Using Time-Space Cluster Analysis to Inform Outbreak and Cluster Detection of HIV and Syphilis, Kansas 2022

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Background

- Between 2016 and 2022, there was a 100% increase in new cases of early syphilis in Kansas, while new HIV cases have remained steady.
- A time-space cluster analysis can be performed to determine if an increase in HIV or syphilis is due to clustering of cases or a general increase in cases.
- A time-space cluster occurs when the number of diagnoses of an infection in a particular geographic area during a specified time is elevated above levels expected given previous patterns.
- This analysis is appropriate for assessing county-level changes.

Methods

- A Z-score was used to measure the variance of new cases for the month, compared to the mean of new cases per county for the previous 36 months.
- A county was flagged as a potential cluster if the count was greater than two standard deviations above the mean.
- A county was flagged to be monitored if the current month's diagnoses were at least one but less than two standard deviations above the mean.

Figure 1. Example Z-score Map of New Cases of Early Syphilis, Kansas December 2022
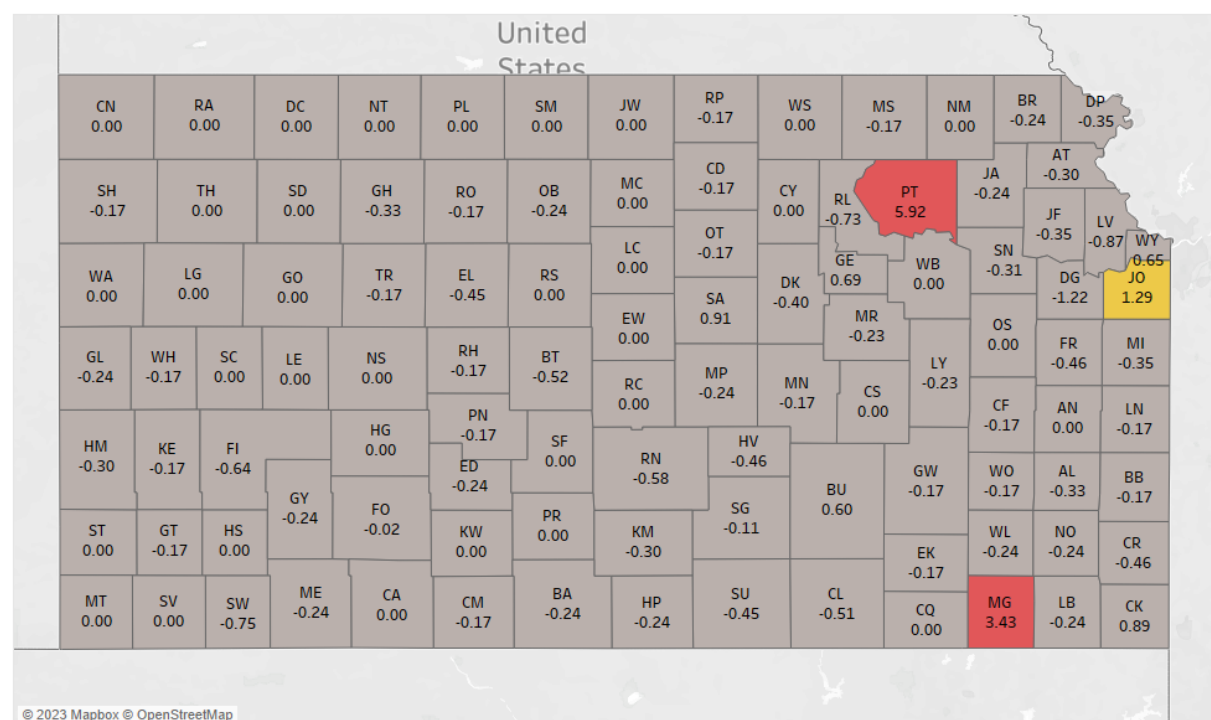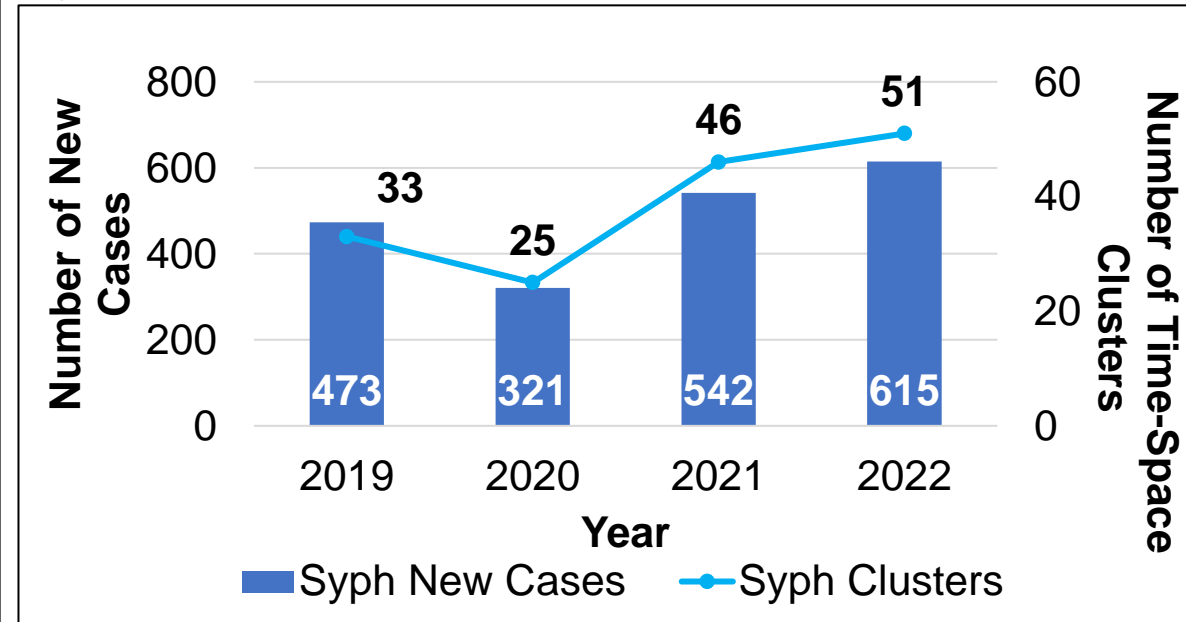

