Use of 911 Ambulance Dispatch Data for Syndromic Surveillance of Heat-related Illness in Toronto

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Outline

- Syndromic surveillance
- Heat effects on human health
- Toronto EMS 911 data
- Heat-related illness case definition
- Retrospective analysis
- Prospective analysis
- Public health implications

Public Health Surveillance

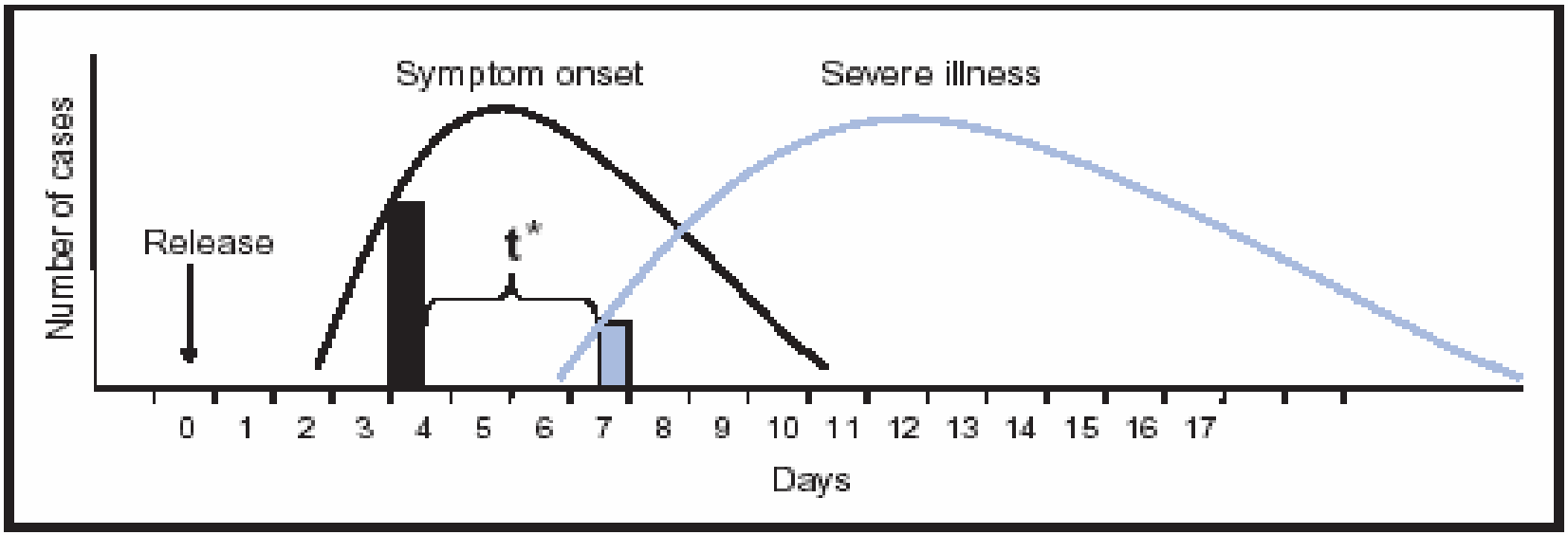
- The practice of surveillance is changing to
  (i) address new and emerging diseases
  (ii) to take advantage of the increasing availability of electronic data
- New approaches to surveillance are being explored to *complement* traditional disease, injury and exposure surveillance.
- One of these approaches is **syndromic surveillance**.

What is Syndromic Surveillance?

- Innovative electronic surveillance systems which use data based on symptoms, rather than diagnosis
- Automated extraction and analysis of routinely collected data
- Provide near real-time data
- Linked to an automated analysis & warning system

