PENN WHARTON
UNIVERSITY of PENNSYLVANIA
Budget Model

Health and Economic Effects of Reducing COVID-19 Vaccine Hesitancy

Summary: PWBM projects that vaccinating all those eligible by reducing vaccine hesitancy would prevent up to 8.3 million cases in 2021, increase employment by 2.6 million in December 2021, and boost Q4 2020 to Q4 2021 GDP growth by 2 percentage points. In fact, failure to reduce vaccine hesitancy could lead to a "perfect storm" if people also become optimistic and increase their social contact rates beyond the baseline rates that we previously projected. Indeed, increasing social contact rates to 85 percent of pre-COVID levels by the end of 2021 would lead to up to 4.6 million additional COVID-19 cases in 2021.

Key Points

- PWBM's baseline projects that, by the end of 2021, social contact rates return to 70 percent of pre-COVID levels and 25 percent of eligible U.S. residents choose to remain unvaccinated.
- If instead all eligible residents are vaccinated, PWBM projects a cumulative 5.3 million to 8.3 million fewer cases in 2021, an increase in employment of 2.6 million by December 2021, and a 2 percentage point increase in Q4 2020 to Q4 2021 GDP growth.
- However, if vaccine hesitancy persists and people optimistically increase social contact rates beyond 70 percent, a "perfect storm" emerges. If social contact rates rise to 85 percent of pre-COVID levels, PWBM projects up to 4.6 million additional cases in 2021.

Background

PWBM recently analyzed the impact of COVID-19 vaccination on the outlook for the pandemic and the economy in 2021, showing that both hinge on the pace of the vaccine rollout this year. In this brief we use the same framework to consider the impact of the public's behavioral choices and how they interact with the vaccine rollout. We explore two variations on our baseline forecasts of behavior: changes in the share of the eligible population that decides to get vaccinated in 2021 ("vaccine hesitancy"), and changes in the degree to which social distancing is relaxed or maintained in 2021.

The Costs of Vaccine Hesitancy

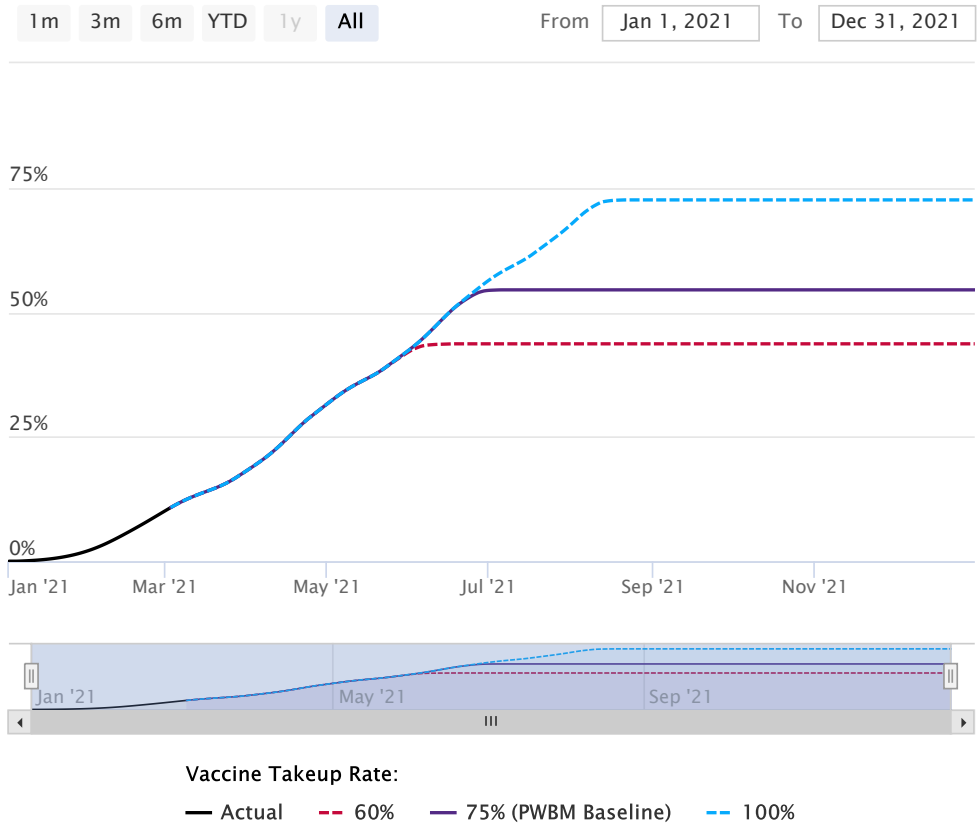
Alternative Paths for COVID-19 Vaccine Take-up in 2021

