolerance, vigorous dietary efforts at weight control, and active exercise have been shown to control or delay the development of diabetes in many persons.

Unfortunately, many older Americans do not have access to these currently available therapeutic measures, or to the insulin injections and oral drugs that are needed to effectively manage their type II diabetes. This leads to high levels of glucose in the blood

and development of complications such as blindness, stroke, heart attack, kidney failure and amputations. These complications are a major reason why diabetes consumes one of every seven health dollars — almost \$100 billion annually.

While there is currently no cure for diabetes, recent research has shown that intensifying self-management of the disease with stricter controls of blood-sugar levels can reduce long-term complications due to the disease.

Medical research focusing on insulin signal transduction, the underlying causes of insulin resistance and the genetics of type II diabetes must be expanded if the impact of the disease is to be reduced. These areas of basic research may lead to the development of more effective treatment agents and more effective treatments for Americans with type II diabetes. Research on new methods of automatic monitoring of blood glucose and automatically controlling insulin administration also hold much promise.

## Parkinson's Disease

Parkinson's disease, a neurologic disorder that afflicts as many as 1.5 million Americans, destroys physical movement, coordination and speech, and ultimately leaves its victims incapable of caring for themselves.

In addition to causing enormous pain and suffering for its victims and placing a tremendous strain on families, Parkinsonism costs our society \$6 billion annually. **If we delayed the onset of Parkinsonism by five years, we would save approximately \$3 billion a year.**

There are many encouraging directions being pursued in Parkinson's disease research. Early studies suggest that environmental exposure (e.g., to pesticides and other farming chemicals) can increase the risk of developing Parkinson's disease. Other research shows foods containing dopa, pyridoxine, or tyrosine could reduce the risk by increasing dopamine formation. Other promising areas for treatment of Parkinson's disease are exercise, which improves physical function, and expanded patient education, which can optimize medical treatment and compliance.

Community-based epidemiologic studies are needed to identify protective and risk factors. New techniques using tissue transplants, neural growth factors and genetic engineering carry major breakthrough potential for treatment. However, further, extensive research is needed to bring each to application.

Since some of the possible treatments for Parkinson's disease may only slow its progression, great incentive exists to identify presymptomatic patients and place them on preventive therapy before significant symptoms appear. Epidemiologic research is thus needed to determine the underlying mechanism of Parkinson's disease and to develop methods for its early detection and treatment.

## Deafness and Hearing Loss

Hearing loss is one of the most profound, and most common, disabling conditions that an older person can suffer. It is estimated that about 30 percent of adults age 65 through 75 and approximately 40 percent of those over age 75 suffer some degree of hearing impairment.

In presbycusis, the hearing loss associated with aging, changes in the inner ear lead to difficulties in understanding speech and intolerance for loud sounds. While the vast majority of cases of presbycusis are due to problems within the inner ear, the central auditory system — with its aging-related decreases in neurotransmitter production — has also been shown to undergo changes. The wide variation in the rate of hearing loss over time suggests that presbycusis is not due to a gradual, universal decline in hearing ability, but rather to specific, discrete events occurring within an individual's auditory system.

Hearing-related illnesses cost the U.S. over \$30 billion annually in lost productivity, special education costs and medical care costs. **If we could successfully delay the onset of hearing loss among older persons by five years, it would save the nation approximately \$15 billion annually.**

Research at the National Institute on Deafness and Other Communication Disorders is trying to correct a chemical depletion thought to occur in the neurotransmitters in the brain related to hearing, helping to delay the onset of aging-related hearing loss.

Recent investigation has also led to the belief that presbycusis is not inevitable, and further research may provide long-sought answers to questions concerning individual susceptibility, prevention and treatment of aging-related hearing losses.

