



THE ECONOMIC

IMPACT

OF VISION PROBLEMS

The Toll of Major Adult Eye Disorders,
Visual Impairment and Blindness on
the U.S. Economy



Our Vision Is Vision™

Founded in 1908, Prevent Blindness America is the nation's leading volunteer eye health and safety organization dedicated to fighting blindness and saving sight. Focused on promoting a continuum of vision care, Prevent Blindness America touches the lives of millions of people each year through public and professional education, advocacy, community and patient service programs and research. These services are made possible through the generous support of the American public. Together with a network of affiliates, divisions and chapters, Prevent Blindness America is committed to eliminating preventable blindness in the U.S.

The Economic Impact of Vision Problems
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Most of us expect vision problems to wield a monetary blow not only on people living with the condition but also on the U.S. economy. This report reveals, for the first time, the extent to which this is true. The impact is felt particularly by third-party payers and patients' caregivers.

Understanding the costs will help policymakers develop better policies and interventions for preventing and treating vision problems. If appropriate preventive steps are not taken, costs will burgeon as the U.S. population ages and life expectancy increases. The number of Americans with impaired vision, including blindness, could more than double over the next three decades.

This report is a companion to a previous publication, *Vision Problems in the U.S.* (Prevent Blindness America, 2002), which documents the *prevalence* of sight-threatening eye diseases in Americans aged 40 and older. *The Economic Impact of Vision Problems* describes the *economic burden* of the same conditions: age-related macular degeneration (AMD), cataract, diabetic retinopathy, primary open-angle glaucoma and refractive error. It also looks at the economic impact of vision problems and blindness.

This is not the first attempt at economic analysis of vision problems. In 1981, Teh-Wei Hu, PhD, of The Pennsylvania State University, submitted a report to the National Eye Institute (NEI) of the National Institutes of Health (NIH) titled *Economic Costs of Visual Disorders and Disabilities: United States, 1981*. Later, applying inflationary adjustments, the NEI's Leon Ellwein, PhD, provided two updates. The total cost figures from reports of 1981, 1991 and 2003 were, respectively, \$14.1, \$38.4, and \$67.6 billion. While the 1991 and 2003 figures are extrapolated from the earlier data, their relevance to the total cost of all visual disorders and disabilities are important. Much of the current report is specific to the costs associated with the four major age-related eye diseases and should be read in that context.

The Economic Impact of Vision Problems report is funded by Prevent Blindness America. Two teams of prominent health economists contributed to the report. They delved into public sources of data, teasing out the impact of vision problems on federal and state budgets, personal expenditures and health-related quality of life. David B. Rein, PhD, of RTI International led one team. Kevin D. Frick, PhD, of Johns Hopkins Bloomberg School of Public Health, led the other team. Rein's research was funded by the Vision Health Initiative of the Centers for Disease Control and Prevention; Frick's research was funded by Prevent Blindness America.

Dr. Rein examined the burden of vision problems in American adults to the U.S. economy; his figures reflect the cost of AMD, cataract, diabetic retinopathy, glaucoma, refractive error, visual impairment and blindness.

Dr. Frick studied the financial burden of visual impairment and blindness to the individual, caregivers and other healthcare payers, including the value of time and quality of life. Adding Rein's and Frick's costs together, \$35.4 billion and nearly \$16 billion, respectively, the annual cost of adult vision problems in the U.S. comes to approximately \$51.4 billion.

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This report contains four sections:

Section 1 defines terminology used in descriptions of analyses and findings. It also provides an overview of the financial burden of adult vision disorders to the U.S. economy and to individuals.

Section 2 presents how \$35.4 billion was calculated as the annual total burden to the U.S. economy of AMD, cataract, diabetic retinopathy, glaucoma, refractive errors, visual impairment and blindness.

Section 3 shows how conclusions were reached concerning the excess monetary impact of visual impairment and blindness to individuals, their caregivers and third-party payers. It also reveals demographic and health data about these groups.

Section 4 describes the methods and sources the investigators used to reach their conclusions.

For the complete articles on which *The Economic Impact of Vision Problems* is based, see Rein DB, Zhang P, Wirth KE, Lee PP, Hoerger TJ, McCall N, Klein R, Tielsch JM, Vijan S, Saaddine J. The economic burden of major adult visual disorders in the United States. *Arch Ophthalmol* 2006 Dec;124(12):1754-1760; Frick KD, Gower EW, Kempen JH, Wolff JL. Economic impact of visual impairment and blindness in the United States. *Arch Ophthalmol* 2007 Apr;125(4).

A Closer Look at Definitions and Breakdowns of Cost

Estimated annual total financial burden

The estimated annual total financial burden to the U.S. economy of four major adult vision problems (AMD, cataract, diabetic retinopathy and glaucoma), refractive errors, visual impairment and blindness is **\$35.4 billion**. The estimate, derived from published data (see Section 4, Methods and Sources), is based on direct medical costs, other direct costs and lost productivity:

Direct medical costs	\$16.2 billion
Other direct costs	\$11.2 billion
Lost productivity	\$8.0 billion

Direct medical costs refer to outpatient services, inpatient services, prescription drugs (see note below), vitamins and other medications used by people with AMD, cataract, diabetic retinopathy, glaucoma or refractive error.

Note: For patients aged 40 to 64, the prescription costs for glaucoma were calculated based on medical claims insurance data using National Drug Code numbers for identification. Both the average costs per patient using prescriptions and the average cost per prescription were calculated. For patients 65 and older, the number of prescriptions was estimated from the 2002 National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey using a drug class variable to identify glaucoma prescriptions. Costs were calculated by multiplying this estimated number of prescriptions by the average cost per prescription found in the data for patients aged 40 to 64. Vitamin supplement costs were estimated using an assumption about the quantity consumed multiplied by the average annual cost of vitamin therapy.

Other direct costs include nursing home care due to visual impairment, government programs for people who are visually impaired (i.e., Department of Education's Independent Living Services for Older Individuals Who are Blind; American Printing House for the Blind; Library of Congress' National Library Service for the Blind and Physically Handicapped) and guide dogs.

Lost productivity is defined as the cost of lower labor force participation and lower wages among people who are visually impaired or blind compared to those in the same age group who have normal vision.

