

GREAT EXPECTATIONS:
POTENTIAL ECONOMIC BENEFITS TO THE NATION
FROM ACCELERATED BROADBAND DEPLOYMENT TO
OLDER AMERICANS AND AMERICANS WITH
DISABILITIES

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**Great Expectations: Potential Economic Benefits to the Nation From Accelerated
Broadband Deployment to Older Americans and Americans with Disabilities
by**

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Abstract

Though it is widely understood that broadband technologies that allow rapid and “always on” connections to the Internet will provide significant benefits to the U.S. economy, this report is the first to estimate the economic benefits to the nation due to cost savings and output expansion resulting from the use of broadband technologies for an important specific sub-group of the U.S. population: the roughly 70 million Americans who are over 65 or under that age but have disabilities.

Three types of benefits from broadband deployment and use are addressed: lower medical costs; lower costs of institutionalized living; and additional output generated by more seniors and individuals with disabilities in the labor force. Considered together, these three benefits are estimated to accumulate to at least \$927 billion in cost savings and output gains in 2005 dollars (with future benefits discounted for the “time value of money”) over the 25 year period, 2005 to 2030. This amount is equivalent to half of what the United States currently spends annually for medical care for all its citizens (\$1.8 trillion). As large as these benefits may appear, they are line with previous estimates for the benefits of broadband for the population as a whole.

Policies designed to accelerate the use of broadband for these populations, however, could significantly add to the benefits, by cumulative amounts ranging from \$532 billion to \$847 billion (depending on the wages earned by the additional working seniors). The policy benefits are as substantial as what the federal government is likely to spend on homeland security over the next 25 years. Total cumulative benefits, under the right set of policies, could exceed what the United States currently spends annually for health care for all its citizens.

Clearly, with so much at stake, policymakers have strong reasons to consider measures to accelerate the deployment and use of broadband technologies for America’s seniors and individuals with disabilities.

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Executive Summary and Key Findings

America is getting on the broadband wagon. According to the most recent estimates, at least one in three U.S. households now has a broadband connection to the Internet, or one that is “always on” and that receives and sends data at far faster speeds than are available through “dial-up” telephone service.

There is wide agreement that broadband will provide enormous benefits to users and to the entire economy, especially as the take-up rate increases. But so far, relatively little attention has been paid to the potential benefits to be reaped by different groups within American society and how this in turn will generate economic benefits and cost savings over time.

It will not surprise many to know that the young – who typically are among the first to adopt many new technologies – have benefited and will continue to benefit greatly from the use of broadband. But it turns out that broadband technologies also hold great promise for a different, important and growing segment of the U.S. population: the 35 million Americans over 65 and as many as 36 million non-elderly Americans with disabilities. This report estimates the potential economic benefits of broadband for these populations from three sources: lower medical costs for both seniors and individuals with disabilities (which can be realized largely through broadband “in the background” rather than through individuals tapping away on computers); lower costs from delayed or avoided institutionalized living arrangements for senior citizens and individuals with disabilities; and additional output made possible by increased labor force participation by individuals in both groups.

The economic benefits are estimated under two broad scenarios and presented in cumulative dollar amounts, discounted by an appropriate interest rate, as of three dates, 2010, 2020 and 2030:

-- The first, “business as usual,” scenario assumes that broadband continues to penetrate and benefit the populations of seniors and individuals with disabilities at rates that roughly continue past patterns (though eventually slowing down).

--The second, “broadband policy,” scenario assumes that a comprehensive set of policies is adopted to accelerate broadband deployment and to remove key legal and institutional obstacles that currently inhibit broadband technologies from benefiting seniors and individuals with disabilities to the fullest extent currently foreseen to be possible.

Admittedly, there are considerable uncertainties surrounding all of these estimates, which in part are addressed by discounting future benefits at a somewhat higher rate than is currently used by the federal government to discount benefits of proposed regulations. In addition, where applicable, the estimates are presented in ranges. Nonetheless, the estimates presented here should capture the magnitude of the potential benefits, which are substantial.

Taken together, the estimates imply that under the business as usual scenario, broadband technologies used to benefit seniors and individuals with disabilities can generate between \$89 billion and \$150 billion in cumulative benefits by 2010, and substantially larger cumulative totals by 2030: \$927 billion to \$1.34 trillion. The \$927 billion lower bound figure (reflecting the assumption that the additional working seniors on account of broadband earn, on average, only half of what they currently earn) is equivalent to half of what the United States currently spends in a single year for medical care *for all its citizens* (\$1.8 trillion).

More importantly, policies that would accelerate broadband use to benefit seniors and individuals with disabilities could significantly increase the total benefits. As derived from the estimates shown in Table S1, by 2030, the cumulative benefits would rise by \$532-847 billion under the “policy scenario” (the range depending on the average earnings of the additional working seniors).

For further details, Table S1 breaks the cumulative estimates down by category, by year, and by scenario.

None of the economic estimates include the additional benefits of lives saved and quality of life improvements made possible by broadband.

**Table S1: Summary of Output Gains and Cost Savings
(Entries are in Billions of 2005 dollars)**

Scenario/Year	Base 2010	Policy 2010	Base 2020	Policy 2020	Base 2030	Policy 2030
Output	\$61-122	\$114-228	\$224-447	\$402-804	\$411-822	\$726-1,452
Health	\$28	\$49	\$208	\$352	\$516	\$733
Total	\$89-150	\$163-277	\$432-656	\$754-1,156	\$927-1,338	\$1,459-2,185

To place these estimates in perspective, the potential cumulative economic benefit of policies designed to accelerate broadband use for seniors and individuals with disabilities is comparable to what the federal government is likely to spend on homeland security measures during the next 25 years (an estimated \$620 billion).

Introduction

America is graying. Currently, about 35 million, or 12 percent of the U.S. population, are over the age of 65. By 2030, the Census projects those over 65 will number 71 million, accounting for 21 percent of the population. The reasons are straightforward and commonly understood: the retirement of the baby boom generation and longer life spans due to advances in medical technology.

Many Americans have some kind of disability. Depending on the definition of the term, as many as 50 million individuals are in this category, of which as many as 36 million are under the age of 65 (non-senior citizens with disabilities).

America has multiple government programs in place to meet the special needs of senior citizens and individuals with disabilities. These programs are already hugely expensive, however, and will grow more so over time, as these populations grow and as technology continues to drive up the cost of health care in general. The same forces will also contribute to rising private sector health care costs incurred by senior citizens and individuals with disabilities.

For example, the federal government spent approximately \$360 billion in 2004 for medical care for senior citizens under the Medicare and Medicaid programs. The government spent additional amounts for medical care for senior veterans. The National Health Expenditures, published by the Centers for Medicare & Medicaid Services, projects that real (inflation-adjusted) Medicare and Medicaid spending will increase 3-4% annually from now until 2014. Unless these programs are changed, it is reasonable to expect a similar rate of increase through 2030, at which point the federal government will spend more than \$970 billion (in 2005 dollars) on Medicare/Medicaid for senior citizens.²

Already, there is a vigorous public debate about how to financially sustain the Social Security program going forward. This debate eventually will be expanded to cover the huge challenge of paying for all other government programs for senior citizens, possibly including programs that cover medical costs for individuals with disabilities.

Governments and individuals will be looking for many ways to reduce the financial burden of these programs – both through cost savings and expansion of national output (which would generate more government revenues). One prominent federal effort is to bring health care into the 21st century by facilitating the widespread use of electronic medical records (EMR).

Broadband: An Unrecognized Source of Potentially Significant Cost Savings

This report examines another important, and heretofore unrecognized, source of potentially significant cost savings for both the public and private sector, and possibly output (and thus revenue) expansion: the broader use of the Internet, and specifically “broadband” technologies, to deliver health care services and information to senior citizens and individuals with disabilities, and to make it easier for members of both populations to work, if they are willing to do so.

² See CMS [2005] for detailed projections. Estimates are similar to those found in CBO [2005]. Medicare and Medicaid spending is assumed to grow at 7.5% and 8% in nominal terms, respectively, after 2014. The inflation adjustment used to arrive at projections for real spending is the rate of projected increase in *health care* prices in particular, which can be found in CMS (2005) through 2014 and is assumed to increase at 4% annually thereafter. It is also assumed that the proportions of the expenditures under both programs spent on the elderly (85% of Medicare and 25% of Medicaid) remain constant.

For purposes of this report, broadband is defined as any technology – currently, cable, telephone-based (DSL), wireless, or through electric power lines (in its nascent stages) – that permits users to communicate at rates substantially faster than older generation “dial-up” services, and unlike dial-up services, is “always on.” As providers lay fiber optic cables to the home (they are now almost exclusively used for transporting data out of neighborhoods and across long distances), speeds will multiply by perhaps as much as 100-fold. Given the rapid pace of technological change in communications, it is conceivable that communications speeds in the future, and well before the outer limit of this report (2030), will be even faster than this. Importantly, broadband also is an “always on” technology that can be used in a variety of new ways, including the monitoring of elderly, infirm, or individuals with disabilities, and the delivery of medical care directly through “telemedicine,” or two-way video communication between patients and health care providers.

