PACIFIC PARADISE

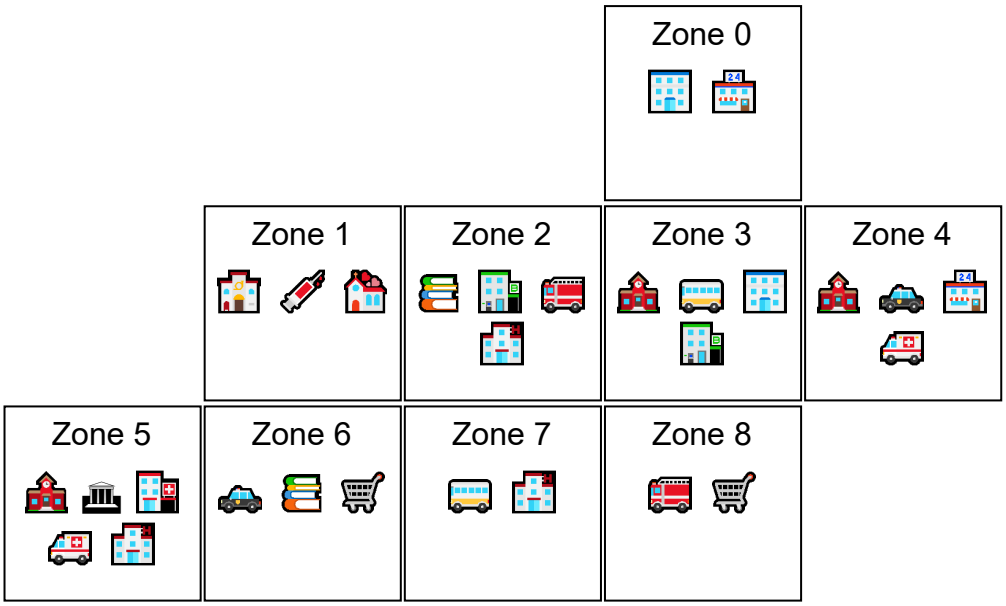
May 9th, 2022

Attention: William Barker

Communication 11

Thank you for your help with planning our Vaccine Distribution Strategy and managing our budget for eradication measures. We are now looking at implementing the public health measures within a local area.

So far, we have excluded CCD25 from our analysis. This is the main town in Pacific Paradise and houses many of our key facilities, from medical centres to schools. The town can be divided into nine zones, as shown on the following map:



The map shows which facilities are located in which zone. The facilities considered are shown in the following table:

School	Police Station	Bus Depot	Town Hall
Post Office	Government Office	Hospital	Library
Bank	Medical Centre	Fire Station	Supermarket
Convenience Store	Wedding Chapel	Ambulance	Hotel

Currently these nine zones are all free of outbreaks and all facilities are available. Using our limited budget, each week we are able to choose one zone that does not have an outbreak in it to be the target of our public health measures. The zone chosen will effectively become immune to any future outbreaks.

Assuming each facility is of equal value, which zone do you think we should target with public health measures in the first week?

5

Communication 12

Unfortunately, at the end of each week there is a 0.2 probability of an outbreak in any zone that has not yet been the target of public health measures. If an outbreak occurs in a zone then that zone has to be quarantined for the foreseeable future and we lose general access to the facilities in that zone.

We have provided our data and a function you might find useful in a Python file.

We would like to keep at least one of each facility accessible. Based on the numbers of facilities in each zone, our current plan is to target public health measures for zones in the following order:

5, 4, 3, 2, 6, 1, 8, 7, 0

We will definitely be able to prevent outbreaks in Zone 5 in the first week but, for example, if there is an outbreak in Zone 4 in the first week then in the second week we will target Zone 3 instead.

If we follow this plan, what is the expected number of distinct facilities that will be accessible after nine weeks?

12.98

Communication 13

Can you recommend a public health strategy that would give a higher expected number of distinct facilities that will be accessible after nine weeks? What would be the maximum expected number of distinct facilities that will be accessible after nine weeks?

13.84

Communication 14

In practice, once an outbreak occurs it becomes more likely that neighbouring zones will also have outbreaks. We think the probability of an outbreak occurring in a given week can be quantified as $0.2 + 0.05\,n$, where n is the number of zones with outbreaks that are directly adjacent (horizontally or vertically).

Taking this into account, what would be the maximum expected number of distinct facilities that will be accessible after nine weeks?

13.62

Communication 15

We have decided we want to prioritise having a hospital, town hall, ambulance and supermarket accessible at the end of the nine weeks. Instead of maximising the expected number of facilities, what should we do if we wanted to maximise the probability of just having at least one of each of these four facilities accessible?

We look forward to reading your final report.