02

Possible Scenarios
Summary

Although the forecast remains uncertain, there will likely be fewer deaths from Covid in 2022 than in each of the two previous years. If new variants are not significantly more transmissible or lethal, infection fatality rates continue their steady decline, and key tasks are completed, influenza will soon overtake Covid to again become the nation’s most deadly viral respiratory illness.

Possible Future Scenarios

Preparing for the future requires a basic understanding of how Covid will behave over the next 12 to 24 months. Just as important is an awareness of the changes already wrought by the pandemic: Hundreds of millions of Americans are vaccinated, tens of millions more have been infected, and information about how to mitigate and treat the virus has grown substantially.

Of course, the trajectory of the pandemic over the next 12 months (March 2022 - March 2023) remains uncertain. The SARS-CoV-2 virus has mutated and surprised scientists many times over the past two years. Omicron was an unanticipated strain. It did not arise from the variants prevalent at the time but had been evolving undetected for many months before spreading widely. Omicron only reemphasizes the importance of humility in anticipating likely scenarios and steering between ill-advised optimism and paralyzing pessimism. Nonetheless, defining possible scenarios for infections and disease is central to rapidly getting to the next normal.

The course of the pandemic is usually measured by the total number of SARS-CoV-2 infections. But as the virus becomes endemic, more infections will likely be asymptomatic or at most cause mild illness, and as more at-home tests are used, the data on cases will be less reliable.
Better metrics for monitoring optimistic, intermediate, and pessimistic scenarios for the next year may therefore include wastewater samples, coupled with the number of Covid-related hospitalizations and deaths. Another important benchmark is the strain that the overall burden of respiratory infections of any severity places on the healthcare system because of permanent or temporary loss of workforce. These metrics are driven in large part by population immunity, viral evolution, and health system resilience (see Chapter 1: Next Normal).

In the optimistic scenario, Covid would be similar to seasonal flu. Although this scenario would still result in 15,000 to 30,000 Covid deaths each year, this outcome would mean SARS-CoV-2 has a similar impact to other seasonal respiratory viruses. Conversely, the pessimistic scenario envisions mortality levels of 100,000 to 300,000 Covid deaths a year (Figure 1). Notably, even the pessimistic forecast projects significantly fewer annual deaths than the approximately 475,000 that the nation experienced in 2021.7

Defining possible scenarios for infections and disease is central to moving forward.

Two Drivers of the Covid Scenarios

There are three scenarios to arrive at estimates of Covid-associated deaths: optimistic, intermediate, and pessimistic. And there are two parameters that inform these estimates as well as the ranges around them: the virus’s attack rate (incidence) and infection fatality rate (IFR).

The yearly attack rate is the total number of infections over the course of a year (including repeat infections), divided by the total population. Using data from household transmission studies, seroprevalence studies, and epidemic dynamics, the projected yearly attack rate for March 2022 to March 2023 ranges between 20% to 80% for SARS-CoV-2. This attack rate varies depending on two primary factors: the virus itself and the level of immunity in the population. The Omicron variant was able to spread widely in a population that had abundant immunity to ancestral Covid viruses. How much future variants increase transmissibility and escape from existing immunity will largely define the effective attack rate. Even so, a complete escape from immunity is unlikely. Vaccinations are very likely to continue reducing infections and transmissions, at least to some degree. Indeed, recipients of booster doses were significantly less likely to have symptomatic illness.8


The infection fatality rate (IFR) is the percentage of infected individuals who die because of their infection. For Covid, current data suggest an IFR of approximately 0.075% during the January 2022 Omicron wave, down from an approximate IFR of 0.5% during the winter 2020-2021 Alpha-dominated wave.

Continued reductions in the IFR may occur as population immunity increases. Conversely, viral evolution and waning immunity could see the IFR increase. The IFR from March 2022 to March 2023 will likely lie between 0.03 - 0.10%. In other words, between three and ten people in 10,000 who are infected will die. Seasonal influenza varies somewhat in its IFR from year-to-year, but commonly used estimates range from 0.05% to 0.1%.

By themselves, these numbers place per-infection severity for SARS-CoV-2 at a level similar to seasonal influenza. But because of SARS-CoV-2’s greater circulation, Covid will likely cause more deaths than influenza.