For many, the term “broadband” conjures up images of individuals plugged into their PCs, browsing the Internet, and frequently downloading songs or even movies at speeds once thought to be impossible. In fact, many senior citizens and individuals with disabilities currently use broadband in precisely this way.

But broadband is about much more than personal computers, which are only one way to access the Internet. Already today, millions of Americans (and many more around the world) use their cell phones and other wireless devices (such as personal digital assistants or PDAs) to access the Internet through broadband technology. Wireless is also becoming the method of access for many PC users, especially as more city governments roll out plans to turn their cities into giant Wi-Fi “hot spots.” Millions more users will take advantage of one or more broadband access technologies in the future, especially as Internet access devices proliferate and prices for both them and the service come down.

Indeed, broadband will be built into many other devices or goods – into homes, clothes and other things people wear (wristwatches, eyeglasses, hearing aids, for example), automobiles, and various appliances. This will significantly enhance broadband penetration throughout the population. In short, *broadband eventually will be ubiquitous*, not just for the young who are always the early adopters of any new technology, but for people of all ages, whether or not they want to or know how to use a personal computer.

Broadband will also confer benefits on society that exceed – very likely far exceed – the benefits that individuals believe they will get from it when they purchase access to it. That is because, like other networks, broadband technologies are *platforms*, on which a variety of services have been and will continue to be built.

Consumers who buy a basic broadband service, however, only take account of the benefits they privately derive from the service – such as entertainment, information, and education. They have no reason or incentive to take account of or to anticipate the broader social benefits the platform enables, such as the “network externalities” that users create for others by enlarging the network and by providing added incentives for more

content creators to develop more and better applications for Internet users. For example, it is unlikely that subscribers to broadband only several years ago realized the full extent to which they would soon have access to music, videos, video games and the wealth of information that is now available on the Internet. Or that they would have a platform – via eBay – to join in what is now surely the world’s largest market for used merchandise.

Specific Broadband Applications and Scenarios

This report focuses on certain specific content or applications of broadband targeted at senior citizens and individuals with disabilities that will lead to lower medical costs for these individuals, and will allow some individuals who otherwise would be placed in expensive institutional care facilities to continue to live independently for some additional period of time, or even indefinitely. In addition, the report quantifies the potential benefits (additional income) to the economy that broadband should generate by enabling more individuals within these two populations to work for longer periods.

The report outlines savings/output estimates under two “scenarios”: “business as usual,” which assumes that broadband penetration and content development will continue roughly at past rates (though eventually slowing down) and under “broadband policies” that accelerate the use of broadband and related content. The report recognizes the considerable uncertainty surrounding the estimates, by presenting them in ranges. Still, readers should consider the estimates to be only “order of magnitude” illustrations of the kinds of savings and additional output that broadband technology might bring through applications and content tailored for senior citizens and individuals with disabilities.

The Changing Demographics of America

There are many ways in which the face of America is changing. Increasingly, more Americans are non-Caucasian and foreign born, and this trend is certain to continue. This report concentrates on two other important demographic trends: the rising number of senior citizens and those with some form of disability.

By 2030, there will be about 70 million Americans aged 65 or over, more than twice their current number. Total population also will increase over the next 25 years. But the number of senior citizens will grow more rapidly. By 2030, those 65 or older will account for 21 percent of the population, up from roughly 12 percent in 2000.³

Many Americans, elderly and non-elderly also have some disability. There are many definitions of disability. Perhaps the narrowest is the one used for granting disability payments under the Social Security System. By this measure, roughly 10 million Americans had some form of disability as of 2004.⁴

³ Estimates and projections come from the 2000 Census (see www.census.gov) and from Rogers, et al [2000].

⁴ These include individuals receiving benefits under either the SSDI and SSI programs, eliminating some who may be eligible for both programs.

The decennial census uses a broader definition, including all individuals who say that they have a substantially limiting sensory or physical condition.⁵ By this standard, approximately 50 million people had some form of disability in 2000.⁶ Of these, 36 million were below the age of 65 (and above the age of 5), and 14 million over 65. For purposes of this report, when mention is made of non-elderly individuals with disabilities, the reference will be (unless otherwise noted) to this current population of roughly 36 million (it is a bit larger now, given that five years have passed since the last census).⁷ This figure represents 16 percent of the total number of Americans between the ages of 5 and 65 in 2000.

Broadband: Some Background

Though the Internet stock bubble “popped” several years ago, there can be little doubt that the economy and indeed our larger society is rapidly changing and benefiting from the Internet. It is a rare business today that operates without the Internet. Much of the labor force is now accustomed to using the Internet, if not at home, then at least at work.

Several years ago, this report’s author co-wrote two studies that attempted to quantify the benefits of Internet usage for the economy as a whole. These studies implicitly assumed that users increasingly would use broadband-based Internet technologies (indeed business users of the Internet, who were the main objects of these studies, already were using dedicated lines that had communication speeds considerably faster than residential dial-up service). One study [Litan and Rivlin, 2001] was based on projections of cost savings in eight different sectors of the economy over a five-year period, 2000-2005. The other study [Varian et al, 2002] was based on survey findings from officers at roughly 2,000 U.S. companies.⁸

Both studies came to roughly the same conclusion: that the Internet would lower costs and thereby add to gross domestic output amounts equivalent to ¼ to ½ of one percent annually over this period. Put differently, after five years, GDP would be roughly 1.25 percent to 2.5 percent higher than it otherwise would be without the Internet. In absolute dollars, those figures translated into roughly \$125-250 billion in additional output *per year* by 2005 (in 2000 prices).

Robert Crandall and Charles Jackson [2003] have estimated the economic benefits associated with broadband in particular. Using the best data they had at the time, Crandall and Jackson estimated that, if it reaches a 94 percent penetration rate (the same as

⁵ See Census 2000, question 16: “Does this person have any of the following long-lasting conditions: a) blindness, deafness, or a severe vision or hearing impairment; b) a condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying?”

⁶ See the U.S. Census, Table 3 at <http://www.census.gov/prod/cen2000/phc-2-1-pt1.pdf>.

⁷ See Waldrop and Stern [2003]. Individuals with disabilities numbers cover the civilian, non-institutionalized population over age 5.

⁸ Separate calculations were made for three European countries – the United Kingdom, France, and Germany – all of which were then considerably behind the U.S. in the use of the Internet in commercial activity.

telephones), broadband ultimately could generate “consumer surplus” of as much as \$300 billion *per year* over an extended period. Extended over a lengthy period, such as the 25 years covered by this report, the cumulative addition to consumer surplus runs into several trillion dollars (discounting future benefits at some positive interest rate). The concept of consumer surplus is discussed further below.

Defining Broadband

As used in this report, “broadband” refers to technologies that allow access to the Internet through some device (typically a personal computer, but increasingly through other devices) that is “always on” (assuming the device for access is turned on) and communicates at the rate of at least one million bits per second (mbps), or much more rapidly than “dial-up” service over ordinary copper telephone lines, 28-56 thousand kilobits per second (kbps) or even faster ISDN service (at speeds of up to 128 thousand kbps).⁹

In the commercial context, broadband is delivered over dedicated T-1 and T-3 (or DS-1 and DS-3) transmission lines. In the residential market, there currently are three dominant broadband technologies: cable modems, which use coaxial cables (with speeds that vary, depending on the number of users online in a neighborhood at any one time); Digital Subscriber Lines, or DSL, which “speed up” the existing copper wire network; and wireless/satellite systems. In addition, broadband delivered through electric power lines is in its very early stages.

The broadband market is very dynamic, however. “Wi-Fi” networks are proliferating in cities, airports, certain restaurants and other public locations. Newer wireless services, such as “WiMax” and third generation (3G) services are now being rolled out. Even faster broadband is fiber to the home (FTTH), which also is in its infancy, but eventually promises transmission rates of up to 100 mbps, or roughly 100 times faster than the typical residential broadband technologies currently in use in the United States.

As broadband speeds increase, the technology will be able to handle more sophisticated content (movies, for example) and greater volume. In turn, better content is likely to deliver greater cost savings and output gains for the target population of this report (and indeed for the population as a whole).

Current Broadband Usage

Although, as of 2003, official government statistics indicated that only a little more than half of all American households had some type of Internet access, more recent private data indicate that the Internet household penetration rate now may exceed 70 percent [Crandall, 2005, p. 110]. Broadband penetration, however, is substantially less, at

⁹ It should be noted that different sources may use different speed thresholds when defining “high-speed” or “broadband.” The FCC, for example, defines broadband as any connection over 200 kbps. See FCC [2005].

roughly one-third of all U.S. households, though this fraction has been steadily increasing.¹⁰

It is important to distinguish between *access to* and *usage of* broadband, for the terms have very different meanings. Virtually all Americans now have “access to” DSL, cable or some form of wireless broadband service.¹¹ But most Americans who could purchase broadband do not do so because they apparently do not believe that the content justifies the price – typically about \$40 per month (though some services are now substantially cheaper than this).

