Monitoring Health Impacts of Climate Change:

A GIS Application to Display *Real-Time* Surveillance (Environment, Demographics, Health)

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Knowledge Management

NCCEH April Webinar

26 April 2018

KFL&A Public Health

Agenda

- introduce Kingston team and what we do
- climate change and public health
- **health outcomes**: traditional and syndromic surveillance
- real-time tool for:
  - ✓ 1. situational awareness
  - ✓ 2. emergency preparation

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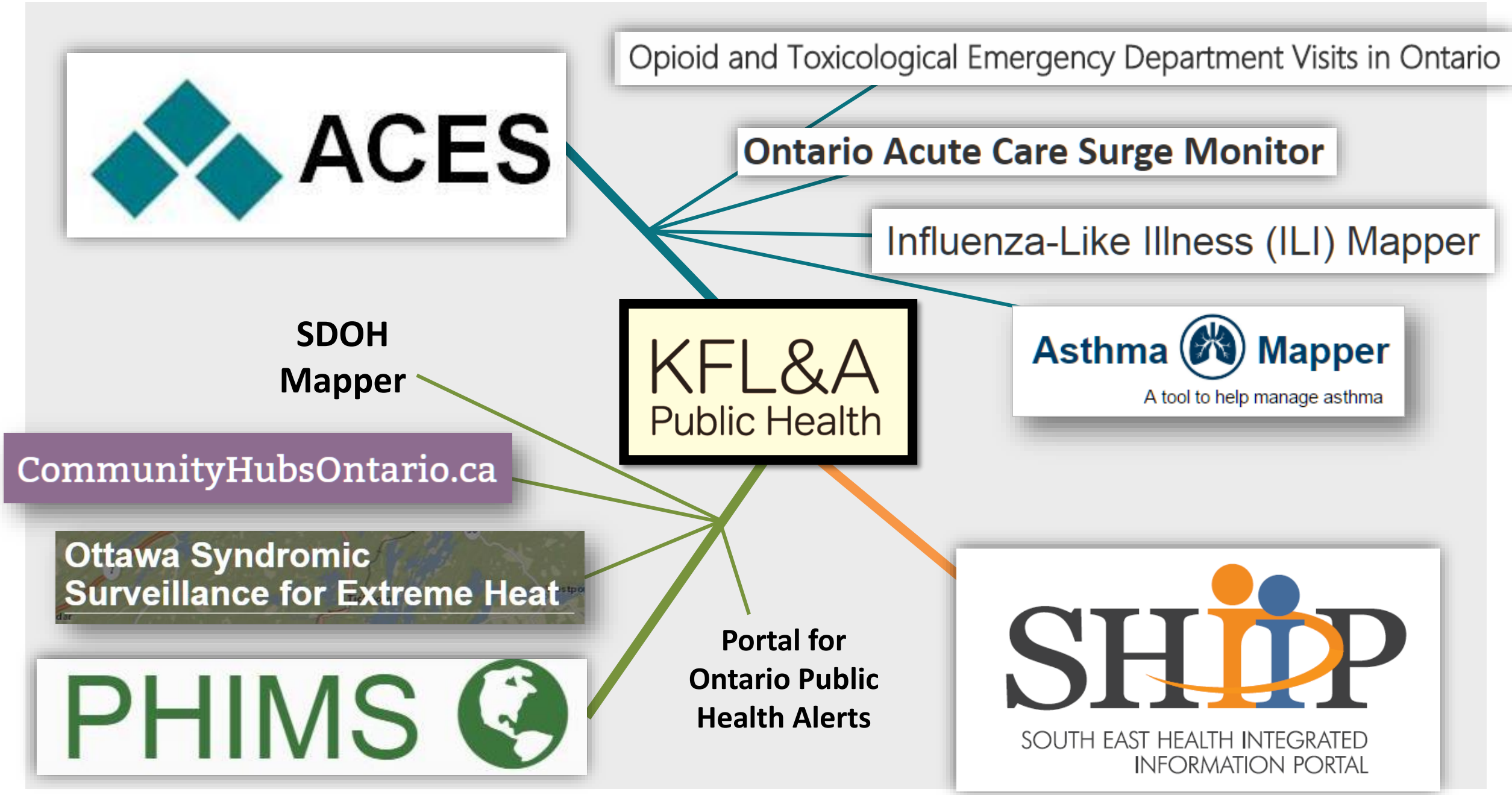
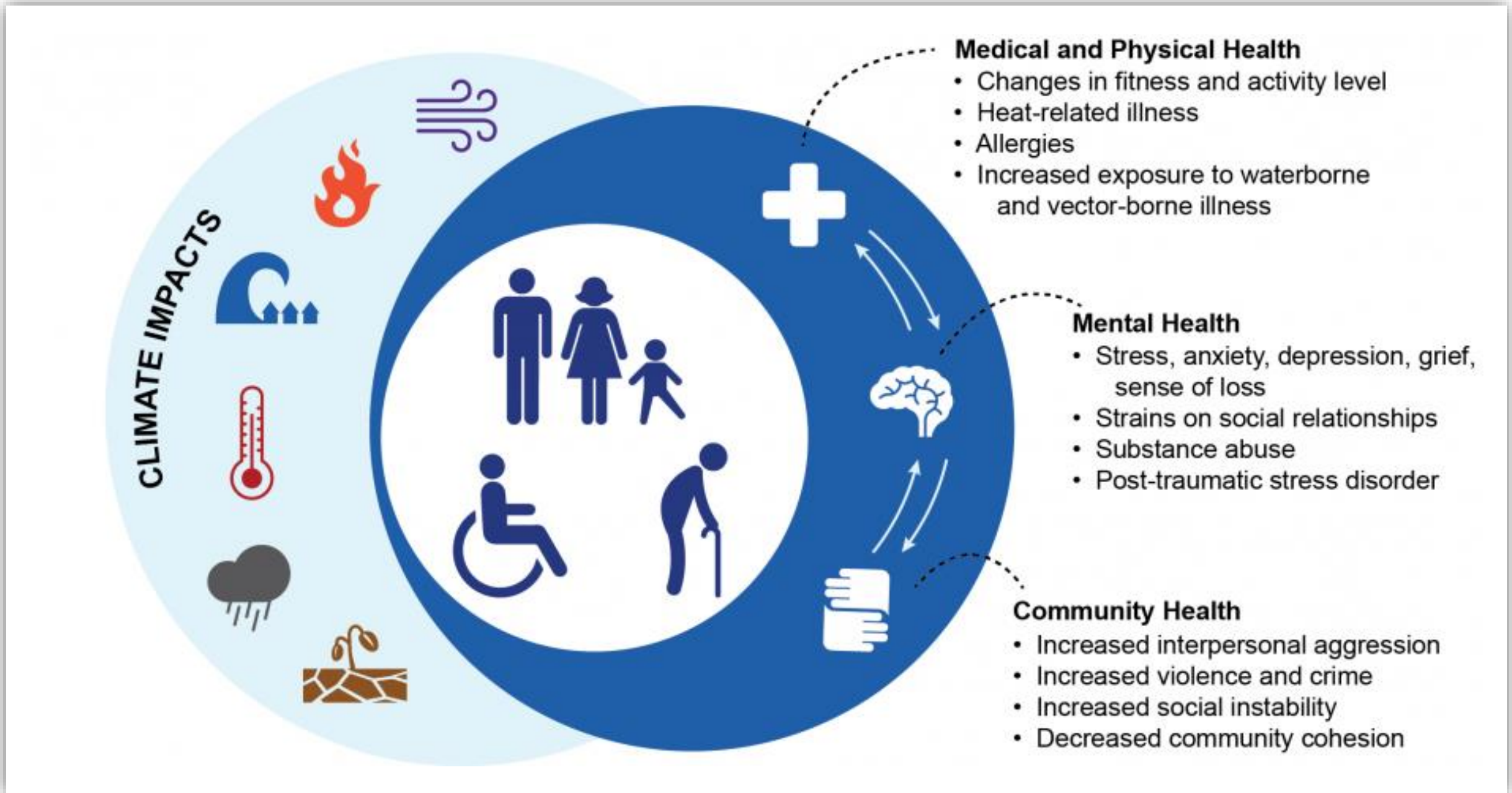

ACES
Opioid and Toxicological Emergency Department Visits in Ontario
Ontario Acute Care Surge Monitor
Influenza-Like Illness (ILI) Mapper
Asthma Mapper
A tool to help manage asthma
SDOH Mapper
KFL&A Public Health
CommunityHubsOntario.ca
Ottawa Syndromic Surveillance for Extreme Heat
PHIMS
Portal for Ontario Public Health Alerts
SHIIP
SOUTH EAST HEALTH INTEGRATED INFORMATION PORTAL



Source: USCRP, 2016: *Impacts of Climate Change on Human Health in the United States: A Scientific Assessment;* http://dx.doi.org/10.7930/J0R49NQX

Public Health Approach

1. healthy behaviours
2. healthy communities
3. population health assessment
4. social determinants of health

- **Assessment and Surveillance**
- **Promotion, Protection, Prevention**
- **Emergency Management**

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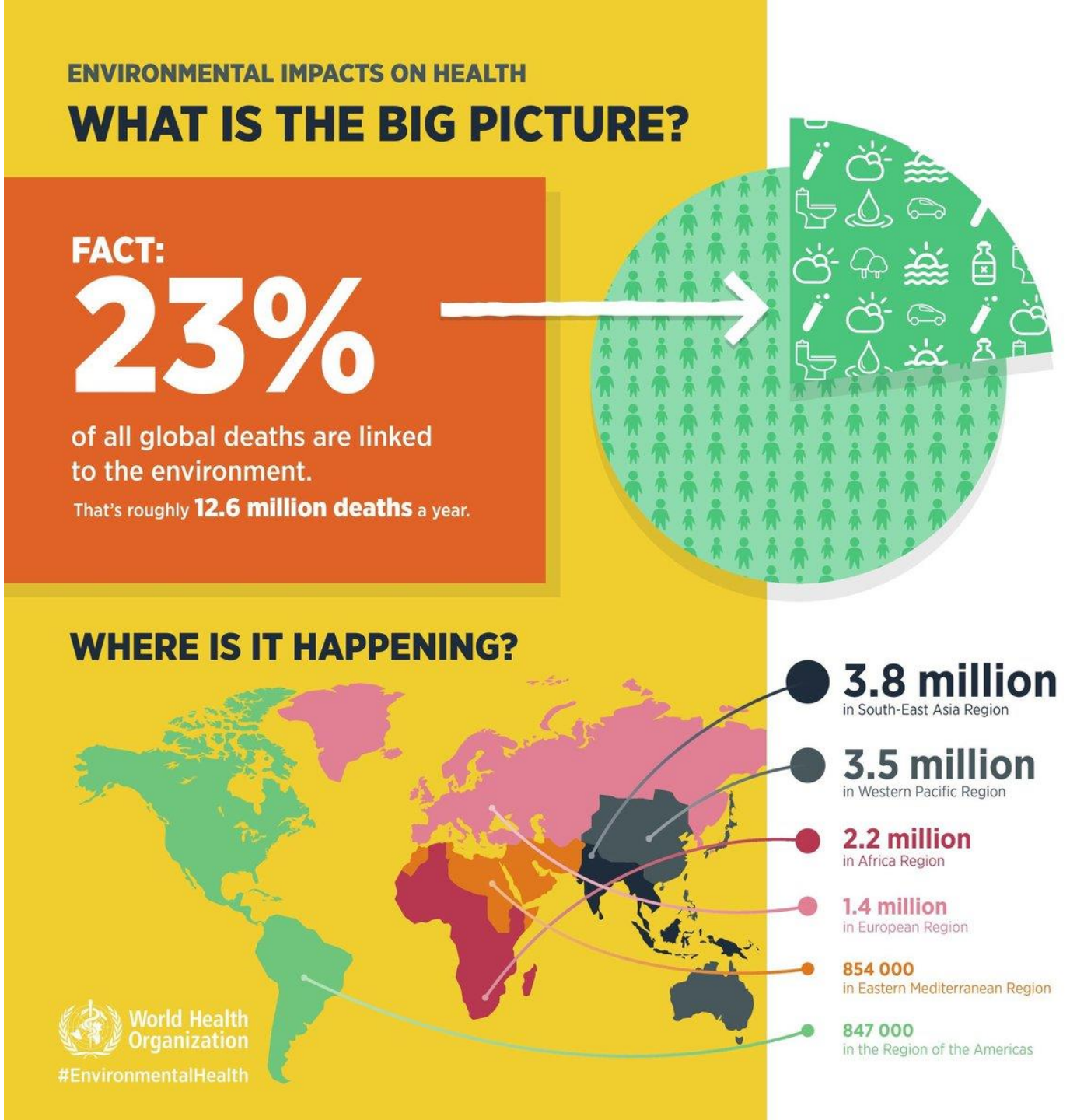
Climate Change and Health

KFL&A PH Surveillance Initiatives:

- health outcomes: syndromic surveillance, traditional surveillance
- climate change health indicators
  - ✓ extreme temperature
  - ✓ air quality
  - ✓ flood risk
- real-time situational awareness
- emergency preparedness



Public Health Surveillance

Public Health Surveillance: ongoing and systematic collection, analysis and dissemination of health-related data with the goal to reduce morbidity and mortality by informing public health action

Syndromic Surveillance: surveillance that uses real (or near-real) time pre-diagnostic data and statistical tools to detect unusual health patterns or signals with the goal of **reducing the time to detect and respond** to outbreaks that will be a public health concern

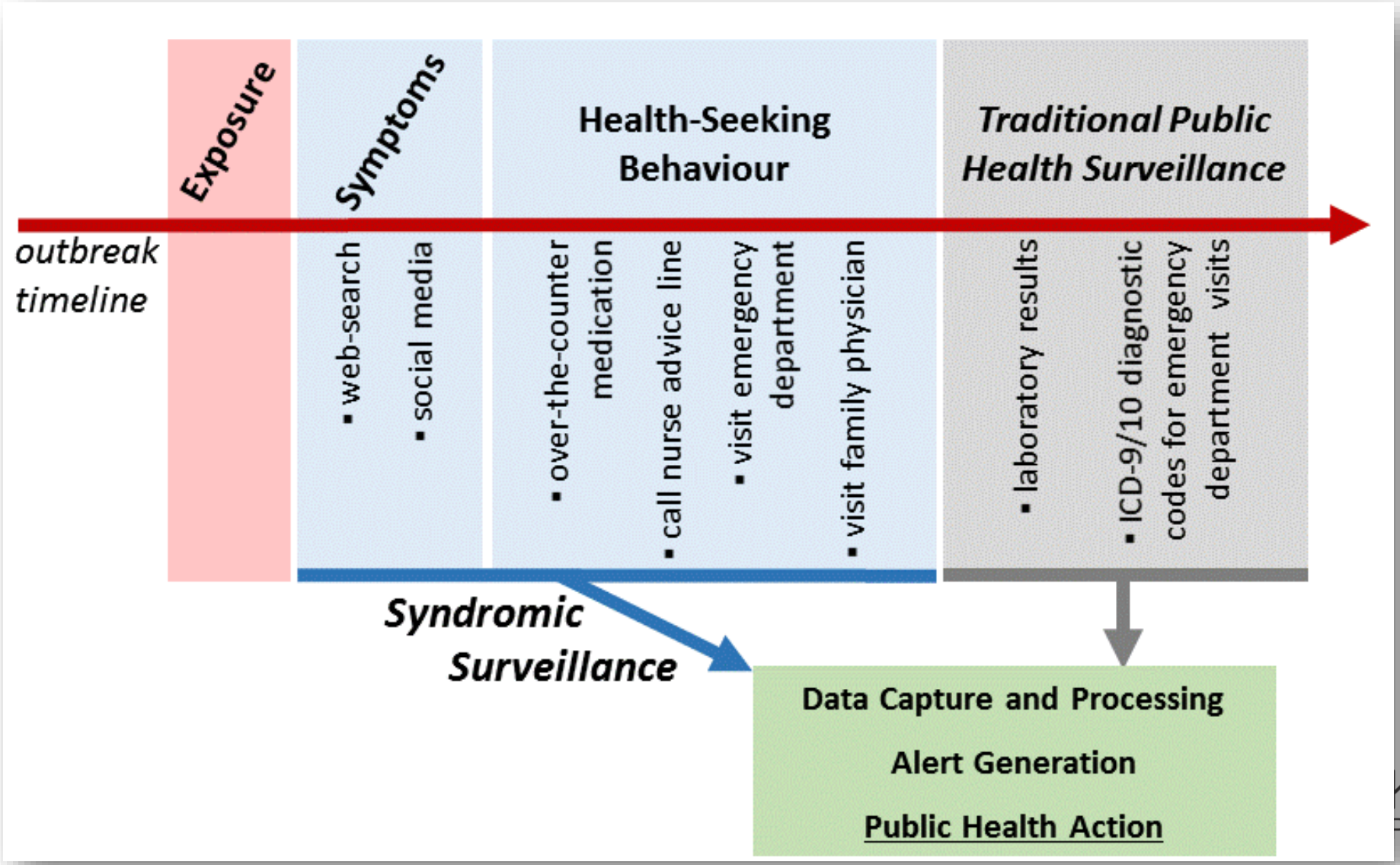
Syndrome: a predefined grouping of symptoms (or health indicators) that may indicate a clinical diagnosis or specific health outcome, but **do not require** laboratory **diagnoses** for confirmation

