Public Health Region 6/5S Flu Report: Predictive Value of Influenza-Like Illness for Subsequent Laboratory-Confirmed Influenza Activity

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Background

DSHS PHR 6/5S sends a weekly Qualtrics survey to the local health departments in its 16 counties and participating school districts to assess the number of reported influenza-like illness cases and confirmed flu cases. Data from this survey is tabulated, used in the 6/5S regional flu report, and sent to the DSHS central office in Austin. Influenza-like illness (ILI) is a "non-specific syndrome defined as fever (temperature of 100^{0}F or greater) and cough and/or sore throat."[1] Counts for ILI tend to be higher because this category encompasses various respiratory pathogen symptoms and because ILI is often used as an indicator of influenza activity when confirmatory laboratory testing has not been performed.[2] This research aims to use the 6/5S regional flu report to determine if ILI activity from previous weeks can help predict future influenza severity within the region.

Methods

Data from the 6/5S regional flu report for MMWR (Morbidity and Mortality Weekly Report) influenza seasons 2023-2024 and 2024-2025 were used in a negative binomial regression with lagged variables. Negative binomial regression was chosen over Poisson regression because the variance was significantly greater than the mean. Data analysis was conducted in R Studio.

Time-Series Plot

Figure 3: Time-Series Comparison of Confirmed Influenza Case Counts and 1-Week Lagged ILI Counts for 2023-2024 Season

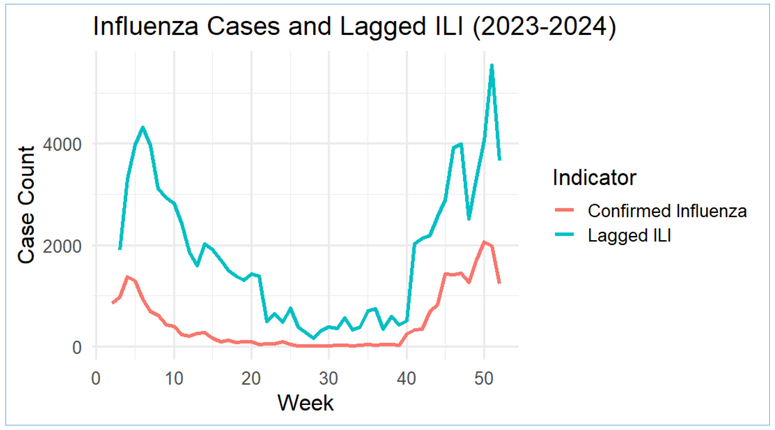
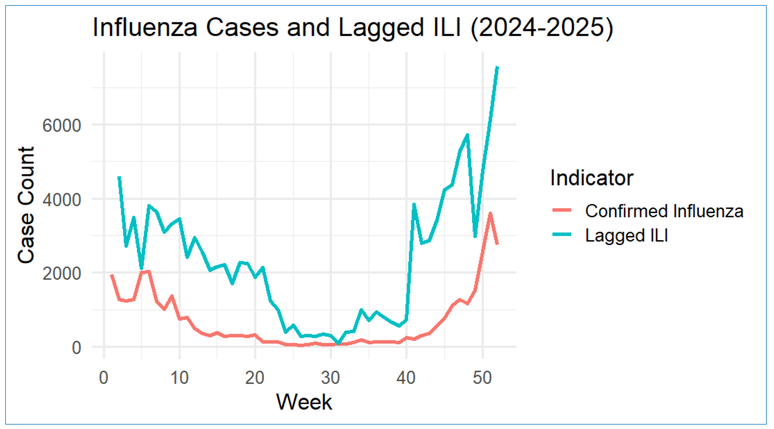


Figure 4: Time-Series Comparison of Confirmed Influenza Case Counts and 1-Week Lagged ILI Counts for 2024-2025 Season



Conclusion

These findings suggest that syndromic surveillance data collected by the region may provide an early indication of increasing confirmed influenza counts, allowing for a potentially vital one-week period for targeted public health response within the region.

