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Reopening cities after COVID-19

The experience of cities suggests that successful reopening requires a conservative, staged approach, beginning at virus levels near zero—coupled with many safety measures for public transport.

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July 2020

Cities are at the center of global economic activity. They have also been hubs for the spread of COVID-19. City governments have had to shoulder a large share of the fight against the virus. Many have acted decisively to curb its spread and to lower infection levels. They have restricted the movements of citizens, put in place the resources to quickly diagnose and manage the sick, and improved hygiene and safety in public places.

The success of these measures, in place for months, has been accompanied by inevitable negative effects on the economy and social activity (such as education). The pressure to reopen has mounted, and in some cities early attempts to do so resulted in flare-ups of COVID-19. The balance between protecting public health and restoring the economy is now absorbing the attention of municipal authorities everywhere.

Given the danger of resurgence, cities seeking to restart their economies must roll back restrictions with care, ensuring that the pandemic remains under control. Cities are using several metrics to evaluate the public-health situation. The most important of these are the absolute number of infections (including new cases, recovered cases, and active cases) and the reproduction number[1] (Rt): the average number of people who become infected by an infected person. Our findings add a third important indicator, *resident mobility*. Together with the number of infections and Rt, it creates a more rounded view of the state of the pandemic in cities.

This mobility metric allows cities to generate new insights into how they are coping with the virus at the initial stages of reopening and to gauge the effectiveness of their initiatives. Changed mobility patterns, as we shall see, can be correlated with the slower spread of the coronavirus, and some approaches to reopening have been correlated with desirable public-health outcomes. Leaders can use these findings to help inform their reopening plans. While direct evidence of causation is difficult, given the multitude of measures implemented simultaneously, cities can look at the associations of different interventions.

Which factors should be tracked?

The story of each city is unique, since the speed of transmission depends heavily on the density and mobility of populations and their local cultures. Medical researchers around the world have mobilized to improve our understanding of the virus's biological transmissibility and how best to fight it. At this stage of the pandemic, scientific proof of causation about what controls the virus's spread in major cities has not been established. While fully recognizing that correlation is not causation, our research suggests an elevated degree of correlation between certain initiatives to reduce social interaction and the desired outcomes in controlling and slowing the spread of COVID-19. This knowledge can be useful to city governments.

Our sample contains many of the biggest cities in the twenty countries with the highest number of registered infections—Berlin, London, Madrid, Milan, Moscow, New York, Paris, and Rome. We also investigated cities, such as Lisbon, at the other end of the spectrum, with low levels of infection. Our sample thus covered cities that were grappling with infection rates ranging from above 1.5 percent of the population (tens of thousands of sick people urgently needing care) to below 0.2 percent of the population (patients numbering only in the dozens). To better understand the effective reproduction number, we researched the relationships of over 50 different factors, using multivariable regression in time and across cities. These factors included 13 categories of measures that cities had implemented (such as physical distancing and face-covering requirements), different mobility types as measures of social interaction, and data on weather and population (including population density, totals, and area).

[1] The reproduction number shows how many people, on average, an infectious person will infect in a relevant period of time. For our analysis, we estimated Rt using a Bayesian-inference approach and assumed a Poisson distribution for the reported new cases.

The analysis yielded two important results:

— Measuring mobility indicators is among the most effective ways to predict the movement of Rt over the next seven to 14 days. The mobility indicators explained around 80 percent of the Rt variation in time. Cities that most reduced social interaction (as measured by mobility indicators) were able to achieve respectively higher reductions in Rt.

