

Healthcare Systems & Services Practice

When will the COVID-19 pandemic end? March 2021 update

Our latest perspectives on the transition to normalcy and herd immunity for the United Kingdom, United States, and Europe.

by Sarun Charumilind, Matt Craven, Jessica Lamb, Adam Sabow, and Matt Wilson



The fall in COVID-19 cases across much of the world over the past ten weeks signals a new dawn in the fight against the disease. Vaccines are proving effective and rapidly scaling, bending the curve in many geographies. This is a fragile dawn, however, with transmission and deaths still high, unequal access to vaccines, and variants of concern threatening to undo progress to date.

The trajectory of UK and US cases has enabled the beginnings of a transition toward normalcy,¹ the first and more important of the pandemic's two endpoints. We expect this transition to continue in the second quarter of 2021 and will likely see many aspects of social and economic life return to the prepandemic normal, consistent with UK Prime Minister Johnson's staged reopening plan for the United Kingdom² and US President Biden's goal of a normal Independence Day.³ We are more confident in this timeline for the United Kingdom than for the United States, given that the first has already experienced a wave driven by a more infectious variant, whereas the latter could still face one. Parts of the European Union have recently faced setbacks: fewer doses in arms than in the United Kingdom or United States, a new wave of cases, and new lockdowns. A transition toward normalcy is mostly likely in Europe during the late second or third quarter of 2021. The timing will probably vary by country, depending on accelerating vaccine supplies, the impact of vaccinations on hospitalization rates, and the occurrence (or not) of new waves driven by new variants.

Herd immunity, the second endpoint, is most likely in the third quarter for the United Kingdom and the United States and in the fourth quarter for the European Union, with the difference driven by a more limited vaccine availability in the European Union. However, the risks to these timelines are real—herd immunity may not be achieved by the end of the year if vaccine hesitancy is high, if countries experience disruptions in vaccine supply,

or if a variant that renders existing vaccines less effective spreads widely. And herd immunity may look different in different parts of the world, ranging from strong nationwide or regional protection to temporary or oscillating immunity to some countries not reaching herd immunity over the medium term.

In this article, we'll review the developments since our last perspective (January 21), offer an outlook for each of the three geographies, assess risks, and outline what the end of the pandemic might look like.

Recent developments and their impact on timelines

The past month or two have seen seven important developments:

1. **Vaccines work.** We have growing evidence that vaccines are effective, as real-world data from Israel and the United Kingdom validate the clinical-trial results by showing a sharp reduction in hospitalizations and deaths.⁴ Emerging evidence also indicates that vaccines likely reduce transmission considerably, though not to the same degree that they prevent severe disease.⁵
2. **The vaccine rollout is improving.** Massive inoculation programs have accelerated, especially in the United Kingdom. As of March 15, the United Kingdom has administered 39 doses per 100 people in the total population; the corresponding figures for the United States and the European Union are 33 and 12 per 100, respectively.⁶ Just as important: sentiment about vaccine adoption is improving.⁷
3. **More vaccines are coming.** Johnson & Johnson's one-shot vaccine appears to be highly effective against severe COVID-19 and received Emergency Use Authorization

¹ See our earlier perspectives, on McKinsey.com, for definitions of normalcy and herd immunity. When we refer to herd-immunity timelines for a country, we mean the point at which the entire nation or a significant portion reaches herd immunity.

² "Lockdown: Boris Johnson unveils plan to end England restrictions by 21 June," BBC, February 22, 2021, bbc.com.

³ "Covid pandemic: Biden eyes 4 July as 'Independence Day' from virus," BBC, March 12, 2021, bbc.com.

⁴ Jacqui Wise, "Covid-19: Pfizer BioNTech vaccine reduced cases by 94% in Israel, shows peer reviewed study," BMJ, February 25, 2021, Volume 372, Number 8282 bmj.com; Benjamin Mueller, "Vaccines sharply cut coronavirus hospitalization, U.K. studies show," *New York Times*, February 22, 2021, nytimes.com.

⁵ "Science brief: Background rationale and evidence for public health recommendations for fully vaccinated people," Centers for Disease Control and Prevention, last updated March 8, 2021, cdc.gov.

