Seasonality of Surgical Site Infections Across the UCHealth System: An Analysis of 352,074 Operations

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Purpose of Study:

Surgical Site Infections (SSIs) remain clinically significant post-operative complications. Many studies investigating the seasonality of SSIs use methods that do not adequately account for confounding factors or the non-parametric nature of seasonal trends. We explored the rates of SSI following surgeries across several hospitals with varying degrees of trainee involvement within the same healthcare system, using novel artificial intelligence (AI) on electronic health record (EHR) data.

Methods Used:

We retrospectively analyzed all surgeries performed across the University of Colorado Health System from 2014 to 2019. Individual preoperative risk and postoperative probabilities of SSIs were estimated using the Automated Surveillance of Postoperative Infections (ASPIN) model previously published by our team. Observed/expected (O/E) ratios were calculated and plotted by week, and cubic smoothing splines were used to visualize trends. 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 observed between July and August. The risk-adjusted O/E ratio and postoperative probabilities of SSIs showed a significant increase during the summer months compared to the winter ($P < 0.01$). Preoperative risk also increased around July but not significantly.

Conclusion:

Our study supports prior work showing a significant increase in SSIs during the summer but not a specific spike in July, which would be associated with a change in house staff. Even after adjustment, the O/E ratios significantly increased between these months.

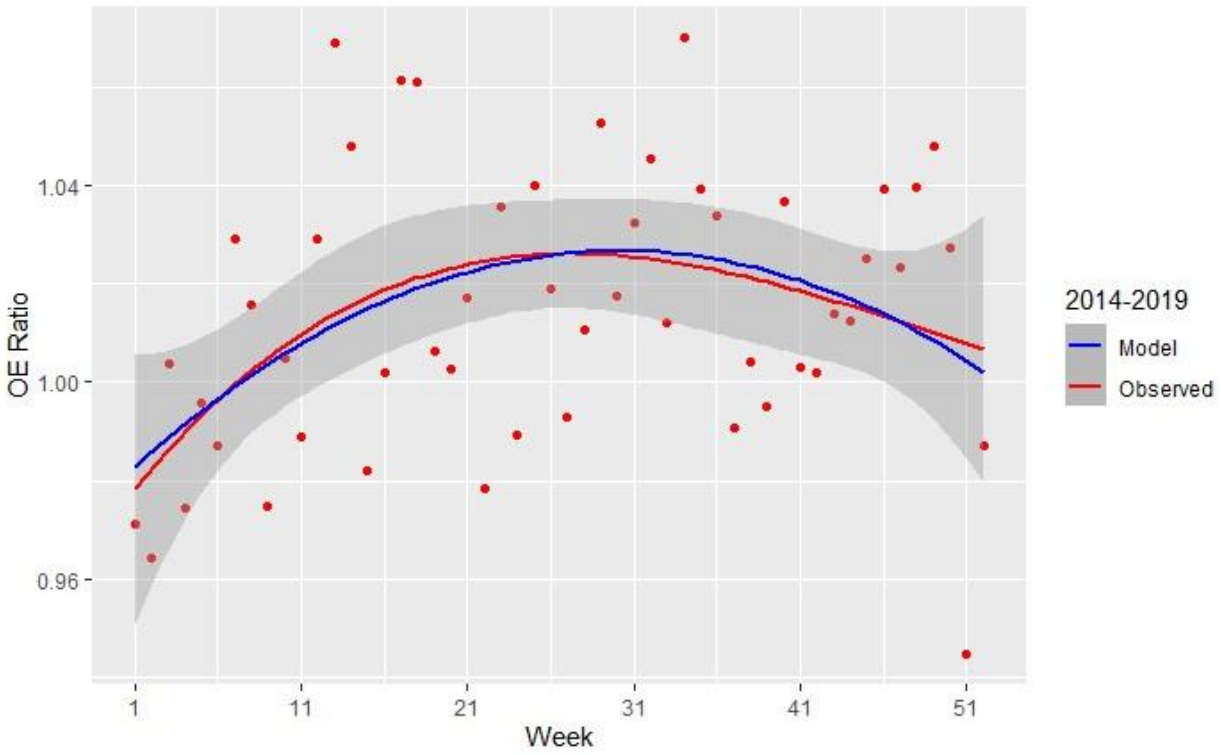

Figure 1. Seasonal trends in surgical site infection observed to expected (OE) ratios by week of the year across 2014-2019 at UCHealth hospitals. Red dots are estimated OE ratios from the ASPIN models, and the red line is fitted using a cubic smoothing spline with 3 degrees of freedom. The blue line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