Advantage of Syndromic Surveillance

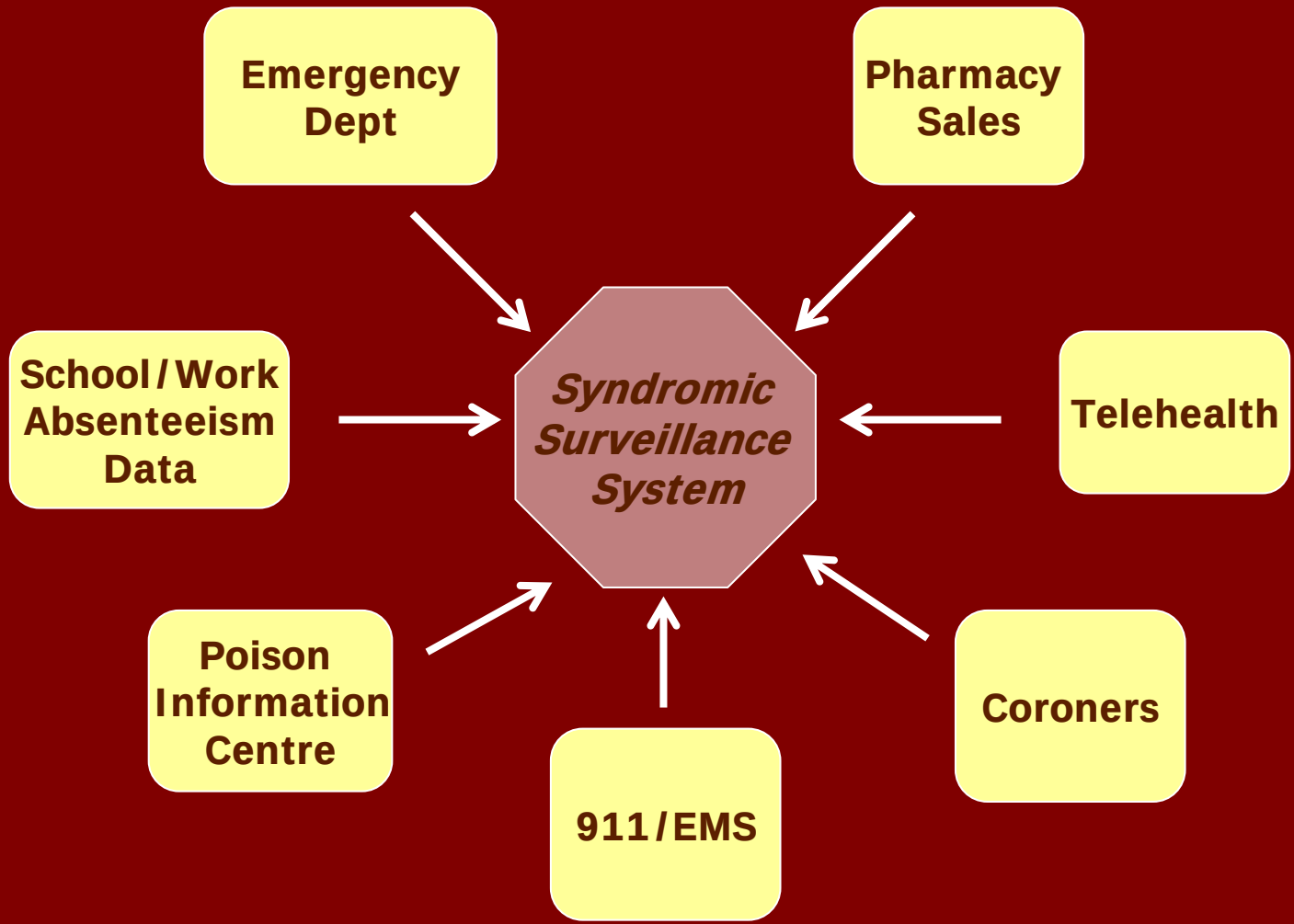
FIGURE. Syndromic surveillance — rationale for early detection



