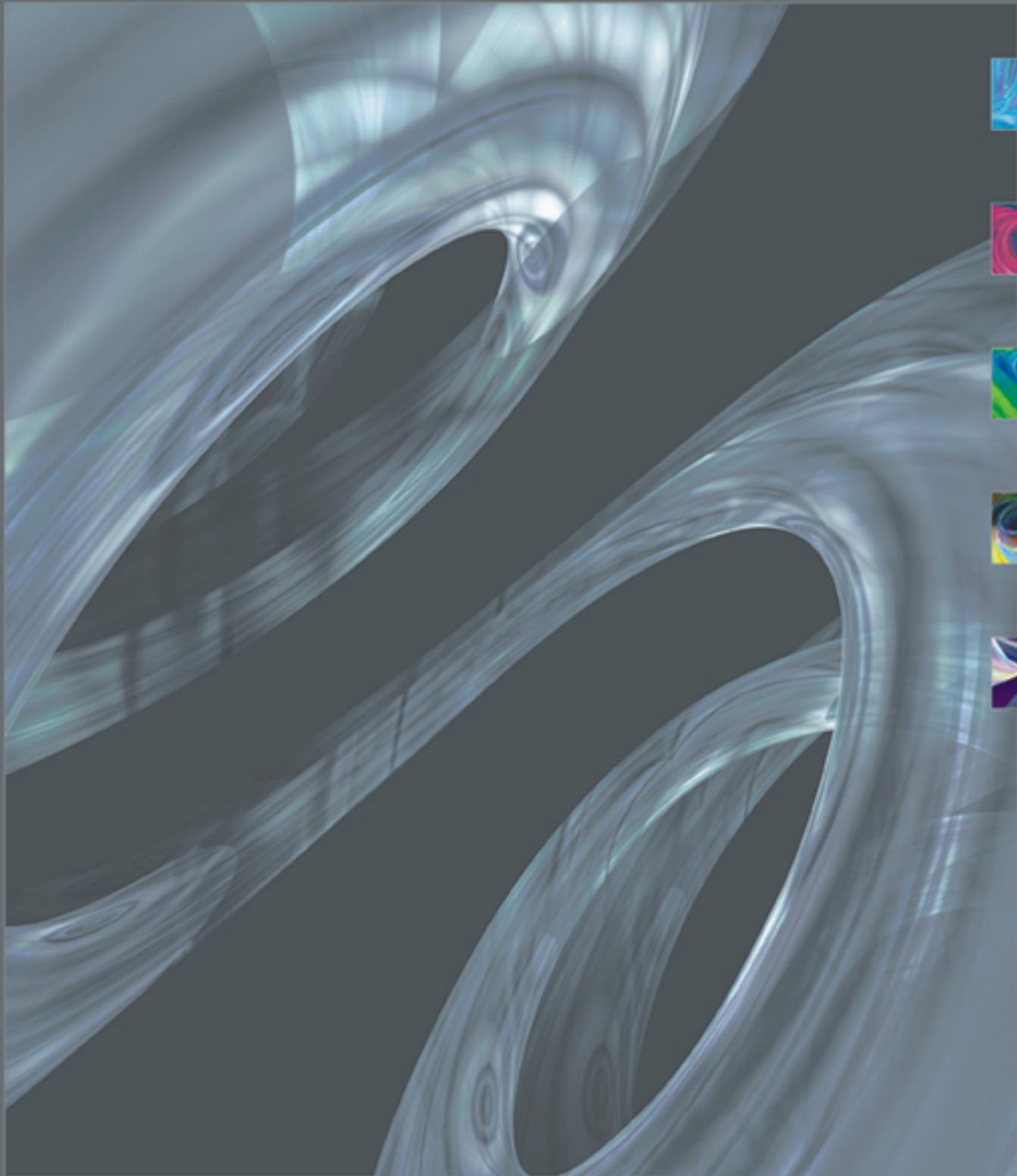
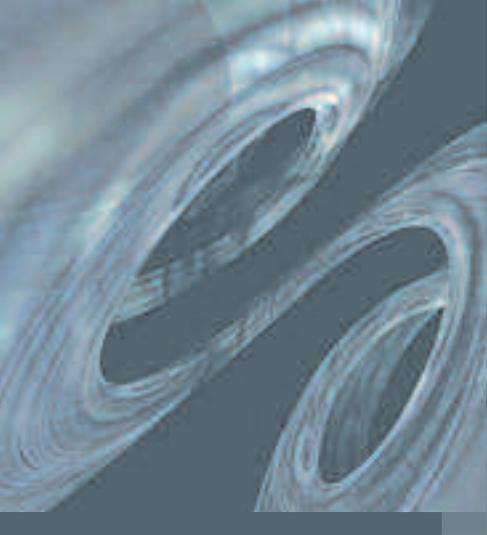


Chronic Disease and Medical Innovation in an Aging Nation

The Silver Book





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- Introduction 
- Cost of Chronic Disease 
- The Growing Older Population 
- Innovative Medical Research 
- Conclusion 
- References 

Preface

The **Silver Book: Chronic Disease and Medical Innovation in an Aging Nation** is a unique almanac of references that the not-profit Alliance for Aging Research has compiled to spotlight the impact of chronic disease on our aging population and health care system, and the significant impact medical breakthroughs will have on future health care use and expenditures. Much of the information on this topic is buried in dense and detailed reports and peer-reviewed papers and is spread out among many important publications. **The Silver Book** brings together statistics and data culled from over 130 of these reports and articles from more than 85 agencies, organizations, and experts. The information is presented in an easy-to-use format that we hope brings it to the fingertips of those shaping public policy.

The Silver Book is organized into three main sections: 1) *Cost of Chronic Disease: The Human and Economic Burden*; 2) *The Growing Older Population: The Silver Tsunami*; and 3) *Innovative Medical Research: Investing in Science*. Each section includes charts, statistics, and key findings that together paint a comprehensive picture of chronic disease spending and the potential mediating effects of medical innovation. The information focuses on the elderly population, those most prone to chronic disease, and on the leading drivers of chronic disease spending—cardiovascular disease, cancer, neurological diseases, and diabetes. **(Information pertaining specifically to the older population is noted in silver type).** All of the sources are cited so that users may easily integrate them into their presentations and work, as well as to find additional information.

The information from **The Silver Book**, plus additional resources, can be found online at www.agingresearch.org. This information is updated on a regular basis to keep data current and to provide an authoritative resource for policymakers and advocates. Please e-mail us at SilverBook@agingresearch.org if you have additional studies that should be considered for **The Silver Book Online**.



Chronic Disease and Medical Innovation in an Aging Nation

The Silver Book



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Introduction

By far, the two trends of greatest consequence for American health in the twenty-first century are the rapid aging of the population and the emergence of new technologies that could redefine old age for millions of people. To better understand these mega-trends, and to point the way for sound decision making in health care and technology policy, the nonprofit Alliance for Aging Research has compiled **The Silver Book: Chronic Disease and Medical Innovation in an Aging Nation**, an almanac that draws upon scores of authoritative studies

□ and analyses by the government, industry, private organizations, and prominent economists. While not exhaustive, the information was gathered from a wide array of sources and provides an accurate snapshot of the human and economic burden of chronic disease and the potential value of medical innovation.

□ Health expenditures in the United States reached \$1.9 trillion in 2004 and were increasing by close to eight percent per year. Not surprisingly, national attention is increasingly turning to the shape of our health care system. Health care cost increases exceeding inflation and employer health insurance premiums running to the double digits have captured the attention of corporate America, policymakers, and the public at large. High health costs add to the numbers of uninsured, make American industry less competitive in the global market, and threaten the stability of public programs that provide care to the elderly and the poor. While many factors drive these costs, the most important driver is the high cost of chronic disease in our aging nation.

Our society is both aging and living longer. Average life expectancy in the United States has increased by more than 50 percent since 1900, reaching an average of 77.4 years at birth. The first baby boomer will qualify for Medicare benefits in less than five years, and the aging of the baby boom generation will double the number of Americans age 65 and older to some 74 million by 2030. Unfortunately, life after age 65 for most people means an increasing risk of developing age-related chronic diseases. **The Silver Book** provides ready access to data on those risks and on the effects of chronic disease on the elderly. This almanac presents data focused on some of the diseases that most disproportionately affect the elderly—cardiovascular disease, cancer, type 2 diabetes, and neurological diseases such as Alzheimer’s and Parkinson’s diseases.

While policy makers and others who influence health care consider an array of options to cope with these conflicting trends, it is important to remember that reducing the cost of care without first addressing the impact of disease will likely exacerbate future expenditures. Therefore, **The Silver Book** goes beyond enumerating the impact of age-related diseases and draws upon studies and input from experts that show the current value of medical innovation, as well as predict the impact of future technology on health and costs in the twenty-first century.

We at the Alliance for Aging Research hope that this almanac will be a ready and trusted resource for thought-leaders. We also provide this compilation online and aim to keep it current in the hopes that it will continue to inform decision making and policy innovations important to our aging society.

Daniel Perry
Executive Director
Alliance for Aging Research



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The Human and Economic Burden

Cost of Chronic Disease

- Chronic Disease ■
- Cancer ■
- Cardiovascular Disease: Heart Disease and Stroke ■
- Diabetes ■
- Neurological Disease: Alzheimer's and Parkinson's Diseases ■

While medical innovation and public health gains in the past century have been measurable in leaps and bounds, significant progress against acute disease has revealed an equally enormous challenge—chronic disease on an unprecedented scale. People are living longer than ever before and are increasingly facing chronic conditions that often require ongoing, expensive medical care. The toll imposed by chronic disease is high and paid in both human and economic terms.

Those living with chronic disease often experience a significant reduction in their quality of life as physical, emotional, and financial burdens take their toll. Even worse, almost half of those with a chronic condition have more than one. With chronic disease often come functional limitations, dependency, and increased medical bills. Cardiovascular disease, cancer, neurological disease, and diabetes account for a hugely disproportionate share of the U.S. health care burden, and with chronic disease prevalence expected to grow at a faster rate than the population as a whole, the forecast is daunting.

Chronic conditions tend to strike later in life and therefore disproportionately affect the elderly population. Vulnerability to chronic disease increases exponentially after middle age, as the risk for many age-related conditions doubles every five to seven years after age 50. By age 65, nearly nine out of ten people have at least one chronic condition. This is emphasized by the fact that almost all Medicare spending is on behalf of those with at least one chronic disease.

Chronic disease also consumes far more than its share of our nation's health care resources. People with chronic illnesses visit their doctors more, stay longer in hospitals, and take more prescription drugs. Increasing medical costs and loss of productivity are leaving our nation with an enormous health care bill. With the senior population growing at a rapid rate, the portion of our population most vulnerable to chronic disease is further exacerbating health care costs.

Chronic Disease

Prevalence and Incidence of Chronic Disease

- Chronic disease is the leading cause of death and disability among Americans and accounts for 70% of all deaths in the United States.

National Center for Chronic Disease Prevention and Health Promotion, *Chronic Disease Overview*

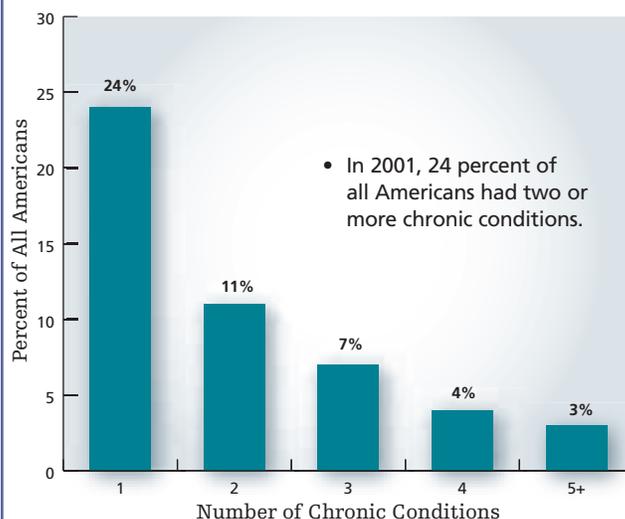
- Almost half of all Americans have a chronic condition.

National Center for Policy Analysis, *Consumer Driven Health Care*

- Five chronic diseases—heart disease, cancer, stroke, chronic obstructive pulmonary disease, and diabetes—account for more than two-thirds of all deaths.

