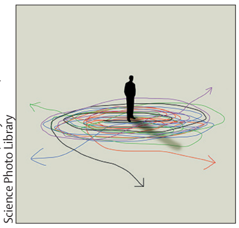
COVID-19: when should quarantine be enforced?



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When children are little, they like to pose dilemmas as “would you rather” questions that involve difficult trade-offs. Would you rather fight an elephant-sized duck or five human-sized rhinos? Would you rather have a runny nose for a month or dry eyes? The options are not only both undesirable, but also incomparable. These questions are how we might think of some of the dilemmas created by the COVID-19 pandemic, which presents us with difficult trade-offs in equity, economics, public health, and civil liberties.

In *The Lancet Infectious Diseases*, Corey M Peak and colleagues[1] explore one such dilemma. Plainly put, they ask the question: should health authorities place potentially exposed individuals into a quarantine setting where their separation from others can be enforced, or should authorities simply let them go home, ask them to avoid contacts, and monitor them for COVID-19 symptoms through phone calls or health-care visits? The authors name the two options individual quarantine and active monitoring, respectively. Individual quarantine impinges more on civil liberties but is less risky from a public health perspective. Aware of this dilemma, Peak and colleagues[1] use a mathematical model of the early spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections to establish the conditions under which individual quarantine works better than active monitoring.

Under a broad range of model parameters the authors find that there is no difference in the effectiveness of the two strategies. They either both contain the outbreak, or they both do not contain it. However, an important exception occurs if the serial interval (time between symptom onset in an infector and their infectees) of the infection[2] is around 4·8 days, and if at least 75% of infected contacts are identified within 12 h, on average. Under those circumstances, individual quarantine could contain an outbreak, whereas active monitoring could not. This prediction appears to be consistent with another recently published model of COVID-19 containment.[3] Crucially, this analysis assumes that testing is rapid and widely available, which is not true for many places.

In view of evidence that the SARS-CoV-2 serial interval is probably about 5 days,[2] these observations raise the question: how hard is it to attain 75% success in tracing of infected contacts? This rate might be impractical with manual contact tracing, depending on the route of transmission. Interviews with individuals are stymied by problems of cognitive bias, inability of individuals to remember their detailed movements, and difficulty in identifying contacts unknown to the patient. By contrast, digital technologies offer vast improvements in terms of location accuracy and contact identification;[3] these technologies put the 75% target within reach, as the experience of South Korea with COVID-19 has shown.[4] However, using digital surveillance to reach the target would then present two infringements on civil liberties: individuals must be tracked to capture enough infected contacts, and those contacts must be individually quarantined. And even if contact tracing fails to contain an outbreak, the combined effect of physical distancing and contact tracing is greater than the effect of either intervention on its own.[1] Hence, the authors’ analysis tells us that many decision makers will need to choose whether to use digital surveillance.

Mathematical models such as those used by Peak and colleagues[1] can help decision makers to adopt an evidence-based approach to addressing the difficult dilemmas that we will continue to face during the COVID-19 pandemic. However, we suggest that mathematical models should go beyond addressing strictly epidemiological questions. The pandemic has affected almost every aspect of our individual and collective lives, and our own reactions to the pandemic shape the outbreaks we experience. Hence, we think researchers should broaden their focus to developing models that explicitly include relevant social processes, equity considerations, and economic impacts in the model structure. There is already a precedent for this approach in modelling endemic infectious diseases[5,6] and in other fields of natural systems modelling.[7]

On a final note, we speculate that the COVID-19 quarantine and monitoring dilemma is in some ways not as difficult to address as the "would you rather" questions of children. Contact tracing represents a race to trace.[8] To prevent exponential growth in the number of cases, public health must trace contacts of infected cases and reduce their chances of causing further spread faster than the virus propagates through the network of personal contacts. Thus, intrusive action in the early stages of a pandemic might reduce how much longer those intrusive measures have to be applied, and to how many people. Additionally, benefits for other fundamental rights are accrued as the pandemic unfolds, such as saving both lives and livelihoods.[9]

We declare no competing interests.

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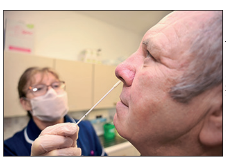
Who is most likely to be infected with SARS-CoV-2?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Despite the daily updates on number of cases, hospital admissions, and deaths around the world and the increasing number of hospital-based case series, some of the fundamental information about how severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spreads in the population and who is really at risk of both infection and severe consequences is still missing. In *The Lancet Infectious Diseases*, Simon de Lusignan and colleagues[1] report on the characteristics of the first 3802 people tested for SARS-CoV-2 within the Royal College of General Practitioners (RCGP) sentinel primary care surveillance network. Unlike most previous studies that examined risk factors for poor prognosis,[2,3] de Lusignan and colleagues[1] report characteristics associated with susceptibility to SARS-CoV-2 infection.

The RCGP surveillance system, set up in 1957, monitors consultations for communicable diseases using a network of 500 general practitioner practices across England, which are broadly representative of the population. Twice-weekly automatic data downloads provide a real-time warning of impending epidemics. In January, 2020, the network expanded to include the testing for SARS-CoV-2 among individuals presenting with symptoms of influenza or respiratory infection. COVID-19 surveillance data, supplemented with data from contact tracing or routine National Health Service facilities, were linked with electronic health records. Of 3802 tests, 587 (15·4%) were positive for SARS-CoV-2. Prevalence of infection was less than 5% in patients younger than 18 years (23 patients were positive [4·6%] of 499 tested) but almost four times as high in people aged 40 years or older (480 [18·2%] of 2637). After adjustment for other factors, infection risk was higher among men than women (odds ratio [OR] 1·55 [95% CI 1·27–1·89]), in black people than white people (OR 4·75 [2·65–8·51]), and in people with obesity than normal-weight people (1·41 [1·04–1·91]). Infection risk was also higher in those living in more deprived or in urban versus rural locations. Surprisingly, household size did not significantly affect infection risk. Among chronic comorbidities examined, only those with chronic kidney disease had an increased risk of infection, whereas the risk in active smokers was around half that observed in never smokers.

Two preprint papers have examined population-level risks. One used UK Biobank data and corroborated the results on age, sex, black race, and obesity as risk factors for severe infection;[4] the other, a study of 17 million patients from UK primary care, showed increased risks of in-hospital COVID-19 mortality with older age, male sex, obesity, greater deprivation, and being part of an ethnic minority.[5] Comorbidities and smoking seemed to play a more important role in poor prognosis in those studies than in developing infection in de Lusignan and colleagues' study.[5,6]

Because there are still few population-level studies, the Article by de Lusignan and colleagues[1] is an

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For the **RCGP COVID-19 surveillance system** see https://clininf.eu/index.php/cov-19/