⁶ Hannah Ritchie et al., "Coronavirus (COVID-19) vaccinations," Our World in Data, last accessed March 15, 2021, ourworldindata.org.

⁷ "Science brief," last updated March 8, 2021; Matthew Smith, "Europe is becoming more pro-vaccine," YouGov, January 22, 2021, yougov.co.uk.

in the United States on February 27.⁸ Novavax's vaccine is now in Phase III trials; preliminary results suggest it was highly effective in the United Kingdom but less so in South Africa.⁹ All of that makes it increasingly clear that the United Kingdom and the United States will have enough doses to vaccinate all adults by the end of the second quarter, and Europe should achieve the same milestone by the end of the third quarter, assuming no major vaccines are withdrawn. Further, vaccine trials on children aged 12 and up are well underway, and new trials on babies and children six months and older raise the possibility of pediatric vaccination, which would add to the population that could potentially contribute to herd immunity.¹⁰

4. ***Therapeutics are poised to make more of a difference.*** A new wave of COVID-19 therapeutics, including those from Eli Lilly,¹¹ Merck–Ridgeback,¹² and Vir Biotechnology,¹³ have produced positive data or received Emergency Use Authorization. The emerging data from these treatments suggest they have the potential to materially reduce hospitalizations and deaths for cases that do occur, accelerating a transition toward normalcy.
5. ***New cases and deaths are lower—but still high.*** New cases, hospitalizations, and deaths have dropped dramatically—by 79 percent and 89 percent, respectively, in the United States and the United Kingdom from the January peak, as of March 15.¹⁴ This trajectory has amplified discussions of a transition toward normalcy in both countries. The

bend in the curve is fragile, however. Much of the decline in Europe has followed strict lockdowns; but lockdowns and other nonpharmaceutical interventions are still confoundingly difficult to get right, and even now, multiple European countries are experiencing upward case trends. And US deaths are still averaging 1,000 per day, many times higher than average daily flu deaths.¹⁵

6. ***It is increasingly clear that more infectious variants of concern¹⁶ may drive a new wave of cases in the coming months.*** The United Kingdom is in a relatively favorable position; cases are declining in spite of the high prevalence of the B.1.1.7 variant, suggesting that the country has a demonstrable ability to control the spread of more infectious variants. In contrast, the United States and parts of the European Union appear to have an increasing prevalence of B.1.1.7.¹⁷ The potential for a variant-driven wave of US cases and ongoing spread in Europe in the coming months is real.
7. ***Variants may also reduce vaccine efficacy or enable reinfection.*** Data from the AstraZeneca vaccine trial in South Africa highlight the potential for variants such as B.1.351 and P.1 to reduce the efficacy of vaccines.¹⁸ Other vaccine data, including those from Novavax and Johnson & Johnson, show a more modest reduction in efficacy, especially against severe disease caused by these variants.¹⁹ There is also early evidence of mutations arising independently in the United States that may reduce the efficacy

⁸ "FDA issues Emergency Use Authorization for third COVID-19 vaccine," US Food and Drug Administration (FDA), February 27, 2021, fda.gov.

⁹ Nick Paul Taylor, "Novavax COVID-19 vaccine 90% efficacious in phase 3, but protection plummets against one variant," Fierce Biotech, January 29, 2021, fiercebiotech.com.

¹⁰ Peter Loftus, "Moderna is testing its COVID-19 vaccine on young children," *The Wall Street Journal*, March 16, 2021, wsj.com.

¹¹ "Lilly's bamlanivimab and etesevimab together reduced hospitalizations and death in Phase 3 trial for early COVID-19," Lilly, March 10, 2021, lilly.com.

¹² Ben Adams, "Merck has better luck with 2nd COVID-19 drug attempt as it sees a positive in early molnupiravir data," Fierce Biotech, March 8, 2021, fiercebiotech.com.

¹³ Mark Terry, "Vir Bio's COVID-19 antibody therapy could be great, but will it be too late?," BioSpace.com, November 11, 2020, biospace.com.