National Center for Chronic Disease Prevention and Health Promotion 2004, *The Burden of Chronic Diseases and Their Risk Factors*

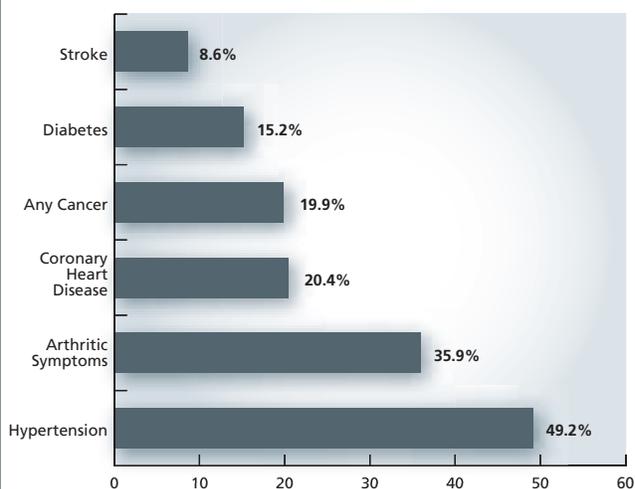
One in Four Americans Have Multiple Chronic Conditions



Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

Age—A Major Risk Factor

Prevalence of Selected Chronic Conditions Among Adults Age 65 and Over, 2000–2001



Merck Institute of Aging and Health 2004, *The State of Aging and Health in America*

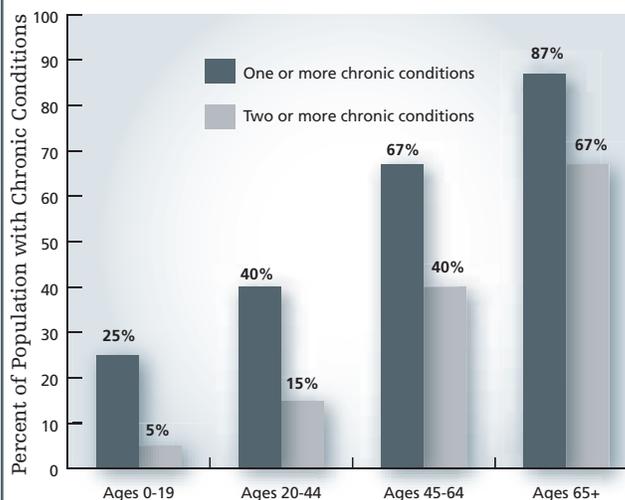
- About 80% of the senior population has one or more chronic conditions. Because of these conditions, 25% of them are limited in their ability to perform activities of daily living.

Goldman et al. 2005, *The Value of Elderly Disease Prevention*

- The number of older Americans with chronic disabilities increased from around 6.2 million in 1984 to 6.8 million in 1999.

Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*

Older Adults are More Likely to Have Multiple Chronic Conditions

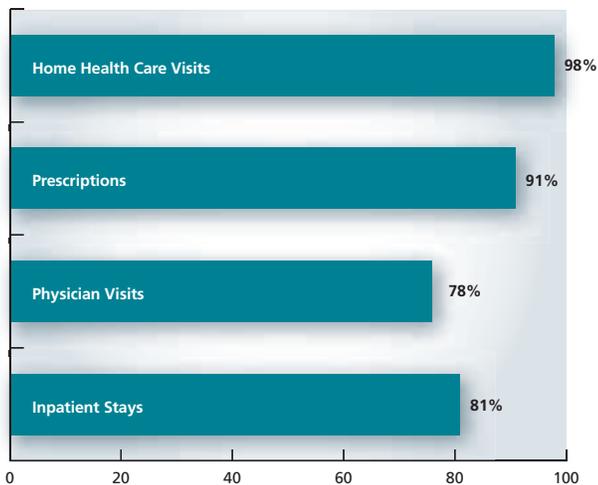


Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

The Burden of Chronic Disease

The Human Burden

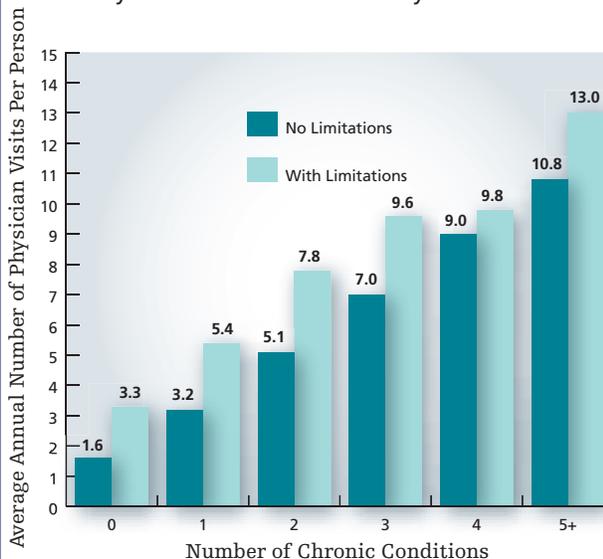
■ People with Chronic Conditions Are the Heaviest Users of Health Care Services



Percent of Services Used by People with Chronic Conditions

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

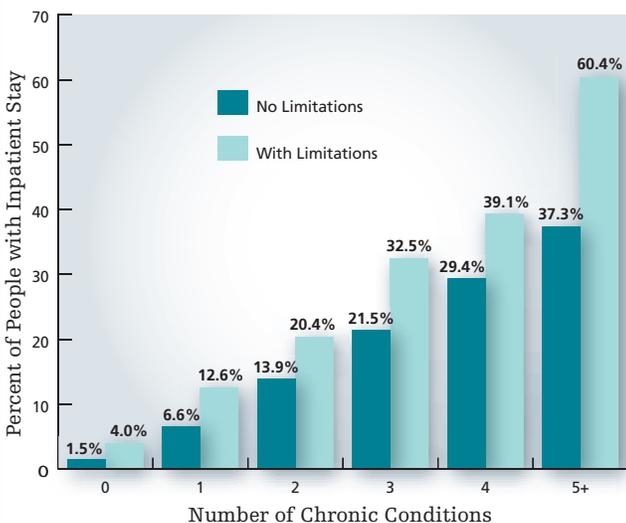
■ People with Chronic Illnesses and Activity Limitations Have More Physician Visits



Average Annual Number of Physician Visits Per Person

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

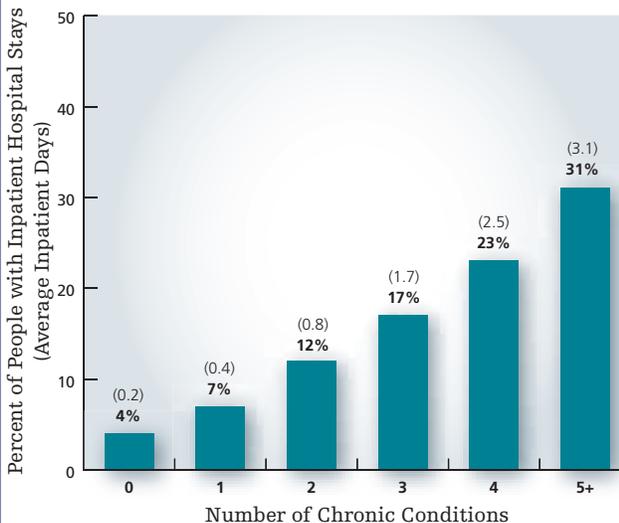
■ People with Chronic Illnesses and Activity Limitations Fill More Prescriptions



Percent of People with Inpatient Stay

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

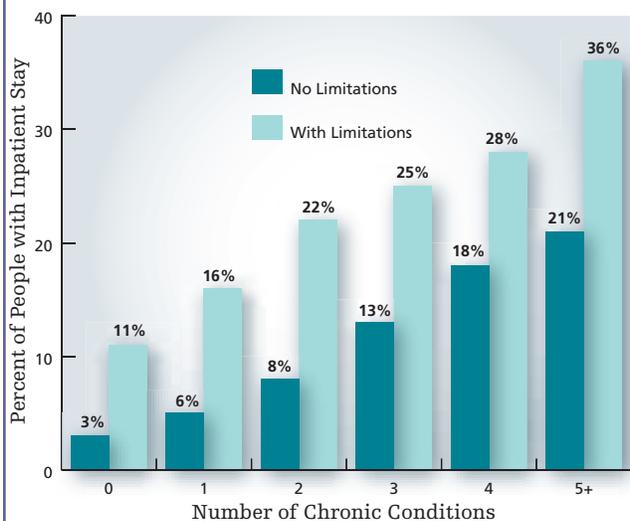
■ People with Multiple Chronic Conditions Are Much More Likely to be Hospitalized



Percent of People with Inpatient Hospital Stays (Average Inpatient Days)

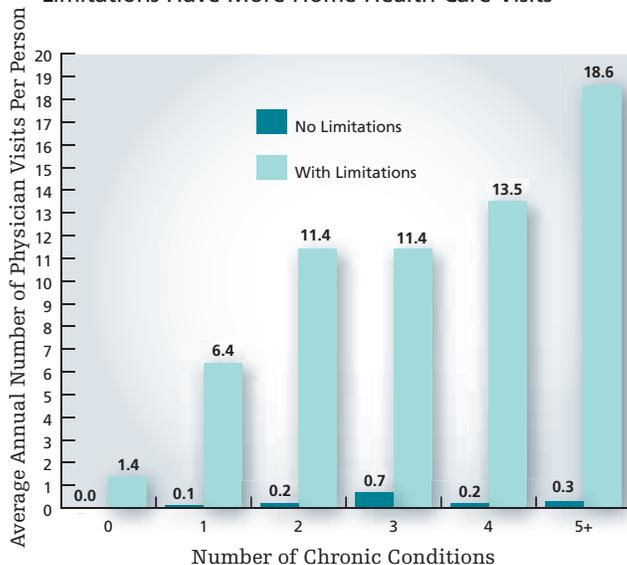
Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

■ People with Chronic Illnesses and Activity Limitations Have More Inpatient Stays



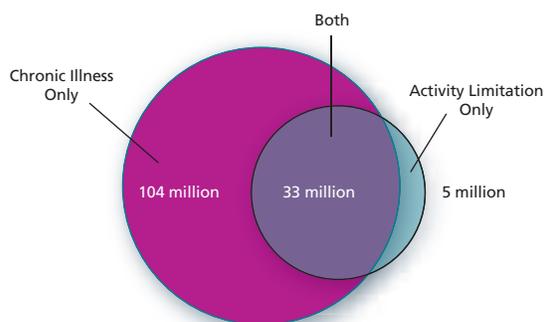
Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

■ Individuals with Chronic Illnesses and Activity Limitations Have More Home Health Care Visits



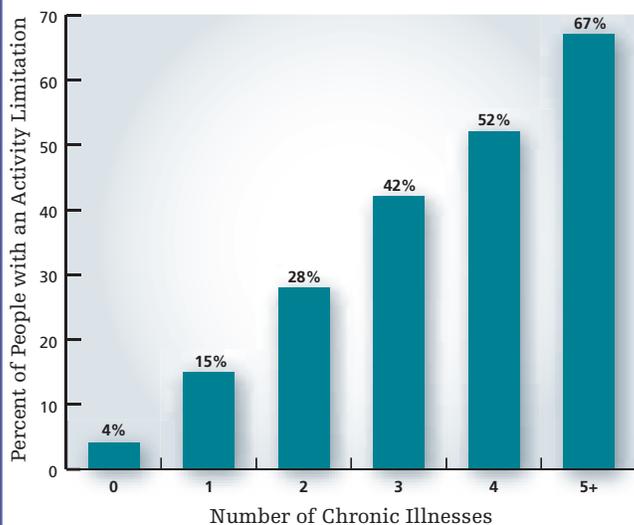
Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

■ One Quarter of Individuals with Chronic Illness Also Have Activity Limitations



Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

■ People with Multiple Chronic Illnesses Are More Likely to Have Activity Limitations



Partnership for Solutions 2002, *Chronic Conditions: Making the case for ongoing care*

- In 2002, older people made up 13% of the U.S. population, yet accounted for 36% of all hospital stays, 49% of all days of hospital care, and 50% of all physician hours.

Alliance for Aging Research 2002, *Medical Never-Never Land*

- The average 75-year-old suffers from three chronic conditions and takes five prescription medications.

Merck Institute of Aging and Health 2004, *The State of Aging and Health in America*

- Medicare beneficiaries with five or more chronic conditions see an average of 14 different physicians in a year.