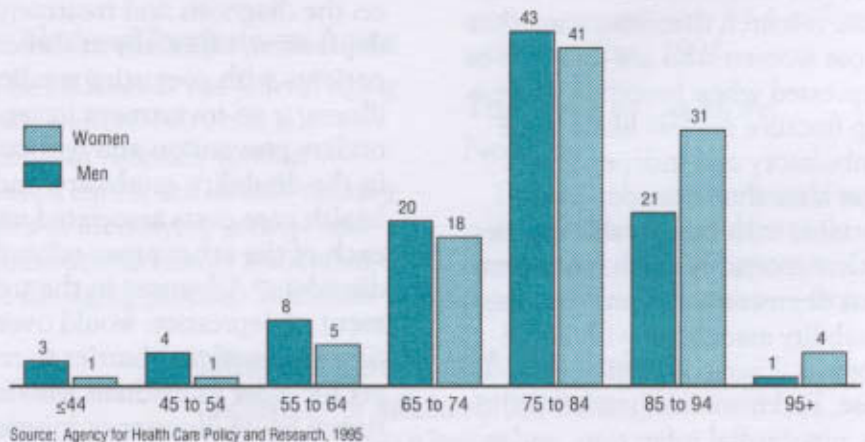
## Nursing Home Admissions

In 1991, the last year for which reliable data have been collected, almost 1.6 million older Americans lived in nursing homes. Ninety percent of nursing home residents were 65 years of age and older. Of this number, about 42 percent were 85 years of age and older, and 72 percent were female.

As with the exponential doubling of risks to aging-dependent chronic diseases, the odds of being admitted to a nursing home rise steadily with increasing age. Less than 1 percent of nursing home residents enter a facility before age 45. Nineteen percent of the occupants are admitted between ages 65 and 75, 42 percent between ages 75 and 85, and approximately one-third after age 85.

In 1993, nursing home expenditures were \$70 billion, with 63 percent of the total paid by government and 37 percent by individuals and their families. Nursing home costs are predicted to soar to between \$84 and \$139 billion in the next 30 years. Delaying the onset of chronic illnesses like Alzheimer's disease, stroke and cardiovascular disease would result in a sharp reduction in nursing home admissions and their attendant costs. **By delaying the onset of aging-dependent diseases, it is estimated that the annual amount spent for nursing home care could be reduced by as much as \$35 billion.**

**Age at First Nursing Home Admission**  
Percent Distribution



## Depression

Clinically significant depression is present in approximately 15 percent of the elderly. It is a heterogeneous condition that includes cases that are recurrences of illnesses that began in earlier adulthood as well as those whose initial onset is in late life. The two conditions differ in terms of causes; early-onset patients are more likely to have an excess of mood disorders in their families, while those with late onset more commonly suffer from chronic medical or neurologic illnesses. It is the late-onset disorder that should be viewed as an aging-dependent disorder, similar to the others discussed here.

The association between depression and chronic disease occurs because mood disorders can be causes as well as results of disability. One source of evidence that depression can be a barrier to recovery and rehabilitation comes from research demonstrating that those women who are found to be depressed when hospitalized for a hip fracture are less likely to be ambulatory and independent a year later than non-depressed patients with comparable injuries. Other recent research has shown that depression can increase the disability associated with conditions as diverse as Alzheimer's disease, Parkinsonism, stroke, arthritis, myocardial infarction, and chronic obstructive pulmonary disease, even after controlling for the severity of the underlying illness. The magnitude of the disability directly attributable to depression has been estimated to be as great as that of the other chronic medical conditions that are common in the elderly. Other consequences of depression include nutritional deficits,

increased sensitivity to pain and to drug side effects, increased utilization of health care services, and increased mortality. Through these effects, depression increases the morbidity and costs associated with other aging-dependent diseases; the resulting economic burdens are embedded within those for acute and long-term care for the other disorders. Although depression is a treatable disorder, it is, as a rule, underrecognized and undertreated in the elderly, especially in patients with coexisting medical illness. This is poignantly illustrated by the facts that suicide rates increase with aging, dramatically so in white males; that suicide in late life is due, almost entirely, to depression; and that more than 75 percent of older individuals who have committed suicide are found to have seen their primary care physicians within a few weeks of their deaths.

Increased support for research on the diagnosis and treatment of depression, especially in those patients with coexisting medical illness, is an investment in secondary prevention and reductions in the disability, morbidity, and health care costs associated with each of the other aging-related disorders. Advances in the treatment of depression would overcome a significant barrier to recovery for older individuals who experience acute illnesses or injuries; it would be an important step toward putting dependence and disability on hold.