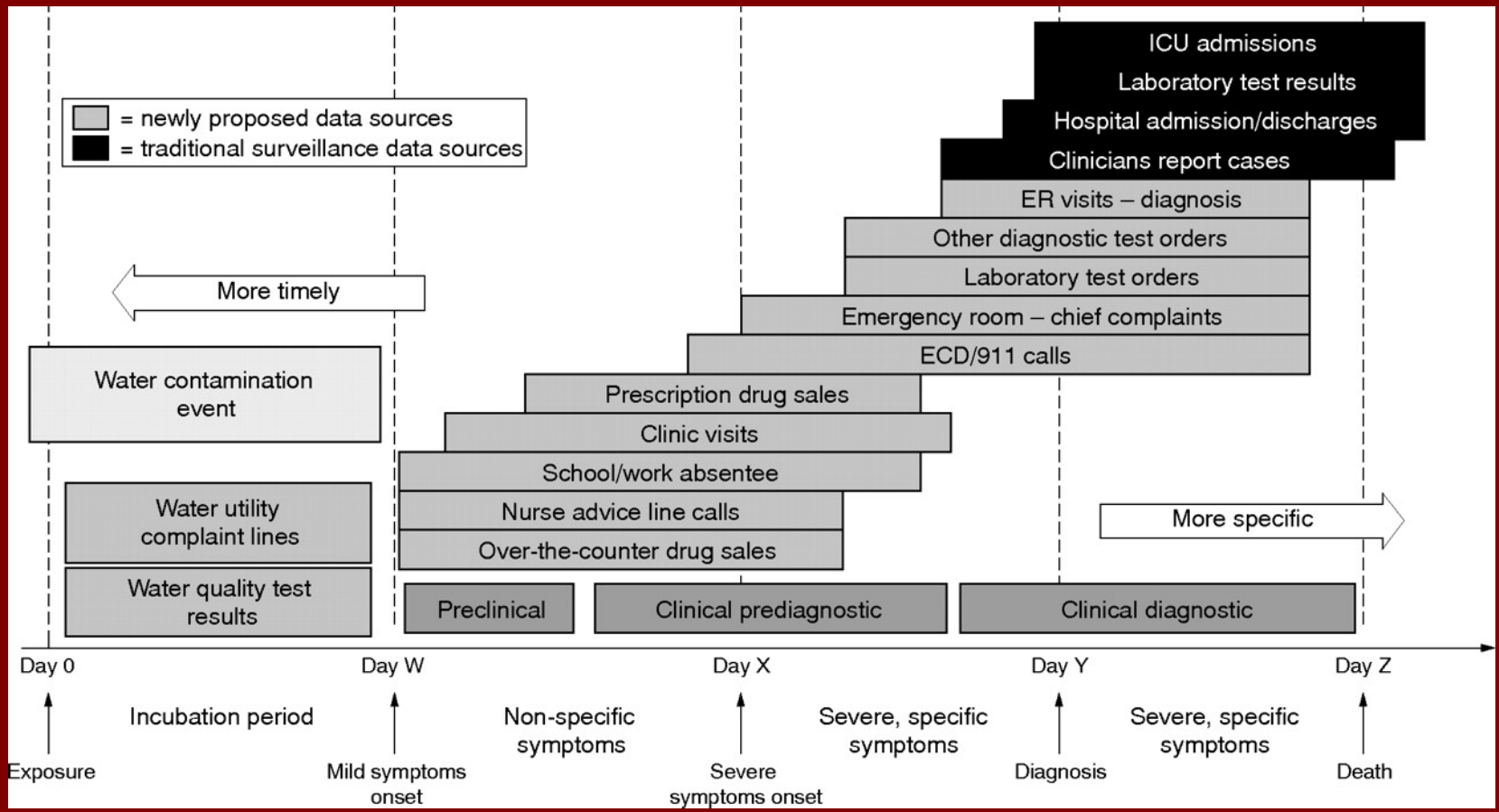
* t = time between detection by syndromic (prediagnostic) surveillance and detection by traditional (diagnosis-based) surveillance.

Source: Kelly J Henning, New York City Dept of Health and Mental Hygiene

Data Sources for Syndromic Surveillance Systems



Surveillance Data Sources and Health Seeking Behaviour



Berger, M. et al. J Epidemiol Community Health 2006;60:543-550

Goals of Syndromic Surveillance Systems

- Early outbreak detection
- Improve response times
- Provide additional information and increasing “situational awareness”
- Build and strengthen relationships with stakeholders – collaboration
- Improve epidemiological analysis

Advantages of Using 911 Dispatch Data for Syndromic Surveillance

- *Timeliness*: in the capture and process of the data
- *Simplicity*: use of pre-existing data
- *Acceptability*: willingness of stakeholders to contribute to data collection and analysis
- *Portability*: system could be duplicated in another setting
- *Cost*: could be done with no significant software or hardware requirements

Aren't The Paramedics Coming?

Emergency Call

Police & Fire may be sent as well

Address

Situational Information

Patient Information

Unit Assigned

Unit Responds

Other Location Information

Patient Care Instructions

Paramedics Arrive

Patient goes to Hospital

Questions re Syndromic Surveillance?