Alliance for Health Reform 2004, *Covering Health Issues*

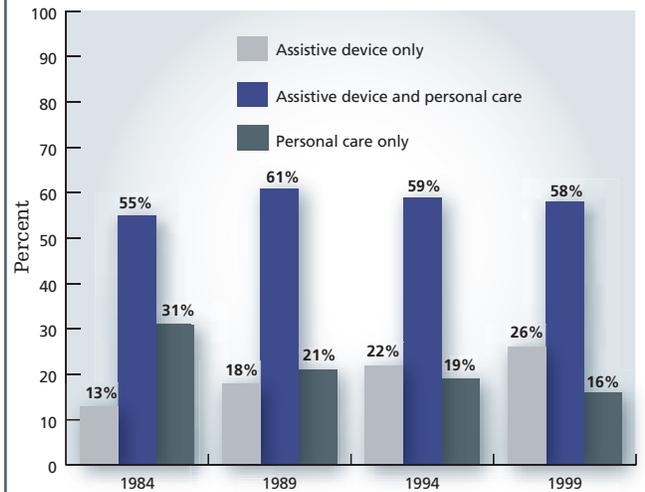
- Medicare beneficiaries with four or more chronic conditions are 99 times more likely to be admitted to the hospital for ambulatory care sensitive conditions than Medicare beneficiaries without chronic conditions.

Wolff, Starfield, and Anderson 2002, *Prevalence, Expenditures, and Complications of Multiple Chronic Conditions in the Elderly*

- Chronic conditions limit the activities of about 12 million seniors who live at home.

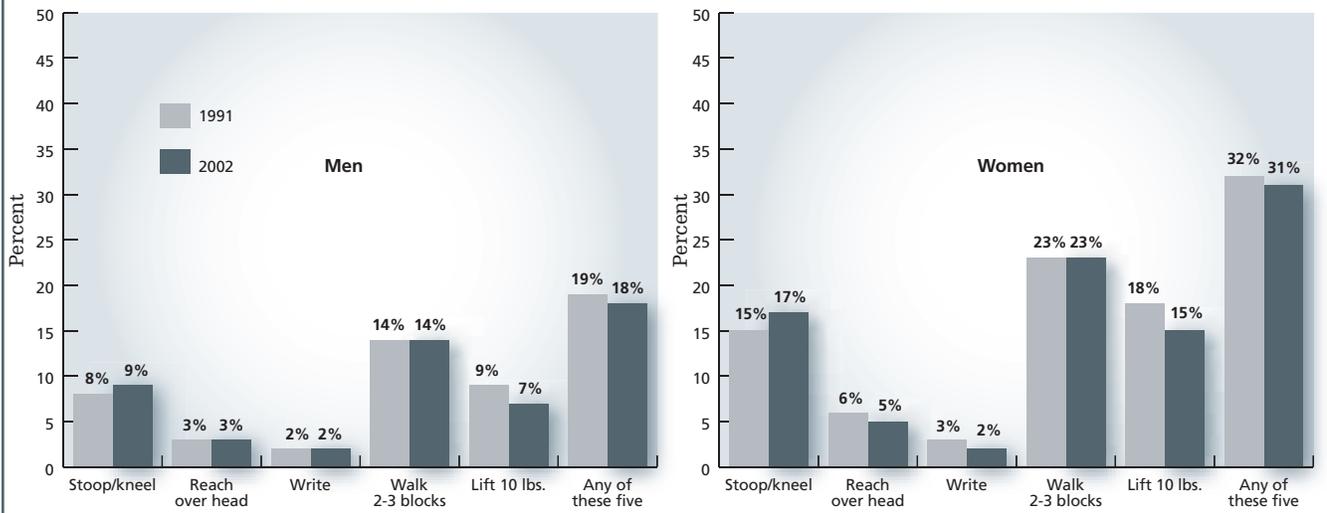
National Center for Chronic Disease Prevention and Health Promotion 2005, *Healthy Aging*

- Distribution of Medicare Enrollees Age 65 and Over Using Assistive Devices and/or Receiving Personal Care for a Chronic Disability, 1984, 1989, 1994, and 1999

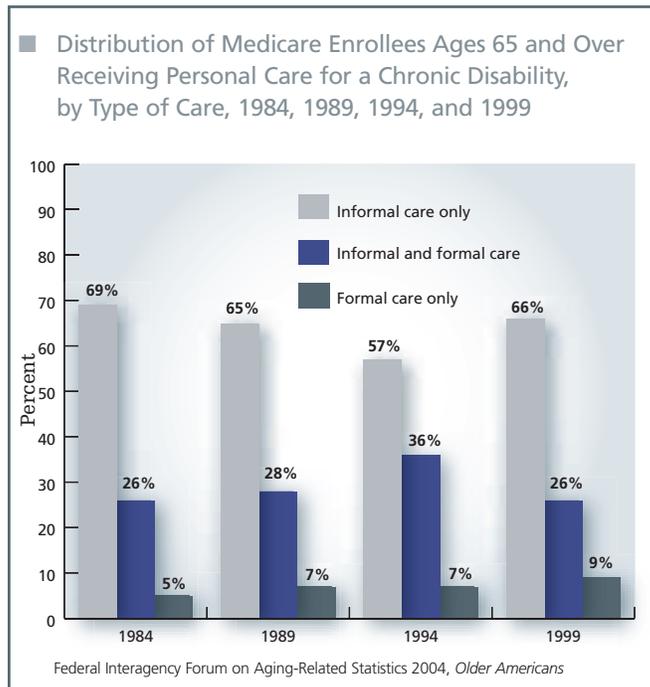
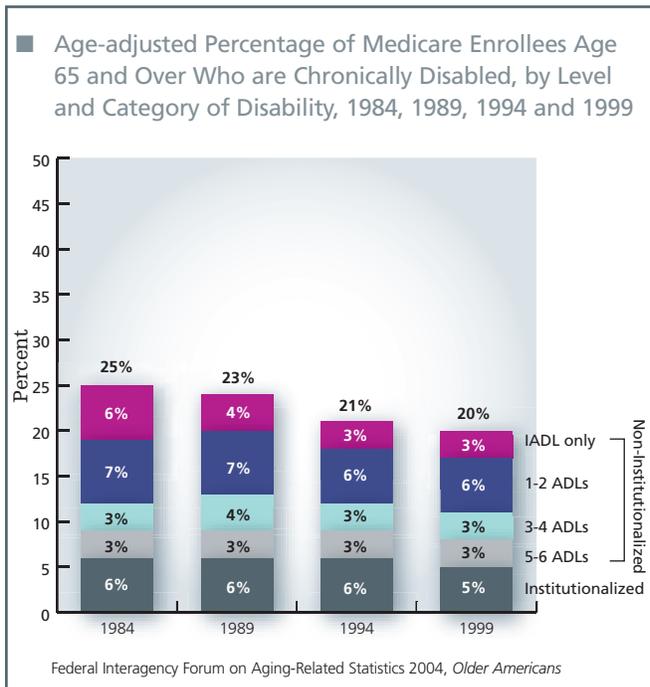


Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*

- Percentage of Medicare Enrollees Age 65 and Over Who are Unable to Perform Certain Physical Functions, by Sex, 1991 and 2002



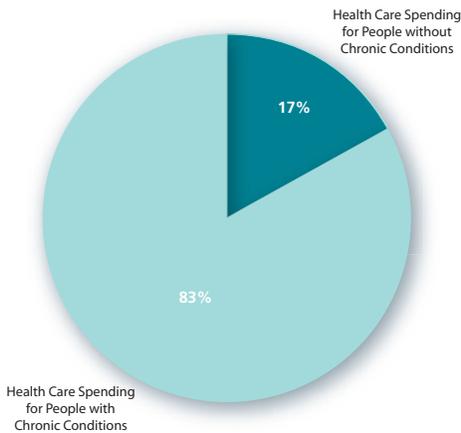
Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*



■ Stays in skilled nursing facilities increased from 28 per 1,000 Medicare enrollees in 1992, to 69 per 1,000 in 2001.
 Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*

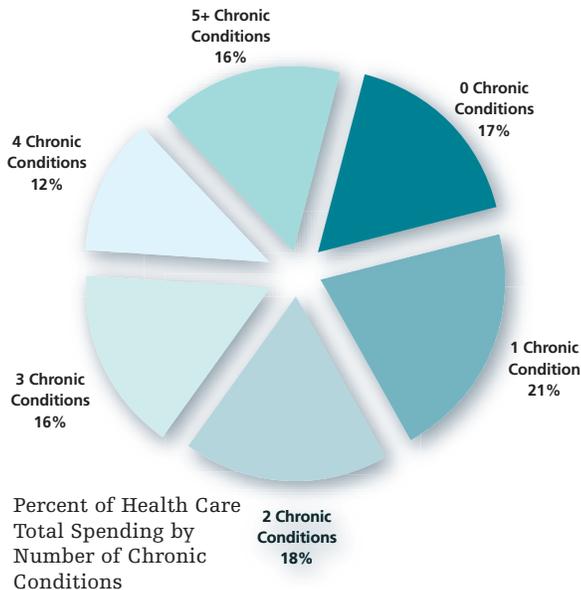
The Economic Burden

■ People with Chronic Conditions Account for 83 Percent of All Health Care Spending



Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

■ More than Three-Fifths of Health Care Spending Is on Behalf of People with Multiple Chronic Conditions



Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

- Compared to individuals with no chronic conditions, the average per capita spending for someone with one chronic condition is more than 2.5 times greater; with three chronic conditions is more than seven times greater; and with five or more chronic conditions is close to 15 times greater.

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

- In 2003, heart disease, stroke, cancer, diabetes and Alzheimer's disease cost an estimated \$771 billion.

Research!America 2005, *Investment in Research Saves Lives and Money*

- The health care costs of a 65-year-old are typically four times greater than those of a 40-year-old.

National Center for Chronic Disease Prevention and Health Promotion 2005, *Healthy Aging*

- 99% of Medicare spending is on behalf of beneficiaries with at least one chronic condition. 96% of Medicare spending is on behalf of beneficiaries with multiple chronic conditions.

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

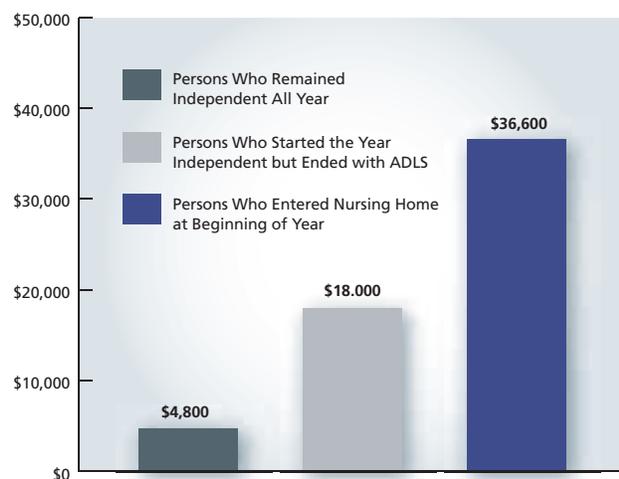
- Two-thirds of Medicare expenditures are for the 9.5 million beneficiaries who have five or more chronic conditions.

Medical News Today 2005, *Coping with Multiple Chronic Conditions*

- The United States spends more than \$26 billion annually on additional health care costs for people over 65 who lose their ability to live independently over the course of a single year.

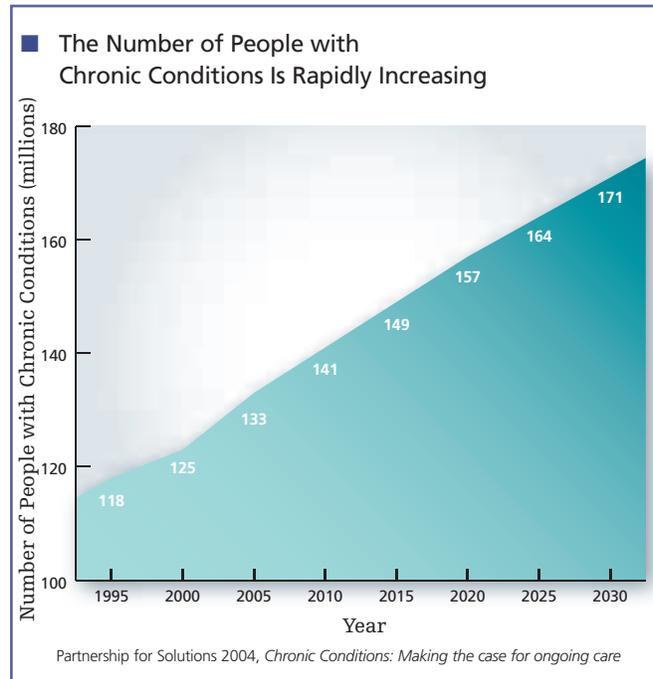
Alliance for Aging Research 1999, *Independence for Older Americans*

■ Cost of Care for Those Who Lose Independence



Alliance for Aging Research 1999, *Independence for Older Americans*

The Future Cost of Chronic Disease



- Between 2000 and 2030, the number of Americans with one or more chronic conditions will increase by 37%—46 million people.

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

- By 2020, 81 million people will have two or more chronic conditions.

