Acute Care Enhanced Surveillance (ACES)

Evaluation Framework and Validation of ENVIRO Syndrome

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Meeting: Monitoring Health Impacts from Extreme Heat Events

CEC, Phoenix AZ, 11 December 2018



Healthy People, Healthy Places

Agenda

Background

- history
- applications

Evaluation Framework

- development
- ongoing results

Validation of ENVIRO

- using gold standard
- case study

Syndromic Surveillance for the province of Ontario provided by ACES



Public Health Surveillance

- Infectious disease outbreak
- situational awareness (mass gatherings, extreme weather)
- opioid overdose monitor, ILI mapper

Health Care Administration

- hospital surge monitor
- provincial, regional hospital use and trends
- Iocal epidemiology

ACES ACES



- since 1994; currently 156 hospitals,
 18 000 ED visits per day
- Natural Language Processing, Maximum Entropy model
- train algorithm with expert-classified data sets
- categorize ED visits into 80+ syndromes
- aberration detection for syndromes of public health interest
- automated alerts to epidemiologists in Ontario's local public health agencies, hospitals, for local investigation



Data Flow Cycle for Acute Care Enhanced Surveillance (ACES)



Data

Flow

Ancillary Products ILI Mapper mapper.kflaphi.ca/ilimapper/

Opioid Monitor

kflaphi.ca/ontario-opioid-surveillance-monitor

Ontario Acute Care Surge Monitor

kflaphi.ca/ontario-acute-care-surge-monitor

Public Health Information Management System phims.ca



Surge Planning



		Evaluative ELEMENT	Data Source
	A. System Description	Define Purpose Stakeholders Simplicity Operation	ACES Advisory
ACES	B. Outbreak Detection	Timeliness — Validity — Selectivity/Specificity —	ACES Internal
	C. System Experience	System Stability Portability System Costs Representativeness Flexibility Usefulness Acceptability	Review Data Quality & Validity ACES User Survey
	D. Conclusions/ Recommendations for Improvement	Summarize Findings Validate with Stakeholders Disseminate	Source: KM, 2018

ACES Advisory Committee (AAC)

 meets quarterly to provide leadership

Data

Sources

- permanent membership of KFL&A
 PH staff and ACES administrators; several term membership of representing external health agencies
- purpose of ACES and its stakeholders
- interview AAC members

 lists of stakeholders, operation details, stability, costs (FTE budgets)

ACES Internal

Review

- internal review with ACES staff
- internal communication and one-on-one interviews

 digitally distributed to active ACES users representing each local public health agency using ACES

ACES User Survey

 focus on evaluative elements related to user perception (i.e., portability, system costs as staff hours, flexibility, usefulness, and flexibility) Data Quality & Validity

- quantitative measures
- validity by comparing ACES to gold standard database (ICD-10 codes)
- timeliness estimated using extreme heat case study



Knowledge Translation



Online Videos



Publish Evaluation

Data Quality Dashboard

Acute Care Enhanced Surveillance (ACES) Data Quality Monitor



ED Visits

Click below between <> to select page. See Notes page (last page) for more information on data.