¹⁴ Jordan Allen et al., "Coronavirus in the U.S.: Latest map and case count," *New York Times*, updated March 18, 2021, nytimes.com. Based on seven-day averages of cases.

¹⁵ "COVID data tracker," Centers for Disease Control and Prevention, last accessed March 20, 2021, cdc.gov; "Weekly U.S. influenza surveillance report," Centers for Disease Control and Prevention, last reviewed March 19, 2021, cdc.gov.

¹⁶ "SARS-CoV-2 variants," Centers for Disease Control and Prevention, last updated March 16, 2021, cdc.gov.

¹⁷ *Risk assessment: SARS-CoV-2 – increased circulation of variants of concern and vaccine rollout in the EU/EEA, 14th update*, European Centre for Disease Prevention and Control (ECDC), February 2021, ecdd.europa.eu.

¹⁸ Shabhir A. Mahdi et al., "Efficacy of the ChAdOx1 nCoV-19 Covid-19 vaccine against the B.1.351 variant," *The New England Journal of Medicine*, March 16, 2021, nejm.org.

¹⁹ "Novavax COVID-19 vaccine demonstrates 89.3% efficacy in UK Phase 3 trial," Novavax, January 28, 2021, ir.novavax.com; Carl Zimmer, Noah Weiland, and Sharon LaFraniere, "New analyses show Johnson & Johnson's one-dose vaccine works well," *New York Times*, February 24, 2021, nytimes.com.

of vaccines.²⁰ These variants also appear to be more infectious than the original wild-type strain. These initial findings are based on very small sample sizes and may change as more information becomes available; we still do not know the impact of vaccines against severe disease from these strains. But if these results hold up, the spread of strains against which existing vaccines are substantially less effective would be a significant risk to lives and could delay the end of the pandemic.

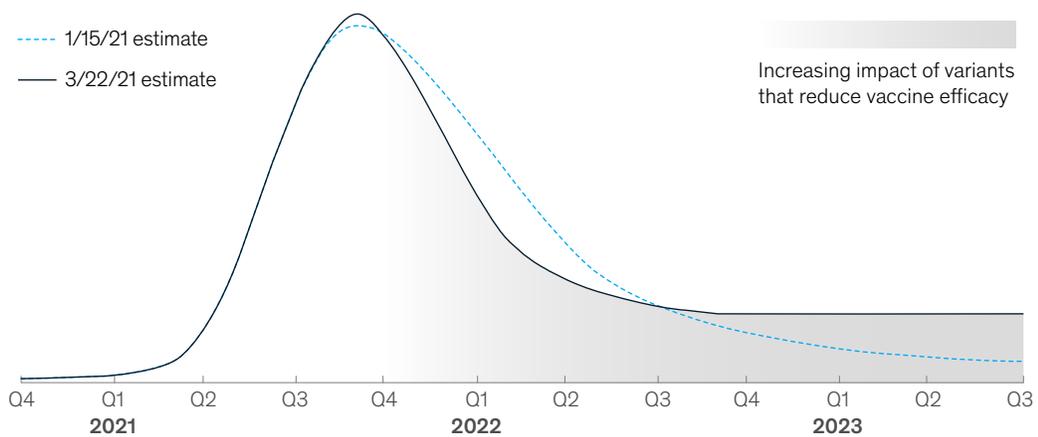
perspectives, that a significant transition toward UK and US normalcy will occur in the second quarter of 2021, although the potential for a variant-driven wave in the United States is real and would blunt the transition (Exhibit 1). Potential herd-immunity timelines are bifurcating as a result of growth in variants that may reduce vaccine efficacy. If the variants turn out to be a minor factor (they only reduce vaccine efficacy modestly, or they don't spread widely), then herd immunity in the second half of the year is likely for both countries—and is more likely in the third quarter than the fourth. However, if the impact of these variants is significant, we could see timelines significantly prolonging into late 2021 or beyond.

What's the net impact of all these developments?
The data continue to indicate, as stated in our earlier

Exhibit 1

Earlier peak, longer tail: Q3 now likelier for herd immunity, given vaccine availability, but variants of concern could prolong the end.