Annual excess monetary impact

The annual excess monetary impact to individuals with visual impairment and blindness, caregivers and other healthcare payers is calculated at \$5.48 billion. This figure is based on pooled, self-reported data (see Section 4, Methods and Sources). On top of the \$5.48 billion is an annual health utility loss of approximately \$10.5 billion:

Medical care expenditures	\$5.12 billion
Informal care costs	\$0.36 billion
Health utility loss	\$10.5 billion

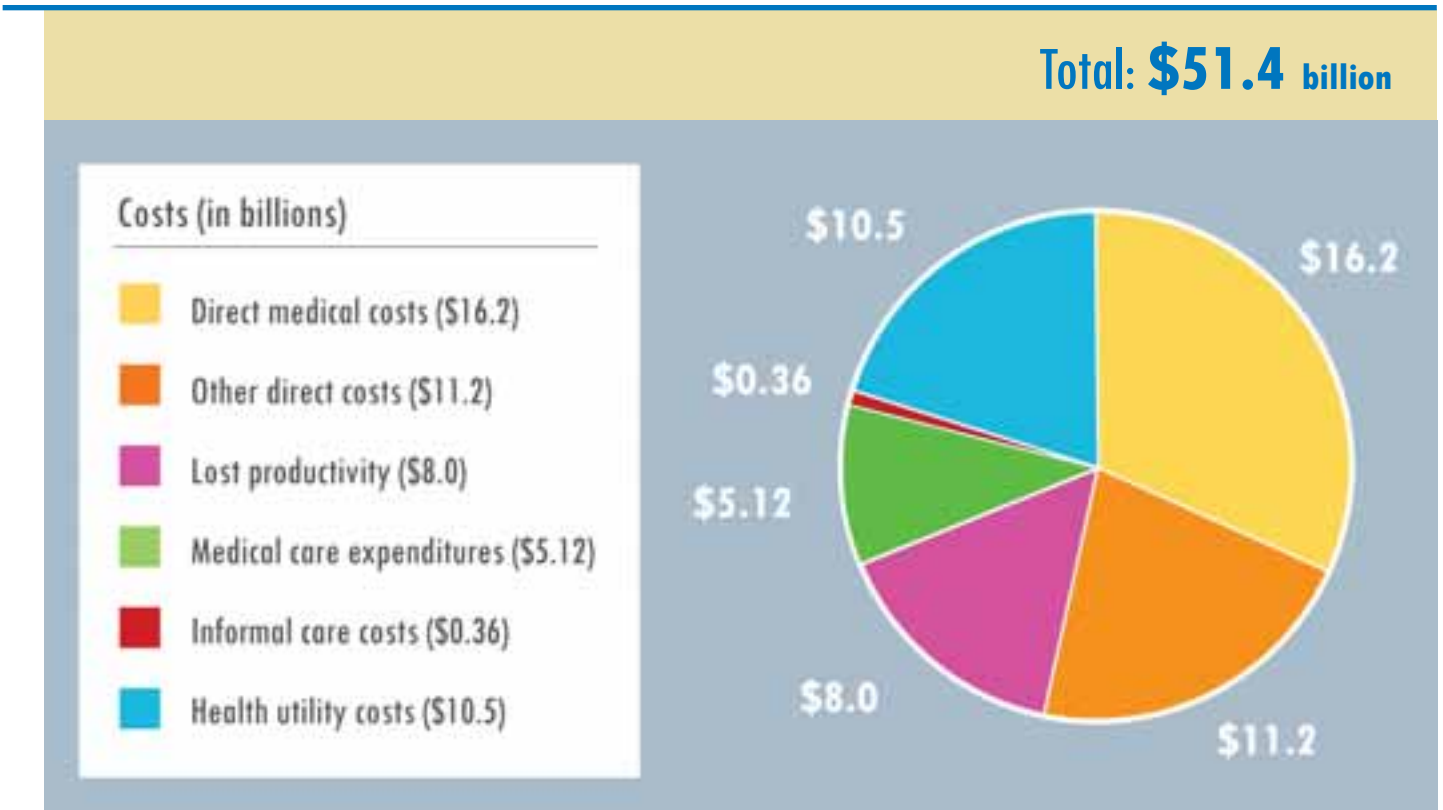
Medical care expenditures reflect costs associated with events such as outpatient doctor visits, emergency room visits, hospital stays, dental visits, home care and also medical supplies and prescription drugs.

Informal care costs refer to the value of time related to unpaid care provided by friends and family members.

Health utility is a useful measure for evaluating quality of life in chronic medical conditions where there is little or no impact on mortality in the short term. It enables health-related quality of life (e.g., distress, depression, mobility, social limitations) to be quantified and transformed into quality-adjusted life years (QALYs) gained or lost. QALYs are used in cost-effectiveness analyses. For the 3.7 million people who are visually impaired or blind, the loss in QALYs is calculated at over 209,200. In the U.S., a regularly used value for QALYs is \$50,000.

Combining these costs arrives at the total annual economic impact of vision problems: \$51.4 billion.

Graph 1.1 Total Annual Economic Impact of Vision Problems in the U.S.



Note: While they both can be considered direct costs, "medical care expenditures" and "direct medical costs" are categorized separately in this report, as they are contained in separate studies and rely on differing elements. For the purposes of this report, *direct medical costs* can be thought of as the expenditures related to the disease management of AMD, cataracts, diabetic retinopathy, glaucoma and refractive error. *Medical care expenditures* refer to the costs associated with the health maintenance of the visual impairment and blindness consequences of these and other conditions.