In PWBM's baseline estimates for 2021, we project that 75 percent of eligible US residents will be vaccinated in 2021. That forecast is based on recent surveys in which between 20 and 30 percent of respondents indicate that they are unlikely to get a vaccine.[1] To estimate the effects of vaccine hesitancy, we consider what would happen if 100 percent of those eligible received a vaccine in 2021. We also consider the effects of a lower take-up rate of 60 percent, which corresponds to the share of respondents indicating they intended to get the vaccine in surveys conducted in late 2020.

Figure 1. Share of the Population with Immunity from Vaccination Assuming 3 Million Daily Vaccinations

(percent)

DOWNLOAD DATA



Note: The vaccine take-up rate is the percentage of eligible US residents who receive a COVID-19 vaccine.

Figure 1 plots the share of the population with immunity from vaccination in PWBM's baseline and the two alternatives, under the assumption that the number of daily vaccinations in the US peaks at 3 million. In the baseline, about 55% of the population obtains vaccine-induced immunity by the end of summer. If 100 percent of the eligible population chose to get vaccinated, that share would rise to nearly 75 percent, with the remaining quarter of the population consisting mostly of children under 16 who will likely not be vaccinated until 2022. If only 60% of the eligible population chose to get vaccinated, less than half of the total population would have vaccine-induced immunity in the second half of the year.

