

# The Seasonality Score: A Quantitative Complement to Qualitative Seasonality Assessment.

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## Introduction:

- Methods for seasonality classification of time series have been developed independently by researchers working in disparate fields.
- Consequently, these methods have been shown to be mutually discordant, thus limiting generalizability.
- Additionally, seasonality methods that assess qualitative aspects of a time series have difficulty yielding quantitative insight.

## Methods:

- The OHDSI package ACHILLES is used for data retrieval and aggregation.
- The OHDSI package CASTOR is used for time series creation and metric computation.
- The seasonality score metric was implemented as part of the CASTOR R package to provide a quantitative method of characterizing seasonality.

# Quantitative Seasonality

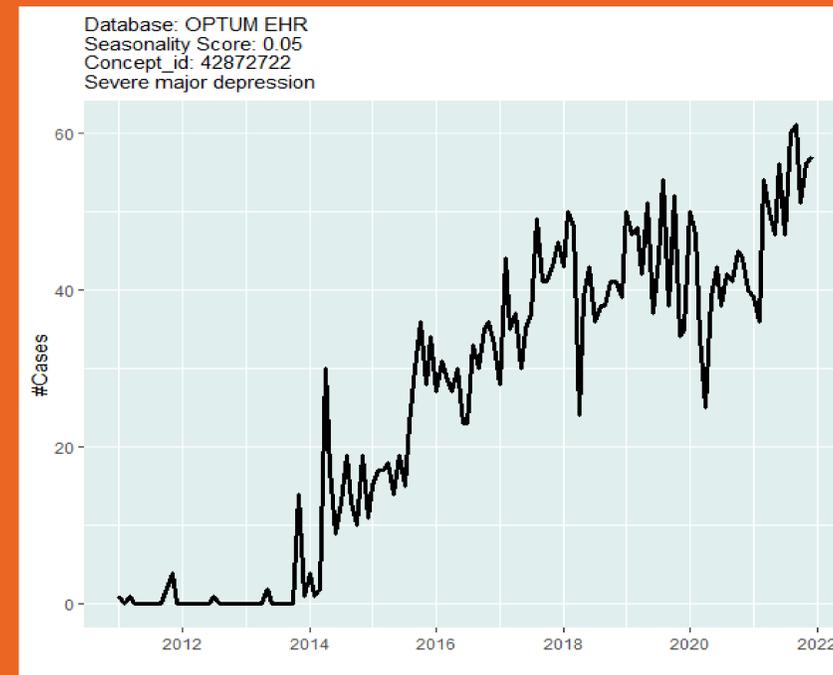
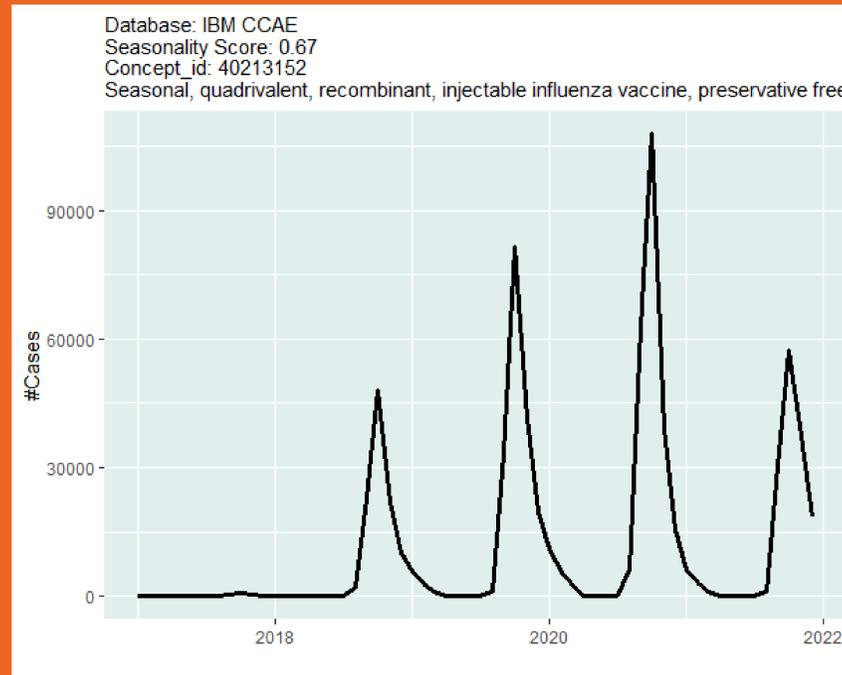
## How do you know:

If one time series is more or less seasonal than another?

If a time series is becoming more or less seasonal?

What the most seasonal events in a given database are?

If a time series is truly seasonal when methods disagree?



## Algorithm:

Let  $u = 1/12$  be a strictly non-seasonal proportion.

Let  $w = (11 \times (1/12) + (1 - 1/12))$  be the normalizing value.

Let  $M = M_{m \times 12}$  be the time series.

Let  $\mathbf{1}_{12}$  be a summing vector.

Let  $\mathbf{1}_m$  be a summing vector.

Let  $\mathbf{y} = \mathbf{1}_m^T M$  be the monthly sum over all years.

Let  $g = \mathbf{1}_m^T M \mathbf{1}_{12}$  be the grand sum.

Let  $\mathbf{p} = \mathbf{y}^T / g$  be the monthly proportion over all years.

Let  $d = \mathbf{1}_m^T |\mathbf{p} - u|$  be the total deviation from strict non-seasonality.

Let  $s = d/w$  be the seasonality score.

## Results:

- A quantitative seasonality score was established to be a complement to existing qualitative methods.
- The seasonality score provides a distribution-free metric that facilitates quantitative characterization and comparison.
- The seasonality score is a numeric value between 0 and 1 (inclusive), that is currently designed to quantify monthly seasonality.
- The seasonality score for all event table domains was computed for fifteen databases converted to the OMOP CDM.

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