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Estimating underlying prevalence of COVID in the community upon detection of a case with no known link to the border

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Summary

We use contagion network simulations to model the spread of COVID from index cases compatible with the known cases of the New Zealand Defence Force (NZDF) Cluster. We use these simulations to estimate the number of cases that might be expected in the community upon detection of a community transmission case with no epidemiological link to the NZDF cluster. Namely that of the retail worker identified on November 12th.

- We find that if the index case was Case A of the NZDF cluster then we could expect around 16 cases present in the community by the date of detection of the retail worker. If the index case was Case B of the NZDF cluster then we could expect around 9 cases present in the community by the date of detection of the retail worker.
- The above results assume completely undetected and uncontrolled spread from the index cases. Since this was not the case for the NZDF cluster, with close contacts of Cases A and B being traced, and isolating, the numbers above present a more pessimistic scenario than reality.

On Thursday the 12th of November 2020, a community case of COVID-19 was detected, with no clear epidemiological link to the border. The infected person reported symptom onset being around the morning of Monday the 9th of November. The person sought testing early in the week but continued to attend work in a customer facing retail position until they were notified of the positive test result. On the morning of the 13th of November, the Hon. Chris Hipkins reported a preliminary genomic link between the strain of infection for the retail worker and strain of infection for the so-called New Zealand Defense Force (NZDF) cluster.

We consider both prior known cases of the NZDF cluster, termed Cases A and B. From information released to the public, Case B of the cluster was first assumed to be infected on the Wednesday 4th of November, from Case A, who had acquired it while working in a managed isolation facility[1].

We used network-based simulations of undetected community spread, with each simulation seeded with a single initial exposure of a randomly selected individual in Auckland. These simulations assumed a relatively low rate of testing - comparable to that observed in Auckland during periods at Alert Level 1. From these simulations, we collated the number of cases present in the simulation, at the time of the first detected case, as a function of the number of days from the initial seed case to the date in initial detection of community spread. The results of these simulations are reported in Figure 1. We used a fit to this data to

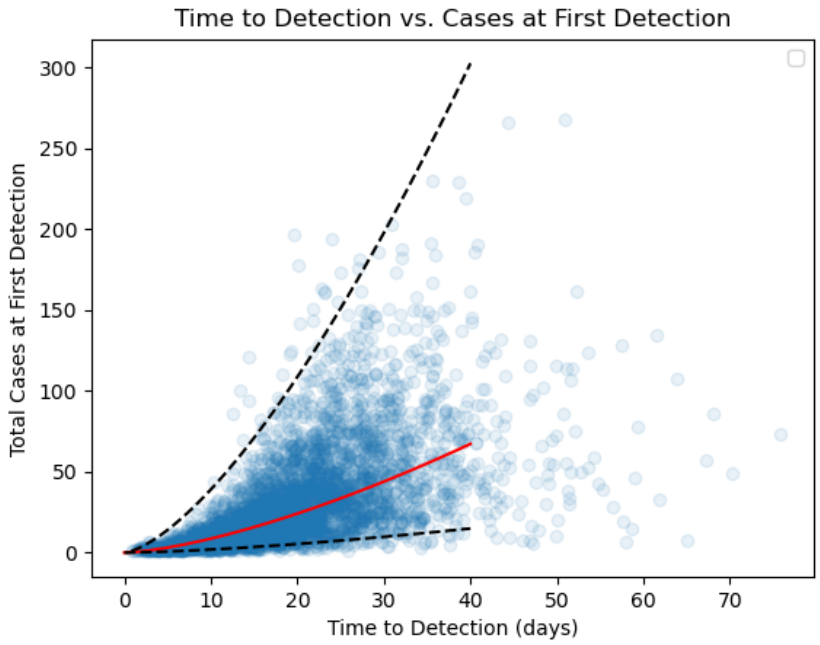

Figure 1. Distribution of time of first detection vs. total cases at first detection with a fitted exponential trendline (red) with 95% prediction intervals (dashed)

estimate the number of community cases that might be expected to exist at the time of detection of the community case - the retail worker.

Since there is currently no known epidemiological link between the retail worker and any of the cases in the NZDF cluster, the index case for the transmission chain to the retail worker could be treated as either Case A or Case B of the NZDF cluster. This does not necessarily imply that Case A or Case B of the NZDF cluster directly infected the retail worker. It also does not take account of the possibility of transmission via fomites. While fomite transmission is believed to be rare relative to person-to-person transmission, there are at least two strongly suspected cases of this occurring in managed isolation facilities in Aotearoa.

Possible community transmission scenarios

If Case A is the index case, we estimate the time to detection to be roughly the incubation period + time since the 4th of November, giving roughly 15 days between the initial exposure of Case A and the detection of the retail worker. From the distribution of total infections at the time of detection, we would **expect around 16 cases present in the community, with an upper bound (95% prediction interval) of 70 cases**.

If we treat Case B as the index case, we get a time to detection of approximately 10 days (the time since the 4th of November). Looking at the distribution of total infections at the time of first detection, we would **expect around 9 cases present in the community, with an upper bound (95% prediction interval) of 39 cases**.

Our model assumes that the cases since the index case are completely undetected, and spread is unmitigated. This is likely not the case for this particular scenario since both Cases A and B were contact traced and their close contacts isolated, limiting potential further spread. **Hence the values presented here correspond to a more pessimistic scenario than what may have occurred**. Additionally, if further information comes to hand, revealing a more recently identified case with an epidemiological link to the NZDF cluster and with a time frame compatible with being an index case for the retail worker then this would correspondingly decrease the number of expected cases in the community.

References

1. Ministry of Health: Media release 08 November 2020, https://www.health.govt.nz/news-media/media-releases/6-new-cases-covid-19-6