How 'What's Going Around?' Works

'What's Going Around' (WGA) demonstrates a new way in which an Electronic Medical Record system can benefit providers and patients. We believe WGA is the first platform in the world to translate EMR-based data into up-to-date local epidemiological information, and provide this information to clinicians at the point-of-care, in a patient-specific manner.

Here's how it works. Every night, a process runs in NorthShore's Enterprise Data Warehouse (EDW), analyzing every patient encounter that occurred within our health system the previous day. For each encounter, the latitude-longitude of a patient's home is established through a geocoding process, and a set of algorithms is applied to determine whether the patient had a syndrome of interest.

This dataset is then processed in two ways, both based on an interpolation technique called Bayesian Gaussian Process regression ("Kriging"):

1. **Temporal analysis (time trend graph)**: A temporal logistic regression model is generated from the past three years of syndromic data. A given day's disease prevalence is determined by averaging with the prevalences of nearby days. In our model, the contribution of the neighboring days decreases exponentially with increasing time interval from the target date. This regression model thus provides a smoothed estimate of the current prevalence of each syndrome, as well as the 95% confidence intervals of each estimate. This process runs similarly for each day, thus producing a (black) time-trend curve with accompanying (grey) 95% confidence intervals for the full 3 years. This process, in addition to yielding the black curve, is augmented with terms that control for patient age. (Note that the dependence on age is determined separately for each syndrome). We divide the patient age range into five groups, and then generate corrected prevalences for each age (e.g. age = 1, age = 2, age = 75) from simple linear interpolation through the binned quantities. This process is repeated for each age relevant to a given syndrome (see Table below), to generate an analogous set of curves (red) for each age.

2. **Geospatial analysis (heatmap)**: For each syndrome, a geospatial heatmap is generated that corresponds to the fraction of patients presenting that are positive (prevalence) for the syndrome of interest at a particular geographic location, over a given lookback period (see **Table**). Importantly, we are not characterizing the *number* of cases of a syndrome in a given region, and so the heatmaps should not be affected by the fact that we may see more patients from, for example, Evanston than from Mundelein. Our catchment area is divided into a grid of pixels. which are used to represent the combined geographical and syndromic data. Each pixel is assigned a value between 0 and 1,corresponding to the syndrome prevalence at that pixel. This array of numbers is then sent to a Geographical Information Systems engine, where the pixel values are projected onto a 9-colored color scale, thus yielding a heatmap. Before we display the map, however, we process it in one more way. We remove any coloring in census tracts in which we only cared for a very small proportion of patients known to live in that tract during the relevant lookback period. Thus, we do not show syndromic prevalence for regions with insufficient data. This heatmap is then layered onto a regional basemap, and is ready for display.

The outputs of the temporal and spatial processes above are delivered to a web server nightly. When an Epic user clicks the WGA button, Epic's 'Clinical KnowledgeBase' functionality is invoked to direct the user to the WGA website. The patient's age is delivered to the webserver so that the patient age time trends ('red curve') are appropriately set. The patient's latitude and longitude (which are geocoded 'on the fly' from the patient address) indicate the location of the blue pushpin on the map.

When WGA is first accessed, the current activity of each syndrome is shown as 'High', 'Medium' or 'Low' by set colored buttons. This classification is based on the current prevalence of a syndrome for *all* relevant age groups throughout our *entire* catchment area. The button colors correspond to the horizontal cutoff lines in the time trend graph. Clicking on a button takes the user to the time trend graph and heatmap for that syndrome.

This first-of-its-kind project could not have been accomplished without a diverse, devoted and exceptionally talented team, which included:

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We welcome questions and ideas! Please write Ari Robicsek at arobicsek@northshore.org.

Table. Disease-specific data handling.

Syndrome	What algorithm looks for	Which encounter types analyzed	Age of patients analyzed	Lookback period for heatmap (# days)	Low Prevalence cutoff	High Prevalence cutoff
COVID-19	Positive confirmed COVID-19 test	All where a test is ordered	All	30	<10%	>20%
Febrile Respiratory Illness (i.e. flu-like illness)	Looks at chief complaint, diagnosis and office temperature to identify both fever *and* respiratory illness	Primary care office visits	All	7	<3%	≥4%
Strep Throat	Looks for a positive rapid or lab strep throat culture	Primary care office visits	0-40	14	<1.5%	≥2.3%
Pediatric Asthma	Primary diagnosis of asthma or a non-primary diagnosis of asthma with a compatible chief complaint	Primary care office visits, ER visits	0-18	14	<1.4%	≥2.2%
Gastroenteritis	Diagnosis of gastroenteritis	Primary care office visits	All	14	<0.42%	≥0.62%
Pertussis	Test for pertussis or diagnosis of pertussis	Primary care office visits	0-18	30	<0.21%	≥0.42%