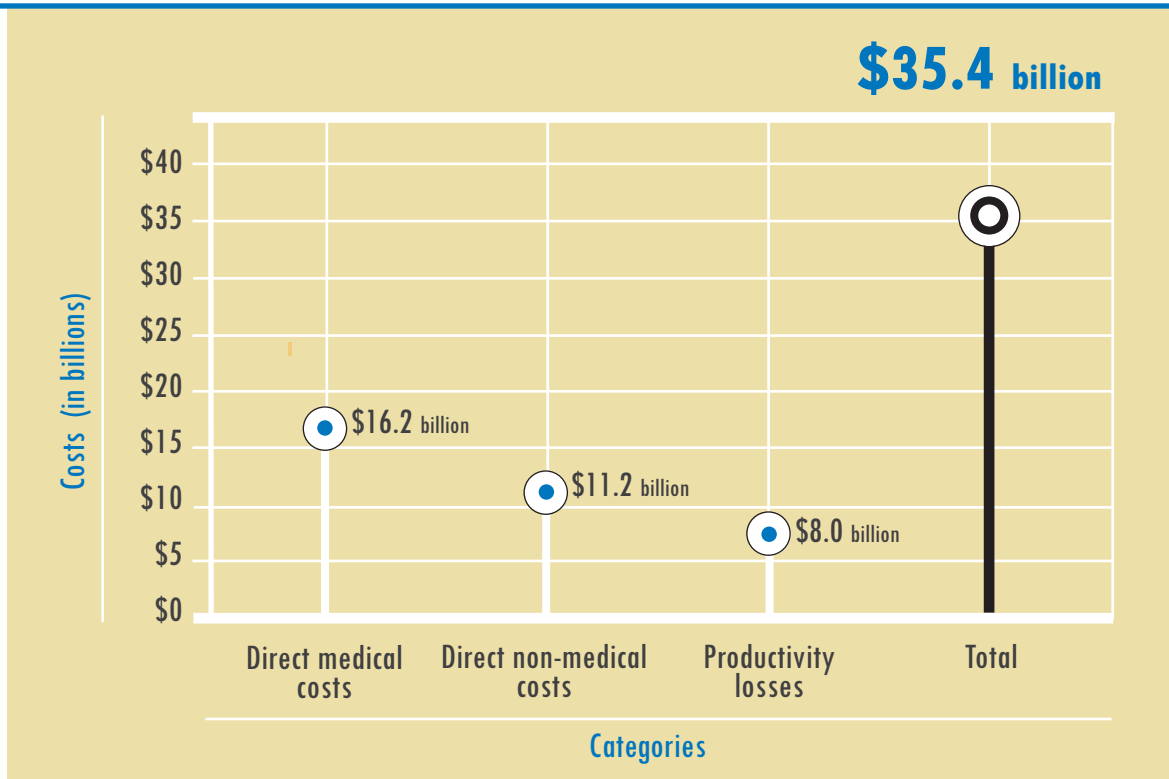
Annual Total Burden to the U.S. Economy of AMD, Cataract, Diabetic Retinopathy, Glaucoma, Refractive Errors, Visual Impairment and Blindness

Total financial cost to the U.S.

For the year 2004, the total financial cost to the U.S. of four common eye disorders (AMD, cataract, diabetic retinopathy and glaucoma), refractive error, visual impairment and blindness in U.S. residents aged 40 and older is estimated at \$35.4 billion.

Direct medical costs:	\$16.2 billion
Direct non-medical costs:	\$11.2 billion
Productivity losses:	\$8.0 billion
TOTAL:	\$35.4 billion

Graph 2.1 Annual Total Burden to the U.S. Economy of AMD, Cataract, Diabetic Retinopathy, Glaucoma, Refractive Errors, Visual Impairment and Blindness

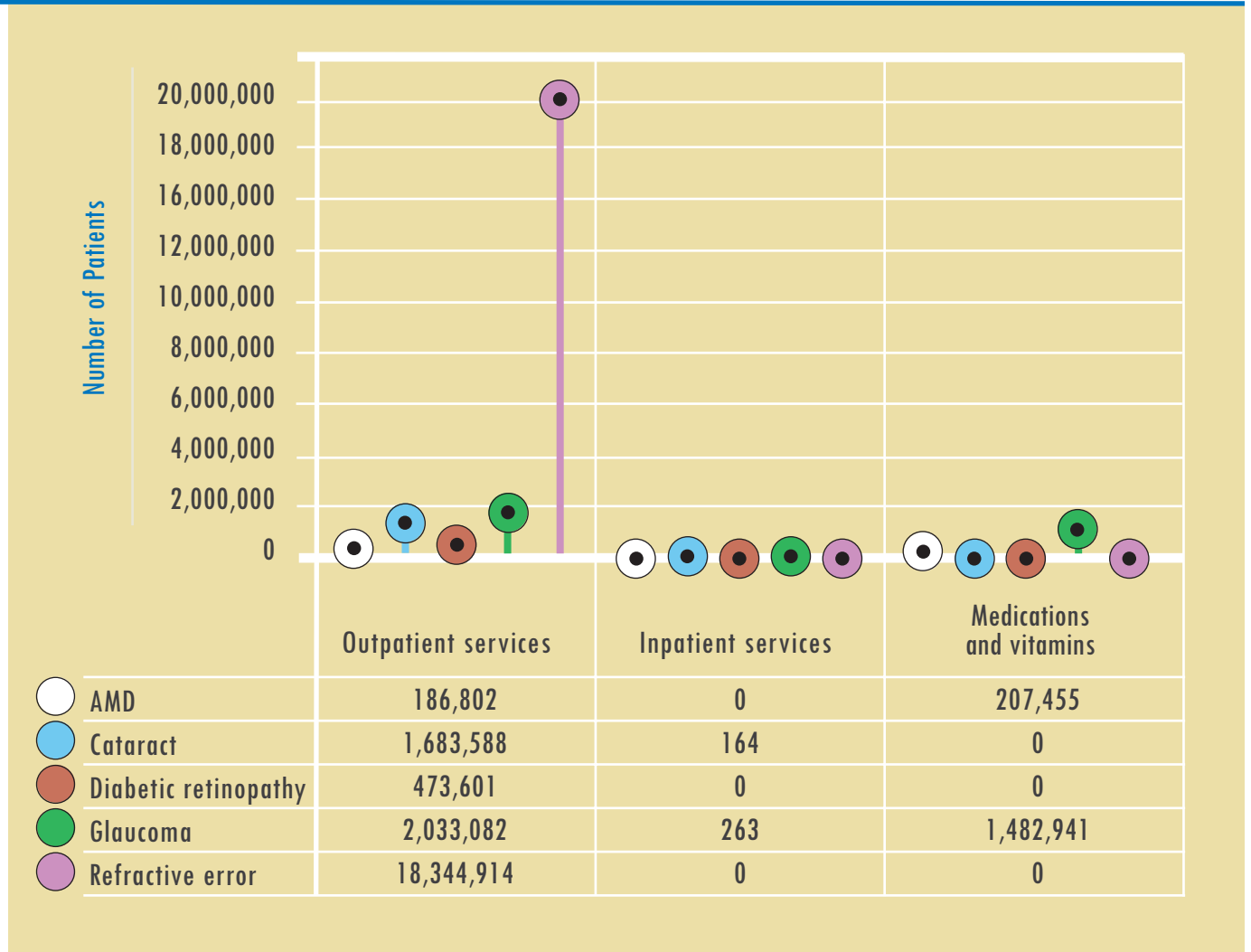


Number of patients (aged 40-64; 65+) incurring direct medical costs for AMD, cataract, diabetic retinopathy, glaucoma or refractive error

Shown first is the number of patients aged 40 to 64 with AMD, cataract, diabetic retinopathy, glaucoma or refractive error who incurred direct medical costs (outpatient services, inpatient services, medications and vitamins). The estimates are based on data from privately-insured patients, from the MarketScan Commercial Claims and Encounters Research Database.

Outpatient and pharmaceutical services comprise the majority of direct medical costs.