Probability of herd immunity¹ to COVID-19 for UK and US² by quarter (illustrative)



Early herd immunity if the following occur:

- Vaccine rollout and adoption are faster than expected
- Natural immunity is significantly higher than realized
- More-transmissible variants lead to higher rates of natural immunity

Peak probability of herd immunity driven by the following:

- Vaccine rollout to the adult population
- Approximately 3–9 months for manufacturing, distribution, and sufficient adoption to reach herd immunity

Later herd immunity if one or more of the following occur:

- Variants that evade natural immunity from prior infection or render vaccines less effective necessitate vaccine reformulation and revaccination campaigns
- Manufacturing/supply-chain issues slow rollout
- Safety issues delay Biologics License Applications
- More-infectious variants raise the threshold for achieving herd immunity
- Adoption is slower than anticipated
- Duration of immunity is short
- Vaccine prevents disease progression but does not meaningfully reduce transmission

¹Herd immunity is achieved when a sufficient portion of a population is simultaneously immune to prevent sustained transmission. At this point, significant, ongoing public-health measures are not needed to prevent future spikes in disease and mortality (this might be achieved while there are still a number of people in particular communities who have the disease, as is the case with measles).

²Timeline to functional end is likely to vary somewhat based on geography.

²⁰Eyewitness News, "Coronavirus vaccine updates: Scientists concerned over New York's 'escape variant!," ABC, Inc., WABC-TV New York, March 16, 2021, abc7ny.com.

How does this vary by geography?

Most of our analysis in this series has focused on the United Kingdom and the United States, which continue to move down a similar path. The end of Europe's pandemic may come somewhat later, and other countries' outlooks will depend on several variables.

European Union. Here, as in other regions, the timing of access to vaccines will be the biggest driver of the end of the pandemic. Levels of natural immunity from prior infection vary within the European Union but are generally in the same range as in the United Kingdom and the United States.²¹ Seasonality is likely to work in similar ways. And public interest in vaccination appears to be similar too, even in countries such as France, where interest

in vaccination was significantly lower than in other countries in the region but may now be improving.²² The prevalence of the more infectious B.1.1.7 variant varies by country; most countries with cases are between the high UK levels and lower US levels.

Exhibit 2 lays out the likely timing of vaccine availability in the European Union. Broadly speaking, availability will be similar to that of the United Kingdom and the United States, but EU countries may need to wait a few months longer to vaccinate all adults. Please note that this would be subject to change and further delay if the Oxford–AstraZeneca vaccine remains suspended in multiple countries following concerns about blood clots; WHO has confirmed its continued support of the vaccine.²³

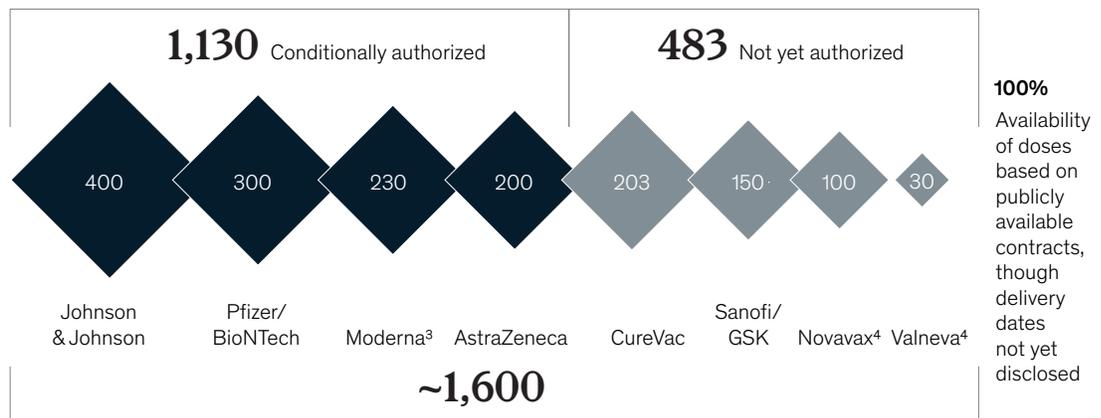
Exhibit 2

Europe's vaccine supply seems sufficient to vaccinate 68 percent of adults by June 2021.