Partnership for Solutions 2002, *Chronic Conditions: Making the case for ongoing care*

- By 2030, half of the U.S. population will have one or more chronic conditions.

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

- It is projected that by 2020 the U.S. will spend \$685 billion a year in direct medical costs for persons with chronic diseases, and by 2050—\$906 billion.

Hoffman and Rice 1996, *Chronic Care in America*

- By 2030, 20% of the population will be people age 65 and older with chronic conditions.

Partnership for Solutions 2004, *Chronic Conditions: Making the case for ongoing care*

- Spending on long-term care services for the elderly is projected to increase at least two and a half times by 2050—to \$379 billion.

United States General Accounting Office 2002, *Long-Term Care*

Cancer

Prevalence and Incidence of Cancer

- More than 18 million new cases of cancer have been diagnosed in the United States since 1990.

American Cancer Society 2004, *Cancer Facts and Figures*

- Approximately 1.37 million new cancer cases were expected to be diagnosed in 2005.

American Cancer Society 2005, *Cancer Facts and Figures*

- The National Cancer Institute estimated that in January 2001, there were approximately 9.8 million Americans with a history of cancer.

American Cancer Society 2005, *Cancer Facts and Figures*

- American men have approximately a one-in-two lifetime risk of developing cancer. American women have approximately a one-in-three lifetime risk.

American Cancer Society 2005, *Cancer Facts and Figures*

Age—A Major Risk Factor

- Age is the major risk factor for cancer—about 76% of all cancers are diagnosed in individuals age 55 and over.

American Cancer Society 2005, *Cancer Facts and Figures*

- The incidence of colorectal cancer is more than 50 times higher in people ages 60-79 than in those under 40. 91% of new cases and 94% of deaths from colorectal cancer occur in individuals 50 and older.

American Cancer Society 2005, *Colorectal Cancer Facts and Figures*

- A woman's risk of breast cancer increases with age—about 80% of breast cancer cases occur in women over age 50.

National Institute on Aging, *Age Page: Cancer facts for people over 50*

- Age is the greatest risk factor for prostate cancer with more than 70% of all cases diagnosed in men age 65 and older.

Prostate Cancer Foundation

The Burden of Cancer

The Human Burden

- In 2002, cancer patients made 25.3 million office visits to their physicians.

Woodwell and Cherry 2004, *National Ambulatory Medical Care Survey*

- In 2002, cancer patients made 2.1 million visits to hospital outpatient departments.

Hing and Middleton 2004, *National Hospital Ambulatory Medical Care Survey*

- 45% percent of middle-age men who have been diagnosed with cancer in the last year have recurring pain. 41% percent of middle-age women with a history of cancer experience recurring pain.

Pfizer 2005, *The Burden of Cancer in American Adults*

- 1.3 million cancer patients were discharged from hospital inpatient stays in 2003. More than 650,000 of them were over 65.

DeFrances, Hall, and Podgornik 2005, *National Hospital Discharge Survey*

- Less than 20% of 65-year-olds who have been diagnosed with cancer are free of comorbidities and physical limitations.

Joyce et al. 2005, *The Lifetime Burden of Chronic Disease among the Elderly*

- 43% percent of older men and 45% of older women with a history of cancer report some type of activity limitation.

Pfizer 2005, *The Burden of Cancer in American Adults*





The Economic Burden

- The National Institutes of Health estimated the overall cost of cancer in 2004 was \$189.8 billion. This figure includes \$69.4 billion in direct medical costs, \$16.9 billion in indirect morbidity costs, and \$103.5 billion in indirect mortality costs.

American Cancer Society 2005, *Cancer Facts and Figures*

- Colorectal cancer treatment costs about \$6.5 billion per year; breast cancer treatment costs nearly \$7 billion per year; and cervical cancer treatment costs around \$2 billion per year.

Brown, Lipscomb, and Snyder 2001, *The Burden of Illness of Cancer*

- Direct annual spending for prostate cancer is \$3.6 billion.

Pfizer 2005, *The Burden of Cancer in American Adults*

- The annual national cost of informal caregiving for cancer patients is an estimated \$1 billion.

Hayman et al. 2001, *Estimating the Cost of Informal Caregiving for Elderly Patients with Cancer*

- Every year, \$38.4 billion of direct medical services is spent on cancer-associated care for community-dwelling adults.

Pfizer 2005, *The Burden of Cancer in American Adults*

The Future Cost of Cancer

- Current patterns predict a doubling of cancer diagnosis from 1.3 million in 2000 to 2.6 million in 2050. At the same time, the number of cancer patients who are age 85 and older is expected to increase four-fold.

Edwards et al. 2002, *Annual Report to the Nation on the Status of Cancer*

- Between 1992 and 2050, the annual number of colon cancer-related admissions for people age 60 and older is projected to increase from 192,000 to 448,000.

Seinfeld and Hantsch 1999, *The Economic Burden Associated with Colon Cancer in the United States*

- By 2015, more than 300,000 new prostate cancer cases will be diagnosed each year—a 50% increase from 2004.

Prostate Cancer Foundation

- If current trends continue, by 2050 breast cancer incidence will have increased by approximately 60%, and colon cancer incidence will have increased by more than 100%.

Prostate Cancer Foundation



Cardiovascular Disease: *Heart Disease and Stroke*

Prevalence and Incidence of Cardiovascular Disease

- Almost 25% of the population—61 million Americans—have some form of cardiovascular disease.

National Center for Chronic Disease Prevention and Health Promotion, *Preventing Heart Disease and Stroke*

- Every year, about 1.5 million Americans suffer a heart attack.

American Heart Association

- 2.6% of all Americans have suffered a heart attack at

some point in their lives.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Approximately 700,000 Americans were expected to have a stroke in 2005.

American Heart Association 2005, *Heart Disease and Stroke Statistics*

- 4.5 million Americans are stroke survivors.

American Stroke Association

Age—A Major Risk Factor

- More than 71 million Americans have one or more types of cardiovascular disease. An estimated 27.4 million of them are age 65 and older.

American Heart Association 2006, *Heart Disease and Stroke Statistics*

- The average age for a first heart attack is 65.8 years for men and 70.4 years for women.

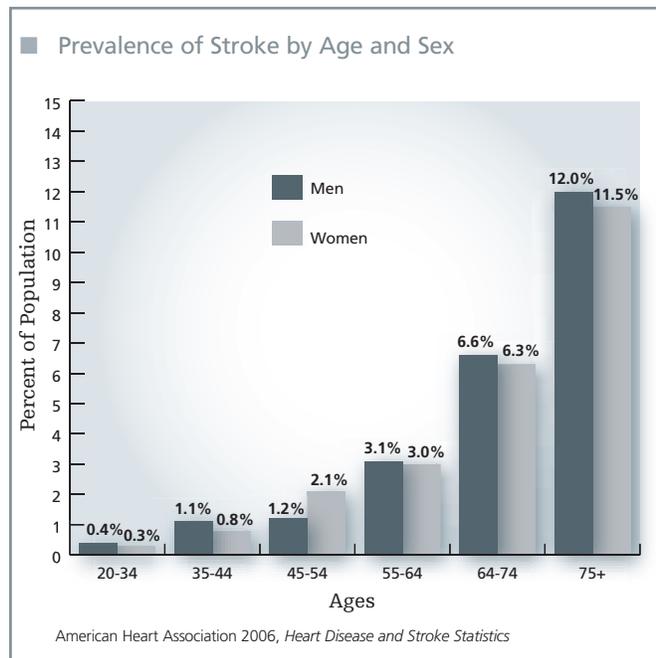
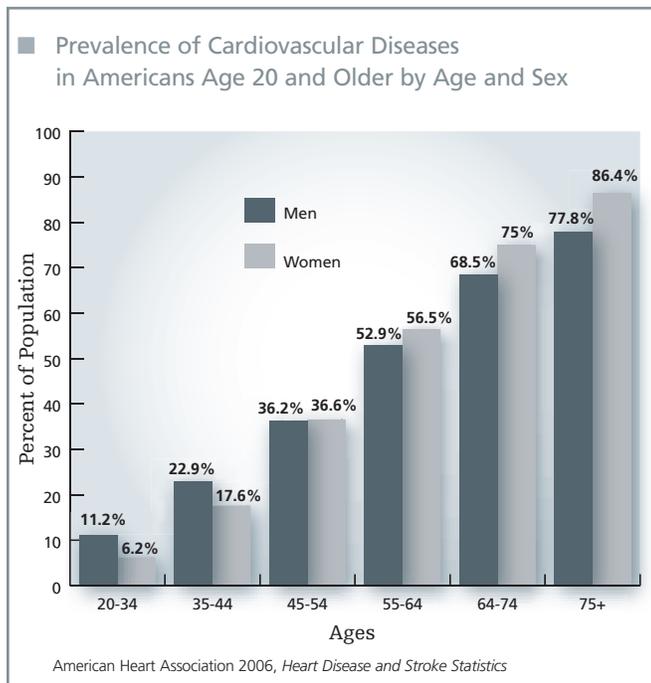
National Center for Chronic Disease Prevention and Health Promotion 2004, *Heart Disease Burden*

- 65% of Americans will have some form of cardiovascular disease by retirement age.

Research!America 2005, *Investment in Research Saves Lives and Money*

- 88% of those who die from stroke are age 65 and older. For those over 55, the incidence of stroke more than doubles each decade.

Alliance for Aging Research 2004, *Task Force on Aging: Research and funding*



The Burden of Cardiovascular Disease

The Human Burden

- Ten million Americans are disabled as a result of stroke and heart disease.

National Center for Chronic Disease Prevention and Health Promotion, *Preventing Heart Disease and Stroke*

- More than 6 million hospitalizations a year are due to cardiovascular disease.

National Center for Chronic Disease Prevention and Health Promotion, *Preventing Heart Disease and Stroke*

- Within six years of a recognized heart attack, about 22% of men and 46% of women will be disabled with heart failure.

American Heart Association 2006, *Heart Disease and Stroke Statistics*

- Approximately 66% of heart attack patients do not make a complete recovery.

National Center for Chronic Disease Prevention and Health Promotion 2004, *The Burden of Chronic Diseases and Their Risk Factors*

- 71.5% of 65-year-olds with coronary heart disease have three or more comorbidities and physical limitations—only 3.8% have none.

Joyce et al. 2005, *The Lifetime Burden of Chronic Disease among the Elderly*

- Stroke is the leading cause of disability in adults in the United States.

MEDTAP International 2004, *The Value of Investment in Health Care*

- 20% of stroke survivors require institutional care within three months after onset and 15% to 30% are permanently disabled.

Hurst 2002, *The Heart, Arteries and Veins*

- Only 2.7% of 65-year-olds who have experienced a stroke are free of comorbidities and physical limitations—66.4% have three or more.

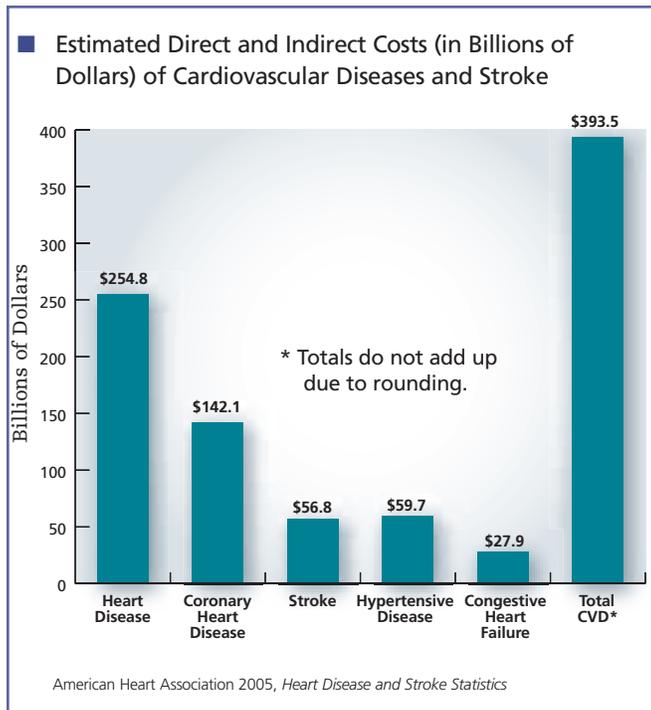
Joyce et al. 2005, *The Lifetime Burden of Chronic Disease among the Elderly*

- A study of ischemic stroke survivors who were at least 65-years-old found that at six months post-stroke 50% had some one-sided paralysis, 30% were unable to walk without some assistance, 26% were dependent in activities of daily living, 19% had aphasia, 35% had symptoms of depression, and 26% were institutionalized in a nursing home.

National Heart, Lung, and Blood Institute, *Framingham Heart Study*



The Economic Burden



- The estimated direct and indirect cost of cardiovascular disease in 2006 is \$403.1 billion.

