U.S. Chamber of Commerce
Global Innovation
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Estimating the Full Value of Medical Innovation

March 4, 2026

University of Chicago

The Initiative on Enabling Choice and Competition in Healthcare

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Abstract

This study evaluates the impact of medical innovation by examining how advances in four major disease areas in the U.S. (HIV, heart disease, breast cancer, and obesity) have influenced health outcomes and economic indicators over a consistent 30-year analytical horizon. Moving beyond traditional evaluations, which often focus narrowly on metrics like Quality-Adjusted Life Years (QALYs) or statistical life years, we adopt a comprehensive framework that captures aggregate health gains, productivity, changes in healthcare spending, and federal tax revenues. We find that these innovations generated approximately $155.3 trillion in health gains and $10.8 trillion in productivity improvements. While some innovations increased healthcare spending and others led to savings, the net effect was an increase of $0.6 trillion in total healthcare spending, including both direct costs on the innovations and indirect costs on other forms of care. We find that federal income tax revenues rose by $2.01 trillion from these innovations. Altogether, over the 30-year horizon analyzed, these innovations produced $167.5 trillion in total value, averaging $5.6 trillion annually. On a per capita basis, this translates into an annualized gain of $16,447 per person. These findings underscore the exceptional and often unrecognized societal return from medical innovation, especially when contrasted with the annual per capita healthcare spending of $14,570 in the U.S.

Keywords: Medical Innovation, Healthcare Spending, Productivity, Tax Revenue

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Philipson is a founding editor of the journal Forums for Health Economics & Policy of Berkeley Electronic Press and has been on the editorial board of the journal Health Economics and The European Journal of Health Economics. His research has been published widely in all leading academic journals of economics such as the American Economic Review, Journal of Political Economy, Quarterly Journal of Economics, Journal of Economic Theory, Journal of Health Economics, Health Affairs, and Econometrica. He is a monthly op-ed contributor for Forbes magazine and frequently appears in numerous popular media outlets such as CNN, CBS, FOX News, Bloomberg TV, National Public Radio, New York Times, Wall Street Journal, Businessweek, The Economist, Washington Post, Investor's Business Daily, and USA Today and is a frequent keynote speaker at many domestic and international health care events and conferences.

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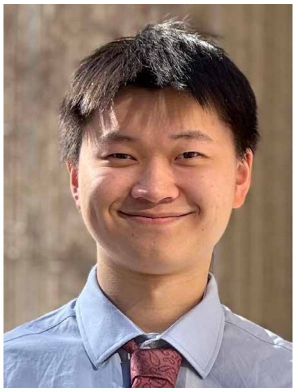

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Executive Summary

The Extraordinary Return on Past Medical Innovation: A $167 Trillion Value Story

American medical innovation isn't just saving lives—it's powering our economy, strengthening our workforce, and delivering returns that dwarf what we invest. This groundbreaking analysis from Dr. Tomas Philipson at The University of Chicago quantifies what we've long known intuitively: when we bet on biomedical breakthroughs, we win big. And the numbers are staggering.

Across disease-specific 30-year analytical windows, innovations in just four disease areas—HIV, heart disease, breast cancer, and obesity— represent $167.5 trillion in total value to American society. That's $5.6 trillion annually, or $16,447 per person per year. To put that in perspective, Americans spent $14,570 per capita on healthcare in 2023. The value we're getting back exceeds what we're putting in.

This isn't about incremental progress. This is transformation. HIV patients who would have died within two years in 1995 now live full lifespans—an average of 40 additional years. Heart disease patients gain critical years in their prime working age. Breast cancer survivors are living seven more years than they did three decades ago. And new obesity treatments are poised to add nearly a year of life while dramatically reducing the chronic disease burden that has plagued millions of Americans.

1. The Ultimate Measure: Lives Saved and Years Gained

The human dimension of these innovations is breathtaking. Across HIV, heart disease, breast cancer, and obesity, medical advances generated $155.3 trillion in health value gains—measured by the years of life added and valued using the same rigorous methodology federal agencies use for regulatory analysis.

HIV innovations delivered $22 trillion in health gains by transforming a death sentence into a manageable chronic condition. Heart disease treatments generated $13.7 trillion by preventing heart attacks and extending survival. Breast cancer advances produced $25.1 trillion in value by dramatically improving five-year survival rates and long-term outcomes. And obesity treatments—still in their early stages—are projected to create $94.4 trillion in health value by addressing a condition affecting 42% of American adults and preventing the downstream complications that shorten lives and diminish quality of life.

These gains reflect not just quantity of life, but quality. They represent grandparents meeting grandchildren, entrepreneurs launching second careers, scientists making discoveries, and millions of Americans living fuller, richer lives than would have been possible a generation ago.

2. The Productivity Powerhouse: $10.8 Trillion in Economic Gains

Here's what gets lost in healthcare cost debates: healthy workers are productive workers. Medical innovation doesn't just extend life—it extends working life, and that translates directly into economic horsepower.

Across these four conditions, medical advances generated $10.8 trillion in productivity gains across a comparable 30-year horizon. HIV innovations alone contributed $1.94 trillion, keeping hundreds of thousands of Americans—many diagnosed in their 20s and 30s—in the workforce for decades longer. Heart disease treatments added $1.11 trillion by preventing premature death and disability among workers in their peak earning years. Breast cancer advances delivered $1.21 trillion, allowing women to remain active contributors to the economy. And obesity treatments, though just emerging, are projected to generate $6.48 trillion in productivity gains, as they prevent the cascade of chronic conditions that force early workforce exits.

These aren't abstract numbers. They represent real people staying on the job, earning paychecks, supporting families, mentoring the next generation, and driving American competitiveness. Every additional year of productive life creates a ripple effect throughout our economy—more consumer spending, more innovation, more tax revenue, and stronger communities.

3. The Fiscal Dividend: $2 Trillion in New Tax Revenue

Medical innovation is also a revenue generator for the federal government. By keeping Americans healthier and working longer, these four disease innovations alone produce $2.01 trillion in additional federal income tax revenue over 30-year period.

HIV treatments generated $330 billion in new tax receipts as patients who would have died young instead worked for decades. Heart disease innovations contributed $103 billion. Breast cancer advances added $49 billion. And obesity treatments are projected to deliver a massive $1.53 trillion in federal tax revenue as they prevent disability and extend working lives across a huge population.

This is the fiscal externality nobody talks about: medical innovation pays for itself. When we invest in R&D and approve breakthrough therapies, we're not just spending—we're creating a revenue stream that flows back to the Treasury for generations.

4. The Bottom Line: A 27-to-1 Return on Investment

From 2016 to 2020, the United States invested an average of $204 billion annually in medical and health R&D. In 2024, Americans spent $806 billion on prescription drugs. The estimated $5.6 trillion in annual benefits from innovations in just these four disease areas represent a return 27 times greater than our annual R&D investment and seven times greater than our total prescription drug spending.

Even accounting for the $878 billion net increase in healthcare spending these innovations required over 30 years (driven primarily by HIV and breast cancer treatments, while heart disease and obesity innovations actually saved money), the return is extraordinary. For every dollar we've invested in treating these conditions, we've generated dollars in health value, productivity, and tax revenue that will compound for decades to come.

5. The Path Forward

This analysis makes one thing crystal clear: medical innovation is not a cost—it's an investment with exceptional returns. Breakthroughs across these 30-year horizons are unlocking value that exceeds our wildest projections, and the innovations on the horizon promise even greater gains.

As policymakers grapple with healthcare affordability and budget pressures, they must recognize that constraining innovation—through restrictive foreign price controls, undermining intellectual property rights, or reduced R&D investment—would be penny-wise and pound-foolish. The American model of biomedical innovation, for all its imperfections, has generated returns that benefit not just patients, but workers, employers, taxpayers, and the entire global economy.

We need to double down on what works. That means protecting the free-market incentives that drive breakthrough research, ensuring patients can access innovative treatments, and measuring success not just by what we spend, but by the extraordinary value we create. The past 30 years prove the model works. The next 30 years could be even better—if we have the courage to defend it and invest in the future of American health and prosperity.

1. Introduction

Medical innovation stands as one of the most powerful forces driving improvements in public health, economic productivity, and overall social welfare. Most people view their health as their most important asset; therefore, improvements in it are of enormous value (Grossman, 2017). In an era of rising healthcare costs and strained public budgets, understanding the full value of medical advances that enhance health is becoming more central (Murphy & Topel, 2006; Nordhaus, 2002). Policymakers face increasing pressure to balance access, affordability, and innovation incentives, yet traditional analyses often understate the broader economic and societal benefits delivered by new treatments (Rettig, 1994; Cutler & McClellan, 2001).

Recent frameworks that quantify long-term value, including gains in life expectancy, reductions in mortality, and productivity improvements, suggest that the true economic impact of medical advances may be significantly underestimated when viewed solely through traditional cost-effectiveness analysis (Cutler et al., 2007; Lakdawalla et al., 2015). Furthermore, medical innovation's value extends beyond individual health to include insurance value guaranteeing future care, reduced uncertainty, and increased national wealth (Lakdawalla et al., 2015; Murphy & Topel, 2006). This growing body of evidence underscores the importance of adopting a broader evaluative lens that captures not only direct clinical outcomes but also long-term social and economic returns.

This paper introduces a comprehensive framework to assess the social return on medical innovation using four key diseases as illustrative cases: HIV, heart disease, breast cancer, and obesity. Our approach goes beyond conventional metrics by incorporating not only health gains but also associated impacts on healthcare spending, productivity, and tax revenue, thereby offering a more holistic view of innovation's contribution to society.

To illustrate the magnitude and methodological scope of our analysis, consider the case of innovation that reduced HIV-related morbidity and mortality. We anchor life expectancy at 39 years in 1995 (pre-HAART) and 77.4 years in 2016 (after broad diffusion) and linearly interpolate annual life expectancy between these two points to reflect gradual uptake. To account for the COVID-19 shock, we assume 2023 returns to the 2015 level (75 years) and interpolate accordingly. Combining these year-specific gains with roughly 50,000 new HIV diagnoses treated each year yields cohort-specific added life years. Averaged from 1995 to 2024, this method implies about 23 additional life years per incident patient. Valued at the median U.S. VSLY ($558,812 per life year), that is about $16.76 million per person.

With nearly 50,000 new patients per year, this translates to $0.84 trillion in health value per year, cumulating to $25 trillion over 30 years. This credits each year's cohort with the gain appropriate to its year rather than assuming an immediate, uniform 40-year increase for everyone. In addition to assessing gains from improved health, our analysis then incorporates three further components: the net effect on health spending over a 30-year horizon, productivity gains from extended working lives, and the resulting increase in federal tax revenues. These are all dimensions, particularly productivity gains, that are central to increased economic growth as measured by GDP and overall economic well-being.

While HIV is one illustrative case, our framework generalizes across other major disease areas: breast cancer, heart disease, and obesity. Together, these conditions account for substantial life years gained for the U.S. population. Distributing the total value of innovation across the entire U.S. population over a 30-year period, we estimate an annualized value of $16,447 per capita. This per-person benefit arising from improved survival, productivity, and reduced public costs is well within the range of typical U.S. health expenditures. For context, per capita healthcare spending in the U.S. reached $14,570 in 2023 (CMS, 2024), smaller than our estimated annualized gain. This comparison highlights that the estimated benefits from innovation are not only substantial but also economically reasonable relative to what society already spends on healthcare.

The rest of this paper proceeds as follows: Section 2 outlines the methodology and criteria used to capture the full spectrum of the economic impact of medical innovation. Section 3 provides an overview of the estimates impact of innovation across the selected diseases and obtains estimates of corresponding life expectancy gains. Section 4 applies our framework to quantify the impact of medical innovation over the past 30 years, focusing on gains in health outcomes, healthcare spending, productivity, and tax revenue. Section 5 concludes with policy implications and directions for future research.

2. Methodology for Assessing the Full Value of Medical Innovations

Our methodology builds upon a well-established foundation in the literature that seeks to evaluate the full societal value of medical innovation beyond immediate clinical outcomes. Early foundational work, such as by Murphy and Topel (2006) and Nordhaus (2002), laid the theoretical groundwork by translating improvements in life expectancy into long-term social value. These studies helped quantify how medical advances contribute to economic welfare by valuing gains in health and longevity at a population level.

More recently, a growing body of research has adopted similar comprehensive frameworks to capture the broader effects of medical innovation. For example, the WifOR Institute's "Social Impact" methodology incorporates a four-part evaluation system that assesses direct patient health benefits, impacts on healthcare system costs, productivity changes, and macroeconomic effects such as tax revenue (Schiener et al., 2021). This integrated approach has been used to gauge the full value of innovative medicines across disease areas. Similarly, a 2024 working paper from the U.S. Bureau of Economic Analysis (BEA) used extensive cost-effectiveness research and administrative data to evaluate the diffusion and welfare implications of innovation across disease areas, reinforcing the feasibility and policy relevance of multi-dimensional value assessments (Dunn et al., 2024).

The approach used in this study—combining estimated health gains, healthcare savings, productivity impacts, and fiscal effects—is not novel. Rather, it builds on these existing efforts as an extension and application of a maturing methodological tradition aimed at capturing the full societal returns to medical innovation.

This section outlines the methodology used to monetize the value components of medical innovations. For each disease, we assess several key dimensions of value, including improvements in survival, quality of life, and productivity. These estimates are compared directly to the marginal costs of new innovations. The analysis covers a 30-year time horizon to capture long-term impacts.

2.1 The Value of Patient Health Improvements

We estimate the dollar value of health improvements brought about by medical innovations, focusing on both individual (per capita) and aggregate (population-level) impacts, considering total disease incidence and prevalence over time. To identify health gains, health improvements are measured in terms of increased life expectancy, which are additional years of life attributable to medical innovations. These estimates are based on population-level mortality data from sources such as the Centers for Disease Control and Prevention (CDC). To monetize these improvements, we use the Value of a Statistical Life Year (VSLY), which reflects the societal monetary value assigned to each year of life gained or extended. We adopt an average VSLY of $558,812 (2020 USD) based on values used by five U.S. government agencies: the Department of Health and Human Services, the Environmental Protection Agency, the Department of Transportation, the Department of Agriculture, and the Department of Homeland Security (Durie & Philipson, 2021). This focus on life expectancy excludes morbidity-related quality-of-life improvements, making our estimates a conservative measure of total health gains.

Although this value may seem high relative to traditional cost-effectiveness thresholds like ICER's $100,000–$150,000 per Quality-Adjusted Life Year (QALY) or Equal Value of Life Years Gained (evLYG), VSLY represents a different evaluative framework. It is based on individuals' willingness to pay to reduce mortality risk and is widely used in federal regulatory analysis. Unlike QALY or evLYG, which incorporate health state preferences and are often debated for potentially embedding biases against people with disabilities or chronic illness, VSLY focuses solely on valuing statistical reductions in mortality risk, making it more neutral to health status and better aligned with societal valuations of life. The literature supports the reasonableness of our estimate. Durie and Philipson (2021) found that the median VSLY used by U.S. government agencies is $580,000. This figure is comparable to the academic median of $512,422 and the meta-analytic median of $529,043. Most academic estimates fall between $450,000 and $650,000, suggesting consistency across methods. VSLY also varies with age, generally peaking around 50 to 55 years, consistent with income and consumption patterns. These findings reinforce that our chosen VSLY is both empirically grounded and appropriate for assessing the social value of medical innovation.

To compute the aggregate health gain over the entire period from t=0 to T, sum the gains for each year of new diagnoses. The total gain G is given by:

$$G = \sum_{t=0}^{T} N_t(L_t - L_0)V$$

Where:

N_t = Number of new treatments in year t

L_t = Life expectancy with the innovation in year t

L_o = Life expectancy without the innovation in year t=0

V = Value of a life year

It is important to note that our analysis tracks the healthcare gain for each individual patient and attributes their lifetime health value gains at the time of treatment initiation. In other words, we do not accumulate the same patient's gains year by year; rather, each newly treated patient is counted once at entry, avoiding double-counting across subsequent years. To achieve this, we focus specifically on newly treated patients, thereby distinguishing them from the prevalent patient stock and those already under treatment in prior years. If we were to only care about the newly diagnosed patients or pool all patients together without this separation, we would risk underestimating or overestimating the healthcare value gains.

Accordingly, the annual number of newly treated patients is calculated as:

$$N_t = P_t \times Uptake_t - s \times P_{(t-1)} \times Uptake_{t-1}$$

where P_t denotes the number of prevalent patients in year *t*, is the uptake rate of treatment in year *t*, and *s* represents the retention rate of patients who initiated treatment in year *t–1*.

Intuitively, this formula captures the net inflow of patients who start treatment in year *t*: It takes the total number of patients with new diagnoses who begin treatment in year and subtracts those who would have already been carried over from the previous year's treated population. This ensures that each patient's health gains are recorded once, at the time they first enter treatment, without repetition in later years.

The above method works well for chronic diseases such as HIV, heart disease, and obesity, where patients need to take medication continuously over long periods. However, it becomes problematic when applied to breast cancer, where the main medical innovation, chemotherapy, typically occurs only once for a patient and lasts about 3–6 months. In such cases, it is difficult to model treatment in the same way as with chronic conditions. Therefore, for breast cancer, we adopt a more conservative approach by estimating the number of newly treated patients each year as the product of the number of new diagnoses and the uptake rate.

2.2 The Impact on Total Current and Future Healthcare Spending

Medical innovations frequently alter the trajectory of total healthcare spending by influencing both direct and indirect costs associated with disease management. While new innovations may initially increase healthcare expenditures, these costs are often offset partially or fully by reductions in other forms of healthcare spending. In some cases, innovations can lead to net savings, meaning total healthcare spending decreases despite the added costs of new treatments.

We employ a cost-benefit analysis framework to evaluate the impact of medical innovations on spending. This approach assesses the incremental costs of new innovations relative to their effect on other healthcare expenditures. By focusing on a 30-year time horizon, the framework captures both the immediate and long-term cost trends associated with the adoption and implementation of these innovations. This methodology ensures a comprehensive understanding of the financial dynamics over time.

Discounting and inflation adjustments are applied to ensure that future cost and savings estimates are directly comparable to current expenditures. Present-value adjustments account for the time value of money, making the financial benefits and trade-offs of medical innovations more accurately comparable over time. This rigorous methodological approach enables a detailed evaluation of how innovations impact healthcare spending both now and in the future.

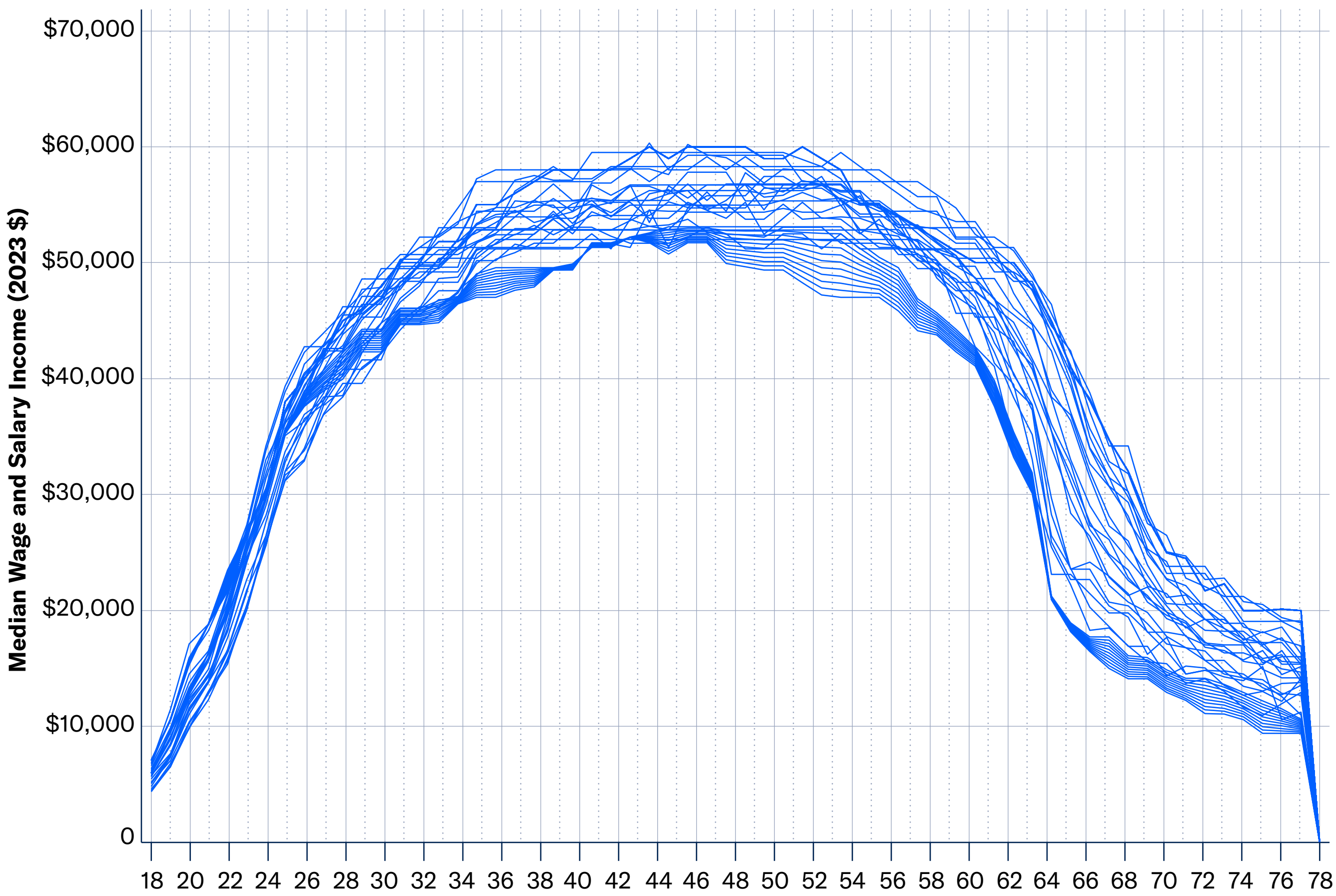
2.3 The Value of Increased Productivity

Medical innovations improve patient health outcomes and enhance economic productivity. By reducing morbidity and mortality, these innovations enable individuals to participate more fully in the workforce, reduce absenteeism, and improve overall work performance. In the productivity analysis, we quantify the economic value of these gains by estimating the additional productive years enabled by innovation and valuing this time at prevailing median wage levels using IPUMS USA data. While affected populations—such as those with HIV or breast cancer—may disproportionately include lower-income groups or women, we apply a uniform wage rate to maintain comparability across conditions and avoid embedding structural inequities in the valuation. Future sensitivity analyses could incorporate subgroup-specific adjustments.