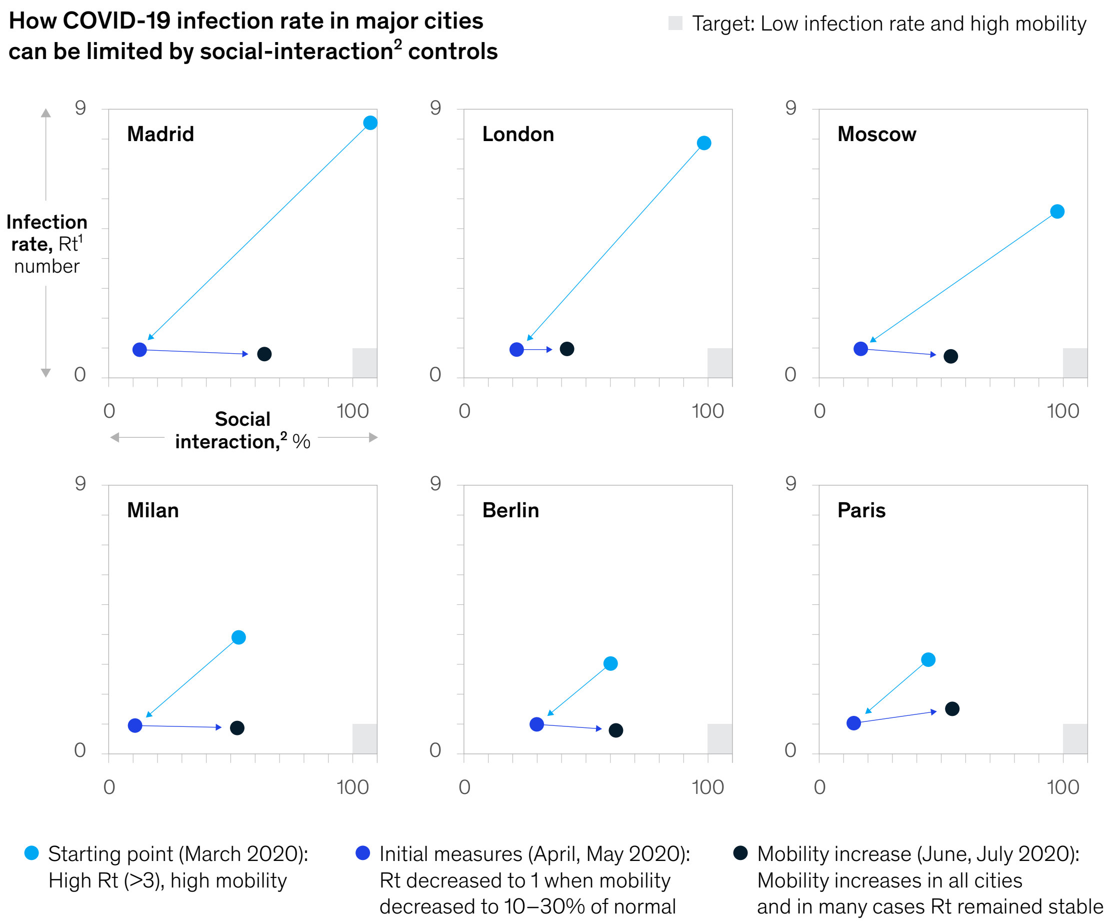
— Among the types of mobility, the best correlations emerged from intercity mobility, measured as the use of public and private transportation. Much weaker correlations attached to local mobility, such as visits to local retail stores.

Using mobility as an additional metric to augment the case count and the Rt number, we looked at how cities were coping with the spread of COVID-19. We found that when lockdown and quarantine measures were first introduced, most of the cities faced very serious conditions: high case counts and an Rt above 3 or even 4. Once urgent steps were put in place, such as limiting the number of visits to public places and local businesses, the trajectory of new cases began to flatten, and the Rt level rapidly fell below 1. This is a crucial threshold, meaning that transmission is falling rather than expanding (Exhibit 1).

Exhibit 1

Measuring mobility is one of the most effective ways to predict the movement of Rt, the reproduction number for COVID-19.

How COVID-19 infection rate in major cities can be limited by social-interaction[2] controls



[1]Rt is the real-time effective transmission rate of the virus.
[2]Level of social interaction is measured by using mobility as a metric.

Given the danger of resurgence, cities seeking to restart their economies must roll back restrictions with care, ensuring that the pandemic remains under control.

These cities fully recognized that their initiatives would probably have a severe impact on economic activity but nonetheless regarded them as necessary during the pandemic. Two groups of typical initiatives were the most widely implemented, with the added rule that facial coverings should be worn in public at all times.