## Chapter 3

### Putting Aging on Hold: The Role of the Federal Government

*"Only three cents of every health care dollar is spent on medical research. Without more support, new discoveries will just have to wait. The treatments of today cannot be those of tomorrow."*

—C. Everett Koop, M.D.  
Former Surgeon General  
U.S. Public Health Service

Despite sharply rising health care costs, the aging of the population and the increased incidence of chronic illnesses, the federal government has not yet given healthy aging the attention it deserves as a major national health objective. Regrettably, funding for aging research has flat-lined and declined in recent years, placing opportunities for enhanced health and longevity for the elderly at risk in the United States and lessening the chance of cost containment in the future.

#### The National Institutes of Health

This year, the U.S. will spend an estimated \$375 billion on health care for people over age 65—more than \$11,000 per person. Yet, the National Institutes of Health (NIH) will spend only 7 percent of its \$11.3 billion medical research budget for aging-related research. This 7 percent includes the entire budget of the National Institute on Aging (NIA) as well as all aging research conducted by the 23 Institutes of Health and research centers at the NIH. This represents a research investment of two-tenths of 1 percent of the health care costs of people over age 65. Considering the certainty of our demographic future, investing such a small sum for research in aging is a gross miscalculation of strategy.

The President's fiscal year 1996 budget calls for a 4.1 percent

increase in the NIH budget, to \$11.7 billion. However, to offset anticipated increases in defense spending, the budgets for fiscal years 1997 through 2000 divide discretionary spending into "protected" and "unprotected" status.

The protected programs and agencies are projected to remain at Fiscal Year (FY) 1996 levels, while the unprotected programs and agencies would be cut by 3 percent in FY 1997, 5 percent in FY 1998, 7 percent in FY 1999 and 9 percent in FY 2000. As part of the "unprotected" group, the NIH budget is projected to drop by \$1 billion in FY 2000.

#### The National Institute on Aging

The NIA leads the federal aging research effort. NIA officials report that federally funded research efforts are already making strides in identifying genetic and environmental factors associated with the aging process. Scientists

are isolating genes believed responsible for the onset of aging-related diseases, as well as those conferring health and longevity. They are working diligently to find the best ways of preventing frailty and disability, and of rehabilitating seniors who experience those conditions.

Regrettably, funds for the NIA have grown an average of just 4 percent a year since 1992. Adjusting for inflation, the 1995 NIA budget actually constitutes a \$3.2 million reduction in funding, and similarly, the President's budget for 1996, although a 3 percent increase on paper, in practical terms, amounts to a \$4.4 million reduction from 1995.

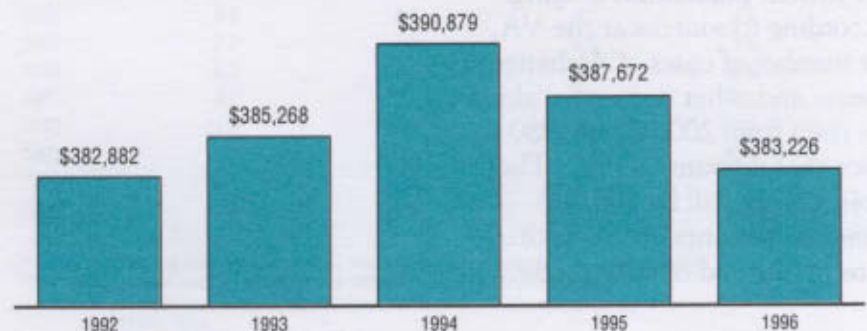
#### The Need to Do More, Not Less

Federal retreat in research support comes at a time of rapidly expanding research opportunities in aging. New advances — from

#### National Institute on Aging Budget

Adjusting for Inflation (1992 Dollars)

Dollars in Thousands



the characterization of telomerase, the enzyme believed responsible for the immortality of cancer cells, to locating one of the genes known to trigger breast cancer, the use of fetal tissue transplantation for treatment of Parkinson's disease and the developing understanding of the role of nutrition in preventing the chronic diseases of aging — all are generating an increased number of excellent research grant applications. Budget restrictions, however, necessitate that a limited number of new and competing awards can be made at the NIA. In fact, for investigator-initiated projects, which are the backbone of NIH research, fewer than one in five applications in aging research will receive funding in 1995.

### The Department of Veterans' Affairs

Outside of the Department of Health and Human Services, the U.S. Department of Veterans' Affairs (VA) is the most active federal agency conducting aging research nationwide. The VA has achieved major advances in the fields of geriatrics and geriatric training. Many medical advances that have benefited all of the elderly in the U.S.—pacemakers, CAT scans, MRI techniques and prosthetic devices — have been pioneered through VA research.

