Submission for Consideration

Assessing the US Medical Innovation System Conference

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Note: This is an extended abstract describing a commentary under development for submission to Health Affairs Forefront in February 2026. Forefront articles are limited to about 2000 words. This extended abstract represents a current draft of some of the arguments and language that will be used in the commentary, but further refinement of calculations and text will be carried out

The Underappreciated Value of Biopharmaceutical Innovation

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Preface. *This commentary outlines an economic perspective on the U.S. and global societal value generated by biopharmaceutical innovation. We argue that this value is often insufficiently recognized, and we identify key factors driving the growing disconnect between what biopharmaceutical innovation delivers and how it is perceived by the public. By synthesizing insights from the existing health economics literature and presenting them in both analytic and plain language, we aim to inform policymakers, contribute to public discourse, and support broader communication efforts about the role of biopharmaceutical innovation in population health.*

Background

The global biopharmaceutical health-innovation ecosystem is complex, and it is not surprising that its economic value is difficult to fully comprehend and hence is underappreciated. The health economics literature of the past 20 years has argued convincingly for the extraordinary value that medical care, in general, and new medicines, specifically, have generated for American patients. Yet, that message has difficulty achieving visibility and salience among the American general public given the focus on the increasing cost of insurance coverage and the rising prices of innovative drugs. One wonders if there is a kind of Kahneman-Tversky bias at work—an inability to comprehend magnitudes when the benefits are in many trillions and the costs are in a few trillions. Still, there are valid perceptions and concerns: the cost of insurance is rising in part because of the rising real costs of hospital care, physician care, pharmaceutical care, and other aspects of medical delivery. New medicines have received an Inordinate amount of attention among the general public though the reasons are multiple and complex. Most prices of services in the US healthcare system are not transparent, and the costs of drugs are arguably more visible to patients than other medical services. For example, patients on medicines for chronic conditions interact frequently with their pharmacies and experience (i) uncertain but substantial varying and hence uncertain copays in some cases and (ii) delayed or denied coverage due to utilization management.

Americans have been made well-aware of the fact that the prices of medicines are two to three times higher in the US in real terms compared to other developed countries in Europe. Although economics makes a strong case for the differential pricing of public goods, such as the information

embedded in medicines,[1] the public has not found this persuasive. We have argued that our field has done a poor job of communicating the pharmaceutical market design.[2] That design suggests that more well-off countries and consumers should pay more for medicines as their contribution to global research and development: some free-riding is optimal. However, it seems clear that the actual patterns of free-riding are suboptimal with the size of countries' contributions poorly correlated with their overall ability to pay and thus contribute to global biopharmaceutical R&D.[3] The recent presidential executive order on Most-Favored Nation pricing attempts to address this but with an arguably blunt tool. As a result, there is a substantial risk of substantial cuts to global R&D. The aggregate economic value generated by improvements in population health in the US and globally could suffer greatly. The commentary is anchored in a standard economics framework for assessing the welfare loss from reduced global R&D and with relevant estimates from the economics literature.

It is important to remind both Americans and non-Americans about the substantial value generated globally by new medicines, which are supported in the health literature of the past 20 years. But the evidence available from that literature is diverse and disparate and needs to be reconciled into a coherent story using a standard economic lens. Furthermore, it needs to be updated given recent advances in the economic methodology and argumentation about an expanded societal perspective.

Some of the relevant literature begins almost two decades ago with a more macro-level spending perspective on the value of medical spending generally. Based on established methods for valuing statistical life and life-years, using market-based evidence from wage–risk tradeoffs to anchor valuations, Murphy and Topel (2006) estimate that medical spending may be welfare-enhancing even at high shares of GDP shares.[4] The found that: "Reductions in mortality from 1970 to 2000 had an (undiscounted) economic value to the 2000 U.S. population of about $3.2 trillion per year" (or $5.0 trillion in 2024$). And they make the case that for plausibly enormous economic returns to medical research, especially pharmaceuticals. Hall and Jones (2007) show that rising health spending is a rational, welfare-maximizing response to growing income, the declining marginal utility of consumption, and the increasing economic value of longevity.[5] And the optimal share of GDP could be much higher (e.g., 30% by 2050) than the current level (18%).