American Heart Association 2006, *Heart Disease and Stroke Statistics*

- In 1999, Medicare spent more than \$26 billion on in-patient hospital costs for cardiovascular disease patients.

Alliance for Aging Research 2003, *Task Force on Aging Research Funding*

- The estimated direct and indirect cost of stroke in 2006 is \$59.9 billion.

American Heart Association 2006, *Heart Disease and Stroke Statistics*

- The conditions and disabilities associated with stroke cost the United States between \$30 billion and \$40 billion a year.

MEDTAP International 2004, *The Value of Investment in Health Care*

- The average cost of care for a patient up to 90 days post-stroke is \$15,000.

The University Hospital, *Stroke Statistics*

The Future Cost of Cardiovascular Disease

- Between 2010 and 2030, the number of survivors of heart disease is expected to grow at a much faster rate than the U.S. population as a whole.

National Center for Chronic Disease Prevention and Health Promotion, *A Public Health Action Plan to Prevent Heart Disease and Stroke*

- A recent study demonstrated that the cost of treating cardiovascular disease could rise by 64% to 84% by 2025.

Steinwachs et al. 2000, *The Future of Cardiology*

- Coronary artery disease accounts for 51% of all heart disease, and if no preventative drugs are made available, is projected to cost the nation \$75.8 billion by 2025, up from \$51.9 billion in 1999.

Steinwachs et al. 2000, *The Future of Cardiology*

- By 2050, more than 1 million Americans will have a first stroke every year. This represents a 167% increase among men and a 140% increase among women, from 1998 incidence rates.

American Heart Association 1998, *Incidence of Stroke to Skyrocket Well Into the 21st Century*

- Ischemic strokes will rise to over 850,000 by 2050, and between 1998 and 2050, the incidence of strokes caused by bleeding in the brain will nearly double.

American Heart Association 1998, *Incidence of Stroke to Skyrocket Well Into the 21st Century*

Diabetes

Prevalence and Incidence of Diabetes

- Diabetes is the sixth leading cause of death by disease in the United States and a leading cause of heart disease and stroke.

Alliance for Aging Research 2004, *Task Force on Aging: Research and Funding*

- About 1.5 million new cases of diabetes were diagnosed in people age 20 and older in 2005.

Centers for Disease Control and Prevention 2005, *National Diabetes Fact Sheet*

- 20.8 million people—7% of the population—have diabetes.

Centers for Disease Control and Prevention 2005, *National Diabetes Fact Sheet*

- Approximately 6.2 million people are unaware that they have diabetes.

Centers for Disease Control and Prevention 2005, *National Diabetes Fact Sheet*

- 17 million Americans—approximately 6% of the population—have type 2 diabetes, the most common form of diabetes.

MEDTAP International 2004, *The Value of Investment in Health Care*

- 41 million people have pre-diabetes, a condition that puts them at risk of developing diabetes because of higher-than-normal blood glucose levels.

American Diabetes Association, *Total Prevalence of Diabetes & Pre-Diabetes*

- Diabetes prevalence in the United States increased by more than 60% between 1990 and 2001.

American Diabetes Association

Age—A Major Risk Factor

- Approximately half of all diabetes cases are in people over age 55.

Alliance for Aging Research 2004, *Task Force on Aging: Research and Funding*

- 20.9% of the population age 60 and older—10.3 million people—have diabetes.

National Center for Health Statistics 2005, *Health*

- Approximately one in five people age 65 and older are affected by diabetes.

Merck Institute of Aging and Health 2004, *The State of Aging and Health in America*

The Burden of Diabetes

The Human Burden

- Diabetes was the cause of approximately 2.3 million hospital admissions, 14 million hospital days, and 70 million nursing home days in 1997.

Goldman et al. 2005, *The Value of Elderly Disease Prevention*

- Diabetes is the leading cause of kidney disease, adult-onset blindness, and lower limb amputations. It is also a significant cause of heart disease and stroke.

American Diabetes Association, *Federal Legislative Priorities for the 109th Congress*

- Diabetes is the leading cause of kidney failure; in 2002, it accounted for 44% of new cases.

Centers for Disease Control and Prevention 2005, *National Diabetes Fact Sheet*

- Approximately 60% to 70% of diabetics have mild to severe forms of nervous system damage causing impaired sensation or pain in the extremities, slowed digestion, carpal tunnel syndrome, and other nerve problems. Almost 30% of diabetics 40 years and older have impaired sensation in their feet.

Centers for Disease Control and Prevention 2005, *National Diabetes Fact Sheet*

- Nearly 82,000 people with diabetes had lower-limb amputations in 2002.

American Diabetes Association, *Complications of Diabetes in the United States*



- Diabetic retinopathy causes between 12,000 and 24,000 new cases of blindness every year.

American Diabetes Association, *Complications of Diabetes in the United States*

- 48.5% of 65-year-olds with diabetes have three or more comorbidities and physical limitations—less than 10% have none.

Joyce et al. 2005, *The Lifetime Burden of Chronic Disease among the Elderly*



The Economic Burden

- One in every 10 health care dollars is spent on diabetes and its complications.

American Diabetes Association, *Federal Legislative Priorities for the 109th Congress*

- In 2002, the nation spent \$13,243 on every person with diabetes, compared to only \$2,650 on every person without diabetes.

American Diabetes Association 2003, *Economic Costs of Diabetes*



- Diabetes cost \$132 billion in direct and indirect costs, in 2002 dollars. This did not include the costs of its complications.

American Diabetes Association, *National Diabetes Fact Sheet*

- Diabetes consumes 25% of Medicare's annual budget.

Research!America 2005, *Investment in Research Saves Lives and Money*

- In 2002, people with diabetes had medical expenditures that were 2.4 times higher than those without the disease.

American Diabetes Association 2003, *Economic Costs of Diabetes*

- In 2002, the cost of medications to treat diabetes was \$7.3 billion.

PhRMA 2003, *Diabetes and Pharmaceutical Spending*

- Diabetic eye diseases consume 25% of eye disease-related health care services.

The Picture of Value: Medical Imaging, *Medical Imaging Helps Employers Defeat Diabetic Eye Disease*

The Future Cost of Diabetes

- The number of Americans with diabetes is growing at a rate of 8% a year.

American Diabetes Association, *Federal Legislative Priorities for the 109th Congress*

- The annual cost of diabetes, in 2002 dollars, could rise to an estimated \$156 billion by 2010, and \$192 billion by 2020.

American Diabetes Association 2003, *Economic Costs of Diabetes in the U.S.*

- Conservative estimates predict that diabetes prevalence will increase 165% between 2000 and 2050.

Boyle et al. 2001, *Projections of Diabetes Burden Through 2050*

- The costs of complications for type 2 diabetics over a 30-year period are estimated at \$47,240 per patient.

Caro, Ward, and O'Brien 2002, *Lifetime Costs of Complications Resulting from Type 2 Diabetes*

- By 2030, more than 30 million Americans could have diabetes—71% higher than in 2000.

Wild et al. 2004, *Global Prevalence of Diabetes*

- The number of people age 75 and older with diabetes is projected to increase from 2 million in 2000 to 8.6 million in 2050.

Boyle et al. 2001, *Projection of Diabetes Burden*

- Without intervention, one in three people born in 2000 will develop diabetes during their lifetime.

U.S. Department of Health and Human Services 2004, *Revised Definition Means Millions More Have Pre-Diabetes*

- An estimated 41 million people between the ages of 40 and 74 have pre-diabetes, and most will develop type 2 diabetes within 10 years.

American Diabetes Association, *Pre-Diabetes*

Neurological Disease: *Alzheimer's and Parkinson's Diseases*

Prevalence and Incidence of Neurological Disease

- 4.5 million Americans suffer from Alzheimer's disease. That number has more than doubled since 1980.

Hebert et al. 2003, *Alzheimer Disease in the US Population*

- 360,000 new cases of Alzheimer's disease are diagnosed every year—980 every day, 40 every hour.

Cummings and Cole 2002, *Alzheimer Disease*

- Parkinson's disease is the second most common neurodegenerative disease in the United States, second only to Alzheimer's disease.

National Institute of Neurological Disorders and Stroke 2004, *Parkinson's Disease*

- As many as 1 million Americans suffer from Parkinson's disease.

Parkinson's Disease Foundation, *Ten Frequently-Asked Questions about Parkinson's Disease*

- Every nine minutes a new Parkinson's case is diagnosed—60,000 new cases every year.

Parkinson's Action Network, *About Parkinson's Disease*

Age—A Major Risk Factor

- The greatest risk factor for Alzheimer's disease is age. One in 10 people over 65, and nearly half of those over 85, have the disease.

Alzheimer's Association, *Statistics About Alzheimer's Disease*

- Beneficiaries with Alzheimer's disease account for 34% of Medicare spending but make up only 12.8% of the 65 and older population.

The Lewin Group 2004, *Saving Lives, Saving Money*

- Parkinson's disease affects one in every 100 people over the age of 60.

Alliance for Aging Research, *Aging Statistics*

- The average age of onset for Parkinson's is 60-years-old.

Parkinson's Action Network, *What is Parkinson's Disease?*

The Burden of Neurological Disease

The Human Burden

- Alzheimer's disease advances at widely different rates and the length of the illness can vary from three to 20 years. The areas of the brain that control memory and thinking skills are affected first. As the disease progresses, cells die in other areas of the brain, leaving the person eventually needing complete care.

Alzheimer's Association

- Almost half of all people with Alzheimer's disease have four or more chronic conditions.

Partnership for Solutions 2002, *Alzheimer's Disease: The impact of multiple chronic conditions*

- Approximately three quarters of Alzheimer's patients are admitted to a nursing home within five years of diagnosis.

PhRMA 2004, *Medicines Reduce the Burden of Alzheimer's Disease*

- By the time symptoms of Parkinson's disease are apparent, as much as 80% of dopamine-producing cells have been damaged.

Research!America 2005, *Investment in Research Saves Lives and Money*

- As Parkinson's progresses, substantial disability—including the inability to maintain balance, walk, speak, and move—makes assisted living and nursing home care necessary.

Parkinson's Action Network, *About Parkinson's Disease*

- An estimated 38% of Parkinson's patients suffer from falls; 13% fall more than once a week.

Parkinson's Action Network, *About Parkinson's Disease*



The Economic Burden

- Alzheimer’s disease is draining more than \$100 billion annually from the nation’s economy, costing American businesses \$61 billion a year.

Alliance for Aging Research 2004, *Task Force on Aging: Research and funding*

- The cost of care for a person with Alzheimer’s disease in a facility is approximately \$64,000 per year.

Alliance for Aging Research 2004, *Task Force on Aging: Research and funding*

- Medicare spends \$91 billion each year on caring for those with Alzheimer’s disease.

Alzheimer’s Association

- State and federal Medicaid spending on nursing home care for beneficiaries with Alzheimer’s disease was \$19 billion in 2000.

The Lewin Group 2004, *Saving Lives, Saving Money*

- Parkinson’s disease costs our society at least \$25 billion annually.

Parkinson’s Action Network, *About Parkinson’s Disease*

- Drug therapy for Parkinson’s disease costs more than \$6 billion a year. Costs such as rehabilitation and home care can run as high as \$150,000 per patient per year.

Mayo Clinic, *Parkinson’s Disease Information*

- The costs for assisted living and nursing home care of a single Parkinson’s patient can cost as much as \$100,000 per year.

Parkinson’s Action Network, *About Parkinson’s Disease*

The Future Cost of Neurological Disease

- By 2050 as many as 16 million people could be affected by Alzheimer’s disease.

Hebert et al. 2003, *Alzheimer Disease in the U.S. Population*

- As the United States population ages, researchers estimate that the prevalence of Alzheimer’s disease will come close to quadrupling over the next 50 years, when one in 45 people may be living with the disease.

Brookmeyer, Gray, and Kawas 1998, *Projections of Alzheimer’s Disease in the United States*

- The number of Medicare claims for Alzheimer’s disease treatment grew by 250% during the 1990s, and is expected to increase by 300% over the next 10 years.

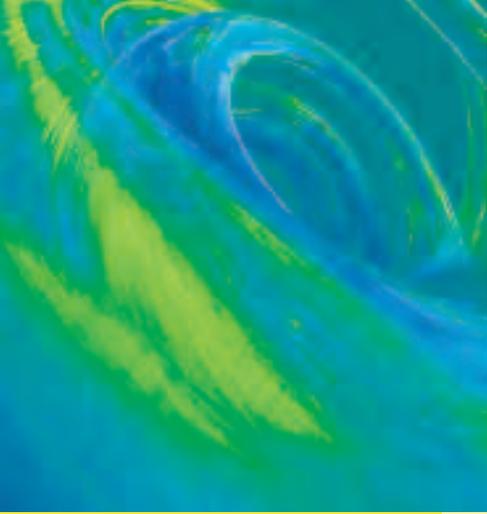
Peck 2004, *Alzheimer’s Disease Costs Expected to Triple*

- Medicare spending for those with Alzheimer’s disease will triple by 2015—to \$189 billion from \$62 billion in 2000. By 2050, Medicare will be spending more than \$1 trillion on beneficiaries with Alzheimer’s and related dementias.

