EMERGENCY DEPARTMENT SYNDROMIC SURVEILLANCE IN MICHIGAN

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SYNDROMIC SURVEILLANCE:

Current MSSS System

Current Heat Surveillance

Integrating Heat Surveillance into MSSS



SYNDROMIC SURVEILLANCE: MICHIGAN OBJECTIVE

The objective of the Michigan Syndromic Surveillance System (MSSS) is to detect bioterrorism, emerging infections, and naturally occurring outbreaks more rapidly than through normal physician detection and reporting



SYNDROMIC SURVEILLANCE: RATIONALE: BIOTERRORISM





* t = time between detection by syndromic (prediagnostic) surveillance and detection by traditional (diagnosis-based) surveillance.

Overview of Syndromic Surveillance. Henning. MMWR / Sep 24, 2004 / 53(Supple);5-11



ED SYNDROMIC SURVEILLANCE: MICHIGAN OVERVIEW

Allows for rapid detection of unusual illnesses and potential outbreaks from ED registrations

MDHHS has been monitoring trends in syndromic presentation for over a decade

LHDs and MDHHS Epidemiologists can view charts, maps and registration data online



SYNDROMIC SURVEILLANCE SYSTEM

Number of Facilities

109

Number of Referrals/Year <u>Statewide</u> 4.9 Million

Number of Referrals per <u>facility</u> <u>per day</u> Varies Greatly



ED SYNDROMIC SURVEILLANCE: THE BASICS

- Based on Real-Time Outbreak Detection System (RODS) developed at the University of Pittsburgh
 Virtual Private Network (VPN) HL7, a healthcare messaging standard, to exchange data in real-time between participants and MDHHS
- Each message consists of:
 - Patient age, sex, home ZIP code
 - Visit date and time
 - Data exchange and acknowledgement information
 - Chief complaint



ED SYNDROMIC SURVEILLANCE: HOW DOES IT WORK?

Patient registers with basic demographic info and the chief complaint – a short descriptions of symptoms that led the person to visit the ED

Registration triggers a message with the necessary information which is sent securely to MDHHS in Lansing

Chief complaint is classified into 1 of 9 syndromic categories that can be aggregated for review and analysis

Detection algorithm runs every hour and an alert is generated if aberration in the levels of a syndrome is detected



EXAMPLE OF CHIEF COMPLAINTS

- Stuck bead in nose
- Fish hook in ear
- Fell and laid in yard for a couple of hours
- Fell onto cactus
- Squirrel bite
- Rt foot pain, dropped turkey (2 days before thanksgiving)
- Run over by golf cart
- Odd behavior after eating fresh peaches
- Blue plate special
- Talking to dead people



SYNDROMIC SURVEILLANCE CATEGORIES

Syndrome	% of Visits	Example	Sample Text (not inclusive)
Gastrointestinal	9-13%	"Stomach Pain"	Abdominal, stomach, gastric, enteritis, diarrhea, vomiting, nausea, n, v, abdomen, abd, gastroenteritis, nvd
Respiratory	8-16%	"Difficulty Breathing"	Cough, sore throat, congestion, wheezing, asthma, croup, respiratory, strep, cold, bronchitis, pneumonia, asthma, sob, sinus, uri, dyspnea, dib
Constitutional	7-10%	"General weakness"	Fever, weakness, dizziness, dizzy, temp, temperature, flu, light headed, chills, lethargy, fatigue, sweating, lethargic, febrile
Neurological	6%	"Confusion"	Migraine, headache, disoriented, syncope, fainted, paralysis, tingling, seizure, stroke, cva, convulsion, loc, mental, vertigo, meningitis, numb, confusion, dizzy, unconscious
Hemorrhagic	3%	"Nose bleed"	Epistaxis, bleeding, hemoptysis, hematuria, hematemesis, blood, bleed, hematochesia, hemorrhagic, hemorrhaging
Rash	1.5-2.5%	"Hives and itching"	Rash, hives, bumps, petechiae, purpura, ivy, dermatitis, pox, scabies, spots, shingles
Botulinic	<0.5%	"Slurred Speech"	Slurred, diplopia, dysphagia, photophobia, dysarthria, speaking, swallowing, blurred
Other	12-19%	"Right foot injury"	Laceration, injury, mva, broken, sprain, bite, abrasion, wound, suture, concussion, sunburn, pressure, fall, sugar, gsw, monoxide
Default	40-44%	"Med Refill"	Everything else (default category) – if complaint contains none of the recognized keywords – e.g. "assault/neck", "jumped from moving vehicle"