Stay-at-home measures
The initiatives correlating with the most substantial reduction in the spread of the virus (case count and Rt) were stay-at-home measures, sometimes called lockdowns. Except for essential workers, governments restricted the movement of people outside their homes, often imposing fines for violating the orders. Residents by and large complied with (and sometimes anticipated) them, at least partly from fear of infection. The stay-at-home measures correlate more closely with a reduction in viral spread than physical-distancing measures do (see below).

The measures were accompanied by efforts to increase public awareness, with literature and media announcements. Many offices, stores, and manufacturing facilities were closed, and public events were canceled. Cities regulated mobility, allowing unrestricted movement mostly for essential workers. As the spread of the virus declined, public officials recognized the limits on the duration of such measures because of their adverse impact on the economy. As Exhibit 2 shows, mobility indicators help the authorities track the reduction in social interaction. That in turn helps them understand the expected change in the number of cases and in Rt over seven to 14 days.

Physical distancing
The second set of initiatives focus on optimizing physical distancing when people do leave their homes and on regulating cleaning and hygiene. These measures are usually put in place while stay-at-home measures are in effect; they also stay in place when the stricter measures are lifted.

The most important of these measures are the maintenance of a minimum distance (such as 1.5 to 2.0 meters) between each person in public places and the prohibition of meetings of more than two people. The wearing of masks is mandatory—in some cases, whenever people leave their homes and, in others, when they use public transportation or enter stores. Another important initiative that city authorities are taking is to set sanitary and hygienic standards for local businesses. The implementation of these measures correlates with some reduction in new cases and Rt, but less than stay-at-home measures do.

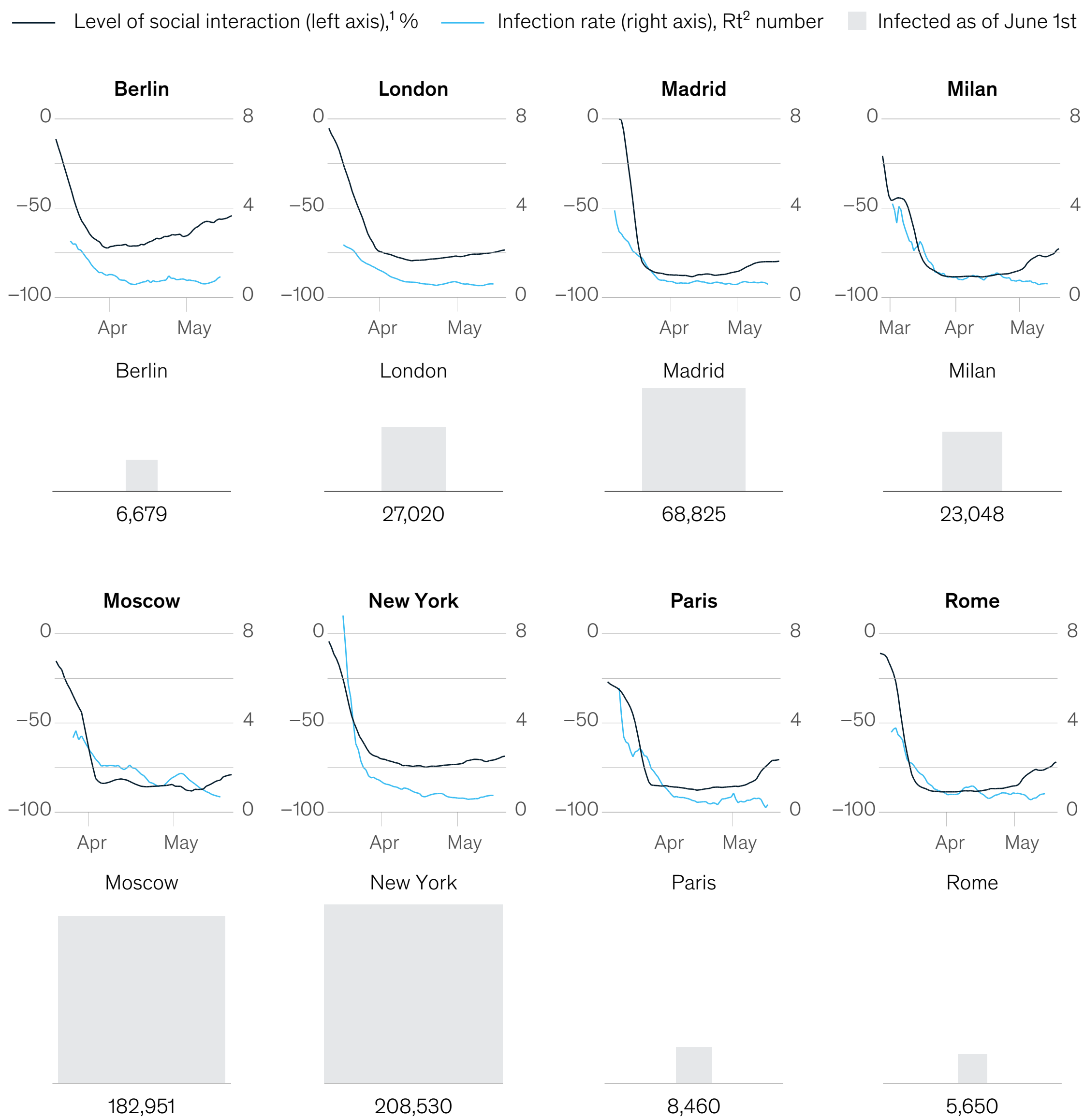
Mobility restrictions and the effects of their removal