The Lewin Group 2004, *Saving Lives, Saving Money*

- According to the U.S. Census Bureau, the prevalence of Parkinson’s disease will grow to between 1.3 million and 1.7 million by 2040.

Lilienfeld and Perl 1993, *Projected Neurodegenerative Disease Mortality in the United States*



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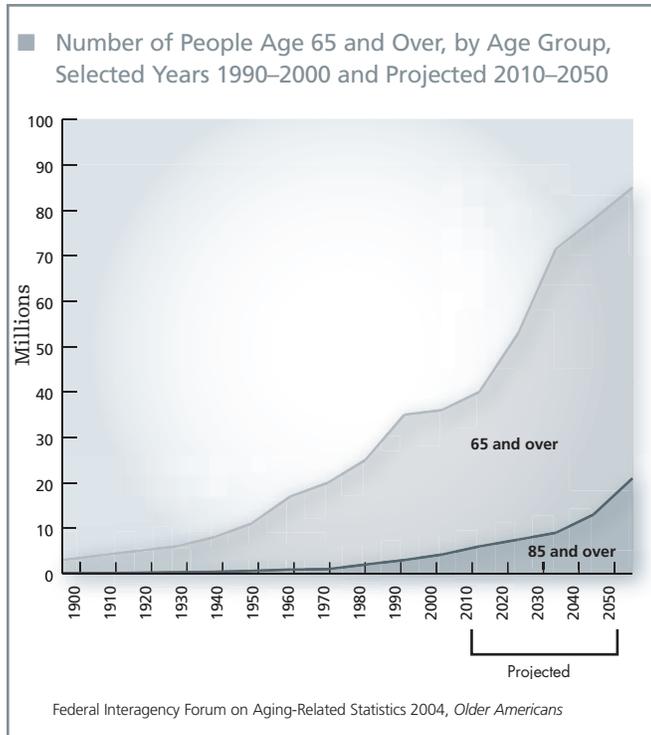
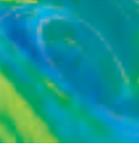
The Silver Tsunami

The Growing Older Population

- Today's Older Population
- Life Expectancy
- Future Demographics

The United States is experiencing a longevity revolution and as the baby boomers approach retirement age, they are touching off an age wave that will double the number of Americans over age 65 to more than 70 million. Individual life expectancy is also increasing and the older population is growing much more rapidly than the entire population of the United States. The prevalence of chronic disease within our senior population has already resulted in increased national health care spending, high rates of disability, and much human suffering. The problem, then, only stands to become exponentially worse as our elderly population grows.

Today's Older Population



- One out of every eight people—approximately 12.4% of the population—is an older person.

Administration on Aging 2004, *A Profile of Older Americans*

- Every day, more than 6,000 Americans celebrate their 65th birthday.

Alliance for Aging Research 1999, *Independence for Older Americans*

- In 2004, there were an estimated 60,800 centenarians (those age 100 and older) in the United States.

United States Census Bureau, *National Population Estimates*

- Since 1900, the 65 and older population has doubled three times.

Friedland and Summer 2005, *Demography Is Not Destiny*

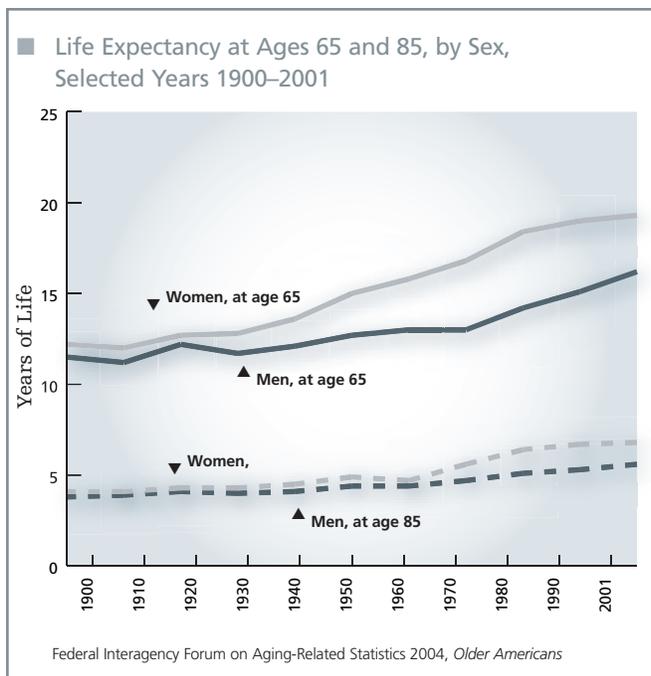
- During the twentieth century, the population of oldest-old Americans (those age 85 and older) grew from just over 100,000 to 4.2 million.

Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*

- The number of people age 100 and older increased 36% between 1990 and 2003—growing from 37,306 to 50,639.

Administration on Aging 2004, *A Profile of Older Americans*

Life Expectancy

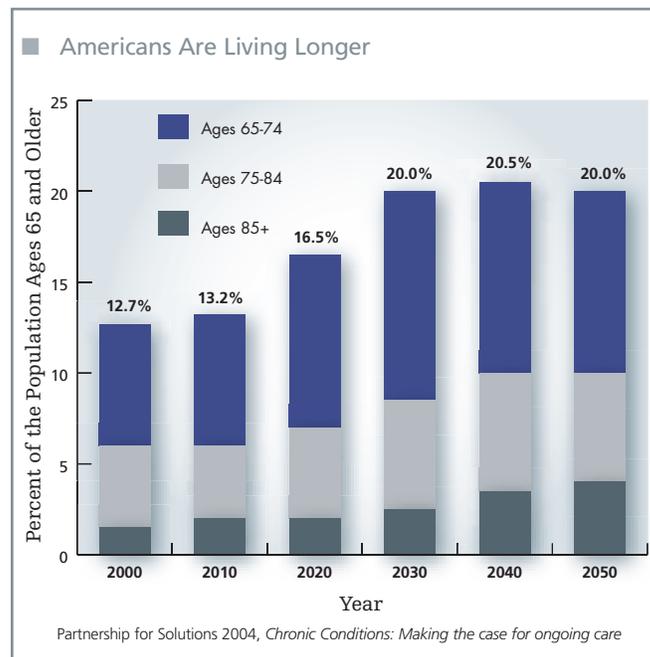


- During the twentieth century, life expectancy at birth increased from 48 to 74 years for men and from 51 to almost 80 years for women.

National Center for Health Statistics 2004, *Health*

- The average life expectancy of those who reach age 65 is close to 18 additional years, six years longer than it was in 1900.

Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*



Future Demographics

- On January 1, 2011, as the baby boomers begin to celebrate their 65th birthdays, 10,000 people will turn 65 every day—this will continue for 20 years.

Alliance for Aging Research

- By 2030, the number of older Americans is projected to have more than doubled to over 70 million—representing nearly 20% of the population.

Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*

- The 65 and older population is projected to increase to between 80 and 90 million by 2050, and the 85 and older population is projected to increase to close to 21 million.

Federal Interagency Forum on Aging-Related Statistics 2004, *Older Americans*

- By 2045, the number of centenarians in the United States is projected to reach 757,000.

United States Census Bureau, *Projections of the Total Resident Population*



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Investing in Science

Innovative Medical Research

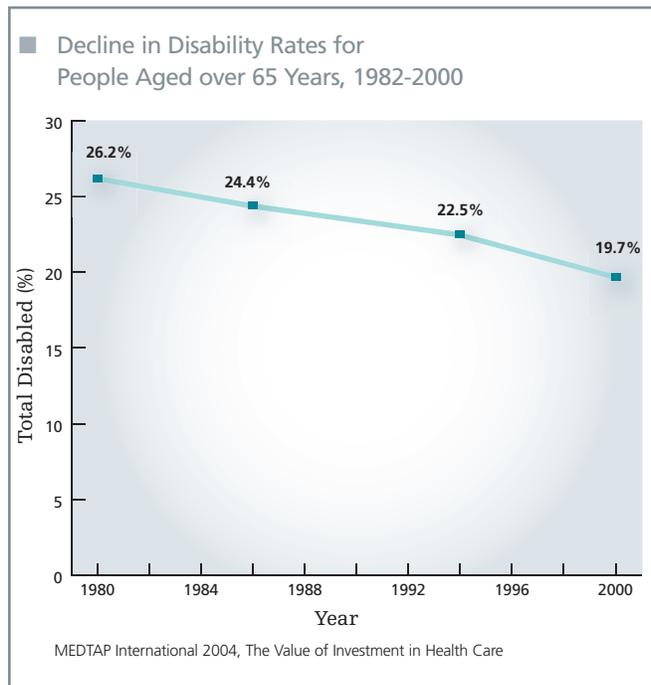
- Chronic Disease
- Cancer
- Cardiovascular Disease: Heart Disease and Stroke
- Diabetes
- Neurological Disease: Alzheimer's and Parkinson's Diseases

As our elderly population grows, the extreme strain of chronic disease on our society will only worsen. In the next 25 years, the number of Americans with chronic diseases is projected to reach 46 million. Cardiovascular disease, cancer, neurological disease, and diabetes are only going to become more pervasive, affecting an increasing percentage of the population as our elderly demographics explode.

The good news is that advances from innovation in medical research are transforming health care and helping us to live longer, healthier lives. Many of us can look forward to old age as an exciting new chapter in our lives, instead of a period of frailty and dependence. Medical innovation has already proven its value in not only improving the length and quality of life, but also in helping to contain medical costs. Resulting improvements in health care often far outweigh increased spending—every dollar invested in health care produces up to three dollars in health care gains. We must be sure to consider both the financial and human impact medical innovation can have on the burden of chronic disease. Short-sighted efforts to reduce spending often target the initial expenses of investing in medical innovation, ignoring the remarkable returns.

Chronic Disease

The Human Value



- Each new drug approved between 1970 and 1991 saved an average of 11,200 life-years in 1991.

Lichtenberg 2004, *Longer Living Through Chemistry*

- The share of elderly with impairments in their ability to live independently went down between 1% and 1.5% annually between 1984 and 2004 compared to the historical annual decline in chronic disability of 0.6% between 1910 and 1985.

Cutler 2004, *Are the Benefits of Medicine Worth What We Pay for It?*

The Economic Value

- Between 1980 and 2000, annual age adjusted per person health care costs increased by \$2,254 (102%) but were accompanied by significant health gains including
 - A 16% decline in annual death rates;
 - A 4% increase in life expectancy from birth;
 - A 25% decline in disability rates for people over 65-years-old; and
 - A 56% decline in the number of hospital days.

MEDTAP International 2004, *The Value of Investment in Health Care*

- The United States would have spent \$634 billion less on health care in 2000 without many of the improvements in health and the associated investments that were seen between 1980 and 2000. However, there would have been 470,000 more deaths, 2.3 million more disabled, and 206 million more days in the hospital.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Increased longevity added about \$3.2 trillion per year to national wealth between 1970 and 2000, an uncounted value equal to approximately half of the average annual GDP during that period.

Murphy and Topel 2005, *The Value of Health and Longevity*

- During the twentieth century, cumulative gains in life expectancy, for both men and women, were worth over \$1.2 million per person.

Murphy and Topel 2005, *The Value of Health and Longevity*

- According to Dr. David Cutler of Harvard, current health technologies return, on average, \$4 in approximate life value for every medical dollar spent.

Warner 2004, *Boomer Health Care Dilemma*



- A \$1 increase in spending on pharmaceuticals is associated with a \$3.65 reduction in hospital-care expenditures.

Lichtenberg 1996, *Do (More and Better) Drugs Keep People out of Hospitals?*

- Every \$1 invested in newer medications saves \$7 in other costs.

Lichtenberg 2002, *Benefits and Costs of Newer Drugs*

- Spending \$11,000 on general medical care adds an average of one year of life. Spending only \$1,345 on pharmaceutical research and development yields the same return.

Lichtenberg 1996, *Do (More and Better) Drugs Keep People out of Hospitals?*

- Analysis suggests that in the past 20 years, each additional dollar spent on health care services produced health gains valued at between \$2.40 and \$3.

MEDTAP International 2004, *The Value of Investment in Health Care*



The Future Value

- Medicare could save \$26 billion per year if currently healthy older people were able to remain fully independent over the course of a single year.