EU adult population that can be vaccinated for COVID-19 with confirmed supplies, %



COVID-19 vaccine courses under contract in EU, millions²



¹Calculation is based on the known availability of vaccine doses and the European Commission's stated goal of 70% of adults vaccinated by end of summer 2021. Specifics not yet announced. Assumes that adult population is those 15 years old and older; total: EU population aged 15 years old or older is about 375 million.
²Two doses needed per person for most vaccines; Johnson & Johnson vaccine is a single dose per person.
³310 million to be delivered in 2021 and optional 150 million to be delivered in 2022.
⁴Concluded exploratory talks; final contract not signed.
 Source: Euronews; European Commission; AstraZeneca; CureVac; Johnson & Johnson; Moderna; Novavax, Pfizer/BioNTech; Sanofi/GSK; Valneva; all data based on public statements

²¹ SeroTracker, last accessed March 15, 2021, serotracker.com.

²² "Global attitudes: COVID-19 vaccines," Ipsos, February 9, 2021, ipsos.com; Yasmeen Serhan, "The vaccine-hesitant man of Europe," *The Atlantic*, March 18, 2021, theatlantic.com.

²³ "WHO statement on AstraZeneca COVID-19 vaccine safety signals," WHO, March 17, 2021, who.int.

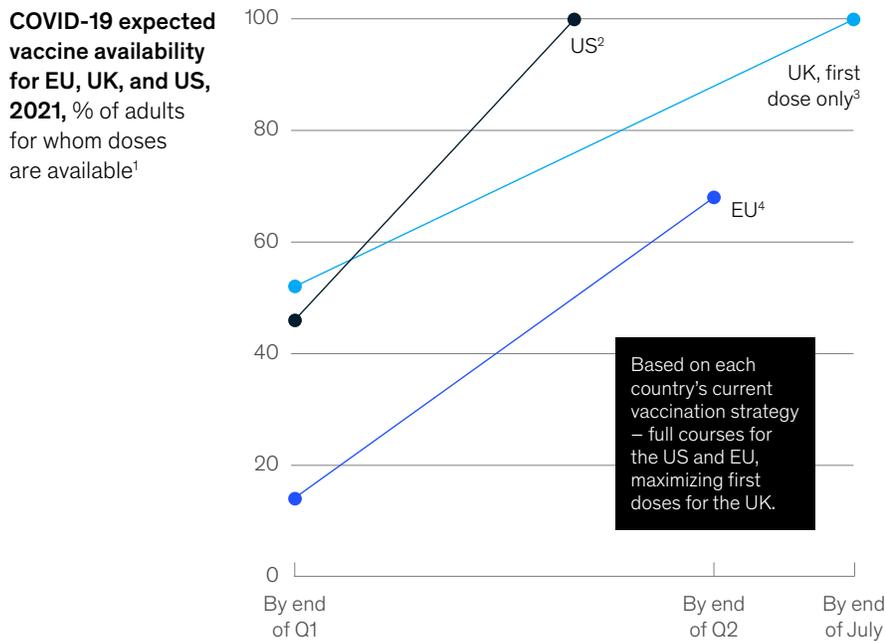
Given that sufficient vaccine doses are available to vaccinate the highest-risk populations in the coming months, we expect to see the EU transition to normalcy during the second quarter of the year, although the start of this transition may be delayed until late in the quarter by a new wave of cases in some countries. A key difference for the European Union, as compared with the United Kingdom and the United States: herd immunity is more likely in the fourth quarter than the third quarter, given the likely timeline of vaccine delivery (Exhibit 3).

Rest of the world. While the European Union, the United Kingdom, and the United States have had broadly similar COVID-19 experiences, other parts of the world look very different. Countries like New Zealand have avoided significant COVID-19-associated mortality but appear to be further from herd immunity because so few New Zealanders have infection-driven immunity to SARS-CoV-2.