Much is made of the fact that the United States lags behind other countries – notably Korea, Japan and Canada – in broadband take-up or use. For example, according to a study released by the International Telecommunications Union (ITU) in 2005, the United States ranked 16th in broadband subscribers per 100 inhabitants among the 20 nations examined, down from 13th a year earlier [Clark, 2005].¹²

Such international comparisons, however, do not take account of the large geographic expanse of the United States and its low population density. Because there are large economies of scale associated with the build-out of cable and DSL services in particular, it is much more efficient for the major broadband providers to provide access in urban areas, especially to high-rise residential buildings, which house much greater shares of the population in Korea and Japan, in particular, than is the case in the United States.

Nonetheless, broadband use could and almost certainly will be higher over time, as service prices come down and more content continues to be delivered for the medium. There is a “chicken-and-egg” aspect to the broadband market, as there is for all markets subject to “network externalities” – or markets in which the value to one user grows as more users join the network. In the case of broadband, the service becomes more valuable as the quality and variety of content improves; but investment in content, in turn, depends on broadband usage. So, which comes first: the service or the content?¹³

The answer, of course, is that both usage and content develop simultaneously, but not as rapidly as all users would desire if they and the content developers had incentives to act in a way that maximized benefits to society as a whole. But each individual, in deciding whether to purchase broadband service, does not – nor can he or she be expected to – take account of the broader social benefits of broadband and related content. Consumers will make their decisions, appropriately so, based solely on the benefits that

¹⁰ See Drucker, et al. [2005]. Other recent statistics from Nielsen//Netratings indicate that as many as 42% of the U.S. population (or about 60% of Internet users) had home broadband access as of August 2005. See Nielsen//Netratings [2005].

¹¹ According to the FCC [2005], 95% of all U.S. zip codes have at least one broadband subscriber, and that 99% of the U.S. population lives in these zip codes.

¹² See www.itu.int for ITU source data. The Organisation for Economic Co-operation and Development (OECD) also reports that the U.S. ranks 16th among developed countries in increase in broadband penetration from 2003-2004. See www.oecd.org.

¹³ See Rohlfs [2001] for further discussion of the “bandwagon effect” of the Internet.

they can expect to reap themselves. But this will mean that, from society's perspective, the usage or take-up rate for broadband will be sub-optimal, at least for some period of time. For this reason, the report concludes with some recommendations for accelerating broadband use, both generally and for seniors and individuals with disabilities in particular.

Furthermore, whatever the rate at which broadband use continues to rise, this report assumes that individuals with disabilities will increase their use at the same rate as the rest of the population, since the best available data indicate that the two rates of usage are roughly the same [Bowe, 2002].

Estimation Methodology

Several features of the methodology used to estimate the benefits associated with broadband for seniors and individuals with disabilities are worth highlighting before describing the results in detail in later sections.

Types of Benefits

First, the estimated benefits are of two broad types: *cost savings* and *additional output*. The cost savings arise because, as described further below, broadband will enable members of both populations to benefit from disease management programs that require constant or "real-time" communication between patients and providers of medical care in a way that would be much less convenient or even impossible in a "dial-up" world (for example, through remote monitoring by health care providers and by two-way communications between patients and health care providers, or "telemedicine"). Lower costs will show up directly in lower amounts spent on medical care. Medical monitoring enabled by broadband should also delay (or conceivably eliminate the need for) institutionalized living for some seniors and individuals with disabilities who through the use of broadband can be monitored at their current residences or less expensive community health care centers. The cost of living in institutional settings is far more expensive than living at home.

The cost savings implicitly assume that seniors and individuals with disabilities will not demand more medical care when it becomes somewhat cheaper. Should they do so, some of the cost "savings" will be offset by additional care – which clearly would be a good thing, and thus to the extent this occurs (and lowers the "cost savings"), it should be welcomed. Calculations of "consumer surplus" – of the type reported in the Crandall/Jackson study referred to earlier – take this feedback between lower costs and additional demand into account.¹⁴ This report does not take this approach, however, because consumer surplus calculations are hypothetical calculations of the value that consumers place on a service that does not directly show up in the marketplace. Furthermore, since seniors and individuals with disabilities who have insurance typically

¹⁴ Technically, consumer surplus represents the aggregate amounts in excess of the prevailing market price that consumers would be willing to pay to purchase the service at those higher prices, minus the costs associated with delivering the service.

absorb only the “deductible” or “co-pay” on their medical bills, they have little or no economic reason to change their behavior if the total cost of a medical procedure or service goes up or down, since the insurers bear that cost.

Broadband should also expand total output because it will enable some seniors and individuals with disabilities who choose to continue working to do so remotely. “Telecommuting” through broadband is a qualitatively different experience than working over a dial-up connection. The availability of broadband therefore should effectively expand the size of the labor force and the income it will generate (aside from enhancing the satisfaction and well-being of individuals who choose to take advantage of the technology).

Quantifying the Benefits

Second, all estimates are reported in 2005 dollars – that is, they are adjusted for future inflation. In addition, all savings and additional output estimated for the future are *discounted* by an appropriate rate of interest, and reported cumulatively at three points: as of the years 2010, 2020, and 2030, respectively.

Discounting is essential because, totally apart from inflation, a dollar earned tomorrow is worth a bit less than a dollar earned today because the dollar earned today can be invested and earn a rate of interest. Economists routinely discount future benefits and costs for this reason. So do many agencies of the federal government in deciding what kinds of regulations to impose to achieve certain social objectives, such as safer motor vehicles or other transportation facilities. The federal budget agency – the Office of Management and Budget – has suggested that agencies use roughly a 3 percent rate of interest (adjusted for inflation) to discount future benefits and costs.¹⁵

The federal government has the unusual advantage, however, of financing its spending by issuing bonds that are effectively risk-free. That is because the government has never defaulted on its debt, and is not likely to (since, as a last resort, it can always print more money to cover debt service, though admittedly this entails the risk of more inflation). Discount rates used for private sector projects typically are somewhat higher than those used for federal initiatives because private activities carry some greater risk of non-payment. To reflect the uncertainties associated with broadband, this report adds another 2 percentage points to the risk-free government rate, and thus uses a 5 percent interest rate to discount future benefits. A higher interest rate means that future benefits are more heavily discounted, which lowers the estimated cumulative benefits. For this reason, the estimates reported here should be conservative.

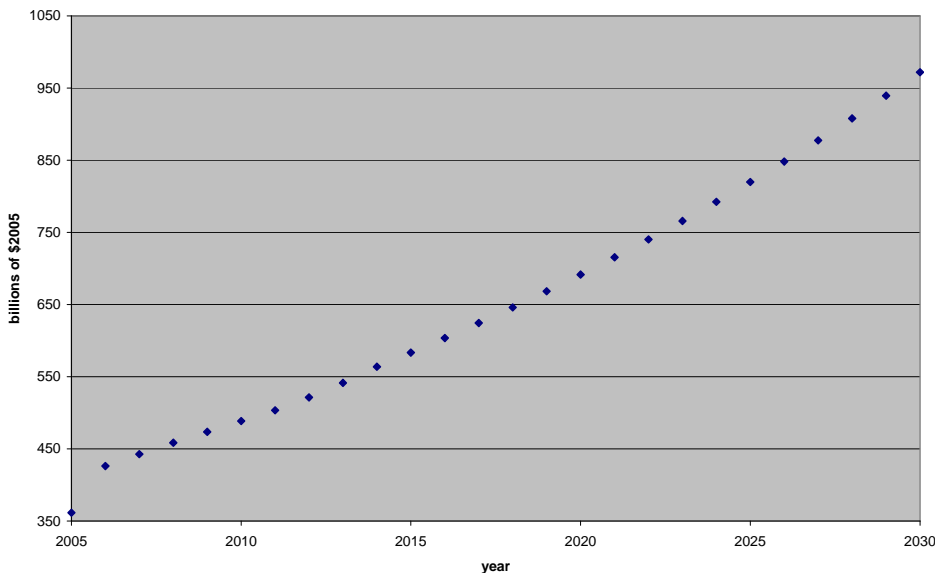
Baseline Figures

¹⁵ To be precise, OMB specifies a 3.1 percent real discount rate for projects with costs and benefits over 30 years [OMB, 2002].

The savings and additional output estimates are generated by applying some percentage figure – from different identified sources – to a baseline set of expenditures or output figures. These baselines are now described.

The Medicare and Medicaid programs (the former is federal and the latter is both federal and state) are the principal programs paying for the *health care costs of senior citizens*. Chart 1 shows the current and projected costs of these programs, adjusted for inflation in health care prices.¹⁶ As the chart indicates, current government medical spending for seniors is about \$360 billion, a figure projected to increase to \$970 billion by 2030 (in 2005 dollars). Some medical costs for seniors are also paid privately; for example, through “Medigap” policies and for prescription drugs (despite the new Medicare prescription drug benefit). This report concentrates, however, on the savings that broadband-based technologies will generate for *government* health care spending, because government is the dominant payer for this population and reliable data for government programs are readily available. Nonetheless, by concentrating only savings in government spending, the broadband-induced savings estimates are likely to understate the total cost savings achievable for the senior population.