SYNDROMIC SURVEILLANCE: MAIN SCREEN

RODS v4.3 Production

Main Epiplot



Note: Graphs will automatically update themselves every 20 minutes



CoCo correctly classified 98% of complaints CoCo originally designed by the RODS team MDHHS version "trained" using MI ED chief complaints System is trained to recognize terms and categorize based on significance "vomiting and fever" could be GI, but "fever" is more significant; categorized as constitutional bleeding lacerations" could be hemorrhagic, but "lacerations" is more significant; categorized as other



Earlier detection of seasonal illnesses

- Example: Respiratory visits
- Alerts are triggered as season begins



Ability to compare past seasons

- Example: Constitutional visits
- Seasonal influenza season vs. pandemic influenza



- Ability to create Ad Hoc searches
 - Examples: Heat Surveillance

Assessment of illness presentations to emergency departments and urgent cares



SYNDROMIC SURVEILLANCE: LOCAL HEALTH DEPARTMENT USER

Can see all healthcare registrations made by residents of local health jurisdiction

Can also see activity for all healthcare providers in their jurisdiction (HPCs that are enrolled in the system)

Can access overall statewide Michigan activity



EXAMPLES OF USE: LOCAL HEALTH DEPARTMENT USERS

- Supplement Surveillance Data
 - Norovirus-like illnesses: gastrointestinal
 - Influenza Season: constitutional
 - Respiratory Illnesses: respiratory
- Rash Illnesses: rash
 Example: Macomb County





SYNDROMIC SURVEILLANCE: HEALTHCARE

- Can see total healthcare registrations made at a facility or system
- Can access overall statewide Michigan activity
 <u>Cannot</u> see specific detailed information about statewide activity



EXAMPLES OF USE: HOSPITAL USERS

Extract own data

- Daily or Weekly ILI data from their ED for aggregate reporting to LHD
- Using a data filter to extract cases who meet the ILI case definition

2	Cases.csv											1			
	А	В	С	D	E	F	G	Н	I	J	K				
1	Admitted	Facility	Perceived	Actual	Valid	FIPS	Gender	Age	Syndrome	Complair	nt				
2	11/26/2013 14:33				Y	26067	F	22	Constitutional	flu like s	ymptoms				
3	11/26/2013 19:33				Y	26117	F	84	Constitutional	flu symp	toms				
4 5 6 7									Healthcare Registrations Hospital A People in: All Counties All Syndromes Filter: flu not tamiflu not imm not flush not fluid not flutter not flushed not inject not reflux not shot not vaccin not stomach not mist					hot not	
.8									2.00 1.75 1.50 1.50 1.50 1.25 0.75 0.50 0.25 0.00 24-Nov	25-Nov	26-Nov Admi Moving Average	27-Nov ssion Date	28-Nov	28-Nov	30-Nov

EXISTING HEAT SURVEILLANCE

Ad hoc searching and manual reporting

FUNCTIONALITY: AD HOC SEARCH – HEAT SURVEILLANCE Filter: Sun2 OR: dehyd sun prostration heat hyperthermia NOT: Sunday heater heatrate cheat heatlh wheat flower beat





Neurological 🔶 Threshold

Print Print Filter OR: dehyd sun prostrat NOT: Sunday heater he Validate Save Del Clear FilterName: Sun2 AND Sun2 All Healthcare Visits All Facilities Period: Custom Dates 🗸 Male & Female 💙 Michigar **Right Plot Features** Entire City Gastrointestinal Emergency Data 🗸 Start: 4 💙 1 💙 2013 All Ages 🗸 Constitutional Detroit City Respiratory Entire County Advanced Plot End: 8 🗸 30 🗸 2013 Min: Rash Alcona County State Levels Hemorrhagic Alger County Daily Aggregation ¥ Max: Botulinic Allegan County Left Right Interval: 16:30 Neurological Alpena County Other Antrim County Download Help ✓ Normalize Default Arenac County Strict Zips Baraga County Barry County

