**Assessment for RF Position – COVID-19 in Regions of Japan. *Please allow time to answer all 5 questions***

In Japan, transmission and variant emergence has resulted in several ‘waves’ of COVID-19 since February 2020. Here we focus on the epidemiology of prefectures (a region in Japan) within Kyushu Island, which is based in the south. The attached file “kyushu\_covid03.csv” contains;

* Reported cases of COVID-19 at a prefectural level

Please answer the questions below. At the end, please email your responses within this document to [Kathleen.oreilly@lshtm.ac.uk](mailto:Kathleen.oreilly@lshtm.ac.uk), along with any computer code etc that were used to put together your responses (eg. r script / jupyter notebook / excel). Please send your responses within 30-40mins of receiving this assessment.

1. Report the incidence (per 1,000 person-years) for each prefecture for the Omicron period only. Note that the Omicron period was between 2022-01-01 and 2022-07-01. The answer should be placed below in table format. Please describe how incidence was calculated. **(2 marks)**

|  |  |
| --- | --- |
| Prefecture | **for Q1:** Incidence during Omicron period (per 1,000 person-years) |
| *Fukuoka* | *137.03379* |
| *Kagoshima* | *104.48185* |
| *Kumamoto* | *107.57340* |
| *Miyazaki* | *99.07003* |
| *Nagasaki* | *84.88158* |
| *iota* | *87.81329* |
| *saga* | *122.61103* |

1. Comment on the relationship between incidence and population density. How reliable is this observation? **(1 mark)**

ANSWER:

Plotting the population size against incidence (see #2 in R script), I see that prefectures with higher population density tend to have higher incidence. This observation may not be generalizable because other factors may be confounding this observation, including social contacts, age structure, or intervention coverage.

A graph with a line going up

AI-generated content may be incorrect.

1. An example map of relative risk is given below. Provide at least 3 improvements to this map that should improve communication of the estimated risk of COVID-19 for each prefecture. **(2 marks)**



ANSWER:

* Add a title, x and y-axis labels, and a legend title. The legend title currently does not communicate what the values mean.
* Make the prefecture labels bigger and use lighter colours when placed on darker backgrounds.
* Grey is shown on the map but not in the legend. Clarify what that means either in the captions or by using a more diverging colour palette that allows you to show the differences more clearly.
* Make the map bigger as it currently only occupies half of the page.

1. Community testing is being discussed as a strategy to reduce community transmission. Further details are provided in the Table below. For an individual that is tested, if they test positive they are requested to quarantine for 5 days (in quarantine hotels, provided by the Japanese Government). It costs the Government US$200 per day to quarantine people who test positive. **(5 marks)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COVID-19 test | Sensitivity | Specificity | Cost | Time from test to result | Estimated infections prevented per case identified |
| PCR | 94% | 100% | US$2.00 | 2 days | 0.5 |
| Rapid antigen | 97% | 98% | US$5.00 | 5 mins | 3 |

**In Saga prefecture there are 811,442 people. In this population suppose 141 people are actively infected when mass testing is implemented.**

The Government want to assess which test should be used. Calculate the following for each test;

* 1. Numbers that test positive
  2. Cost of testing
  3. Cost of quarantine
  4. Number of infections prevented
  5. Cost (from testing and quarantine) of infections prevented

ANSWER:

Below is a table summarising the results for both tests.

|  |  |  |
| --- | --- | --- |
| Metric | PCR | Rapid antigen test |
| Total positive tests | 133 | 16,363 |
| Testing cost | US$1,622,884 | US$4,057,210 |
| Quarantine cost | US$133,000 | US$16,363,000 |
| Infections prevented | 66.3 | 410 |
| **Cost per infection prevented** | **US$26,496** | **US$49,768** |

1. Which test would you recommend the Government uses for community testing? Comment on the approach used, including the strengths / weaknesses of approach. Should an alternative testing strategy be considered, why? What other information might you need to assess whether investment in testing is an efficient use of resources? **(2 mark)**

ANSWER:

I recommend using the PCR test for community testing because it offers a lower cost per infection prevented (US$26,496) and has 100% specificity, avoiding unnecessary quarantines. Although rapid antigen tests identify more cases and prevent more infections overall, their high false-positive rate leads to a much higher quarantine cost. In my analysis, I focused on direct testing and quarantine costs, which helps compare strategies, but this approach has limitations. It assumes everyone is equally likely to transmit the virus and follow quarantine rules, and it doesn’t account for indirect or long-term effects. I think a better strategy might be to use rapid tests for initial screening, followed by PCR confirmation for positives. This could reduce costs while still catching most infections early. To decide whether testing is a good investment, I’d want more information about local transmission rates, immunity levels, healthcare capacity, and how much the government is willing to pay per infection prevented.