To estimate the age-wage profile of the U.S. population, we use data from IPUMS USA and extracted a dataset from 1990 and then from 2000 to 2023 (Ruggles et al., 2023).

This dataset contains individuals aged 18 to 78, along with their total personal wage and salary income, which is all pretax money received as an employee, and employment status. Observations were filtered to keep only those with the “Employed” employment status. The data was then grouped by age and year, and the median total wage and salary income for each age group was then calculated. Then, since this was real income, we imputed the inflation from the CPI inflation calculator into a data frame to find real wages in terms of 2023 purchasing power (U.S. Bureau of Labor Statistics, 2024). Also, owing to missing data, we did a linear transformation from 1990 to 2000. To fully calculate the productivity gained by each cohort, we expand from the 2023 wage at the predicted wage growth from the U.S. Congressional Budget Office (CBO)’s January 2025 Report (2025), then deflate this by its predicted PCE inflation rate for this same period. This is used to calculate the real wage from 2024 to 2084 to follow through to the end of each cohort. This results in predicted real wage growth ranging from 1.3% to 0.9% per year. In Figure 1, we see the median income from 1990 to 2025, where in 2023, income peaks around workers’ late 40s to early 50s at $60,000 and then declines, presumably as people exit the workforce.

Figure 1: Median Total Wage Income by Age From 1990 to 2025



Then, we calculate the gain in life years by medical innovation by age for each disease. Using the average increase in life expectancy per disease each year due to innovation, we find how much increased productivity exists for every age at which one can be diagnosed. In other words, how many years were added to a given age from the medical innovation into a disease. For example, in HIV, it is more prevalent to be diagnosed in people around 30 years of age, so for these individuals, the added life expectancy will be very high. For those diagnosed in a given year at a specific age, we calculate their cumulative productivity by summing up the median wages they would earn each year over these added years. To represent a realistic population value, we then adjust this individual productivity by considering the probability of being diagnosed at a particular age by the annual influx of new cases. This gives us a comprehensive measure of how innovation extends productive life and generates aggregate gains over time. The methodology can be expressed in a formula as seen below:

$$Added\ Productivity = \sum_{t \in T, a \in A} N(t)P(a) \left(\sum_{i=1}^{L(t,a)} MedianWage_{t+L_0+i,a+L_0+i} \right)$$

Where:

N(t) = Number of new treated in year t

P(a) = Probability of being diagnosed with a disease at a certain age

L = Remaining life expectancy with the innovation (L_t)- Remaining life expectancy without the innovation (L_o), simply marked as L = $L_t - L_o$

The inner summation in the formula captures per person added productivity by summing up the wages of additional years. Assuming an individual of years old is diagnosed at year , they will live to the age of   and the year of without innovation. If there is innovation, they can live to the age of and the year of . At each additional future year , the individual is aged at and earns the median wage associated with that year and age.

The outer summation iterates over all sample years and all possible diagnoses at age to calculate the total added productivity gains. We multiply the influx of a given disease at year by a fixed percentage of diagnoses at age to get the associated number of patients, which is captured by . Then, we can estimate the total added productivity of the group aged at in the year by multiplying the number of patients in that age group and the corresponding per-person added productivity. Finally, we sum up values for all age groups and all years to get the total added productivity gain from the innovation.

In addition, we have multiple assumptions in productivity analysis. First, since age prevalence data is found binned, we assume that each age has a linear probability. We also calculate productivity for cohorts until death or the U.S. life expectancy of 78. This means in the analysis individuals will live until 78 years old or younger due to disease. Additionally, since we project the wage data to 2084, we stop accumulating the productivity gain this year, even if one in the sample might live beyond it. Finally, for age bins that contain ages under 18, we assume the wages for those age groups to be zero considering the work regulations for youth.

2.4 Tax Revenue Impact

Medical innovations not only improve health outcomes but also significantly influence public finances, particularly through increased tax revenues. By extending life expectancy and improving productivity, these innovations enable individuals to participate in the labor force for longer periods. This prolongation of productive life increases lifetime earnings and, consequently, federal income tax contributions. In this section, we evaluate how medical innovations in HIV, heart disease, breast cancer, and obesity contribute to federal tax revenues and compare these fiscal benefits to the costs associated with adopting new treatments. While we apply a standardized wage-income profile to estimate tax effects for comparability, it is important to note that affected populations—such as those with HIV or breast cancer—may differ demographically in income potential. Future analyses could incorporate more granular demographic adjustments or conduct sensitivity analyses to reflect these differences.

To estimate the federal income tax revenue generated by age due to medical innovations, we focus solely on federal income tax contributions from extended productive lifespans.

The methodology draws on three primary data sources: (1) age-specific median income data from IPUMS USA (2025), which provides the earnings trajectory over an individual's working life; (2) projected 2025 federal income tax brackets, assumed to mirror 2023 marginal rates; and (3) disease-specific gains in life expectancy derived from Section 3.1 of the working paper, which quantifies the years of life added by medical interventions for each condition.

The analysis makes several simplifying assumptions to isolate the federal income tax effects. First, taxable income is based on age-specific median earnings, and income is only considered up to age 70 to reflect typical retirement behavior. Second, we assume full-year employment among those in the labor force, which provides a tractable baseline without modeling labor force participation heterogeneity. Third, standard deductions are applied using 2024 values ($14,600 for single filers) to calculate adjusted gross income. Finally, the analysis excludes state and local taxes as well as payroll taxes (e.g., Social Security and Medicare) to focus solely on federal income tax contributions. These assumptions yield a conservative estimate of fiscal benefits while maintaining transparency and analytical clarity.

For each disease cohort, the calculation proceeds in three steps:

1. Productive Years Gained: Multiply the disease-specific life expectancy gains (e.g., 23 years for HIV, 1.1 years for heart disease) by the duration of expected employment, truncating at age 70 to reflect typical retirement patterns.

2. Tax Liability Estimation: Apply the relevant federal marginal tax rates to taxable income (median earnings minus standard deductions) for each age group. For example, a 50-year-old HIV survivor earning $63,000 (median) would face an effective tax rate of 12%–22% after deductions.

3. Aggregate Revenue Projection: Scale individual tax contributions by the annual incidence of each disease (e.g., 37,981 new HIV cases) to estimate total federal revenue gains.

This approach captures the fiscal externality of medical innovation—where longer, healthier lives generate additional tax revenue—while controlling age-related variations in earnings and tax burdens. The methodology is intentionally conservative by excluding indirect effects (e.g., increased consumption taxes) and behavioral responses (e.g., labor supply changes), providing a lower-bound estimate of revenue impacts. Sensitivity analyses could relax these assumptions in future work.

This framework quantifies the fiscal externality of medical innovation: healthier, longer lives yield not only private benefits but also public returns through enhanced tax contributions. The model remains conservative by excluding indirect tax effects (e.g., sales taxes from increased consumption) and behavioral changes, ensuring a focused and robust estimation of federal income tax benefits.

3. Overview of Disease-Specific Innovations and Associated Life Expectancy Gains

This section provides the foundation for our subsequent analysis of innovation-driven health gains. We examine four major disease areas: HIV, heart disease, breast cancer, and obesity. Each condition illustrates a distinct pattern of medical progress over the past three decades. For each condition, we identify the core therapeutic innovation that has shaped modern clinical practice: antiretroviral therapy (ART) for HIV, statin-based lipid-lowering therapy for heart disease, multi-agent chemotherapy as the central systemic treatment for breast cancer, and GLP-1–based pharmacologic therapy for obesity. These therapeutic domains are not intended to capture the full universe of medical advances within each disease. Rather, they represent the most influential and most measurable innovations, selected because they (i) have documented changes in uptake over time, (ii) are associated with clear improvements in survival or long-term health outcomes, and (iii) allow us to meaningfully connect population-level survival gains with observable patterns of treatment adoption.

The remainder of this section introduces the clinical background, key innovation milestones, and the evolution of life expectancy gains for each disease area. This overview sets the stage for our subsequent estimation of the aggregate value of medical innovation over the past 30 years.

3.1 HIV-Related Innovations and Associated Life Expectancy Gains

In this analysis, the relevant innovation for HIV is antiretroviral therapy (ART), the medical breakthrough that fundamentally altered the natural history of HIV and remains the dominant driver of survival gains over the past three decades. ART transformed HIV from a rapidly fatal infection into a manageable chronic condition, extending life expectancy, improving quality of life, and reducing long-term healthcare costs.

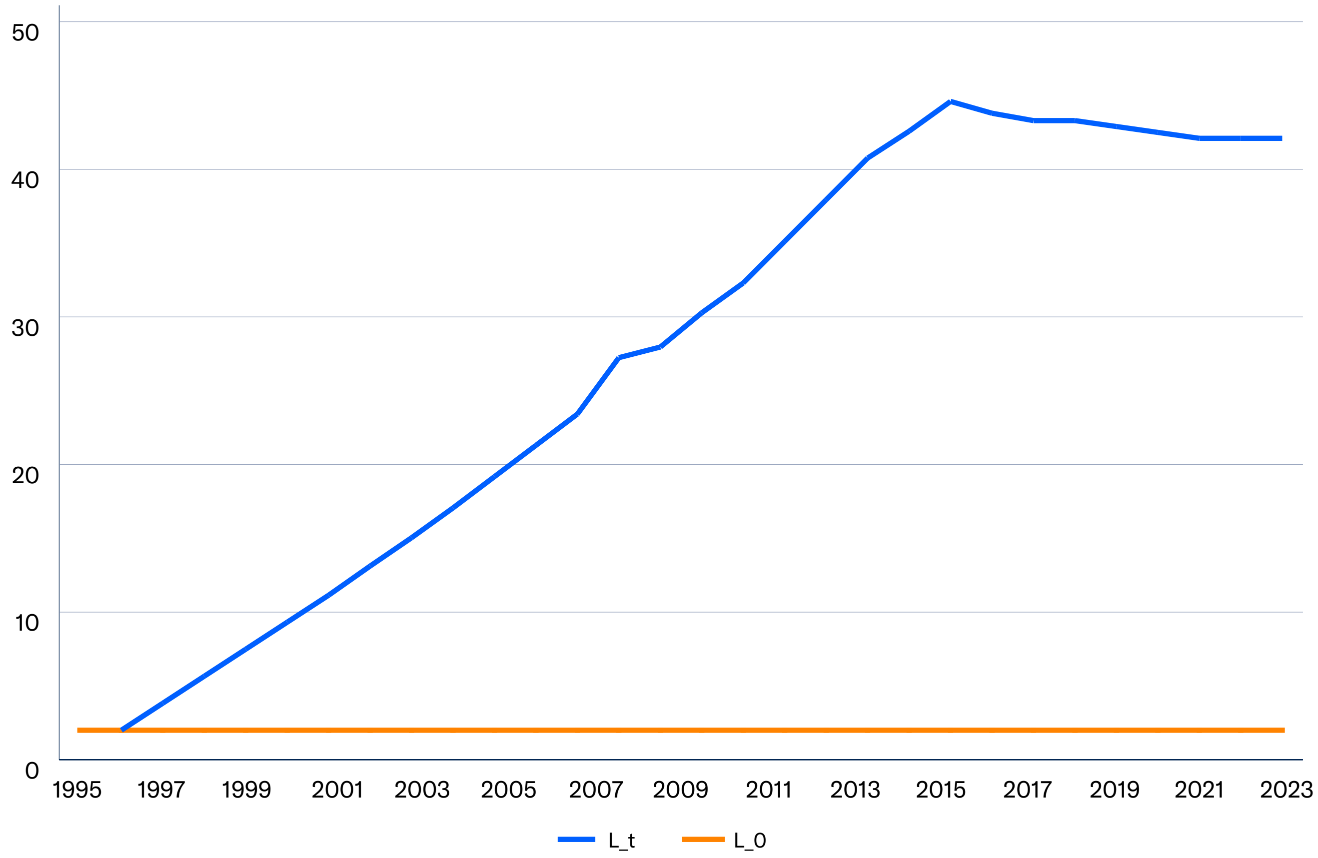
Human Immunodeficiency Virus (HIV) serves as a powerful example of the transformative potential of medical innovation. Advances in ART and diagnostic tools have revolutionized the treatment of HIV. In the 1990s, survival after an HIV diagnosis was typically just 1 to 2 years (Editorial Team, 2024). Yet, today, with consistent adherence to treatment, individuals with HIV are expected to live as long as those HIV-negative individuals (Pebody, 2020). Although life expectancy has converged, differences remain in quality of life and years without HIV comorbidities.

Before the advent of effective ART, the prognosis for individuals with HIV was very poor. In the pre-ART era, most people with HIV eventually progressed to AIDS, and once AIDS developed, the median survival time was generally only about 1 to 2 years. Many patients survived merely 1 to 3 years after diagnosis due to the lack of effective viral suppression and the high mortality associated with opportunistic infections.

The dramatic improvement in survival rate highlights the success of ART. The life expectancy for a 20-year-old person with HIV has more than doubled between 1996 and 2016, increasing from approximately 39 years to about 77.4 years (Trickey et al., 2023; Scaccia, 2024).

Using linear interpolation, we derive the life expectancy of people who have HIV/AIDS with ART from 1995 to 2024 as shown in Figure 2. The slight decline after 2020 reflects excess mortality during the COVID-19 pandemic rather than any change in ART effectiveness.

Figure 2: Life expectancy of HIV With Innovation From 1995 to 2024



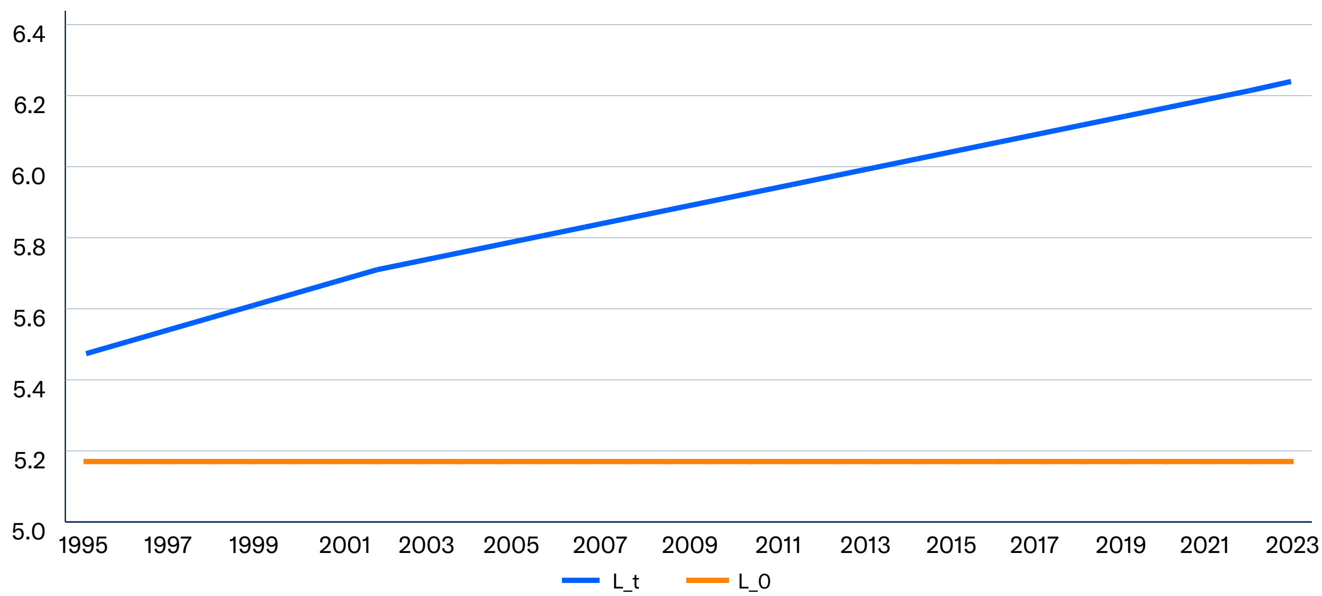
3.2 Heart Disease Innovations and Their Impact on Survival

In this analysis, the relevant innovation for heart disease is statin-based lipid-lowering therapy, which has become the cornerstone of cardiovascular prevention and remains the most important pharmacologic driver of reductions in cardiovascular mortality over the past several decades.

In 1987, the U.S. Food and Drug Administration (FDA) approved lovastatin (Mevacor®) as the world's first statin for clinical use. Since its introduction, randomized trials have consistently shown that statin therapy reduces deaths and major cardiovascular events by approximately 20% to 30% compared to a placebo (Ross, 1999). Although the absolute extension in life expectancy is modest on a 5-year horizon, typically ranging from several weeks to a few months depending on baseline cardiovascular risk, statins deliver meaningful cumulative benefits over a lifetime.

For example, among 58-year-old adults at moderate cardiovascular risk, statin therapy is estimated to increase life expectancy by about 6.6 months in men and 6.4 months in women (Blake et al., 2002). A 2024 analysis further estimated that lifetime standard-dose statin increases survival by 0.28 to 1.85 years. (Mihaylova et al., 2024). Taking the midpoint of the reported range, lifelong standard-dose statin therapy increases survival by about 1.07 years on average. High-risk individuals can expect somewhat more; very low-risk or frail elderly adults may see little or no extension in total lifespan.

Figure 3: Life expectancy of Heart Disease With Innovation From 1995 to 2024



3.3 Advances in Breast Cancer Treatment and Life Expectancy Improvements

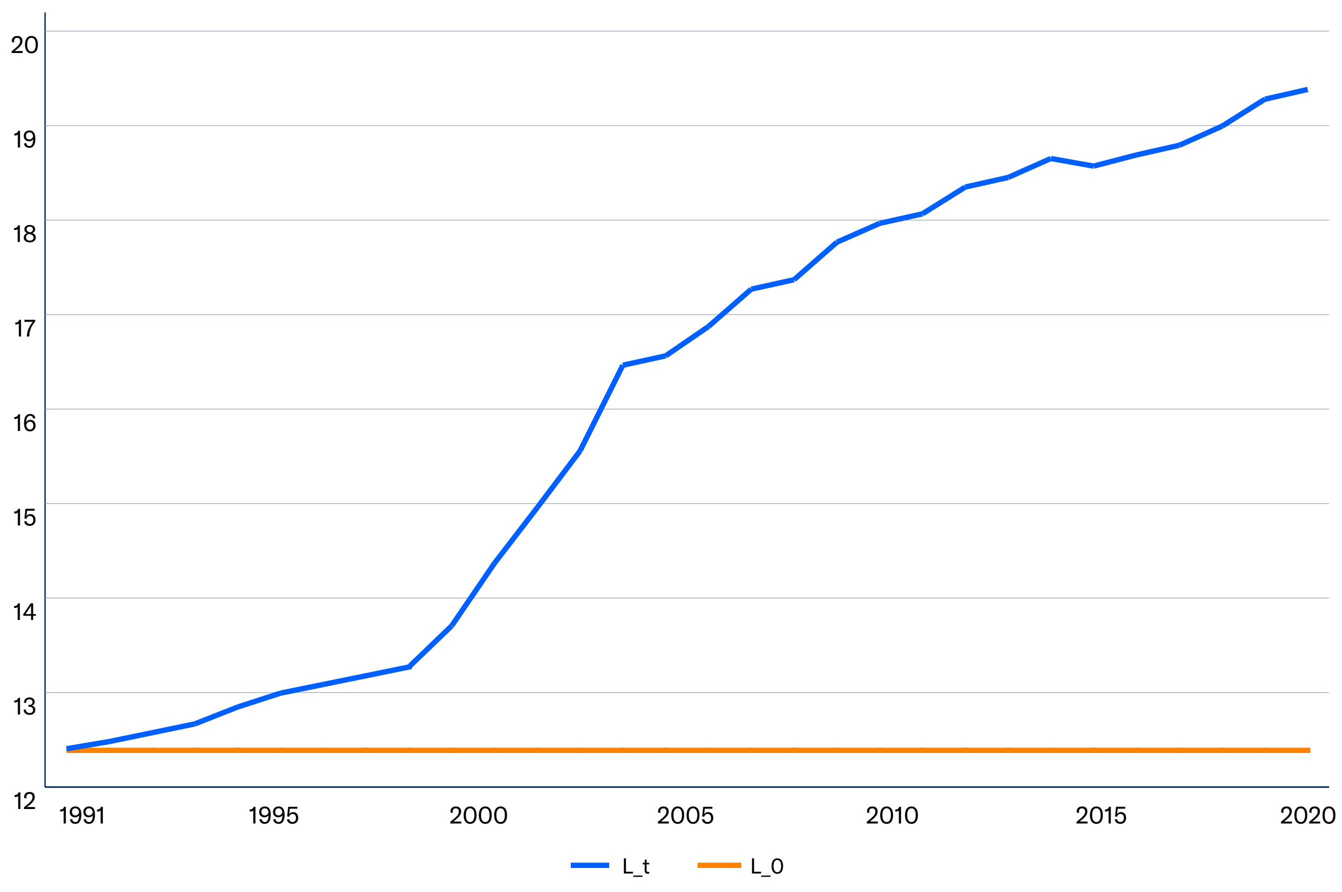
In this analysis, the relevant innovation for breast cancer is systemic therapy, with multi-agent adjuvant chemotherapy as the central and most consistently adopted component of modern treatment for early-stage, higher-risk disease. Over the past several decades, chemotherapy has become the backbone of systemic management for patients with node-positive or otherwise high-risk tumors, and changes in its use and effectiveness are a key driver of improvements in population survival.