Public Health Surveillance

	Traditional Surveillance	Syndromic Surveillance
data sources	diagnostic data from case reports, laboratory reports	pre-diagnostic data (e.g., triage, drug sales, school records)
timing	days to weeks	immediate (real time) to hourly or daily (near-real time)
goal	individual cases or clusters of cases, monitor reportable diseases	excess or unusual case counts; bioterrorism; influenza; asthma
data transfer	telephone/fax transfer of records, paper files	automated electronic data transfer

Source: ISDS, 2007

Timeline of Disease Outbreak



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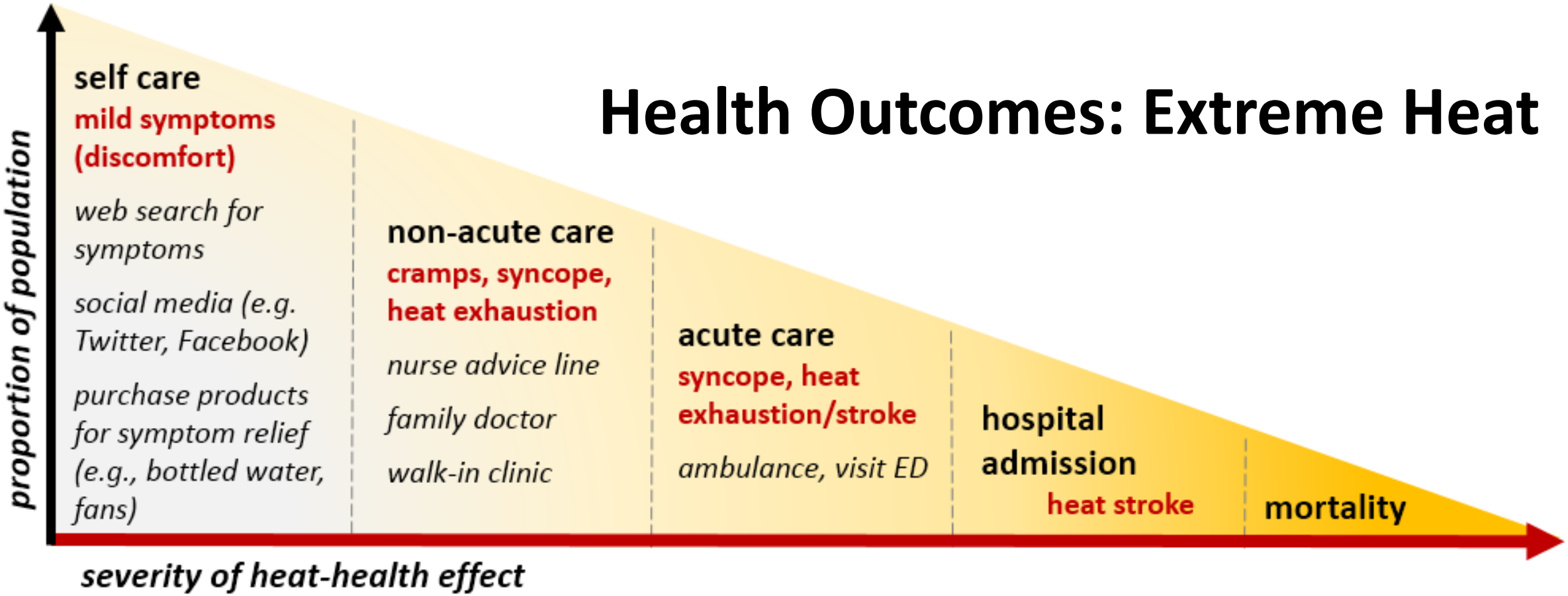
Health Outcomes: Extreme Heat



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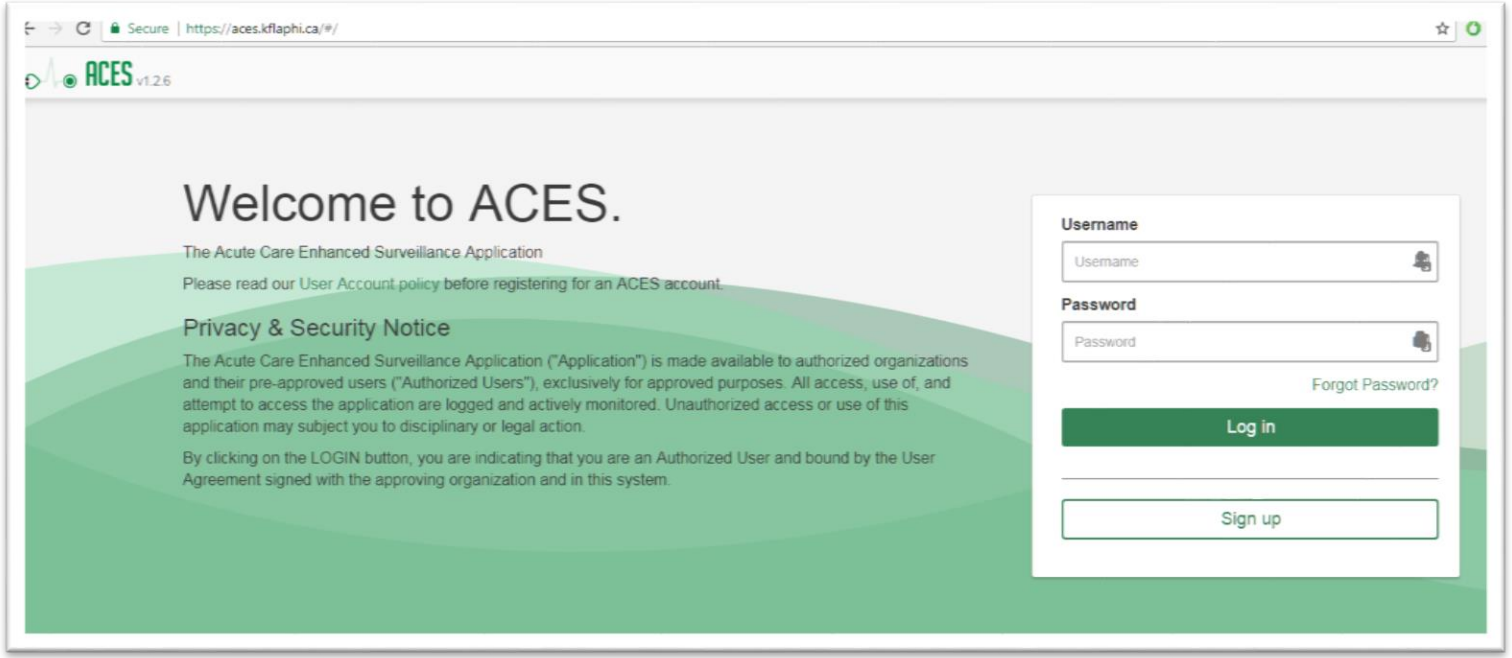
Source: Bassil and Cole, 2010

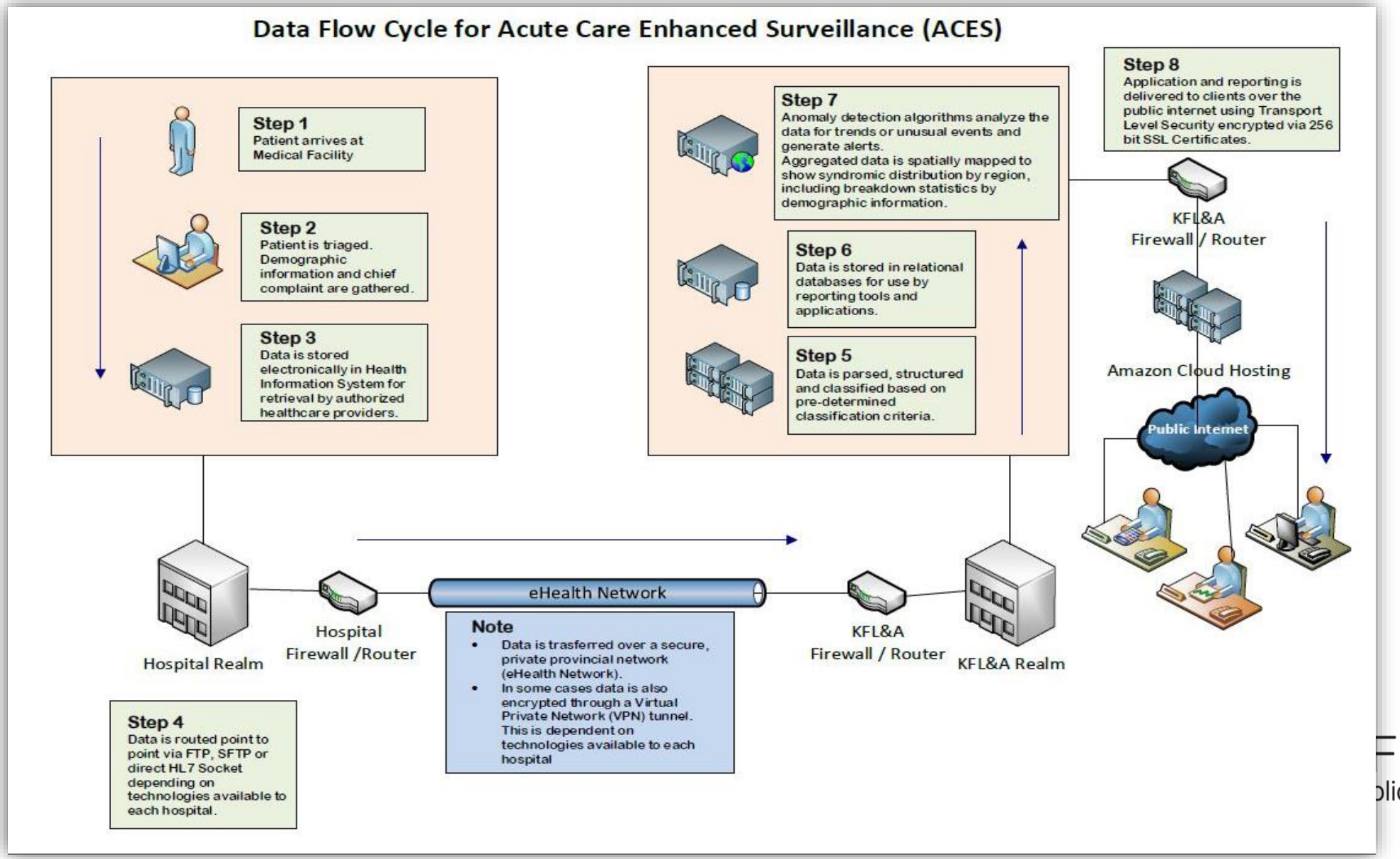
Acute Care Enhanced Surveillance (ACES)

- 161 hospitals participating in Ontario
- collection and analysis of patient data based on disease symptoms (chief complaints), *not* disease diagnosis



- monitor 18,000 ED visits and 3,000 admissions daily
- chief complaints assigned to one of 84 syndromes using natural language processing
- provides real-time surveillance with built-in analytics: volume, demographics, acuity, mapping

ACES Data Flow



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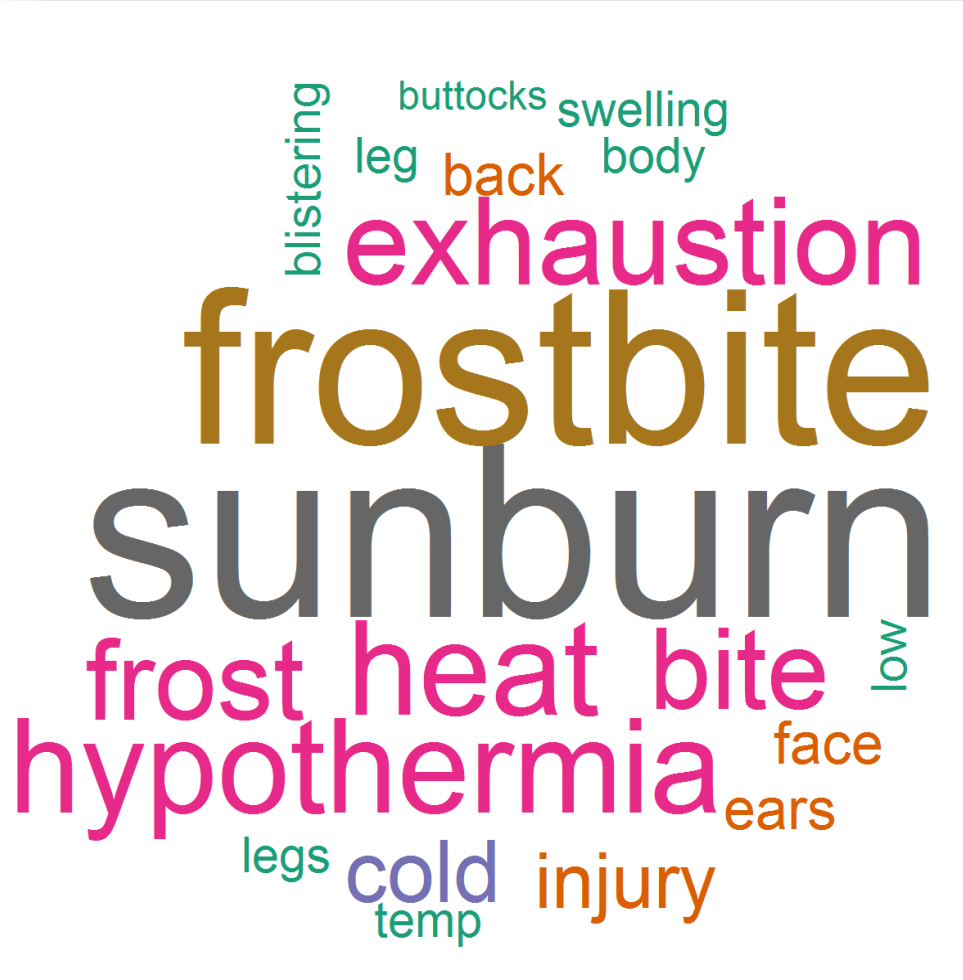
Syndrome Classification



- categorize ED visits into 80+ syndromes
- train sorting algorithms with expert-classified data sets—machine learning techniques, natural language processing
- validate classification with NACRS diagnostic data

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Syndromes

ACES Code	Syndrome Description
ALLERG	allergic reaction, angioe
AST	asthma, wheeze, difficu
BITE	human, animal, bug (nc
BRONCH	bronchiolitis, RSV
BURN	burns –chemical and th
CAD	coronary artery disease
CARD	pericarditis, effusion, m
CDIFF	c difficile
CELL	cellulitis, non wound int
CHF	congestive heart failure
CO	carbon monoxide expos
CONC	concussion, head injury
COPD	chronic obstructive lung
CROUP	croup-PIV
CV	cardiovascular (exclude
DEHY	dehydration
DENT	dental pain, infection, t
DERM	rash, undifferentiated,
DM	diabetes and its compli
ELECT	electrolyte imbalance,
ENT	related to ears nose thr
ENVIRO	heat stroke, heat synco
EOH	alcohol and complicatio damage
FALL	falls undifferentiated
FBI	foreign body ingestion-nose to anus
FEB	febrile neutropenia

ACES Code	Syndrome Descrip
GASTRO	gastroenteritis
GB	Guillain Barre syndrome
GI	GI bleed-upper and low
GMED	general medical admiss
GNSURG	general surgical admissi
GYN	gynecological, bleed, hy
HEAD	undifferentiated headac
HEM	hematological condition
HEP	hepatitis, undifferentiat
ILI	fever, myalgia, undiffer
INF	non specific infections-p
INJ	sprain, strain, laceration
INS	insomnia, sleep disorde
INT	intussecption
LAC	lacerations
MEDREN	medication renewal, re
MEDSE	medication side effect-m
MEN	meningitis and encepha
MH	mental health
MHS	suicidal ideation, attem
MIGR	migraine
NEC	necrotizing fasciitis, sev
NEURO	dementia, Alzheimer's,
NEUS	neurosurgery-aneurysm
NEWB	newborn
OBS	related to obstetrics
ONC	oncology

ACES Code	Syndrome Description
OPI	opioid intoxication, addiction overdose, withdrawal
OPTH	general ophthalmological condition
ORTHF	fracture, non hip
ORTHH	fracture of the femur or hip
ORTHO	orthopedic elective surgery, cast change or assessment
OTHER	null, missing, other
PAIN	pain, undifferentiated, non cancer, radiculopathy, back pain, sciatica
PE	pulmonary embolism, DHT, VTE
PHYSC	physician consultation
PN	pneumonia
PO	post op infection or complication
REN	renal failure, dialysis, renal disease and its complications
REPORT	reportable diseases
RESP	respiratory infection non croup, non bronchiolitis
SEP	bacteremia, SEPSIS
SI	smoke inhalation, chemical, gases
SOC	social admission
TEST	test results, blood or diagnostic imaging, xray, US, biopsy,transfusion, tube change
THOR	thoracic, pneumothorax
TICKS	ticks
TOX	toxicology-not alcohol or opioids, withdrawal, substance abuse, chemical exposure
TRMVC	trauma from a MVC/ATV
TRO	trauma from another means, fall etc.
TRW	gunshot or stab, violence, assault
TRS	sexual assault, rape
URO	urological -stones, prostate, UTI
VOM	vomiting-alone-NORO like illness, not secondary to chemo or with other symptoms