Epidemiological Effects

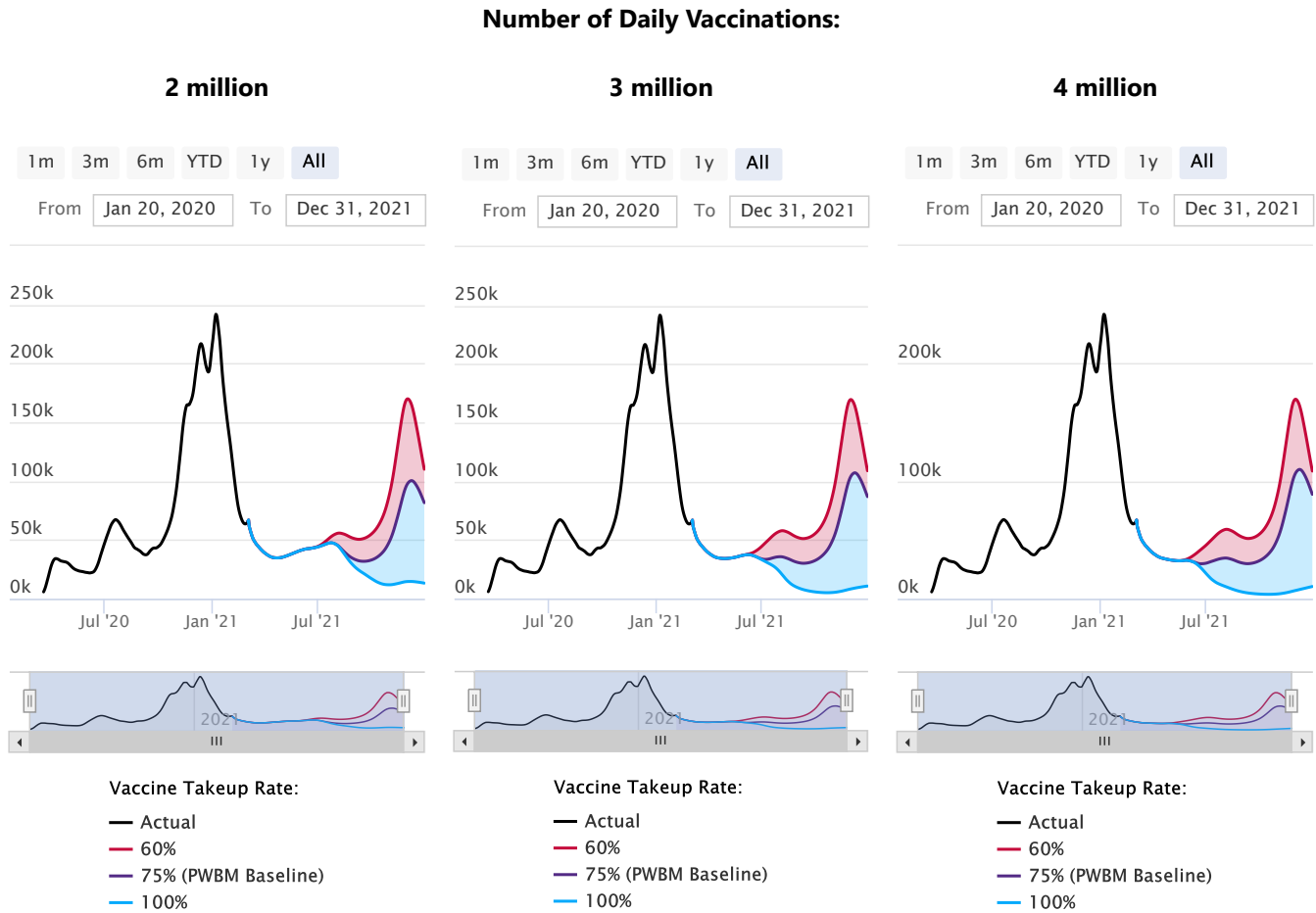
In PWBM's baseline, new cases continue declining into the spring and stabilize between 25 and 50 thousand (depending on the pace of vaccination) over the summer. However, we project a surge in daily cases to around 100 thousand in the winter of 2021. This surge is driven by four factors: the persistence of relaxed social distancing; the prevalence of the more transmissible B.1.1.7 variant of the virus; a seasonal increase in infectiousness; and the lack of immunity among most children—who will likely not be vaccinated until 2022—and among most adults who decline the vaccine.[2] Because many in this remaining susceptible population will become infected during the winter wave and then develop natural immunity, we project that the US will attain effective population immunity by the end of 2021 and that the pandemic will be essentially over in early 2022.

Figure 2 shows the daily number of new confirmed cases under the three paths for the vaccine take-up rate, given alternative assumptions for the peak number of daily vaccinations in 2021. We assume that vaccination capacity is fully utilized in all scenarios, meaning that changes in the take-up rate affect how long it takes to administer the vaccine to everyone who wants it but do not affect the maximum number of doses administered per day. Differences in take-up rate therefore have no impact until the second half of the year, when the vaccination campaign either ends sooner or continues longer than in the baseline.

Figure 2. Daily New Cases by Vaccine Take-up Rate

(thousands)

DOWNLOAD DATA



Note: The vaccine take-up rate is the percentage of eligible US residents who receive a COVID-19 vaccine.

If only 60 percent of eligible US residents are vaccinated in 2021, the number of infections would be significantly higher than in our baseline throughout the second half of the year. Daily new cases would remain above 50 thousand over the summer and rise sharply to a higher peak during the projected winter wave. In total, the number of cases in 2021 would be between 5 and 6 million higher than in the baseline.

If all eligible US residents are vaccinated in 2021, we project that the pandemic will effectively be over by the fall. With a vaccine take-up rate of 100 percent, effective population immunity would be attained at some point this summer, depending on the pace of vaccination. Including children under 16 who have immunity from having been previously infected, we project that around 80 percent of the population would be immune by mid-August at the latest. At a daily vaccination rate of 4 million doses, this point would be reached by the end of June. In this environment, new cases would decline over the summer and early fall to the lowest levels since the initial outbreak in March of 2020. Cases would remain at low levels for the rest of 2021, rising slightly in the winter rather than surging in a new wave as in the baseline. Critically, new infections towards the end of 2021 would be concentrated among children, who are less likely to experience severe symptoms and have much lower rates of hospitalization and mortality than adults. In total, the number of cases in 2021 would be between 5.3 and 8.3 million lower than in our baseline, depending on the pace of vaccination.