Chemotherapy did not become a cornerstone of breast cancer treatment until the late 1970s and 1980s, when clinical trials demonstrated that adjuvant multi-agent chemotherapy substantially reduced recurrence and mortality among women with early-stage disease. Before this period, the standard approach relied heavily on surgery, and the prevailing view of the 1950s and 1960s attributed recurrence to insufficient surgical removal, leading many patients to undergo radical mastectomies with extensive disfigurement (ACSH Staff, 2016). As evidence accumulated that systemic treatment improved outcomes, chemotherapy became the backbone of care for patients with node-positive or otherwise high-risk tumors, while slower-growing hormone-receptor-positive cancers benefited from endocrine therapy. For a large share of early-stage breast cancer in women, particularly those with biologically aggressive disease, chemotherapy has been the principal driver of improvements in post-diagnosis survival.

Survival outcomes today reflect the long-run effect of these changes. In 2025, the probability of dying from breast cancer is about 2.3%, a decline of roughly 44% since 1989. Overall 5-year relative survival across all stages is approximately 91% , though outcomes vary widely by subtype: triple-negative breast cancer has a 5-year survival rate of 77% , while inflammatory breast cancer has a survival rate of 39% (American Cancer Society, 2025). The majority of patients, however, are diagnosed with localized disease, which accounts for roughly 66% of new cases in 2025 and has a 5-year relative survival rate of 99% (NBCF, 2025). Localized breast cancer, generally corresponding to stage I and some stage II tumors, represents precisely the setting in which adjuvant chemotherapy has historically had its greatest impact, improving long-term survival for women with node-positive or biologically aggressive early-stage disease. For this reason, survival trends for localized disease provide a useful summary of the cumulative effect of chemotherapy adoption and evolving systemic treatment practices in early-stage breast cancer.

To quantify these gains, we use 5-year relative survival rates for localized breast cancer as reported in Yang et al. (2021) for 1991, 1995, 1996, and 2000 and interpolate the intervening years. For 2004–2020, we draw from the National Cancer Institute's Recent Trends in SEER Relative Survival Rates (National Cancer Institute, 2024), selecting localized, female breast cancer. Although these survival measures capture all improvements in early-stage care, much of the observed increase during this period is attributable to the expanded use and refinement of multi-agent chemotherapy, which has consistently shown strong benefits for women with higher-risk localized disease. We convert 5-year survival rates into expected years of life after diagnosis using a weighted-average method. Patients who die within 5 years are assumed to live an average of 2.5 years post-diagnosis, while long-term survivors are assumed to live to the U.S. female life expectancy of 81.4 years. For each year, these 2 outcomes are weighted by the observed 5-year survival rate to produce an estimate of expected post-diagnosis life expectancy. For example, in 2020, the 5-year survival rate for localized breast cancer is 99.9%. Roughly 0.01% of patients are expected to live 2.5 additional years, while the remaining 99.9% diagnosed at an average age of 62 are projected to live to age 81.4. This yields an average of 19.4 additional years of expected life. In contrast, in 1991, 16.2% of patients survived only 2.5 years, while 83.8% survived from an average diagnosis age of 64.5 to a life expectancy of 78.8, yielding 14.3 expected years of life after diagnosis (Silverberg et al., 1990; National Center for Health Statistics, 1997). As shown in Figure 4, post-diagnosis life expectancy for localized breast cancer increased by 6.99 years between 1991 and 2020, reflecting the population-level impact of improvements in systemic therapy and the sustained role of multi-agent chemotherapy in early-stage disease management.

Figure 4: Life Expectancy of Localized Breast Cancer With Innovation From 1991 to 2020



3.4 Obesity Treatment Innovations and Impact on Life Expectancy

In this analysis, the relevant innovation for obesity is GLP-1–based pharmacologic therapy, which represents the first clinically validated and widely scalable treatment capable of producing sustained, double-digit weight loss in the general population. Prior to the emergence of GLP-1 medications, the management of obesity was marked by decades of ineffective or unsafe therapies. Throughout the late 20th century, multiple pharmacologic options were approved and subsequently withdrawn due to adverse side effects or limited long-term efficacy (Bray et al., 2022). Even as the health consequences of excess weight became increasingly recognized, few treatments were able to reliably alter the long-term risk profile for individuals with obesity. The introduction of GLP-1 therapy for weight loss in 2021 therefore represents a major shift in the clinical management of obesity.

Excess weight is closely tied to increased mortality risk, with higher body mass index (BMI) categories associated with progressively elevated hazard ratios. According to Berrington de Gonzalez et al., (2010), mortality risk rises gradually with overweight (HR 1.13) and accelerates sharply across obesity classes (HR 1.44 for class I, 1.88 for class II, and 2.51 for class III). Corresponding estimates from Worthing (2020) suggest substantial reductions in life expectancy, ranging from 6.5 to 13.7 years of life lost for severe and morbid obesity. These relationships make clear that long-term mortality in obesity is driven less by episodic complications and more by cumulative exposure to elevated BMI.

GLP-1 therapy is therefore clinically meaningful not only because it reduces weight but because it reliably shifts individuals into lower-risk BMI categories, thereby decreasing their long-term mortality profile. Research indicates that GLP-1 treatment produces an average weight reduction of roughly 14.8% from baseline (Zheng et al., 2024). For many individuals with a BMI under 35, this level of weight loss is sufficient to move them from the obesity range into the overweight range, substantially lowering their associated hazard ratio. For example, a person with a BMI of 34 would experience a reduction of approximately 5 BMI points, transitioning from class I obesity into the overweight category. This change lowers their projected mortality hazard from 1.44 to 1.13.

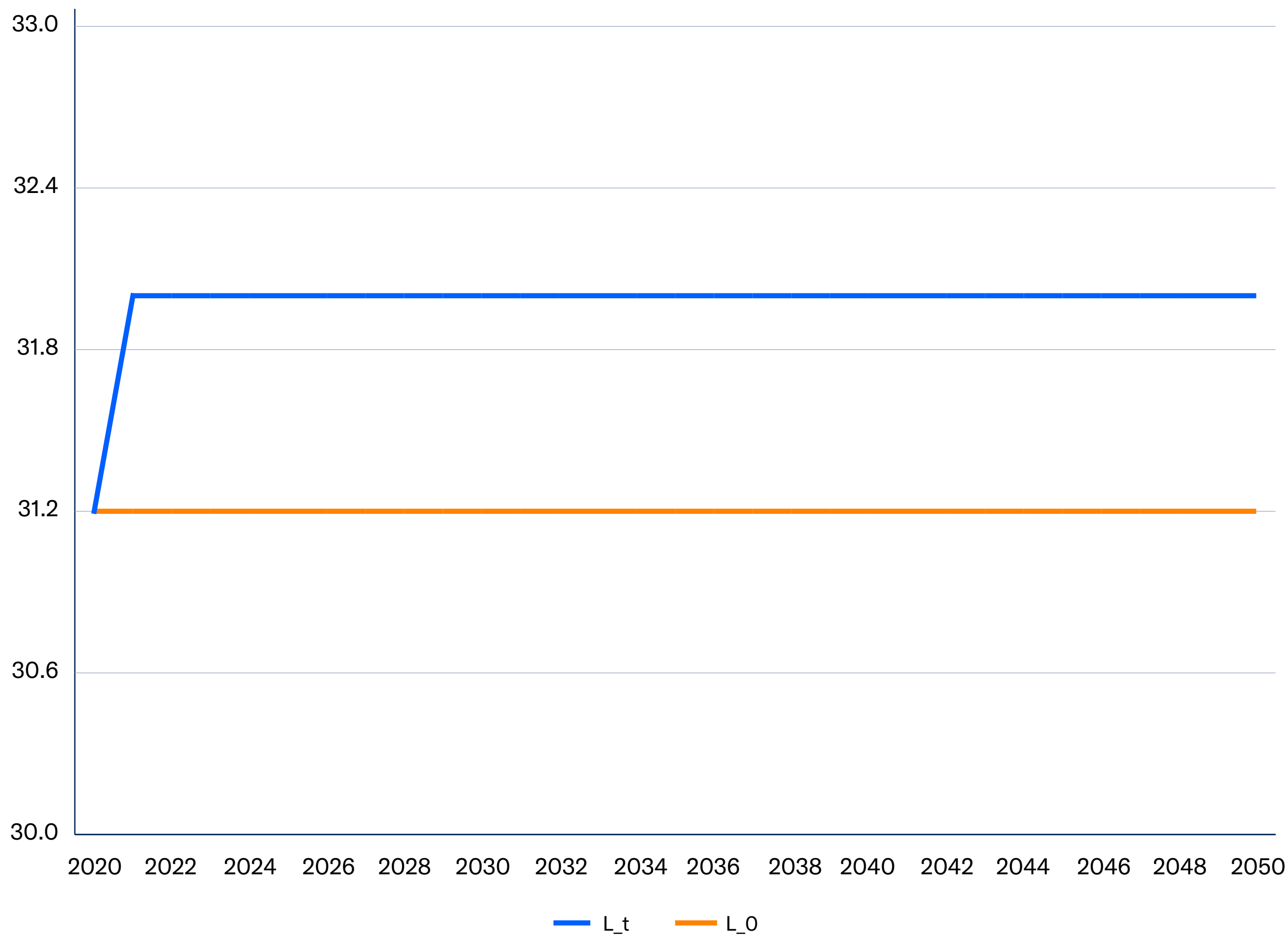
To quantify these gains, we translate hazard ratios into years of life lost using the log-linear function: Years of Life Lost where k is calibrated to match life-loss estimates for class III obesity; this yields k = 7.07. Applying this function produces estimated life-loss values of approximately 0.9 years for overweight, 2.6 years for class I obesity, and 4.5 years for class II obesity.

Using these estimates, we simulate the effect of GLP-1-induced weight loss on life expectancy. Based on the U.S. average life expectancy of 77.5 years in 2021 (National Center for Health Statistics, 2024), an individual in the class I obesity range would be expected to live approximately 74.9 years without treatment. After GLP-1 therapy and the resulting reclassification into the overweight category, life expectancy increases to approximately 76.6 years. Figure 5 summarizes predicted life expectancies across BMI categories with and without GLP-1-driven improvements in weight and corresponding changes in mortality risk.

Individuals with normal or slightly elevated BMI are not eligible for GLP-1 treatment, so their BMI and their projected life expectancy remain unchanged.

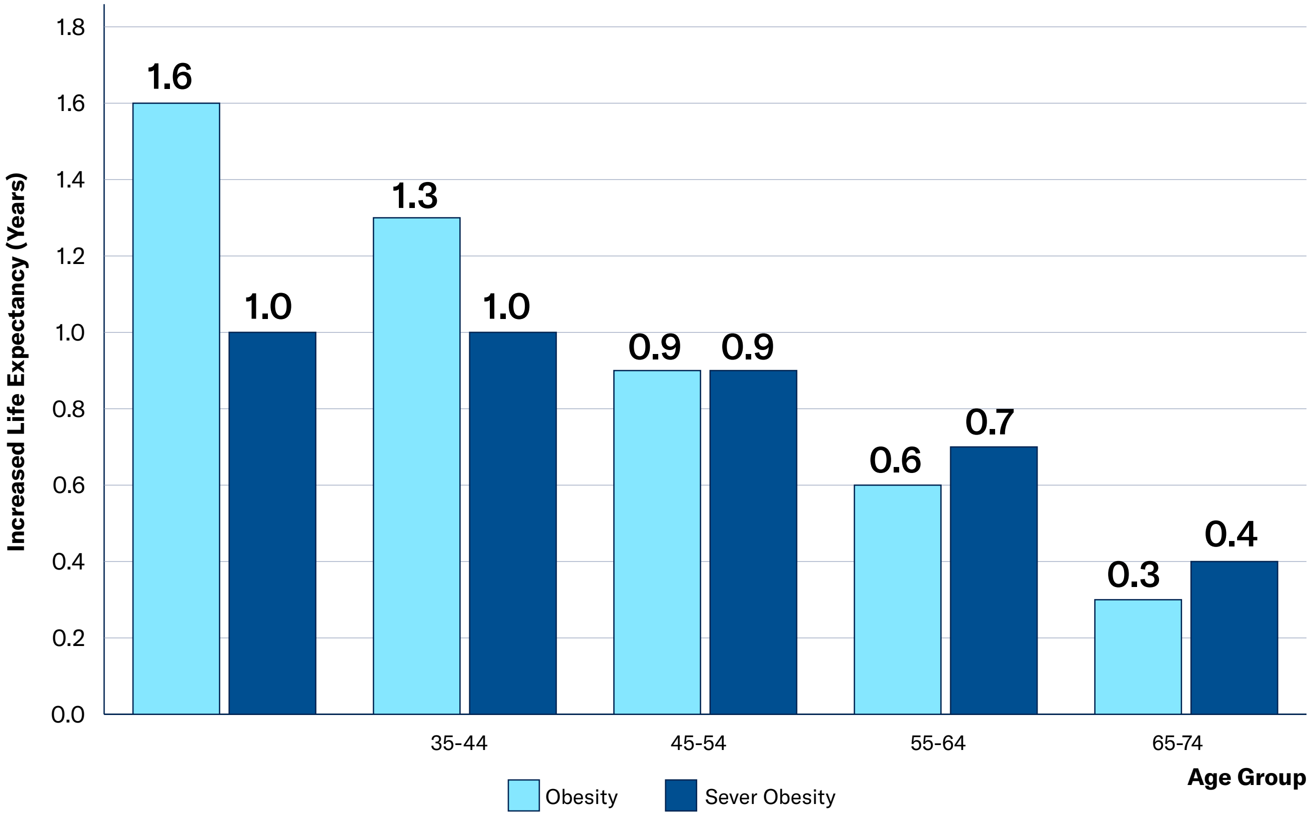
Figure 5: Life Expectancy of Obesity With Innovation 2021 Cohort

(Estimated From BMI Reduction)



While the life expectancy gains implied by BMI category shifts illustrate the upper bound of potential benefit, real-world estimates provide a more conservative benchmark. Recent work by Ward et al. (2025) from the Schaeffer Center suggests that obese individuals may gain up to 1.8 additional life years from anti-obesity medications such as GLP-1 therapy. The largest improvements occur among adults aged 25–34, who receive the full 1.8-year benefit under sustained treatment. Older adults, particularly those aged 65–74, experience smaller gains—on the order of 6 months—reflecting both higher baseline mortality risk and shorter remaining life expectancy. Combining these estimates across the age distribution yields an average improvement of roughly 0.8 years in expected lifespan for individuals with obesity. This value provides a policy-relevant midpoint between the theoretical gains implied by BMI-based hazard reductions and the empirically grounded survival benefits observed in early modeling of GLP-1 therapy.

Figure 6: Increased Life Expectancy Estimated by the Schaeffer Center



Source: the Schaeffer Center

Note: The Schaeffer Center's research estimates increased life expectancy for multiple BMI groups across five age bins. This graph presents the arithmetic average increased life expectancy for the obesity groups and the exact increased life expectancy for the severe obesity groups in each age bin.

4. Estimate the Impacts of Innovation

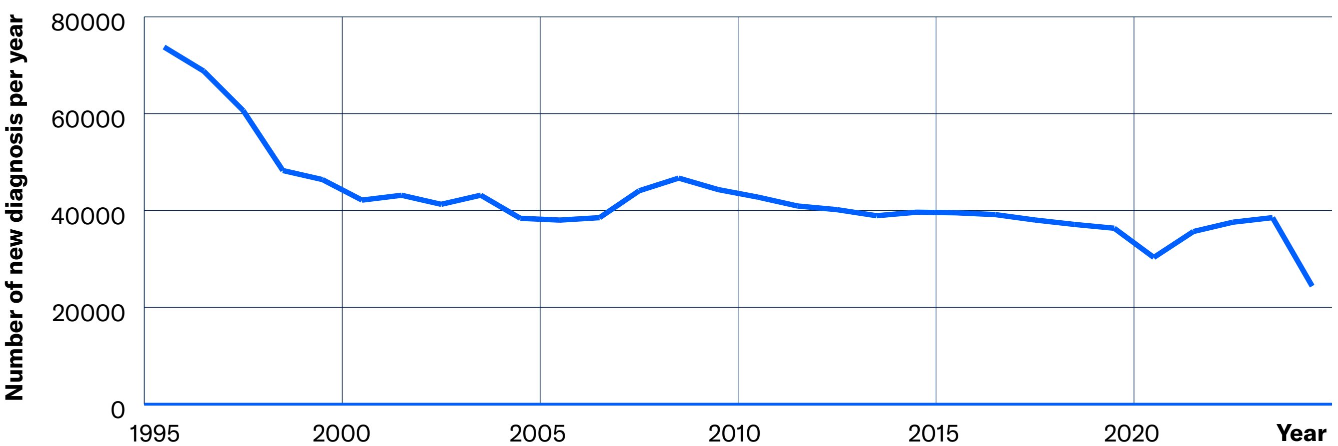
The impact of medical innovation unfolds over long periods of time, often spanning decades rather than years. To capture this broader arc of value, we examine a 30-year horizon across all four disease areas. For HIV, heart disease, and localized breast cancer, this horizon reflects the actual historical window over which these therapies have been adopted and their health and economic benefits fully realized. The case of obesity is different: GLP-1 therapy is a recent breakthrough, with large-scale adoption only beginning in 2021. For this reason, our estimates for obesity use the early evidence from 2021 to 2025 as the basis for a forward-looking projection that extends over the same 30-year window. This approach allows all four conditions to be evaluated on comparable terms, highlighting the long-run health, fiscal, and productivity consequences of innovation.

4.1 The Full Value of Medical Innovation for Several Disease Classes

4.1.1 HIV

In terms of HIV diagnosis rates, 32,000 new HIV diagnoses were reported in the U.S. in 2021, marking a 16% decrease from the previous year. However, diagnoses rebounded to 37,981 in 2022 (HIV.gov, 2025). This dip-and-rebound pattern likely reflects disruptions in screening and access to care during the COVID-19 pandemic rather than a true decline in incidence. While this analysis focuses on treatment-related gains, it is worth noting that additional innovations across the HIV care continuum, including screening, prevention (e.g., PrEP), and earlier diagnosis, also contribute to substantial fiscal and health benefits that are not fully captured here. Figure 7 shows the number of new diagnoses per year of HIV/AIDS, with data from CDC Stacks.

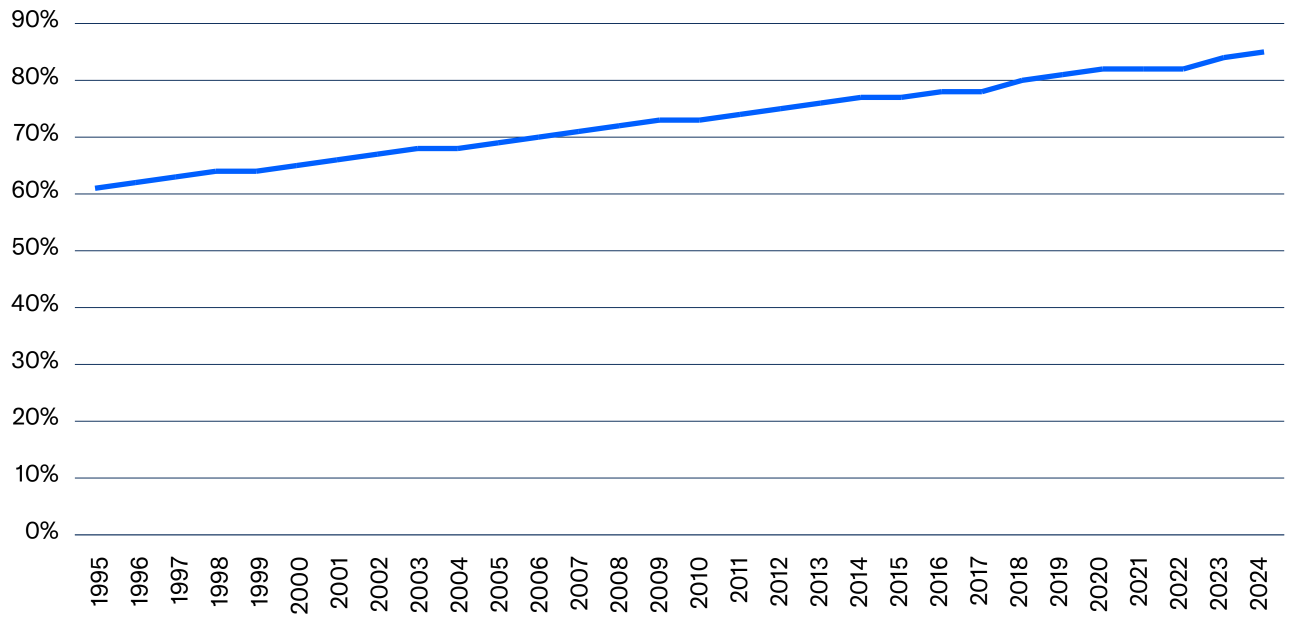
Figure 7: Number of New Diagnoses Per Year of HIV/AIDS



Previously, the impact of HIV in the U.S. was devastating. In 1991, 29,850 U.S. residents died from HIV-related causes. Of these, 3% were under 25 years old, 74% were between 25 and 44 years old, and 23% were 45 years or older. This data starkly contrasts with the improved survival outcomes seen today due to medical advancements in HIV treatment.

When calculating the health gains from HIV treatment, it is important to note that 1995 marks the introduction of antiretroviral therapy (ART). Before this breakthrough, available treatments for HIV were relatively inefficient and provided only limited clinical benefits. However, due to social and cultural barriers, such as stigma and discrimination, the uptake rate of ART has historically been suboptimal (see Figure 8). Although the uptake rate has gradually improved, rising from around 60% in the early years to about 84% by 2024, this still falls short of the UNAIDS 95-95-95 targets (i.e., 95% of all people living with HIV knowing their status, 95% of those diagnosed receiving sustained ART, and 95% of those on ART achieving viral suppression) (UNAIDS, 2021). HIV retention rates may also vary due to different diagnosis stages and treatment conditions (Clouse et al., 2013), and we use an average retention rate of 98% in our estimates.

