Mass testing—an underexplored strategy for COVID-19 control

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Mass testing is an intervention strategy for COVID-19 control in the general population regardless of the presentation of symptoms. It involves collecting nasal or pharyngeal swabs for DNA testing, often using the polymerase chain reaction method. Countries that have used mass testing consider it to be a viable strategy to control the COVID-19 pandemic as the strategy can potentially identify and isolate asymptomatic cases in the early stages of infection and reduce the risk of virus transmission. Since the reopening of Wuhan, China, in early April 2020, China has conducted mass testing in three megacities with populations of over 10 million, including Beijing and Qingdao at the beginning of their local outbreaks, and Wuhan immediately after the reopening. Several other smaller cities and districts, including Shijiazhuang, Dalian, Kashi, and Binhai New District in Tianjin, also conducted mass testing among their residents. In November 2020, after piloting mass testing in the city of Liverpool, England introduced mass testing in 67 local authorities in “tier 3” areas where community spread of COVID-19 was prevalent.

Mass testing should be implemented when contact tracing cannot effectively control the spread of the virus. A mathematical modeling study suggested that a new COVID-19 outbreak can be controlled within 3 months with highly effective contact tracing (tracing >80% infected individuals) and quarantine of infected individuals. This modeling projection has been confirmed by experiences in China during its first wave of the COVID-19 pandemic from February to April, 2020. The main purpose of Wuhan’s post-reopening mass testing was to ensure the city was free from COVID-19.
and rebuild the confidence of city residents in normal economic activities. In contrast, the purpose of subsequent mass testing in other Chinese cities was to rule out the risk of a potential large outbreak following the detection of a handful of cases. In theory, when community outbreaks are still in the early stages, an effective contact tracing may be sufficient to curb the epidemic, and a population-wide mass testing may not be needed. For most of the Chinese cities that implemented mass testing, the nearly 100% testing coverage provided important public health evidence that the vast majority of the infections, regardless of symptoms, were identified and subsequently isolated in the same way as contact tracing. Similarly, for many other countries that are still fighting an upward battle against the pandemic and contact tracing is insufficient to contain the spread of the virus, mass testing may provide a potential solution to curb the epidemic by identifying most infected individuals in a relatively short time. Mass testing is particularly helpful in identifying asymptomatic cases to prevent further transmission.

Second, testing costs need to be sufficiently low. Batch testing (mix 5–10 samples into a “cluster” and test the cluster with a single test kit, further individual testing is required only if a positive cluster is detected) has been implemented in both China and Luxembourg, which proved to be an efficient way to test a large number of individuals in a short time for low-prevalence areas. However, the number of samples per batch is negatively associated with the feasibility of mass testing implementation.

Mass testing may be practically feasible under the following conditions. First, the testing capacity of a healthcare system determines its ability to scale up testing coverage to the general population, and strict sterilization is required to prevent potential transmission. The testing should be administered using an appointment system and distributed evenly among the general population, and strict sterilization is required to prevent potential transmission when a large number of people gather for mass testing. Third, practically, mass testing should not be repeatedly implemented as it itself is a significant interruption to the society. During its implementation in a city or suburb, the population mobility should be minimized with appropriate border closure or city lockdown to prevent the import of new cases from high-risk areas.

We conclude that mass testing should complement contact tracing when the latter can no longer effectively control the epidemic. Epidemiology, testing costs, and economic implications of extensive lockdown are key considerations for the cost-effectiveness of mass testing. Healthcare capacity, population accessibility, willingness, and mobility add to the practical feasibility of mass testing implementation.

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