Chart 1: Real Medicare/Medicaid spending on elderly



The cost trend for *non-elderly individuals with disabilities* is estimated by a similar method. According to CMS, government spending on non-elderly individuals with disabilities amounted to 43% of Medicaid and 15% of Medicare in 2003. To project the spending on this population through 2030, it is assumed that these proportions stay constant, and that overall spending on these programs grows at the rates noted in the

¹⁶ The Centers for Medicare and Medicaid Services [2005], or CMS, projects health care prices to rise at nearly 4% per year through 2014. As noted above, we assume that the 4% rate of inflation continues through 2030. The cost projections in Chart 1 reflect the nominal costs projected through this date by CMS, deflated by the projected 4% rate of health care price inflation.

previous section. Under these assumptions, government spending on non-elderly individuals with disabilities will total \$186 billion in 2005, and would climb to \$483 billion in 2030. Once again, these figures are conservative since they do not include any private spending on medical costs, which are likely to be significantly higher for this population since there is no comprehensive government coverage (as there is in Medicare for the elderly).

Society also spends substantial sums for *institutionalized care for senior citizens*. In 2004, the United States spent \$135 billion on long-term care for the elderly, of which \$92 billion (68 percent) was spent for nursing home care, and the remaining \$43 billion (32 percent) on home care [CBO, 2004]. This baseline includes both public and private spending.

The baseline and method for estimating additional output gains due to broadband are outlined in the relevant section later in this report.

Two Scenarios

The benefits reported below are calculated under two different “scenarios”: a “base case” in which it is assumed that further penetration and use of broadband, without additional policy intervention, would generate these benefits; and a “policy scenario” in which it is assumed that some combination of generic and more targeted suggestions outlined later in this report would be adopted and have the effect of accelerating and enlarging the broadband-related benefits associated with these populations. Special attention is paid below to the difference between these two estimates, or the benefits projected to accrue from adopting policies aimed at accelerating the use of broadband for seniors and individuals with disabilities.

Other Points

Two final methodological points should be noted. First, the estimates attribute the cost savings and output gains to “broadband” when admittedly other factors are also necessary for these benefits to be realized. For example, medical cost savings cannot be generated without the software to monitor patients, interpret the results, and alert health care providers to the need for prompt interventions. In addition, as discussed below, reimbursement policies will need to be changed to encourage various health care providers to make use of the broad-based monitoring technology (and other cost-saving technologies that broadband should encourage, such as telemedicine).

Still, without the broadband platform in place, none of these other changes would be necessary; they would not even be relevant. To debate whether the benefits arise from the platform or the applications on top of it (broadly defined to include both software and institutional changes) is like asking whether the benefits from railroads are attributable to the track or to the engines. Clearly, both are needed – the same is true for broadband. So, perhaps one way to think of this exercise is to define broadband “broadly” to include *both the platform and the content/applications that make the technology useful, since neither would exist without the other*.

Second, while all of the estimates below are illustrative, where possible, assumptions are made that err in a conservative direction. For this reason, it is quite possible that the cost savings and output gains shown here understate the potential impacts.

Potential Benefits of Additional Broadband Usage for Seniors and Individuals with Disabilities

As noted, the benefits reported here are of three types: direct cost savings in delivering medical care; cost savings due to delayed or avoided institutionalization; and additional output arising from enhanced labor force participation. The sources of the benefits and their estimated amounts are now described, in turn.

A. Potential Broadband-Related Medical Cost Savings

It has been widely observed that of all industries in the economy, health care has been among the least beneficially affected by the Internet revolution. As one report puts it, “The health care sector lags every other major service industry in its investment in information technology.” [ITAA, 2004, p. 6].¹⁷

This disappointing conclusion is due to several factors. One reason is that the limited technology investments that are made in this sector focus on high-tech diagnostic devices (such as CAT scans) that assist in acute care, but not in routine care or in managing patients with chronic illnesses. In addition, many physicians, especially those who have been in practice for some time, grew up in a generation when the Internet and indeed computers were not integral to their practice, or to business in general. As a result, many physicians and other health care providers (including hospitals) still do not take full advantage of information technology to digitize record-keeping, invoicing, prescription ordering, and other functions. Meanwhile, of particular importance to patients, there is no generally available system of portable, easily used patient medical records so that patients need not fill out new sets of forms, including their medical histories, each time they visit a new health care provider (physician, HMO, or hospital).

Internet-based technologies have much potential to bring substantial cost savings to the medical care system. Several years ago, economists Patricia Danzon and Michael Furukawa [2001] analyzed the multiple opportunities for savings of just administrative costs in the system. Among other things, they concluded that the savings from web-based claims processing alone would shave 1.5 percent off of total U.S. health care expenditures (then estimated at \$1.2 trillion in 1999). Additional savings could be realized through widespread online access to patients’ electronic medical records (EMR); clinical decision support and payer guidelines; prescription and ordering of medical tests; real-time verification of reimbursement eligibility; appointments scheduling and referrals; patient education and interaction (including “email appointments” rather than in-person visits); compliance monitoring; and greater use of the Web in ordering supplies

¹⁷ As this report notes, whereas financial services companies invest 11 percent of their revenues in information technology, the health care industry invests only 2 percent of its revenues in IT.

(business-to-business or B2B commerce). At the time, the authors noted that such an “integrated system” was years away.

It remains years away. Although significant advances are being made in some or all of these areas (and indeed were recognized to be underway when Danzon and Furukawa wrote in 2000), numerous institutional hurdles remain, including the lack of standardization for information all along the “food chain” of the medical system. The Bush Administration is addressing a major part of the technology problem by promoting the development and widespread adoption of EMR. In particular, the Commission on Systemic Interoperability created by the Congress as part of the Medicare Modernization Act of 2003 has recently issued a wide-ranging report, *Ending The Document Game*, which outlines a series of recommendations to make EMR a reality within the next decade.

But EMR will not work without cooperation from physicians, and that in turn will require systems that allow easy data entry, portable devices with which physicians are comfortable and which they will use, and devices that patients trust to carry their information (such as chips on a card, since patients wary of their privacy are unlikely to trust a single, centralized medical data bank). Ultimately, the cost savings from universally used EMR could be substantial. A recent RAND study estimates them at \$42 billion annually over a 15-year period, an amount equivalent to approximately 2.5 percent of all current medical costs (\$1.8 trillion).¹⁸

Perhaps the most important way in which broadband may be used to save medical costs is through integrated monitoring and intervention systems for patients with chronic illnesses. Below, we describe such a system that is now in place in the Veterans Administration for all veterans. As features of this system are introduced for seniors and individuals with disabilities generally, there should be significant opportunities for cost savings. One major factor holding back accelerated implementation of such systems, however, is the failure so far of the highly fragmented U.S. health care system to reimburse – and thus give incentives for – physicians and other health care providers to use this technology. In addition, there is a need to educate patients, especially those with one or more chronic conditions, on the benefits of broadband-enabled integrated monitoring and intervention systems.

Medical Cost Savings for Seniors

Although generic cost savings from broadband should help all seniors (in the same way that they should benefit all Americans) – through lower administrative costs, savings arising from implementation of EMR, and other cost reductions – the sub-population among seniors likely to benefit the most *are those with chronic diseases that require continued medical care and monitoring*. These patients are at high-risk for serious health care problems and acute episodes requiring hospitalization.

¹⁸ See Hillestad, et al [2005].

Roughly 8 million Medicare beneficiaries (out of a total senior population of approximately 35 million) currently have five or more chronic conditions, and account for over 2/3 of the program's spending [Partnership for Solutions, 2002]. Of the U.S. population in general, 45 percent suffer from at least one chronic condition (which can include coronary heart disease, chronic obstructive pulmonary disease, mental health disorders, diabetes, hypertension and asthma). Nationwide, care for those chronic illnesses accounts for at least 78 percent of all health care spending, or well over \$1 trillion annually – an amount that is certain to climb as both the population and health care costs continue to increase [ITAA, 2004].

The potential savings that broadband could bring to this population are perhaps best realized through integrated systems of home monitors – wireless devices and clothes with transmitters that relay information about vital signs to a central office that can alert health care providers when immediate interventions are necessary, and otherwise reduce the need for individuals to see their physicians and even be admitted to the hospital, which is a very expensive form of health care. A key advantage of such systems is that *they do not require the patients to have access to or use a computer, but instead only to wear a monitor that transmits vital signs and other relevant medical data over current wireless networks in real-time--made more efficient with broadband wireless technologies--to a central office that itself has computers and a data base that are linked by broadband connections.*

As it turns out, there are data indicating the magnitude of the possible savings for Medicare (and the elderly portion of Medicaid) programs from such integrated systems of monitoring, clinical information tools and targeted interventions – all enabled by broadband technology. The data come from a chronic care program adopted by the Veterans Administration for its patients. The VA uses nurses as “care managers” who regularly log on to a web-based application that tracks the patient data. Patients who are in need of immediate attention are notified, typically by telephone.