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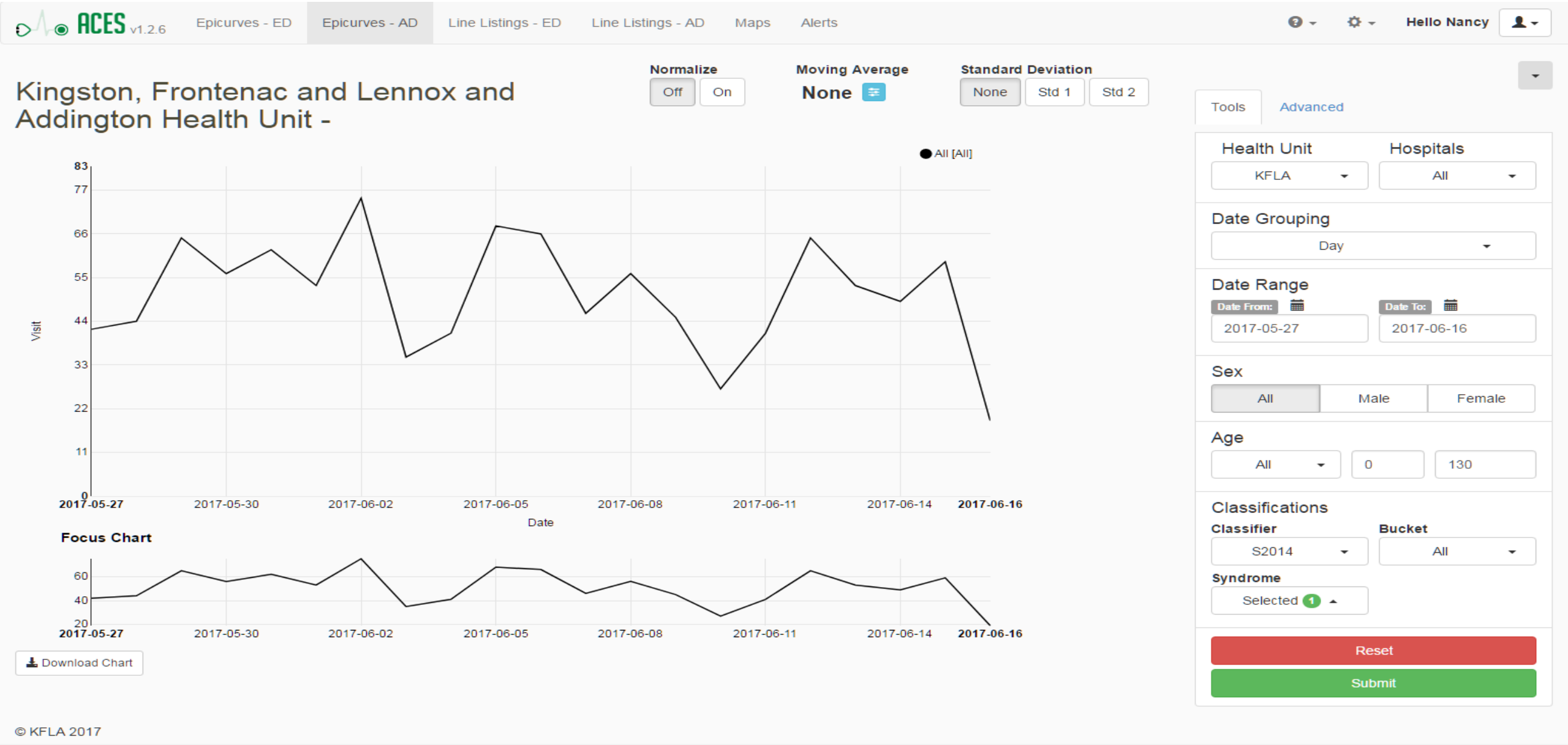
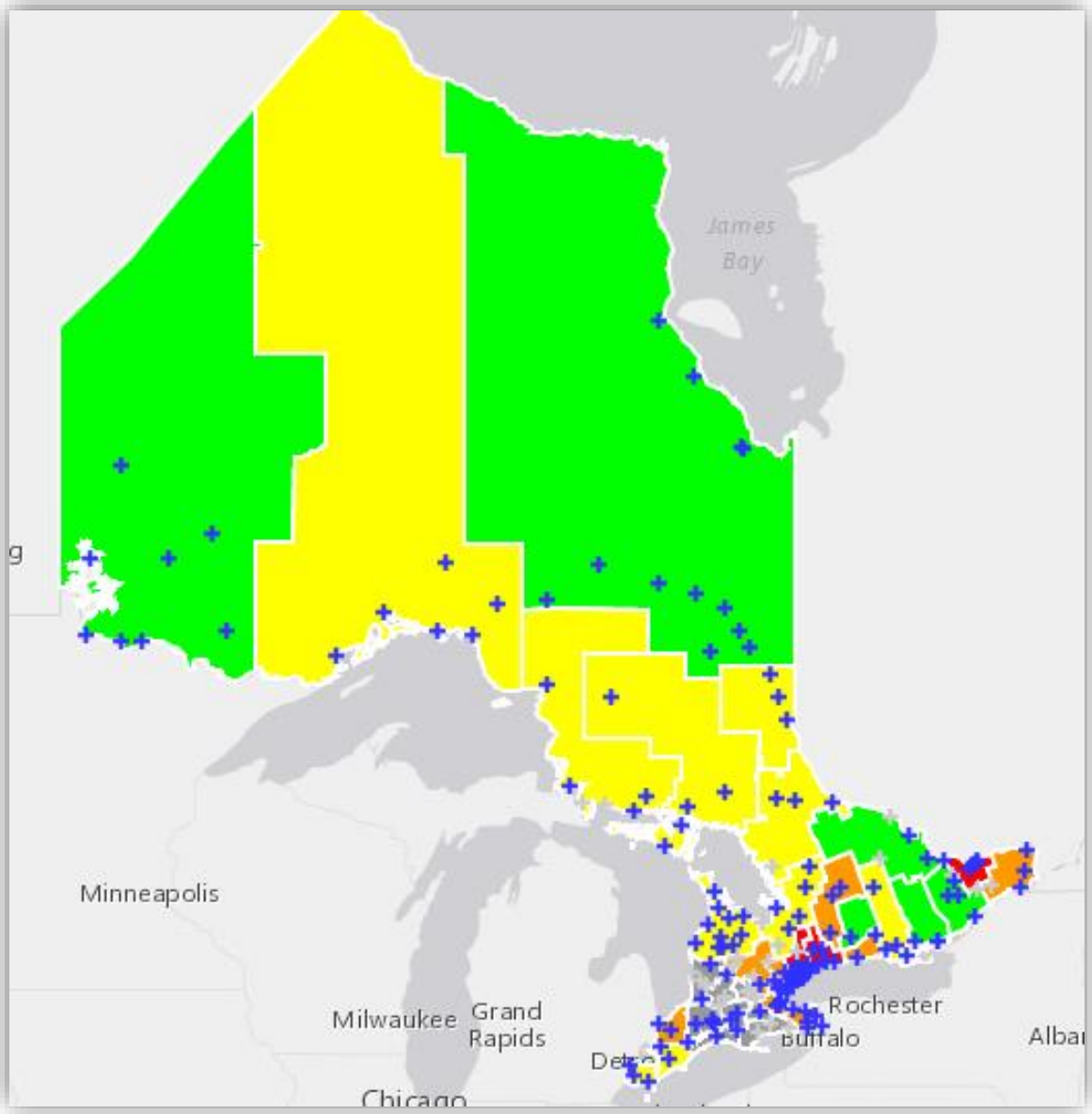
ACES (admissions)

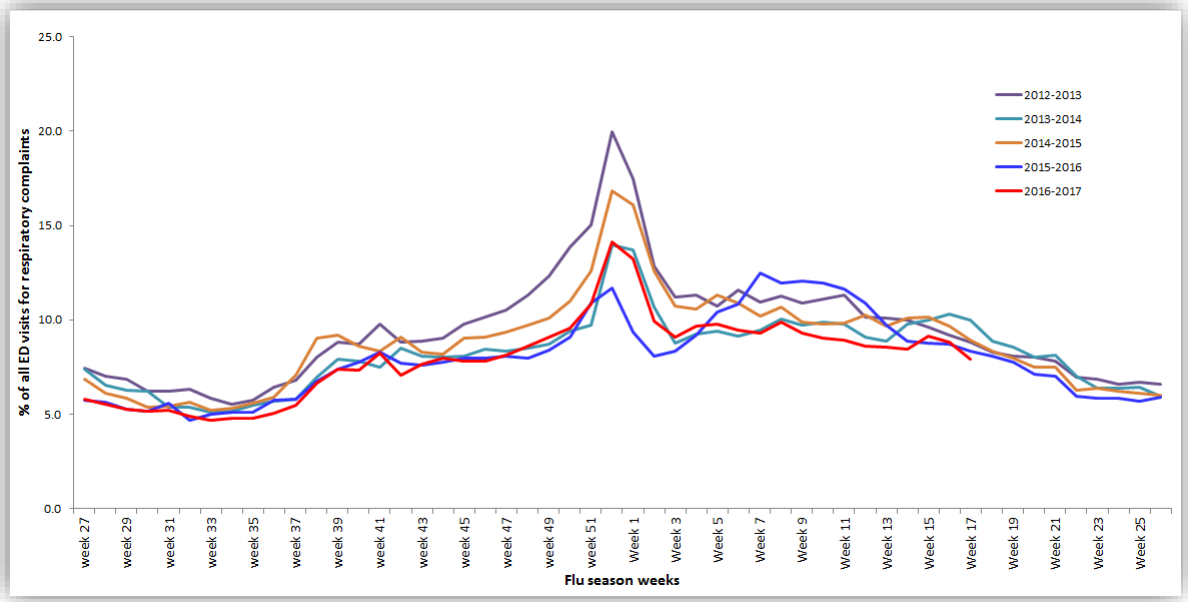




http://mapper.kflaphi.ca/ilimapper/

Overall Activity Levels for ILI in Ontario

Ontario	Date	Status	Activity Level in ACES
2 Weeks Ago	Dec. 18 to Dec. 24		Seasonal/Expected
This Past Week	Dec. 25 to Dec. 31		Elevated
Next Week (Projection)	Jan. 01 to Jan. 07		Elevated

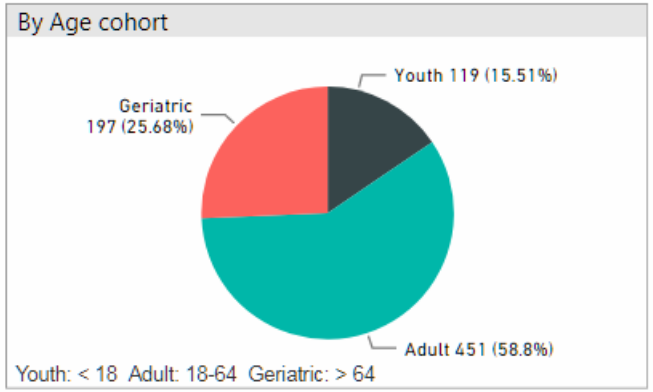


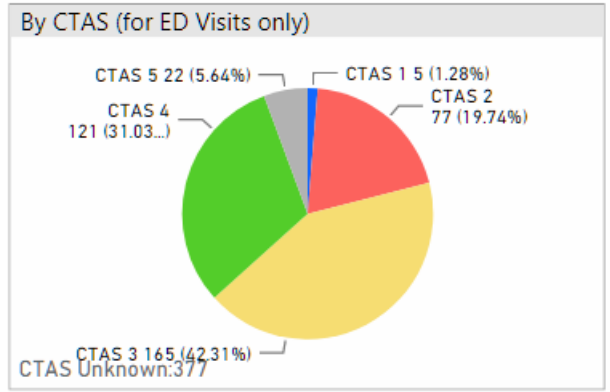
Ontario Acute Care Surge Monitor

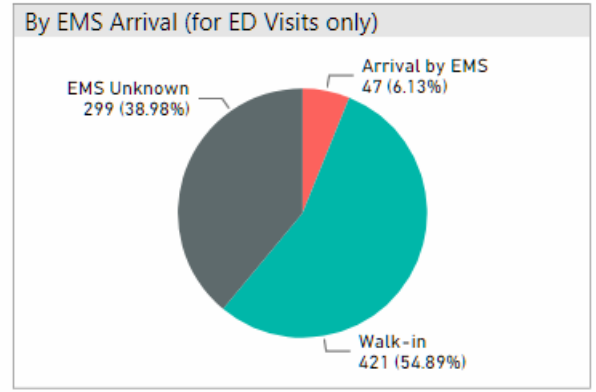
Last updated: 2017-11-17 10:00

Number of hospitals	Number of Patients in Last hour	Number of Patients in Last 24 Hours
141	767	14753

Number of visits / admissions, Last hour







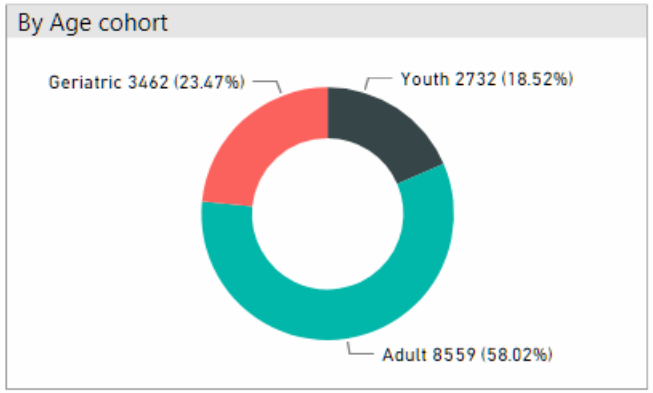
ED Visits

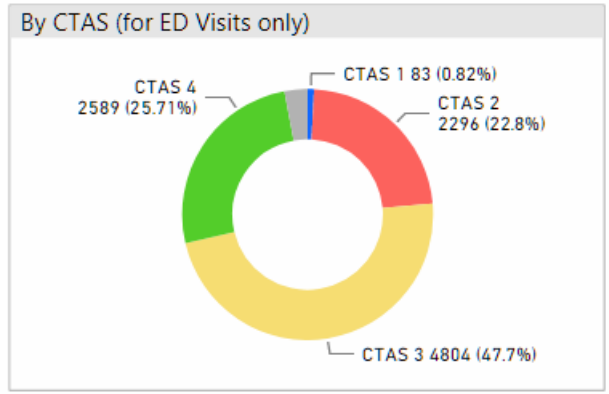
All Admissions

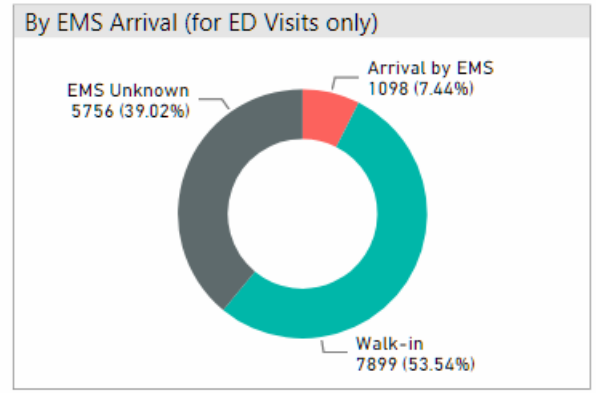
Emergent Admissions

Elective Admissions

Number of visits / admissions, Last 24 hours

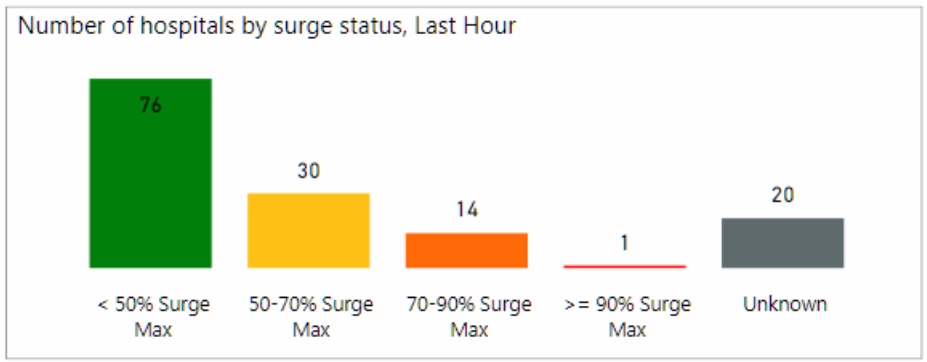




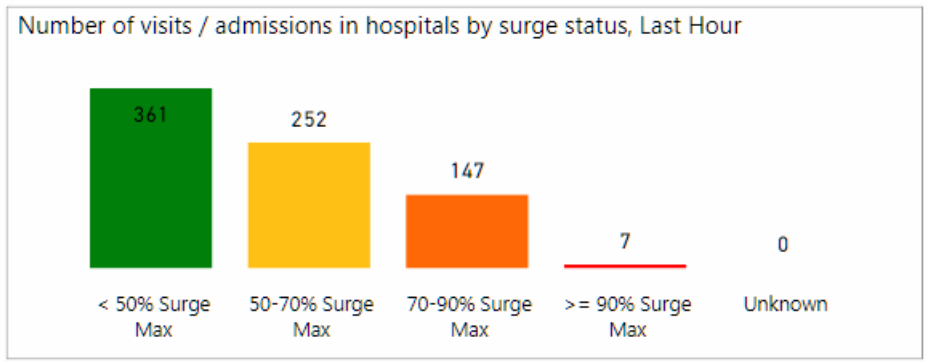


Hospital
(AAA 3511) Arnprior and District Memorial Hospital
(AGH 3513) Anson General Hospital
(AH 3502) Alexandra Hospital (LHSC)
(APG 3509) Rouge Valley Ajax and Pickering
(ATGH 3514) Atikokan General Hospital
(BCH 3505) William Osler Health System – Brampton Civic Hospit
(BCHS 3504) Brantford General Hospital
(BGH 3510) Quinte Health Care – Belleville General Hospital
(BMH 3513) Bingham Memorial Hospital
(BRGH 3510) Brockville General Hospital
(BRH 3513) Blind River Hospital
(BRSH 3512) Muskoka Algonquin Healthcare – South Muskoka M
(BWH 3501) Bluewater Health – Sarnia Campus
(BWHP 3501) Bluewater Health – Petrolia Campus
(CAMH 3503) Cambridge Memorial Hospital
(CCC 3511) Carleton Place and District Memorial Hospital
(CCH 3511) Cornwall Community Hospital
(CGMH 3512) Collingwood General and Marine Hospital
(CHEO 3511) Children's Hospital of Eastern Ontario
(CHS 3513) Chapleau General Hospital
(CKHA 3501) Chatham-Kent Health Alliance Chatham Campus
(CKHAW 3501) Chatham-Kent Health Alliance Sydenham Campus

Number of hospitals by surge status, Last Hour



Number of visits / admissions in hospitals by surge status, Last Hour



* Status unknown: Data not available in real time

Click below between < > to select page

Opioid and Toxicological Emergency Department Visits in Ontario

Last updated: 2017-10-12 00:06

ACES | NACRS | Opioid | Toxicology

Number of Visits
2977

Note: Click box to select a filter (hold CTRL while clicking to select multiple boxes). Click again to deselect a filter. If no filter is selected, charts display all historic data available.