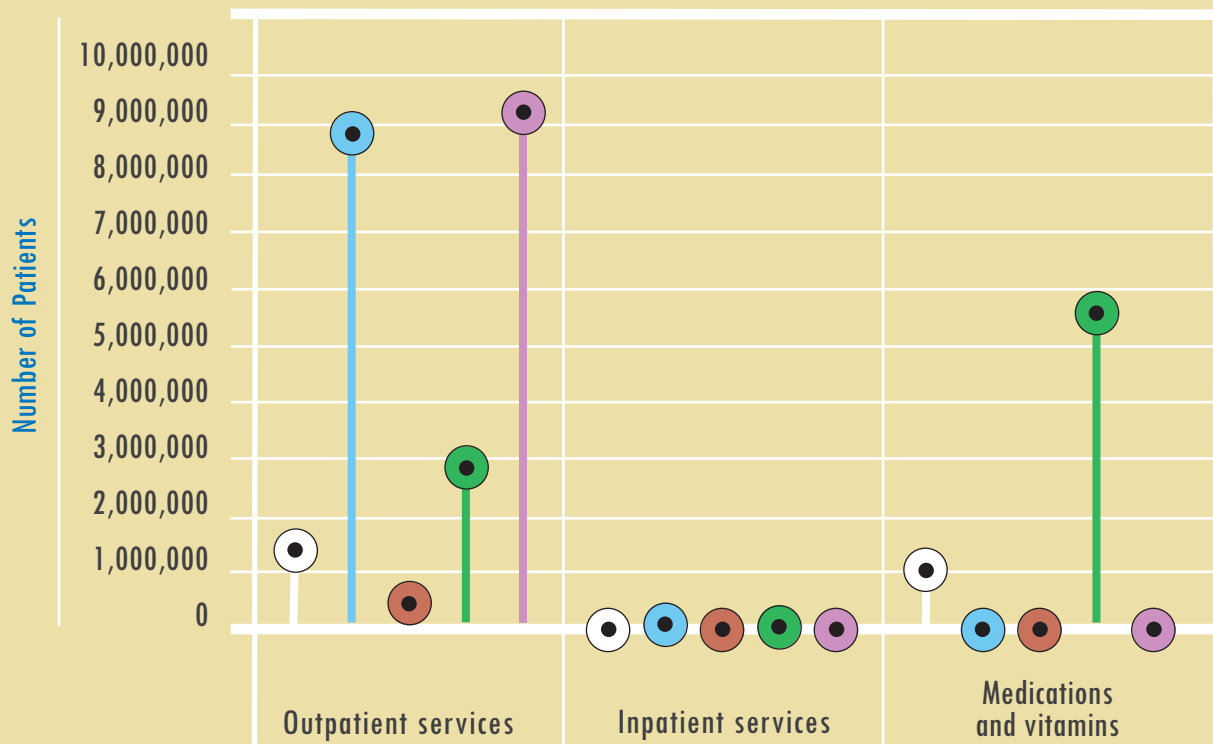
Graph 2.2 Number of Patients Aged 40 to 64 Using Medical Services, Medications and Vitamins



Next is the number of patients aged 65 and older incurring direct medical costs annually for each of the five vision disorders, based on Medicare claims data and the National Ambulatory Medical Care Survey.

The number of people seeking outpatient medical services in this age group has risen in all areas except refractive error, where it has fallen. The use of prescription drugs, vitamins and other medications has risen among people with glaucoma and AMD.

Graph 2.3 Number of Patients Aged 65 and Older Using Medical Services, Medications and Vitamins



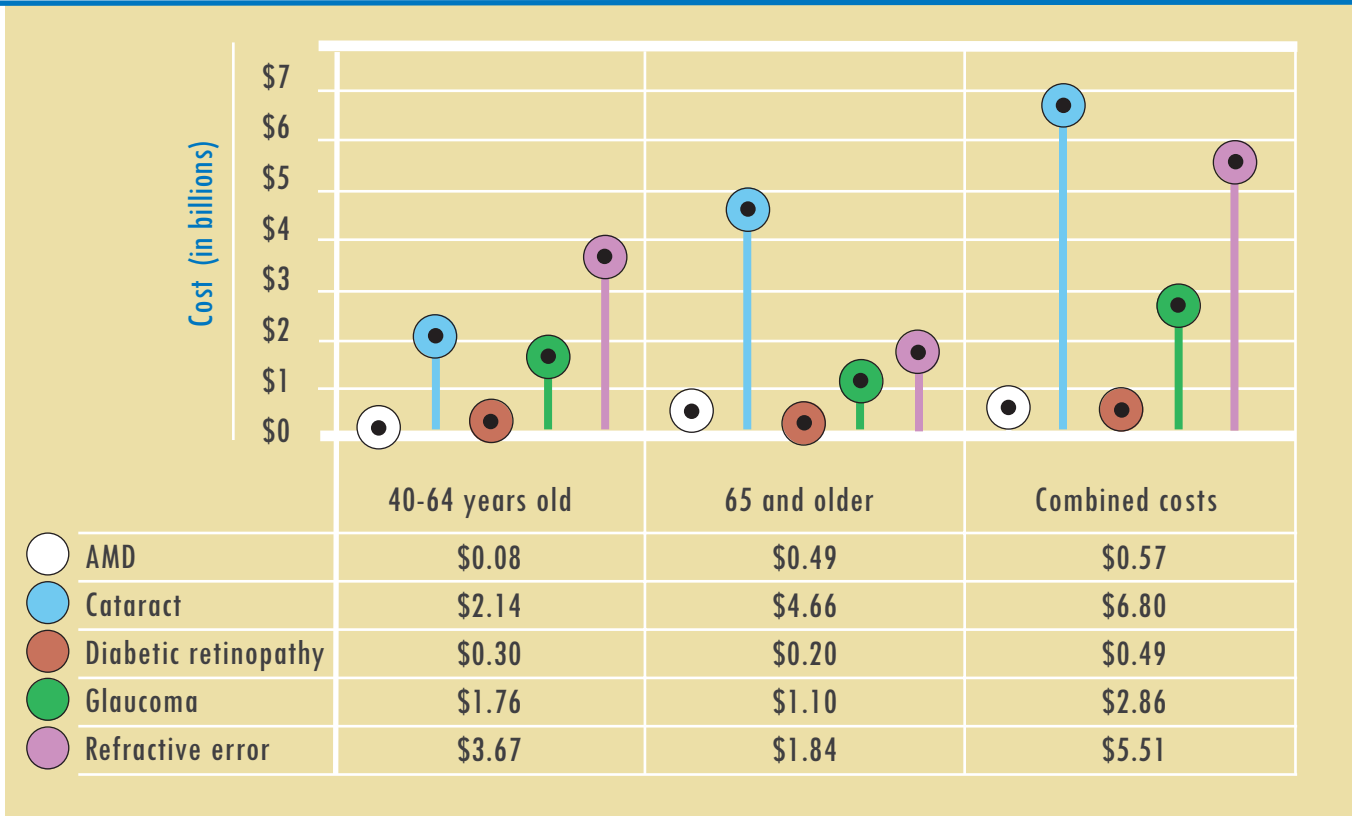
○ AMD	1,408,861	0	1,020,234
● Cataract	8,919,820	863	0
● Diabetic retinopathy	420,697	0	0
● Glaucoma	2,986,937	449	5,645,921*
● Refractive error	9,214,112	0	0

*The number for glaucoma medications represents the number of prescriptions for glaucoma medications and not the number of patients.