Custom charts were created

Comparison of previous summers

Seasonal (May 15 - August 31) Daily Heat-Related ED Visits, 2012 – 2016



Custom charts were created Heat-related illnesses and temperature







Visits were further categorized based on chief complaint
 Sun-associated: sunburn, sun poisoning, sunscreen reactions
 Heat-associated: heat exhaustion, heat stroke, heat reaction
 Dehydration





Age

 In July significant increases in visits were among those 18-64 years
 These are age groups that are considered less vulnerable to heatrelated illnesses





INTEGRATING MSSS AND EHE

Defining Extreme Heat Events and integration into MSSS

EHE INTEGRATION PROCESS

Contractor and Workplan
 Altarum Institute, Ann Arbor MI

Workplan and Deliverables:
 1.0 Requirements Gathering
 2.0 Syndrome Development
 3.0 Code Development, Implementation, Testing
 4.0 Project Reporting and Dissemination



EHE INTEGRATION PROCESS

Syndrome Development
Keywords
Probabilities
Validation
Alerting threshold



HEAT SYNDROME KEYWORDS

Syndrome	Keywords
Gastrointestinal	Abdominal, stomach, epigastric, gastric, gastritis, enteritis, appendicitis, diarrhea, vomiting, vomitting, nausea, n, v, rlq, abdomen, abd, crohns, gerd, diverticulitis, gastroenteritis, emesis, hyperemesis, poisoning, pud, peptic, ruq, llq, luq, nv, nvd, gastrointestinal, ab, abdmnal, abdominalpain, diaherra, gastrointest, vom, vomitinghyperemesis, vomitng
Constitutional	Fever, weakness, dizziness, dizzy, temp, flu, influenza, flulike, lightheaded, chills, lethargy, fatigue, weak, sweating, lethargic, febrile, constitutional
Respiratory	Cough, ribs, breath, wheezing, croup, pharyngitis, respiratory, thrt, st, congestion, shortness, rib, strep, throat, cold, bronchitis, pneumonia, copd, asthma, sob, tonsillitis, breathing, sinus, sinusitis, uri, dyspnea, resp, dib, pneumonitis, pleural, pleurisy, airway, sorethroat, coughing, congested, breathe, breather, db, nasopharyngitis, shortnessofbreath, whez
Rash	Rash, urticaria, hives, bumps, petechiae, purpura, ivy, dermatitis, pox, scabies, spots, shingles, boils , erupt
Hemorrhagic	Epistaxis, bleeding, hemoptysis, hematuria, hematemesis, blood, bleed, hematochesia, hemorrhagic, hemorrhaging, bleeds, bloody, epitaxis, hemorr, nosebleed
Botulinic	Slurred, diplopia, dysphagia, photophobia, dysarthria, speaking, swallowing, blurred, blurry, swallow, botulinic
Neurological	Migraines, memory, headpain, migrane, migrain, disoriented, disorientation, passed, syncopal, palsy, fainting, paralysis, tingling, seizures, headaches, cephalgia, stroke, tia, cva, ha, headache, migraine, seizure, convulsion, syncope, fainted, loc, mental, vertigo, meningitis, numbness, numb, h, confused, confusion, dementia, unresponsive, dizziness, dizzyness, unconscious, dizzy, sz, blacked, consciousnes, consciousness, convulsions, migrne, szr, neurologicaldeficit, siezure, syncopy, neurological
Heat	Dehydration, dehydrated, dehydrate, dehydrat, dehydraton, heat, heatstroke, overheating, overheated, heating, heated, sun, sunburn, sunburnt, sunburned, hyperthermia, sunstroke, heat rash, heat exhaustion, heat stroke, over heated, heat exposure, heat related, heat exhaust, over heating, heat cramps, heat illness, heat issues, heat bumps, sun burn, sun poisoning, sun burned, sun blisters, sun reaction, heat syncope, heat fatigue
Other	Lac, mva, laceration, cnt, contusion, contusions, fx, broken, sprain, bee, injury, inj, mvc, bite, fb, abrasion, wound, suture, crisis, injured, doi, concussion, physical, pe, sunburn , pressure, fall, sugar, gsw, fell, monoxide, attack, flash, palpitations, rate, racing, flashes, pad, pack, vent
Default	Everything else (default category)