Like the U.S. public at large, the VA patient population is aging. According to sources at the VA, the number of cases of Alzheimer's disease and other dementias alone has risen from 200,000 in 1980 to twice that amount in 1990. They project there will be 600,000 dementia patients in VA institutions by the end of the decade.

The VA allots less than 10 percent of its medical research budget for aging studies, although by the end of this century, two-thirds of all men in the U.S. age 65 and over will be veterans.

Severely limited budgets for almost all the NIH and the VA aging research programs point to the need to enlarge the nation's entire health research enterprise. Any substantial boost to aging research should not be made at the expense of other areas of health research. Rather, the importance of a vigorous research effort in aging should highlight the greater goal of a concerted national effort to increase investment in biomedical research and development.



# Chapter 4

## Putting Aging on Hold: The Role of the Private Sector

*"The [pharmaceutical] industry is one of the most research-oriented in the United States. In 1991, it spent almost three times as much on research and development (as a percentage of sales) as the average from all U.S. manufacturers."*

Congressional Budget Office\*

*"Today and in the 21st century, medical progress will depend largely on the growth and profitability of biopharmaceutical industries and the support of clinical experimentation with new drugs."*

—Robert M. Goldberg, Ph.D.  
Senior Research Fellow, Gordon Public Policy Center  
Brandeis University\*\*

By capitalizing on the research findings of the NIH, the VA and other federal health research agencies, private companies can apply their resources to developing new treatments, cures and methods of delaying illness. But if this essential government pipeline of laboratory research slows to a trickle due to cutbacks and regulatory roadblocks to technology transfer, even the most well-endowed and productive private industry will have little to work with.

their very existence. However, government also has a responsibility to allow the marketplace to reward these companies for developing effective new products, or they may choose to spend their money promoting current products, rather than in risky research and development, which may be able to delay aging.

### The Public-Private R&D Link

An important link in the development of new medical interventions to delay the diseases of aging is private sector research and development. New scientific findings developed through government-sponsored research are translated into products such as vaccines, technologies and other therapeutic agents.

A growing trend in the United States is to rely less on government for solutions to social problems and to rely more on public-private partnerships. Certainly a robust working relationship between government and industry is essential for delaying the illnesses of aging. Private foundations and corporations, which have become increasingly interested in supporting aging research and in developing the careers of researchers, also play a part. The federal government is uniquely positioned to conduct high-caliber biomedical research around the nation. Pharmaceutical companies, biotechnology firms, medical device manufacturers and others depend upon this resource for

### Pharmaceutical Industry and NIH Research and Development Expenditures in Billions

	Total* Pharm. R&D	NIH R&D	Difference in Pharm. and NIH R&D Spending	Percent More or Less Spent by Pharm.
1982	2.8	3.4	-0.7	-19%
1983	3.2	3.8	-0.6	-15%
1984	3.6	4.3	-0.7	-16%
1985	4.1	4.8	-0.7	-15%
1986	4.7	5.0	-0.3	-5%
1987	5.5	5.9	-0.4	-7%
1988	6.5	6.3	0.2	4%
1989	7.3	6.8	0.5	8%
1990	8.4	7.1	1.3	18%
1991	9.7	7.7	2.0	26%
1992	11.5	8.4	3.1	37%
1993	12.7	9.8	2.9	30%
1994*	13.8	10.3	3.5	34%
1995*	14.9	11.3	3.6	32%

\*Note: Pharmaceutical industry R&D includes amount spent by U.S.-owned subsidiaries in foreign countries and amount spent by foreign-owned companies within the United States

Source: 1. Pharmaceutical Research Manufacturers of America (PhRMA) Annual Survey  
2. NIH Data Book  
3. NIH Budget Office, FY 1995 Appropriations

\*How Healthcare Reform Affects Pharmaceutical Research and Development, June 1994.

\*\*From materials issued by the National Health Council.

