Investigation Background

You work for a state health department that has identified several cases of Carbapenem Resistant *Acinetobacter baumannii* (CRAB). Based on your state’s investigation guidelines, you need to investigate all the facilities that an identified case has visited in the last 90 days. Additionally, if there is a/are known roommate(s) at any location then they are also tested. If a roommate tests positive, then point prevalence screening (PPS) is conducted at the location to identify the extent of the spread. Your assignment is to explore the investigation data using MicrobeTrace and identify how CRAB is spreading in this outbreak.

MicrobeTrace Instructions:

1. From the Github Repository (https://github.com/halosere/Genomic-Epidemiology/blob/main/AMD%20Academy%202024), download and/or clone the data into a folder on your computer.
2. Go to https://microbetrace.cdc.gov/MicrobeTrace/
3. Click the gear in the top left corner of the screen and select SNPs in the “Distance Metric” dropdown menu and Phylogenetic Tree in the “View to Launch” dropdown menu.
4. Load the AMD\_exercise\_edge, AMD\_exercise\_node, and the amd\_tree files onto MicrobeTrace
   1. Drag and drop
   2. Or click the “Add File(s)” dropdown menu in the bottom left, select files, then “Open”
5. Click Launch
6. Click the “File” dropdown menu in the top left and click “Add Data”.
7. Add the AMD\_exercise\_edge.xlsx and AMD\_exercise\_node.xlsx files.
8. Then click “Update”
9. Click the “View” dropdown and select the “2D Network” view.
10. Click the “Settings” dropdown and change the “Filtering Threshold” to 2.
    1. Based on peer reviewed literature, a mean SNP distance of 2.5 is more likely to represent a cluster of CRAB cases.
11. Adjust the aesthetics and add new views to investigate the outbreak.

Outbreak Overview:

Facility D

Person 1 was diagnosed at Facility D with CRAB that contains the resistance gene OXA-23 (CRAB-OXA-23) on 2/15/2024. His roommate, Person 16, was also diagnosed with CRAB-OXA-23 on 2/28/2024. PPS was conducted at Facility D, and another case of CRAB-OXA-23 was found, Person 10 (Date of Diagnosis (DoD)=3/4/2024).

Facility E

One month before visiting Facility D, Person 1 stayed at Facility E with roommate Person 18. Person 18 tested positive on 3/4/2024 with CRAB-OXA-23. PPS is conducted at Facility E, and another case of CRAB-OXA-23 is found, Person 17 (DoD=3/15/2024).

Facility A

Two months before staying at Facility D, Person 1 stayed at Facility A with roommate Person 40. Person 40 tested positive on 3/4/2024 for CRAB-OXA-23 and OXA-24 (SURPRISE). Unknowingly, Person 40 had been previously infected with OXA-24. PPS is conducted at Facility A, and five more cases are identified, Person 40, Person 41, Person 43, Person 46, and Person 49, on 3/20/2024. Person 43, Person 46, and Person 49 test positive for CRAB-OXA-24; meanwhile, Person 40 and Person 41 test positive for both CRAB OXA-23 and OXA-24. During the investigation, it was found that Person 40 roomed with Person 41 after Person 1 left the facility.

Facility C

Three months before staying at Facility D, Person 1 stayed briefly at Facility C with roommate Person 48. Person 48 tested positive on 3/4/2024 for CRAB OXA-24 (SURPRISE). Unknowingly, Person 40 had been previously infected with CRAB OXA-24. PPS is conducted at Facility C and two more cases are identified, Person 45 and Person 42.

Facility B

Further investigation shows that most cases that tested positive for OXA-24 at Facilities A and C also had previously stayed at Facility B within the last year. Epidemiologists reached out to Facility B and conducted a PPS. PPS identified three more cases, Person 44, Person 47, and Person 50, positive for OXA-24 on 4/2/2024.

**Visual Summary**:

**Facility D** has 3 red (“During”) links and 10 blue links (aka “After”) connecting to blue nodes (OXA-23). **Facility E** has 2 green (“Before”) links, 3 red links, and 10 blue links, connecting to 15 blue nodes. **Facility F** has 2 green links and 13 blue links connecting to 16 blue nodes.

**Facility A** has 7 links connecting to orange, blue, and yellow nodes. Two green (“Before”) links are connected to a yellow (OXA-24) node and the other is connected to a blue (OXA-23) node. Of the 5 red links, only two are connected to orange (OXA-23 & OXA-24) nodes and the rest are connected to yellow (OXA-24) nodes.

**Facility** B has 6 links connecting to yellow and blue nodes. Three green (“Before”) links are connected to 2 yellow (OXA-24) nodes and 1 blue (OXA-23) node. The other three links are red (“During”) connected to yellow (OXA-24) nodes.

**Facility C** has 4 links connected to yellow and blue nodes. The 3 red (“During”) links are connected to yellow (OXA-24) nodes meanwhile a green (“Before”) link is connected to a blue (OXA-23) node.

P1 has the most connections to facilities and the epidemiological data supports the transmission of OXA-24 to P40 before leaving to Facility A.

At the top of the network, some nodes have an initial connection to Facility A, B, or C and a secondary link that also connects to one of these facilities. A similar pattern is observed at the bottom of the network, where some nodes are initially connected to Facility D, E, or F and also have a secondary link to one of these facilities.

**Conclusion**

There appears to be two propagated outbreaks occurring in the network. One of which Facilities A, B, and C are involved regarding the transmission of the OXA-23 gene. The other propagated outbreak involves Facilities D, E, and F regarding the transmission of the OXA-24 gene. The result of this outbreaks has led two individuals in Facility A to acquire both AMR genes.