Results

- The total number of time-space clusters per year is proportional to the number of new cases.
- From 2019-2022, approximately 15% of new cases of HIV per year resulted in a space-time cluster.

- Approximately 10% of new cases of early syphilis per year resulted in a time-space cluster.
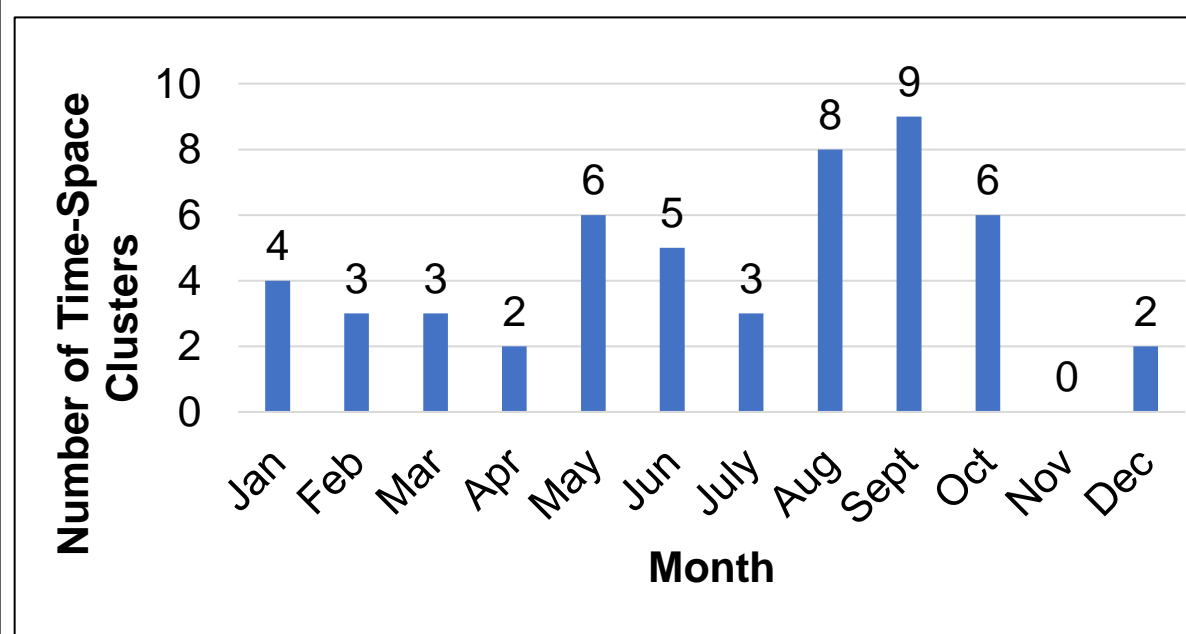
Figure 2. New Cases and Cluster Count of Early Syphilis by Year, Kansas 2022