The VA's integrated chronic disease monitoring program has produced impressive cost savings, cutting *hospital admissions by up to 60 percent. Moreover, the system not only saves money, it can save lives* by helping patients identify and deal with problems before they become acute enough to require emergency room attention (see the discussion of life-saving below). Patients seem very satisfied with the outcomes [ITAA, 2004 and Meyer, Kobb and Ryan, 2002].

According to one estimate, if the same disease management system were used for just the 4 million chronically ill Medicare patients posing the highest risks, the number of hospitalizations would decline by 1.7 million per year, producing annual net savings of \$30 billion. This would be equivalent to a 10 percent saving of overall Medicare costs [ITAA, 2004]. Savings from disease management in one other integrated setting are of similar magnitude.¹⁹

¹⁹ PacificCare Behavioral Health, a division of a large HMO, reported a 50 percent decline in hospitalizations, a 73 percent reduction in emergency room visits, and a 51 percent reduction in in-patient costs for a technology-based monitoring program for heart failure patients [Meyer, Kobb, and Ryan, 2002].

In fact, the potential savings from disease management enabled by broadband-based remote monitoring for all chronically ill patients are potentially quite extraordinary – as much as 30 percent of all hospital, out-patient, and drug expenses [Adomeit, Baur and Saufield, 2001]. Since care for the chronically ill already accounts for 78 percent of total medical costs, a 30 percent saving of costs in this category could reduce overall health care expenses for the United States by roughly one quarter, or about \$350 billion annually.

The Center for Medicare and Medicaid Services (CMS) – the federal government’s arm that helps administer both programs – is recognizing the potential benefits of chronic disease management. To be sure there are major differences between medical care delivered by the VA, which is an integrated system that can internalize all of the cost savings itself, and the Medicare/Medicaid systems that reimburse diverse health care providers. But CMS is in the process of rolling out chronic care management programs in selected geographic regions of the country, pursuant to Section 721 of the Medicare Modernization Act of 2003. In addition, 31 states between 2001 and 2004 adopted some form of the chronic care management model in their Medicaid programs.

One key impediment to more widespread use of such cost-saving programs is that current reimbursement practices do not reward or encourage physicians to use them. Though it may be difficult (or politically impossible) for the federal government to require private insurers to change their reimbursement policies, both federal and state governments have a direct interest in generating efficiencies in the insurance programs they directly operate, Medicare and Medicaid. Thus, the estimates of cost savings from broadband assume that governments eventually will change their reimbursement practices so that these benefits can be realized. In particular, governments may want to experiment with capitation plans and different fee-for-service models that reimburse providers who serve their chronically ill patients through broadband-enabled chronic disease management programs.²⁰

In any event, the cost savings estimates from broadband based solely on chronic disease management programs should understate the potential broadband-related medical cost savings that may be realized for seniors (and individuals with disabilities). The estimates do not take account of the potential cost savings from the wider use of telemedicine – or two-way video communication between patients and health care providers – that would eliminate the need for many in-person visits to health care providers. In addition, the costs savings estimated here are based on existing technologies and thus may understate the range of uses for broadband-enabled remote monitoring and delivery of health care that will benefit both seniors and individuals with disabilities. Thus, researchers are already at work on new technologies that would monitor certain vital signs via attachments to one’s personal computer, cell phone and even television. In

²⁰ For a general discussion of the need to change reimbursement policies and to involve physicians more directly in chronic care management programs, see [Berenson, 2004].

the future, it is not difficult to imagine even more complete monitoring devices in wristwatches, hearing aids, jewelry and clothing.²¹

More broadly, seniors and individuals with disabilities should be able to use broadband accessed through computers to help lower medical costs in other ways. Already, there are numerous patient support groups that individuals with certain diseases and conditions can and do access regularly. These groups not only improve the mental state of individuals – by giving them access to information about their health and letting them know they are not alone – but can also reduce the frequency of visits to health care providers. In addition, seniors and individuals with disabilities use the Internet much as everyone else does: to communicate with others, to make purchases and to learn new information. All of these activities are mentally stimulating and thus could potentially help delay the onset or severity of dementia and Alzheimer's. As more seniors and individuals with disabilities have access to and use broadband, cost savings arising out of both of these PC-based uses of broadband, therefore, should mount.

The base case estimates for cost savings for seniors assume only that savings are realized from gradual implementation of chronic disease management, such that Medicare and senior-related Medicaid spending as a whole is 10 percent less than it would otherwise be in 2030 (with percentage savings phased in linearly in the 25 years before then). As noted above, the cost estimates for seniors reflect only savings in government cost, and thus should understate total cost savings for this population (since some senior costs are privately paid). The base case assumes no other broadband-related cost savings: including savings in administrative costs, savings from wider use of telemedicine, savings from EMR, and ancillary savings in mental and physical health from PC-based broadband use. Or, put differently, if these other sources of savings materialize, then the base case estimates presented here will understate actual cost savings.

To calculate the absolute dollar amount of these savings, it is essential first to specify a baseline for medical care costs for seniors: \$361 billion in 2005, increasing in real terms at roughly a 4 percent annual rate.²² This amount includes all Medicare spending and the federal portion of Medicaid spending on the elderly. *If the base case percentage savings are applied to this baseline, the total cumulative savings over the next 25 years, discounted at a 5 percent real rate of interest, would be \$401 billion (2005 dollars).*

²¹ This research and the technologies it promises to generate thus would further the goal of Section 255 of the Telecommunications Act of 1996, which requires manufacturers of telecommunications and customer premises equipment to ensure that it is designed, developed and fabricated to be accessible and usable by individuals with disabilities, if readily achievable.

²² See the methodology section above for baseline details. In particular, nominal Medicare and Medicaid cost projections through 2014 are taken from National Health Estimates [CMS, 2005], and thereafter are increased at 7.5 percent and 8 percent for the two programs, respectively (the same rates at which they increased during the 2005-14 period). The nominal figures are deflated using a medical price deflator, which is explicitly projected through 2014 and assumed to grow at a similar rate (4 percent) thereafter.

The *broadband policy case* assumes that measures are taken to accelerate the use of broadband-based chronic care technologies, such that the 10 percent savings are realized 10 years sooner, or by 2020 (with the percentage savings between now and then ramped up in a linear fashion). From 2020 to 2030, the 10 percent savings are assumed to continue. These assumptions are not only conservative for reasons already discussed, but also because it is quite possible that accelerated use of broadband will stimulate applications/content developers (of which the chronic disease management program is one example) to develop other cost-savings content. Should this occur, then either the 10 percent cost savings would be reached at an earlier date and/or an even larger percentage savings may be realized.

In any event, should the 10 percent target savings be reached by 2020 rather than 2030, the additional cumulative savings under the policy scenario, relative to the base case, would be another \$163 billion (in 2005 dollars, assuming a 5 percent discount rate). Under these assumptions, total savings would reach \$564 billion.

The savings under both scenarios will be phased in over time. Table 1 provides projections of the cumulative savings, appropriately discounted, for the years 2010, 2020 and 2030.

Table 1: Savings to Elderly (billions of \$2005)

Year	2010	2020	2030
Base	\$22.36	\$162.76	\$401.09
Policy	\$37.27	\$271.27	\$563.65
Difference	\$14.91	\$108.51	\$162.56

Medical Cost Savings for Non-elderly Individuals with Disabilities

Some portion of non-elderly individuals with disabilities also should benefit from a chronic disease management program, while the entire population of individuals with disabilities should benefit to some degree as well as from the savings in general administrative costs, increasing use of EMR, and the ancillary benefits of PC-based broadband.

The estimated potential savings in both the base case and policy scenarios are derived from a base level of government expenditures on non-elderly individuals with disabilities, which are conservatively estimated at \$186 billion in 2005.²³

In the base case, it is assumed that the combination of cost-saving benefits listed at the outset of this section ultimately would save 5 percent of total medical expenditures

²³ As noted above, the projections for total Medicare and Medicaid spending used here are the same as those in the elderly calculation. The amounts of each spent on non-elderly individuals with disabilities in 2003 were 43% and 15%, respectively, according to CMS, and for the purposes of the baseline calculation are assumed to stay constant in future years.

for this population by 2030 (with percentage savings phased in gradually in a linear fashion). This is half the amount for the senior population; it is also equivalent to double the projected savings from EMR alone; or alternatively, the 5 percent figure can be interpreted as a combination of savings from enhanced monitoring and administrative cost savings. *Assuming the 5 percent savings target is gradually realized by 2030, the cumulative, discounted savings for the non-elderly individuals with disabilities (in 2005 dollars) would be \$98 billion.*

In the policy case, the 5 percent target savings would be achieved 10 years sooner, in 2020 (analogous to the time pattern for savings for the senior population in this scenario). *Should this occur, relative to the base case, the additional cumulative savings would be another \$39 billion, or a total of \$137 billion.*

Table 2 shows that these savings would be phased in over time, under both scenarios.