Over the past 20 years, there is also considerable relevant insightful work on pharmaceutical innovation. We will also review and integrate the pharmaceutical-oriented work from the

[1] Danzon PM, Towse A. Differential pricing for pharmaceuticals: reconciling access, R&D and patents. Int J Health Care Finance Econ. 2003 Sept;3(3):183–205.
[2] Olivença F, Diaz J, Ramagopalan SV, Garrison LP Jr. Why is the market design for innovative pharmaceuticals not well understood? Journal of Comparative Effectiveness Research. 2024;13(10).
[3] Mullahy, AW https://www.rand.org/pubs/research_reports/RRA788-3.html
[4] Murphy KM, Topel RH. The value of health and longevity. Journal of Political Economy. 2006;114(5):87
[5] Hall and Jones Hall RE, Jones CI. The value of life and the rise in health spending. Quarterly Journal of Economics. 2007;122(1):39–72.

collaboration of Tomas Philipson, Darius Lakdawalla, and Anupam Jena,[6,7,8] who were early contributors to this literature highlighting the connection between dynamic efficiency and surplus appropriation. Frank Lichtenburg contributed a number of empirical studies over this period.[9]

We regard Buxbaum et al. (2020) as the most recent and rigorous effort to quantify the determinants, including pharmaceuticals of US life expectancy gains from 1990 to 2015.[10] They attribute 35% of the 3.3-year gain in life expectancy gain to pharmaceuticals. Our rough preliminary calculations suggest R&D annual benefits in trillions of dollars when the annual costs are the hundreds of billions. And we will then also document the value created since 2015 including the complex impact of innovations during the COVID-19 pandemic. Finally, we will adjust this value of life estimates by applying the latest methods, including Generalized Risk-Adjusted Cost-Effectiveness Analysis.[11,12]

Importantly, this calculation reflects only gains in the quantity of life. It excludes improvements in quality of life, risk reduction and insurance value, productivity gains, post–loss-of-exclusivity benefits, and global diffusion of innovation, suggesting that total social returns are likely substantially larger.

Methods

We conduct a transparent back-of-the-envelope accounting exercise to compare the economic value of longevity gains attributable to pharmaceuticals with the investment required to generate them. We begin with published estimates of the increase in U.S. period life expectancy between 1990 and 2015 and attribute a fixed share (35%) per Buxbaum et al. of these gains to biopharmaceutical innovation in the US. Table 1 provides important context for interpreting these gains.

Table. Population, life expectancy (LE), healthy life expectancy (HALE), and GDP per capita (PPP, deflated to 2024 dollars using the US PCE price index), selected years.

Panel A. United States

Metric	1990	2015	2024
Population (millions)	249	322	340
Life expectancy at birth (years)	75.2	78.8	79.3

[6] Philipson TJ, Sun EC. Is the United States getting a good deal from prescription drugs? Health Affairs. 2008;27(5):w421–w432.

[7] Philipson TJ, Jena AB. Who benefits from new medical technologies? Estimates of consumer and producer surplus for HIV/AIDS antiretroviral therapy. Forum for Health Economics & Policy. 2006;9(2)

[8] Lakdawalla D, Sood N. Innovation and the welfare economics of medical care. Journal of Health Economics. 2009;28(6):1135–1147.

[9] Lichtenberg FR. The effect of new drug launches on longevity: Evidence from longitudinal, disease-level data from 52 countries, 1982–2001. International Journal of Health Care Finance and Economics. 2005;5(1):47–73.

[10] Buxbaum JD, Chernew ME, Fendrick AM, Cutler DM. Contributions of public health, pharmaceuticals, and other medical care to US life expectancy changes, 1990–2015. Health Affairs. 2020;39(9):1546–1556.

[11] Lakdawalla and Phelps Lakdawalla DN, Phelps CE. Risk preferences, risk aversion, and the value of risk protection in health. American Journal of Health Economics. 2017;3(2):166–208.