Year: 2010, 2011, 2012, 2013, 2014, 2015

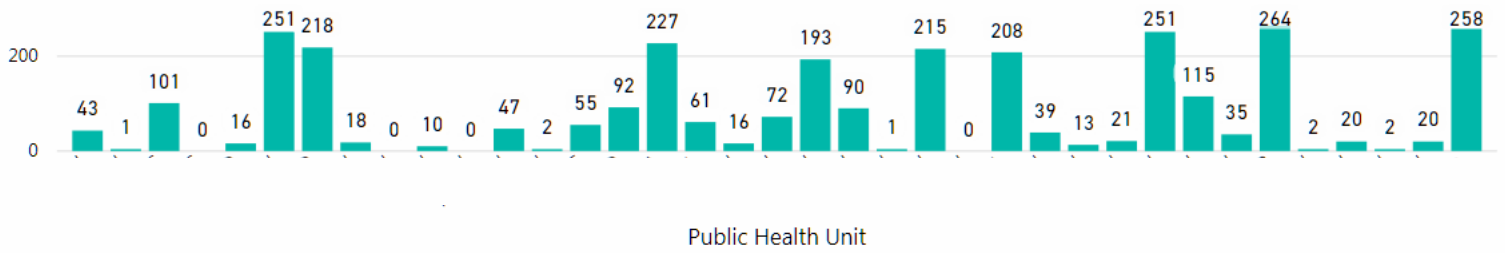
Gender: Female, Male, Other

Age Group: 0-14, 15-24, 25-44, 45-64, 65+, Unknown

Public Health Unit: All

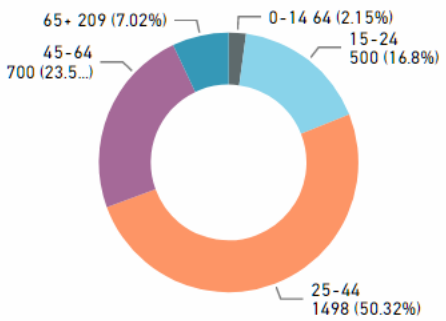
LHIN: All

Number of Visits by Patient PHU

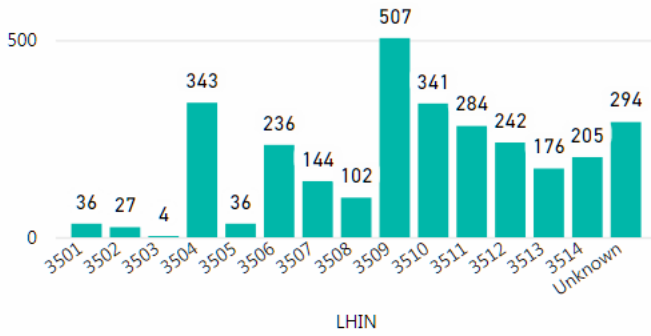


Click arrows at top left corner of each epi-curve to toggle between Day, Month, Quarter, and Year groupings

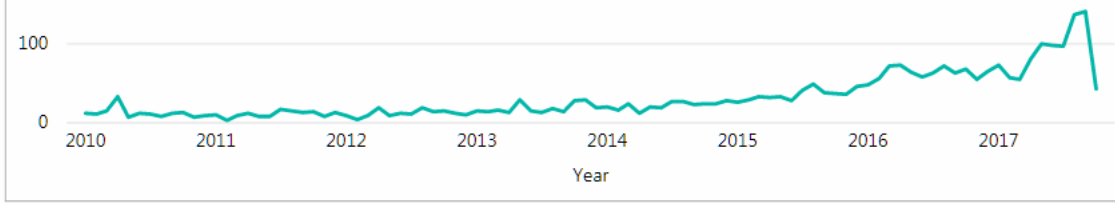
Number of Visits by Age Group



Number of Visits by Patient LHIN

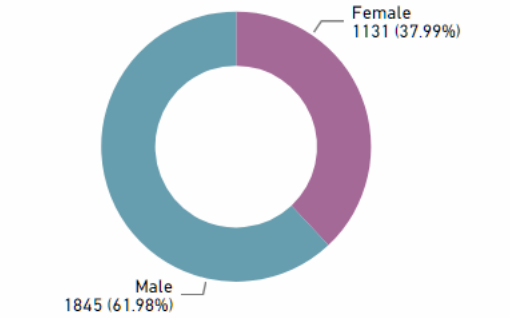


Number of Visits by Year, Quarter and Month

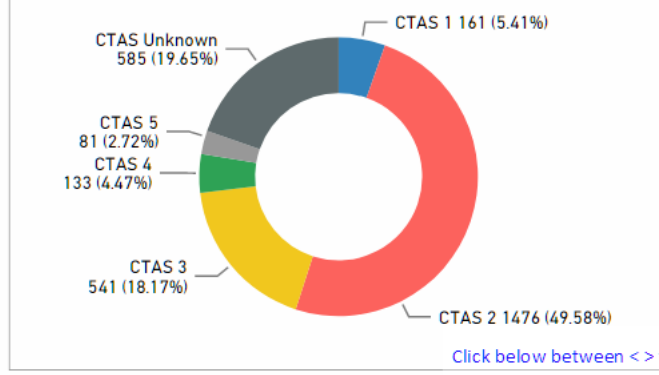


Rate per 100,000 Population and Population by Year, Quarter and Month

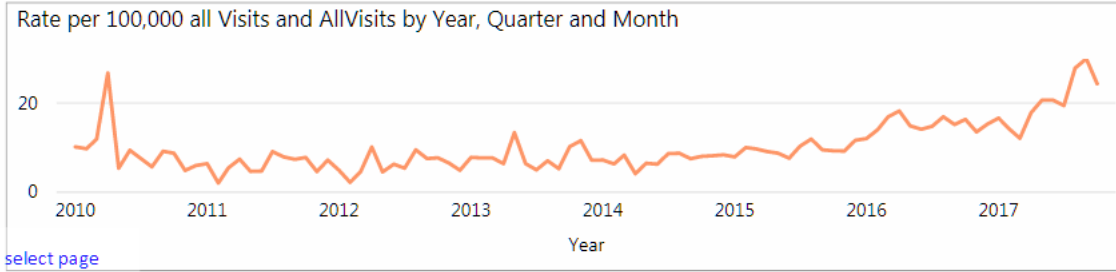
Number of Visits by Gender



Number of Visits by CTAS



Rate per 100,000 all Visits and AllVisits by Year, Quarter and Month



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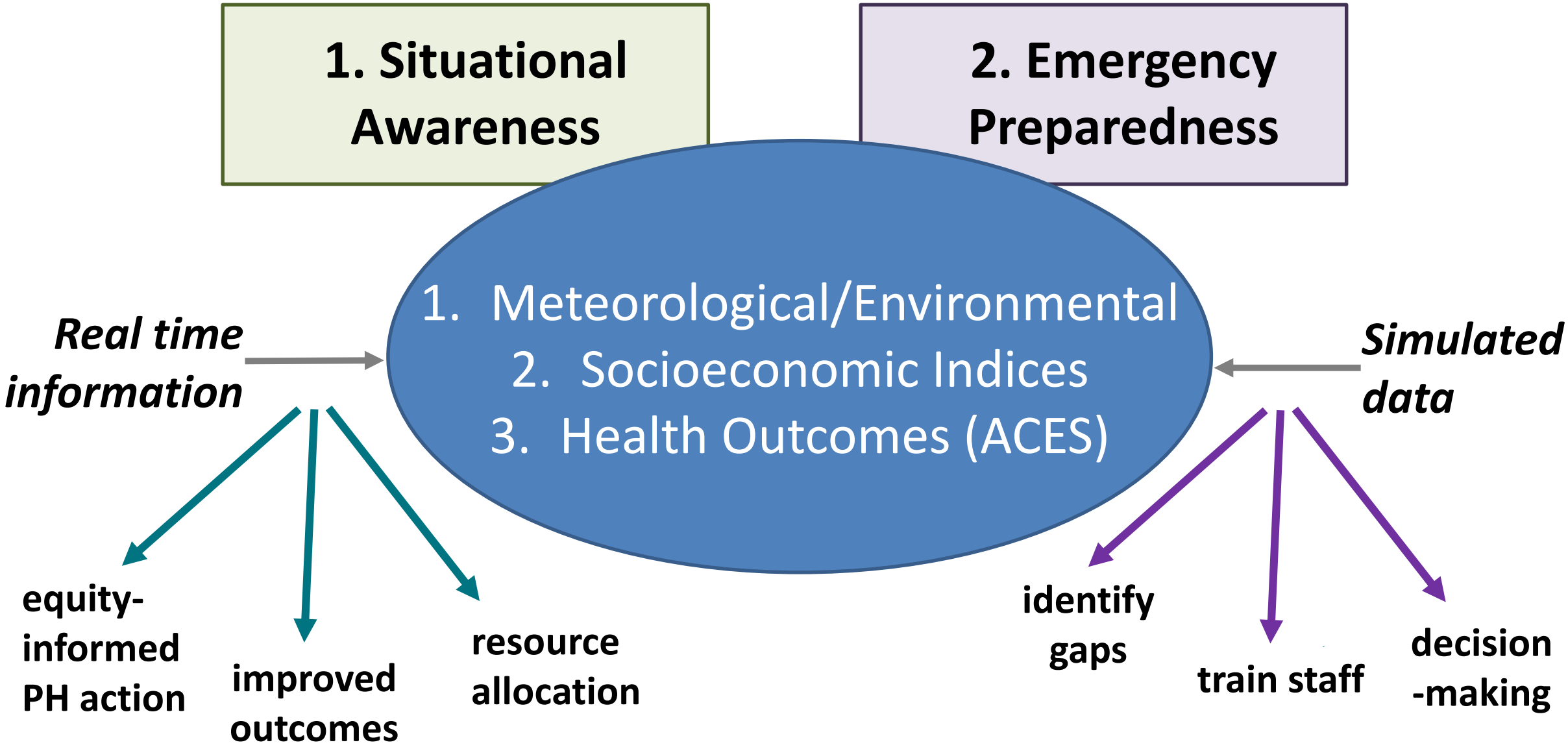
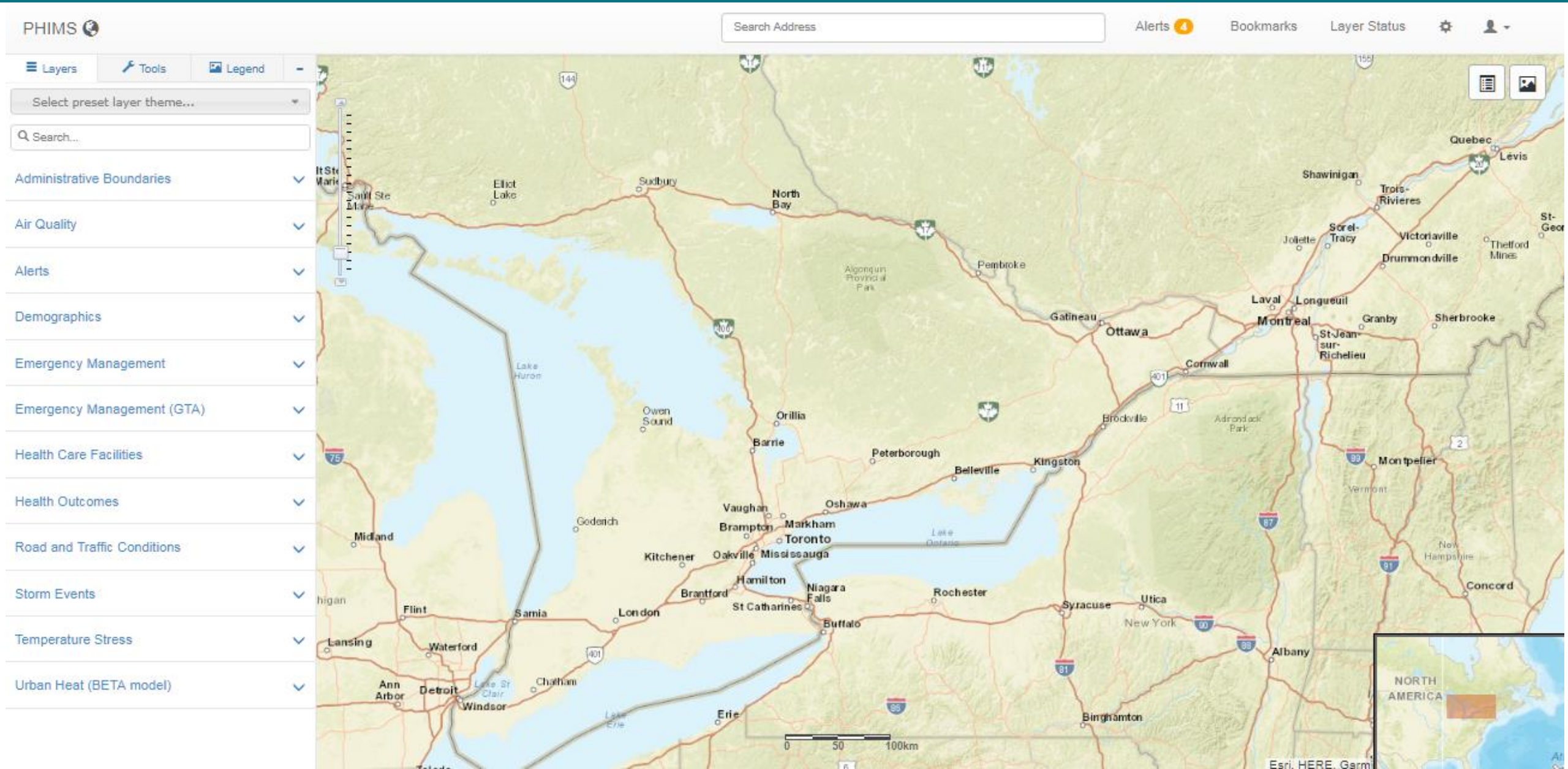
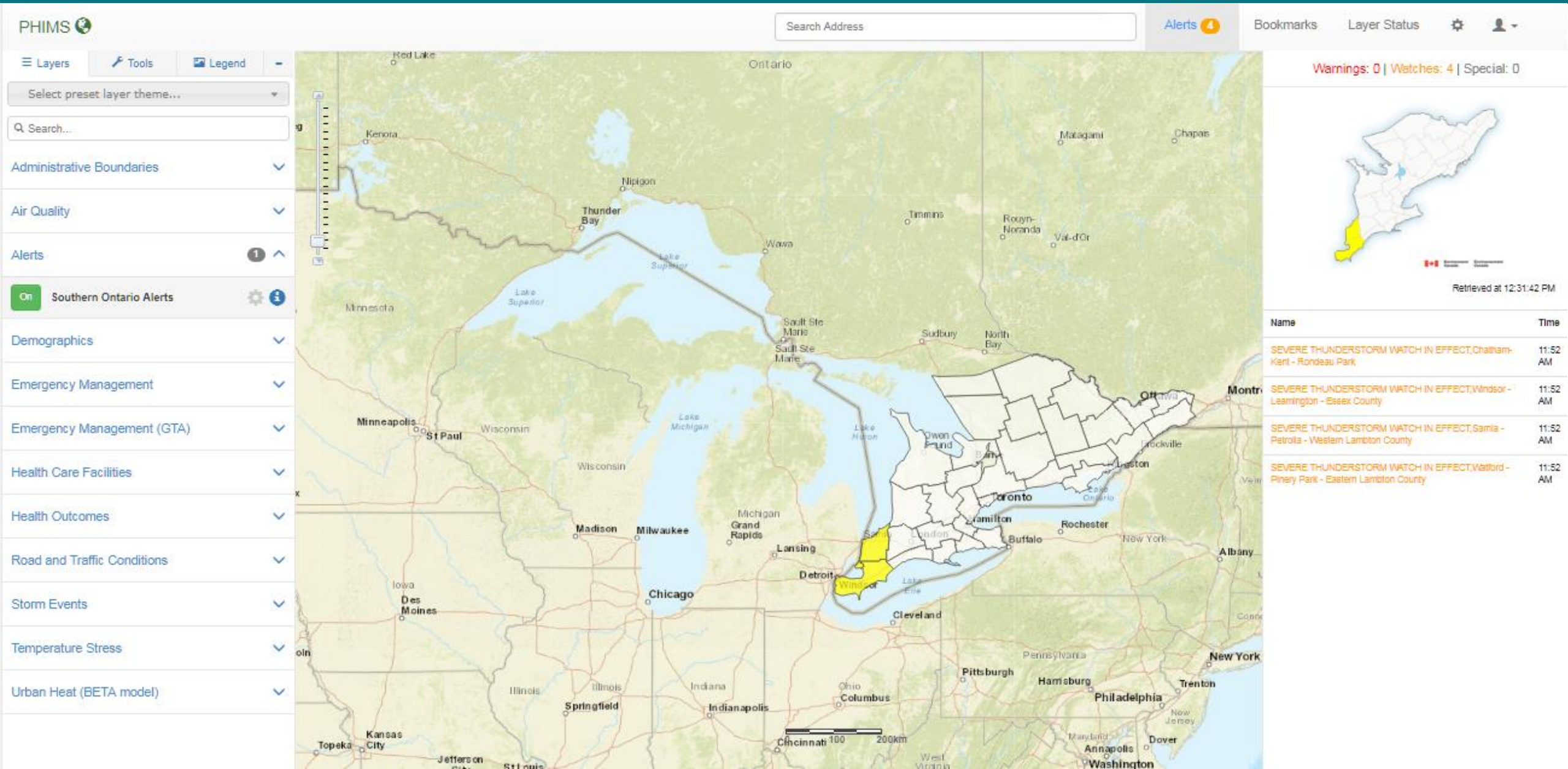
Surveillance of Climate Change Health Impacts