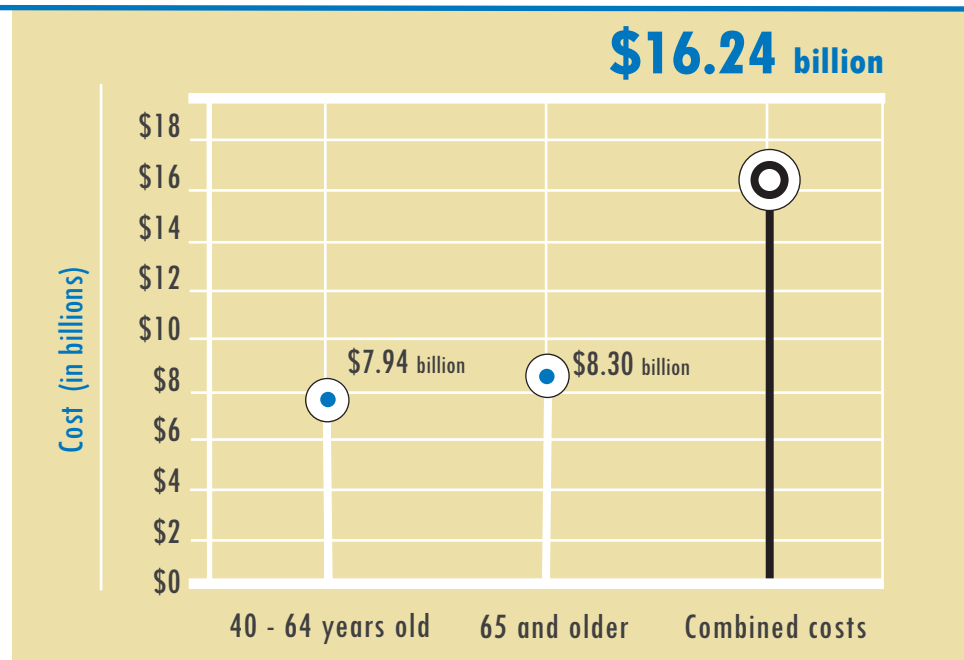
Direct medical costs by disorder

By combining direct medical costs for all patients, regardless of age, we achieve an overview of the source of the \$16.2 billion annual burden of these vision disorders to the U.S. economy.

Graph 2.4 Direct Annual Medical Costs for Outpatient, Inpatient and Prescription Drug Services



Graph 2.5 Total Direct Medical Costs by Age Group Combined



Direct medical cost per patient by disorder

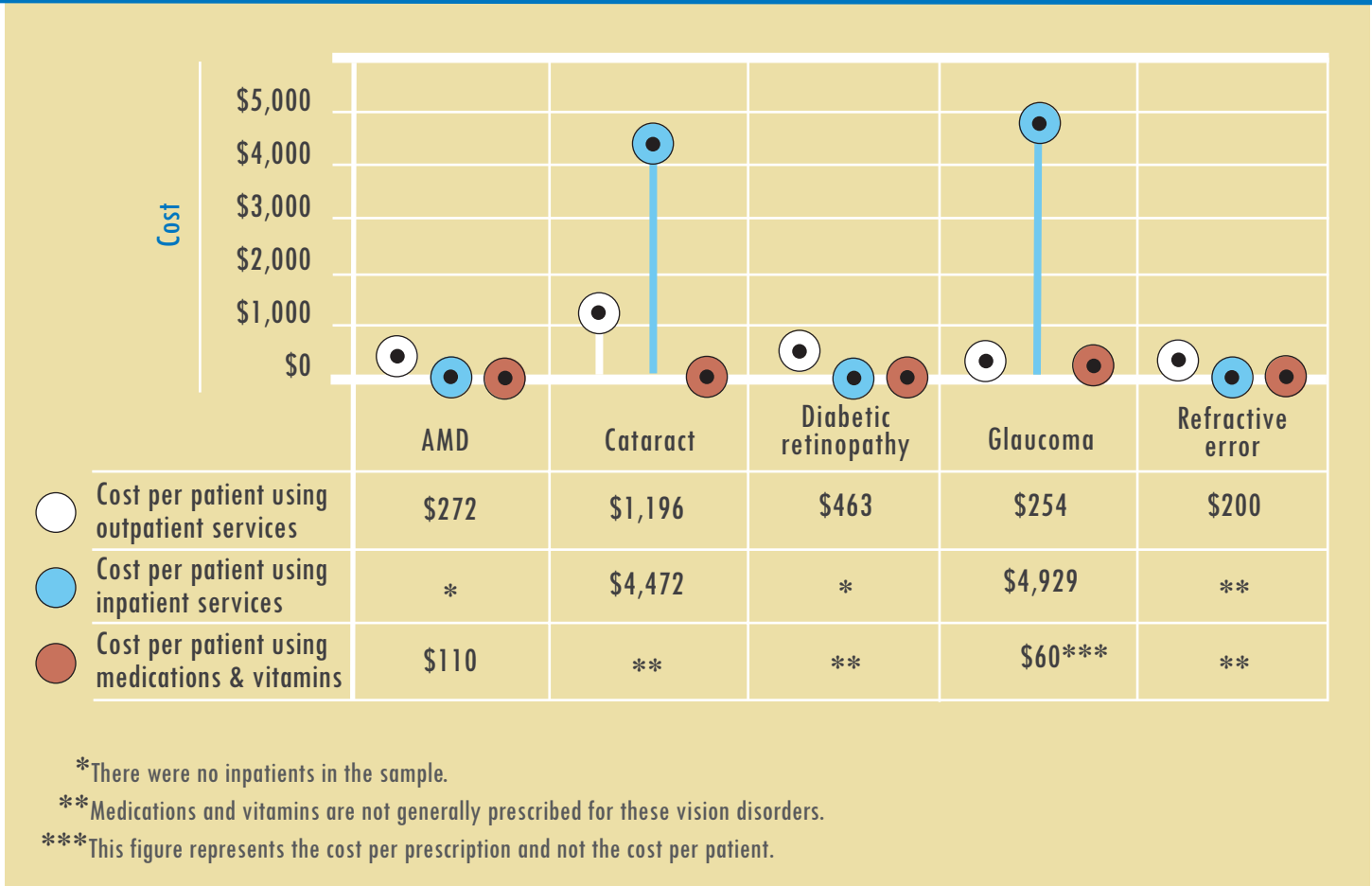
Outpatient and prescription costs comprise virtually all the direct medical costs for patients aged 40 to 64. The costs of outpatient service among those who used any services was \$305 for AMD, \$1,268 for cataract, \$629 for diabetic retinopathy, \$276 for glaucoma and \$200 for refractive error. Prescription costs, for people who used them, averaged \$110 per year for AMD (the estimated annual cost of vitamins recommended by AREDS, the Age-Related Eye Disease Study) and \$806 for glaucoma. Inpatient costs represent the average cost for patients who received inpatient services. Although these appear high for cataract and glaucoma, **only an extremely small proportion of total patients with these vision problems received any inpatient services (see Graphs 2.2 and 2.3).**

