

## Seasonality Of Surgical Site Infection Rates Across The UHealth System: An Analysis of 352,074 Operations.

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**Purpose of Study:** Surgical Site Infections (SSIs) are one of the most frequent and costly post-operative complications. Although there are studies investigating the seasonality of SSIs, most use methods that do not adequately account for confounding factors or the non-parametric nature of seasonal trends. While some studies attribute this seasonality to the “July effect” of new resident house staff, others believe it is related to increased body flora at high temperatures during the Northern Hemisphere’s summer months. This study aimed to explore SSI rates from various surgeries performed at different hospitals within the same system, varying in degree of trainee involvement using novel artificial intelligence methods on electronic health record (EHR) data.

**Methods Used:** We analyzed 352,074 surgeries performed across the University of Colorado Health System from 2014 to 2019 using the EHR. Individual preoperative risk and postoperative probabilities of SSIs were estimated using the Automated Surveillance of Postoperative Infections (ASPIN) models previously published by our team. We estimated complication rates, preoperative risk of complications, and observed/expected (O/E) ratios. These values were plotted by week, and cubic smoothing splines were used to visualize trends (Figure 1). Seasonality was modeled using generalized linear mixed models with sine and cosine transformations of the week of the year or quadratic transformations as predictors, depending on the observed trends. Fitted values from these models were compared to the splines (Figure 1).

**Summary of results:** More SSIs were seen between July and August. Preoperative risk also increased around July but not significantly. The risk-adjusted O/E ratio and postoperative probabilities of SSIs showed a significant increase during the summer months compared to the winter ( $P < 0.01$ ).

**Conclusion:** Our study supports prior work suggesting a significant peak in SSIs during the summer but not a specific spike in July, which would be associated with a change in house staff. This study incorporated novel application of artificial intelligence methods to predict preoperative risk and postoperative probability of SSI, and showed that even after adjustment, the O/E ratios significantly increased between these months. Further research is needed to understand this increase beyond what would be expected, given the patient risk factors.

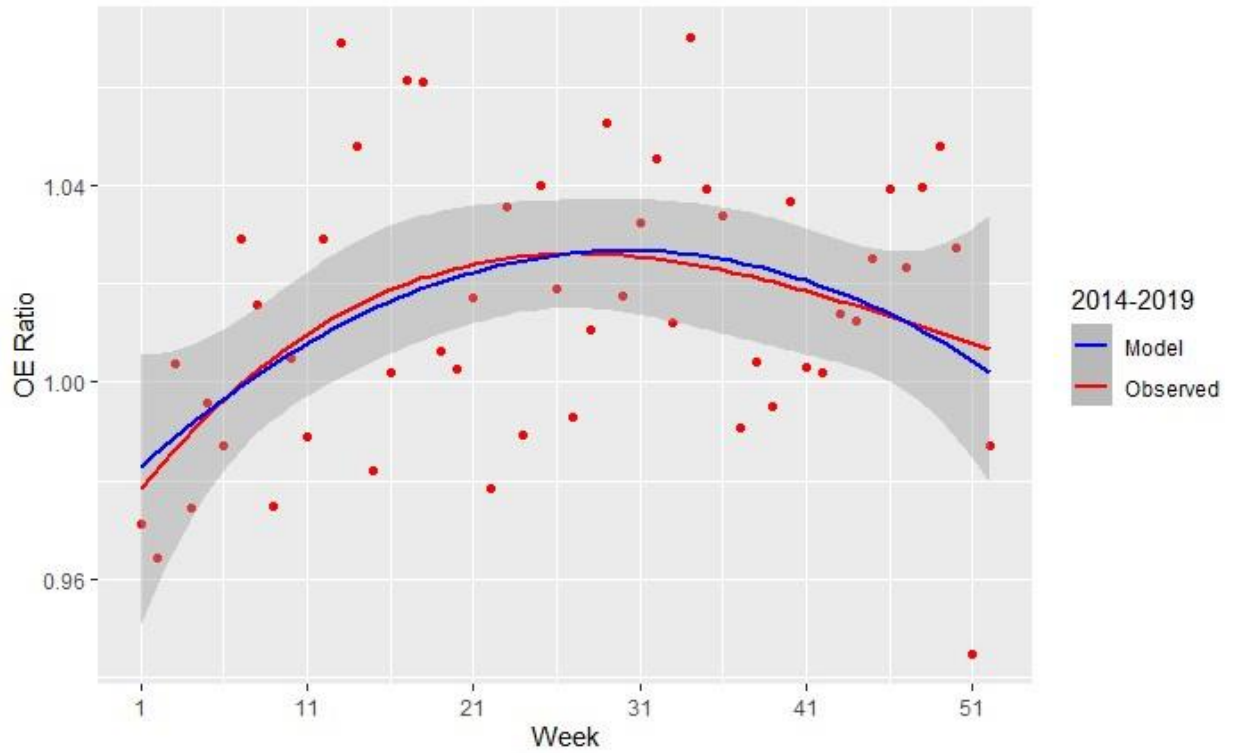


Figure 1. Seasonal trends in surgical site infection observed to expected (OE) ratios by week of the year across 2014-2019 at UHealth hospitals. Red dots are estimated OE ratios from the ASPIN models, and the red line is fitted using a cubic smoothing spline with 3 degrees of freedom. The blue line represents the model-fitted O/E ratios.