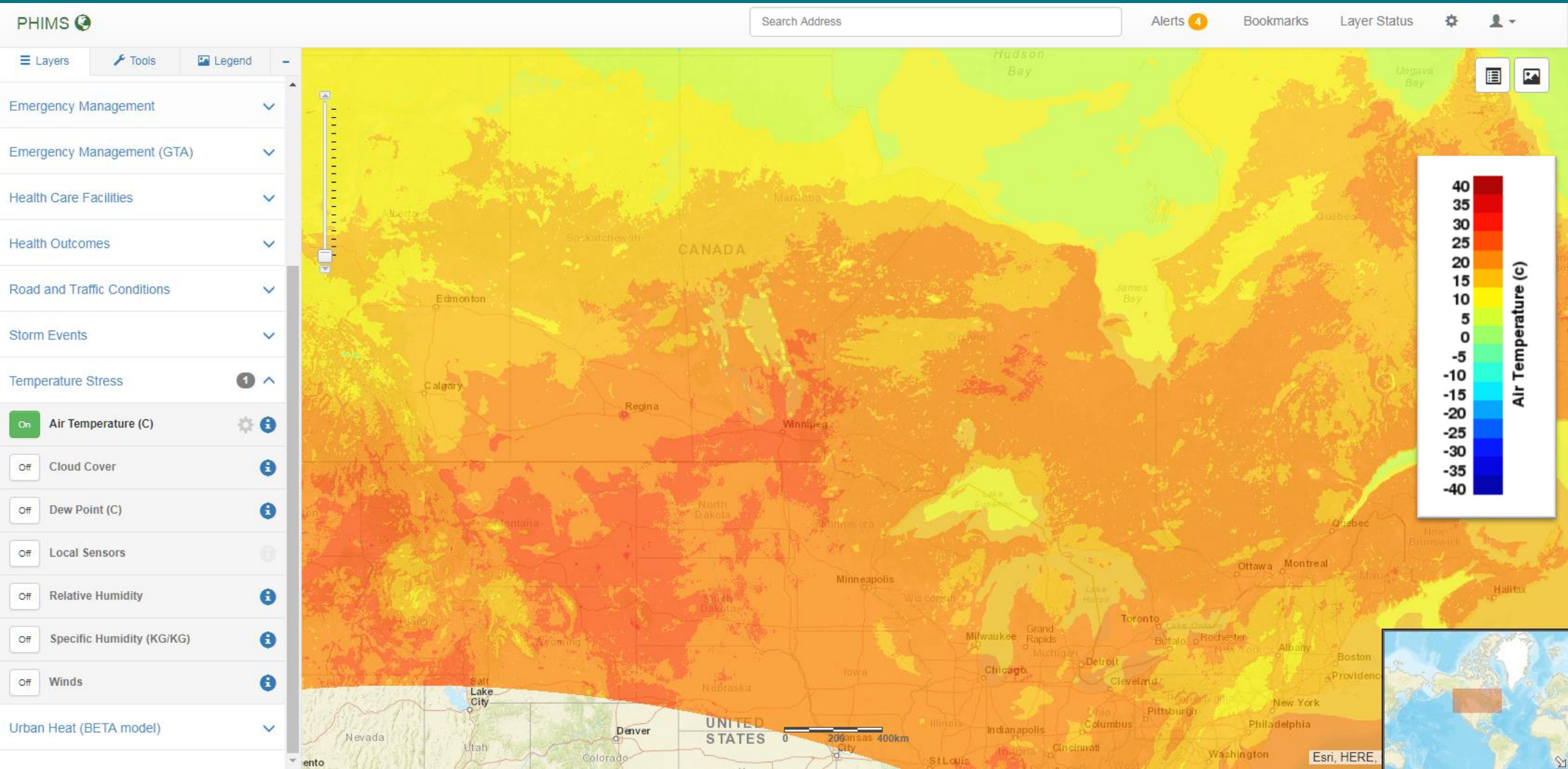
Public Health Information Management System (PHIMS)



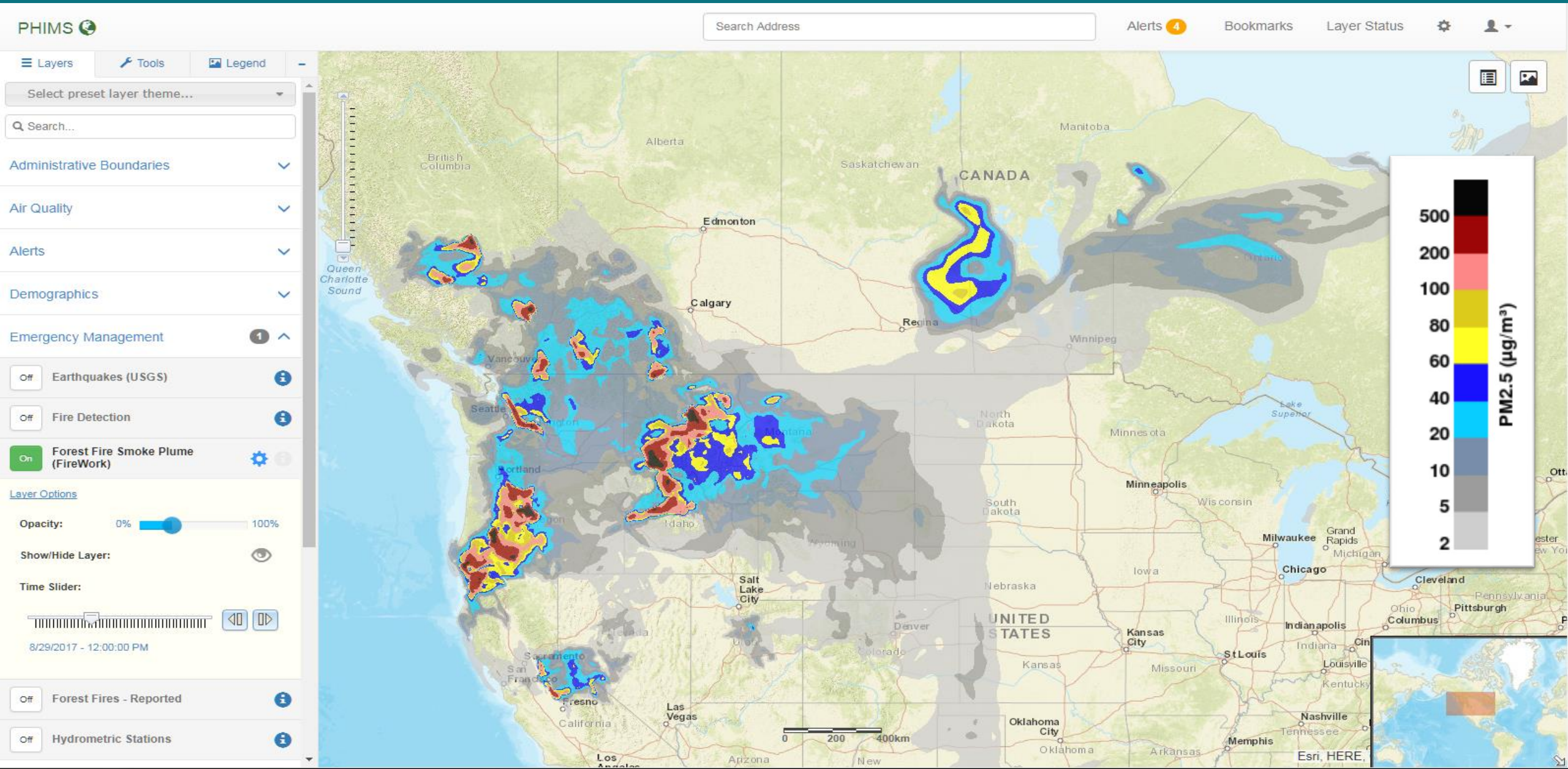
Environment Canada Alerts



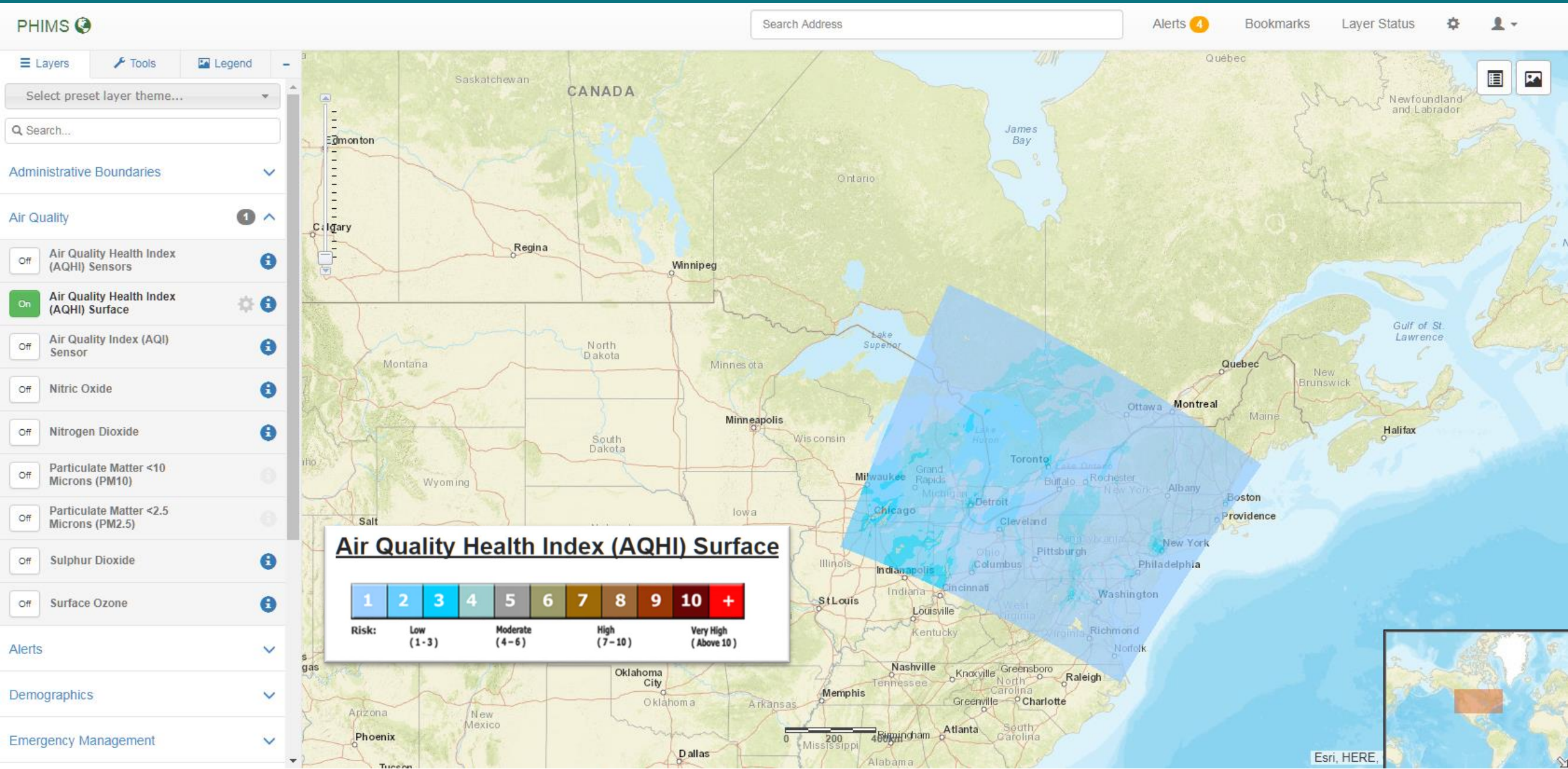
Air Temperature



Fire Detection (FireWork)