Attack rate and IFR have changed over time not only because of the virus and variants, but because population immunity has increased. Assessing possible scenarios for the next 12 months depends on future changes in population immunity, including the percentage of the population that is immune as a result of vaccination or infection, as well as the durability of this immunity and resistance to escape from immunity by future viral variants. Population immunity can also be altered by future vaccination efforts.

By estimating those two key variables — attack rate and IFR — and incorporating population immunity, it is possible to project optimistic and pessimistic scenarios over a range of population immunity over the next 12 months (Figure 2).
There are three additional factors that influence the impact of these possible scenarios. First, mortality and infections are unlikely to be spread uniformly over time and geographies. There is likely to be seasonality, such that the deaths and hospitalizations will be concentrated around the Thanksgiving and Christmas holidays, as well as the summer (especially in southern states where heat drives indoor congregation). Similarly, some states and geographies are likely to be harder hit than others. Variables such as the percentage of the population fully vaccinated or with immunity from infection, as well as the quality of local health care, could continue to be critical determinants of local outcomes. Thus, even in the optimistic scenario, health care use and mortality could sometimes strain healthcare infrastructure in some places while not doing so in others. New York City was hit hard by Covid early in the pandemic, stressing the healthcare system significantly at a time when other parts of the nation experienced relatively few Covid infections and saw normal hospital operations.

Second, even if the IFR and overall deaths are low, the number of people sickened could still be high in some scenarios. Such a disease burden could disproportionately impact critical sectors of the workforce including healthcare workers, first responders, and teachers, as well as vulnerable populations, such as the elderly, immunocompromised, and communities of color.

Finally, as emphasized in Chapter 1, the impacts of hospitalization and deaths are not solely a function of Covid, since SARS-CoV-2 infections do not occur in isolation. Influenza, RSV, parainfluenza, adenovirus, other respiratory viruses, other diseases, and co-morbidities impact hospitalizations and deaths. Co-infections with other respiratory viruses and SARS-CoV-2 can occur that may complicate outcomes in the future. Consequently, the focus must shift away from looking at Covid in isolation and towards assessing the impacts of major viral respiratory illnesses both singly and in combination (see dashboard in Chapter 1).
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Holistically, the strains on local health systems impede healthcare providers’ ability to effectively treat and respond to both viral respiratory illnesses and other population health needs. Although no formal definition of health system strain exists, health providers and communities should consider the overall bed occupancy rates, how health workforce shortages are exacerbated by required Covid isolation and quarantine periods, and equipment shortages that include personal protective equipment, therapeutic drugs, and ventilators. If a local Covid or other viral respiratory illness outbreak strains one or more of these components, there will likely be downstream care and quality impacts. Health systems should have plans in place to requisition supplies and staff or transport patients. Health systems’ resilience to strain is dependent upon their respective abilities to absorb high patient caseloads and shortages of equipment and staff. Investments and partnerships with other local providers can bolster this resilience. Ultimately, if scenario variation at the local level contributes to high system strain, local outcomes will likely suffer.

Optimistic scenario
In this scenario, SARS-CoV-2 evolution beyond Omicron does not result in variants of concern with substantial impact on hospitalizations and death. Any newly emerging variants are less deadly, less transmissible, or both. Also, population immunity is high and durable. In this optimistic scenario, the number of annual Covid-related deaths would likely be in the range of 15,000 - 30,000 from March 2022 to March 2023, a lower toll than from influenza in moderate seasons. The burden on the healthcare system would therefore be reduced to a level similar to that caused by influenza-like illnesses in most years prior to 2020. Even in this scenario, SARS-CoV-2 infections will arise, likely with some seasonality and in some geographies. Surges that occur in winter will likely occur simultaneously with influenza or seasonal respiratory viruses, potentially causing strain and disruption for healthcare and other industries.

Intermediate scenario
The Omicron wave subsides by the early spring, but other variants of concern emerge or resurface that have characteristics similar to the viruses seen in 2020 and 2021. The outcome would be substantial virus circulation but, because of greater population immunity, a lower disease burden than in previous years. In this scenario, the virus will likely cause between 30,000 and 100,000 deaths from March 2022 to March 2023.