## The Role of Pharmaceuticals in Controlling Disease

Life expectancy increases and disease incidence and death rate declines are due in significant part to pharmaceutical discoveries over the past three decades.

cycle of basic research followed by breakthroughs in treatment. As innovations occur, the ability to treat a disease typically evolves from palliation of symptoms to control of fundamental disease mechanisms, to cure and possible

drug trials and other problems have caused investments in the field to dwindle. Analysts predict a wave of bankruptcies and consolidations, which may whittle the number of U.S. biotech firms from 265 publicly-traded companies in 1994 to less than half that number by the end of 1997. According to *Science* magazine (February 3, 1995, p. 618), "The loss of confidence hits the undercapitalized industry where it hurts. According to a 1994 report from the accounting firm Ernst & Young LLP of Palo Alto, California, one half of all biotech companies have less than 2 years' funding in their coffers — far below the 5 to 12 years that's needed to get a drug to the market." As one industry observer points out, however, many biotechnology companies are seeking other sources of funding, including foreign investors, to stay in business.

## Top Illnesses Causing Death

Top 20 Disease Killers	Death rates per 100,000			Lives Saved (000)
	1965	1990	Change 1965-1990	
Ischemic heart disease	309.4	195.1	114.3	285.1
Malignancies (all types)	153.5	201.7	-48.2	-120.2
Cerebrovascular diseases	103.7	57.9	45.8	114.2
Influenza and pneumonia	31.9	31.3	0.6	1.5
Early infancy diseases	28.6	7.0	21.6	53.9
Hypertensive heart disease	28.4	9.4	19.0	47.4
Arteriosclerosis	19.7	3.6	16.1	40.2
Diabetes mellitus	17.1	19.5	-2.4	-6.0
Other heart diseases	15.1	77.1	-62.0	-154.6
Other cardiovascular diseases	14.1	9.7	4.4	11.0
Cirrhosis of the liver	12.8	10.2	2.6	6.5
Ill-defined symptoms	12.1	10.5	1.6	4.0
Congenital anomalies	10.1	5.3	4.8	12.0
Emphysema	9.6	6.6	3.0	7.5
Active rheumatic fever	8.0	2.5	5.5	13.7
Chronic diseases of the endocardium	6.6	4.9	1.7	4.2
Nephritis and nephrosis	6.2	8.3	-2.1	-5.2
Hypertension	6.0	3.7	2.3	5.7
Peptic ulcer	5.4	2.5	2.9	7.2
Hernia and intestinal obstruction	5.2	2.2	3.0	7.5
Total	803.5	669.0	134.5	335.4
Total other diseases*	74.6	133.1	-58.6	-146.0
Population (100,000)	1935.0	2494.0		

\* Does not include deaths from accidents, suicides and homicides; 1965 is an extrapolated figure. Sources: Statistical Abstracts of United States, BCG analysis.

**If the U.S. population experienced 1965 death rates today, there would be 335,000 additional deaths per year from the top 20 killers of 1965.**

Of the top 20 killer diseases of the 1960s, six experienced death-rate reductions of over 50 percent by 1990, and an additional six improved 25 percent to 50 percent. Many of these, including cardiovascular conditions, diabetes and pneumonia, are aging-related disorders. Of the ten diseases that showed the greatest improvement, pharmaceuticals played an important role in eight.

Pharmaceutical innovations have historically been driven by a

prevention. The mix of treatments available is expected to continue to shift toward cure and prevention in the future.

## The Biotechnology Industry

There is also growing concern over the health of the biotechnology industry, which has focused on developing novel therapeutics through recombinant DNA technology. Biotechnology was one of the most bullish industries of the 1980s, but several unsuccessful

## The Role of Private Foundations

In addition to the important contributions of the pharmaceutical and biotechnology industries, non-profit, private and corporate foundations support aging research and, in particular, help aging researchers to develop their careers. For example, both the Brookdale Foundation's National Fellowship Program and the grant programs of the American Federation for Aging Research (AFAR) provide funding to new investigators who need preliminary data to then go on to compete for larger government grants in aging research. Throughout the 1980s and 90s, these programs have grown significantly, raising their total grant-making by more than 1,000 percent.

Several other private and corporate foundations have played

pivotal roles in building the private "pot" for aging research. For example, the John A. Hartford Foundation recently committed more than \$8 million to establish the Paul Beeson Physician Faculty Scholars Program in Aging Research. The Beeson Program will recognize 30 junior faculty over the next three years and form a core of elite academic geriatricians, ready to train our nation's medical students in the complexities of aging-dependent diseases and conditions. The Commonwealth Fund and donors to the Alliance for Aging Research have contributed an additional \$6 million to the Beeson Program, making it the largest aging research scholarship in the nation.