This early signal could provide a critical window for public health action, enabling the region and its counties to anticipate rising influenza activity and implement targeted interventions, whether it be at a county or regional level, before confirmed case counts peak. Such actions may include:

- Strengthening clinical preparedness
- Enhancing public health messaging
- Allocating healthcare resources,
- Increasing situational awareness among health care providers and public health professionals

By using the weekly Qualtrics survey and incorporating routine, syndromic influenza surveillance, PHR 6/5S may be able to support proactive and informed public health decision making at both the county and regional level by improving the timeliness of influenza outbreak and response.

Model Specification

Figure 1: Negative Binomial Regression Model Used to Model Influenza Case Counts

$$\text{ALLFLU}_t \sim \text{NegBin}(\mu_t, \theta)$$

$$\log(\mu_t) = \beta_0 + \beta_1(\text{flu\_lag1}_t) + \beta_2(\text{ili\_lag1}_t) + \beta_3(\text{season}_t)$$

ALLFLU_t = Number of influenza cases at time t

flu_lag1_t = Influenza cases in the previous time step

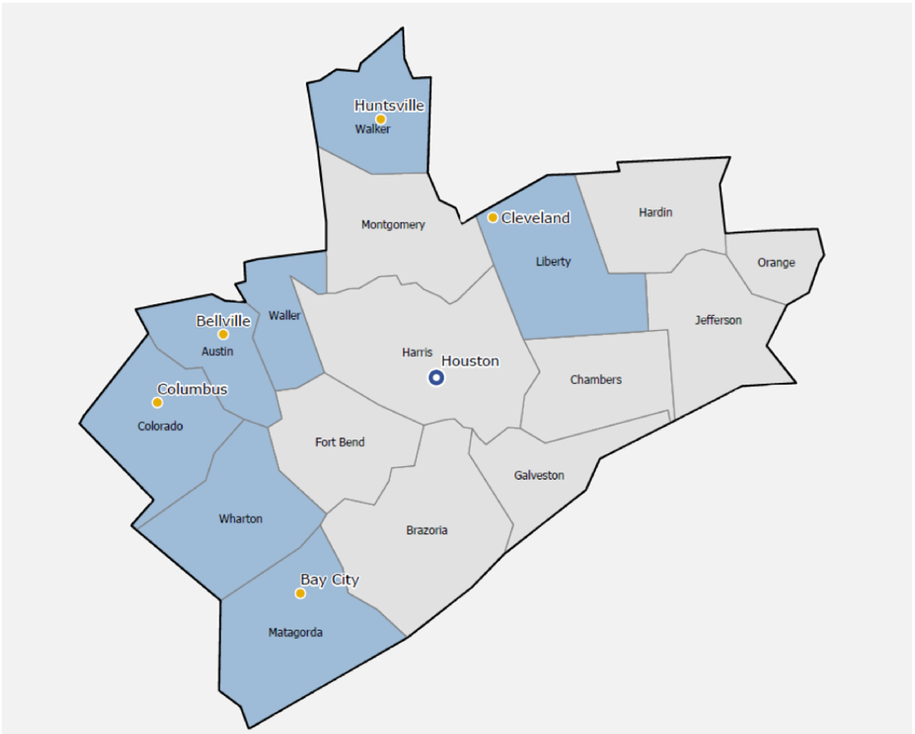
ili_lag1_t = Influenza-like illness cases in the previous time step

season_t = Seasonal indicator variable

μ_t = Expected influenza cases

θ = Dispersion paramter

Figure 2: The Sixteen Counties Within Public Health Region 6/5S[3]



References
1. CDC. (2024, September 30). Glossary of Influenza (Flu) Terms. Influenza (Flu). cdc.gov/flu/glossary/index.html
2. CDC. (2024). U.S. Influenza Surveillance: Purpose and Methods. FluView. cdc.gov/fluview/overview/index.html
3. RHLO, Akleinert (2019). *Public Health Region 6/5S* [Photograph]