Health Impacts of Hot Weather

Heat-Related Mortality

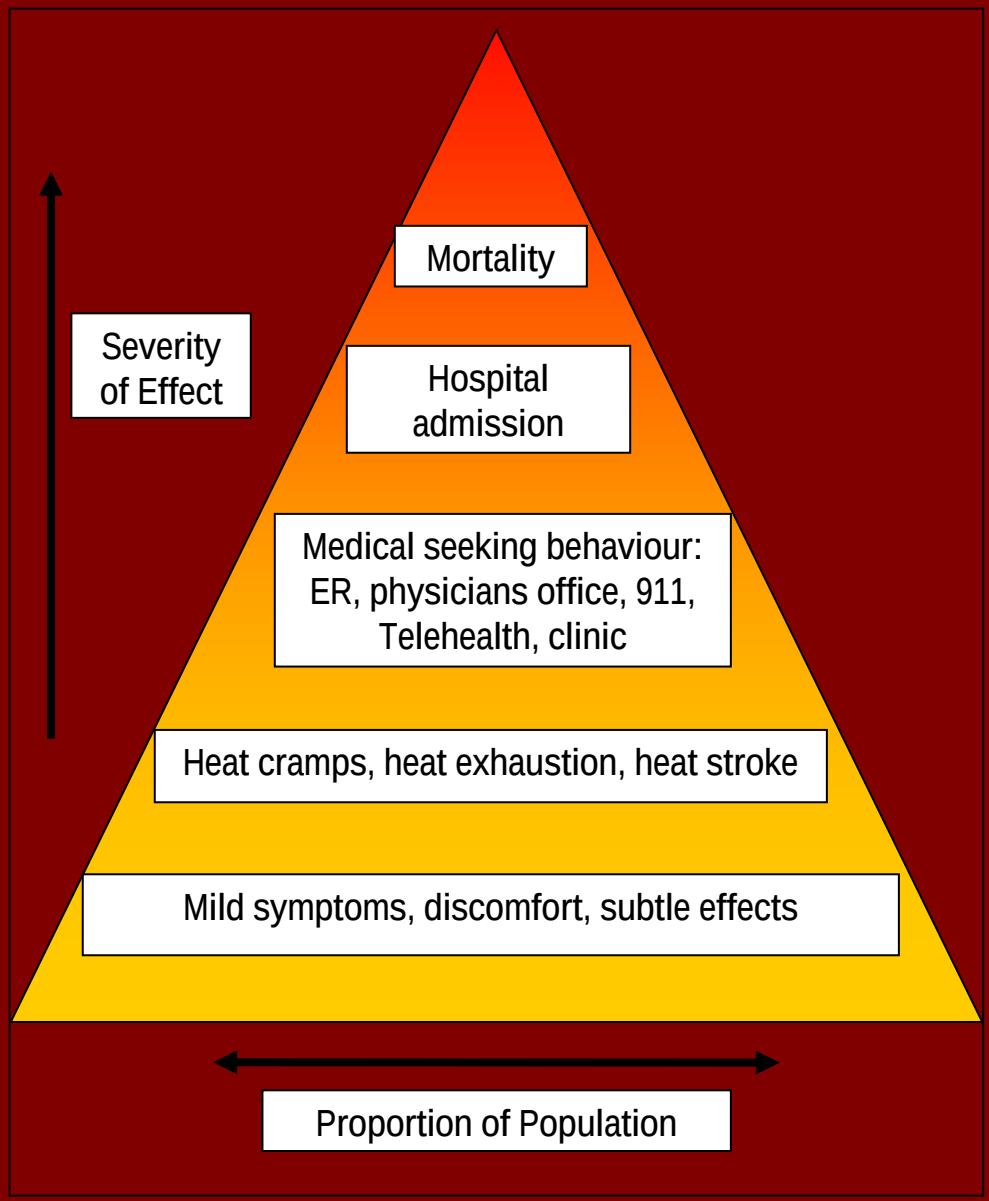
- Europe, 2003: > 70,000 excess deaths
- Chicago, 1995: > 700 excess deaths
- V- or U-shaped curve
- Historical analysis of Canadian cities:
  - Toronto: 120 annual heat-related deaths
  - Projected that in the future these values will more than double by 2050 and triple by 2080

  (TPH, 2005).