In other, no less important areas, the Glenn Foundation for Medical Research, the Ambrose Monell Foundation and The Starr Foundation, and corporate supporters like Goldman, Sachs & Co. and AlliedSignal Foundation, Inc., have provided significant funds for the field.

While the corporate and private foundation sector has begun to recognize the importance of aging research, there is a great deal more it can do. For example, just as the NIA can only support one-quarter of the qualified applicants in its annual pool, the Brookdale Foundation and AFAR report that they can only support one-fifth of the excellent proposals they receive. Clearly, additional funds would deepen the numbers of people working in the field considerably.

In general, private sector monies -- while smaller in absolute terms than those allocated by government and industry -- have important long-term effects. First,

they can point grant support toward innovative, burgeoning aspects of research that may not attract government or industry support, but that may eventually yield important results. Second, and perhaps most importantly, these funds can provide critical incentives for new investigators to consider and pursue careers in aging research. Often, a seed grant of \$30,000 or \$40,000 can transform a recent Ph.D. into a scientist who spends three to four decades in pursuit of the scientific information needed to prevent, delay, or even cure what today is an intractable, aging-dependent condition. These are modest investments, well worth taking.

### Summary

Dramatic breakthroughs in the private sector must continue if the nation aims to delay, prevent and cure the illnesses of old age. The federal government can encourage these developments by providing private industry with incentives for innovation.

The United States is second to none in the development of new medical treatments, devices and core technologies. To maintain that status, a favorable economic climate is needed for greater research and development in aging-related diseases.

## Chapter 5

### Implementing the Delay Strategy: Policy Recommendations

Treating dependency and disability in older Americans is exacting high financial and human costs on the elderly, on their families, and on both public and private institutions. **To date, our nation's response to mounting health bills is to add more money for "sick care" and try to figure out who will pay the bills and how. A different approach is seeking ways of preventing these bills.**

The most promising remedy is biomedical and behavioral research to delay the diseases and conditions of aging, enhance the independence of older Americans and slow rising health care costs. As policymakers grapple with health care costs and other mounting pressures of a far larger number of older Americans, they should demand new answers from science. With a vigorous research effort in the public and private sectors, imbued with the goal of delaying chronic aging-related disease, the U.S. can lead the way to enrich the universal human experience of aging.

Postponing the diseases and conditions of aging must be pursued on several fronts.

#### A Greater National Commitment to Aging Research

*"The federal government should move aggressively to contain costs and mitigate human suffering by funding a research and development program aimed at preventing, delaying and dealing with long-term*

*illnesses and disabilities."*

*—Final Report of The Pepper Commission  
1990*

Today, our nation's research and development investment in aging research is seriously underfunded. Only a fraction of what the nation devotes to health care is spent on research into human aging. According to recommendations by the U.S. Bipartisan Commission on Comprehensive Health Care ("The Pepper Commission") in 1990, a \$1 billion annual research investment is warranted. In 1991, the Institute of Medicine suggested a \$913 million annual investment in aging research, along with a one-time construction expenditure of \$110 million. The Federal Task Force on Aging Research (TFAR), in its 1995 report, *Threshold of Discovery: Future Directions for Aging Research*, recommends that \$1.1 billion in the next five years be spent over and above the \$841 million currently spent annually on aging research by the Department of Health and Human Services and the Department of VA.

The funds from such an expanded research effort should be applied to aging research at the NIH, the VA and other federal agencies involved in research, which will increase independence for older Americans. As the focal point for aging research at the NIH, the NIA should receive the majority of new funds earmarked for aging research. Other institutes and centers under the direction of

the Public Health Service should receive increased funding in proportion to their current spending levels on aging research.

#### Encouraging Development of New Therapies by the Private Sector

Realizing the very best that research has to offer will require nurturing the current structure of basic research so it can be translated into innovative clinical therapies. A vigorous technology transfer is critical if the breakthroughs of the laboratory are to be transformed into new pharmaceuticals, biotechnology-related therapies, behavioral interventions, medical technologies and better means of disease prevention.