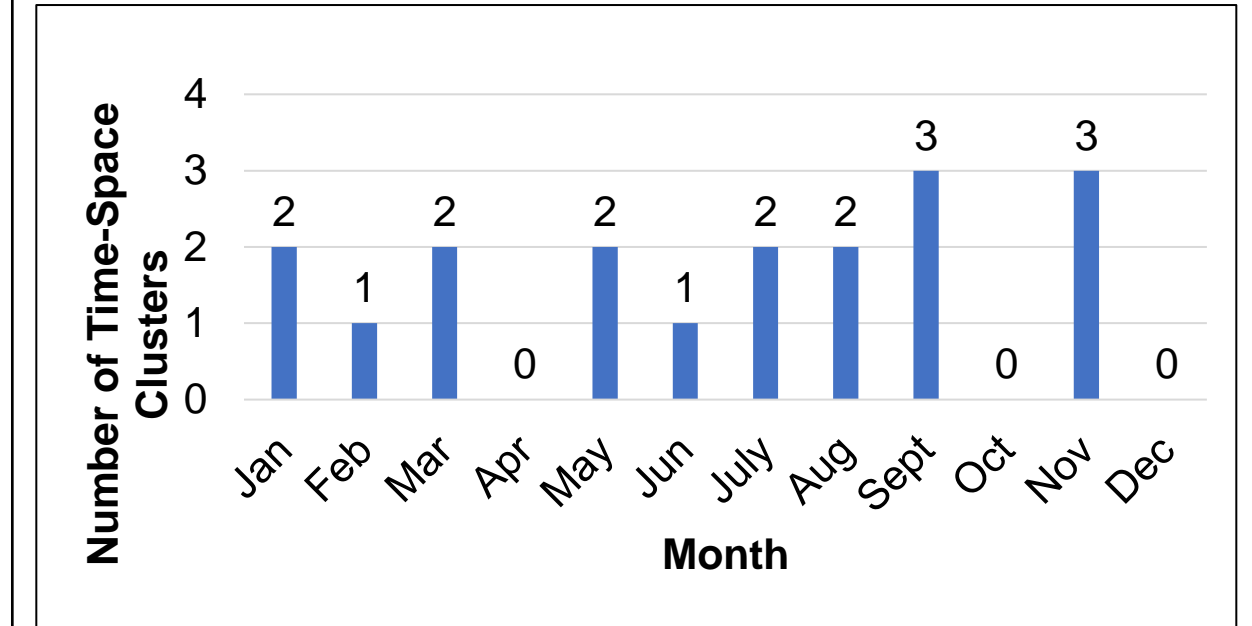**Figure 3. New Cases and Cluster Count of HIV by Year, Kansas 2022**
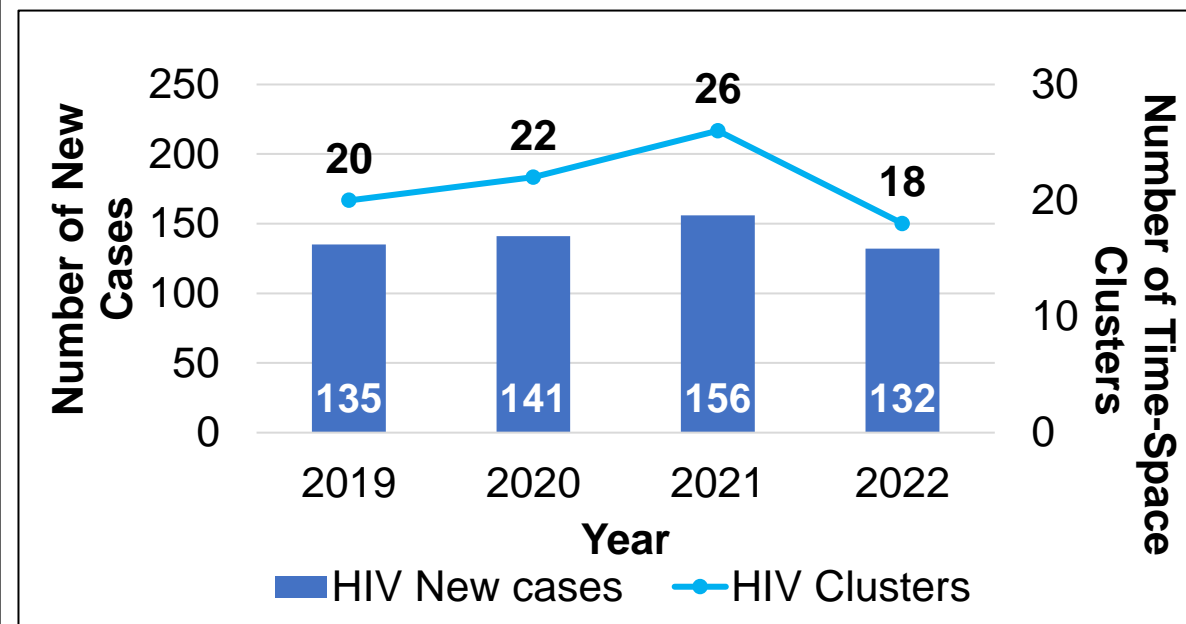
Figure 4. Cluster Count of Early Syphilis by Month, Kansas 2022

Figure 5. Cluster Count of HIV by Month, Kansas 2022

Conclusion

- In 2022, the time-space analysis revealed specific county-level increases in newly diagnosed HIV and syphilis cases.
- Monthly outbreak monitoring meetings, along with the time-space cluster analysis and visualizations, allow both the DIS and surveillance staff to stay informed of the number of new cases and any changes that may be occurring.
  - These meetings make it possible to provide outreach as quickly as possible.
- For both HIV and syphilis, the goal is to identify and treat new cases as quickly as possible.
- If a cluster is detected, surveillance staff along with the DIS will assess whether there is a need to provide aid to the area.
- In 2022, this analysis provided a better understanding as to the geographical locations that are most responsible for new cases of HIV and syphilis in Kansas.

Limitations

- While Z-score is useful for determining variance in normally distributed populations, it may not be the best use for small, non-normally distributed populations.
  - Reviewing other methods for identifying variance among small, non-normally distributed populations may be beneficial.
- The DIS are often aware of the increases before the data is analyzed.
  - Adding other stages of syphilis to the analysis, analyzing the data more frequently and increasing the frequency of outbreak meetings may aid in making the analysis more effective.