Table 2: Savings For Non-Elderly Individuals with Disabilities (billions of \$2005)

Year	2010	2020	2030
Base	\$5.23	\$39.05	\$97.71
Policy	\$8.72	\$65.08	\$136.98
Difference	\$3.49	\$26.03	\$39.27

Lives Saved From Broadband Technologies

In addition to the cost savings it should make possible, broadband should also help save lives – just as telephone service (through 911) has in the past, but in the case of broadband, perhaps to a greater extent. This should happen in at least three ways.

First, the wider use of broadband should cut down on errors associated with wrong doses or inappropriate medications. In a widely cited study from 2000, the Institute of Medicine reported that as many as 98,000 people die unnecessarily each year because they are given the wrong amount of a medication or indeed even the wrong medication itself.²⁴ The *Ending The Documents Game* report cites subsequent studies suggesting that the true number may be twice as high.²⁵

Medical errors would be significantly reduced if prescriptions were digitized, and if pharmacists and doctors had access to patient-specific medical records that would identify whether the patient was allergic to the medication. Broadband technologies would facilitate this process because physicians, nurses and other medical personnel should find them so much easier and more convenient to use than the much slower dial-up services. Physicians and hospitals could use broadband-based landline or wireless transmission devices working over broadband networks to relay this information to

²⁴ See Kohn, et al [2000]. The range estimated in the study is 44,000-98,000 deaths annually.

²⁵ U.S. Department of Health and Human Services [2005], Executive Summary.

pharmacists and thus dramatically reduce the totally unnecessary and tragic loss of life associated with what, in essence, are simple-to-fix problems in the medical system.

Second, as more individuals use the Internet for medical information, many of them may be encouraged to make appointments with physicians at earlier points when their diseases or conditions may be more amenable to treatment. Similarly, patients can use information on the Internet to avoid seeing doctors when it is unnecessary to do so.

To be sure, there are offsetting dangers and costs associated with Internet-based information. Some patients can interpret the information wrongly and make needless demands on their physicians as a result. But with guidance from physicians themselves, these kinds of mistakes over time can be reduced. This author agrees with Danzon and Furukawa, who concluded [2001, page 213] in 2000 that improved access to Internet-based medical information in the long run “must surely improve real health care productivity, through improved self-care and more productive interactions between patients and physicians... .”

Third, it is quite possible that in the not-so-distant future when a sizeable number of seniors and individuals with disabilities have video capabilities associated with their broadband, they will be able to interact remotely – in a visual fashion – with health care providers. These interactions may permit interventions or advice that could save lives, as well as avoid some expenses associated with unnecessary trips to emergency rooms and physicians’ offices.

B. Potential Broadband-Related Cost Savings from More Independent Living

As of 2002, only about 5 percent of all Medicare-eligible individuals, or 1.6 million seniors, lived in nursing homes [Federal Interagency Forum, 2004]. This number, however, is expected to dramatically increase over time, especially as the baby boomers retire and as life spans lengthen. By one estimate, 44 percent of 65-year-olds today can expect to live in a nursing home at some point in the future. For the 2020 cohort of 65 year-olds, this figure is projected to rise modestly to 46 percent due to likely longer life spans [Spillman and Lubitz, 2002].

Nursing home, or institutionalized, care is expensive, far more so than personal medical attention given at home. In 2004, a private room in a nursing home facility cost about \$78,000 annually; a semi-private room cost nearly \$62,000. By comparison, home health care – delivered three hours a day for five days a week – cost an average of about \$14,000. The difference between institutionalized and home care then, runs easily in the range of \$50,000 or more per person [Johnson and Uccello, 2004].

In 2004, \$135 billion was spent on long-term care for the elderly, of which \$92 billion (68 percent) was spent on care provided through nursing homes, and the \$53 billion balance (32 percent) spent on home care [CBO, 2004]. Of the total, Medicaid paid 35 percent, Medicare covered 25 percent, and private health insurance picked up 4

percent. The rest, or about 33 percent, of all costs were borne by the individuals and their families [CBO, 2004].

The projections here use as a baseline the long-term nursing home expenditures projected by the Congressional Budget Office in 1999 (which result in a slight discrepancy from the actual 2004 figures, but one not significant enough to materially affect the cost savings projections) [CBO, 1999].

In principle, the same broadband-based monitoring programs for the chronically ill can be used to monitor the health of the elderly. However, unlike other senior citizens (or many of those with disabilities), monitoring alone cannot deliver services in persons in need. The issue is whether monitoring, *in conjunction with home health care*, can delay or, in some cases, avoid institutionalization of individuals.

It is reasonable to expect that the answer is “yes,” though the magnitude of this effect has not been well studied. In addition, as broadband equipped with two-way video transmission diffuses throughout this population, seniors will be able to interact much more intimately with their relatives and friends than is possible now through the telephone. This should reduce feelings of loneliness and depression, and thereby enhance the willingness of some who might otherwise feel resigned toward moving to a nursing home, to remain in their homes. Nonetheless, given all of the uncertainties about these impacts, this report takes a very conservative approach toward the possible cost savings relating to delayed/avoided institutionalization from using broadband-based technologies.

For example, although no cost savings associated with reduced institutionalization of individuals with disabilities on account of broadband technology are presented here, such savings clearly will exist. In particular, broadband should facilitate compliance with the Supreme Court’s decision in *Olmstead v. L.C. and E.W.*, 527 U.S. 581 (1999). In that seminal case, the Court affirmed the right of individuals with disabilities to live in their communities and called for states to reduce the number of such individuals living in institutionalized settings. Broadband should reduce the states’ costs of compliance with *Olmstead* by enabling small teams of support workers at remote locations to be available – at the touch of a button or the sound of a voice – to provide guidance, information and emergency assistance to individuals with disabilities who are no longer institutionalized.

As for the senior population, this report makes the assumption that in the base case broadband-based monitoring would save 1 percent of total nursing home costs by 2020, 2 percent by 2030. The policy scenario assumes that the savings schedule would be accelerated and magnified a bit: 1 percent by 2010, 2% by 2020, and 3% by 2030.

The savings assumptions also implicitly reflect the possibility that broadband will provide some cost savings that have not yet been fully realized for individuals who live in institutional settings. Such savings can arise from greater use of telemedicine – and thus savings from avoided physician visits – as well as through broader use of the Internet by residents to locate more effective treatments for their conditions.

These admittedly arbitrary percentage cost savings should be interpreted more as illustrations than as true estimates, since there is no clear benchmark for gauging the impact of broadband on the utilization of nursing homes. For that reason, the illustrative percentages presented here are rather small, and in the opinion of the author, likely to be conservative (perhaps by a substantial margin).

To quantify absolute savings, it is necessary to apply the assumed percentage savings to the CBO baseline amounts, which imply real nursing home expenditures, in the absence of broadband savings, of \$157 billion by 2020 and \$217 billion by 2030.²⁶ The cumulative savings under each scenario are calculated as they were for the medical cost savings: multiplying the base level of costs times the percentage savings, adding the annual savings, and then discounting the annual figures at a 5 percent real rate of interest.

The cumulative cost savings in the base case through 2030 are estimated to be \$17 billion. The policy scenario adds an additional \$15 billion in cumulative cost savings. All figures are in 2005 dollars. Table 3 shows the projected cumulative cost savings, appropriately discounted, under both scenarios for the intervening years of 2010 and 2020 as well.

Table 3 also translates the base case and policy assumptions into annual numbers of seniors whose institutionalization would be delayed or avoided in 2010, 2020 and 2030, on the assumption that the approximate difference between institutional and home care expenditures of \$50,000 in 2005 rise at the real rate of 2.6 percent per year, the CBO [1999] assumption. Thus, for example, under the base case, institutionalization would be delayed or avoided for roughly 176,000 seniors annually by 2030. The policy scenario would nearly double that number, adding another 162,000 per year by that date.

Table 3a: Estimated Cost Savings in Long Term Care (billions of \$2005)

Year	2010	2020	2030
Base	\$0.95	\$6.51	\$16.73
Policy	\$2.86	\$15.25	\$32.12
Difference	\$1.91	\$8.74	\$15.39

Table 3b: Estimated Delayed/Avoided Cases of Institutionalization

Year	2010	2020	2030
Base	16,770	88,657	176,155
Policy	50,309	207,566	338,179
Difference	33,539	118,910	162,023

²⁶ See CBO [1999] for detailed long term care spending projections. For the cost-savings calculation described, the spending estimates for institutionalized care, given in 2000 dollars, are inflated to 2005 dollars using the Consumer Price Index (see www.bls.gov). Values are interpolated linearly for years in between the given 10-year intervals.

C. Potential Broadband-Related Output Gains From Increased Labor Force Participation

Finally, because they enable workers to “telecommute” – that is, to work from home or at locations other than at an employment site – broadband technologies have the potential for increasing labor force participation by both senior citizens and individuals with disabilities. In particular, broadband can permit individuals to continue working as consultants for their former employers and/or for new clients, or to establish new enterprises so that they are “working” for themselves (for example, by running Internet-based businesses).