City governments seek guidance on the criteria and time lines for lifting COVID-19 restrictions. We believe our analysis will be helpful. At the lowest point, mobility levels in the cities we studied ranged from 10 to 25 percent of prepandemic levels. The reduced mobility brought down the number of new cases and the Rt levels. Once restrictions on mobility are lifted, it is reasonable to expect that the downward trend in the spread of the virus may slow or stop. Cities must therefore guard against the

Exhibit 2

Falling infection rates can be correlated with reduced levels of social interaction as measured by mobility, with a lag of five days.

Social interaction compared to COVID-19 infection rate in major cities



[1]Level of social interaction is measured by use of mobility as a metric.
[2]Rt is the real-time effective transmission rate of the virus.

real risk that the infection rate will move back again to epidemic levels—that is, to an Rt of more than 1. We observe that most cities are succeeding in increasing mobility while keeping Rt stable, though none of them has attained anything close to normal levels of mobility.

Significantly, in some cities mobility revived even before restrictions were lifted. In New York, for example, mobility reached 43 percent of normal, from a low of 25 percent, while restrictions were still in place. Rt increased in New York as well but stayed below 1. Cities need to keep an eye on the number of new infections and on Rt levels and to impose further restrictions when the numbers rise unacceptably.

Our research suggests that two approaches are correlated with avoiding a viral resurgence. The first combines conservative timing and very low infection levels. The second is linked to urban mobility levels and focuses on preventive measures in urban public-transportation systems. The two approaches are not counterposed, but rather express different, partly sequential aspects, of controlling the virus and reopening the economy.

'Near zero' virus levels
A conservative approach to reopening is needed, commencing at the point where the virus is at near-zero levels. Our research suggests that cities can safely begin lifting restrictions when almost no new cases are being registered and Rt has been at 0.7–0.6 (or lower) for several weeks. Cities that have met these criteria have found that the Rt number remains stable thereafter.

Surveyed cities have used either of two time frames for lifting restrictions. Berlin and Madrid acted after Rt remained low for one to two weeks. London and Paris waited three or more weeks before lifting restrictions. Under both approaches, rigorous processes were put in place to monitor public health and ensure that any rebound in Rt was kept within manageable and acceptable levels. The mobility metric is increasingly important for such decisions because it helps cities to track whether initiatives are still effective.

Preemptive countermeasures in public transport
Cities have applied a number of measures to limit the spread of infection in public transport.[2] These include more frequent cleaning and disinfecting of trains, trams, buses, and stations; requiring passengers and employees to wear face coverings; applying stickers, markers, shields, and barriers to aid in physical distancing; running public conveyances more frequently; limiting the number of passengers; and increasing access to bicycle sharing. Our research shows that once mobility restrictions start to be lifted, the use of public transport comes back slowly. As of June, ridership has reached 30 to 40 percent of prepandemic levels in Berlin and Lisbon; 25 percent in London, Milan, and Paris; and 17 percent in Madrid.