Economic Effects

Differences in the vaccine take-up rate lead to large differences in the state of the economy at the end of 2021. With a take-up rate of 100%, the pandemic would largely be over by the fall, allowing most economic activity to resume. We project that civilian employment would rise from around 150 million in February to 156.5 million in December. This is 2.6 million higher than PWBM's baseline projection, though still more than 2 million below the pre-pandemic peak. We project that real GDP would grow about 8 percent from the fourth quarter of 2020 to the fourth quarter of 2021, compared with just above 6 percent in PWBM's baseline.

The negative effects of a lower take-up rate of 60% are smaller but still significant. We project that employment would end the year at 152.5 million and four-quarter real GDP growth of around 5.5 percent in 2021.

Effects of Relaxing Social Distancing

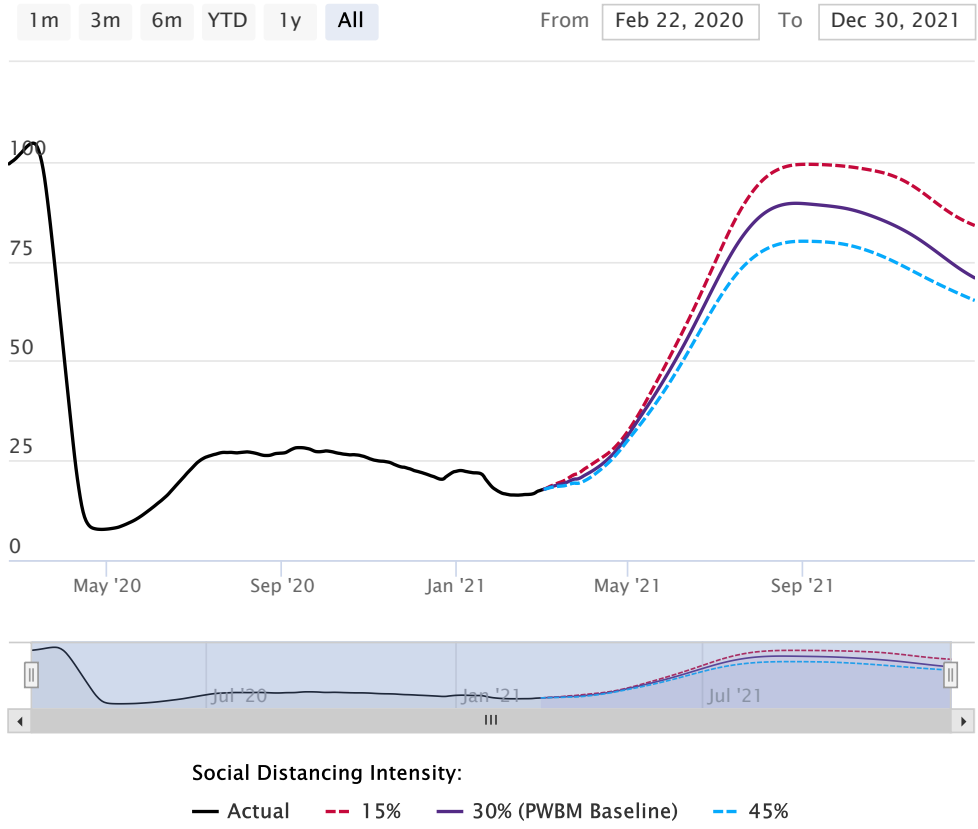
Alternative Paths for Social Distancing in 2021

In PWBM's baseline estimates for 2021, we project that both voluntary and mandated social distancing behaviors will be substantially relaxed over the course of the spring and summer. The intensity of social distancing is reflected in the contact rate—the frequency of close physical proximity to other persons outside the home.[3] In PWBM's baseline, the contact rate rises from about 80 percent below its pre-COVID "normal" at the end of 2020 to around 30 percent below normal at the end of 2021. To explore the effects of relaxing social distancing more or less rapidly, we consider two alternative paths for the contact rate in 2021: a faster increase to roughly 15 percent below normal at the end of the year (i.e. less social distancing) and a slower increase to roughly 45 percent below normal at the end of the year (i.e. more social distancing).