Additional Labor Participation By Seniors

According to the U.S. Census, there were 2.6 million men and 2.0 million women 65 years old or older in the labor force as of 1999 [U.S. Census, 2004]. According to the Bureau of Labor Statistics, the total number of seniors who had a job or were looking for work – in other words, those in the labor force – represented 12.3 percent of those 65 or over.

Since 1999, the senior participation rate has increased to 14.8 percent through mid-year 2005.²⁷ One likely factor contributing to this increase is the bursting of the stock market bubble in 2000 and the fact that stock prices since have not fully recovered to their pre-bubble peak. This has disappointed those seniors and recent retirees who may have thought their pension funds would be adequate to permit earlier retirement.

Using 2005 estimates of the total labor force from the Social Security Trustees, and taking into account the increased labor force participation rate among seniors since 1999, the baseline level of seniors in the labor force should be approximately 5.5 million in 2005.²⁸

In addition, the Census reports that the median earnings (from wages and self-employment) of working senior men was approximately \$31,500, while the corresponding figure for senior women was \$22,500. For simplicity, this report assumes that the median is a good approximation for the mean, and that the blended average of earnings for all seniors in the labor force was \$27,000 in 1999, and \$29,000 in 2005 (taking account of real wage growth since then).

The Social Security Administration’s Actuary’s Office projects some modest increase in the participation rate in the future. The SSA Actuary’s Office anticipates that changes in the social security benefit formulae will enhance participation rates to some degree. It also points to other factors that reinforce this effect:

²⁷ These data are from the Bureau of Labor Statistics, <http://stats.bls.gov/cps/home.htm>.

²⁸ Trustee labor force estimates come from “intermediate” case of OASDI [2005] Report, available at http://www.ssa.gov/OACT/TR/TR05/IV_LRest.html#wp222190.

“... Other factors, like the trend away from defined benefit pension plans that often provided incentives to retire and toward defined contribution plans, are expected to provide additional upward pressure on labor force participation rates. In addition to this shift in private pensions, the aging of the population is expected to both increase the demand for workers and, through improved health associated with greater life expectancy, improve the ability of the older population to work. Longer life expectancy, will also increase the amount of assets that will be needed to live comfortably through retirement years, and thus influence workers to stay employed longer.”²⁹

When all these factors are taken into account, the SSA’s Actuary’s Office projects that delayed retirement will increase the overall U.S. labor force by 1.5 percentage points by 2080. Table 4a illustrates what this means for the senior labor force participation rate between now and 2030, assuming that the SSA’s projected increase in the total labor force is realized incrementally, in a linear fashion, until then. This implies that by 2030 there will be about 1 million extra workers in the labor force due to changes in retirement patterns.

It is noteworthy that nowhere does the SSA’s Actuary’s Office mention the labor force implications of technology – broadband in particular – that will make it easier and more pleasurable for older Americans to continue working. In particular, most baby boomers who will be retiring after the year 2000 are already highly familiar and comfortable with using broadband technologies at work, and to a lesser extent at home. Accordingly, when they do retire, many who do not now have broadband services at home will want the service, not only for entertainment, but also to be able to continue some employment or self-employment. This is especially likely for boomers who already have broadband and more broadly, for all those who currently are working in managerial and professional jobs where continued part-time consulting after “retirement” is likely to be easier and more attractive than for workers in blue-collar and other service jobs.

Those who do opt to work at least part-time for some years into retirement may do so for other reasons. It is possible that continued mental stimulation helps delay the onset of Alzheimer’s and ward off depression, two conditions that can afflict the elderly. In addition, as life spans lengthen and health care continues to improve, seniors may delay their exit from the labor force. Indeed, two analysts from the Urban Institute have projected that if longer life spans and improved health cause workers to retire in a manner that will *keep their expected years in retirement constant*, the U.S. labor force would be 4.4 percent higher by 2040 [Toder and Solanki, 1999]. As shown in Table 4a below, this projection implies about 6.2 million additional workers in the labor force due to postponed retirement, compared to the SSA projection, by 2030.

This more optimistic Urban Institute projection, however, also does not explicitly take account of broadband technology, which is understandable since it was made several years ago, when broadband was in its infancy. Nonetheless, it is plausible to assume that one reason why workers would retire later so as to keep their expected years in retirement constant is that technology makes it easier to do so. In addition, it is plausible that

²⁹ See http://www.ssa.gov/OACT/TR/TR05/V_economic.html#wp180099.

because of the convenience of working remotely that broadband allows, the senior population, on average, will want to work somewhat longer still, so that the number of expected years in retirement actually may drop somewhat in the future.

To be sure there are legal and institutional impediments to increased senior labor force participation rates.³⁰ Defined benefit pension funds can penalize workers who stay on the job longer. The combination of tax rules, pension rules under the Employment Retirement Income Security Act (ERISA), and Age Discrimination Employment Act (ADEA), also can deter the rehiring of former “retired” employees on a part-time or temporary basis [Penner, et al, 2003]. Still, these rules have not inhibited the rather substantial increase in labor force participation by seniors since 2000. In addition, disincentives under defined benefit plans gradually will become less important as new retirees are less likely than their predecessors to be covered under such plans (which have been significantly replaced by defined contribution plans). As for the combination of legal impediments, presumably one way around them is for “retired” employees to work part-time as independent contractors. In addition, the nature of broadband technology will allow more workers in the future to be self-employed, working as consultants and engaging in other compensated activities unrelated to their former employer.

Of course, more employers will need to make accommodations for flexible arrangements for senior workers, but this is likely as labor force growth is projected to slow down. For example, after increasing at the rate of 1.1 percent annually in the 1990s, the labor force is projected to grow at only 0.36 percent annually between 2010 and 2020 [Penner, et al, 2003]. As more firms see their older, more experienced workers leaving, they are likely to be much more interested in finding ways to keep many of them on at least part-time or through independent contractor arrangements, especially in technical positions where there may be a shortage of incoming, trained workers. The fact that broadband technologies will enable senior workers to continue in some kind of working capacity – even from remote locations – should facilitate these arrangements. In addition, broadband technologies will make it possible for more seniors (and individuals with disabilities, as discussed shortly) to operate their own businesses from home. Indeed, the timing of the broadband revolution and the impending “retirement” of the baby boom generation could not be more fortuitous in this regard.

Taking all of these factors into account, this report makes the conservative assumption that in a “base case” the increase in the labor force that can be plausibly attributed to broadband technology is an increment at the mid-point between the SSA’s incremental projection (1 million) and the Urban Institute incremental projection (6.2 million). This assumption implies 3.6 million additional workers by 2030, making the

³⁰ This is why previous surveys of older workers who find that only modest numbers say they would want to work part-time if they could should be heavily discounted. For example, Penner and his colleagues [2003] report that only 13 percent of all workers who left their jobs between 1992 and 2000 said that they would have stayed longer if their employer had offered them arrangements with fewer hours. This survey result does not capture the attitudes of baby boomers who are about to retire and for whom broadband will provide a convenience that previous older workers could never have imagined. Indeed, the fact that the senior labor force participation rate jumped so smartly after 2000 illustrates how dated the experience of the 1992-2000 cohort is already.

total labor force about 2 percent higher than it would be otherwise. The base case scenario also translates into a senior labor force participation rate in that year of almost 20 percent, compared to the current rate of 14.8 percent.

For the “policy case,” which assumes faster broadband penetration, an assumption is made that the labor force will increase on account of broadband at the rate implied in Urban Institute projection. As table 4b indicates, this implies that by 2030, all 6.2 million additional seniors will be in the labor force, making it about 3.4 percent larger than it would be otherwise due to the availability of broadband technology. This overall projection implies that the senior labor force participation rate by that date would be 23.4 percent.

Table 4a: Estimated Additions to Labor Force Relative to Current Levels (in 1000s)

Year	2010	2020	2030
SSA	201.87	605.61	1,009.35
Midpoint ("base")	1,127.13	2,355.20	3,583.26
Urban Inst ("policy")	2,052.39	4,104.78	6,157.17
Difference	925.26	1,749.59	2,573.91

Table 4b: Increase in Total Labor Force from Delayed Retirement (in %)

Year	2010	2020	2030
SSA	0.12	0.36	0.56
Midpoint ("base")	0.68	1.39	1.99
Urban Inst ("policy")	1.23	2.41	3.42
Difference	0.56	1.03	1.43

More people in the labor force will mean higher output for the economy as a whole. Among other things, that will ease the financial burden of the various government health care programs for senior citizens.

How much higher will output be if the projected increases in labor force participation materialize? This question can be answered by multiplying the additional seniors in the labor force under the base case and policy scenarios by an estimate of their average earnings. The report answers this question using two different earnings assumptions. At the high end of the range, the incremental seniors are assumed to earn the average (median) income of all other working seniors, scaled up at one percent per year in real terms in future years.³¹ At the low end of the range, earnings of the

³¹ The one percent growth rate is half the roughly 2 percent annual increase in economy-wide productivity growth that it is reasonable to assume will continue into the foreseeable future (a figure well below the 3 percent annual increase since the mid-1990s). The one percent growth assumption is conservative, and also reflects an implicit assumption that older workers, being lower income earners, are also likely to see their earnings grow at a slower pace than the working population generally.

incremental seniors are assumed to be half of the high end earnings path. In both cases, as with the savings projections, future output is discounted at a 5 percent rate of interest.