Figure 8: Annual Antiretroviral Therapy Uptake Rate



Note: The uptake rate comes from America's HIV Epidemic Analysis for the years between 2017 and 2022; for the rest of the year, we use linear extrapolation to estimate the data (USAFacts team, 2023).

Building on these values, the aggregate health gain from ART for HIV patients is calculated as follows. Using 1995 as the start year with survival of 2 years without the medical innovation of ART, we calculate the aggregate gain of value of life for newly treated persons each year and add up the values from 1995 to 2024, which is , to a total value of $22.00 trillion for the past 30 years.

4.1.2 Heart Disease

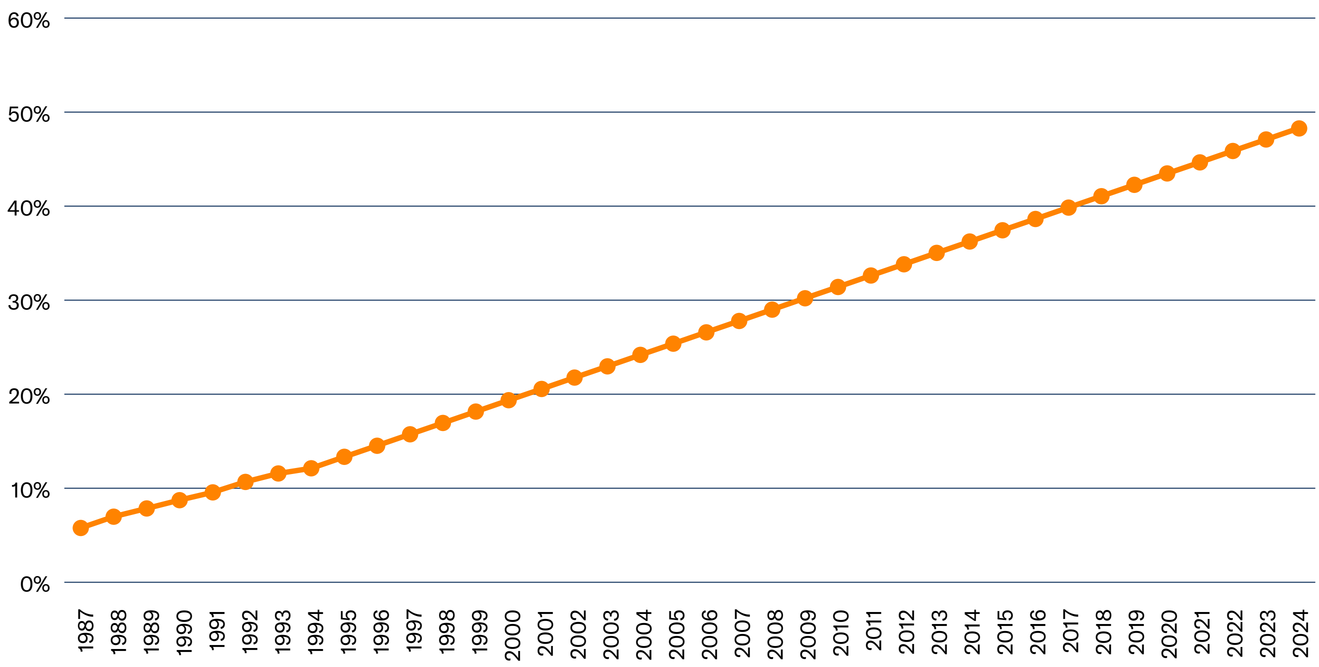
Heart disease remains a leading health concern in the U.S., with significant impacts on morbidity and mortality. According to the CDC, in 2022, heart disease was responsible for 702,880 deaths, accounting for every 1 in 5 deaths nationwide (CDC, 2024). This has been the case since the 1950s, and since then, significant improvements have been made to combat cardiovascular disease (Nesvisky, 1998). According to data from 2005 to 2014, the U.S. experiences approximately 605,000 new heart attacks annually, along with 200,000 recurrent attacks; this equates to someone in the U.S. having a heart attack approximately every 40 seconds (American Heart Association, 2024). For the number of heart attacks in previous years, we are assuming the same numbers in our calculation. Significant improvements have been made in the last 25 years to make treatment less invasive and allow people to return to everyday life (Cleveland Clinic, 2025).

The life expectancy after diagnosis has improved since the 1990s for both men and women. The age-standardized coronary heart disease (CHD) mortality rate for females in 1990 was 210.5 per 100,000 population, while in 2019, it decreased to 66.8 per 100,000 population. For males, the rate in 1990 was 442.4 per 100,000, decreasing to 156.7 per 100,000 in 2019. Additionally, the mean age at cardiovascular disease diagnosis in the general population was 54 ± 16 years, indicating a wide range of ages at which individuals are diagnosed (Lee et al., 2022).

Comparing each dollar invested with the additional years of life it secures highlights the extraordinary economic payoff of cardiovascular advances. Every $1 devoted to treating heart disease translates into roughly $7 of life-extension value, and each $1 channeled into research that shifts the behaviors underpinning the disease (e.g., diet, smoking, physical activity) returns on the order of $100 (Cutler, 1999). Put differently, expenditures on both frontline care and upstream research in cardiovascular medicine rank among the most economically productive uses of society's resources.

In 1987, lovastatin became the first statin approved by the FDA, a major advance in the prevention and treatment of atherosclerotic cardiovascular disease (CVD). In the 1990s, additional statins, including simvastatin, pravastatin, fluvastatin, and atorvastatin, were introduced, followed by rosuvastatin, expanding both potency and indications. Long-term statin therapy reduces CVD morbidity and mortality, and its benefit depends on adherence and continued use. Based on recent real-world evidence, 12-month class-level persistence among CVD patients is relatively high, around 78% to 83%, and even higher in a previously treated or secondary-prevention cohort (Martín-Fernández et al., 2025). Accordingly, we use 85% as a literature-based approximation in our calculations. By contrast, population uptake has been modest: from roughly 5% at introduction to about 48.3% by 2024, still below one-half, reflecting factors such as out-of-pocket burden and real or perceived adverse effects.

Figure 9: Annual Statin Drug Uptake Rate



Note: The uptake rate comes from Gao et al., (2023) for the years between 1999 and 2017; for the rest of the year, we use linear extrapolation to estimate the data.

Building on these values, the aggregate health gain for heart disease is calculated as follows. To quantify the impact of innovation, we calculate annual survival improvements by finding the difference between overall life expectancy (with innovation) and the average age at heart attack diagnosis each year. Using this, we determine the incremental value of life years gained annually, and sum these annual gains from 1995 to 2024 to obtain the total aggregate value of increased longevity resulting from medical innovations, which is, to a total value of $13.7 trillion for the past 30 years.

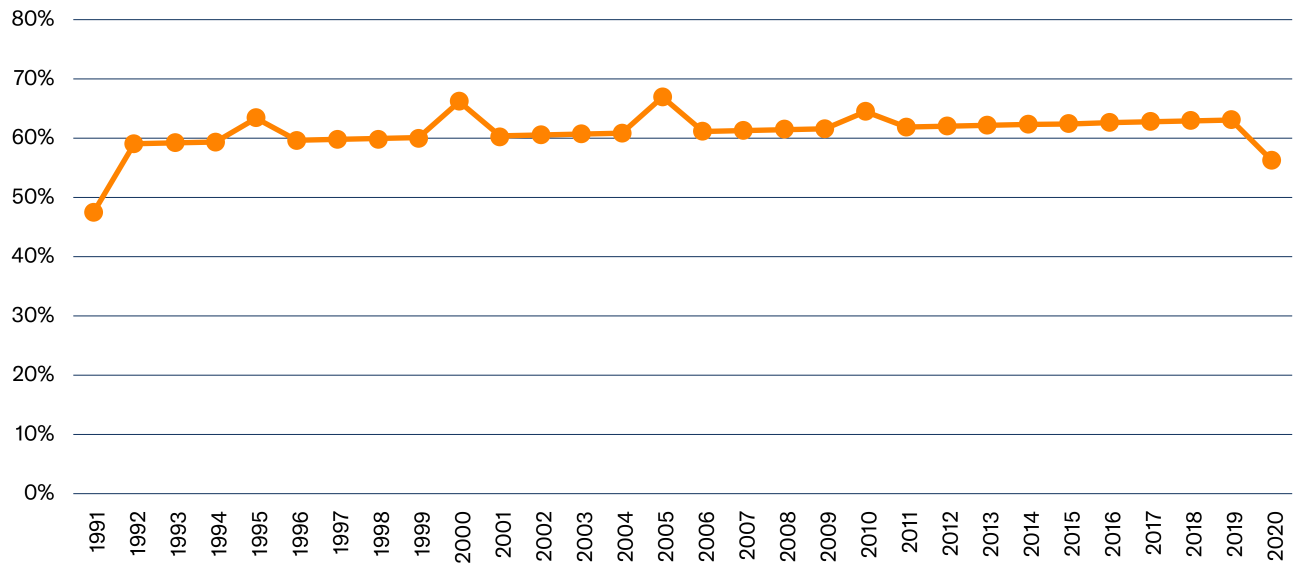
4.1.3 Breast Cancer

Breast cancer is among the most common cancers in the U.S., and the lifetime risk for women is about 1 in 8. Chemotherapy was introduced for breast cancer in the 1970s and soon became a core treatment. In the 1980s and 1990s, its effectiveness was enhanced by combining it with other modalities, for example anthracycline and later taxane regimens used in adjuvant or neoadjuvant settings together with surgery and radiation. Since the 1990s, the overall use of chemotherapy has remained relatively stable at about 60% in our data (see Figure 10).

Chemotherapy is a short course rather than a chronic therapy. Most adjuvant regimens last about 3 to 6 months. For this reason, a stock or retention model that is appropriate for long- term maintenance drugs would greatly overestimate the number of newly treated patients in a given year. Some patients who do not receive chemotherapy at diagnosis will start it later after metastatic progression, but this group is small relative to the overall early-stage population.

To remain conservative and avoid double counting, we estimate the annual number of newly treated patients as new diagnoses in that year multiplied by the chemotherapy uptake rate within 12 months of diagnosis.

Figure 10: Annual Breast Cancer Chemotherapy Uptake Rate



Source: National Cancer Institute, Breast Cancer Treatment (2025)

Building on these values, we estimate the annual number of newly treated patients as the number of new diagnoses in each year multiplied by the chemotherapy uptake rate. We then compute each newly treated patient's health value as life expectancy gain times the value of a life year (VLY), and aggregate across cohorts. Accumulating from 1991 to 2020 yields a 30-year total health value gain of $25.13 trillion. Complete mathematical details are provided in Appendix A.

4.1.4 Obesity

Obesity, defined as a body mass index (BMI) of 30 or higher, is recognized as a severe chronic disease. In 2020, approximately 42% of U.S. adults were classified as obese (CDC, 2024), compared to only 11.6% in 1990 (AHR, 2019). The prevalence of severe obesity (BMI ≥ 40) has also risen substantially, from 4.7% in 1999 to 9.2% in 2018 (CDC, 2024). By extrapolating CDC data with a linear trend between 2015 and 2020, we estimate that the adult obesity prevalence will reach 44% by 2025, corresponding to approximately 153 million individuals (World Obesity Federation, 2023; Census Bureau, 2025). From 2026 to 2050, we assume that due to the availability of effective pharmacologic treatment, obesity prevalence will remain stable at this 2025 level of 44%. Using Weldon Cooper Center's population projections, we thus obtain annual estimates of the obese adult population from 2021 through 2050 (Sen, 2024).

It is important to note that unlike other diseases where historical data is used to estimate past trends, our analysis of obesity involves projecting future scenarios based on existing data. This inherently requires assumptions about treatment diffusion dynamics. Specifically, we assume that in the early phase of pharmacologic innovation, uptake and persistence rates will be relatively low due to high drug prices and greater side effects. However, as prices decline and side effects diminish, both the treatment uptake rate and persistence rate (the probability that a patient remains on therapy over time) will gradually increase.

From the perspective of treatment uptake, we focus on glucagon-like peptide-1 receptor agonists (GLP-1RAs), which since 2021 have become the dominant pharmacologic therapy for obesity. Prior to the approval of semaglutide (Wegovy®) in 2021, most pharmacologic options had limited use due to modest efficacy and safety concerns, and GLP-1RAs such as Ozempic and Mounjaro were often prescribed off-label (Truveta Research, 2024). Following their formal approval for weight management, adoption increased rapidly. Dispensing data from the IQVIA National Prescription Audit shows that the prescription rate of anti-obesity medicines rose from about 0.9% of the obese adult population in 2020 to 4% in 2024 (Berning et al., 2025). However, these rates reflect prescription events rather than distinct patients. To calibrate to a patient-level prevalence measure, we align these data with evidence from Kim et al. (2025), who reported that 2.3% of eligible patients had an active prescription for semaglutide or tirzepatide in 2024 based on electronic health record data. We therefore apply a uniform scaling factor (2.3% ÷ 4% = 0.575) to the IQVIA-based series, producing adjusted patient-level shares of treated for 2021–2025. We then linearly extrapolate these rates through 2050, yielding the full trajectory of uptake shown in Figure 11.

As for the persistence rate, following Rodriguez et al. (2025), we find that in 2023 the average persistence rate for GLP-1-based therapies was about 40%, meaning that the average patient remained on treatment for approximately 2 years. We assume that as drug safety improves and prices fall, this rate will gradually increase, reaching a long-run persistence of 95% by 2050, equivalent to an average treatment duration of roughly 20 years (based on exponential conversion). Using linear extrapolation between 2021 and 2050, we obtain the annual trajectory of persistence rates displayed in Figure 12.

Based on these inputs, the annual number of newly treated patients is calculated as:

$$Newly\ Treated_t = P_t \times Rx_t - s \times P_{t-1} \times Rx_{t-1}$$

where P_t is the obese adult population in year t, RX_t is the share treated, and s_t is the one-year persistence rate defined as the fraction of patients treated in year $t-1$ who remain on therapy in year t. For calibration purposes, we set $s_{2021} = 40\%$, consistent with Rodriguez et al. (2025) and allow it to rise gradually toward 0.95 by 2050 in line with the assumed improvements in adherence. The difference between total treated patients in successive years thus represents the number of new initiators entering therapy each year. Each new initiator is assigned an incremental lifetime health gain, measured in life years adjusted by quality of life and monetized using the value of a statistical life year (VSLY). Following our framework, annual health value gains are obtained by multiplying the number of new initiators by the estimated per-patient lifetime gain.

Following our framework, annual health value gains are obtained by multiplying the number of new initiators by the estimated per-patient lifetime gain. Our estimates suggest that annual health value gains will rise from $621.68 billion in 2021 to $5.39 trillion in 2050, yielding a cumulative total of $94.44 trillion over the period. To illustrate how these estimates are derived, consider 2025: In that year, the obese adult population is projected to be 152.8 million, with 2.75% of them receiving treatment, a figure converted from prescription rates. To identify the number of new initiators, we take the total treated population in 2025 and subtract 48% of the treated population from 2024 since we assume that share continues therapy into the following year. This calculation yields roughly 3.01 million new initiators in 2025. Multiplying this influx by the assumed per-patient lifetime health gain (0.8 additional life years valued at $558,812 each) produces a total health value gain of about $1.35 trillion for that year alone. This example illustrates how by repeating the same calculation across all years from 2021 to 2050, we obtain the cumulative estimate of $94.44 trillion. The total health value highlights the substantial long-term value that could be realized from the continued uptake of GLP-1-based anti-obesity therapies under current trends, partly due to the enormous prevalence of the disease.

Figure 11: Estimated Uptake Rate for Anti-Obesity Medicine From 2021 to 2050

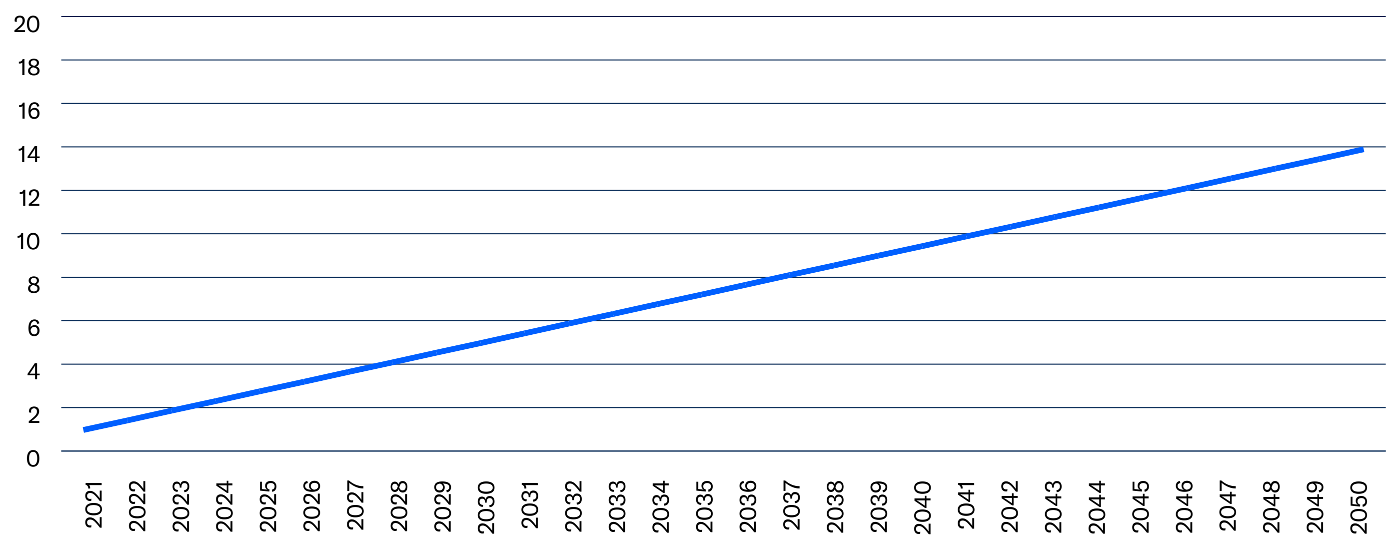


Figure 12: Estimated Persistent Rate for Anti-Obesity Medicine From 2021 to 2050

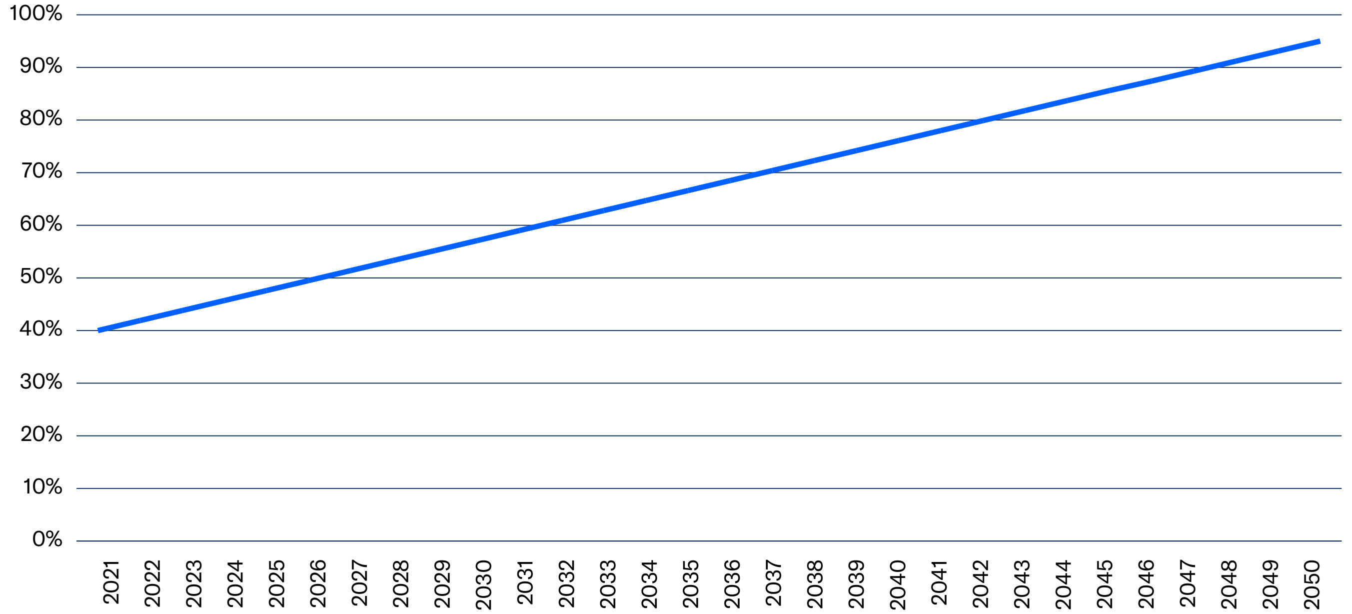


Table 1:
Summary Table of 30-Year Aggregate Health Gains (in Trillions of 2020 USD)

Disease	Aggregate Gain, G, from Innovation
HIV	$22.00
Heart Disease	$13.74
Breast Cancer	$25.13
Obesity	$94.44

Note: The 30-year horizon for each disease area reflects the approximate period since the introduction of breakthrough therapies and availability of impact data. Specifically, HIV (1995–2024), heart disease (1986–2024), breast cancer (1991–2020), and obesity (2021–2050) are each assessed over this span. All values are normalized to 2020 USD to enable cross-condition comparison on a consistent 30-year basis.

4.2 The Impact on Total Current and Future Healthcare Spending

4.2.1 HIV

Incidence anchor.

CDC surveillance shows U.S. diagnoses averaging ≈ 37, 000 per year since the late-1990s, summing the annual counts in Table 1A of the HIV Surveillance Report 2023 yields ≈ 1.4 million new treated cases between 1995 and 2025 (CDC, 2024).

Pre-HAART cost profile.

A national cost survey of AIDS patients receiving only palliative care in 1995 reported $2, 764 in monthly expenditures—$1,765 hospital inpatient, $999 outpatient and hospice—equivalent to $33,168 per patient-year in 1995 USD (Bozzette et al., 1998). After CPI-U adjustment (+12%) that becomes ≈ $37,000 in 2024 USD. Median survival from diagnosis to death in the pre-HAART era was ~2 years, giving a discounted lifetime bill of ≈ $70, 000 per patient.