Changes in bold red

HEAT SYNDROME WEIGHTING

Heat syndrome weighting: Heat,0.18947368421052632
 Keyword weighting for Heat (inclusion) and Other (exclusion from Heat)

Heat, dehydration, 0.02 Heat, dehydrated, 0.02 Heat, dehydrate, 0.02 Heat, dehydrat, 0.02 Heat, dehydraton, 0.02 Heat, heat, 0.05 Heat, heatstroke, 0.05 Heat, overheating, 0.05 Heat, overheated, 0.05 Heat, heating, 0.05 Heat, heated, 0.05 Heat, sun, 0.05 Heat, sunburn, 0.05 Heat, sunburnt, 0.05 Heat, sunburned, 0.05

Heat, hyperthermia, 0.05 Heat, sunstroke, 0.05 Heat, heat, rash, 0.06 Heat, heat, exhaustion, 0.06 Heat, heat, stroke, 0.06 Heat, over, heated, 0.06 Heat, heat, exposure, 0.06 Heat, heat, related, 0.06 Heat, heat, exhaust, 0.06 Heat, over, heating, 0.06 Heat, heat, cramps, 0.06 Heat, heat, illness, 0.06 Heat, heat, issues, 0.06 Heat, heat, bumps, 0.06 Heat, sun, burn, 0.06

Heat, sun, poisoning, 0.06 Heat, sun, burned, 0.06 Heat, sun, blisters, 0.06 Heat, sun, reaction, 0.06 Heat, heat, syncope, 0.05 Heat, heat, fatigue, 0.05 Other, attack, 0.6 Other,flash,0.6 Other, palpitations, 0.6 Other, rate, 0.6 Other, racing, 0.6 Other, flashes, 0.6 Other, pad, 0.06 Other, pack, 0.06 Other,vent,0.06

HEAT SYNDROME DEPLOYMENT

- Existing RODS-based "previous 120 days" baseline not effective for Heat
- Altarum developed a custom baseline for the Heat syndrome
 - Used historical data from multiple years to develop a year-round baseline ratio (per 100 visits) of Heat syndrome classifications for State and each Michigan county
 - Also applied a minimum threshold of 5 classifications per county
 - To signal alert, Heat classifications must exceed the minimum and the historical baseline ratio
 - The historical visit baseline was calculated per day, per county, and with a two-week averaging of these values around a given day when calculations are performed
- When alerts are generated they use the existing MSSS set up to notify the appropriate people



EHE INTEGRATION PROCESS

Implementation





EHE PRELIMINARY RESULTS

- MDHHS performed a review of results after the final Heat syndrome changes were implemented on 14-Nov-2016
- For the time period of 15-Nov-2016 to 27-Nov-2016, the set of TEST visit (n=184) chief complaints included 161 dehydration, 14 heatassociated, and 11 sun-associated keywords, representing off-season baseline activity
- No Heat syndrome alerts occurred during this timeline (15-Nov-2016 to 27-Nov-2016)
- Additional "peak season" results will be available through MDHHS after the summer of 2017



EHE INTEGRATION PROCESS

Lesson Learned	Solution					
For RODS-based systems, syndrome IDs must be reassigned	Altarum's solution was to change Other and Default to negative numbers and then—since arrays can't include negative numbers—convert the arrays to mappings					
The Heat syndrome needs a tailored alerting baseline in RODS-based systems	 Altarum's solution was to implement a dual threshold of both: a ratio based on date-based historical visits per county and a minimum lower boundary of 5 per county 					
Unable to apply exclusion terms as negatives in Heat syndrome	Altarum's solution was to add those terms as keywords in the Other syndrome so that their presence would decrease the likelihood of a Heat classification					
Best to deploy during spring or summer	Heat was added to MSSS in November and robust results may not be known until warm weather returns					

MERCI, GRACIAS, THANKS

For questions about the Heat syndrome and results, please contact:

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