Public Health Practice Problem Definition

CONTACT INFORMATION

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PROBLEM DESCRIPTION

Summarize the problem:

Given the background of climate change, there is an increasing demand for public health to characterize weather-related illness. The public health impact of extreme heat or cold events can be characterized from Emergency Department syndromic surveillance data to monitor conditions that aren't routinely captured by other surveillance methods. However, case detection is limited to the selected terminology in the syndrome definition. A statistical approach to monitor all-cause, excess morbidity during a weather event and estimate the risk attributed to specific conditions would allow public health to: 1) characterize the broad impact of these events more appropriately; and 2) create targeted interventions to reduce overall burden in at-risk populations due to specific causes.

The Chicago heat wave in 1995 captured a lot of attention over the estimates of the magnitude of heat-related deaths and the debate over conservative verses broad case definitions. Shen compared deaths coded from a broadly-defined, heat-related mortality definition from the Cook County Medical Examiner's Office during the heat wave against excess all-cause mortality and found that even a broadly-defined heat-related classifier underestimated deaths due to the heat wave (19 per 100,000 vs. 24-25 per 100,000).

Our emergency preparedness staff has questioned the completeness of heat-related estimates from ED data. Fewer studies have reviewed non-fatal heat-related illness. Re-visiting the heat wave of 1995, Semenza analyzed hospital discharge data to characterize the underlying diseases of at risk populations. The majority of excess hospitalizations were the result of dehydration, heat stroke, heat exhaustion and acute renal failure in the primary diagnosis. Co-morbid conditions were exacerbated by cardiovascular disease, diabetes, renal disease, and nervous system disorders, particularly in the population 65 and older.

A study by Knowlton looked specifically at emergency department visits during the 2006 California heat wave and found a significant increase in ED visits but not hospitalizations. Stratifying by region, age (under 5, 5-64 and 65 and older), conditions, race and ethnicity they calculated risk ratios in a case-crossover design, from a baseline established from the weeks surrounding the heat wave. There were significant increases for acute renal failure, cardiovascular disease, diabetes, electrolyte imbalance and nephritis. Patterns that were distinct for ED visits included electrolyte imbalance in the youngest age group, and cardiac-related illness in Hispanic population.

There have been very limited studies into excess visits due to violence or mental health conditions in syndromic data during a heat wave. These are important health issues, particularly in our urban centers that warrant further investigation.

Syndrome definitions sometime exclude common terms, such as dehydration, over concerns that the baseline presents less specificity to characterize heat related illness. However, a conservative definition underestimates the true impact of a critical public health event, such as a heat wave, which limits our ability to assess the magnitude and appropriate prevention and response.

References:

Knowlton K[1], Rotkin-Ellman M, King G, Margolis HG, Smith D, Solomon G, Trent R, English P. The 2006 California heat wave: impacts on hospitalizations and emergency department visits. Environ Health Perspect. 2009 Jan;117(1):61-7. doi: 10.1289/ehp.11594. Epub 2008 Aug 22.

Semenza JC[1], McCullough JE, Flanders WD, McGeehin MA, Lumpkin JR. Excess hospital admissions during the July 1995 heat wave in Chicago. Am J Prev Med. 1999 May;16(4):269-77.

Shen T, Howe HL, Alo C, Moolenaar RL. Toward a broader definition of heat-related death: comparison of mortality estimates from medical examiners' classification with those from total death differentials during the July 1995 heat wave inChicago, Illinois. Am J Forensic Med Pathol. 1998 Jun;19 (2):113-8.

SOLUTION REQUIREMENTS

Describe the type of solution you are seeking (e.g., anomaly detection, signal validation, data quality characterization):

Anomaly detection (with flexible baselines and excess all-cause morbidity calculation), Cause-specific morbidity risk ratios stratified by age, gender, race/ethnicity.

Describe what type of solution would enable you to implement it in your practice setting (e.g., Do you need an algorithm? Do you need code? If you need code, does it have to be written in any particular programming language?).

Statistical calculations of excess and risk ratio, coded in R and easy to understand visualizations or reports

Describe who will use the solution. For example, how many users will there be and what level of skill do the users have? Are the users all within a single jurisdiction/organization?

Local health department staff, particularly emergency preparedness and environmental health-could be 10-20 users with basic analytical capabilities. HHS Regions could implement this across jurisdictions for data sharing.

Note any other constraints:

Illinois DPH has data in BioSense. Statewide implementation is on-going and facility participation is increasing weekly. There is very limited historic data.

For a portion of the state, syndromic surveillance data could come from Cook County's ESSENCE system, which is well established and may be more readily available.

VALIDATION

Does a gold standard exist with which to validate the proposed solutions?

- ☐ Gold standard exists within the provided data set (e.g., an outbreak signal nested within baseline data)
- ☐ Gold standard exists in a separate data set, which can be provided to the workgroup (e.g., laboratory data to validate ED data)
- ☐ Gold standard exists but cannot be furnished
- X Gold standard does not exist

INPUT DATA

List the minimum data elements that can be provided to address the problem:

Visit date/time, Facility ID, age, gender, ZIP code, chief complaint and discharge diagnosis

Illinois only: race, ethnicity and for a portion of the data, triage note and clinical impression are available

How much historical data can be provided?

Cook County data has five or more years. Illinois data is limited to 2013-2014 and only for a portion of facilities.

Describe any restrictions for sharing the data:

Illinois will have to prepare a DUA and obtain IRB approval

Note any other relevant data characteristics:

OUTPUT DATA

NOTES