On the other hand, if vaccine uptake is fast, New Zealand might achieve a longer-lasting vaccine-based herd immunity. A second factor is seasonality: the timing of seasonality-driven changes will be different in tropical locations and the Southern Hemisphere. A third is demographics: while the younger populations of many lower-income countries have led to lower COVID-19-associated mortality, they also make it harder for adult-only vaccination programs to drive herd immunity. And perhaps most importantly for timelines, access to vaccines is unequal. While COVAX and other access initiatives are working to close the gap, many low-income countries may not receive enough doses to vaccinate all adults until well into 2022.²⁴ The world is on pace to manufacture enough doses for 80 percent of the global population—or close to 100 percent of the adult population—by the end of 2021, but the distribution of these doses may continue to be asymmetric.²⁵

Exhibit 3

Vaccines should be available for most adults in the European Union, United Kingdom, and United States, but timing varies.



¹Two doses needed per person per course for Pfizer/BioNTech and Moderna; one dose per person per course for Johnson & Johnson.

²Total US population eligible for vaccines is about 280 million—derived from CDC Advisory Committee on Immunization Practices interim recommendations (December 22, 2020), Phases 1a–c and Phase 2 (estimate based on 2019 census population data, includes all persons aged 16 years or older not previously recommended for vaccination).

³Total EU population eligible for vaccines is about 375 million; this population includes those aged 15 years old or more.

⁴Estimate of available doses in UK at end of Q1 is based on vaccinations of adult population as of March 25, and population of about 54 million people 15 years old or more.

Source: BBC; Bloomberg; CDC; CNBC; Euronews; European Commission; Eurostat; HHS; Moderna; Our World in Data; Pfizer; Reuters; *Wall Street Journal*; all data derived from public statements

²⁴ “More than 85 poor countries will not have widespread access to coronavirus vaccines before 2023,” Economist Intelligence Unit, January 27, 2021, [eiu.com](https://www.eiu.com).

²⁵ Gaurav Agarwal, Michael Conway, Jennifer Heller, Adam Sabow, and Gila Tolub, “On pins and needles: Tracking COVID-19 vaccines and therapeutics,” February 18, 2021, [McKinsey.com](https://www.mckinsey.com).

Exhibit 4 provides a global view of seven factors that are likely to drive herd-immunity timelines for the rest of the world. These factors include the following:

- Population vaccinated—the proportion of people who have received the vaccine so far
- Vaccine courses secured—the additional supplies for which a country has contracted
- Supply-chain readiness
- Consumer vaccine sentiment—the public's willingness to be vaccinated
- Population under 19 years of age—a greater proportion of children makes a transition toward normalcy easier to achieve but herd immunity more difficult
- Natural immunity, or the rate of prior COVID-19 infection—higher *historical* infection rates decrease the vaccination rate needed to achieve herd immunity
- Prevalence of variants of concern

Risks to herd immunity

Herd immunity requires that enough people be simultaneously immune to SARS-CoV-2 to prevent widespread ongoing transmission. While data indicate that the most likely scenario is to reach this state on the timelines described above, five risks could delay progress.

First, vaccine adoption may prove lower than expected. That could happen if a real or perceived safety issue increases hesitancy or if younger populations see little reason to be vaccinated once older cohorts are protected and a transition toward normalcy is well underway. Second, herd immunity relies on the efficacy of vaccines at reducing transmission (rather than the usually reported efficacy at preventing disease in the vaccinated

person). While initial data suggest that COVID-19 vaccines do block significant transmission,²⁶ the efficacy rate may not prove high enough to drive herd immunity. Third, the duration of vaccine-mediated immunity may prove shorter than anticipated, making it hard to reach the necessary threshold for simultaneous immunity. Fourth, supply-chain disruptions and delays are real, and could produce supply shocks and interfere with timelines. Fifth, and most concerning, variants that reduce the efficacy of vaccines or the benefits of natural immunity may spread widely. Some initial data offer concerning evidence that B.1.351 and P.1 may be examples of such variants, although recent Novavax data (with a small sample size) offer some reassurance that its vaccine is effective against severe disease caused by B.1.351.²⁷ Similarly, limited data from the Pfizer-BioNTech and AstraZeneca vaccines show evidence of some protection against P.1.²⁸

These five factors combined mean that there is still a meaningful chance that herd immunity is not reached in the medium term.