Graph 2.6 Approximate Annual Direct Medical Cost per Patient per Disorder (40 to 64 years old)



For patients 65 and older, outpatient costs account for the majority of direct medical costs. Again, inpatient costs represent the average for patients who received these services and very few out of the total number of patients received any inpatient care.

Graph 2.7 Approximate Annual Direct Medical Cost per Patient per Disorder (65 and older)



Note: "Direct medical costs" broken out per disorder do not include costs related to ongoing consequences or symptoms of these conditions. Further, it remains unclear what effect recent treatment advances (such as those for AMD) or policy changes (such as prescription drug coverage) may have on these figures.

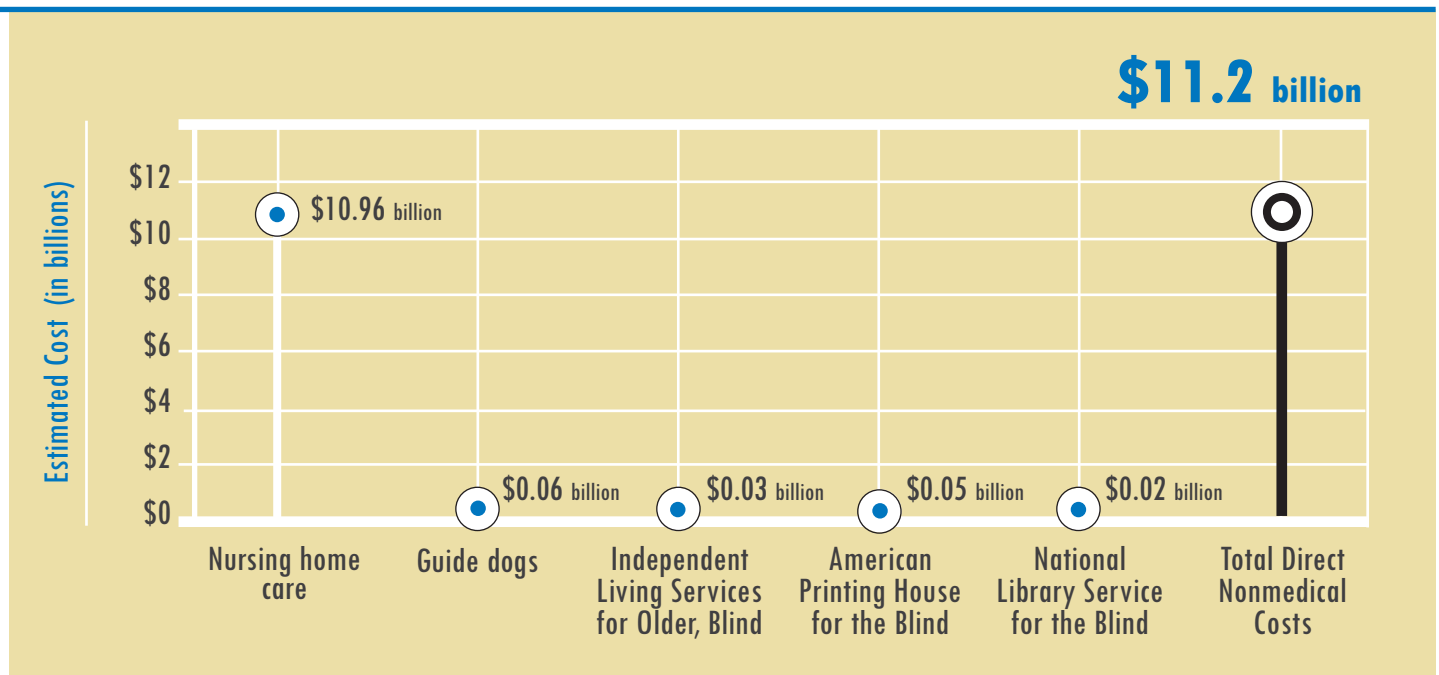
Direct nonmedical costs

Direct nonmedical costs refer to costs attributed to nursing home care, guide dogs and government programs for people who are visually impaired or blind. The government programs are the Department of Education's Independent Living Services for Older Individuals Who are Blind; the American Printing House for the Blind; and the Library of Congress' National Library Service for the Blind and Physically Handicapped.

Nearly \$11 billion of the total \$11.2 billion in direct nonmedical costs goes to nursing home care.

Nearly \$11 billion of the total \$11.2 billion in direct nonmedical costs goes to nursing home care. While only 4.3 percent of the general population aged 65 and older live in nursing homes, for people who are visually impaired or blind the proportion is 16 percent and 40 percent, respectively.