Alliance for Aging Research 1999, *Independence for Older Americans*

- Using newer drugs could lower overall health expenses by as much as \$111 per person, per condition, for the general population, and \$155 for Medicare beneficiaries.

Lichtenberg 2002, *Benefits and Costs of Newer Drugs*



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Cancer

The Human Value

"Knowing that his disease had a high cure rate, Ben Dacus felt a sense of security at a time of great uncertainty. In 1988 he was diagnosed with Hodgkin's disease.

Strangely enough, Ben's reaction to his diagnosis was one of relief.

'I was relieved to know my illness had a name, and because of the high cure rate, I never really feared that I was going to die. Hodgkin's had a long history of research, and doctors had been treating it successfully for many years.'

When radiation treatments didn't work, Ben was devastated. But to his relief chemotherapy afforded him a rapid recovery.

Looking back on his illness, Ben says he is thankful for medical research. 'It didn't occur to me at the time I was going through treatment to consider how medical research had brought treatment methods to the point it had. But I was thankful to live in a day and age when cancer is treatable. If it had been the 1950s, I would have died four years later.'

Research!America 2005, *Investment in Research Saves Lives and Money*

- Cancer mortality declined more than two percent in 2003, a continuation of the decline that began in 1990.

National Center for Health Statistics 2005, *Health*

- The five-year survival rate for all cancers diagnosed between 1995 and 2000 was 64%, up from 50% between 1974 and 1976.

American Cancer Society 2005, *Cancer Facts and Figures*

- Treating cancer patients with oral medicine versus intravenous chemotherapy resulted in a two-thirds reduction in hospital time and a greater than 50% reduction in costly medication side effects.

Twelves 2001, *Oral Chemotherapy Saves Resources and Time*

- Intensity modulated radiation therapy (IMRT) precisely maps and targets tumors with better tumor control and fewer side effects than other forms of radiation. In one study, IMRT increased the success rate of tumor reduction from 43% to 96% and reduced complications from 10% to 2%.

Brown 2002, *Cancer in the Crosshairs*

- A 2002 study found that image-guided percutaneous needle biopsies are between three and seven times more cost-effective than open surgical biopsies, require a shorter procedure time, result in fewer infections, and allow earlier treatment if cancer is found.

Jelinek et al. 2002, *Diagnosis of Primary Bone Tumors with Image-Guided Percutaneous Biopsy*



The Economic Value

- A drug for testicular cancer that cost an estimated \$56 million to develop led to a sharp increase in survival rate and an annual return of \$166 million in treatment savings.

Research!America 2005, *Investment in Research Saves Lives and Money*

- Every additional dollar spent on overall breast cancer treatment has produced health gains valued at \$4.80.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Surgical biopsy for lumps in the breast was found by one study to cost two and a half to three times more than image-guided core-needle biopsy (\$698 versus \$243).

Burkhardt and Sunshine 1999, *Core-Needle and Surgical Breast Biopsy*

- Every additional dollar spent on newer, less toxic hormonal therapy for breast cancer patients has produced health gains valued at between \$27.03 and \$36.81.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Use of tamoxifen, a drug used to treat breast cancer, has resulted in a direct cost savings of \$41,372 per year of life gained in women 35- to 49-years-old, \$68,349 in women 50- to 59-years-old, and \$74,981 in women 60 to 69.

Joint Economic Committee 2000, *The Benefits of Medical Research and the Role of NIH*

- Virtual colonoscopy is more efficient at detecting cancerous polyps than standard colonoscopy without imaging, and costs \$500–\$1,500 less.

The Picture of Value: Medical Imaging, *Virtual Colonoscopy*

- A drug that can reduce the risk of breast cancer in high-risk women costs approximately \$1,050 per year. The average cost per year for surgery or other invasive methods of treating breast cancer is \$14,000.

PhRMA 2001, *The Value of Medicines*

The Future Value

- Medical research that resulted in a one-fifth reduction in deaths from cancer would be worth \$10 trillion to Americans—double the national debt.

The Lasker Foundation 2000, *Exceptional Returns*

- A modest 1% reduction in cancer mortality would be worth close to \$500 billion. A cure for cancer (if one is feasible) would be worth around \$50 trillion.

Murphy and Topel 2005, *The Value of Health and Longevity*

- Widespread use of cancer vaccines could result in a cure of melanoma/renal cell carcinomas and a 25% boost in survival for all other cancers.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- Widespread use of selective estrogen receptor modulators could result in an approximately 30% decrease in breast cancer.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- A new DNA-based test for cervical cancer could save an estimated \$1 billion a year by providing more accurate diagnoses.

AdvaMed, *Medical Technology: Saves and improves lives*

- Widespread use of telomerase inhibitors could result in a 50% cure rate and a 25% prolongation of life for 50% of eligible patients with solid tumors.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- If the one million surgical breast biopsies performed annually were instead performed using image-guided needle core biopsies, the total savings could be \$1.6 billion a year.

Burkhardt and Sunshine 1999, *Core-Needle and Surgical Breast Biopsy*

Cardiovascular Disease: *Heart Disease and Stroke*

The Human Value

"Sherri Selph was 41 when she was first diagnosed with second-stage congestive heart failure. However, her rapidly diminishing health led to a diagnosis of end-stage heart disease. A heart transplant was not an option. Survival statistics for patients with Sherri's condition are grim. Even with the best treatment available, only 50 percent of heart failure patients live beyond a year.

Her doctor suggested that Sherri enroll in [a] clinical trial....Sherri soon became a patient and a member of the group that received an implantable heart pump.

The results were immediate. Four days after receiving her heart pump Sherri was back on her feet. 'I could not believe it. The pump had given me back my life,' she said. 'Without this procedure, I would not have lived to see my youngest grandson who is now two and a half years old.'

...Sherri is now back in South Carolina with her heart pump and her five grand-children—who prefer that she stay right where she is."

Research!America 2005, *Investment in Research Saves Lives and Money*

- About two-thirds of reduced mortality from cardiovascular disease is a result of medical interventions.

Cutler 2004, *Are the Benefits of Medicine Worth What We Pay for It?*

- Increased use of non-acute medications in primary and secondary prevention explains about one-third of the total reduction in cardiovascular disease mortality since 1950.

Cutler 2004, *Your Money or Your Life?*

- Mortality rates in the first three months after a heart attack have fallen by about 75%.

Cutler 2004, *Are the Benefits of Medicine Worth What We Pay for It?*

- Since 1950, reduction in heart disease mortality has added more than three and a half years to the expected lifetimes of both men and women.

Murphy and Topel 2005, *The Value of Health and Longevity*

- About 70 percent of the survival improvement in heart attack mortality resulted from changes in technology.

Cutler and McClellan 2001, *Is Technological Change in Medicine Worth It?*

- Glycoprotein inhibitors have been shown to reduce the risk of death, a second heart attack, or the need for revascularization by 48% to 52% in patients who have suffered a first heart attack.

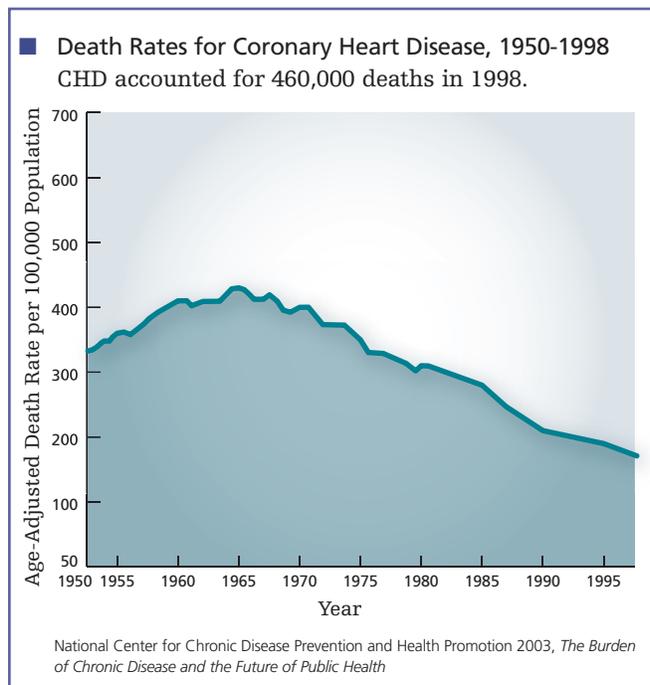
MEDTAP International 2004, *The Value of Investment in Health Care*

- Primary angioplasty reduces 30-day mortality risk by 34% to 50%.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Statin treatment soon after an acute heart attack reduces the risk of fatal heart disease or a recurrent heart attack by 24%.

MEDTAP International 2004, *The Value of Investment in Health Care*





- Use of beta blockers to treat high blood pressure in congestive heart failure patients reduced death rates by 35%.

Winslow 2001, *GlaxoSmithKline's Coreg Benefits Heart Patients in Two Big Studies*

- A blood thinning drug was found to reduce the risk of heart attack, stroke, and cardiovascular disease by 20% in patients with acute coronary syndrome when given in addition to aspirin.

Salim et al. 2001, *Effects of Clopidogrel*

- Between 1980 and 2000, stroke mortality rates fell from 96.2 to 60.8 per 100,000 persons.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Ischemic stroke patients treated with t-PA (a drug used to treat blood clots) within three hours of onset are 33% more likely to be free of disability three months after treatment.

Broderick 1998, *Practical Considerations in the Early Treatment of Ischemic Stroke*

- Because of reduced mortality rates, the number of stroke survivors who are non-institutionalized increased from 2.0 to 2.4 million between 1980 and 1991.

MEDTAP International 2004, *The Value of Investment in Health Care*



The Economic Value

- For every dollar spent on cardiovascular medical treatments, a return of \$4 is realized.

Cutler 2004, *Your Money or Your Life?*

- The value of a 10% reduction in mortality from cardiovascular disease equals \$5,725 billion in 2004 dollars.

Murphy and Topel 2005, *The Value of Health and Longevity*

- During the 1970s and 1980s, the gains associated with the prevention and treatment of cardiovascular disease totaled \$31 trillion.

The Lasker Foundation 2000, *Exceptional Returns*

- Between 1984 and 1998, the cost of treating heart attack patients rose \$10,000. However, medical technology increased the life expectancy of heart attack patients by an average of one year—a value of \$70,000 and a net benefit of \$60,000.

Cutler and McClellan 2001, *Is Technological Change in Medicine Worth It?*

- Every \$1 spent on technological innovations in heart attack care has produced an estimated \$7 gain.

Cutler and McClellan 2001, *Is Technological Change in Medicine Worth It?*

- Coronary stenting costs \$15,000—significantly less than the \$27,000 cost of open bypass surgery.

AdvaMed, *Medical Technology: Saves and improves lives*

- Performing renal angioplasty to unclog arteries costs \$6,000 less than performing a surgical bypass operation. When post-procedure costs are factored in, it costs \$14,000 less. The performance of renal angioplasty also takes an average of three hours less than bypass surgery and reduces hospital stays by over two weeks.

Xue et al. 1999, *Outcome and Cost Comparison of Percutaneous Transluminal Renal Angioplasty, Renal Arterial Stent Placement, and Renal Arterial Bypass Grafting*

- Every additional dollar spent on the routine use of beta-blockers (versus under-use) in acute heart attack patients has produced health gains valued as high as \$38.44.

MEDTAP International 2004, *The Value of Investment in Health Care*

- According to the National Institutes of Health, use of the clot-busting drug t-PA saves \$4,400 per patient in hospitalization and nursing home costs.

Houston 2004, *Innovative Drugs Cost Patients Less in the Long Run*

- Use of ACE inhibitor drugs for people with congestive heart failure helped avoid \$9,000 per person in hospital costs over a three-year period and reduced deaths by 16%.

The SOLVD Investigators 1991, *Effect of Enalapril*



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- A year-long study of patients with congestive heart failure found that increased use of medicines increased pharmaceutical costs by 60%; however, hospital costs declined by 78%, producing a net savings of \$9.3 million. The ability of patients to perform activities of daily living went up 15% and the death rate dropped from an expected 25% to 10%.

Managed Healthcare 1998, *Provide Education About Congestive Heart Failure and Pump Up Your Savings*

- Spending \$1,000 per year on anticoagulants can save \$100,000 in hospital costs for care of a person disabled by a stroke.

Giorgianni, Grana, and Scipioni 2001, *Global Impact of Innovations on Chronic Disease in the Genomics Era*

- Every additional dollar spent on antiplatelet therapy versus aspirin for the prevention of stroke in high-risk patients has produced health gains valued between \$2 and \$6.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Every additional dollar spent on the overall treatment of stroke has produced health gains valued at \$1.55.