#### A New Commitment to Geriatric Training

There is currently a shortage of trained geriatricians to meet the needs of the growing number of elderly Americans. The 33.6 million Americans who are 65 and older make up 13 percent of the population, but account for 44 percent of all days spent in the hospital, 40 percent of all visits to internists, and more than one-third of the nation's health care expenditures. Yet only 13 of America's 126 medical schools require either a course or a clinical rotation in geriatrics, and fewer than 4 percent of medical students take an elective course in geriatrics during medical school. As a result, only a small fraction of the

more than 550,000 physicians in this country are trained to meet the special needs of older patients.

One promising new private-sector initiative is the \$14.3 million Paul Beeson Physician Faculty Scholars in Aging Research program, described in Chapter 4. This program will support outstanding junior faculty committed to careers in geriatric teaching and practice.

But Congress, too, must increase training opportunities in geriatric medicine nationwide, so that health care professionals can diagnose the health problems of the elderly more effectively, ensure the most appropriate and efficient treatments, extend seniors' independence as long as possible and, by their specialized care, achieve cost savings.

The government should also standardize reimbursement for and support the use of geriatric assessments, to help determine appropriate health care and social services for seniors. Geriatric assessments are conducted by a multidisciplinary team which may include a doctor, a nurse, a physical therapist, an occupational therapist and a social worker, among others. Together they perform a thorough exam to assess the patient's physical and mental health, family life, income, living arrangements, access to community services and ability to perform daily tasks.

### **A New Commitment to Delaying Aging**

The federal government should move aggressively to contain costs and mitigate human suffering by funding a strategic research and development program aimed at delaying long-term illnesses and disabilities that affect the elderly.

This effort should also examine the best treatments for these conditions once they do strike, and include research on outcome measures and national practice guidelines for long-term care.

Unfortunately, impediments can arise to block the progress of any new initiative. Different groups performing aging research within the federal government may have different agendas for and perspectives on unlocking the secrets of aging and may not coalesce behind a "delay" strategy. Public and private funding for aging research has plateaued in recent years and may decline in the future. Without a renewed national commitment to advancing aging research, the delay strategy, with its tremendous potential for cost savings, may itself be delayed or, worse, abandoned.

## Chapter 6

### Conclusion

The United States is at a crossroads. We can choose to make an increased investment in finding new ways to prevent, cure, treat and delay aging-related illnesses today or we can choose to wait and pay later for an unparalleled increase in the cost of caring for our oldest citizens.

We must do better if this country is truly committed to improving the quality of health care. If Congress does not act to reverse the decline in NIH funding, we risk losing many opportunities in the quest to find cures and prevention for debilitating, aging-related diseases.

Aging research helps all Americans. By shedding light on

the basic aging process, demonstrating the difference between normal aging and disease and developing ways to slow deterioration in various body systems, researchers in aging can help us add years to our lives and quality to those years.

Most importantly, aging research yields information that can prevent or postpone health problems. Research and innovation remain our best, most cost-effective way to stop or slow the incidence of our toughest health challenges — chronic conditions such as Alzheimer's disease, arthritis and stroke.

Research breakthroughs in aging will offer new hope for many

older Americans who would otherwise be dependent on others for care. Delaying the diseases and conditions of aging is a new approach, and it has huge potential. Excellent efforts are already underway to learn the best ways of spotting those at risk for these health problems, and postponing their predicament. These and other high-quality efforts merit the nation's strongest support.

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## **Alliance for Aging Research**

The Alliance for Aging Research is a private, nonprofit, bipartisan advocacy organization dedicated to promoting research on human aging and successful aging in the national interest. The Alliance strives to broaden the public discussion of the "graying of America" to include scientific research that could lead to a healthy, vigorous, productive and independent old age for a greater number of people.

The Alliance is sponsored by a variety of corporate and nonprofit organizations, and advised by a bipartisan committee of members of Congress and by a board of prominent scientific advisors.

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## **American Federation for Aging Research**

The American Federation for Aging Research (AFAR) is America's leading private organization supporting basic aging research. Since its founding in 1981, AFAR has provided more than \$10 million to nearly 400 new investigators conducting cutting-edge biomedical research on the aging process and aging-related diseases. The important work AFAR supports leads to a better understanding of the aging process and to improvements in the health of all Americans as they age.

**Stephanie Lederman**  
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