Heat wave, Chicago, 1995: refigerator trucks by city morgue

Source: Klinenberg, “A Social Autopsy of Disaster in Chicago”, 2003

Heat-Related Illness Pyramid

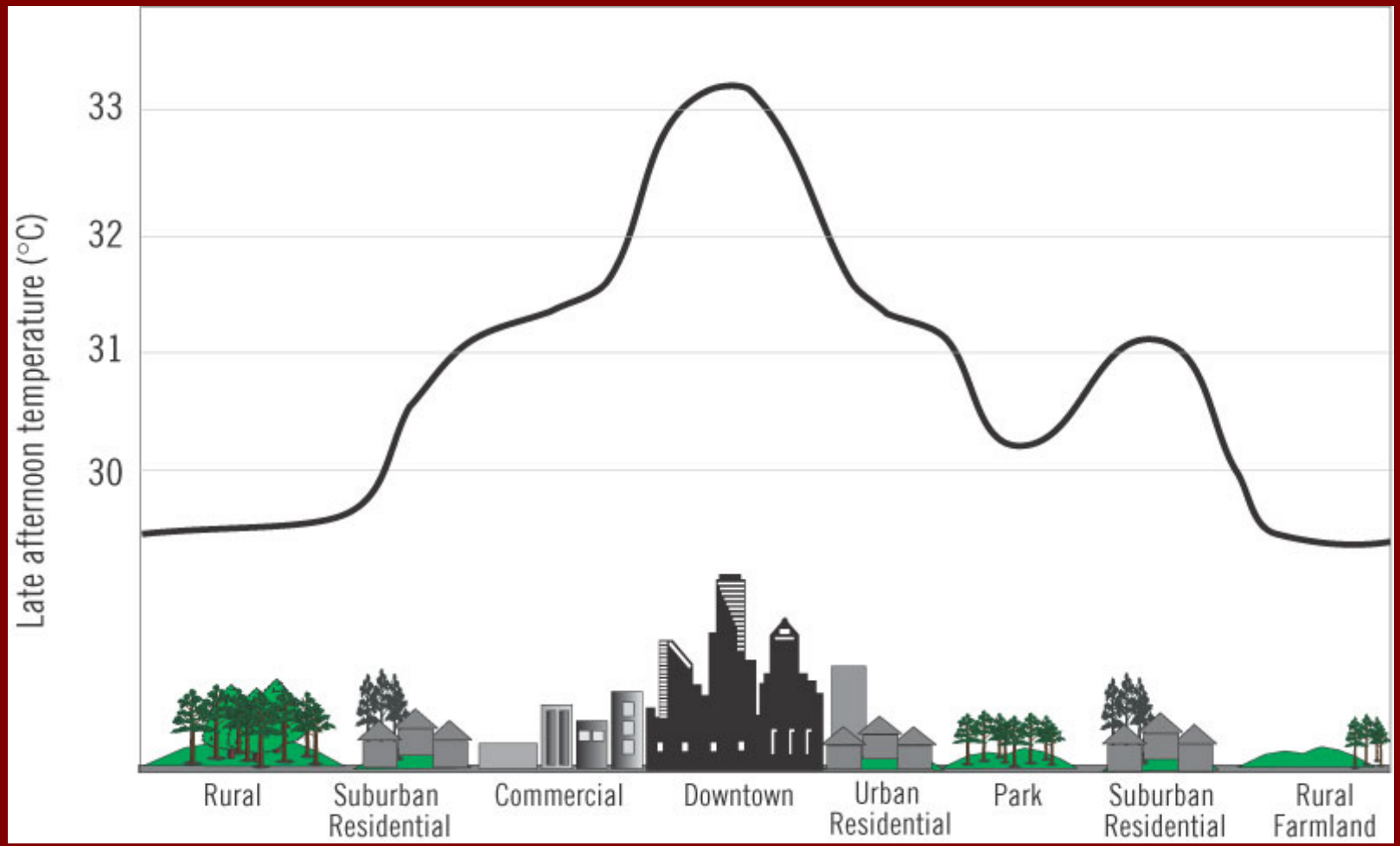


Adapted from sources: Angus (2006); Health Canada (2006).