Figure 3. Contact Rate by Social Distancing Intensity, Assuming 3 Million Daily Vaccinations

(February 2020 = 100)

DOWNLOAD DATA



Note: Social distancing intensity is defined in terms of the percentage gap between the projected contact rate at the end of 2021 and an estimate of the "normal" contact rate in the absence of COVID-19.

Figure 3 plots the contact rate under PWBM's baseline and the two alternative paths, under the assumption that the number of daily vaccinations in the US peaks at 3 million. As we discuss in the brief, PWBM's model accounts for the two-way relationship between behavior and public health outcomes: growth in infections depends on the intensity of social distancing, which determines the likelihood that the virus will spread. At the same time, the intensity of social distancing depends on perceptions of the risk of infection, which the public assesses based on confirmed infections. If an initial relaxation of social distancing leads to an increase in the number of COVID-19 cases, the public's response to the increased risk will eventually offset some of the initial rise in the contact rate. The reverse occurs in response to an intensification of social distancing. Because of these feedback effects, the differences between the baseline and the two alternative paths are not symmetric over the course of the year even though the initial changes are.

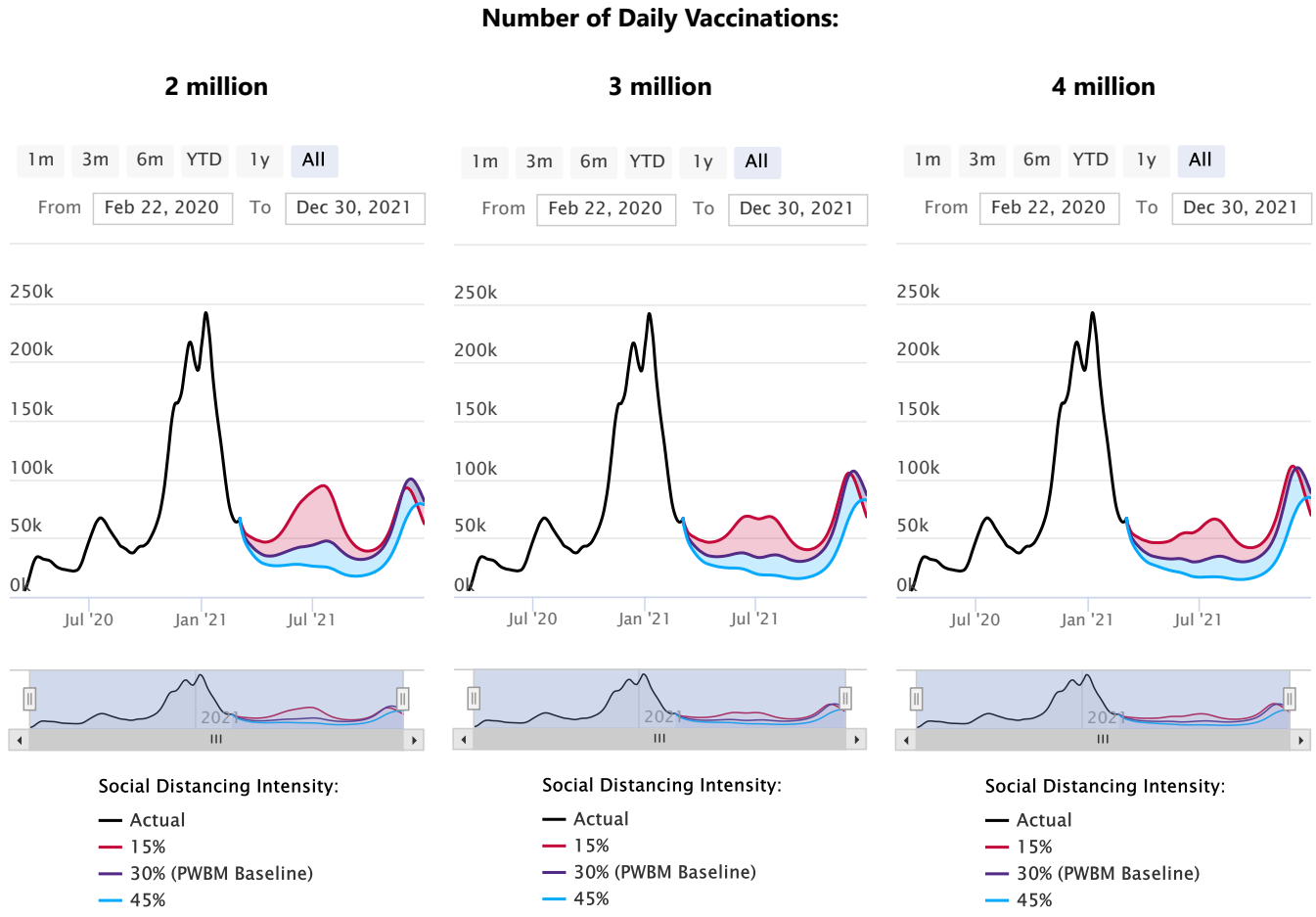
Epidemiological Effects

Figure 4 shows the daily number of new confirmed cases under the three paths for social distancing, given alternative assumptions for the peak number of daily vaccinations in 2021.[4]

Figure 4. Daily New Cases by Social Distancing Intensity

(thousands)

DOWNLOAD DATA



Note: Social distancing intensity is defined in terms of the percentage gap between the projected contact rate at the end of 2021 and an estimate of the "normal" contact rate in the absence of COVID-19.

If social distancing is relaxed more rapidly and the contact rate rises to 15 percent below normal over the course of 2021, the epidemiological outlook for the spring and summer worsens considerably. We project that the rapid decline in new cases this year would cease almost immediately and eventually reverse in a summer wave of new cases. The size of that wave depends on the pace of vaccinations earlier in the year, but even with high rates of vaccination, new cases would be twice as high as in the baseline through most of the summer. The surge in cases subsides by October but only temporarily; as in the baseline, cases rise sharply in the last months of 2021 in a final winter wave. Notably, the winter wave would not be meaningfully smaller even though a larger share of the population would have natural immunity due to the rise in infections over the summer. Because that rise in infections occurs at the same time as the peak in the number of vaccinations administered daily, many of those infected over the summer would have obtained immunity from vaccination by the end of the year anyway. Overall, we project an additional 4.2 to 4.6 million cases in 2021 as a result of relaxing social distancing more rapidly.