Graph 2.8 Estimated Direct Nonmedical Costs for People Who Are Visually Impaired or Blind

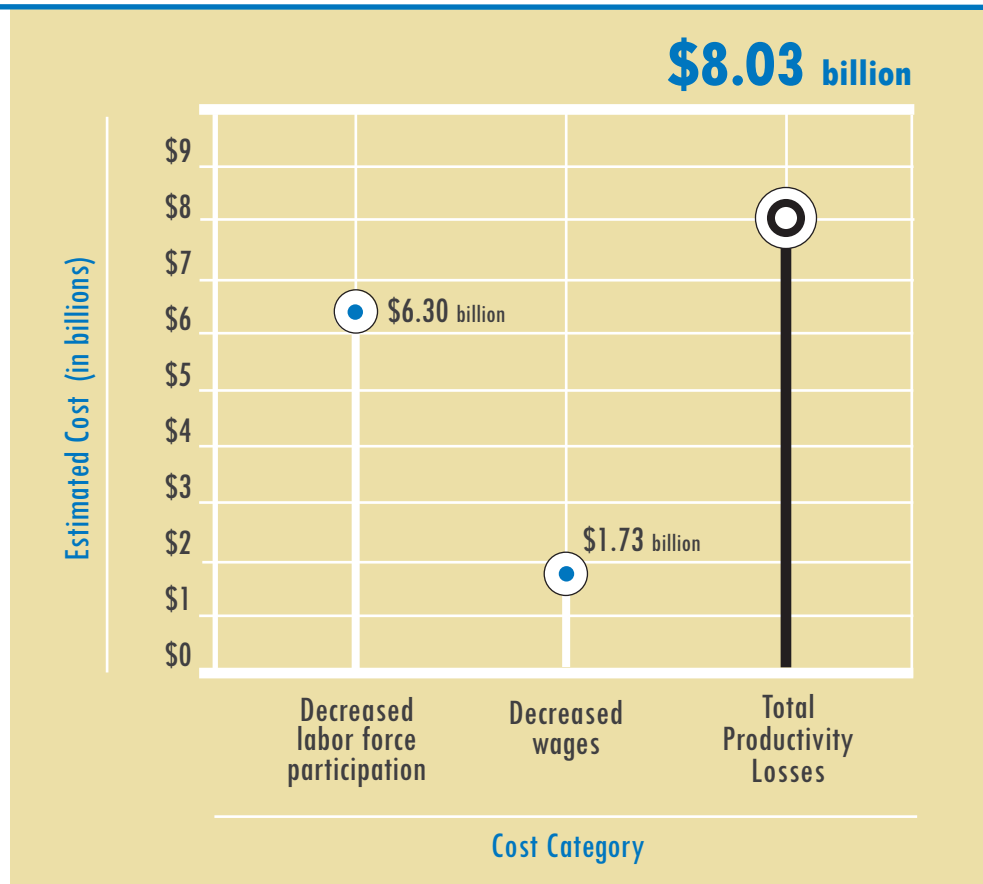


Lost productivity

Lost productivity refers to the cost to the U.S. of lower labor force participation and lower wages for people who are visually impaired or blind compared to people in the same age group with normal vision.

According to estimates based on data from the 1997 Survey of Income and Program Participation, approximately 15,583 visually impaired and 74,133 blind people would have worked if they were fully sighted. Assuming the same average annual wage for people with normal vision (\$33,195) it is estimated that the reduced labor force participation of these individuals accounts for \$6.3 billion in lost productivity annually. Assuming, also, lower earnings by an estimated 125,882 visually impaired and 40,671 blind people who do work, there is an added productivity loss of \$1.7 billion, for a total of \$8.0 billion in lost productivity.

Graph 2.9 Estimated Cost of Reduced Labor Force Participation by People Who Are Visually Impaired or Blind



Annual Excess Economic Burden of Visual Impairment and Blindness for Individuals Aged 40 and Older

Total excess monetary impact

Visual impairment and blindness in individuals aged 40 and older are associated with significantly higher medical expenditures, a greater number of informal care days and a decrease in health utility. Informal care, in this case, refers to unpaid care provided by people not living with the visually impaired or blind person.¹ To translate days of care into a dollar value for care, a monetary value was assigned to the days of informal care. (Informal care was valued by assuming that each day involved eight hours of care and that each hour was valued at the 2004 minimum hourly wage of \$5.15.) Health utility (e.g., distress, pain, depression, mobility, social limitations) was converted into quality-adjusted life years (QALYs). (One year of perfect health is worth one QALY.) In the U.S., one year of perfect health is often valued at \$50,000 per year, although the "correct" value of this number is subject to serious debate.

The total excess monetary impact of visual impairment and blindness, attributable to medical and informal care, is estimated at **\$5.48 billion** annually. An additional annual health utility loss of approximately **\$10.5 billion** is based on a loss of 209,200 QALYs (209,200 x \$50,000).

Excess medical care expenditures	\$5.12 billion
Excess informal care costs	\$0.36 billion
	<hr/>
	\$5.48 billion
Health utility loss	\$10.5 billion

¹ No data were available to report on the amount of informal care provided by household members. The data source was the 1996-2002 Medical Expenditure Panel Survey (MEPS). The collective economic impact on the population of visually impaired and blind individuals was estimated by projecting average effects on individuals. According to the most recent 2004 figures by the U.S. Census Bureau, 2.6 million are visually impaired and 1.1 million Americans are blind.

Table 3-1 Demographic Characteristics of the Participants in the 1996-2002 Medical Expenditure Panel Survey (MEPS) Aged 40 and Older

Vision status	Number of participants	Less than high school education	High school education or GED	Some college	College or more	Married	Health status reported as excellent or very good
Visually impaired	6,288	33%	33%	18%	17%	47%	33%
Blind	512	35%	34%	15%	16%	45%	30%
Not visually impaired	70,711	20%	34%	21%	25%	68%	60%

Demographic and health data

Table 3-1 shows demographic and health data representing participants in the 1996-2002 Medical Expenditure Panel Survey aged 40 and older. The majority of the 77,511 participants over the seven years reported no visual impairment; 6,288 reported visual impairment; 512 reported being blind.

People who are visually impaired or blind are less likely to report excellent or very good health. They are more likely to lack private health insurance. They are more likely to have hypertension or diabetes and to have lower mean incomes.