Toronto

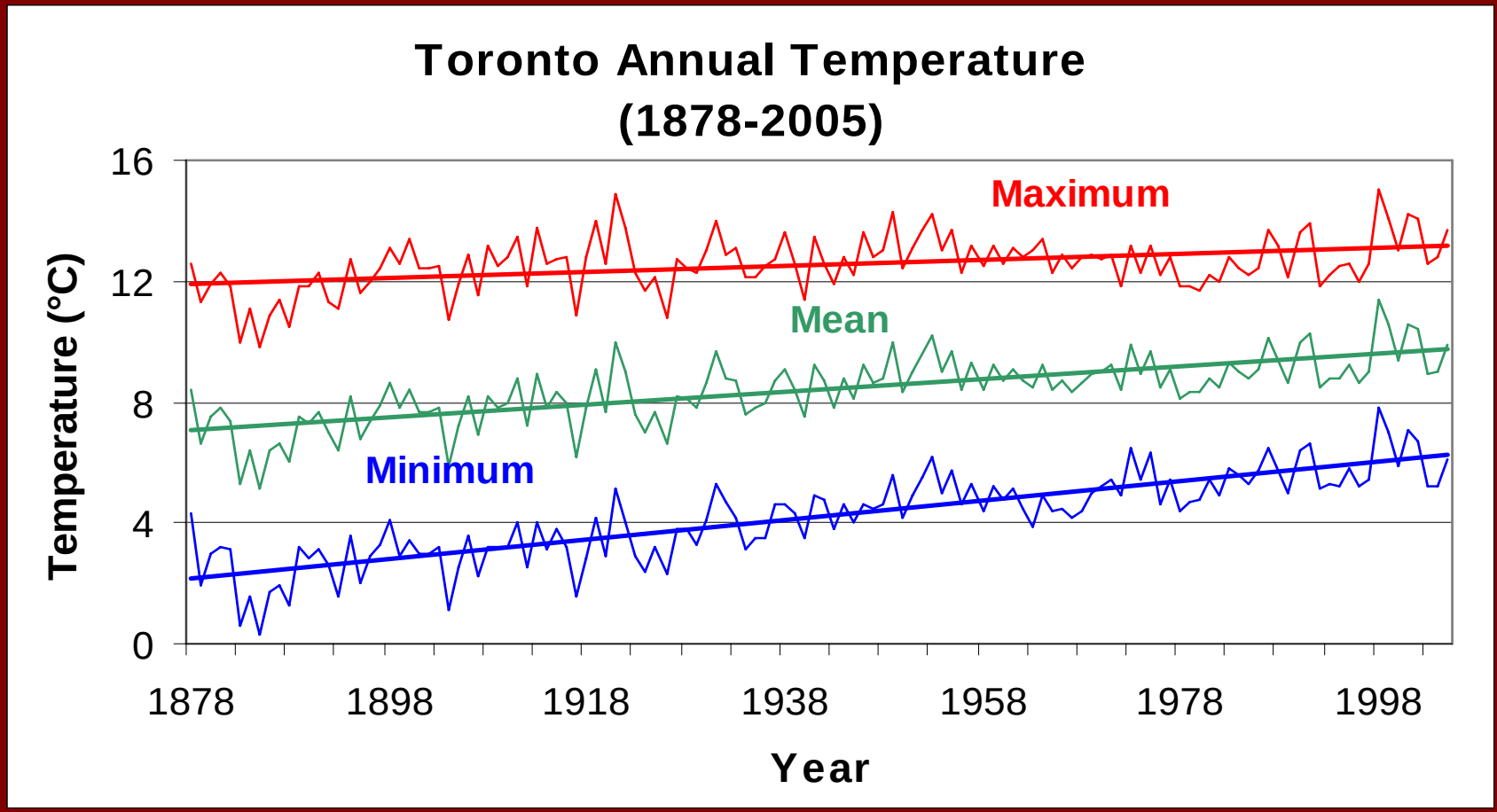
- Urban Heat Island
- Vulnerable population
- Aging population
- Continued urbanization
- Lack of acclimatization in temperate zones
- Future projections of increasing temperature mean and variance

Urban Heat Island Profile

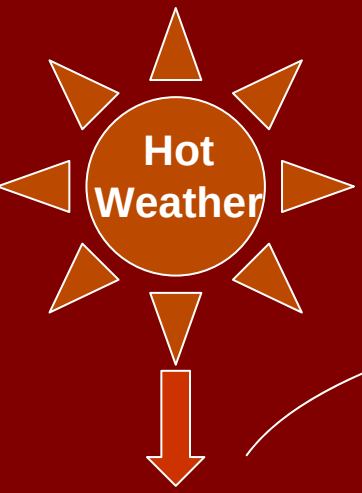


Natural Resources Canada

Temperature Trends, Toronto



Influencing Factors in the 911 Call Process for Heat-Related Illness



Individual calls Toronto EMS directly

More severe illness?
Elderly?
No other means of transportation?