Modern ART cost profile.

Starting from the lifetime HIV treatment cost estimated by Bingham et al. (2021) using the PATH 3.0 model (Bingham et al., 2021)—$420,285 (2019 USD) for a 35-year-old initiating an integrase-based regimen at a 3% real discount rate—we first adjust for inflation (+11% from 2019 to 2024), giving $466,500 in 2024 USD. As 74% of this total is attributable to antiretroviral drugs and laboratory monitoring, we further apply a 15% nominal price increase (IQVIA) to this component, yielding a drug + lab present value of $358,000 and an all-other medical present value of $121,000. These components sum to a midpoint lifetime cost of $479,000, which reflects all direct medical costs (ART, inpatient/outpatient care, opportunistic infection treatment, and prophylaxis) but excludes indirect costs and future cost offsets. This aligns with a broader published range of $326,000 to $490,000 under varying assumptions, including diagnosis timing and retention in care (Schackman et al., 2016). A recent observational claims-based study by Cohen et al. (2025) offers a higher estimate: for a cohort of commercially insured U.S. adults, the discounted lifetime cost per person with HIV is $1.3 million (2022 USD), with an incremental cost of $1.1 million compared to non-HIV individuals. While this estimate reflects broader all-cause costs and may include comorbidity-driven utilization, it underscores the significant long-term financial burden of HIV care.

To express that present value as a constant, undiscounted annual stream, we divide by the 40-year annuity factor at 3% real . The result is ≈ $20,700 per patient-year in 2024 USD. Allocating that annual figure in proportion to the updated present-value shares gives ≈ $15,500 per year for drugs and laboratory monitoring and ≈ $5,200 per year for all other inpatient and outpatient care.

While drug prices may vary over a 30-year horizon due to factors such as patent expiry, competition, and policy shifts, the approach of expressing lifetime costs as a constant annual stream is consistent with established practices in cost-effectiveness and budget impact assessments (e.g., Schackman et al. 2016; Bingham et al. 2021). Generic availability does not uniformly lead to proportional cost savings, especially in the case of fixed-dose combinations and branded STRs, which often remain in widespread use even after patent expiration. Recent analyses highlight that projected savings from generics are highly context dependent and moderated by factors like manufacturer rebates, pill burden, and patient adherence (HHS, 2025). By applying inflation adjustments and separately estimating drug-related versus non-drug costs, our method already incorporates key components of price dynamics in a tractable form.

Aggregate budgets.

Multiplying the updated per-patient present values by the ≈ 1.4 million Americans treated with HIV from 1995 to 2025 yields starkly different national ledgers. In the counterfactual world where 1995-era palliative care persisted, lifetime spending would total about $98 billion (1.4 m × $70 000). Under the midpoint modern-ART profile—$479 000 present value per patient—the cumulative outlay rises to ≈ $671 billion. The differential, ≈ $573 billion, represents the net addition to U.S. healthcare spending that can be traced directly to three decades of antiretroviral innovation. Even with these more moderate unit costs, drugs and laboratory monitoring account for nearly three-quarters of the total, underscoring that the fiscal impact is driven not by residual inpatient care but by the medication bill required to sustain the extra four decades of life that ART now affords each newly diagnosed person.

4.2.2 Heart Disease

In the mid-1990s, hospital treatment of acute coronary events was the cost driver of cardiac care. American Heart Association expenditure tables for 1995 put hospitalizations for myocardial infarction, PCI, and coronary bypass at about $22 billion (2024$), which serves as our "no-statin" baseline for direct costs (Mozaffarian et al., 2015). Statin innovation reshaped that ledger in three ways.

First, brand-era drug spending appeared. Medical Expenditure Panel Survey data shows outpatient prescription outlays for statins climbing from $7.7 billion in 2000 to $19.7 billion in 2005, averaging across 1997–2005 gives ≈ $12 billion a year in brand-era pharmacy costs (Stagnitti, 2008). Over the nine-year window, that amounts to $108 billion (present value).

Second, hospital costs fell as events were prevented. The U.S. adaptation of the Heart-Protection Study economic analysis found that allocation to simvastatin reduced hospital spending for vascular events by ≈ 20% over 5 years (Heart Protection Study Collaborative Group, 2009). Applying that 20% cut to the $22 billion baseline from 2006 onward yields $4.4 billion a year in avoided admissions and procedures—$88 billion present value over 20 years.

Third, generic entry refunded large sums to payers. A 17-year MEPS trend study tracking the switch from brands to generics estimated $11.9 billion in system-wide savings every year once full generic competition took hold (2005–2021) (Lin et al., 2021). Discounting that stream to 2024 gives ≈ $238 billion in price-erosion savings.

Even after accounting for post-2006 generic-era drug costs, now only $3–$4 billion a year, or ≈ $80 billion present value for 2006–2025, the ledger shows a clear surplus:

Table 2: Healthcare Spending Savings and Costs (Billions), Past 30 Years Summary

Component (1995–2025)	PV (+cost / -saving, billion)
Brand-era drug spending (1997–2005)	+$108
Generic-era drug spending (2006–2025)	+$80
20% fewer event-related hospital costs	-$88
Savings from generic price erosion	-$238
Net fiscal impact	-$138

Thus, while statins added roughly $190 billion to pharmacy budgets, the combination of fewer coronary events and deep generic discounts more than offset that outlay, leaving the U.S. healthcare system about $138 billion better off in present-value dollars over 1995–2025. Even before counting the trillions of dollars in life years gained, lipid-lowering therapy is therefore a cost-saving medical innovation.

4.2.3 Breast Cancer

Inflation-adjusted national spending on breast cancer care has climbed sharply since the mid-1990s, tracking the diffusion of screening and the uptake of high-priced biologics. The *Cancer Trends Progress Report* shows that in 2020 breast cancer accounted for $26.2 billion in medical services outlays and $3.5 billion in oral prescription drugs, together ≈ 14% of all U.S. cancer costs (National Cancer Institute, 2025). Course-of-therapy list prices for HER2-targeted antibodies and CDK4/6 inhibitors now top $100,000 per patient-year, and a systematic review of stage-stratified real-world costs puts two-year direct medical spending at $72 000 for ductal carcinoma in situ and $160,000 for stage III disease (2024 USD) (Russo et al., 2006; Allaire et al., 2016).

These outlays are partly offset downstream: Adjuvant trastuzumab and extended endocrine therapy reduce metastatic relapse by about 40%, avoiding an estimated $3 billion–$4 billion a year in late-stage hospital and hospice care—savings that will expand as biosimilar price erosion works through claims data (Gogate et al., 2021).

To gauge the net fiscal footprint, we benchmark to 1995, the oldest year with site-specific cost data. NCI's SEER-linked cost series records ≈ $11 billion (2024 $) in breast cancer spending that year—screening, surgery, radiation, and short CMF courses—but before trastuzumab, aromatase inhibitors, or molecular diagnostics entered routine care (Biskupiak et al., 2021). Treating $11 billion as the flat "no-innovation" baseline and using CDC and NCI micro-data to anchor actual spending at $18 billion in 2005, $26 billion in 2015, and $42 billion (projected) in 2025, we interpolate linearly across the three decades. The area above the baseline sums to ≈ $375 billion in gross incremental expenditure:

- 1995–2005 premium:
  ½ × ($18 – $11) × 10 y = $35 b
- 2005–2015 premium:
  ½ × ($26 – $18) × 10 y = $110 b
- 2015–2025 premium:
  ½ × ($42 – $26) × 10 y = $230 b

Applying the 40% reduction in metastatic recurrence to the pre-2000 metastatic-care bill (≈ $10 b/y) yields $4 billion per year in avoided late-stage costs; discounted over the 20 trastuzumab years (2005–2025) at 3% real discount rate, the present value of those savings is ≈ $70 billion. Subtracting that from the gross increment gives a net addition of ≈ $305 billion to the national breast-cancer ledger over 1995–2025. Thus, even after accounting for sizable downstream savings, therapeutic innovation in breast cancer has added a little over three-tenths of a trillion dollars to U.S. medical spending during the past 30 years—a figure that sets the stage for evaluating the parallel trillions in health-value gains.

4.2.4 Obesity

Estimating the fiscal impact of obesity drugs requires a forward-looking framework, since these medications are only recently available and long-run outcomes remain uncertain. Unlike retrospective analyses used for HIV, cardiovascular disease, and breast cancer, our approach relies on prospective simulation of spending trajectories, integrating health technology assessment (HTA) benchmarks, real-world persistence data, and expenditure models.

To project the total fiscal impact over 2021–2050, we divide the analysis into two phases based on FDA-listed patent protections for semaglutide: an exclusivity period (2021–2031) and a post-patent period (2032–2050) (U.S. Food and Drug Administration, 2023). During the exclusivity period, all drug spending is measured at net prices reported by ICER. In 2022, ICER estimated a net annual price of $13,618 for semaglutide (Wegovy®), which declined to $6,829 by 2025, indicating that price reductions occur even within the patent period. This downward trend reflects strategic pricing behavior by the manufacturer: Early price cuts help maintain market leadership by expanding patient access, preempting competitors, and supporting a volume-driven growth strategy amid surging global demand (Barrie, 2025). Consistent with Lin et al. (2025), who found an average 4.7% price reduction before loss of exclusivity (LOE) across major drugs, semaglutide's observed annual price decrease of roughly 13% substantially exceeds the historical average. However, given that such aggressive discounting may not persist throughout the patent term, we conservatively adjust the annual decline rate to 9% through 2031. This implies that by the final year of exclusivity, the net price will have fallen by approximately 70% relative to its 2021 level, consistent with observed price erosion patterns for branded biologics prior to generic or biosimilar entry.

After patent expiration, we model price declines following generic or biosimilar entry. Drawing on Vondeling et al. (2018), we assume that in the first year post-LOE, prices drop to 30% of pre-expiry levels, followed by an average 80% reduction after 8 years, and ultimately reaching 5% of the original net price by 2050. The trajectory between these anchor points follows a gradually declining curve, reflecting progressive market competition and expanded generic availability. This pattern captures the realistic evolution of drug pricing dynamics over the life cycle of semaglutide-class treatments.

Annual pharmacy spending is projected as the product of net price and total person-years on treatment. Let T_t denote the total number of treated in year . For parsimony, and consistent with real-world evidence showing steep early discontinuation (Terhune, 2024), we approximate average persistence as 2 years. Under this simplification, the number of person-years in year t is given by:

$$T_t = E_t \times Rx_t$$

Thus, annual drug spending is:

$$DrugSpend_t = T_t \times P_t$$

where P_t is the net price in year , derived from the market-adjusted price trajectory described above.

The second component of the model captures medical cost savings from weight loss. Recent evidence (Thorpe & Joski, 2024), using the Medical Expenditure Panel Survey and instrumental variable models, provides updated estimates of the reduction in annual healthcare spending associated with lower BMI. For adults with employer-sponsored insurance, a 14% weight loss is associated with an average annual spending reduction of about $1,852 per person, while Medicare beneficiaries with comorbidities see a larger reduction (≈$1,262 per person). Although optimistic, this reflects evidence that GLP-1 receptor agonists typically produce sustained weight loss of 5%–18% on average (Ghusn & Hurtado, 2024). Because our goal is to estimate systemwide healthcare expenditure changes rather than payer-specific budgets, we adopted a unified medical savings coefficient of $1,852 per person-year, corresponding to the 14% benchmark weight loss. This value represents the annual offset in healthcare costs conditional on continuous therapy.

Furthermore, consistent with clinical evidence from semaglutide withdrawal studies, which shows that patients regain roughly two-thirds of lost weight within the first year after discontinuation (Ryan et al., 2024). We assume that medical savings accrue only during active treatment and do not persist beyond cessation. Thus, the annual medical savings in each year are calculated as:

$$MedicalSavings_t = 1852 \times T_t$$

This formulation directly ties cost savings to the number of person-years under active pharmacologic treatment, ensuring that projected fiscal gains are strictly contemporaneous with ongoing medication use.

Finally, the annual net fiscal impact is defined as the difference between total drug spending and medical savings:

$$NetImpact_t = DrugSpend_t - MedicalSavings_t$$

Under this framework, annual medical savings begin to exceed annual drug spending after the loss of exclusivity, reversing the overall fiscal trend observed during the early years (see Figure 12). Cumulative pharmacy spending in 2021–2031 is estimated at $320.99 billion, offset by $100.53 billion in medical savings, resulting in a net fiscal cost of $220.42 billion. In the post-patent period (2032–2050), pharmacy spending is projected at $183.61 billion and medical savings at $570.18 billion, yielding a net fiscal saving of $386.57 billion. Taken together, total drug spending across 2021–2050 reaches $504.60 billion, offset by $670.76 billion in savings, for a net fiscal saving impact of $166.15 billion over the 30-year horizon. This turning point underscores how declining post-patent prices and sustained treatment benefits gradually transform the fiscal balance from a short-term cost to a long-term source of savings.

Figure 13: Estimated Health Drug Spending and Medical Savings forAnti-Obesity Medicine From 2021 to2050 (Million USD)

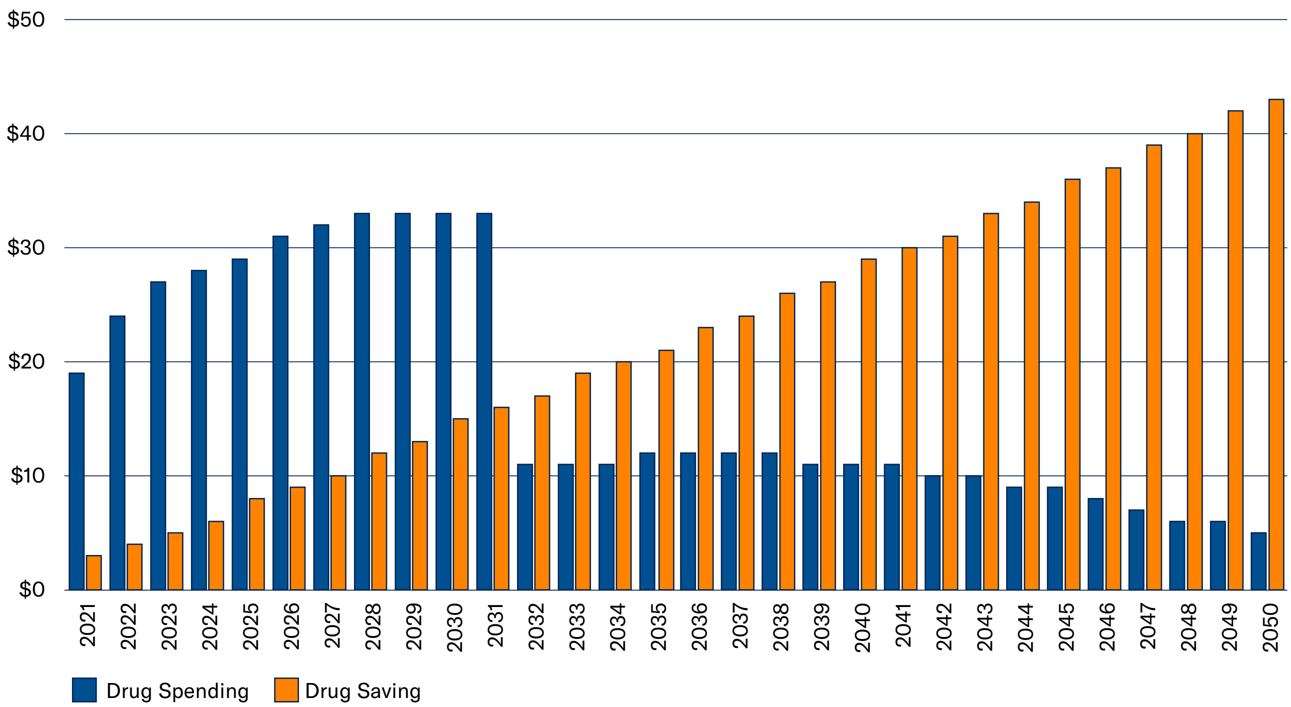


Table 3: Net Change in 30-Year Health Spending (Billions of 2023 USD)

Disease	Aggregate Health Spending Saving, From Innovation
HIV	-$573
Heart Disease	$138
Breast Cancer	-$305
Obesity	$166

Note: Negative numbers represent net increases in healthcare spending over 30 years; positive numbers represent net savings.

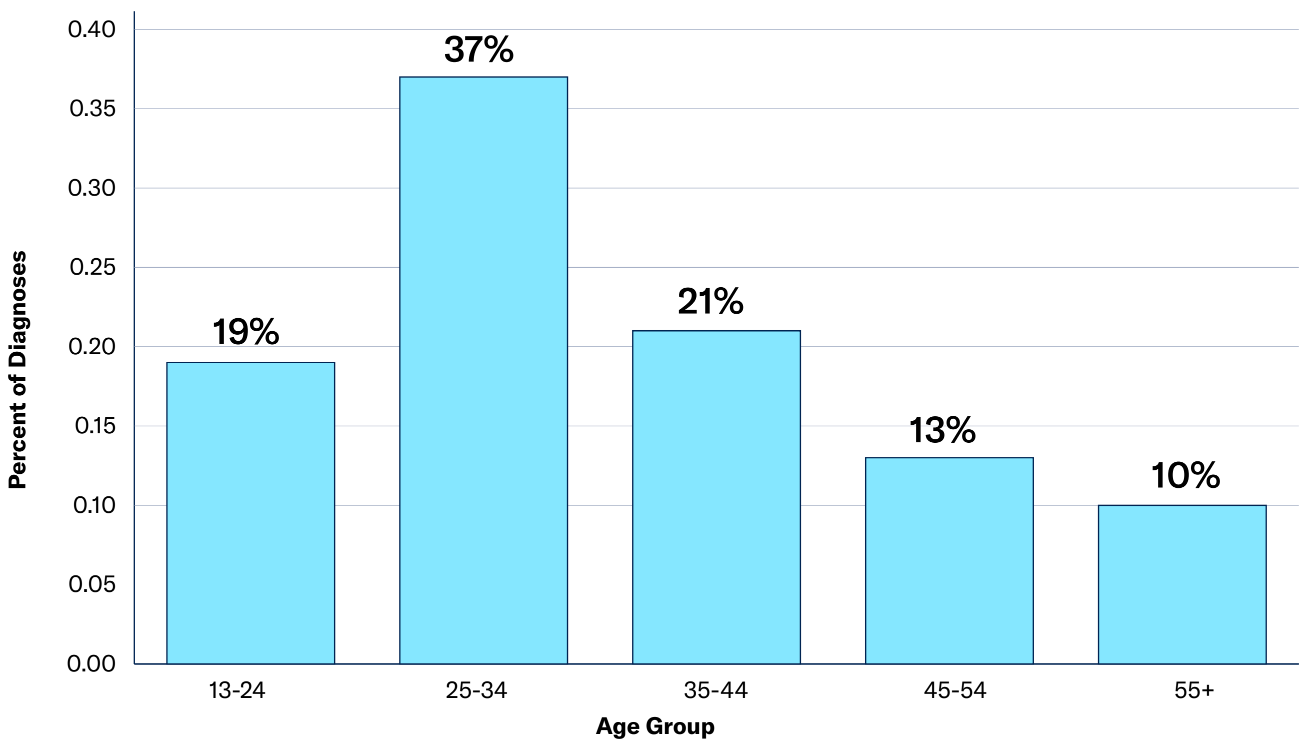
4.3 The Value of Increased Productivity

In this section, we estimate the increased productivity resulting from medical innovation. Our analysis remains based on a 30-year cohort window for each disease, consistent with all other sections of the paper. However, since productivity gains from medical innovation occur after the baseline life expectancy (L_0), we project these gains beyond the 30-year window to capture the full realization of benefits within the same cohort. For instance, in obesity, the life-extension effect causes the majority of productivity improvements to occur after their baseline life expectancy of 31.2 years. Thus, the projection to 2084 enables us to capture the realization of productivity among the 30-year cohorts while not expanding the analytical window.

4.3.1 HIV

To understand the increased productivity, we must understand the prominence of HIV at each age. Using the CDC HIV surveillance report, we found the highest rate of diagnosis between ages 20 and 24 for those assigned male at birth. For those assigned female at birth, the highest rate is among those who are between 35 and39 (Centers for Disease Control and Prevention, 2023). Using CDC data, we found the prevalence by percentage for each group was 19% (13–24), 37% (25–34), 21% (35–44), 13% (45–54), and 10% (55+) as shown in Figure 14 (CDC, 2023).

