METHODS

14. To estimate the impact of lifting government price controls in non-US OECD countries on global pharmaceutical innovation and population health.

Challenges included:

7. The number of additional new molecules introduced annually

Life expectancy (years)

To estimate the number of such policy changes, we relied on past research that found that increased spending on pharmaceuticals leads to average increases in life expectancy of around 0.6 years if implemented in the United States.18

Furthermore, contrary to previous policy changes also increased the overall effects. Combined they estimated that these policies could lead to an additional 15% decrease on top of the 20% initial impact.6

The Health Economics Medical Innovation Simulation (THEMIS) was used to estimate the contribution of these policies on global pharmaceutical innovation.6,13

Themis is a microsimulation that tracks individuals 50 and older over their remaining lives to project their disease and comorbidity burdens. We examine the functional status, health care costs, employment status, and personal taxes and transfer payments (including disability and insurance receipt). A number of publications have used THEMIS to project the long-term consequences of disability trends in older US populations.6

THEMIS tracks the evolution of future health and innovation for US populations aged 50 and older using different technological, policy, and health trends.

People age in the model under a Monte Carlo simulation in which next year’s health status depends on today’s health status, and on a set of random number seeds that vary with individual’s own risk factors — e.g., their age, health behaviors, and current disease conditions.

In a given year, say 2024, some individuals may have diseases and functional status limitations that put them at risk of contracting new diseases or disabilities, or even dying. In 2025, however, new drugs may be introduced in 2024 that reduce some of these risks.

THEMIS estimates a health transition model to simulate how population health will evolve in the next ten years (2025), given the number of new drug introductions and existing health conditions. However, potentially will have shrunk the population in 2026, but the sample is “refreshed” by introducing those who were 40 in 2024 and who have never lived in a 2020 population. This forms the set of sample individuals for 2025. The same procedure is repeated to obtain the population in 2026 and subsequent years.

Costs are calculated using a variety of different matrices, including: medical expenditures, non-medical public spending, income, revenues, disease-free life-years, disability-free life-years, quality-adjusted life-years, and life expectancy. Expenditures are modeled based on data from the Medical Expenditure Panel Study and the Medicare Current Beneficiary Survey.6

A novel feature of THEMIS particularly relevant to this project is its ability to project the long-term consequences of new drugs on a range of outcomes including: population life expectancy, quality-adjusted life expectancy, and the number of new molecules introduced. The model allows for a direct estimate of the impact of policy interventions on population health.

The impact of these government price control policies on innovation and population health was modeled using three scenarios:

1. Baseline pricing — the status quo pricing schemes in all countries
2. A 20% increase in OECD price and revenues
3. A 30% increase in OECD price and revenues

According to a recent report,16 pharmaceutical spending in other OECD countries is roughly 40% of all OECD countries, including US drug spending.

Thus, we assumed an 8% increase in US and OECD market size for scenario 1 (20% increase in revenues) and a 15% increase in the market size for scenario 2 (30% increase in revenues).19

Previously work with this model calculated an innovation elasticity of 3% for small molecules and 4.69% for biologics, yielding a market-share-weighted elasticity of 3.46%. This means that there is a 3.4% change in the number of new drugs on the market for every 1% change in revenues.20

RESULTS

In Figure 1, we show how lifting price controls will impact global innovation in terms of new molecules to market. In the baseline scenario, we find that if government price control policies in non-US OECD countries were directly responsible for a 20% drop in the world’s innovation leading to 4 new drugs per year by 2030. Similarly, assuming the larger more realistic 12% increase in global revenues in scenarios 1, and at 2% increase in the market size, resulting in 13 new drugs per year. These impacts grow to 28 and 44 new molecules per year by 2060 respectively.

Figure 1. Estimated number of additional new molecules introduced annually if price controls were lifted in ex-US OECD countries.

In Figure 2, we show the impact of lifting government price controls on longevity. In scenario 2, we estimate that the average life expectancy of all US citizens in 2026 would increase by 0.58 years in OECD prices by increased.20 These benefits are magnified for younger individuals, such that the average life expectancy of 15-year olds in 2014 would increase to 1.1 year.

Similarly, in scenario 3, we find that average life expectancy increases by 0.56 years and 1.4 years for 45-year olds and 15-year olds respectively. Figure 2 also reports life expectancy in OECD countries for the same scenarios. In this case, non-US OECD countries would increase by 0.44 years and 0.81 years in scenario 2 and 1.3 years in scenario 3, respectively.

Figure 2. Effect of lifting government price control policies on longevity for selected age cohorts.

In Figure 3, and 4, and we estimate the total value of lifetime benefits gained by various age cohorts. For example, under scenario 2, with the 20% increase in prices, all individuals age 45 in the US in 2014 would gain $842 billion in social value over the lifetime of their possible increases in 2014 to use more benefit across their lifetimes. We estimate that 15-year-olds in the US in 2014 would gain $2.28 billion in social value over the lifetime of their possible increases in 2014 to use more benefit across their lifetimes.

Figure 3. Net present value (NPV) of lifetime welfare gains from lifting government price controls in ex-US OECD countries, for selected age cohorts.

In Figure 4, we show the per capita net present value (NPV) of lifetime welfare gains from lifting government price controls in ex-US OECD countries, for selected age cohorts (S(columns).