AQHI


PHIMS
Search Address
Alerts 4
Bookmarks
Layer Status
Layers
Tools
Legend
Select preset layer theme...
Search...
Administrative Boundaries
Air Quality 1
Off Air Quality Health Index (AQHI) Sensors
On Air Quality Health Index (AQHI) Surface
Off Air Quality Index (AQI) Sensor
Off Nitric Oxide
Off Nitrogen Dioxide
Off Particulate Matter <10 Microns (PM10)
Off Particulate Matter <2.5 Microns (PM2.5)
Off Sulphur Dioxide
Off Surface Ozone
Alerts
Demographics
Emergency Management
Air Quality Health Index (AQHI) Surface
1 2 3 4 5 6 7 8 9 10 +
Risk:
Low (1-3)
Moderate (4-6)
High (7-10)
Very High (Above 10)
CANADA
Saskatchewan
Québec
Newfoundland and Labrador
James Bay
Ontario
Edmonton
Calgary
Regina
Winnipeg
Montana
North Dakota
Minnesota
Lake Superior
Gulf of St. Lawrence
Quebec
New Brunswick
Ottawa
Montreal
Maine
Halifax
Minneapolis
South Dakota
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Albany
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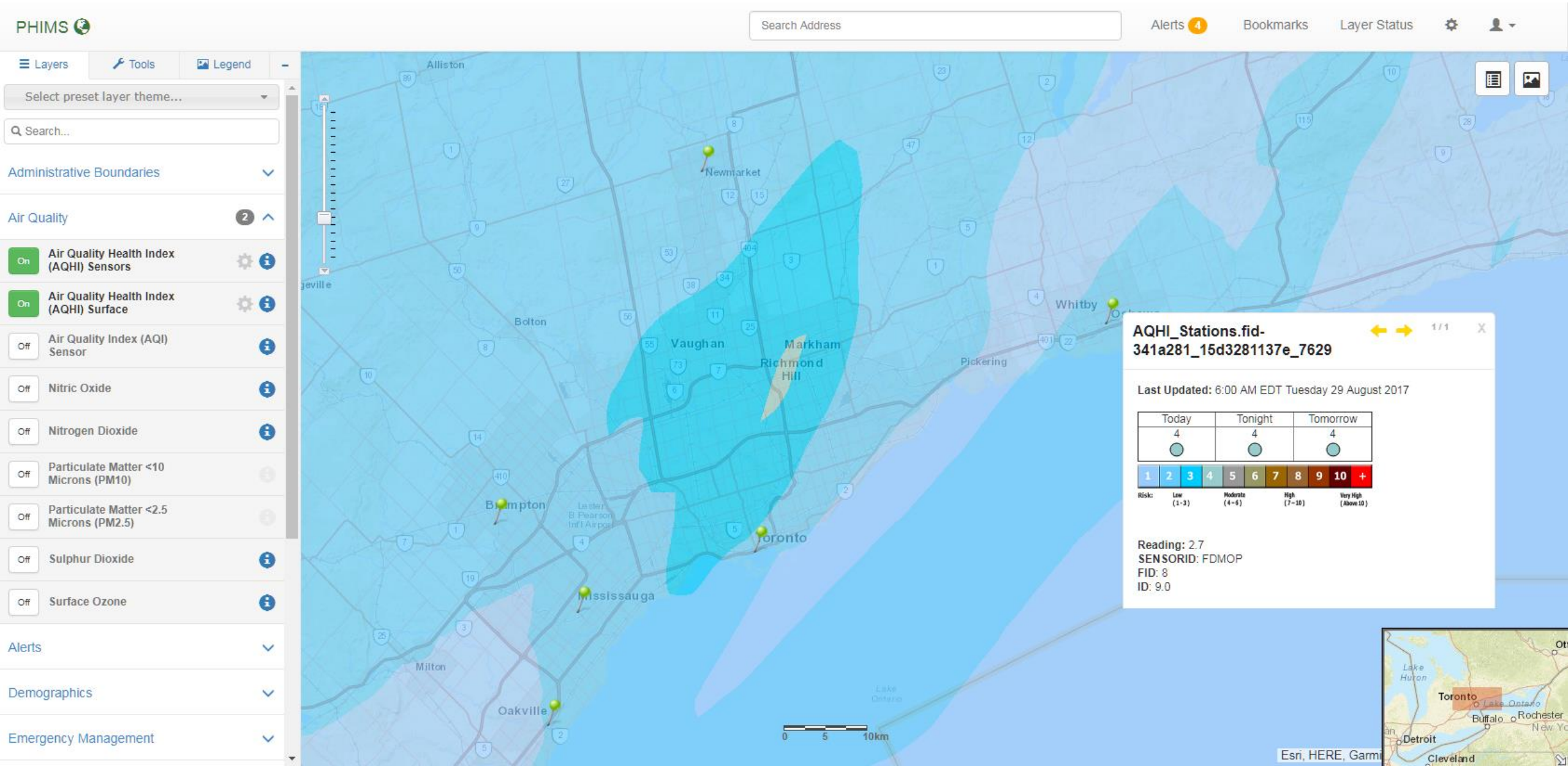
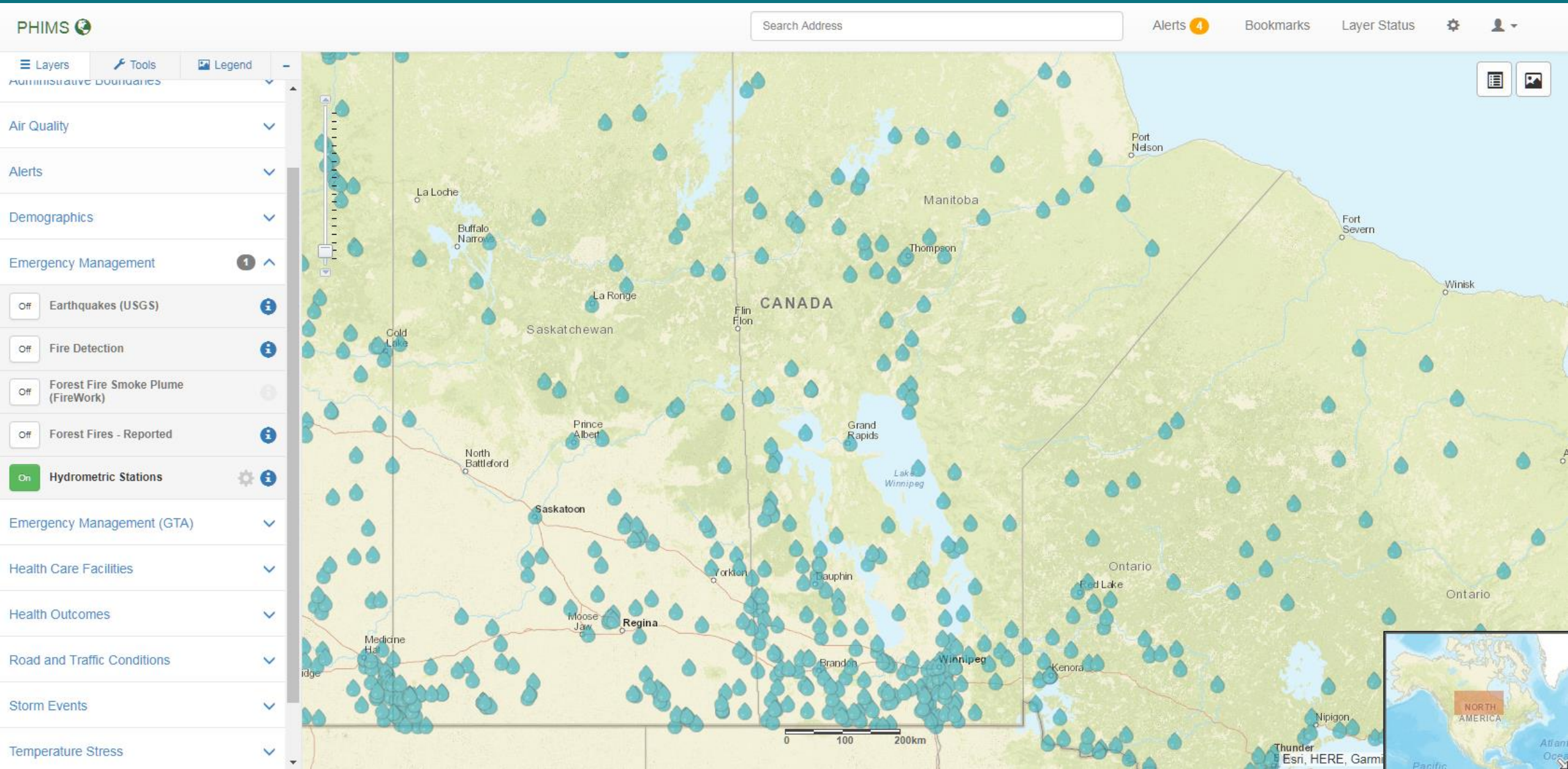
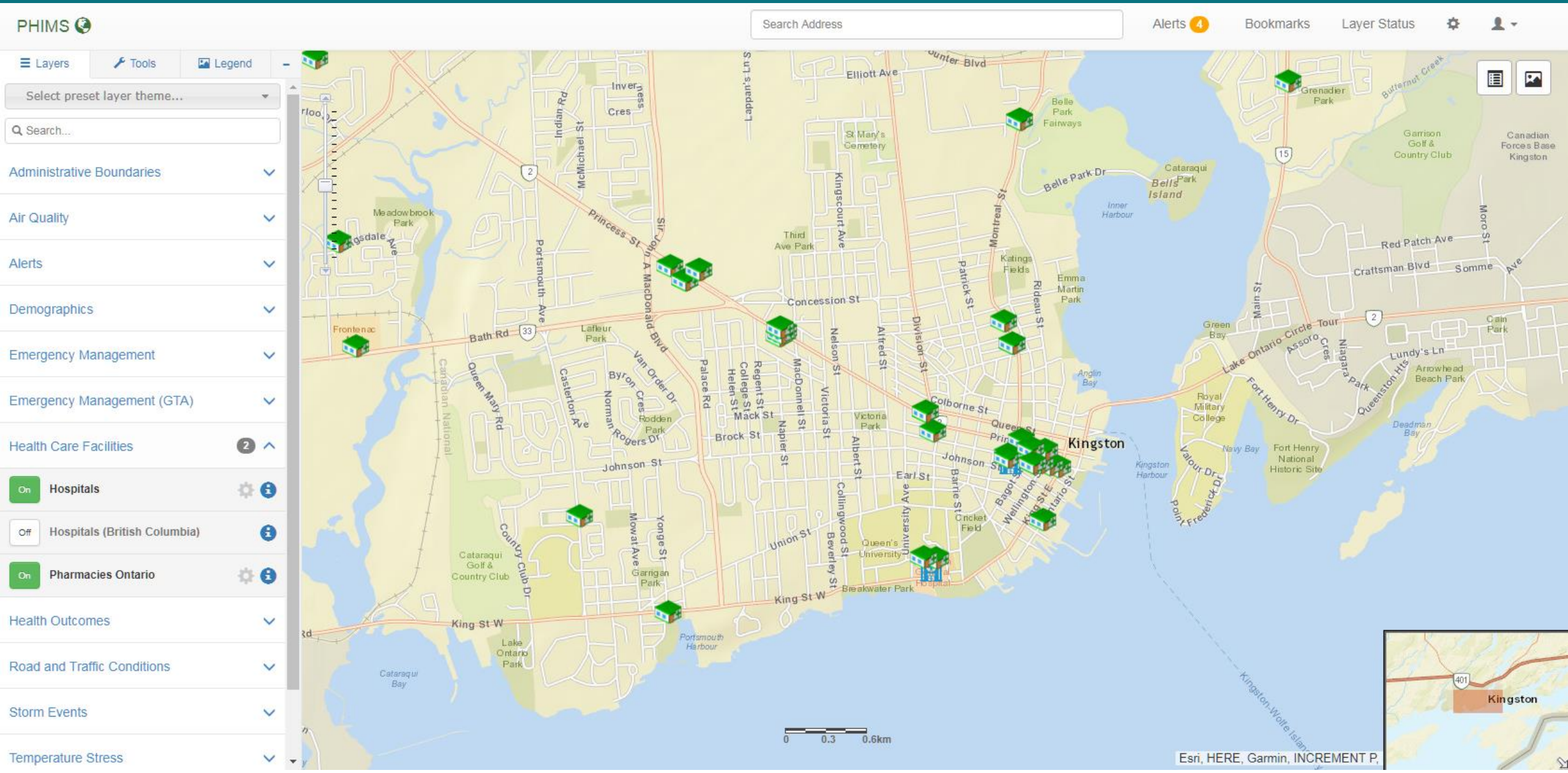
AQHI and Sensors



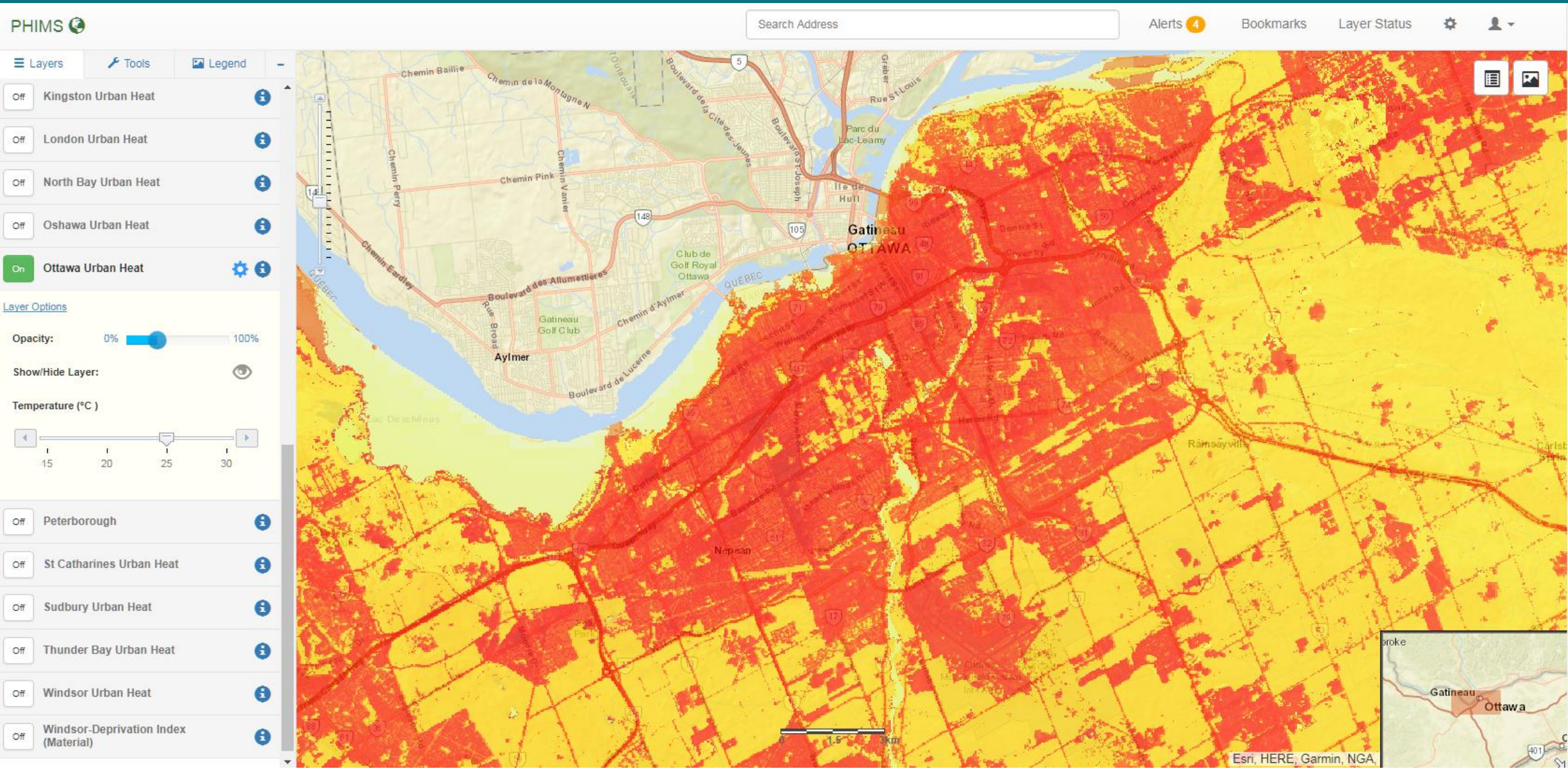
Hydrometric Stations



Hospitals and Pharmacies

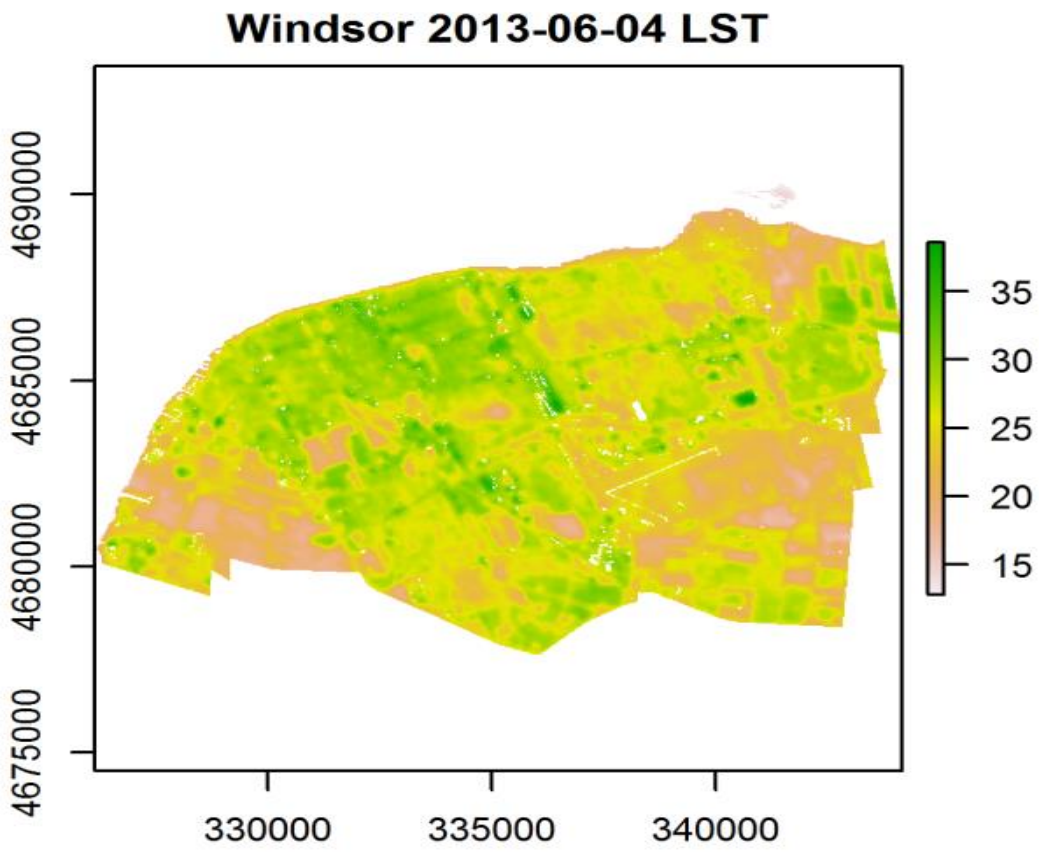


(Surface) Urban Heat Island



LST Model

Land Surface Temperature (LST)



LST ~ ambient temperature + 3-day ave. temperature + wind speed + land cover class + extent of vegetation + distance to water + week # + region

KFL&A Public Health

PHIMS

Search Address

Alerts Bookmarks Layer Status

Layers Tools Legend

Health Care Facilities

Health Outcomes 1

On Acute Care Enhanced Surveillance (ACES)

Layer Options

Transparency: 0% 100%

Show/Hide Layer:

Syndrome: Environmental

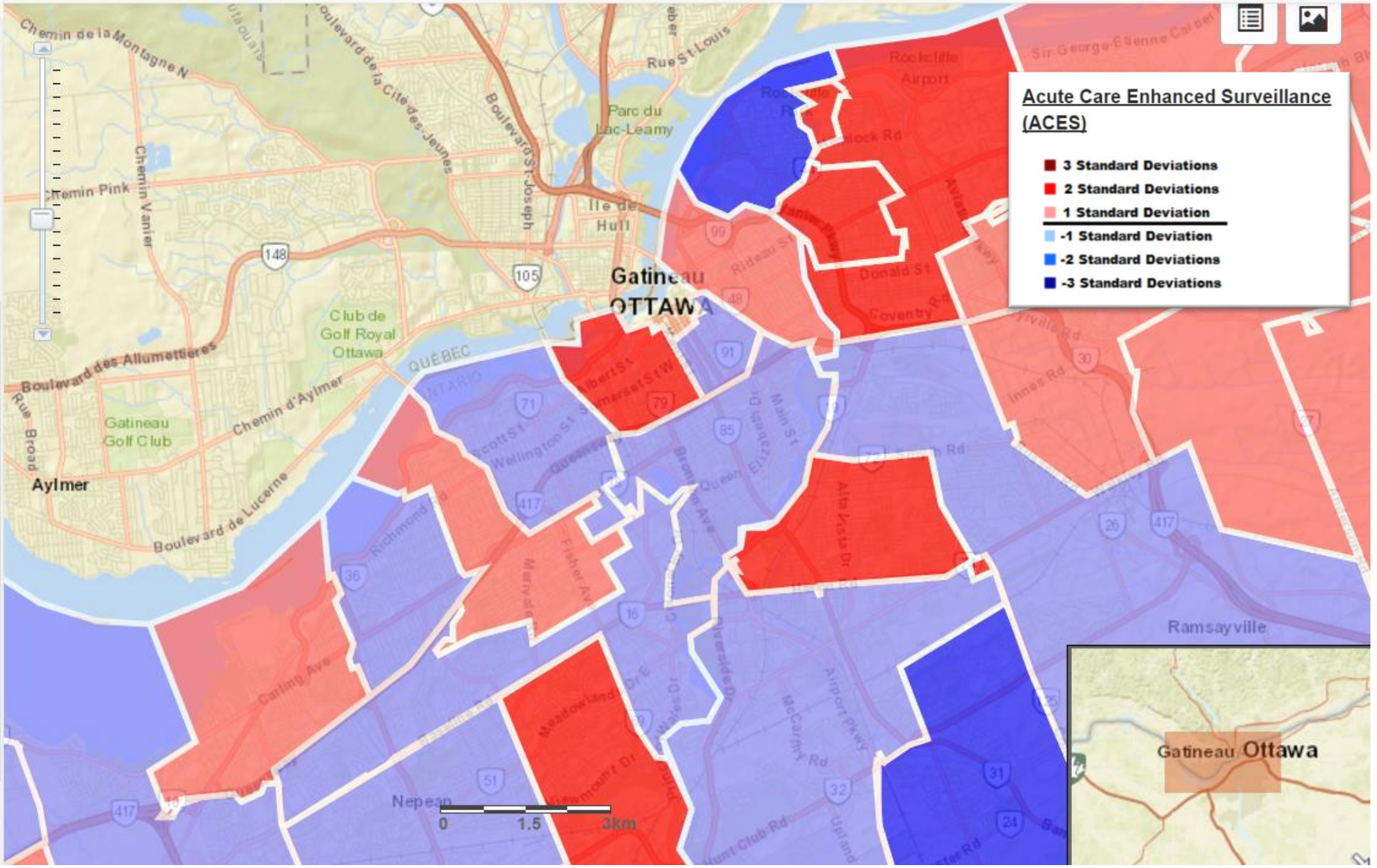
Level of Geography: FSA

Time Period: 7 Day

Update

Storm Events

Temperature Stress



PHIMS

Search Address

Alerts Bookmarks Layer Status

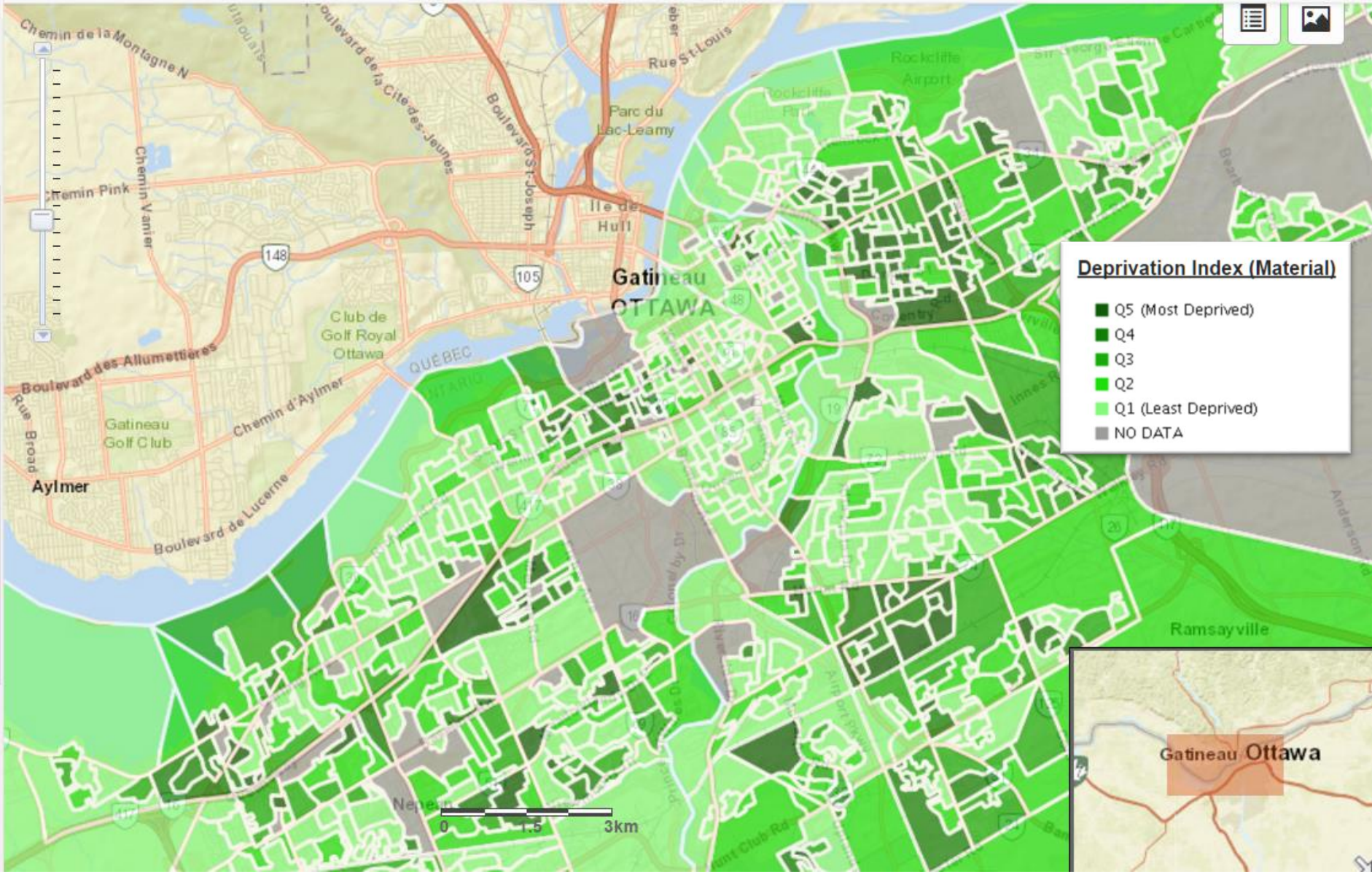
Layers Tools Legend

Demographic Analyses 1

- Off — Combined Deprivation (Deprivation Index)
- On — Deprivation Index (Material)
- Off — Deprivation Index (Social)
- Off — Ontario Marginalization Index (Dependency)
- Off — Ontario Marginalization Index (Ethnic Concentration)
- Off — Ontario Marginalization Index (Residential Instability)
- Off — Percent of the Population Age 4 and Under
- Off — Percent of the Population Age 65+

Emergency Management

Health Care Facilities



Situational Awareness

Real time information

1. Meteorological/Environmental
2. Socioeconomic Indices
3. Health Outcomes (ACES)

1. **equity-informed PH action**
2. **resource allocation**
3. **improved health outcomes**

Register for an account:

www.phims.ca

KFL&A Public Health

Emergency Preparedness

Simulated Data

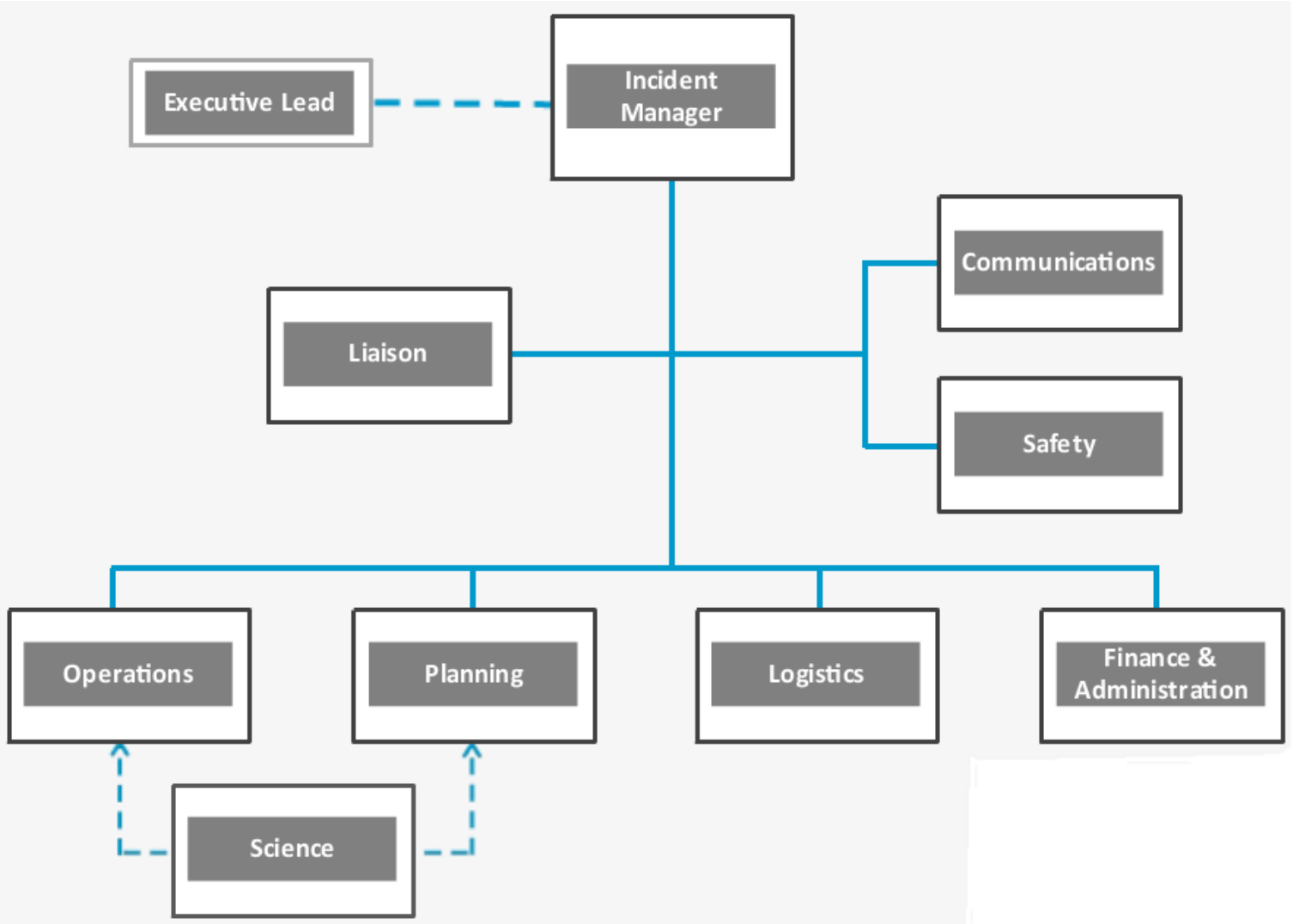
Train public health residents:

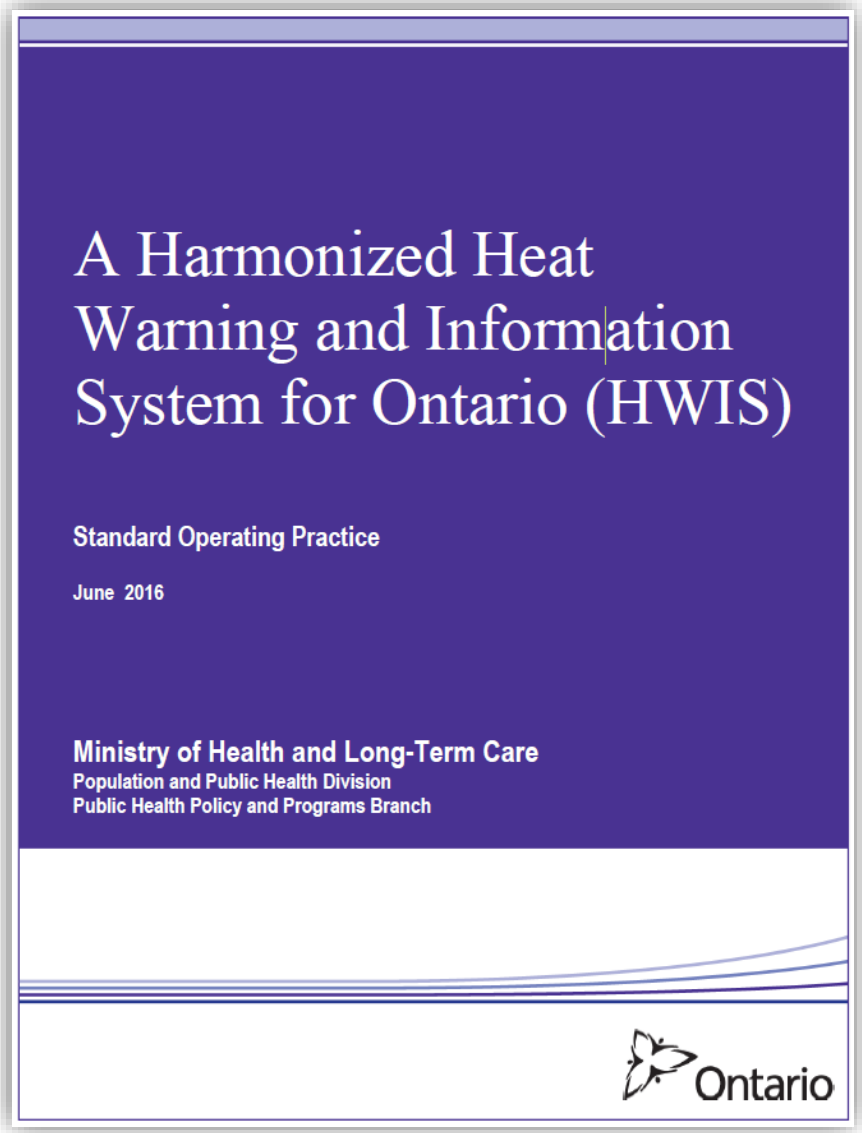
- infectious disease pandemics
- natural disasters
- mass casualty attacks

1. train staff
2. identify gaps
3. decision-making

KFL&A Public Health

Incident Management System





Source: PHO's Intro to PH Emergency Management System

Day 1: Tuesday July 5, 2016

Emergency Simulation Slide 1

This morning at 9:00 AM you receive a heat warning for South-Central Ontario from Environment Canada.

The 7-day forecast from Environment Canada for the City of Barrie shows that temperatures are expected to stay above 30 °C and humidex values above 40°C for the rest of the week.

Forecast

Wednesday July 6	Thursday July 7	Friday July 8	Saturday July 9	Sunday July 10	Monday July 11	Tuesday July12
32°C	35°C	36°C	39°C	35°C	30°C	28°C
Feels like: 38	Feels like: 43	Feels like: 45	Feels like: 43	Feels like: 42	Feels like: 35	Feels like: 32

Day 1: Preparation

What action do you take in response to this heat warning and to prepare for the continuing high temperatures throughout the week?

Group 1: What is the role of local public health? Who are your partners?