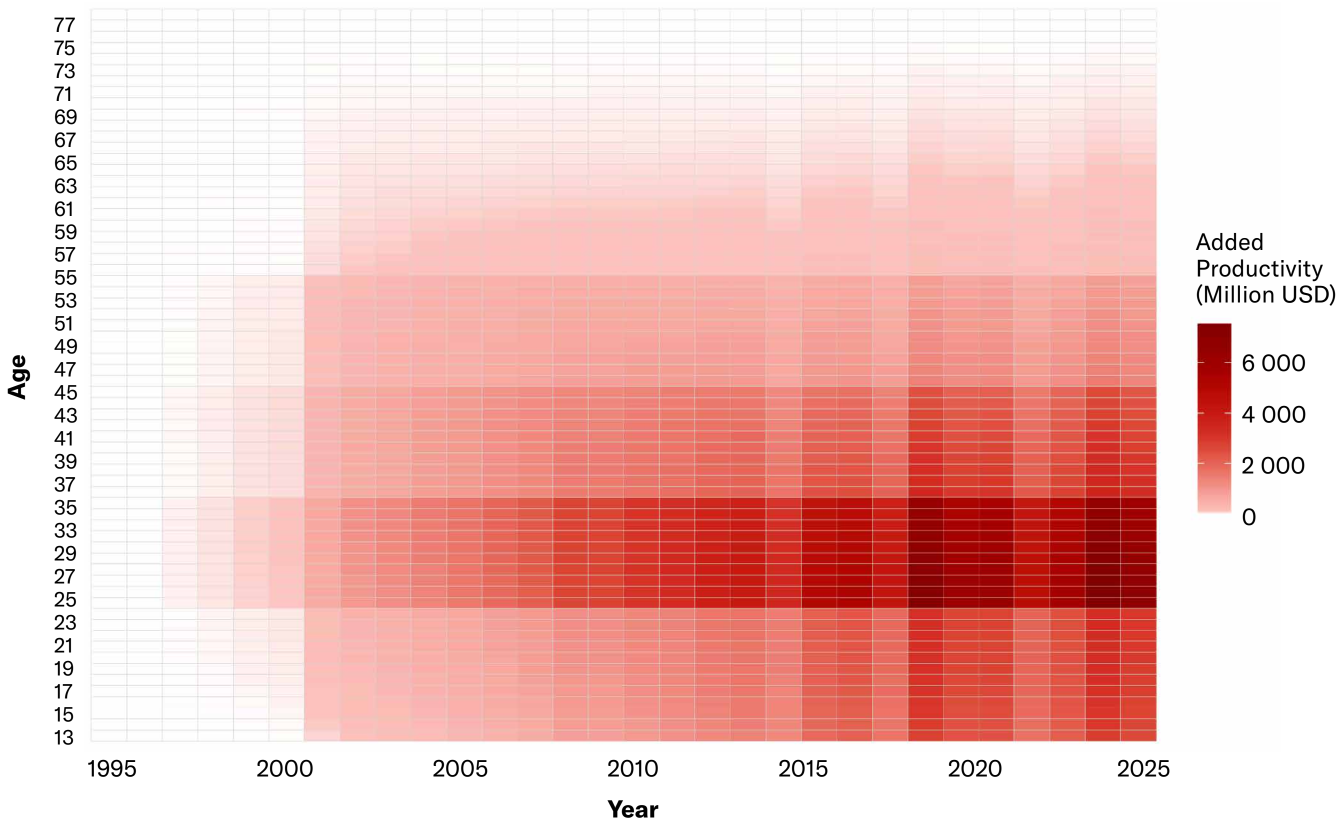
Figure 14: HIV Diagnoses Probability by Age Group



To find the total productivity in the U.S., we look at the difference in life after diagnosis due to innovation. For HIV, this is a change from about 2 years after being diagnosed in 1995 to full life expectancy since 2016, where we use the average U.S. life expectancy, the most recent estimate of 77.5 (National Center for Health Statistics, 2024).

Figure 15 displays a heatmap of estimated productivity gains resulting from medical innovation in HIV treatment, considering the years from 1995 to 2024 and the age of diagnosis ranging from 13 to 78. Each cell represents the added productivity in USD obtained by multiplying the influx of HIV diagnoses at a given age in a specific year, with darker shades indicating higher gains. The intensity of gains is concentrated among younger to middle-aged groups, particularly those aged 25 to 34, which is consistent with the higher diagnosis in this age group. In addition, it reflects that the medical innovations allow these individuals to live through their highest-wage career. Over time, gains increase substantially, especially after the early 2000s, suggesting the compounding benefits of advancements in HIV treatment.
The total productivity gain over the entire period is approximately $1.94 trillion, considering all HIV diagnoses, which emphasizes the substantial economic value generated by HIV-related innovations.

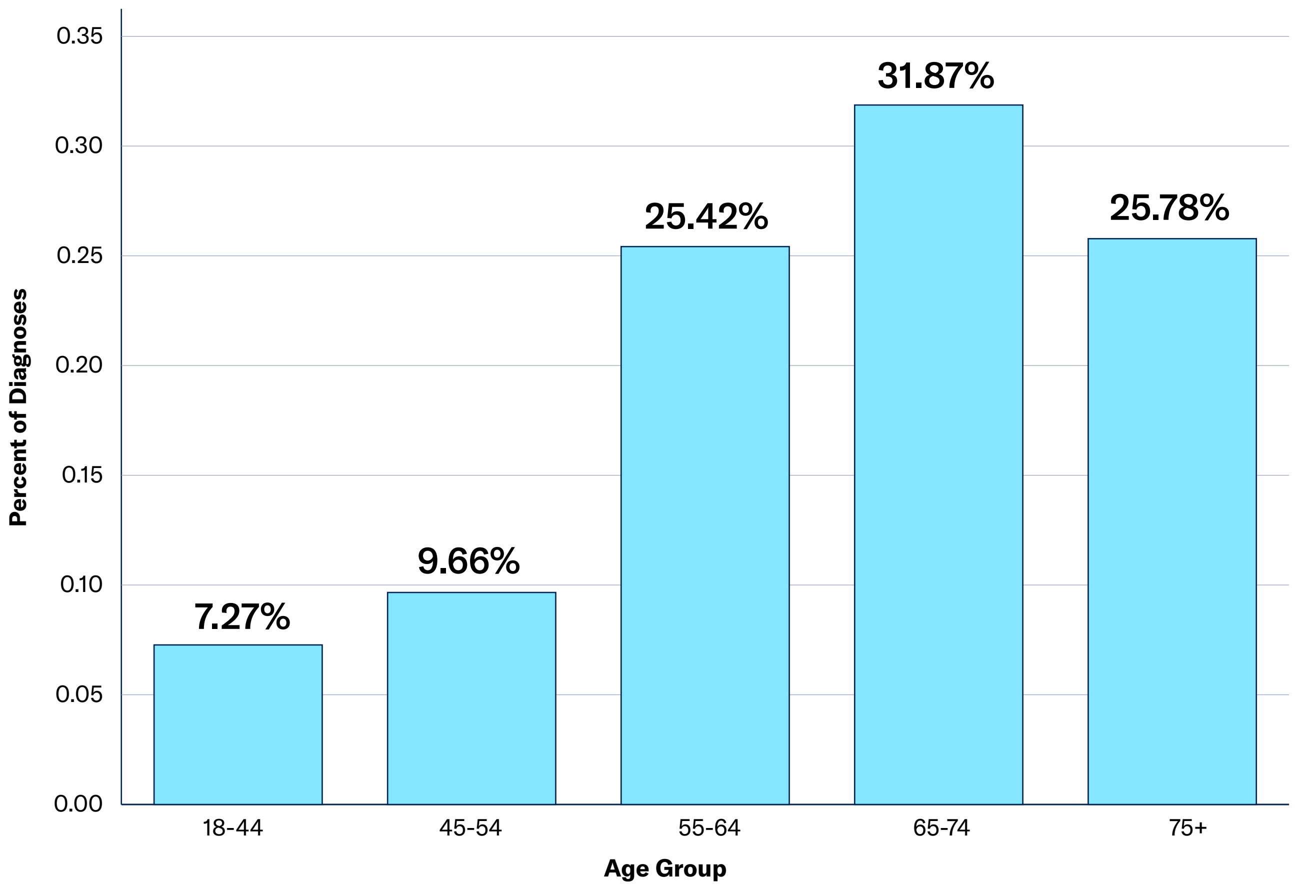
Figure 15: Heatmap of HIV Increased Productivity by Age and Year 1995–2024



4.3.2 Heart Disease

The occurrence of heart disease typically emerges later in life for most individuals. On average, men experience their first heart attack at 65.6 years, while women do so at 72.0 years (American Heart Association, 2025). In 2019, the prevalence of heart disease by age group was recorded at 1.0% for those aged 18–44, 3.6% for ages 45–54, 9.0% for ages 55–64, 14.3% for ages 65–74, and 24.2% for those aged 75 and older (CDC, 2024). To understand how these figures translate to the specific population affected by heart disease, we can calculate the total population with heart disease by dividing the number of cases by the total population in each age group (U.S. Census Bureau, 2021). This allows us to determine the percentage of total heart disease cases represented within each age category and find standardized percentages for heart disease prevalence: 7.27% for ages 18–44, 9.66% for ages 45–54, 25.42% for ages 55–64, 31.87% for ages 65–74, and 25.78% for those aged 75 and older.

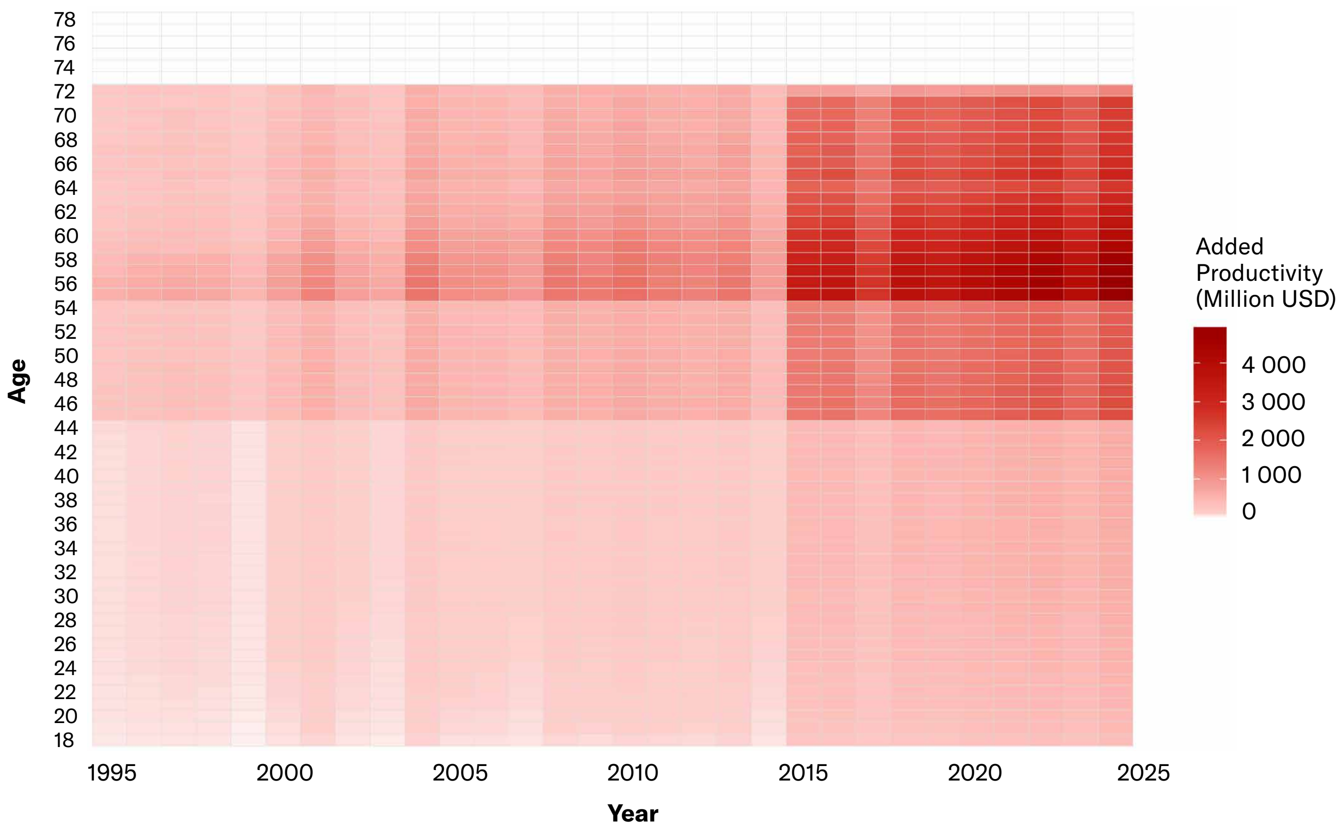
Figure 16: Heart Disease Diagnoses Probability by Age Bin



To find the total productivity in the U.S., we look at the difference in life expectancy after diagnosis due to innovation. For heart disease, this is a change from about 5.17 years after being diagnosed in 1987 to 6.24 years in 2024.

Figure 17 displays a heatmap of estimated productivity gains brought by medical innovation for heart disease treatment, considering a 30-year horizon from 1995 to 2024 and age of diagnosis from 18 to 78. Each cell represents the added productivity in USD obtained by multiplying the influx of heart disease diagnoses at a given age in a specific year, with darker shades indicating higher gains. The total productivity gain over the entire period is approximately $1.12 trillion, considering all heart disease diagnoses. The groups aged from 55 to 71 benefit the most from innovation for heart disease treatment. This aligns with the great proportion of diagnoses in those age bins.

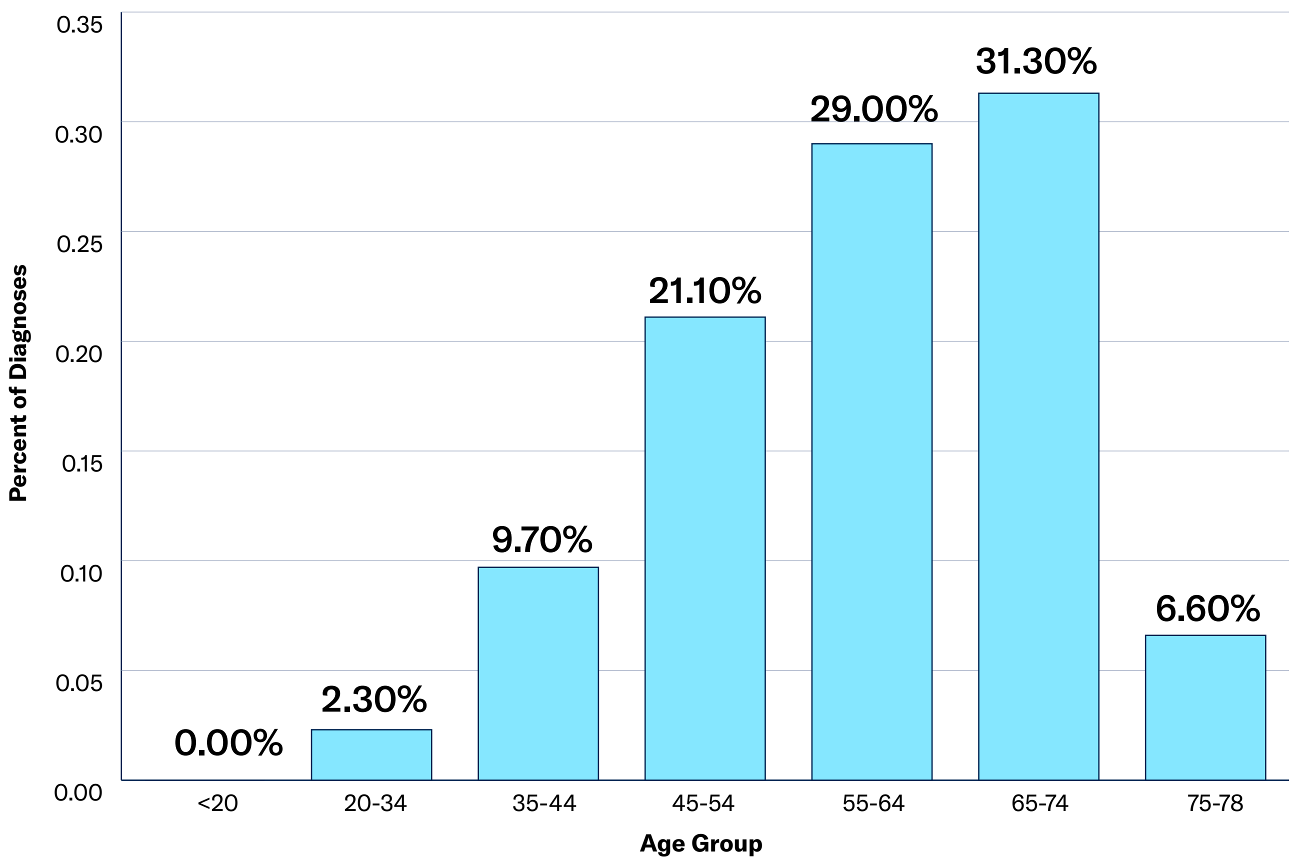
Figure 17: Heatmap of Heart Disease Increased Productivity by Age and Year1995–2024



4.3.3 Breast Cancer

The prominence of breast cancer has the highest risk in older women, where the risk of diagnosis begins around 30 and increases every decade of life (NCI, 2020). This results in a prevalence of 0% (<20), 2% (20–34), 8.4% (35–44), 18.2% (45–54), 25.1% (55–64), 27.1% (65–74), 14.2% (75–84), 5% (>85) (NCI, 2022). In light of life expectancy and the average working age, we have removed the final age category, resulting in the last group being 78 years old. We are assuming a uniform distribution within each age bin; thus, upon eliminating the additional age from this group, the corresponding distribution approximately represents 5.7%. To standardize the data, we divide each percentage by the total of the revised percentages, leading to the distribution depicted in Figure 18.

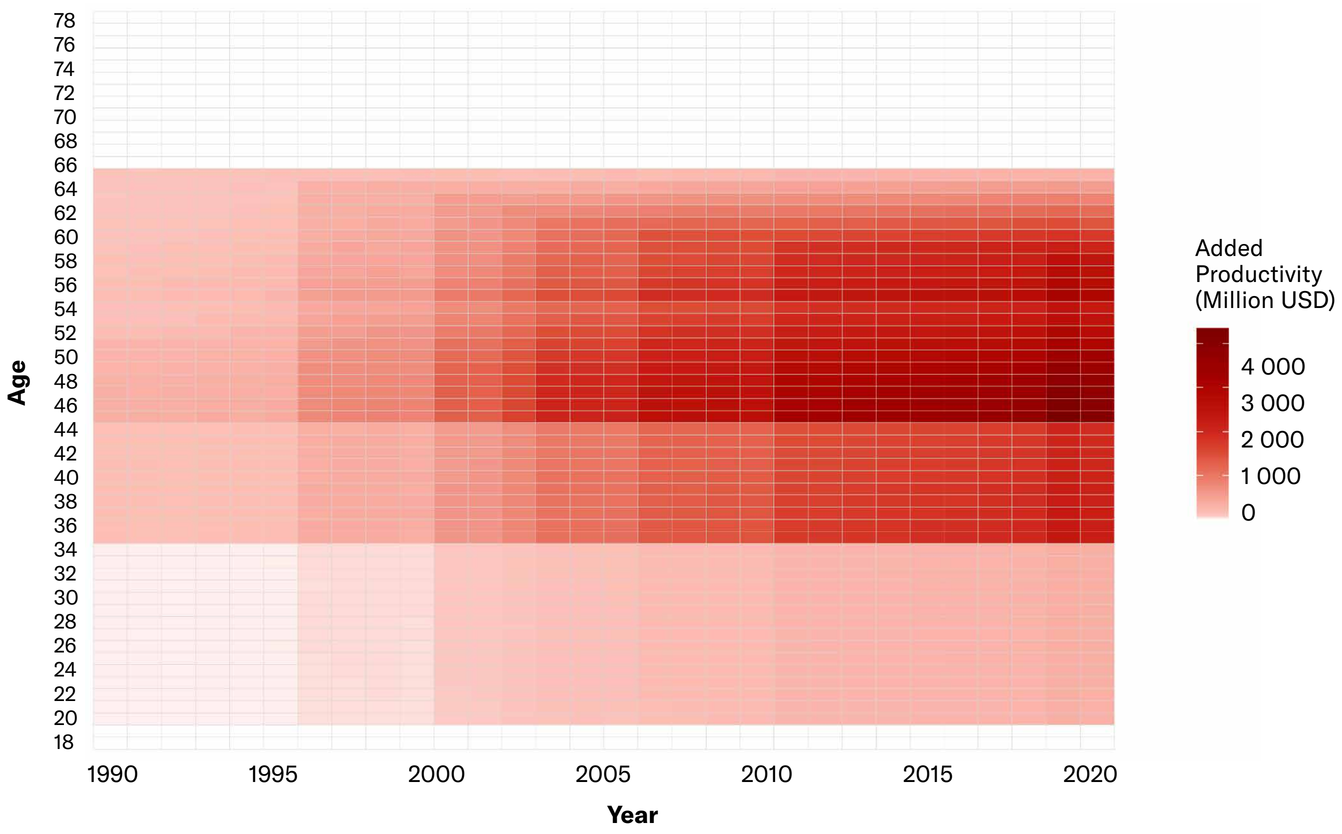
Figure 18: Breast Cancer Diagnoses Probability by Age Bin



To find the total productivity in the U.S., we look at the difference in life expectancy after diagnosis due to innovation. For breast cancer, this is a change from about 12.4 years after being diagnosed in 1991 to 19.4 years in 2020.

Figure 19 displays a heatmap of estimated productivity gains brought by medical innovation for breast cancer treatment, considering years from 1991 to 2020 and age of diagnosis from 20 to 78. Each cell represents the added productivity in 2023 USD obtained by multiplying the influx of breast cancer diagnoses at a given age in a specific year, with darker shades indicating higher gains. The intensity of gains is concentrated among older people, particularly those who are 46 to 60 years old. Over time, gains have increased substantially, especially after 2007, due to novel treatment options that have expanded life expectancy and the ability to diagnose at an earlier age. The total productivity gain over the entire period is approximately $1.21 trillion, which emphasizes the substantial economic value generated by innovations.