The most important factor in the intermediate scenario is likely to be the ability of policymakers to have accurate real-time information about new variants, relevant population immunity, and other pandemic-related variables. Policymakers will need to rapidly and appropriately react to changes in these variables with strategies and measures outlined in subsequent chapters. Efforts to quickly and regularly gather information about viral mutations, population immunity, characteristics of viral spread, and geographies with high transmission rates can facilitate appropriate and focused mitigation strategies. In the intermediate scenario, population immunity is a critical factor. The higher the vaccination rate and population immunity, the lower the number of hospitalizations and deaths. Public health mitigation efforts will be extremely important in influencing the severity of the scenario.
Possible Scenarios

Pessimistic scenario
This scenario arises with an Omicron-like emergence event involving a highly mutated virus that is more transmissible, more deadly, and/or evades population immunity. A virus with these characteristics would spread widely and cause more severe illness than Omicron, including in vaccinated people. This type of virus (and the concern it elicits amongst the general populace) may also contribute to additional downstream health complications, if individuals forgo other important medical care or experience increased stress and anxiety. Finally, a pessimistic scenario becomes more likely if population immunity wanes dramatically or is ineffective against new variants. This could result in between 100,000 and 300,000 deaths over the next year and even more strain on the healthcare and public health infrastructures.

Likelihood of each scenario
It is very challenging to predict with any certainty how probable each scenario is. However, rough estimates are possible. These estimates are influenced by the growing sustained cellular and broadening antibody immunity on a population level, due to vaccination, boosting, and infection, which at minimum significantly reduce severe outcomes and deaths. Additionally, estimates must consider the evolution of the virus. Potential evolutionary outcomes include continued drift within the Omicron variant without increase in virulence, Omicron drift leading to an increase in virulence to Delta-like levels, and new highly-diverged variants with Omicron-like infectivity. It is unclear how rare Omicron-like variants will be, but the observation of one event in just over two years of viral evolution suggests that it may be encountered in the next year but is far from certain.

Considering these possibilities, it seems the optimistic scenarios are the least likely, with a likelihood of only approximately 10%. Conversely, there is about a 40% likelihood of a pessimistic scenario with more than 100,000 deaths, but a reasonably low chance of any variants’ virulence and infectivity being sufficiently high to drive mortality above 200,000 in the next year. Scenarios with greater than 200,000 deaths almost certainly require evolution of a novel variant that both infects a large fraction of the population (attack rate >60%) and is more severe than Omicron (IFR >0.1%). The most likely scenario is some intermediate situation in which COVID-related mortality over the next year is in the 30,000 —100,000 range.

These are estimates, with wide confidence intervals. There is known high population immunity, but how the virus will evolve is entirely unknown. Additionally, there is greater uncertainty at the upper end of the mortality range, as there are a greater number of variables at play. These projections are made in the spirit of humility, with a pragmatic eye. The virus may surprise scientists again, and characterizations of possible scenarios are important for planning.

Combined deaths from major respiratory viruses
The prior chapter outlined that public health leaders must strive for an interim goal of less than 0.5 deaths per million people per day in the next normal from major respiratory viruses. To stay below this threshold, the country must keep combined deaths from Covid, RSV, and flu equal to or below 60,000. This is possible. The lower end of the intermediate Covid scenario, combined with average annual flu and RSV-related deaths, would yield approximately 60,000 deaths —but it is far from guaranteed.

Mitigating Adverse Scenarios

There are specific actions policymakers, businesses, institutions, and the public can take now to influence the toll each of the three scenarios might take over the next 12 months. To ensure deaths and hospitalizations stay at the lowest end of each range requires ongoing and active disease surveillance, management, planning, and investment (Figure 3). The remaining chapters have recommendations on how to increase this likelihood and how to deploy key resources most effectively. Failing to take such actions increases the chances of seeing the worst tolls that are projected within each scenario, with overwhelmed health care systems and more deaths and strife.

Taking comprehensive action across four key areas can help shift the nation from the highest to lowest range in each scenario: virus surveillance, population immunity and resistance, health infrastructure, and public health measures.
First, the nation must invest in proactive virus surveillance at the local, national, and international levels, which likely involves surveying, consolidating, and strengthening existing systems and establishing new ones to fill gaps as needed. Effective, real-time viral surveillance will accelerate effective responses if problematic variants emerge. These efforts should be coupled with support for global vaccination efforts to reduce the development of variants.