Some city experiences

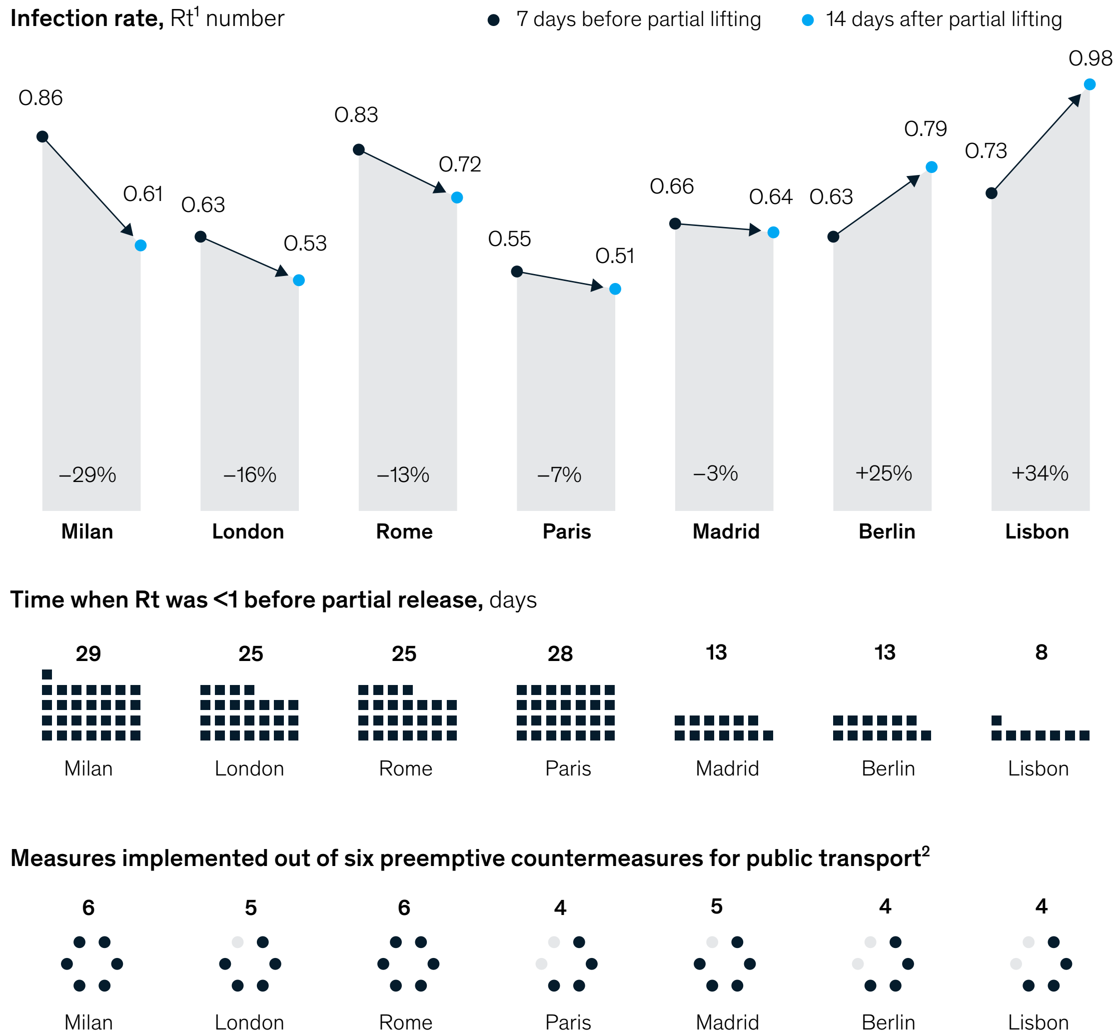
Our research shows a correlation between the evolution of Rt in cities and these two approaches (Exhibit 3). Rt evolved more desirably overall, and Rt rates did not increase, in cities that chose longer waiting periods (three or more weeks) and implemented more safety measures. Rt movements appear to be satisfactory in cities that waited only one to two weeks and implemented only some of the preemptive countermeasures, although that approach has been slightly more risky.