[12] Shafrin J, et al. Valuing the Societal Impact of Medicines and Other Health Technologies: A User Guide to Current Best Practices. Forum Health Econ Policy. 2024 Nov 8;27(1):29-116

Healthy life expectancy, HALE (years)	64.3	66.6	66.9
GDP PPP per capita (2024 $)	58,000	66,000	85,000

Panel B. Global

Metric	1990	2015	2024
Population (billions)	5.32	7.38	8.16
Life expectancy at birth (years)	64.5	71.6	73.3
Healthy life expectancy, HALE (years)	56.9	63.1	65.6
GDP PPP per capita (2024 $)	13,500	17,500	20,500

Notes and sources:

- Population: United States Census Bureau; United Nations World Population Prospects 2024 revision.
- Life expectancy (LE): United Nations Population Division; CDC/NCHS for United States.
- Healthy life expectancy (HALE): World Health Organization and Global Burden of Disease Study (GBD 2019/2021 updates; 2024 values are GBD-consistent extrapolations).
- GDP per capita (PPP): IMF World Economic Outlook database; deflated to real 2024 dollars using the US Personal Consumption Expenditures (PCE) price index from the Bureau of Economic Analysis.

Some Preliminary Results

In 2015, there 322 million Americans, a 38% increase from 1990, and they enjoyed a life expectancy gain of 3.6 years (Buxbaum et al. had had 3.3 years). Total economic value would depend on the value of an expected life year gained, but there are several ways to calculate this. for the population alive in 2015, the total value of their incremental gain due to biopharmaceutical innovation is $40.6 trillion (322 million x 3.3 years x 35% x $100,000 per life year).

How does this compare in scale to annual investments in US pharmaceutical R&D made over period 1990 to 2015? Chandra et al. (2024) estimated that: "Global biopharmaceutical R&D investment in 2021 was $276 billion across 4,191 companies…".[13] Expressed in real 2024 dollars using the U.S. PCE price index, this corresponds to approximately $314 billion." For the illustrations and the sake of the current discussion (to be refined over refined over the next two months), we can assume that real global biopharmaceutical R&D spending was less than 150 billion per annum (in real 2024$) as a conservative upper bound between 1990 and 2015. This would amount to $3.7 trillion over this period. The implied return on investment would be 11 to 1 (=$40.6 trillion/$3.7 trillion).

If we apply the same calculation logic to the more recent period (2016-2024), what do we find? Mortality rates in this period have been significantly affected by the opioid crisis and by the COVID-19 pandemic. Case and Deaton (2015; 2020) argue that U.S. mortality after ~2015 continued to reflect structural health disadvantages linked to socioeconomic distress and "deaths of despair,"

[13] Chandra, A., Drum, J., Daly, M., Mirsberger, H., Spare, S., Neumann, U., Martin, S., & Kirson, N. (2024). *Comprehensive measurement of biopharmaceutical R&D investment*. Nature Reviews Drug Discovery, **23**(9), 652–653.

which contributed to stagnating or declining life expectancy trends that diverged from other high-income countries.[14,15]

Note on next steps:
There are several more steps that we need to carry out to prepare this for submission to Health Affairs Forefront and for presentation (if invited) to the March NBER conference:

1. Clearly state that there are a number of assumptions and limitations in these calculations.
2. Compare the value of health gain estimates using the value of a statistical life versus the cost-effectiveness thresholds used in traditional cost-effectiveness analysis per, for example, by the Institute for Clinical and Economic Review. But also, for the latter, discuss the implications of applying the GRACE framework, which implies higher thresholds for rare, health-catastrophic conditions.
3. Reconcile disparate published estimates of biopharmaceutical R&D over time and make assumptions about US R&D versus global R&D in order to estimate US and ex-US returns separately. Explore using a 10-year or similar lag between biopharmaceutical R&D investment and realized life-year gains to reflect the time required for clinical development, regulatory approval, and diffusion into clinical practice, ensuring that costs and benefits are plausibly aligned.
4. Discount life-years gained to reflect the timing of health benefits and apply compounding adjustment to account for the opportunity cost of investment when estimating social returns.
5. Cite and discuss the global burden of disease study and the gap between target life expectancy (86 years) and what is realized. Note that diminishing returns to R&D investment will increase the cost of closing the gap.
6. Identify and select most appropriate references given that Health Affairs Forefront allows only a limited number.

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[14] Case, A., & Deaton, A. (2015). *Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. Proceedings of the National Academy of Sciences of the United States of America, 112*(49), 15078–15083.
[15] Case, Anne, and Angus Deaton. *Deaths of Despair and the Future of Capitalism*. Princeton: Princeton University Press, 2020.