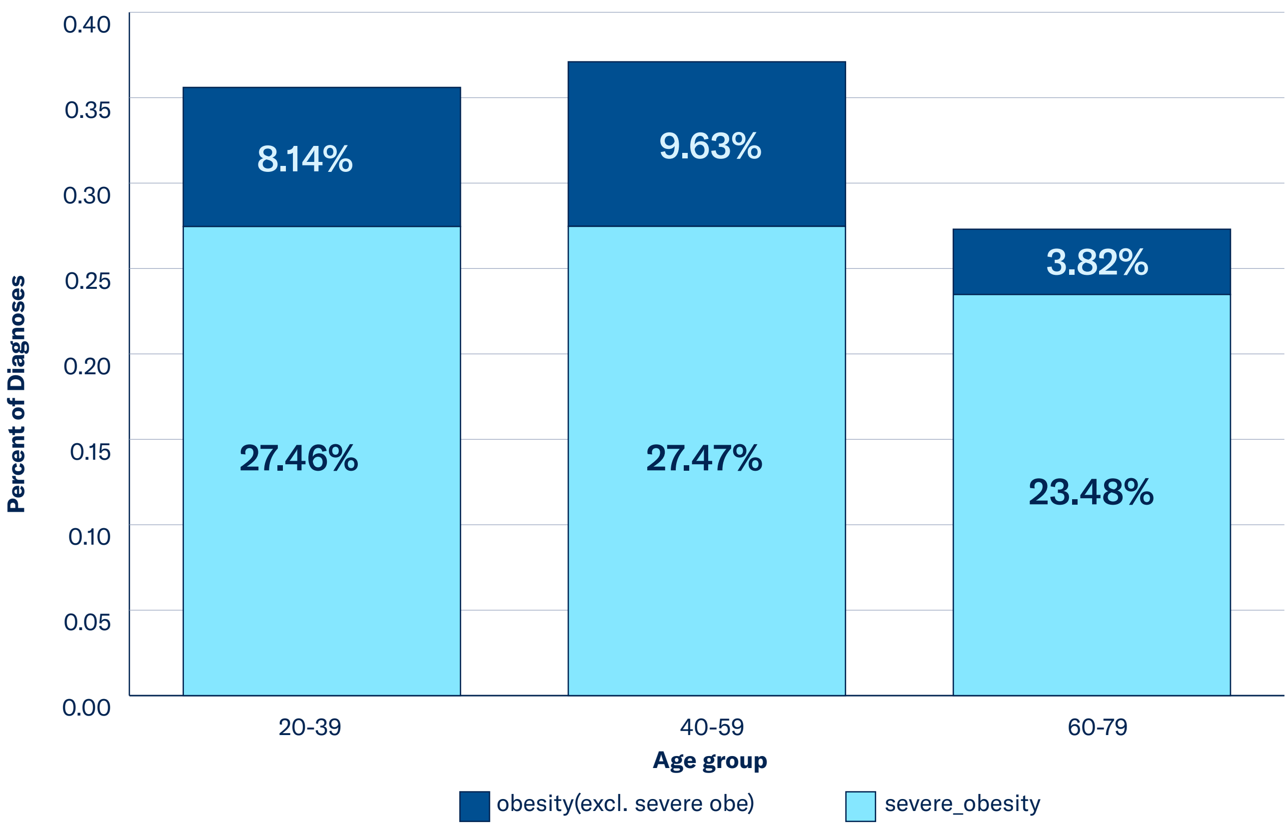
Figure 19: Heatmap of Breast Cancer Increased Productivity by Age and Year 1991–2020



4.3.4 Obesity

The prevalence of obesity increases with age, where from 2017 to 2020, the CDC found the prevalence of obesity of 39.8% (20–39), 44.3% (40–59), and 41.5% (60+) in each age group (CDC, 2024). For severe obesity, the rates were 9.1% (20–39), 11.5% (40–59), and 5.8% (60+). To find prevalence numbers, we use population breakdowns of these age groups from the Census Bureau to find the population for each age bin in 2021, which we then multiply by the age bin prevalence rates to find the obesity estimated sample size (U.S. Census Bureau, 2021). In 2021, the estimated influx for those who are obese will be 382,267 people for the 20–39 cohort, 382,406 for the 40–59 cohort, and 326,862 for the 60–79 cohort. Among these people, the estimated influx number for severely obese individuals will be 113,316 for the 20–39 cohort, 134,058 for the 40–59 cohort, and 53,178 for the 60–79 cohort. The standardized percentages for the three age bins regarding obesity and severe obesity are used to approximate the percentages of diagnoses as seen in Figure 20.

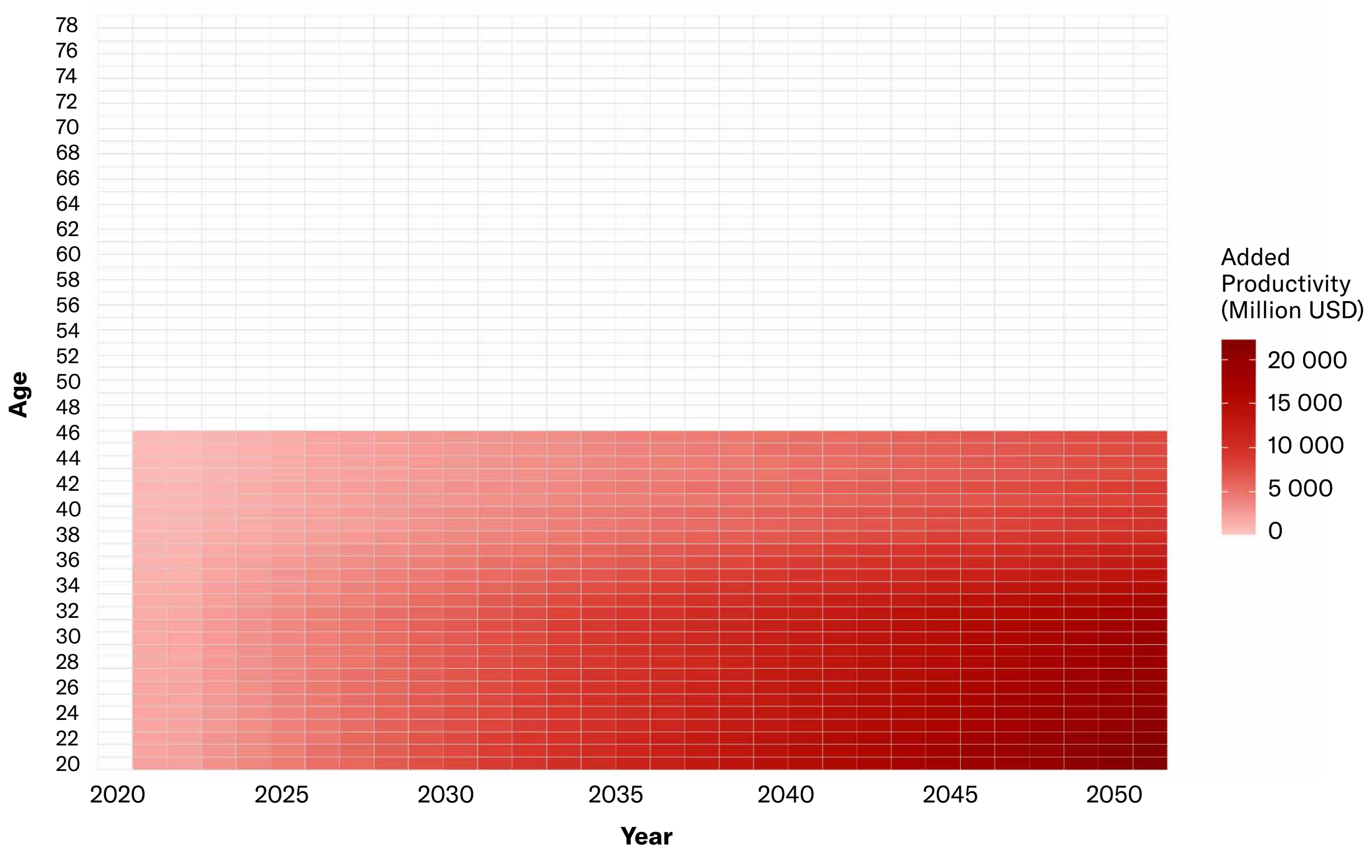
Figure 20: Obesity Diagnosis Probability by Age Bin in 2021



To find the added productivity in the U.S., we look at the difference in life expectancy after diagnosis due to innovation. For obesity and severe obesity, this is a change from about 31.2 years after being diagnosed in 2020 to 32 years since 2021.

The results are shown in Figure 21. Each cell represents the added productivity in USD in either the obese or severely obese group at a given age by year, with darker shades indicating higher gains. The total productivity gain is approximately $6.48 trillion for the 30-year horizon. It is worth noting that the blank areas in the upper half of the heatmap reflect the fact that any patient aged above 46 can live to the U.S. life expectancy of about 78 even without the innovative treatment. As a result, there are no added productivity gains for these age groups. Across cohorts, the shading deepens horizontally because the uptake rate of innovative therapy increases over the years, generating larger added productivity gains. Overall, the total number indicates that innovation in obesity-related treatment will produce a substantial productivity gain over the next few decades.

Figure 21: Heatmap of Obesity Increased Productivity From 2021 to 2050



Aggregate Gain from Innovation

Table 4: Summary Table of 30-Year Productivity Gains in Trillions of 2023 USD

Disease	Aggregate Gain from Innovation
HIV	$1.94
Heart Disease	$1.12
Breast Cancer	$1.21
Obesity	$6.48

In summary, medical innovations contribute to remarkable increases in productivity through extended life expectancy. Using 2023 USD, we estimated 30-year productivity gains from medical innovations. HIV innovation leads to an aggregate productivity gain of $1.94 trillion, while heart disease innovation results in $1.12 trillion in added productivity. Meanwhile, breast cancer treatment innovation contributes $1.21 trillion in aggregate gains, and obesity innovation contributes $6.48 trillion.

4.4 Tax Revenue Impact

4.4.1 HIV

In our analysis, HIV-related medical innovation generates an estimated $330.34 billion (see Appendix B) in additional federal income tax revenue over the study period (1995–2024). We calculate this by first determining how many extra years HIV patients remain in the workforce as a result of improved therapies, relative to the pre-innovation era. Next, we multiply those added working years by age-specific real median income to estimate extra earnings over a patient's lifetime. We then subtract the standard deduction to determine taxable income and apply marginal federal tax rates to find the incremental tax contributions. Finally, we sum these individual-level values across all new HIV diagnoses. This result underscores the broader economic implications of effective HIV treatments, highlighting not only the health and productivity gains for patients but also the positive fiscal impact through increased tax revenues.

4.4.2 Heart Disease

Applying the same life-year-gained framework we used for productivity, we find that lipid-lowering therapy adds roughly two years of work-eligible life to each post-infarction survivor and about one year to high-risk primary-prevention users. When those extra working years are valued at age-specific real wages and filtered through the 2024 federal tax schedule, the result is $102.76 billion in additional individual-income-tax receipts over 30 years based on the data (see Appendix B).

4.4.3 Breast Cancer

Modern adjuvant biologics and endocrine maintenance extend survival by roughly two years and slow the average transition to retirement. In our analysis, breast cancer innovations generated an estimated $49.31 billion (see Appendix B) in additional federal income tax revenue from 1991 to 2020.

4.4.4 Obesity

Based on the influx levels projected in the preceding Section 4.1.4—where annual new case (denoted as NewlyTreated_^{t}) is defined as the previous year's obese population multiplied by the uptake rate minus the persistence rate times the prior year's treated population—we estimate future treatment dynamics. To forecast economic outcomes, we further incorporate the Congressional Budget Office's long-term projections (2025), assuming an average annual real GDP growth of 1.5% and a CPI inflation rate of 2.3% and use these to project median income and standard deduction values for 2026–2050 from the 2025 baseline. Under this framework, GLP-1 pharmacotherapy is expected to delay the onset of diabetes, heart failure, and chronic kidney disease, thereby keeping millions of individuals in the labor force longer and with fewer disabling comorbidities. These longevity and morbidity gains translate into $36.95 billion in present-value federal income tax collections from the 2021 launch through 2025 and $1.53 trillion in total over 30 years, assuming the same patent duration (see Appendix B), which is $51.1 billion per year.

5. Conclusion

This study provides a comprehensive assessment of the full value of medical innovations across four major disease areas: HIV, heart disease, breast cancer, and obesity. By quantifying improvements in life expectancy, healthcare spending, productivity, and federal tax revenue, we find that medical innovations have yielded enormous societal benefits over the past three decades. While the estimates for HIV, heart disease, and breast cancer reflect retrospective gains over the full 30-year period, the obesity estimates represent a forward-looking projection based on post-2021 evidence on GLP-1 adoption and treatment effects. This forward-looking treatment of obesity is not intended as a long-range forecast but rather as a way to place GLP-1 therapies on the same 30-year analytical footing as the other disease areas.

Over a 30-year period, medical innovations in HIV, heart disease, breast cancer, and obesity have generated substantial societal value. Health value gains amounted to $22.0 trillion for HIV, $13.7 trillion for heart disease, $25.1 trillion for breast cancer, and $94.4 trillion for obesity. The impact on healthcare spending varied: HIV and breast cancer led to net spending increases of $570 billion and $310 billion, respectively, while heart disease and obesity generated net savings of $138 billion and 166 billion, respectively. Productivity gains were also significant, totaling $1.94 trillion for HIV, $1.12 trillion for heart disease, $1.21 trillion for breast cancer, and $6.48 trillion for obesity. In addition, federal income tax revenue increased by $330.3 billion for HIV, $102.8 billion for heart disease, $49.3 billion for breast cancer, and $1.5 trillion for obesity. These figures underscore the broad economic and fiscal returns of sustained medical innovation. Table 5 shows the total estimation for the four diseases.

Over the 30-year horizon, total value gains from medical innovation across the four disease areas reached $155.31 trillion, averaging approximately $5.18 trillion per year (Table 5). Among them, obesity generated the largest overall gain at $94.44 trillion, followed by breast cancer at $25.13 trillion, HIV at $22.00 trillion, and heart disease at $13.74 trillion. These figures highlight the substantial and multifaceted returns that sustained investment in biomedical innovation can deliver to society. While this aggregate value may appear high at first glance, it becomes more intuitive when broken down to individual-level estimates. For example, HIV treatments have extended patients' life expectancy by an average of 23 years. If we value each additional life year at $558,812, which aligns with the median Value of a Statistical Life Year (VSLY) used by U.S. government agencies, then the total value for a single HIV patient is $20 million. If 1 million individuals benefit from such therapies, the aggregate value reaches $20 trillion, which already accounts for a significant portion of our estimate.

Similar logic applies to other conditions. Advances in breast cancer treatment result in an average gain of 12.4 years per patient, amounting to over $6,929,269 per individual. For heart disease, the average gain is approximately one year, or $558,812 per patient, and for obesity-related innovations, the average gain is 0.8 years, or about $447,050 per person. These simple but evidence-based calculations help contextualize our findings and support the plausibility of the overall value figures.

To make the results more tangible, we also report annualized value per capita. As seen in the last column in Table 5, these range from $1,483 (heart disease) to $10,076 (obesity), with a total per-capita gain of $16,447 per year. These values illustrate that, despite the large overall totals, the benefits per person each year are in line with conventional valuations of improved health and longevity. These per capita gains are also modest in comparison to national health spending levels: in 2023, the U.S. spent $14,570 per person on healthcare, lower than our estimated annualized value per capita of $16,447. Taken together, these results highlight the enormous but realistic societal return generated by sustained investment in medical innovation.

Table 5: Summary Table of 30-Year Value Gains in Trillions

Disease	Health Value Gain	Health Spending Saving	Productivity Gain	Tax Revenue Gain	Total Value Gain	Annualized Value Per Capita (in $)
HIV	$22.00	$-0.57	$1.94	$0.33	$23.70	$2,327
Heart Disease	$13.74	$0.14	$1.12	$0.10	$15.10	$1,483
Breast Cancer	$25.13	$-0.31	$1.21	$0.05	$26.08	$2,561
Obesity	$94.44	$0.17	$6.48	$1.53	$102.62	$10,076
Total	$155.31	-$0.57	$10.75	$2.01	$167.50	$16,447

According to Research!America (2022), based on national estimates, U.S. investments in medical and health research and development averaged $204.2 billion annually from 2016 to 2020. Additionally, U.S. prescription drug expenditures reached $805.9 billion in 2024, according to the ASHP News Center (2025). On average, the estimated $5.58 trillion in annual benefits from innovations in HIV, heart disease, breast cancer, and obesity are more than 27 times greater than the annual investment in medical R&D and approximately 7 times greater than annual spending on prescription drugs.

We compare innovation benefits to both R&D investment and prescription drug expenditures to reflect the full spectrum of costs associated with developing and delivering medical advances. This approach captures both the upstream resource commitments and downstream financial burdens borne by payers. Similar comparisons have been adopted in prior health economics research to assess the societal returns of innovation and are widely recognized as valid benchmarks for evaluating long-term value (Murphy & Topel, 2006; Lakdawalla et al., 2015; Goldman et al., 2010). These findings reveal not only the profound societal returns of medical innovation but also the importance of incorporating these broader benefits into public investment decisions and healthcare policy evaluation.

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Appendix A

Full Calculations for Value of Gain From Medical Innovations

HIV

Year	Influx	Life Expectancy	Age for Diagnosis	L_t	L_0	VLY	G
1995	157513	39	37	2	2	$558,812.00	$0.00
1996	6295	39	37	2	2	$558,812.00	$0.00
1997	5922	40.92	37.067	3.829	2	$558,812.00	$6,052,650,824.91
1998	6043	42.84	37.134	5.658	2	$558,812.00	$12,352,732,908.39
1999	6818	44.76	37.201	7.487	2	$558,812.00	$20,906,189,786.81
2000	6293	46.68	37.268	9.316	2	$558,812.00	$25,728,588,298.76
2001	32741	48.6	37.335	11.145	2	$558,812.00	$167,316,227,205.82
2002	44061	50.52	37.4	13.12	2	$558,812.00	$273,791,569,843.78
2003	43689	52.44	37.4	15.04	2	$558,812.00	$318,360,279,358.12
2004	45084	54.36	37.3	17.06	2	$558,812.00	$379,412,595,652.59
2005	44937	56.28	37.1	19.18	2	$558,812.00	$431,408,689,692.66
2006	46526	58.2	36.9	21.3	2	$558,812.00	$501,790,048,141.24
2007	48256	60.12	36.7	23.42	2	$558,812.00	$577,606,665,014.23
2008	48387	62.04	34.8	27.24	2	$558,812.00	$682,469,144,959.01
2009	48057	63.96	36	27.96	2	$558,812.00	$697,156,834,666.55
2010	48060	65.88	35.6	30.28	2	$558,812.00	$759,500,836,083.77
2011	48151	67.8	35.5	32.3	2	$558,812.00	$815,292,578,275.32
2012	48876	69.72	34.6	35.12	2	$558,812.00	$904,584,950,326.33
2013	49062	71.64	33.7	37.94	2	$558,812.00	$985,350,241,174.71
2014	38590	73.56	32.8	40.76	2	$558,812.00	$835,838,287,284.11
2015	52883	75.48	32.9	42.58	2	$558,812.00	$1,199,205,525,560.75
2016	54327	77.4	32.8	44.6	2	$558,812.00	$1,293,286,961,286.07
2017	43972	77.4	33.6	43.8	2	$558,812.00	$1,027,117,890,945.96
2018	73545	77.4	34.1	43.3	2	$558,812.00	$1,697,335,719,432.78
2019	62275	77.4	34.1	43.3	2	$558,812.00	$1,437,250,405,038.30
2020	64084	77.4	34.5	42.9	2	$558,812.00	$1,464,663,739,016.08
2021	46876	77.4	34.9	42.5	2	$558,812.00	$1,060,895,070,726.35
2022	56870	77.4	35.3	42.1	2	$558,812.00	$1,274,363,411,538.41
2023	74230	77.4	35.3	42.1	2	$558,812.00	$1,663,369,742,971.96
2024	66361	77.4	35.3	42.1	2	$558,812.00	$1,487,037,787,232.56
						∑G	$21,999,445,363,246.30

Heart Disease

Year	Influx	L_t	L_0	VLY	G
1995	502604	5.47375	5.17	$558,812.00	$85,311,533,514.63
1996	578332	5.5075	5.17	$558,812.00	$109,072,802,101.00
1997	630590	5.54125	5.17	$558,812.00	$130,821,508,082.87
1998	589733	5.575	5.17	$558,812.00	$133,467,675,008.46
1999	412594	5.60875	5.17	$558,812.00	$101,159,190,452.62
2000	756880	5.6425	5.17	$558,812.00	$199,845,523,238.14
2001	1057463	5.67625	5.17	$558,812.00	$299,154,748,293.41
2002	694150	5.71	5.17	$558,812.00	$209,465,779,808.86
2003	566008	5.734	5.17	$558,812.00	$178,388,625,125.19
2004	1245243	5.758	5.17	$558,812.00	$409,163,800,102.61
2005	949582	5.782	5.17	$558,812.00	$324,750,398,431.09
2006	917511	5.806	5.17	$558,812.00	$326,087,510,662.27
2007	775095	5.83	5.17	$558,812.00	$285,867,304,962.16
2008	1197607	5.854	5.17	$558,812.00	$457,758,198,104.97
2009	1097579	5.878	5.17	$558,812.00	$434,244,818,853.16
2010	1237985	5.902	5.17	$558,812.00	$506,398,272,898.17
2011	1097861	5.926	5.17	$558,812.00	$463,804,584,791.97
2012	1013821	5.95	5.17	$558,812.00	$441,897,460,664.12
2013	1117637	5.974	5.17	$558,812.00	$502,137,531,037.55
2014	677502	5.998	5.17	$558,812.00	$313,477,601,810.22
2015	1309346	6.022	5.17	$558,812.00	$623,390,103,956.27
2016	1377768	6.046	5.17	$558,812.00	$674,443,945,258.60
2017	1053477	6.07	5.17	$558,812.00	$529,826,086,871.94
2018	1433330	6.094	5.17	$558,812.00	$740,089,149,122.92
2019	1358414	6.118	5.17	$558,812.00	$719,624,866,404.91
2020	1480408	6.142	5.17	$558,812.00	$804,106,116,292.76
2021	1585513	6.166	5.17	$558,812.00	$882,459,909,912.26
2022	1670520	6.19	5.17	$558,812.00	$952,176,537,094.07
2023	1436272	6.214	5.17	$558,812.00	$837,920,718,376.18
2024	1780512	6.24	5.17	$558,812.00	$1,064,619,189,987.49
				Sum G	$13,740,931,491,220.90