ACES Feeds

Last Updated: 2018-10-12

Summary of ACES Feeds						
Hospital	ED Visits?	CTAS?	Admissions?	Emergent and Elective Admissions Differentiated?	Additional CIHI Admissions Feeds	
(AAA 3511) Arnprior and District Memorial Hospital	Yes	No	Yes	Yes	CCRS	
(AGH 3513) Anson General Hospital	Yes	No	Yes	Yes	CCRS	
(AH 3502) Alexandra Hospital (LHSC)	Yes	Yes	Yes	No	CCRS	
(AMGH 3502) Alexandra Marine and General Hospital	Yes	Yes	Yes	Yes	OMHRS	
(APG 3509) Rouge Valley Ajax and Pickering	Yes	No	Yes	Yes	NRS	
(ATGH 3514) Atikokan General Hospital	Yes	Yes	Yes	Yes	None	
(BCH 3505) William Osler Health System – Brampton Civic Hospital	Yes	Yes	Yes	Yes	NRS, OMHRS	
(BCHS 3504) Brantford General Hospital	Yes	No	No	N/A	N/A	
(BGH 3510) Quinte Health Care – Belleville General Hospital	Yes	Yes	Yes	Yes	NRS, OMHRS	
(BMH 3513) Bingham Memorial Hospital	Yes	No	Yes	Yes	None	
(BRGH 3510) Brockville General Hospital	Yes	No	Yes	No	CCRS, NRS	
(BRH 3513) Blind River Hospital	Yes	No	Yes	Yes	None	
(BRSH 3512) Muskoka Algonquin Healthcare – South Muskoka Memorial Hospital	Yes	Yes	No	N/A	N/A	
(BWH 3501) Bluewater Health – Sarnia Campus	Yes	Yes	Yes	Yes	CCRS, NRS, OMHRS	
(BWHP 3501) Bluewater Health – Petrolia Campus	Yes	Yes	Yes	Yes	CCRS	



Notes

1. Not at all hospitals may have emergency departments or admissions. This is not captured on this page (i.e., it is assumed every hospital has both).

 ACES feeds for some hospitals represent multiple hospital sites. These hospitals are not included on the map.
 Additional CIHI Admissions Feeds represent designated beds captured by databases other than the Discharge Abstract Database (DAD).



Hospitals not in ACES Almonte General Hospital Blind River District Health Centre - Rich... Blind River District Health Centre - Thes... Deep River and District Hospital Groves Memorial Community Hospital Haldimand War Memorial Hospital Norfolk General Hospital North Wellington Health Care - Mount ... North Wellington Health Care - Palmers... St. Francis Memorial Hospital Stevenson Memorial Hospital - Alliston

Syndrome Validation

Gold Standard (diagnostic) = National Ambulatory Care Reporting System (NACRS)

measure	ACES	NACRS
source	triage chief complaints (free-text)	physician's diagnoses
coverage	>95% acute care facilities	all acute care facilities
timeliness	real time	lag time >3 months

 real-time ACES data
 validation
 Gold Standard

 (pre-diagnostic syndrome)

 (diagnostic ICD-10 code)
 from NACRS

ENVIRO

toes temp bite heat S exposure frostbi

ICD-10 Codes for ENVIRO				
L 55 Sunburn				
L55.0 Sunburn of first degree	L55.8 Other sunburn			
L55.1 Sunburn of second degree	L55.9 Sunburn, unspecified			
L55.2 Sunburn of third degree				
T33 Superficial frostbite				
T33.0 Superficial frostbite of head	T33.5 Superficial frostbite of wrist and hand			
T33.1 Superficial frostbite of neck	T33.6 Superficial frostbite of hip and thigh			
T33.2 Superficial frostbite of thorax	T33.7 Superficial frostbite of knee and lower leg			
T33.3 Superficial frostbite of abdominal wall, lower	T33.8 Superficial frostbite of ankle and foot			
back and pelvis				
T33.4 Superficial frostbite of arm)	T33.9 Superficial frostbite of other and unspecified sites			
T34 Frostbite with tissue necrosis				
T34.0 Frostbite with tissue necrosis of head	T34.5 Frostbite with tissue necrosis of wrist and hand			
T34.1 Frostbite with tissue necrosis of neck	T34.6 Frostbite with tissue necrosis of hip and thigh			
T34.2 Frostbite with tissue necrosis of thorax	T34.7 Frostbite with tissue necrosis of knee and lower leg			
T34.3 Frostbite with tissue necrosis of abdominal wall,	T34.8 Frostbite with tissue necrosis of ankle and foot			
lower back and pelvis				
T34.4 Frostbite with tissue necrosis of arm	T34.9 Frostbite with tissue necrosis of other and unspecified			
	sites.			
T35 Frostbite involving multiple body regions and unsp	ecified frostbite			
T35.0 Superficial frostbite involving multiple body	T35.4 Unspecified frostbite of upper limb			
regions.				
T35.1 Frostbite with tissue necrosis involving multiple	T35.5 Unspecified frostbite of lower limb			
body regions				
T35.2 Unspecified frostbite of head and neck	T35.6 Unspecified frostbite involving multiple body regions			
T35.3 Unspecified frostbite of thorax, abdomen, lower	T35.7 Unspecified frostbite of unspecified site			
back and pelvis				
T67 Effects of heat and light				
T67.0 Heatstroke and sunstroke	T67.5 Heat exhaustion, unspecified; Heat prostration NOS			
T67.1 Heat syncope; Heat collapse	T67.6 Heat fatigue, transient			
T67.2 Heat cramp	T67.7 Heat oedema			
T67.3 Heat exhaustion, anhidrotic; Heat prostration due	T67.8 Other effects of heat and light			
to water depletion				
T67.4 Heat exhaustion due to salt depletion; Heat	T67.9 Effect of heat and light, unspecified			
prostration due to salt (and water) depletion				
T68 Hypothermia				
T69 Other effects of reduced temperature	1			
T69.0 Immersion hand and foot; Trench foot	T69.8 Other specified effects of reduced temperature			
T69.1 Chilblains	T69.9 Effect of reduced temperature, unspecified			
	/ // / / / / / / / / / / / / / / / / / /			