Fluids, air conditioning…

Individual feels unwell → **Self-care** → **Individual worsens** → **Call to Toronto EMS**

Influenced by underlying risk factors:

Age
Pre-existing illness
SES
Behavioural
Environmental

Telehealth

Hospital (non-ambulance)

Visit physician, clinic

Does not seek help

Recovery

Death
- Direct effect
- Indirect effect (i.e. harvesting)

Spectrum of heat-related illness

Mild → **Severe**

Other work with 911?

- Few studies have examined the relationship between heat and health using ambulance dispatch data.
- Examine increase in all ambulance response calls above what is expected with increases in high temperatures (Cerutti et al. 2006; Dolney et al. 2006).
- During World Youth Day in Toronto, most useful 911 call-code cluster was for heat-related illness (HRI) specifically.

Toronto Emergency Medical Services (EMS): Communications Centre

- Single-provider EMS system
- Annual call volume - approx. 425,000
- Fully computerized system
- Uses the Medical Priority Dispatch System (MPDS), a widely used EMS call sorting algorithm, to classify calls.

MPDS Code Categorization

Entry Questions

↓

Key Questions:

1. Is s/he completely awake?
2. Is s/he breathing normally?
3. Is s/he changing colour?
4. What is her/his skin temperature?

↓

Dispatch Codes:

20-D-1 Heat/Cold Exposure, not alert
20-C-1 Heat/Cold Exposure, cardiac history
20-B-1 Heat/Cold Exposure, change in skin colour
20-A-1 Heat/Cold Exposure, alert

Medical Priority Dispatch System, Priority Dispatch Corp., Salt Lake City, Utah

Added value

- 911 data provides geospatial information about the location where the individual has become ill.
- Differs from many other traditional medical data sources that use place of residence.
- Important for syndromes where place matters like heat illness.

Questions re 911 Data?