Breast Cancer

Year	New Diagnosis Per 100,000	U.S. Population	Uptake Rate	Influx	Women Life Expectancy	L_t	L_0	VLY	G
1991	132.13	248,709,873	47.49%	334264	78.8	12.40517862	12.3884	$558,812.00	$3,134,088,832.19
1992	131.3	248,709,873	59.06%	336803	78.8	12.48144224	12.3884	$558,812.00	$17,511,432,733.89
1993	128.85	248,709,873	59.21%	334906	78.8	12.57478621	12.3884	$558,812.00	$34,882,046,075.11
1994	131.33	248,709,873	59.35%	345563	78.8	12.6684319	12.3884	$558,812.00	$54,075,549,172.37
1995	131.99	248,709,873	63.36%	351460	78.9	12.84687931	12.3884	$558,812.00	$90,045,451,634.45
1996	134.5	248,709,873	59.65%	362335	78.9	12.99371034	12.3884	$558,812.00	$122,561,486,421.77
1997	137.86	248,709,873	59.80%	375885	78.9	13.08569828	12.3884	$558,812.00	$146,466,817,016.78
1998	141.57	248,709,873	59.95%	390527	78.9	13.17794483	12.3884	$558,812.00	$172,303,077,954.38
1999	142.3	248,709,873	60.10%	397074	78.9	13.27045	12.3884	$558,812.00	$195,717,784,643.41
2000	136.63	281,421,906	66.16%	385519	79.3	13.70601379	12.3884	$558,812.00	$283,856,655,230.21
2001	139.41	281,421,906	60.39%	397275	79.5	14.36885776	12.3884	$558,812.00	$439,665,901,164.54
2002	136.68	281,421,906	60.54%	393126	79.6	14.95763966	12.3884	$558,812.00	$564,419,791,823.69
2003	126.67	281,421,906	60.69%	367480	79.7	15.55805948	12.3884	$558,812.00	$650,896,156,280.78
2004	128.11	281,421,906	60.84%	375113	80.1	16.46471724	12.3884	$558,812.00	$854,467,720,853.38
2005	126.99	281,421,906	66.94%	375277	80.1	16.56367931	12.3884	$558,812.00	$875,593,764,737.90
2006	126.32	281,421,906	61.13%	376914	80.3	16.8742069	12.3884	$558,812.00	$944,817,648,089.64
2007	128.76	281,421,906	61.28%	387865	80.6	17.2696	12.3884	$558,812.00	$1,057,969,764,394.67
2008	129.51	281,421,906	61.43%	393832	80.6	17.36966552	12.3884	$558,812.00	$1,096,267,455,600.70
2009	130.62	281,421,906	61.58%	400705	80.9	17.76630345	12.3884	$558,812.00	$1,204,213,398,541.83
2010	127.76	308,745,538	64.48%	395196	81	17.96591379	12.3884	$558,812.00	$1,231,740,750,913.74
2011	130.98	308,745,538	61.88%	408112	81	18.06689655	12.3884	$558,812.00	$1,295,026,039,259.00
2012	130.03	308,745,538	62.02%	408135	81.2	18.35024138	12.3884	$558,812.00	$1,359,721,961,960.55
2013	131.04	308,745,538	62.17%	414165	81.2	18.45168276	12.3884	$558,812.00	$1,403,288,263,394.97
2014	132.22	308,745,538	62.32%	420970	81.3	18.65249655	12.3884	$558,812.00	$1,473,586,828,593.20
2015	132.66	308,745,538	62.39%	425492	81.1	18.57195172	12.3884	$558,812.00	$1,470,264,519,476.57
2016	132.3	308,745,538	62.62%	427424	81.1	18.69015172	12.3884	$558,812.00	$1,505,171,017,604.29
2017	133.57	308,745,538	62.77%	434266	81.1	18.79235517	12.3884	$558,812.00	$1,554,066,008,847.48
2018	134.95	308,745,538	62.91%	441068	81.2	18.99453103	12.3884	$558,812.00	$1,628,240,694,151.49
2019	137.81	308,745,538	63.06%	452472	81.4	19.28016552	12.3884	$558,812.00	$1,742,558,848,833.80
2020	124.68	331,449,281	56.23%	423209	81.4	19.3831	12.3884	$558,812.00	$1,654,206,466,224.35
								∑G	$25,126,737,390,461.10

Obesity

Year	U.S. Population	Adult Obesity Rates	Prevalence	Uptake Rate	Persistent Rate	Influx	Age for Diagnosis	L_t	L_0	VLY	G
2021	340,161,441	42.32%	143956321.83	0.97%	40.0%	1390618	46	32	31.2	$558,812.00	$621,675,251,449.78
2022	341,534,046	42.74%	145971651.26	1.41%	41.9%	1473707	46	32	31.2	$558,812.00	$658,819,975,671.65
2023	343,477,335	43.16%	148244817.79	1.86%	43.8%	2107793	46	32	31.2	$558,812.00	$942,288,177,802.71
2024	345,426,571	43.58%	150536899.64	2.30%	45.7%	2499087	46	32	31.2	$558,812.00	$1,117,215,900,456.62
2025	347,275,807	44.00%	152801355.08	2.75%	47.6%	3010180	46	32	31.2	$558,812.00	$1,345,699,662,981.86
2026	350527547	44.00%	154232120.68	3.19%	49.5%	3431894	46	32	31.2	$558,812.00	$1,534,226,645,065.14
2027	352411032	44.00%	155060854.08	3.64%	51.4%	3879834	46	32	31.2	$558,812.00	$1,734,478,302,337.79
2028	354304638	44.00%	155894040.72	4.08%	53.3%	4296423	46	32	31.2	$558,812.00	$1,920,714,010,755.01
2029	356208418	44.00%	156731703.92	4.53%	55.2%	4729888	46	32	31.2	$558,812.00	$2,114,494,637,696.06
2030	358122428	44.00%	157573868.32	4.97%	57.1%	5136564	46	32	31.2	$558,812.00	$2,296,298,926,635.22
2031	359392076	44.00%	158132513.44	5.42%	59.0%	5543767	46	32	31.2	$558,812.00	$2,478,338,994,429.81
2032	360666225	44.00%	158693139.00	5.87%	60.9%	5931198	46	32	31.2	$558,812.00	$2,651,539,810,331.77
2033	361944892	44.00%	159255752.48	6.31%	62.8%	6329819	46	32	31.2	$558,812.00	$2,829,743,241,836.20
2034	363228091	44.00%	159820360.04	6.76%	64.7%	6702470	46	32	31.2	$558,812.00	$2,996,336,491,156.02
2035	364515840	44.00%	160386969.60	7.20%	66.6%	7091635	46	32	31.2	$558,812.00	$3,170,312,694,646.06
2036	365808155	44.00%	160955588.20	7.65%	68.5%	7451308	46	32	31.2	$558,812.00	$3,331,104,472,061.35
2037	367105051	44.00%	161526222.44	8.10%	70.4%	7831442	46	32	31.2	$558,812.00	$3,501,042,925,979.91
2038	368406545	44.00%	162098879.80	8.54%	72.3%	8179086	46	32	31.2	$558,812.00	$3,656,456,979,152.59
2039	369712653	44.00%	162673567.32	8.99%	74.2%	8550999	46	32	31.2	$558,812.00	$3,822,720,507,523.77
2040	371023391	44.00%	163250292.04	9.43%	76.1%	8887193	46	32	31.2	$558,812.00	$3,973,015,896,199.65
2041	371982360	44.00%	163672238.40	9.88%	78.0%	9236352	46	32	31.2	$558,812.00	$4,129,107,397,166.73
2042	372943808	44.00%	164095275.52	10.32%	79.9%	9556839	46	32	31.2	$558,812.00	$4,272,380,829,371.34
2043	373907740	44.00%	164519405.60	10.77%	81.8%	9900835	46	32	31.2	$558,812.00	$4,426,164,232,695.88
2044	374874164	44.00%	164944632.16	11.21%	83.7%	10207418	46	32	31.2	$558,812.00	$4,563,222,206,091.02
2045	375843086	44.00%	165370957.84	11.66%	85.6%	10546357	46	32	31.2	$558,812.00	$4,714,744,878,386.73
2046	376814512	44.00%	165798385.28	12.10%	87.4%	10850306	46	32	31.2	$558,812.00	$4,850,624,800,336.71
2047	377788449	44.00%	166226917.56	12.55%	89.3%	11175895	46	32	31.2	$558,812.00	$4,996,179,530,088.01
2048	378764903	44.00%	166656557.32	13.00%	91.2%	11464603	46	32	31.2	$558,812.00	$5,125,246,228,542.17
2049	379743881	44.00%	167087307.64	13.44%	93.1%	11788837	46	32	31.2	$558,812.00	$5,270,194,739,939.27
2050	380725389	44.00%	167519171.16	13.89%	95.0%	12062736	46	32	31.2	$558,812.00	$5,392,641,313,377.45

Appendix B

HIV

Year	Influx	Life Expectancy	Age for Diagnosis	L_t	L_0	Additional Survival Years (Life Years Gained)	Median Income by Age	Taxable Income	Effective Tax Rate	Tax revenue
1995	157,513	39	37	2	2	0	24192.25	20,292	0.28	$0.00
1996	6,295	39	37	2	2	0	24953.8	20953.8	0.28	$0.00
1997	5,922	40.92	37.067	3.829	2	1.829	25715.35	21565.35	0.28	$65,402,513.49
1998	6,043	42.84	37.134	5.658	2	3.658	26600	22350	0.28	$138,335,258.62
1999	6,818	44.76	37.201	7.487	2	5.487	27480	23180	0.28	$242,817,860.38
2000	6,293	46.68	37.268	9.316	2	7.316	29000	24600	0.28	$317,134,414.08
2001	32,741	48.6	37.335	11.145	2	9.145	30000	25450	0.275	$2,095,524,872.69
2002	44,061	50.52	37.4	13.12	2	11.12	32000	27300	0.27	$3,611,442,956.34
2003	43,689	52.44	37.4	15.04	2	13.04	33000	28250	0.25	$4,023,570,490.55
2004	45,084	54.36	37.3	17.06	2	15.06	34300	29450	0.25	$4,998,864,082.18
2005	44,937	56.28	37.1	19.18	2	17.18	35000	30000	0.25	$5,790,078,188.54
2006	46,526	58.2	36.9	21.3	2	19.3	36000	30850	0.25	$6,925,505,798.53
2007	48,256	60.12	36.7	23.42	2	21.42	38000	32650	0.25	$8,437,031,422.34
2008	48,387	62.04	34.8	27.24	2	25.24	39000	33550	0.25	$10,243,534,414.69
2009	48,057	63.96	36	27.96	2	25.96	40000	34300	0.25	$10,697,908,880.38
2010	48,060	65.88	35.6	30.28	2	28.28	39000	33300	0.25	$11,314,797,213.37
2011	48,151	67.8	35.5	32.3	2	30.3	39000	33200	0.25	$12,109,490,132.08
2012	48,876	69.72	34.6	35.12	2	33.12	40000	34050	0.25	$13,779,731,626.47
2013	49,062	71.64	33.7	37.94	2	35.94	40000	33900	0.25	$14,943,922,632.22
2014	38,590	73.56	32.8	40.76	2	38.76	40000	33800	0.25	$12,639,015,496.36
2015	52,883	75.48	32.9	42.58	2	40.58	42000	35700	0.25	$19,152,969,720.82
2016	54,327	77.4	32.8	44.6	2	42.6	43000	36700	0.25	$21,234,167,966.69
2017	43,972	77.4	33.6	43.8	2	41.8	45000	38650	0.25	$17,760,045,634.78
2018	73,545	77.4	34.1	43.3	2	41.3	45000	33000	0.22	$22,051,525,957.00
2019	62,275	77.4	34.1	43.3	2	41.3	48000	35800	0.22	$20,256,873,850.39
2020	64,084	77.4	34.5	42.9	2	40.9	50000	37600	0.22	$21,681,170,857.36
2021	46,876	77.4	34.9	42.5	2	40.5	50000	37450	0.22	$15,641,601,267.89
2022	56,870	77.4	35.3	42.1	2	40.1	52000	39050	0.22	$19,591,662,434.82
2023	74,230	77.4	35.3	42.1	2	40.1	55000	41150	0.22	$26,947,320,893.48
2024	66,361	77.4	35.3	42.1	2	40.1	55000	40400	0.22	$23,651,589,180.12
									SUM	$330,343,036,016.66

Heart Disease

Year	Influx	L_t	L_0	Additional Survival Years (Life Years Gained)	Median Income by Age	Taxable Income	Effective Tax Rate	Tax revenue
1995	502,604	5.47375	5.17	0.30375	20796	16896	0.15	$386,916,441.56
1996	578,332	5.5075	5.17	0.3375	21456.8	17456.8	0.15	$511,100,895.75
1997	630,590	5.54125	5.17	0.37125	22117.6	17967.6	0.15	$630,949,727.81
1998	589,733	5.575	5.17	0.405	22778.4	18528.4	0.15	$663,803,516.11
1999	412,594	5.60875	5.17	0.43875	23439.2	19139.2	0.15	$519,702,326.88
2000	756,880	5.6425	5.17	0.4725	24100	19700	0.15	$1,056,783,893.63
2001	1,057,463	5.67625	5.17	0.50625	25000	20450	0.15	$1,642,157,273.63
2002	694,150	5.71	5.17	0.54	27000	22300	0.15	$1,253,843,928.66
2003	566,008	5.734	5.17	0.564	28000	23250	0.15	$1,113,308,823.23
2004	1,245,243	5.758	5.17	0.588	29000	24150	0.15	$2,652,405,220.13
2005	949,582	5.782	5.17	0.612	29300	24300	0.15	$2,118,270,907.36
2006	917,511	5.806	5.17	0.636	30000	24850	0.15	$2,175,134,385.08
2007	775,095	5.83	5.17	0.66	32000	26650	0.15	$2,044,971,388.56
2008	1,197,607	5.854	5.17	0.684	34300	28850	0.15	$3,544,928,531.06
2009	1,097,579	5.878	5.17	0.708	35000	29300	0.15	$3,415,291,688.19
2010	1,237,985	5.902	5.17	0.732	35000	29300	0.15	$3,982,771,324.50
2011	1,097,861	5.926	5.17	0.756	35000	29200	0.15	$3,635,326,516.59
2012	1,013,821	5.95	5.17	0.78	36000	30050	0.15	$3,564,441,715.54
2013	1,117,637	5.974	5.17	0.804	37450	31350	0.15	$4,225,574,503.95
2014	677,502	5.998	5.17	0.828	38000	31800	0.15	$2,675,834,020.45
2015	1,309,346	6.022	5.17	0.852	40000	33700	0.15	$5,639,171,985.39
2016	1,377,768	6.046	5.17	0.876	40000	33700	0.15	$6,101,003,813.95
2017	1,053,477	6.07	5.17	0.9	42000	35650	0.15	$5,070,121,972.23
2018	1,433,330	6.094	5.17	0.924	43000	31000	0.12	$4,926,758,256.33
2019	1,358,414	6.118	5.17	0.948	45000	32800	0.12	$5,068,687,634.07
2020	1,480,408	6.142	5.17	0.972	45000	32600	0.12	$5,629,197,524.28
2021	1,585,513	6.166	5.17	0.996	46000	33450	0.12	$6,338,793,866.97
2022	1,670,520	6.19	5.17	1.02	50000	37,050	0.12	$7,575,672,827.21
2023	1,436,272	6.214	5.17	1.044	50000	36,150	0.12	$6,504,692,233.37
2024	1,780,512	6.24	5.17	1.07	50000	35,400	0.12	$8,093,065,859.48
							total	$102,760,683,001.94

Breast Cancer

Year	Influx	Survival Rate	Women Life Expectancy	L_t	L_0	Additional Survival Years (Life Years Gained)	Median Income by Age	Taxable Income	Effective Tax Rate	Tax revenue
1991	334,264	0.86	78.8	14.86235	14.86235	0	5790	2390	0.15	$2,010,641.94
1992	336,803	0.87	78.8	14.89095	14.86235	0.0286	6080	2480	0.15	$11,657,324.78
1993	334,906	0.86	78.8	14.84662	14.86235	-0.01573	6370	2670	0.15	$24,999,927.44
1994	345,563	0.87	78.8	14.99391	14.86235	0.13156	6660	2860	0.15	$41,513,801.77
1995	351,460	0.87	78.9	15.07552	14.86235	0.21317	6950	3050	0.15	$73,720,310.45
1996	362,335	0.87	78.9	15.05824	14.86235	0.19589	7240	3240	0.15	$106,591,988.72
1997	375,885	0.89	78.9	15.37072	14.86235	0.50837	7530	3380	0.15	$132,886,688.60
1998	390,527	0.90	78.9	15.49744	14.86235	0.63509	7820	3570	0.15	$165,115,098.18
1999	397,074	0.90	78.9	15.4672	14.86235	0.60485	8110	3810	0.15	$200,161,617.72
2000	385,519	0.90	79.3	15.88512	14.86235	1.02277	8400	4000	0.15	$304,778,696.84
2001	397,275	0.90	79.5	16.036	14.86235	1.17365	9000	4450	0.15	$525,180,184.08
2002	393,126	0.91	79.6	16.22892	14.86235	1.36657	8500	3800	0.15	$575,720,065.67
2003	367,480	0.91	79.7	16.28032	14.86235	1.41797	8800	4050	0.15	$707,607,236.32
2004	375,113	0.91	80.1	16.65544	14.86235	1.79309	8950	4100	0.15	$940,383,614.39
2005	375,277	0.91	80.1	16.75216	14.86235	1.88981	10700	5700	0.15	$1,339,686,099.89
2006	376,914	0.92	80.3	16.9965	14.86235	2.13415	11800	6650	0.15	$1,686,534,297.71
2007	387,865	0.92	80.6	17.2637	14.86235	2.40135	11350	6000	0.15	$1,703,923,301.50
2008	393,832	0.92	80.6	17.23955	14.86235	2.3772	12500	7050	0.15	$2,074,584,715.96
2009	400,705	0.92	80.9	17.5962	14.86235	2.73385	13100	7400	0.15	$2,391,997,438.10
2010	395,196	0.92	81	17.62555	14.86235	2.7632	13700	8000	0.15	$2,645,055,763.11
2011	408,112	0.92	81	17.74435	14.86235	2.882	14000	8200	0.15	$2,850,479,281.56
2012	408,135	0.92	81.2	17.85064	14.86235	2.98829	14000	8050	0.15	$2,938,133,520.88
2013	414,165	0.92	81.2	17.90742	14.86235	3.04507	15000	8900	0.15	$3,352,450,970.33
2014	420,970	0.92	81.3	17.99296	14.86235	3.13061	16000	9800	0.15	$3,876,388,907.24
2015	425,492	0.93	81.1	17.92638	14.86235	3.06403	16650	10350	0.15	$4,084,711,256.18
2016	427,424	0.93	81.1	17.95792	14.86235	3.09557	17000	10700	0.15	$4,323,098,793.97
2017	434,266	0.93	81.1	17.90978	14.86235	3.04743	18000	11650	0.15	$4,859,828,261.49
2018	441,068	0.93	81.2	18.02265	14.86235	3.1603	17000	5000	0.12	$1,748,252,393.45
2019	452,472	0.93	81.4	18.22883	14.86235	3.36648	20000	7800	0.12	$2,918,754,576.69
2020	423,209	0.93	81.4	18.24911	14.86235	3.38676	20000	7600	0.12	$2,699,720,652.38
									SUM	$49,305,927,427.35

Obesity

Year	Influx	Age for Diagnosis	L_t	L_0	Additional Survival Years (Life Years Gained)	Median Income by Age	Taxable Income	Effective Tax Rate	Tax revenue
2021	1390618	46	32	31.2	0.8	45000	12550	0.12	$4,332,053,408.20
2022	1473707	46	32	31.2	0.8	47850	12950	0.12	$4,937,506,814.66
2023	2107793	46	32	31.2	0.8	50000	13850	0.12	$7,314,886,071.36
2024	2499087	46	32	31.2	0.8	52150	14600	0.12	$9,008,709,275.14
2025	3010180	46	32	31.2	0.8	54300	15000	0.12	$11,356,806,243.64
2026	3431894	46	32	31.2	0.8	56363	15345	0.12	$13,513,995,165.02
2027	3879834	46	32	31.2	0.8	58505	15698	0.12	$15,944,171,910.87
2028	4296423	46	32	31.2	0.8	60728	16059	0.12	$18,424,195,650.13
2029	4729888	46	32	31.2	0.8	63036	16428	0.12	$21,163,143,537.58
2030	5136564	46	32	31.2	0.8	65431	16806	0.12	$23,977,610,308.04
2031	5543767	46	32	31.2	0.8	67918	17193	0.12	$26,995,990,711.36
2032	5931198	46	32	31.2	0.8	70499	17588	0.12	$30,127,010,122.58
2033	6329819	46	32	31.2	0.8	73178	17993	0.12	$33,533,854,410.01
2034	6702470	46	32	31.2	0.8	75958	18407	0.12	$37,031,030,751.22
2035	7091635	46	32	31.2	0.8	78845	18830	0.12	$40,858,013,316.20
2036	7451308	46	32	31.2	0.8	81841	19263	0.12	$44,763,640,091.88
2037	7831442	46	32	31.2	0.8	84951	19706	0.12	$49,052,316,907.47
2038	8179086	46	32	31.2	0.8	88179	20159	0.12	$53,408,615,007.80
2039	8550999	46	32	31.2	0.8	91530	20623	0.12	$58,207,211,618.57
2040	8887193	46	32	31.2	0.8	95008	21097	0.12	$63,058,466,109.58
2041	9236352	46	32	31.2	0.8	98618	21582	0.12	$68,306,866,554.72
2042	9556839	46	32	31.2	0.8	102366	22079	0.12	$73,659,746,783.41
2043	9900835	46	32	31.2	0.8	106256	22587	0.12	$79,525,718,429.01
2044	10207418	46	32	31.2	0.8	110293	23106	0.12	$85,435,813,293.08
2045	10546357	46	32	31.2	0.8	114485	23638	0.12	$91,977,997,522.32
2046	10850306	46	32	31.2	0.8	118835	24181	0.12	$98,594,042,412.54
2047	11175895	46	32	31.2	0.8	123351	24737	0.12	$105,800,750,333.42
2048	11464603	46	32	31.2	0.8	128038	25306	0.12	$113,066,589,511.35
2049	11788837	46	32	31.2	0.8	132903	25888	0.12	$121,111,898,894.28
2050	12062736	46	32	31.2	0.8	137954	26484	0.12	$129,084,658,264.82

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