SOURCE: apps.who.int/classifications/icd10/browse/2016/en#/T35

Analysis	Total No. ACES Visits	Total No. NACRS Visits	Ratio
2016 - All Hospitals	1 361	2 824	0.48
2016 - Good Quality Hospitals	1 106	2 178	0.51
2017 - All Hospitals	1 055	1 928	0.55
2017 - Good Quality Hospitals	862	1 493	0.58
Source: KM, 2018			





Source: KM, 2018





Analysis	Daily Count: Pearson's corr. coeff (P value)	Daily %: Pearson's corr. coeff (P value)	2-Day Ave Count: Pearson's corr. coeff (P value)	2-Day Ave % - Pearson's corr. coeff (P value)	Mean Relative Daily % Difference
2016 - All Hospitals	0.9 (<0.001)	0.897 (<0.001)	0.932 (<0.001)	0.93 (<0.001)	-49.3
2016 - Good Quality Hospitals	0.887 (<0.001)	0.886 (<0.001)	0.922 (<0.001)	0.921 (<0.001)	-35.4
2017 - All Hospitals	0.823 (<0.001)	0.809 (<0.001)	0.887 (<0.001)	0.874 (<0.001)	-33.4
2017 - Good Quality Hospitals	0.808 (<0.001)	0.797 (<0.001)	0.875 (<0.001)	0.863 (<0.001)	-47.1



Outbreak Detection: Case Study

Validity Data Quality Representativeness Predictive Value Positive
 Timeliness Comparison to extreme heat events
 Selectivity/Specificity Comparison to Gold Standard





DATE (dd-mm-yy)

Syndrome	Actual Counts	Expected Counts	Excess Counts	Excess Counts (%)
ALL	161,561	157,917	3,644	2.3
ENVIRO	200	45	155	344.4
RESP	9,677	8,316	1,361	16.4
ILI	4,406	3,780	626	16.6
DERM	5,218	4,572	646	14.1
LAC	5,492	4,761	731	15.4
BITE	1,890	1,467	423	28.8

Extreme Heat 2018

- ✓ may provide real-time evidence of indirect impacts
- no obvious relationships with populations that are traditionally considered vulnerable
- emergency management/situational awareness



Visualization of ENVIRO



Visualization of ENVIRO





Visualization of ENVIRO





Evaluation Framework specific for ACES

Emphasis:

- knowledge translation/education
- increasing access, applications and usage
- ✓ *Case Study* using ENVIRO
- emergency management/ situational awareness

We thank **Health Canada** for providing funding for this evaluation project and ongoing support of development of ACES protocol for climate change health impacts.



Health Canada



Summary