Tables 5a and 5b illustrate the striking results under any of these assumptions (the ranges reflect the different earnings assumptions). The base case broadband scenario is projected to generate \$411 billion to \$822 billion in cumulative additional output through 2030, measured in 2005 dollars, beyond what GDP would otherwise be. The “policy scenario” would generate an additional \$315-630 billion in cumulative output above the base case scenario.

Table 5a: Output Gains from Elderly, Half Salary (billions of \$2005)

Year	2010	2020	2030
Base	\$60.75	\$223.72	\$411.20
Policy	\$114.24	\$402.19	\$726.08
Difference	\$53.49	\$178.47	\$314.89

Table 5b: Output Gains from Elderly, Full Salary (billions of \$2005)

Year	2010	2020	2030
Base	\$121.51	\$447.44	\$822.40
Policy	\$228.49	\$804.37	\$1,452.17
Difference	\$106.98	\$356.94	\$629.77

Additional Participation by Individuals with Disabilities

Broadband should also make it easier for individuals with disabilities who are not now working to work remotely, assuming they choose to do. The choice will not be made lightly, however, since many such individuals currently receive disability payments they might no longer receive if they find work or enter self-employment by working over the Internet. It is difficult, therefore, to estimate what the additional impact on the labor force will be under either a base case or broadband policy scenario.

Nonetheless, it is possible to calculate the additional output that would be associated with each one percentage point increase in the labor force participation rate among the population of adults with disabilities. In 2004, there were 2.5 million disabled, working-age individuals, of whom 37.5% were working.³² A full one percentage point increase in the participation rate in, say, 2006, therefore implies that roughly 25,000 additional individuals would join the labor force, a figure that itself would grow over time with the growth of the overall population (assumed for purposes of this calculation to be 0.8%, the approximate growth rate used in the SSA projections). How much additional output these individuals would generate depends on both the average wages they earn and when they join the labor force. For purposes of this calculation, it is

³² See Cornell University [2004] for disabled population, employment and earnings figures used in this section. Total working age population for 2004 comes from www.bls.gov.

assumed that any incremental workers with disabilities would earn the median such individuals currently earn, or \$30,000 annually (scaled up in future years at a growth rate of 2%, a rough estimate of future productivity growth). As for when they join the labor force, Table 6 provides estimates of the cumulative discounted amount of additional output that would be generated by each one percentage point increase in the labor force participation rate of individuals with disabilities at different starting points: 2006, 2010 and 2020.

The estimates in table 6 are not included in the total benefits estimates presented at the beginning and conclusion of this report. Nonetheless, the figures can be easily used to translate any given percentage point increase in labor force participation by individuals with disabilities into total output gains for the economy as a whole.

Table 6: Output Gains from Non-Elderly Individuals with Disabilities (billions of \$2005)

Employment increase by	2020	2010	2006
Output gain (2005-2030) per 1% increase	\$5.33	\$11.37	\$14.17

Potential Policies to Enhance Broadband Use

The disparity between private and social benefits of broadband justifies some role for government to help bridge the gap. Although, in principle, subsidies may be called for to reduce this gap, that approach is more questionable in the case of broadband. The reason for the ambiguity is that any subsidy system, as it would be implemented in practice, could generate inefficiencies that would offset the benefits. In addition, it is difficult to make any subsidy scheme neutral between different technologies – especially with respect to broadband technologies that do not yet even exist – so there is a danger that subsidies could distort the development of broadband in a way that would be socially sub-optimal.³³

Nonetheless, given the potential social benefits involved – both for the U.S. population generally and the population that is the subject of this report (senior citizens and individuals with disabilities) – it is important for policy makers to do the best they can to accelerate the use of broadband in ways that narrow the gap between private and social benefits. Potential “broadband” policies considered here fall into two broad categories: those that promote the take-up of broadband generally, and those that benefit the senior/individuals with disabilities populations in particular.

Several policies for accelerating broadband take-up rates generally – by lowering the price of the service –deserve serious attention:

³³ See Goolsbee [2002].

--One potentially important step is federal preemption of state and local ordinances and other restrictions that inhibit the ability of broadband providers to obtain necessary rights of way [Wallsten, 2005]. Such a measure would lower broadband costs and hence prices, as well as speed up deployment of current and newer broadband technologies. Ideally, it would be desirable for the federal government also to preempt municipalities from extracting various subsidies from telecommunications providers, but this may be practically and legally impossible.³⁴

--Various analysts have also long called for the end of any federal requirements that broadband providers share their networks (albeit at rates that presumably allow them to earn a profit) with other Internet Service Providers. The courts have approved an FCC decision to reject line-sharing for both DSL and cable, so this obstacle seems no longer to be present. To the extent the end of line-sharing will give broadband providers greater incentives to invest in their networks, this also would lead to the faster deployment of higher-speed broadband services, which in turn would generate the demand for better content. The result presumably would be greater demand, and thus take-up, of broadband services.

--Robert Crandall has suggested a third policy: one that would allow broadband platform providers greater ability to vertically integrate content offerings along with the platform service, without having the obligation to share such content on a non-discriminatory basis with other broadband providers [Crandall, 2005]. Crandall argues that such a policy would have much the same virtues as the end of line-sharing. Of all the generic policies mentioned here, however, permissive vertical integration is probably the most controversial. Although vertical integration would give broadband providers economic incentives to “internalize” the content development that is a critical part of stimulating demand for broadband, allowing exclusive integration could lead to a highly fragmented market, where content depends on the broadband provider – much as video games made today for one platform (such as Sony’s Playstation, Nintendo’s GameCube or Microsoft’s X-box) are not interchangeable with one another.

As for more targeted policies, a key theme of this report is that the cost savings from broadband for seniors and individuals with disabilities quantified here do not depend on these individuals being able to use personal computers or other devices to connect to the Internet. As already discussed, the cost savings related to medical costs and delayed institutionalization may be realized through unobtrusive devices that have broadband access built into them, together with a network whose users at the other end probably will need computers (which they almost certainly already are using).

Given this reality, the policies that are needed to realize the cost savings from broadband for seniors and individuals with disabilities are likely to focus more heavily on changes in reimbursement practices that give incentives to patients and health care providers to use the broadband-based technologies, so that they can be developed and

³⁴ For an excellent guide to how municipalities can “hold up” telecommunications providers that want to add services to local areas, see Dionne Searcey, “As Verizon Enters Cable Business, It Faces Local Static,” *The Wall Street Journal*, October 28, 2005, p. A1.

implemented more quickly than might otherwise be the case. In addition, there is a role for the government – as administrator and sponsor of the Medicare and Medicaid programs – to help educate both patients and health care providers about the benefits of these technologies.

Finally, the benefits from enhanced labor force participation that broadband could generate would likely require seniors and individuals with disabilities to use the technology with a computer or similar access device. To this extent, therefore, any generic policies that make broadband more affordable would also generate added demand among seniors and individuals with disabilities for broadband. This, in turn, would enhance participation by these groups in the labor force, generating the additional output that is estimated here.

Conclusion

Table 7 summarizes both the cumulative cost savings and additional output associated with broadband, under both the base case and policy scenarios, over the 2005-2030 period, in 2005 dollars. The table illustrates that by 2030, the cumulative additional benefits arising from policies designed to accelerate broadband use for seniors and individuals with disabilities range between \$532 billion and \$847 billion. Total cumulative benefits could exceed \$2 trillion, or more than the \$1.8 trillion the United States currently spends in a single year on medical care for all citizens.

To put the benefits estimated here in some perspective, federal homeland security spending (currently at about \$31 billion per year) can be projected to total \$620 billion over the next 25 years, discounting future spending at the government's long-term borrowing rate of 3 percent and assuming a one percent annual increase in real spending over the period. *In other words, the benefits from accelerating broadband use for and by the senior and individuals with disabilities populations through 2030 are comparable to what the federal government is likely to spend on homeland security over the same period.*

The benefits estimated here are clearly substantial amounts, but they seem reasonable compared to other estimates of the benefits of broadband more broadly. For example, the \$300 billion in added consumer welfare annually generated by broadband for the population as a whole that Crandall and Jackson have estimated would translate into several trillion dollars in cumulative savings (discounted by an appropriate interest rate) over the 2005-2030 period.

Clearly, with so much at stake, policymakers have strong reasons to consider measures to accelerate the deployment and use of broadband technologies for America's seniors and individuals with disabilities.

Table 7: Total Cost Savings + Output Gains (billions of \$2005)

Year	2010	2020	2030
Base	\$89-150	\$432-656	\$927-1,338
Policy	\$163-277	\$754-1,156	\$1,459-2,185
Difference	\$74-127	\$322-500	\$532-847

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