

Pooled testing as an efficient approach for regular testing to protect residential care homes for the elderly

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Hong Kong has so far contained two community epidemics of COVID-19, one in March-April and another in July-August. A total of 4000 cases have been laboratory confirmed. To date nearly one third (30/101) of all deaths from COVID-19 in Hong Kong have occurred in elderly care home residents, in a number of outbreaks involving between 5 and 45 persons. As we approach winter, a crucial aspect of the response will be to protect this high-risk group. When the virus is circulating in the community, the risk to these facilities may be reduced by public health measures such as prohibiting visitors, quarantining new admissions, and by enhanced surveillance for illnesses in staff and residents.

The average incubation period of COVID-19 is 5-6 days, i.e. on average an infected person will develop symptoms 5-6 days after infection, although in some persons incubation can be as short as 1 day and as long as 14 days. It is now well established that COVID-19 transmission can occur prior to symptom onset (“pre-symptomatic transmission”), and it is suspected that some persons who never develop symptoms (“asymptomatic infections”) can also pass on infection.

There is considerable variability in transmission potential among COVID-19 cases, some cases seem to be highly contagious while others seem to be barely contagious. This means that outbreaks may not result from every introduction of an infectious case into an elderly home, but outbreaks that do occur could be explosive. Timely detection of infections and outbreaks is therefore of the utmost importance.

We have been investigating the idea of regular testing of all staff as a means of detecting infections and outbreaks more quickly. Of course, if sufficient resources are devoted to routine testing, it might be possible to regularly test every member of staff (including volunteers) and every resident, even multiple times per week. In reality, resources may be constrained, including financial resources as well as laboratory testing capacity. We are considering how routine testing could be implemented most efficiently for a fixed set of resources.

One approach is to consider pooling samples, which would involve collecting swabs from each member of staff and grouping the samples, so that only one test is used for each group. For example, swab samples from four staff are mixed together and the single “pooled” sample is tested for COVID-19. If the test for a pool is negative then all individuals in that pool are considered uninfected. If the test is positive then the swab samples from each individual in that pool can then be subsequently tested one by one to identify the infected individual. In a low prevalence setting this will substantially reduce the number of tests needed to detect and isolate infected members of

staff, as most pools will be truly negative, and only a small number of pooled samples will need to be retested individually. Pooling samples means that testing may be conducted more frequently hence further reducing the time until the outbreak is detected. For instance, if the availability of tests dictates that screening staff across all nursing homes could be implemented monthly, pooling samples into groups of 4 would allow for weekly testing instead, and pooling samples of 14 would allow for testing every two days, using the same number of tests. An important limitation is the slight reduction in sensitivity of pooled tests, and it is important to consider the trade-off between the increased frequency of pooled testing and the slight reductions in sensitivity associated with pooling. It should be recognized that reagents are not the only testing constraint, because pooling samples also consumes technician time and expenses, but on average pooling should be a more efficient approach to regular testing, and has the potential to save many lives.

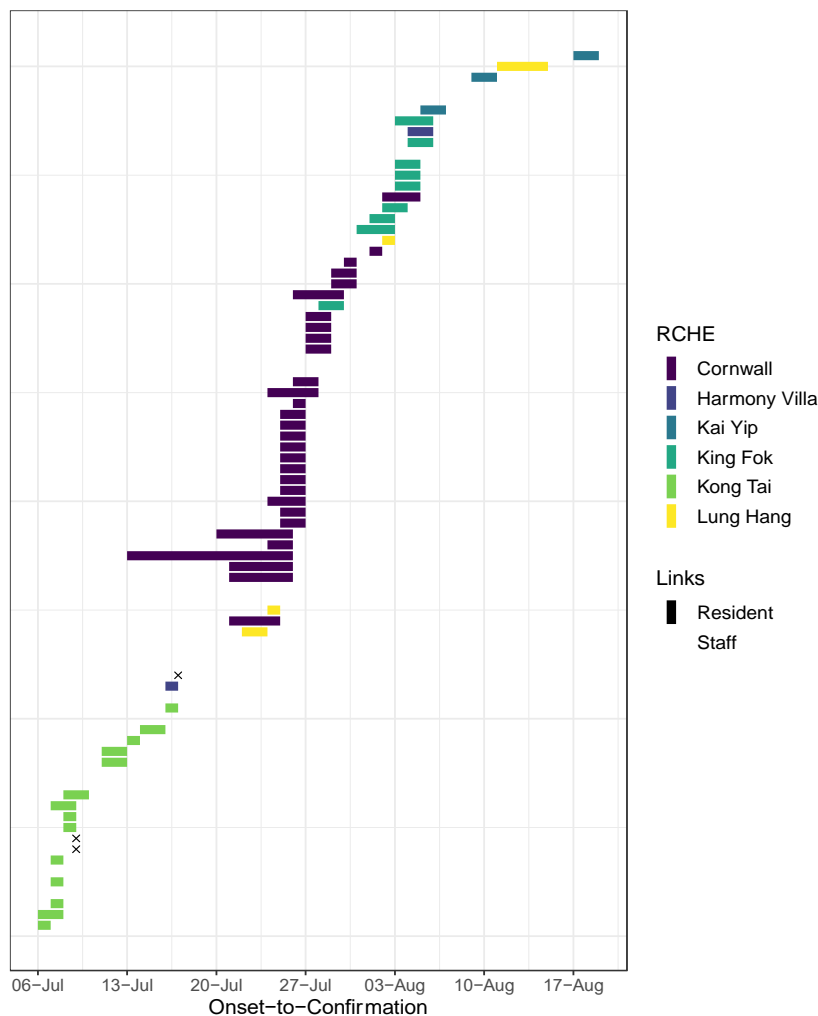


Figure 1 Time from onset to confirmation of COVID-19 cases in outbreaks in six residential care homes for the elderly (RCHE) in Hong Kong from 06/07/2020 to 19/08/2020 including both staff and residents, where x indicates that symptom onset and confirmation occurred on the same day. The 81 cases shown are those who developed symptoms out of a total of 127 cases, where 46 out of 127 cases (36.2%) were asymptomatic at the time of confirmation.