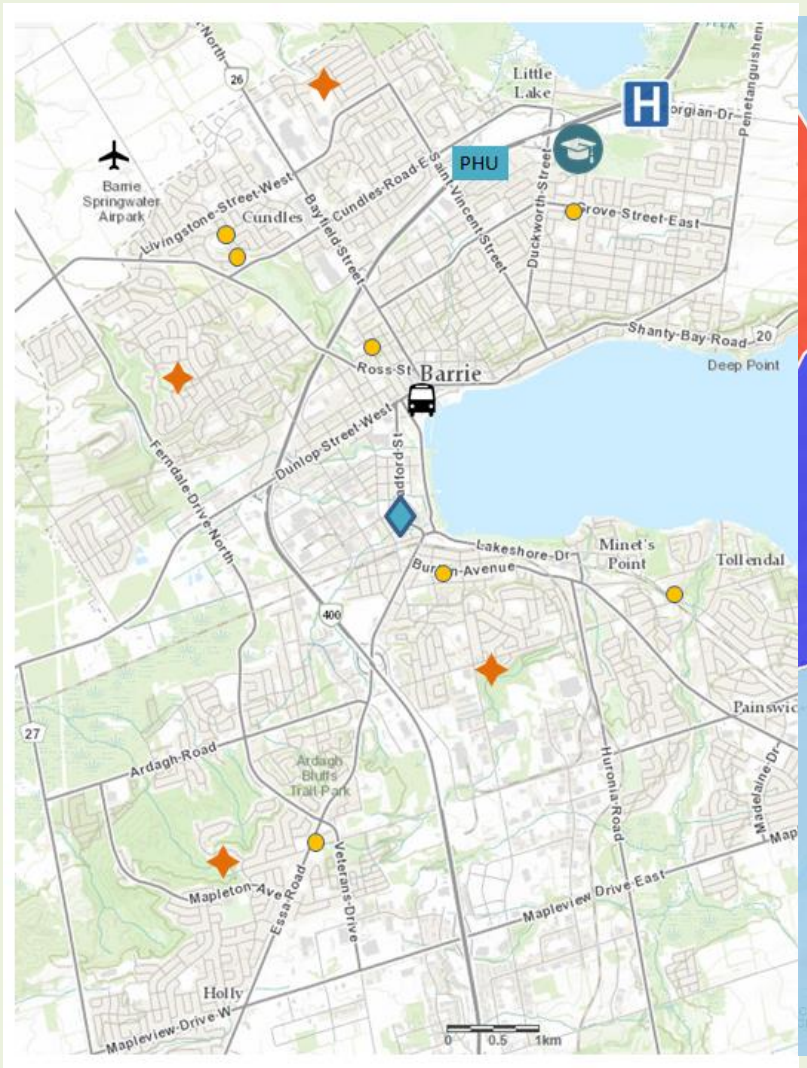
Group 2: What hazards are associated with extreme heat?

What information should be monitored?

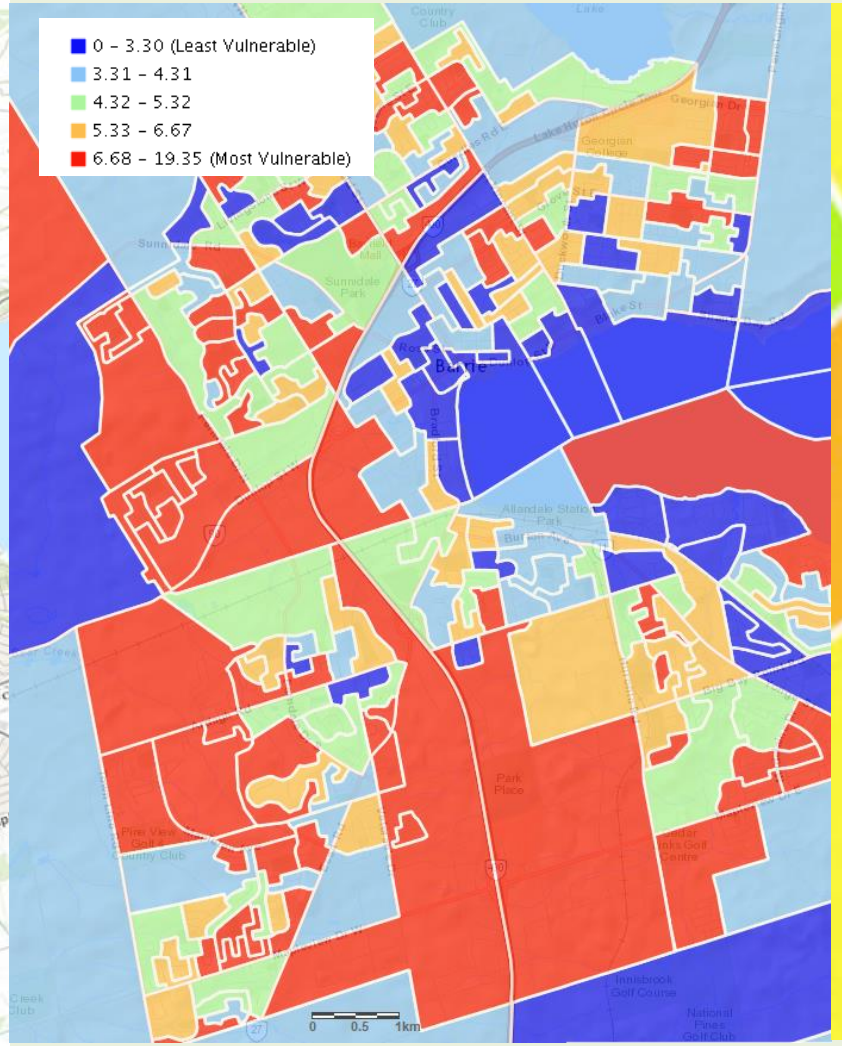
Group 3: What are the health effects of extreme heat? Who is at risk?

What information should be monitored?

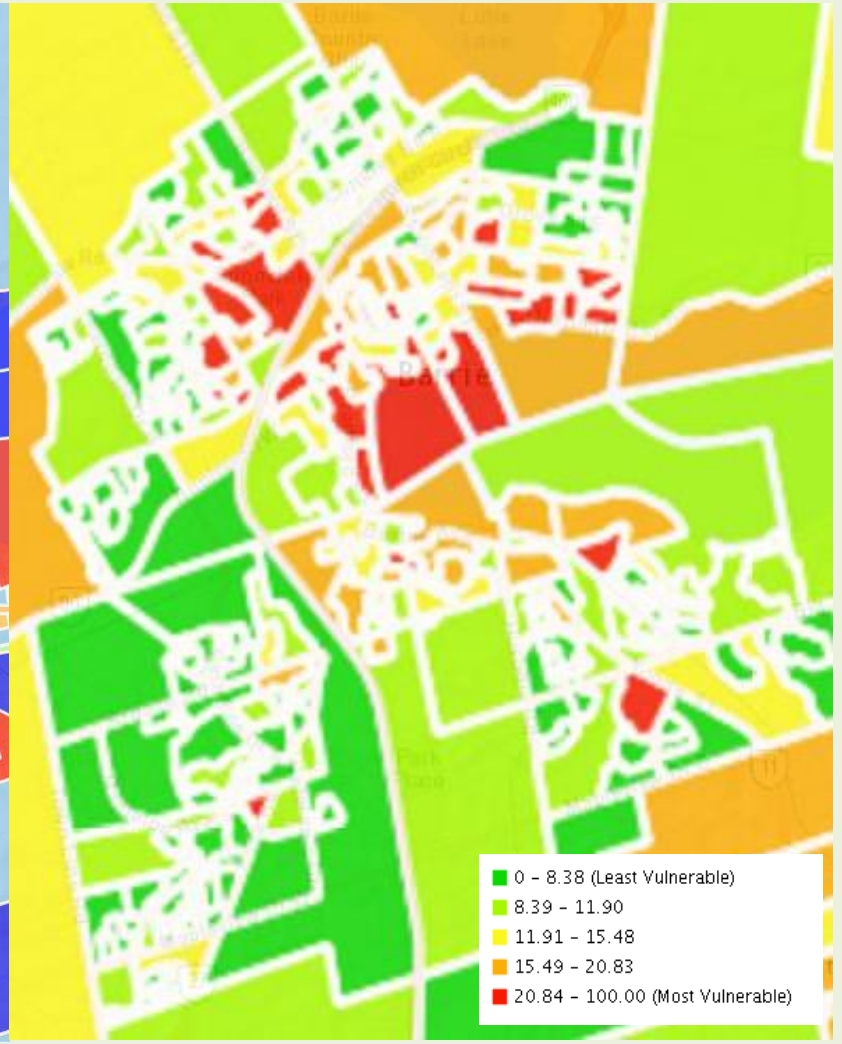
Group 4: How do you communicate the heat warning?



Percent of the population age 4 and under

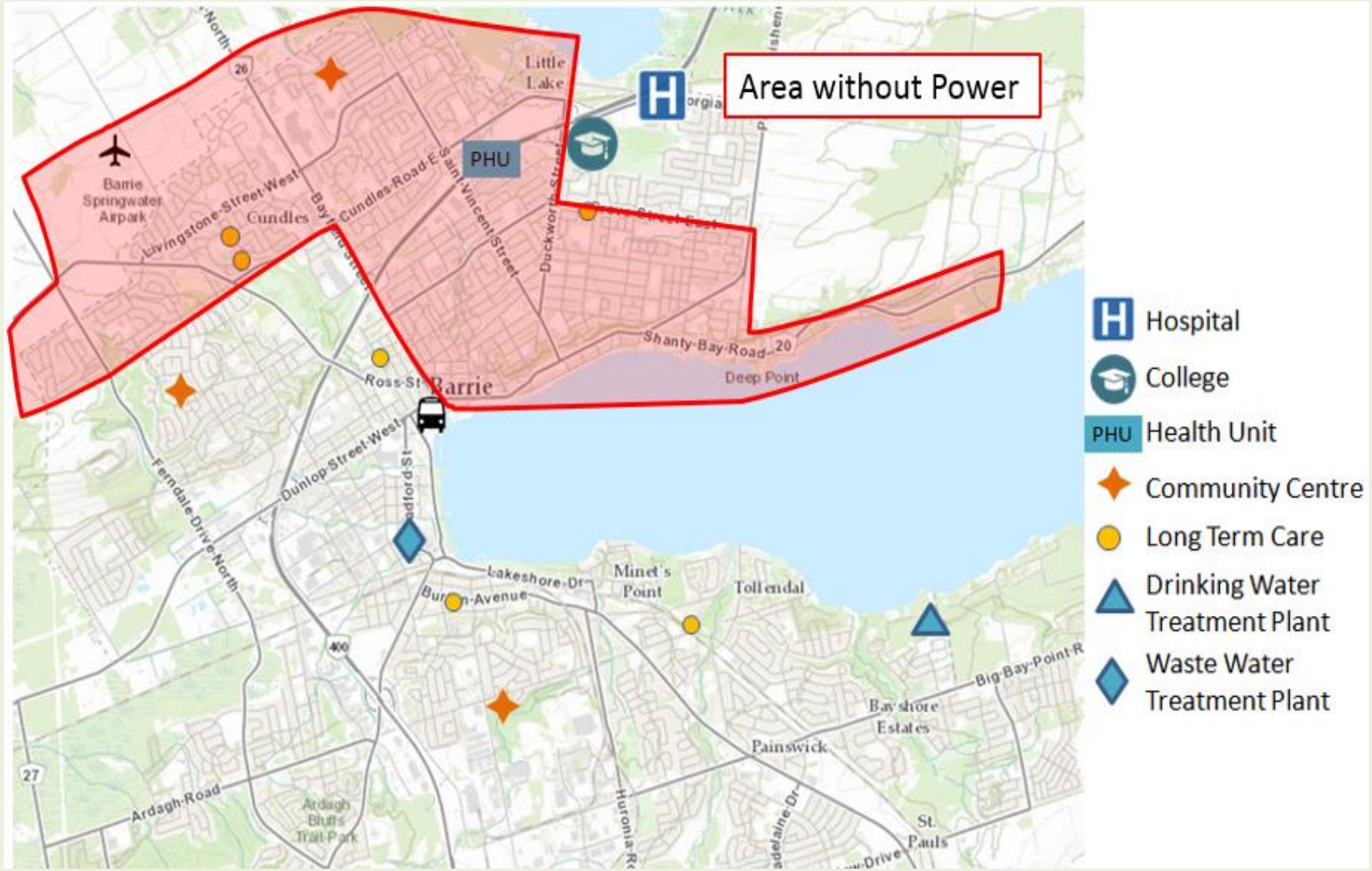


Percent of the population age 65+



Day 4: Friday July 8, 2016

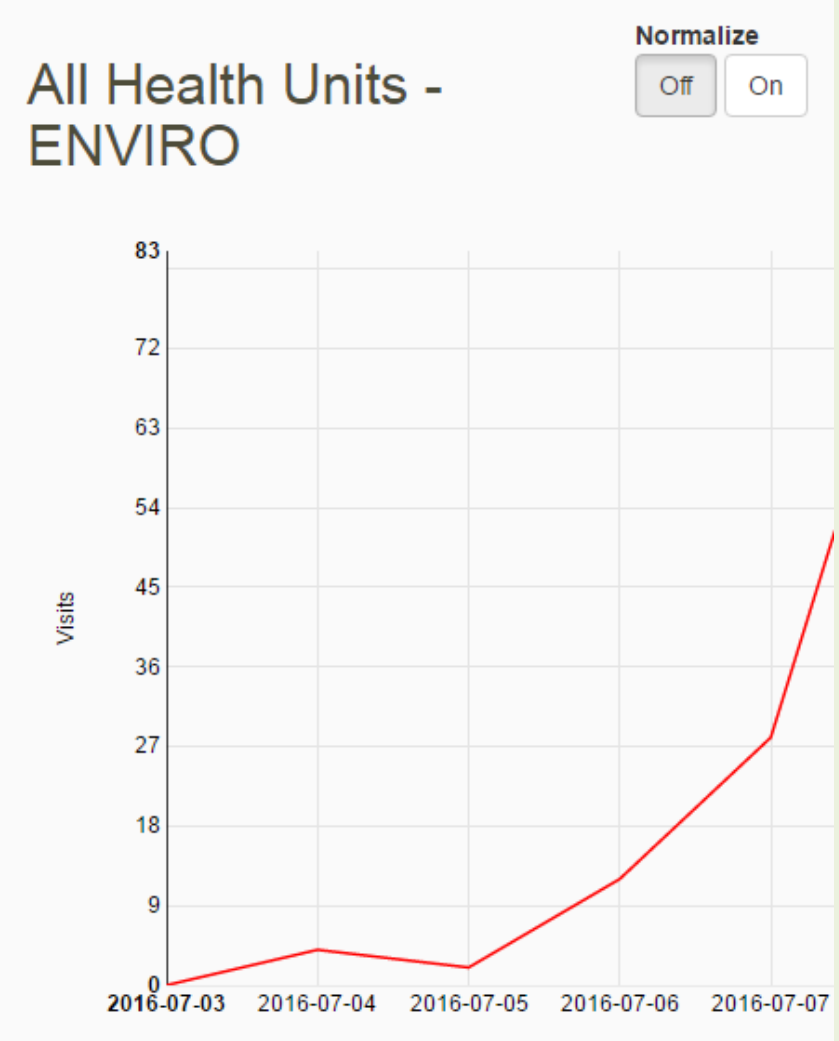
Emergency Simulation Slide 4



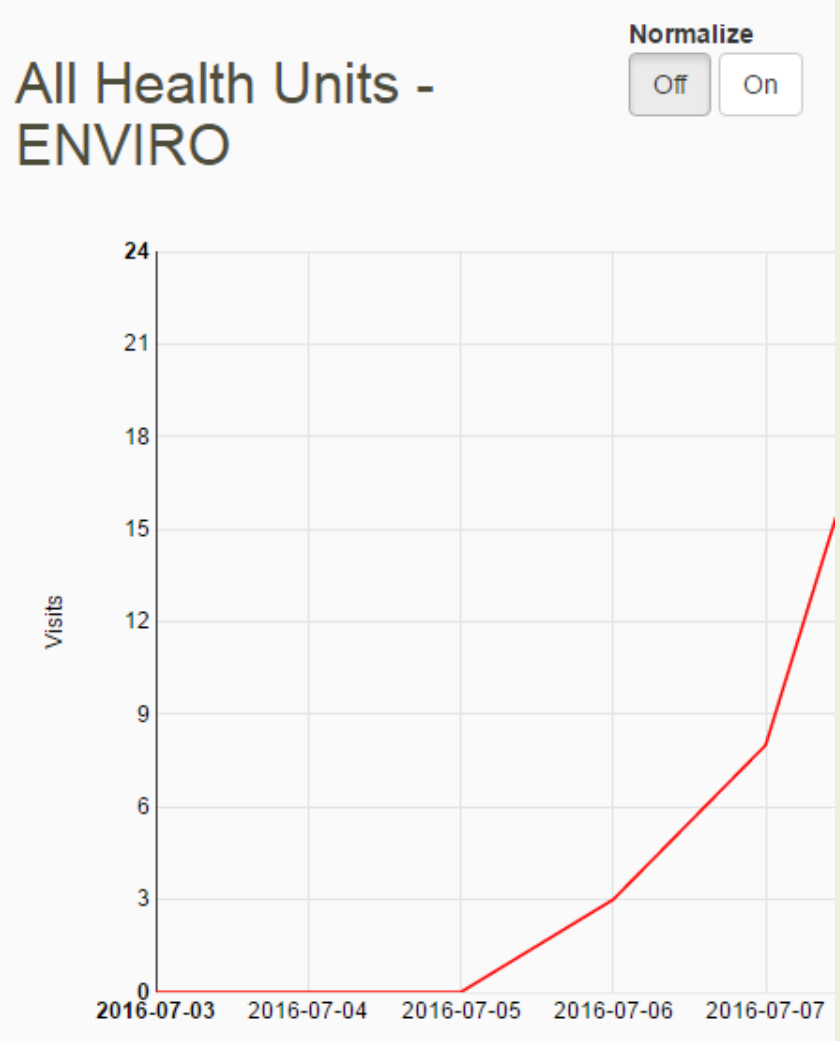
Heat related emergency room visits July 3 – July 7

Emergency Simulation Slide 5

Adults aged 65+



Children aged 0-4



KFL&A PH Climate Change Surveillance Initiatives

- health outcomes: **syndromic surveillance**, traditional surveillance in development
- developing products to build capacity for Ontario and beyond
- **PHIMS and ACES**
    1. real-time situational awareness
    2. emergency preparedness

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KFL&A Public Health