Background:

Understanding how school closures influence students' interaction patterns is essential for assessing and mitigating the spread of infectious diseases within primary schools. It's crucial to visualize the pattern of spread of infectious disease, such as which individuals or groups can effectively deliver and assist to lower disease propagation and methods to mitigate public health concerns. Our alternative goal is to use the dataset obtained from Social patterns[1], considering the density, degree of centrality and betweenness centrality of finding the relationship between central nodes and detecting key bridges of individuals linked with different groups. The purpose of network modeling is to reduce overall micro-community infection risk in primary school.

Data:

The dataset were obtained from Social patterns[1], this dataset has total of 5 columns and 125,773 rows as observation. More details shown as below(first 5 rows from the dataset):

A tibble: 6 × 5

Timestamp (in seconds) <dbl>	First person's ID <dbl>	Second person's ID <dbl>	Class of person i <chr>	Class of person j <chr>
31220	1558	1567	3B	3B
31220	1560	1570	3B	3B
31220	1567	1574	3B	3B
31220	1632	1818	4B	4B
31220	1632	1866	4B	4B
31220	1673	1698	1B	1B

6 rows

Timestamp records the interaction(in seconds) when the contact occured. First person's ID(i) and second person's ID(j) are the anonymous IDs of different person in contact, class of different person are label as Ci and Cj.

For example:

Timestamp (in seconds) <dbl>	First person's ID <dbl>	Second person's ID <dbl>	Class of person i <chr>	Class of person j <chr>
31220	1558	1567	3B	3B

This briefly summarize after 31220 seconds after the data collection started, the first student ID of 1588 from class of 3B has in contact of second person 1567 also from class of 3B.

Analysis:

- What's the overal density, average degree and cluster coefficient of the network? Also, what does all these stands for?

	density	average_degree	cohesion	compactness	clustering coefficient
interconnectedness	4.3	1039.4	20.0	0.0	0.5

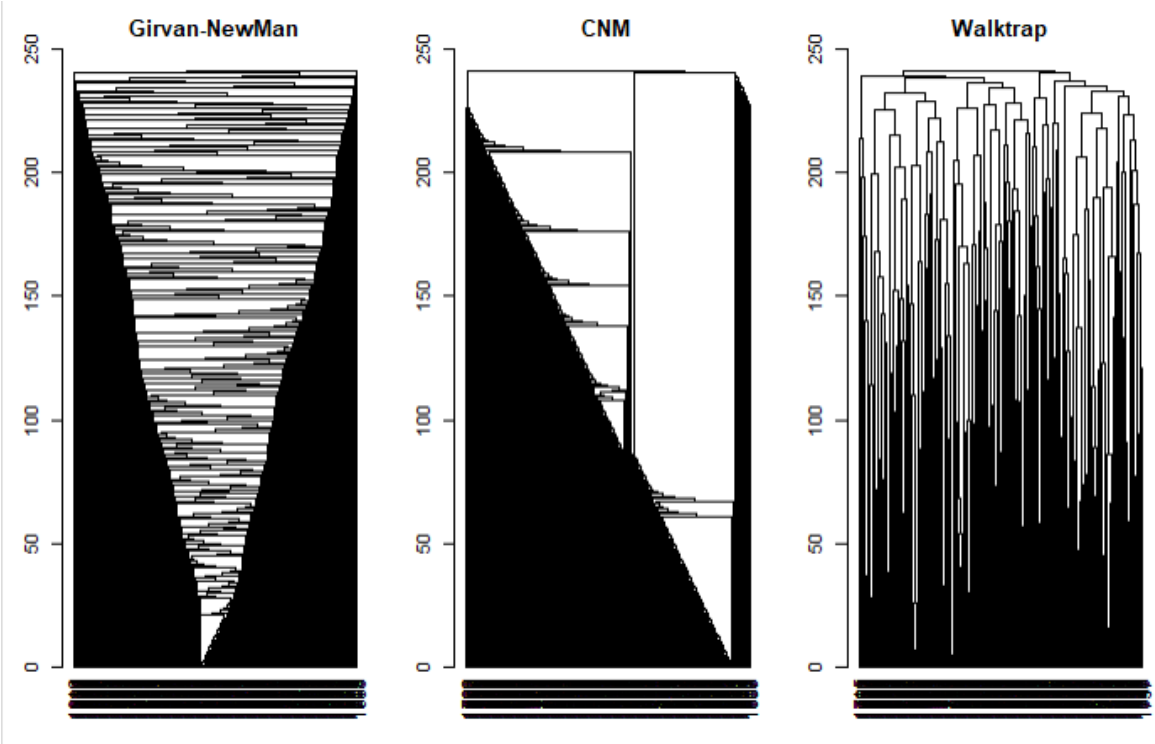
The density of 4.3 represents the possible interaction of students in school. This reflects the pattern of overall connectedness. The average degree of 1039.4 indicates that each student has roughly a connection of 1039.4 with others. In fact, these numerous interactions suggest the potential risk for the rapid spread of disease within primary school, which influences the mitigation of the effectiveness of public health treatment services. The clustering coefficient of 0.5 represents that students in the school usually form small groups, or "family" of the central nodes. One central actor has its own family members and these also have connections with other families.

- Which node has the highest betweenness centrality?

```
> which.max(g.bc)
[1] 157
> V(g)$name[which.max(g.bc)]
[1] "1551"
>
```

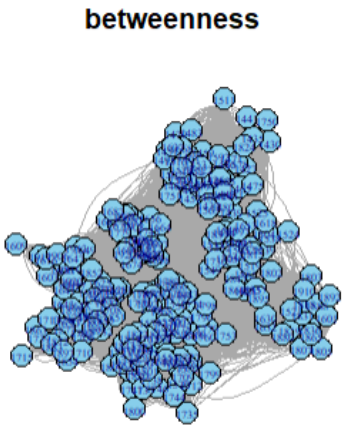
The student with ID 1551 has the highest betweeness centrality, this indicates that they serve as the most important bridge of connecting other groups. The student has characterize of welcoming and sociable, interact with numerous classmates and has strong relationship with

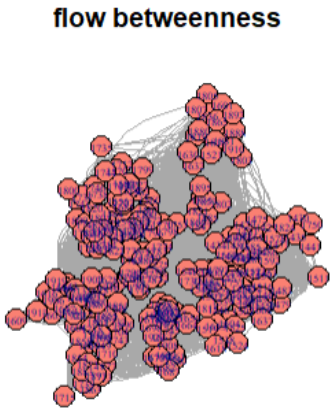
majority of students. These characteristic usually priority consider of student council president or class leader.



These three dendrogram identify essential bridges connection between individuals and groups. The walktrap method focuses on spotting small groups and recognizing these small groups is valuable for implementing early interventions to prevent or slow the spread of diseases within the school. For example, if one student in a tightly connected “family” group becomes sick, the school can temporarily isolate that specific group to reduce the risk of further spread. This targeted approach helps control the situation without causing the same level of panic that might occur if the entire school were announced to close.

Network Visualization:





The betweennes colored in skyblue show nodes with higher betweenness scores. They act as bridge or connect with other individuals or groups. They also link parts of the network that would otherwise be separate. The flow betweenness shows the interactions flowing through to other “family”.

Citation:

1. SocioPatterns. “Primary School Temporal Network Data.” SocioPatterns.org, 30 Sept. 2015