Exhibit 3 presents early-stage evidence of the success of the approaches used in all the cities. While Rt jumped in some cities, it remained below 1 in all. The approaches taken so far have, by and large, effectively prevented the disease from

[2] For a more detailed description of the initiatives, see David Chinn, Carsten Lotz, Luuk Speksnijder, Sebastian Stern, Raphaelle Chapuis, Ruby Holmes, Arthur Knol, Karim Tadjeddine, and Koen Wolfs, "Restoring public transit amid COVID-19: What European cities can learn from one another," June 2020, McKinsey.com.

Exhibit 3

Stay-at-home regulations can push a city's Rt number below 1, but additional measures are needed to keep Rt low.



[1]Rt is the real-time effective transmission rate of the virus.
[2]The six measures are (1) frequent disinfection, (2) masks required for passengers and employees, (3) distance stickers, marks, shields, and other physical barriers, (4) increased frequency of public transport, (5) limits on number of passengers, and (6) Increased access to bicycle infrastructure.

spreading rapidly again. These cities not only waited for Rt to stabilize before easing their rules but also lifted restrictions step-by-step: they made a change, waited to see its effects, and then decided on their next move. The waiting period was generally two to three weeks. However, it is important to recognize that cities are taking very different approaches to gradual reopenings, with variations in what industries should go first, and what restrictions are kept in place.

In the cases we examined, rigorous processes monitor public health and ensure that Rt remains within manageable and acceptable levels. If the Rt rate rises above 1.0, this triggers extra measures and a delay in additional steps toward reopening, until Rt rates again fall below 1. These cities also keep in place all safeguards—for example, the obligatory wearing of masks—to protect people who leave their homes, and they continue to enforce rules for physical distancing.

Cities are reopening their economies in rounds. Restrictions are lifted step-by-step for different industries, depending on how essential they are, the level of risk they present for spreading the virus, and their economic condition. In the first round, cities have often allowed manufacturing and construction activities to resume operation, along with small retail stores and parks. In some cases, schools and public spaces (such as museums) also reopen during the first round. After it starts, these cities have waited two to three weeks and then moved on to the second round of reopening. The process can also be reversed as we see in some US locations where virus levels have resurged.

Berlin and London present a study in contrasts. In Berlin, small stores (including pharmacies, household-goods stores, pet shops, and dry cleaners) opened in the first round. Secondary schools, starting from the tenth grade, also opened at this stage; the entire primary and secondary school system was scheduled to reopen in late August. Berlin has also reopened public places such as museums, art galleries, and zoos. Yet a number of restrictions were kept in place, such as the obligatory wearing of face coverings and restrictions on public events of more than 1,000 people.

In Berlin, the phases followed each other more quickly than they did in London. There the authorities are moving more slowly. A waiting period of 30 days, on average, has separated each phase. In its first phase, London opened food production, construction, manufacturing, and logistics and distribution companies. Educational facilities were reopened for vulnerable children only. During June and July, London began opening schools generally, and restaurant openings are slated for July and August.

Our research suggests that leaders of city governments can focus their efforts in three broad areas. The first is to get the number of cases toward zero and Rt below 1 as rapidly as possible. Stay-at-home measures appear to achieve these goals more effectively than physical-distancing measures alone, but both are needed. Our findings also align with recent research on the importance of banning large public events, which accelerate the spread of the virus.

Second, the reopening should begin only after the number of cases has stabilized toward zero for a number of weeks and Rt rates are low. At this point cities must take countermeasures to prevent resurgence, particularly addressing the danger of infection on public transportation.

Finally, restrictions should be lifted in a step-by-step approach. A meaningful waiting period should precede each step, to ensure that performance criteria have been met, before the next stage is begun. It should be noted that in late July (the time this article was written), the cities farthest along in the process of safe reopening have only reached 50 to 60 percent pre-COVID mobility. For all of us, a long journey to the new normal still lies ahead.

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The authors wish to thank Matt Craven, Alexander Kuzmenkov, Carsten Lotz, Nicola Sandri, Darya Satco, and Sebastian Stern for their contributions to this article.

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