Excess medical expenses for visual impairment and blindness

Visual impairment, compared to no visual impairment, is associated with over \$1,000 of excess medical expenses and a little more than a day of informal care days. Blindness, compared to no visual impairment, is associated with over \$2,000 of excess annual medical expenditures per

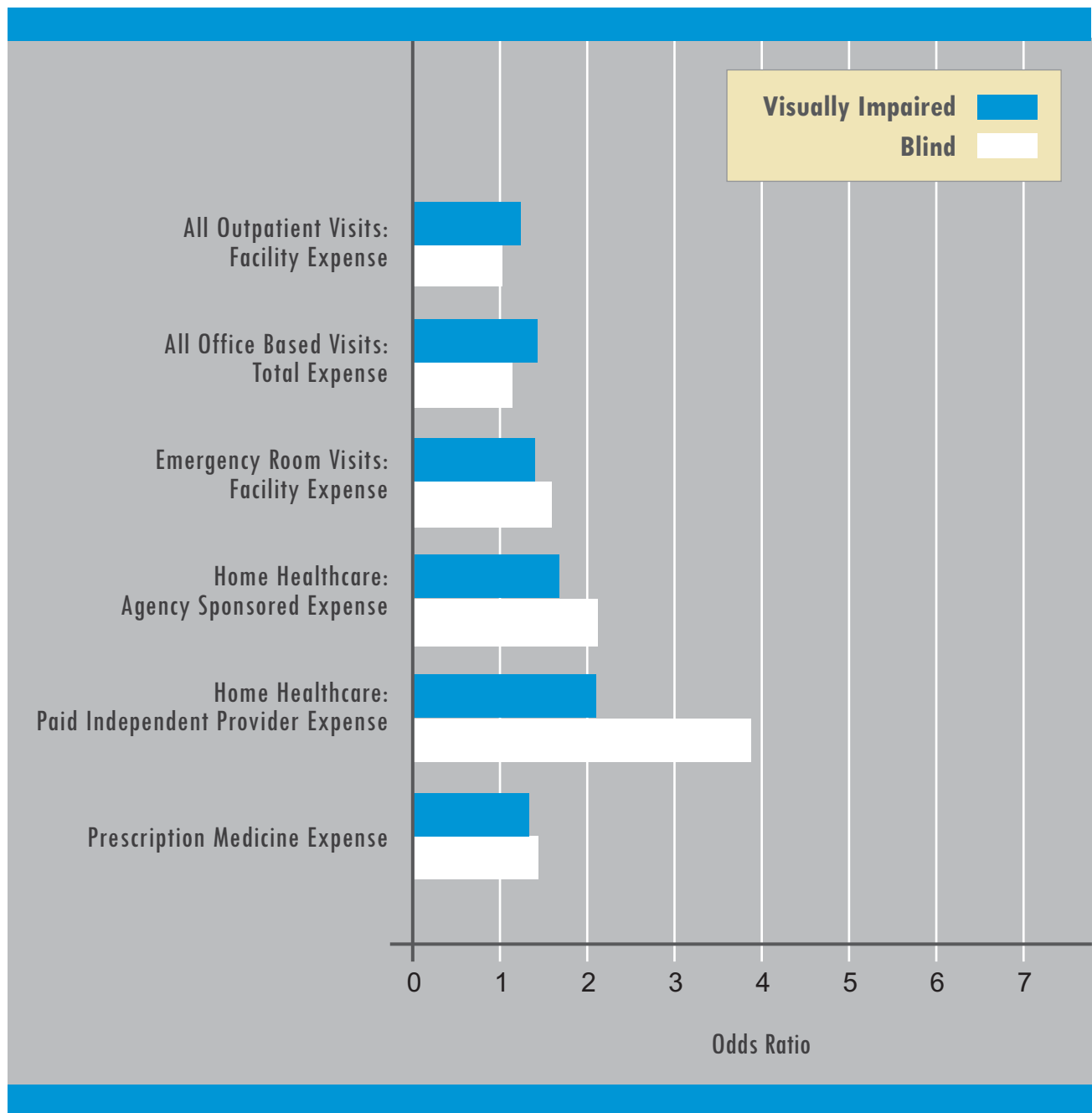
Any private insurance	Public insurance only	Uninsured	Diabetes	Hypertension	Age	Total income	Family size
61%	29%	10%	18%	38%	62	\$25,152	2.0
54%	39%	7%	22%	41%	67	\$20,658	2.0
77%	15%	8%	9%	26%	57	\$34,139	2.6

year and to more than five extra days of informal care from someone outside the household. The negative impact on quality of life is approximately 50 percent greater for blindness than it is for visual impairment.

Table 3-2 Excess Expenditures Related to Visual Impairment and Blindness

Vision status	Total excess medical expenditures (in 2004 dollars)	Informal care days	Health utility
Visual Impairment	\$1,037	1.2	-4.8
Blindness	\$2,157	5.2	-7.5

Table 3-3 Odds of Additional Medical Care Expenditures



Excess medical expenses are tied mainly to home healthcare expenditures, particularly from private providers. In other words, for people who are visually impaired or blind, most of the additional medical dollars are spent on home healthcare, sometimes provided by a nursing agency and other times provided by a private individual. Table 3-3 shows several medical expenses and the odds of each being more likely among individuals with visual impairment. An "odds ratio" of 1 implies no difference in the likelihood of medical expenditures between people who are visually impaired and those who are blind.

The \$5.48 billion in total excess expenditures for people who are visually impaired or blind represents nearly \$1,479 per year for 3.7 million people. At this rate, an individual accumulates nearly \$12,000 in vision-related expenses in 8 years. Including QALY losses, the calculation increases by \$2,823 to approximately \$4,302 per person per year.

Methods and Sources

For their analyses, Rein and colleagues used private claims and Medicare data to estimate direct medical costs, epidemiological evidence from various published sources to estimate other direct costs and data from the Survey of Income and Program Participation (SIPP) to estimate productivity losses. SIPP is a product of the U.S. Census Bureau. To estimate the impact of vision disorders on state and federal budgets, they added the annual cost of income assistance programs, tax losses, and medical and other direct costs borne by taxpayers.

Frick and colleagues used pooled data (1996-2002) from the Medical Expenditure Panel Survey (MEPS) to estimate the relationship of visual impairment and blindness in individuals aged 40 and older to total medical expenditures, components of expenditures, days of informal care received and health utility. MEPS, administered by the Agency for Healthcare Research and Quality of the U.S. Department of Health and Human Services, is a collection of data from patients, families, doctors, hospitals, pharmacies, employers and others across the U.S. Frick's estimates are based on weighted linear regressions including confounders such as comorbidities and demographics. The cumulative economic impact of visual impairment and blindness is estimated by projecting the average individual effects to the entire population of visually impaired and blind individuals based on information from *Vision Problems in the U.S.*

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Advising Organizations

Throughout the development of this report numerous organizations provided insight and guidance, including: American Academy of Ophthalmology, American Academy of Optometry, American Optometric Association, American Society of Ophthalmic Registered Nurses, Association for Research in Vision and Ophthalmology, Centers for Disease Control and Prevention, Lighthouse International, National Alliance for Eye and Vision Research, National Association of Chronic Disease Directors and National Eye Health Education Program.

Investigators

Research described in this report was conducted by two teams of investigators. Their original work was published in two separate journal articles. We gratefully acknowledge the invaluable contribution of data from their work.

"Economic Impact of Visual Impairment and Blindness in the United States," Archives of Ophthalmology, April 2007

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