MEDTAP International 2004, *The Value of Investment in Health Care*

The Future Value

- Development and widespread use of left ventricular assist devices could result in a 50% decrease in heart failure-related hospitalizations.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- Initiating and continuing beta-blocker use in most first-time heart attack survivors for 20 years would result in 72,000 fewer coronary heart disease deaths, 62,000 fewer heart attacks, and 447,000 gained life-years. Additionally, it would save up to \$18 million.

Phillips et al. 2000, *Health and Economic Benefits of Increased Beta-Blocker Use*

- The projected economic value of eliminating deaths from heart disease is approximately \$48 trillion.

Murphy and Topel 2003, *Measuring the Gains from Medical Research*

- Widespread use of pacemaker/defibrillators to control atrial fibrillation could result in a 50% decrease in stroke.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- Development of a neuroprotective drug could potentially reduce disability from stroke by 50%.

Goldman et al. 2005, *Consequences of Health Trends and Medical Innovation for the Future Elderly*

- Treating acute stroke with drugs that minimize cell death could result in a median decrease in disability of 30%. Treatment with stem cell transplants could result in a median decrease in disability of 25%.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- The projected economic value of eliminating deaths from stroke is \$7.6 trillion.

Murphy and Topel 2003, *Measuring the Gains from Medical Research*

- Greater use of clot-busting drug t-PA in ischemic stroke patients could save the health care system over \$100 million a year.

National Institute of Neurological Disorders and Stroke 1998, *New Stroke Treatment Likely to Decrease Health Care Costs and Increase Quality of Life*

Diabetes

The Human Value



“Suffering from diabetes for nearly 20 years, Paul faced a number of complications from the disease, including neuropathy—a profound numbness of the limbs that primarily affects the lower extremities.

The loss of feeling in the limbs, particularly the feet, contributes to the high rate of chronic wounds faced by those with diabetes. Calluses build up and often ulcerate—meaning the tissue erodes and can become infected—before the patient notices. By then, it is extremely difficult to treat the wounds effectively. An estimated 15 percent of patients with diabetes will develop a lower extremity ulcer during the course of their disease.

Paul was one of those patients. About ten years after being diagnosed with diabetes, drainage and odor from the wound on his foot drew his attention for the first time—he never felt any pain associated with it. For the next eight to ten years, Paul received regular,

conventional treatment in his doctor’s office for the wound, but it failed to heal...

The bodies of diabetic patients are so compromised in terms of blood flow that when there is a wound, it requires extraordinary measures to initiate healing... Researchers and doctors understood this problem and developed a new medical technology that combines living, fast-growing human cells with a high-tech mesh to create a growth-promoting skin substitute...

The ground breaking treatment Paul received offers great promise. The process...has been successful in even seemingly hopeless cases like Paul’s. Equally important for patients and payers, this healing procedure can take weeks, rather than years, meaning patients can return to their lives, and payers are not faced with an open-ended and often fruitless treatment process.”

AdvaMed, New Hope for Diabetic Foot Ulcers

- A study by the Diabetes Prevention Program found that the use of the drug metformin by high-risk patients reduced the risk of development of type 2 diabetes by 31%.

National Diabetes Information Clearinghouse, Diabetes Prevention Program

- Blood pressure control in diabetics reduces the risk of cardiovascular disease by 33% to 50%, and the risk of microvascular complications by approximately 33%.

Centers for Disease Control and Prevention 2005, National Diabetes Fact Sheet

- Detection and treatment of diabetic eye disease with laser therapy can reduce development of severe vision loss by an estimated 50% to 60%.

Centers for Disease Control and Prevention 2005, National Diabetes Fact Sheet



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The Economic Value

- The value of a 10% reduction in mortality from diabetes is \$486 billion in 2004 dollars.

Murphy and Topel 2005, *The Value of Health and Longevity*

- Every additional dollar spent on the overall treatment of type 2 diabetes has produced health gains valued at \$1.49.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Laser treatments save up to \$1.6 billion per year through prevention and treatment of blindness in diabetics.

Research!America 2005, *Investment in Research Saves Lives and Money*

- Every additional dollar spent on intensive blood glucose control for newly diagnosed type 2 diabetic patients has produced health gains valued at \$3.77.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Every additional dollar spent on screening and treating diabetic eye disease in type 2 diabetics on insulin has produced health gains valued at \$36.

MEDTAP International 2004, *The Value of Investment in Health Care*

- Every additional dollar spent on statin therapy for diabetes patients without cardiovascular disease has produced health gains valued between \$7 and \$31.

MEDTAP International 2004, *The Value of Investment in Health Care*

The Future Value

- Widespread use of diabetes prevention drugs that enhance insulin sensitivity could result in a 50% prevention of type 2 diabetes over a 10–15 year period.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- One economic model predicts that if type 1 and type 2 diabetics had begun Captopril (a drug that controls blood pressure and delays the onset of kidney failure) treatment in 1995, the aggregate health care cost savings in 1999 would have been \$189 million and in 2004 would have been \$475 million—a present value cumulative cost savings of \$2.4 billion for those 10 years.

Rodby, Firth, and Lewis 1996, *An Economic Analysis of Captopril in the Treatment of Diabetic Nephropathy*

- The U.S. could save up to \$2.5 billion by preventing diabetes-related hospitalizations. Much of these savings would come from Medicare with preventable hospital costs of \$1.3 billion, and Medicaid with preventable hospital costs of \$386 million.

Agency for Healthcare Research and Quality 2005, *Economic and Health Costs of Diabetes*

- Shifting to home-based dialysis could save between \$750 million and \$1.6 billion in health care costs.

AdvaMed 2001, *Cost of Diabetes, Promise of New Technologies*

Neurological Disease: *Alzheimer's and Parkinson's Diseases*

The Human Value

"Willena is 75 and was diagnosed with Alzheimer's disease five years ago. Her daughter and primary caregiver, Wanda Richardson, believes that her mother went undiagnosed for at least 15 years prior to that time.

Willena's family was told by an emergency room doctor that she had Alzheimer's disease after she wandered away one morning and turned up at the neighborhood doughnut shop in her night clothes. She had displayed odd behaviors for many years says Wanda, 38, who now provides full-time care for her mother.

Willena requires 24-hour supervision. The smallest tasks have become test of endurance for her. Wanda explains,

'She does not respond to me anymore. It takes two hours to even get her ready for the day.'

Wanda's life has changed as dramatically as her mother's. She only works part-time now and her personal life is on hold. Mostly, she worries about her young son and how he is affected by her severely restricted life.

Wanda realizes that her mother will not get better and may live this way for years. 'There needs to be more research done. We need a cure. I might be next,' Wanda says."

Research!America 2005, *Investment in Research Saves Lives and Money*

- A recent study showed that memantine, a medicine approved to treat moderate-to-severe Alzheimer's, significantly slows cognitive decline and reduces the need for caregiving by 45.8 hours per month.

Reisberg et al. 2003, *Memantine in Moderate-to-Severe Alzheimer's Disease*

- Donepezil, a cholinesterase inhibitor, has been found to slow progression of Alzheimer's disease in its early stages, delaying the need for nursing home care by an average of 30 months.

Provenzano et al. 2001, *Delays in Nursing Home Placement for Patients with Alzheimer's Disease Associated with Donepezil May Have Care Cost Saving Implications*

- Deep brain stimulation, an electrical signal delivered deep inside the brain, provides significant symptomatic relief for Parkinson's patients whose medication is no longer effective.

Parkinson's Action Network, *About Parkinson's Disease*

- Electrical stimulation of a portion of the thalamus, guided with MRI, can rapidly and dramatically reduce tremors from Parkinson's.

AdvaMed, *Medical Technology and Assistive Devices*

The Economic Value

- Research shows that use of donepezil leads to a four-fold increase in drug costs; however, it significantly lowers overall medical costs, reducing medical treatment and prescription drug costs by \$3,891 per patient, per year.

Hill et al. 2002, *The Effect of Donepezil Therapy on Health Care Costs in a Managed Care Plan*

- A clinical trial in Europe found that treating Alzheimer's patients with an Alzheimer's drug reduced annual treatment costs by \$1,000 per patient.

PhRMA Japan 2000, *Aricept Reduces Annual Treatment Cost*

- Galantamine, a cholinesterase inhibitor, delays Alzheimer's patients' need for full-time care, with overall cost savings estimated between \$323 and \$4,256 per patient.

Caro et al. 2003, *Rational Choice of Cholinesterase Inhibitor for the Treatment of Alzheimer's*

- Positron emission tomography (PET) is an effective tool in detecting and monitoring Parkinson's disease. Because it can eliminate the need for other, more invasive diagnostic procedures and detect the disease earlier, it also significantly reduces health care costs.

AdvaMed, *Medical Technology and Assistive Devices*

- In one study, deep-brain stimulation for Parkinson's patients significantly reduced their required dosages of antiparkinsonian medications, consequently decreasing their medication costs by 32% one year after surgery, and 39% two years after.

Charles et al. 2004, *Deep Brain Stimulation of the Subthalamic Nucleus Reduces Antiparkinsonian Medication Costs*





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The Future Value

- Use of existing or new drugs/compounds for Alzheimer's prevention could result in a delay of onset of between two and five years.

Shekelle et al. 2000, *Identifying Potential Health Care Innovations for the Elderly of the Future*

- Delaying the onset of Alzheimer's by only five years could reduce the number of people with Alzheimer's by almost 50% after 50 years.

Brookmeyer, Gray, and Kawas 1998, *Projections of Alzheimer's Disease in the United States and the Public Health Impact of Delaying Disease Onset*

- Delaying the onset and progression of the disease would reduce the projected number of people with moderate to severe cases of the disease to 4.4 million instead of 10.3 million in 2050.

The Lewin Group 2004, *Saving Lives, Saving Money*

- Delaying the onset of Alzheimer's disease by just five years could save \$50 billion per year.

Alzheimer's Association

- Research breakthroughs that slow the onset and progression of Alzheimer's disease could achieve annual Medicare savings of \$51 billion by 2015, \$126 billion by 2025, and \$444 billion by 2050.

The Lewin Group 2004, *Saving Lives, Saving Money*

- A \$1 billion-investment in Alzheimer's research that led to research breakthroughs by 2010 could have a 10-to-1 return by 2015, and a 90-to-1 return by 2050.

The Lewin Group 2004, *Saving Lives, Saving Money*

- Based on rates of admission in 1998, delaying admission of Alzheimer's patients to nursing homes by one month could save as much as \$1.12 billion a year.

Leon, Cheng, and Neumann 1998, *Alzheimer's Disease Care*

- In one study, despite a four-fold increase in prescription drug spending, overall health spending for Alzheimer's patients undergoing drug therapy went down by one-third.

Hill et al. 2002, *The Effect of Donepezil Therapy on Health Costs in a Medicare Managed Care Plan*

- Researchers have found how to manipulate embryonic stem cells to form dopamine-producing brain cells. This new source of cells could someday be used to replace cells lost to Parkinson's.

Perrier et al. 2004, *Derivation of Midbrain Dopamine Neurons from Human Embryonic Stem Cells*

- According to one Parkinson's expert, a 10% slowing of Parkinson's disease progression would save \$327 million per year.

Parkinson's Action Network, *About Parkinson's Disease*

- Nineteen new medicines are currently in development for the treatment of Parkinson's disease.

PhRMA, *New Medicines in Development Database*



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Conclusion

■ When **The Silver Book** was first conceived, our intent was to cull facts and figures from the multitude of relevant reports and studies, creating a comprehensive resource that would outline the burden of chronic disease and highlight the value of innovation in reducing that burden. What we found is that while the information highlighted here paints an accurate picture, it is just the tip of the iceberg. As we brought the magnitude of this problem into focus, we also found that there are many gaps in the available data. We hope that the identification of these gaps will encourage future studies on these issues.

■ In order to share additional information that could not fit within the printed version of **The Silver Book** and to keep the almanac updated as future studies are produced, the Alliance for Aging Research is developing an interactive, online resource that will allow experts to provide information, keeping it current and comprehensive. Please visit our website to learn more about **The Silver Book Online**—www.agingresearch.org.

We hope that **The Silver Book** will become an important tool in shifting the dialogue from cutting costs to investing in science and innovation. The steadily increasing prevalence of chronic conditions begins a new battle in our country's war against disease. As we address the cost of this war we must balance our concerns about reducing costs with the need to provide quality care and a long-term vision that will ultimately result in decreased health care costs, both personal and economic. We must consider how today's investments will bring enormous health and economic returns tomorrow. Investments in medical innovation have been proven to pay for themselves many times over through decreased medical expenses and increased productivity. Medical innovation is vital in containing the impending health care crisis and ensuring the future of our nation's health.

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