If social distancing is relaxed more slowly and the contact rate rises only to 45 percent below normal over the course of 2021, we project that new cases would continue declining to below 20 thousand in the summer and remain lower than the baseline through the end of the year. In total, we project around 4.5 million fewer cases

in 2021. This estimate is roughly the same irrespective of the assumed pace of vaccination, because the effect of increased social distancing on transmission is greatest in the near-term when most of the population remains vulnerable under any forecast of vaccinations.

Economic Effects

Changing the intensity of social distancing would have a negligible impact on the economy in 2021. While some changes in social distancing translate directly into changes in economic activity, two factors largely offset these direct effects. First, the initial change in social distancing is moderated by its eventual impact on the spread of the virus, which feeds back to behavior through the public's response to infection risk. Second, economic activity is currently much closer to its pre-COVID trend than the contact rate—that is, there is less slack in economic activity than in social activity. This largely reflects the ways in which businesses have adapted their operations to the pandemic over the last year, allowing a substantial share of economic activity to resume despite widespread social distancing. Given the already significant relaxation of distancing projected in all three scenarios, a moderate change in the pace of relaxation may affect the share of business activity conducted in-person but has little impact on the overall level.

This analysis was conducted by Alex Arnon and John Ricco. Directed by Richard Prisinzano. Prepared for the website by Mariko Paulson.

---

1. See surveys from NPR/PBS/Marist, Pew Research, and the Kaiser Family Foundation. ↩
2. See our previous brief for a more detailed discussion of PWBM's baseline projections. ↩
3. See the brief and Arnon, Ricco, and Smetters (2020) for a description of the data and procedure used to estimate the contact rate. ↩
4. Projections of confirmed cases are based on projections of the total number of infections and the rate at which infections are confirmed by a test. See the brief and Arnon, Ricco, and Smetters (2020) for additional detail. ↩