From theory to practice: What the 'end' might look like

The pandemic's two endpoints, a transition toward normalcy and herd immunity, may look different in different places. As the name implies, a transition will include a series of steps that will gradually normalize aspects of social and economic life. The order and pace of these steps will vary by geography. Not everyone will immediately resume all of their prepandemic activities; rather, there will be a noticeable shift toward more of them. Steps may include a return to fully in-classroom education, fewer restrictions on the operations of bars and restaurants, more gatherings with larger groups of people, the reopening of offices, and fewer prohibitions on interregional or international travel. The United Kingdom's plan for reopening provides an example of the stepwise manner in which a transition to normalcy is likely to occur.²⁹

²⁶ Smriti Mallapaty, "Can COVID vaccines stop transmission? Scientists race to find answers," *Nature*, February 19, 2021, nature.com.

²⁷ Lee Landenberger, "Novavax's COVID-19 vaccine shows 100% protection against severe disease," March 12, 2021, bioworld.com.

²⁸ "Existing vaccines may protect against the Brazilian coronavirus variant," University of Oxford, March 18, 2021, ox.ac.uk.

²⁹ "Lockdown: Boris Johnson unveils plan to end England restrictions by 21 June," February 22, 2021.

Exhibit 4

Seven factors will likely influence the timing of herd immunity in countries and regions.

Factors favoring or slowing progress to herd immunity, March 14, 2021 Unfavorable Favorable

	Vaccine immunity					Natural immunity ³	Presence of variants of concern ⁴
	Population vaccinated	Vaccine courses secured ¹	Supply-chain readiness ²	Consumer vaccine sentiment	Population under 19 years		
Israel	60	1.4	77	N/A	36	10–29	N/A
UK	41	3.2–4.2	91	89	23	10–29	B.1.1.7
Chile	30	2.4	68	N/A	26	30+	N/A
USA	25	2.3–4.1	85	71	25	30+	B.1.427/9
France	9	2.3–3.5	85	57	24	10–29	B.1.1.7
Italy	9	2.3–3.5	69	80	18	10–29	B.1.1.7
Spain	9	2.3–3.5	80	80	19	10–29	B.1.1.7
Germany	9	2.3–3.5	88	68	19	2–9	B.1.1.7
Other EU	9	2.3–3.5	72	56	21	30+	B.1.1.7
Canada	9	4.3–5.8	88	79	21	2–9	B.1.1.7
Other Europe	6	<0.5	55	70	29	2–9	B.1.1.7
Russia	4	0.5	46	42	23	2–9	N/A
China	3–5	0.6	62	85	23	0–1	N/A
Latin America and Caribbean	4	0.6–0.8	47	87	32	30+	B.1.351/P.1 ⁶
India	3	0.8–1.1	62	87	35	10–29	N/A
Other Asia	2	0.4–0.6	49	85	34	10–29	Minimal
South Korea	1	1.3	N/A	78	17	0–1	B.1.1.7
Middle East	1	<0.5	41	84	41	10–29	N/A
Africa	1	0.3–0.6	35	61	51	2–9	B.1.351/P.1 ⁶
Australia and New Zealand	1	2.5–2.7	90	73	25	0–1	B.1.1.7
Japan	0	2.2	86	64	17	0–1	B.1.351/P.1 ⁶
	% at least one dose	Courses per capita	Score (100 = best)	% plan to get vaccine	% share	% share	% cases in past 4 weeks

Note: Latin America and Caribbean: Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela; Middle East: Afghanistan, Bahrain, Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Pakistan, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen; Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe; Other Asia: Bangladesh, Bhutan, Brunei, Burma, Cambodia, Fiji, Indonesia, Laos, Malaysia, Maldives, Micronesia, Mongolia, Nepal, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Timor-Leste, Vanuatu, Vietnam; Other Europe: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Iceland, Kazakhstan, Kosovo, Kyrgyzstan, Liechtenstein, Monaco, Montenegro, North Macedonia, Norway, San Marino, Serbia, Switzerland, Tajikistan, Turkey, Ukraine, Uzbekistan, Holy See/Vatican; Other EU: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Moldova, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden.

