ACUTE CARE ENHANCED SURVEILLANCE
Improving Ontario's Capacity to Prevent and Respond to Outbreaks

Threats to global public health, like bioterrorism or pandemics such as SARS or H1N1, require accurate monitoring to ensure an effective public health response. Likewise, seasonal influenza or local gastroenteritis outbreaks can easily overwhelm a healthcare system that is already working at maximum capacity. To improve the Ontario public health system's ability to prevent and respond to outbreaks of disease, a syndromic surveillance system was developed and tested in the Kingston area—the **Acute Care Enhanced Surveillance** (ACES) system. ACES has expanded and now provides real-time monitoring of patient symptoms at healthcare facilities across Ontario.

ACES collects and monitors patient registrations at emergency departments and hospital inpatient admissions in real time—these records are monitored for abnormal numbers of specific symptoms (or syndromes) that may indicate a disease outbreak. Surveillance of syndromes in this manner provides situational awareness of population health and can improve the time it takes for public health to identify and respond to health threats. Early response saves lives and resources.

The Ministry of Health and KFL&A Public Health work together to maintain ACES for healthcare facilities and public health units across Ontario. We provide ongoing training to epidemiologists and other users of the system, including how to use ACES for decision-making. Most public health units use ACES to inform local healthcare providers and the public about seasonal influenza, including estimates of timing and local impact. This information can be used, for example, to plan healthcare staffing or the opening of specialized flu clinics.

> "ACES helped us to develop relationships and open communication channels with our partners at our hospitals."
> *ACES User, Northern Ontario*

> "ACES has allowed our small capacity health unit to effectively and efficiently conduct surveillance"
> *ACES User, Southeastern Ontario*

USE CASES

- Gastroenteritis Outbreaks
- Epidemics
- Bioterrorism
- Surge Planning
- Influenza
- Natural Disasters
- Mass Gatherings
- Opioids

MONITORING HEALTH OUTCOMES

ACES provides **syndromic surveillance** of ED visits and inpatient admissions for nearly all of Ontario's acute care hospitals. Patient data are collected at registration using each healthcare facility's standard data entry workflow, so healthcare service providers are not required to do extra work. Data collected include patient age and sex, first 5 digits of postal code, time and date, and symptoms. Each patient visit is categorized using natural language processing (see below) into a **syndrome** (a predefined grouping of symptoms). Syndromes of public health interest are monitored for abnormal numbers of patients in comparison to historical baselines (or background patient counts). When counts are higher than expected, ACES sends automated alerts to epidemiologists at public health agencies and hospitals for local analysis, investigation, and action. Identifying an outbreak early can lead to early intervention and harm reduction.

Natural language processing (NLP) is used to categorize patient records into syndromes based on the words or phrases in the chief complaints (text description of the patient's symptoms). NLP algorithms are developed by a team of content experts (acute care physicians and epidemiologists) that manually classify a large dataset of patient triage records into syndromes based on the chief complaint. Next, the resulting algorithm's performance is tested with different data sets—training and testing is repeated until the system performs within acceptable parameters. The algorithms do not rely on key word searches, but rather probabilistic decisions based on attaching learned weighted values to each word, part of word, or phrase in the chief complaint. A common example of NLP algorithms are the spam filters for email applications. The performance of each syndrome is validated yearly against diagnostic hospital records.

ED visits in all participating Ontario hospitals for the environmental syndrome (heat exposure) for the summer months of 2018.

No. of ED Visits

07-May-18 18-June-18 20-July-18 21-August-18

Location of healthcare facilities partnered with ACES.

Sample Syndromes:

ENVIRO (exposure to extreme temperatures) ◆ **GASTRO** (gastroenteritis)
ILI (influenza-like illness) ◆ **OPIOID** (withdrawal, overdose)
RESP (respiratory ailments) ◆ **TICK** (tick bites) ◆ **TOX** (chemical or drug exposure)
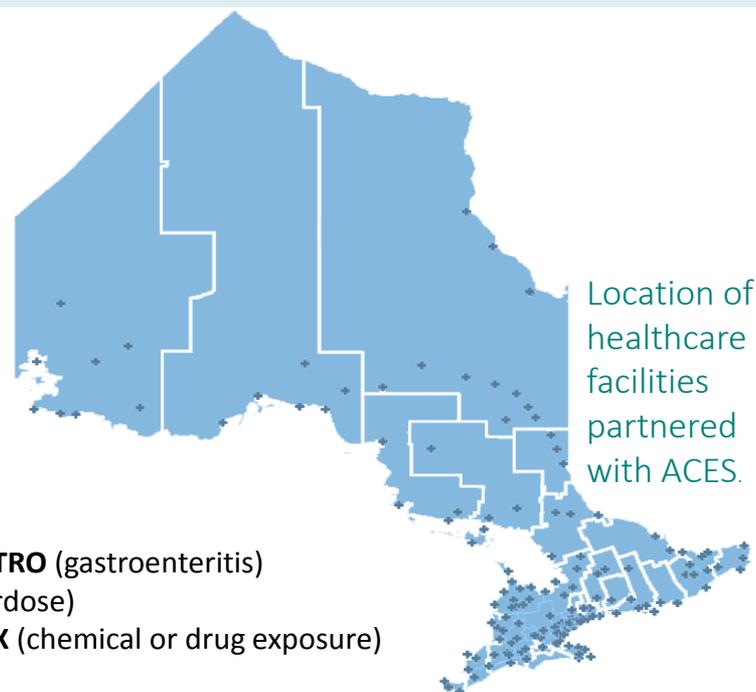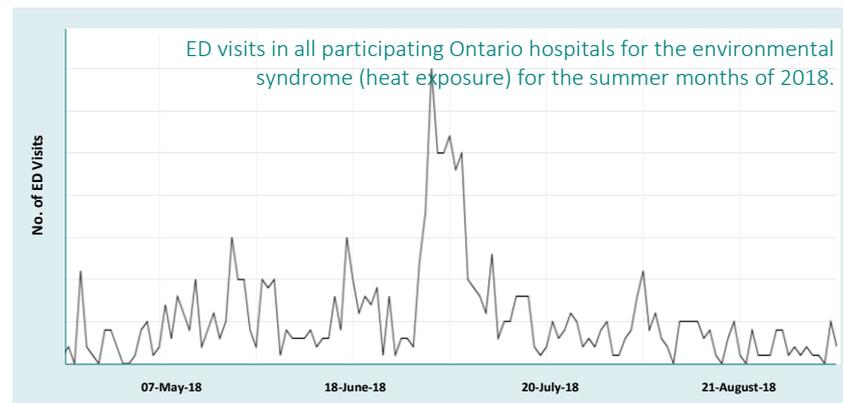
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