If new variants of concern emerge, early detection and analysis will enable public health responses and better equip policy decision-makers. A strong viral surveillance, virological, and epidemiological scientific infrastructure will be needed for these efforts. The U.S. government can also bolster access to affordable testing and invest in domestic surveillance to identify outbreaks and reduce disease transmission (Ch 3: Testing and Surveillance).

Next, the federal government should prioritize bolstering population immunity and disease resistance. This can be achieved by increasing vaccination rates, including boosters, especially among vulnerable populations, taking comprehensive action across four key areas can help shift the nation from the highest to lowest range in each scenario.
and investing in technologies to accelerate vaccine
development, improve vaccination efficacy, counter vaccine
disinformation, and mitigate adverse outcomes (Ch 6: Vaccines). A key factor will be developing approaches to
accurately measure and track the durability and effectiveness
of population immunity at a national level through immune
surveillance (also discussed in Ch 3: Testing and Surveillance).
Additionally, streamlining development and deployment of
effective therapeutics will play a critical role in mitigating
disease spread, health system overload, and deaths when
variants evade population immunity or populations are not
vaccinated (Ch 7: Therapeutics). Finally, efforts to prevent
and mitigate the effects of long Covid can improve recovery
processes and protect against long-term consequences of
infection (Ch 8: Long Covid).

The federal government can also reduce the impact of
viral respiratory illnesses by strengthening the country’s
public health and data infrastructures (Ch 10: Public Health
Infrastructure; Ch 9: Health Data Infrastructure), as well
as augmenting the healthcare workforce (Ch 11: Healthcare
Workforce).

Finally, effective and evidence-based public health
measures will play a critical role in reducing virus
transmission, hospitalizations, and deaths. These actions
will be particularly important if and when new variants
emerge and new transmission waves occur. These measures
should be instituted in schools, childcare settings (Ch 13: 
Schools and Childcare), and workplaces (Ch 14: Worker
Safety). Key actions to protect against catastrophic outcomes
should include the effective deployment of personal
protective equipment (Ch 5: Personal Protective Equipment)
and air filtration and ventilation system improvements
(Ch 4: Cleaner, Safer Indoor Air). To increase trust in
government and promote adherence, these countermeasures
and the country’s overall health status should be regularly
and effectively communicated to the public (Ch 12: 
Communication and Education).

Several examples of how actions can mitigate adverse
consequences are delineated in Table 1.

Table 1
Risk-Based Triggers And Recommended Actions

<table>
<thead>
<tr>
<th>Risk-based Trigger</th>
<th>Infrastructure</th>
<th>Policy Maker Action</th>
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</thead>
<tbody>
<tr>
<td>New high-risk variant of concern</td>
<td>Surveillance for variants of concern</td>
<td>Assess need for initiation of variant vaccine</td>
</tr>
<tr>
<td>Surge transmission in a country</td>
<td>Bolstered global vaccine/booster manufacturing capacity</td>
<td>Deploy more vaccines and increase administration capacity</td>
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<tr>
<td></td>
<td>Mask/test supply chain and production</td>
<td>Local/regional mitigation methods and test availability</td>
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<tr>
<td>Drop in population immunity</td>
<td>Immune surveillance</td>
<td>Deploy additional vaccine boosters</td>
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</table>
Conclusion

The uncertainties in this forecast are considerable. The SARS-CoV-2 virus continues to evolve in unpredictable ways. Nonetheless, this year’s death toll is expected to be below those of each of the past two years. The scenario that evolves over the next year is not predetermined, however, and will be influenced by actions taken in response to changes in the virus and population immunity. Effective and rapid reaction to new information can change a potentially pessimistic scenario towards an intermediate outcome or an intermediate scenario to an optimistic outcome. However, the reverse is also true. Inaction or complacency in the setting of an optimistic or intermediate set of variables could lead to more pessimistic outcomes. Thus, the following chapters are intended to provide a framework of information and actions that can be taken to ensure a consistent shift towards lower death and hospitalization numbers through well-coordinated policy implementation. And if civil society makes some crucial changes, the pandemic is likely to recede.