Strategic Policy, Planning and Performance Report

Subject:	**Estimate of instantaneous reproduction number (R_t) for Covid-19 in Jersey**
Date:	**18 November 2021**

Please note that publication of this report has been temporarily paused due to recent changes in testing effort. See below for more details about the conditions which need to be met for the appropriate use of this R_t estimation method.

Background - What is the R_t number?

The instantaneous reproduction number (R_t) of an infection describes how quickly the infection is spreading. It can be thought of as the number of subsequent infections that are introduced into a population by each infection. If this number is below 1, each successive generation of infections is smaller than the previous, and the number of infections dies out over time. Any number above 1, and the number of new infections will grow.

R_t may vary due to aspects of the infection itself, as well as the size, behaviour and immunity of the population. Producing an estimate of R_t through time can give useful insight into changes in the rate of spread of infection during different phases of mitigation, and indicate the likelihood of infection numbers increasing.

Model Assumptions and Limitations

There are several methods for modelling R_t, and each will produce a slightly different estimate. The estimation method[1] used here uses the time-series of new incidences (i.e. the numbers of positive confirmed cases over time) to estimate R_t with a 95% credible interval. The 95% credible interval indicates a range of likely values of the R_t estimates. The width of the 95% credible interval indicates the uncertainty around the estimates.

When prevalence of the virus is low, it is not appropriate to attempt to calculate the instantaneous reproduction number R_t, as the model requires a minimum incidence level (number of confirmed positive cases within a certain time period).

A central assumption of the model is that testing effort is constant over time. When there are substantial changes to testing effort, the model is not statistically robust, and it may not be appropriate to use this model estimate of R_t. Testing policies continue to adapt in response to the pandemic, and this means there have been changes in both the number of Covid-19 tests carried out, and where that testing is targeted. Therefore, estimates of R_t for Jersey should be treated with caution, particularly when there have been stark changes to testing regime. The estimates of R_t should be considered in the context of the many other metrics used to track the coronavirus situation in Jersey. Key metrics (such as testing rate, positivity rate and more) are published regularly in the Coronavirus Weekly Update.

In larger jurisdictions with higher populations, hospital admission rates and/or death rates can be used to validate estimates of R_t, as these metrics are not as sensitive to changes in testing rates. However, as Jersey's population is small, the numbers of admissions and deaths are small, and it is not statistically appropriate to base models on such low numbers. In a small jurisdiction like Jersey, the R_t number should not be used in isolation to understand the spread of coronavirus locally. Decision makers use these R_t estimates in conjunction with other public health intelligence metrics in order to build a detailed picture of the local coronavirus outbreak.

[1] Cori et al. (2013) "A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics", American Journal of Epidemiology, Vol 178, No. 9

Weekly estimates of R_t

The table below shows the estimated range of R_t at the end of each week since February 2021. The range indicates the 95% credible interval of likely values of the R_t at that point in time.

The estimated range of R_t is colour coded as follows:
Red when the range is above 1 (Highly likely that the infection is spreading exponentially)
Amber when the range straddles values both above and below 1 (Some likelihood the infection is spreading exponentially, but also possible that the rate of infection is slowing)
Green when the range is below 1 (Likely that the rate of infection is slowing)

Table 1. Weekly estimates of the likely range of instantaneous reproductive number (R_t) for Covid-19 in Jersey.

Week Ending	Range
03/02/2021 – 27/06/2021	Paused due to low case rates on-Island*
04/07/2021	1.8-2.2
11/07/2021	1.6-1.8
18/07/2021	1.4-1.7
25/07/2021– 01/08/2021	Paused due to sharp changes in testing effort**
08/08/2021	0.4-0.5
15/08/2021	0.6-0.7
22/08/2021	0.7-1.0
29/08/2021	0.6-0.9
05/09/2021	1.1-1.4
12/09/2021	0.9-1.2
19/09/2021	0.7-0.9
26/09/2021	0.9-1.2
03/10/2021	0.6-0.9
10/10/2021	0.8-1.2
17/10/2021	1.0-1.3
24/10/2021	1.1-1.4
31/10/2021	1.2-1.4
07/11/2021 – 14/11/2021	Paused due to sharp changes in testing effort**

**Note 1 - At low incidence levels, this modelling technique cannot precisely estimate R_t as there is a reduced amount of data to work from. Between 21st Feb and 27th June 2021, incidence was low, and using this methodology to estimate R_t was not appropriate (see also Page 1) as the confidence interval was too wide for the estimate to be meaningful.*

***Note 2 - No estimates are provided for the weeks ending 25th July, 1st August, 7th November and 14th November 2021, because testing effort fluctuated considerably over these periods. The model is not statistically robust when testing effort changes markedly, and a stable testing effort for a ~10 day period is required.*

Discussion of Results

- In the week ending 31st October 2021, R_t is estimated to be between 1.2-1.4. An R_t in this range (slightly above 1) means each infected person was on average passing the virus to 1 or more people.
- Due to a significant recent change in testing regime for inbound travellers and the roll-out of household lateral flow testing, the estimation of R_t has been temporarily paused. The model requires at least a 10-day period of relatively constant testing effort to give an appropriate estimate of R_t. Reporting of the R_t estimate will be resumed when this condition is met.

These estimates of R_t are produced with the best available data to date and may be subsequently revised as more information comes to light. The estimate of the range of R_t is continually monitored, and these estimates will be used in conjunction with other key indicators to assess local infection rates.

Appendix

Further Notes

1. Jersey's borders testing programme prior to the 2nd November 2021 had meant we are able to distinguish between "seed" coronavirus cases (picked up at borders screening) and other "non-seed" cases picked up by on-island testing. Using incidence of non-seed cases only (those identified through contact tracing, workforce and admission screening, and testing of symptomatic individuals) allows us to more accurately assess the local reproduction number. The change to the border testing regime on 2nd November 2021, which no longer requires fully vaccinated passengers to have a PCR test on arrival or evidence of a recent negative PCR result, has impacted on the visibility of "seed" cases in the testing data.
2. The model requires an estimate of the distribution of the "serial interval" – the time between someone developing symptoms, and the persons they infect developing symptoms. A serial interval of 5.19 days was used for this modelling, with a standard deviation of 3 days, following the findings of a published metanalysis[2] of data available for Covid-19 infectious pairs.
3. Symptomatic cases are recorded against the date of symptom onset, whilst date of swab is used for asymptomatic cases. Note that when positive cases are found, interviews with track and trace can reveal that symptom onset occurred several days in the past. For this reason, estimates of R_t will be revised to incorporate this new information when it becomes available.

[2] Rai et al. (2020) "Estimates of serial interval for COVID-19: A systematic review and meta-analysis", Clinical Epidemiology and Global Health