¹Calculation assumes 1 course equals 2 doses for all vaccines except Johnson & Johnson, for which 1 dose equals 1 course; range reflects difference between announced committed courses and announced committed plus optional doses. ²The FM Global Resilience Index is an equally-weighted composite measure of three core resilience factors: economic, risk quality and the supply chain itself, each factor is comprised of four core drivers. Scores are bound on a scale of 0 to 100 with 0 representing the lowest resilience and 100 being the highest resilience. ³Seroprevalence estimate by location uses reported deaths by age group with estimates of infection fatality ratio (IFR) by age group to get infections by age. For locations where there is no data on age distribution of deaths, an estimated population-level IFR is calculated by weighted average of age-specific IFRs, weighted by the percentage of population in each age group in that location and uses total deaths with that IFR. ⁴Minimal: <10% of VOCs (variants of concern, such as P.1 or B.1.351, B.1.427, B.1.429, or B.1.1.7) or any amount of VOIs (variants of interest, such as B.1525) documented in last 4 weeks. B.1.1.7: >10% samples documented in that location are of VOCs B.1.1.7. B.1.427/9: >10% samples documented in that location are of VOCs B.1.427 or B.1.429. B.1.351/P.1: >10% samples documented in that location are of VOCs B.1.351 or P.1. ⁵South Africa accounts for 30%+ of all B.1.351 cases to date, however data for last 4 weeks for South Africa has no reported B.1.351 cases.

Source: Our World in Data (population vaccinated); Launch and Scale Speedometer (vaccine courses); FM Global (supply-chain readiness); Ipsos (consumer vaccine sentiment); UN World Population Prospects 2019 (age and population); COVerAGE-DB, Johns Hopkins University COVID-19 dashboard, Nature (seroprevalence); GISAIID (variants); McKinsey analysis

Herd immunity will represent a more definitive end to the pandemic. Isolated cases may still occur—indeed, the virus may continue to circulate for one or more quarters after herd immunity is reached. But with herd immunity, population-wide public-health measures can be phased out. As populations get closer to this state, it may be helpful to introduce some nuance to what we mean by the term.

1. **Nationwide herd immunity.** The full population is well protected so that the country experiences, at most, occasional small flare-ups of disease. This scenario is most likely in smaller countries where immunity to COVID-19 can become uniformly high.
2. **Regional herd immunity.** Some regions, states, or cities are well protected, while others experience ongoing outbreaks of COVID-19. In large, diverse countries like the United States, this situation is especially easy to imagine.
3. **Temporary herd immunity.** A population or region achieves herd immunity for some period, but as variants are introduced, against which prior immunity is less effective, a new wave of cases is launched. Another potential trigger for such a wave could come as immunity (particularly natural immunity) wanes. As the number of new cases of COVID-19 falls globally, the rate of emergence of important variants should also decrease, but some risk will remain.

4. **Endemicity.** A region fails to achieve herd immunity. Endemicity is most likely in places where vaccine access is limited, where few people choose to be vaccinated, if the duration of immunity is short, or variants that reduce vaccine efficacy are common and widespread. Endemicity might include cyclic, seasonal waves of disease, broadly similar to the flu, or a multiyear cycle of resurgence.

The next few years are likely to see a combination of some or all of these options around the world. Given the likely timing of herd immunity in various geographies and the uncertain duration of protection from vaccines (both duration of immune response and efficacy versus new variants), it is likely that some measures such as booster vaccines are likely to be required indefinitely. Herd immunity is not the same as eradication. SARS-CoV-2 will continue to exist. Even when a country reaches herd immunity, ongoing surveillance, booster vaccines, and potentially other measures may be needed.

A year ago, the world was coming to terms with a long, difficult journey ahead. Twelve months later, the end of the pandemic is in sight for some parts of the world. It's much too soon to declare victory, however. We hope that our perspectives prove useful to leaders as they set policy and strategy; we will continue to update the series.

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