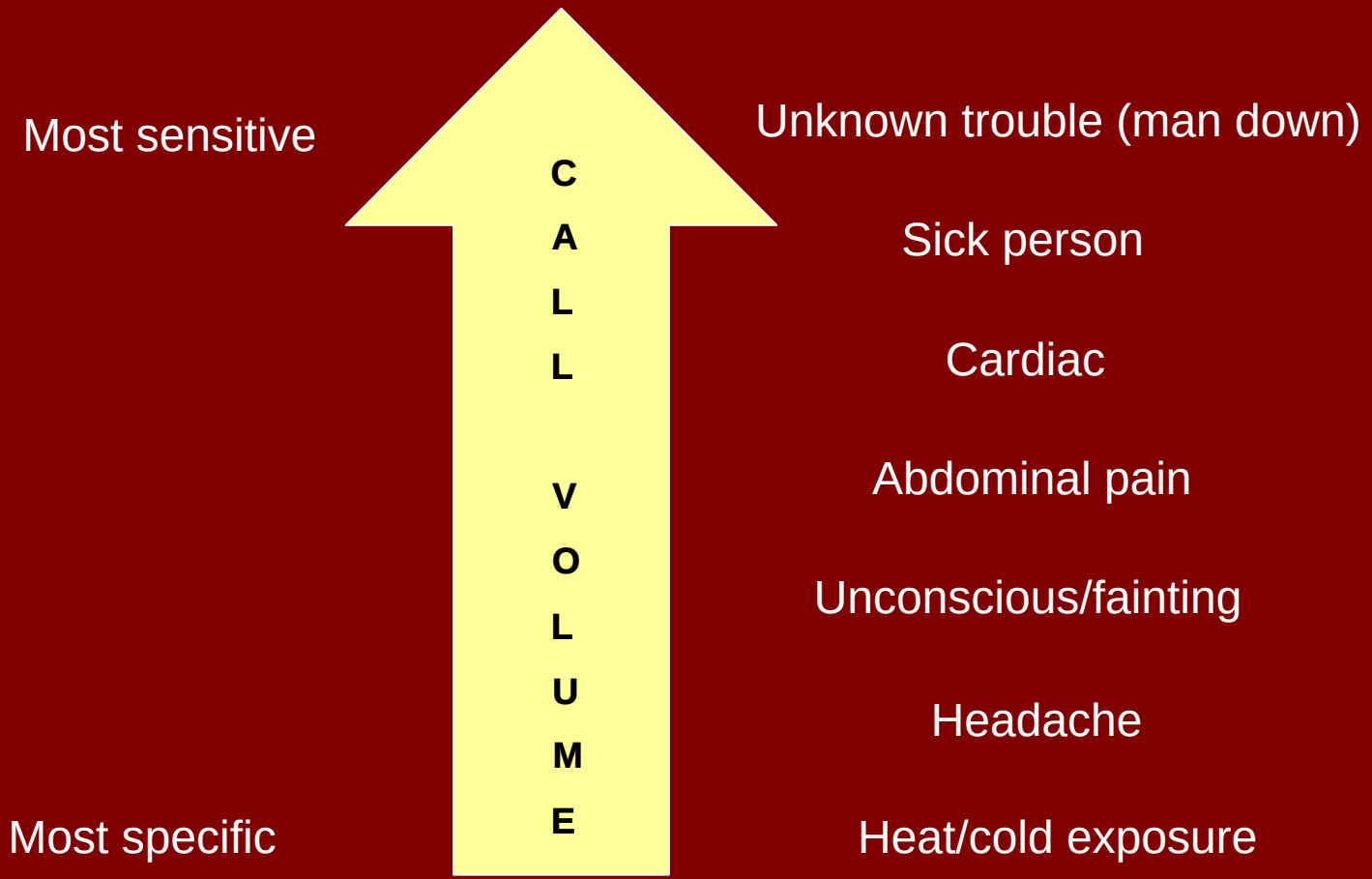
Our Research Program

- Retrospective:
  - Develop case definition, analyze data from 2002-2005 using time series analysis, compare with emergency department visits for the same time period.
- Prospective:
  - Test the system in near-real time as a public health tool (summer 2007 – CUHI funded)
- Public Health Responses:
  - Systematic review, NCCEH funded

911 Ambulance Dispatch Data – Retrospective

- Daily call information for all *emergency* calls to EMS between 2002-2005 (approximately 850,000 calls)
- Excludes cancelled calls and inter-facility transfers.
- Microsoft Access database format
- Quality assurance of MPDS assignation – 98% agreement, call assignation to US National Academy of Emergency Medicine standards

Defining HRI with 911 Call Data



Process for Selecting Codes - Clinical

- Approx 500 medical dispatch call categories reviewed.
- Series of expert focus groups: EMS paramedics, EMS dispatch operators, public health physicians, epidemiologists, public health managers, medical residents
- Selected call categories that could represent HRI and ranked according to specificity

Process for Selecting Codes - Empirical

- Each call category was assessed graphically with daily mean temperature
- Relationship with mean temperature explored using time series.
- 4 groups of call categories were selected as ones which may represent HRI:
  - Heat/cold exposure,
  - Breathing problems,
  - Unconscious/fainting,
  - Unknown problem/“man down”

Call Categories That Most Clearly Represent HRI

20D01	Heat/Cold exposure- Not alert
20C01	Heat/Cold exposure – Cardiac history
20B01	Heat/Cold exposure – Change in skin colour
20B02	Heat/Cold exposure – Unknown status (3rd party caller)
20A01	Heat/Cold exposure - Alert

Questions re Case Definition?

911 Ambulance Dispatch Data – Prospective

- Daily call information for all heat-related calls and aggregate counts of all emergency calls
- Sent to researchers on a shared secure server
- The proportion of calls for HRI to all emergency calls was calculated for each day.
- Values for maximum & mean temperature (ºC) were obtained from Environment Canada for each day.

Prospective Analysis cont.

- Processed through an aberration detection program, EARS (Early Aberration Reporting System)
- Informed Emergency Heat Response Team at Toronto Public Health if aberration
- Mapped call locations

Public Health Advantages

- Additional data source to support decisions around declaring heat alerts
- New geospatial information to assist in intervention targeting

Public Health Challenges

- Technical issues – several days when data was not sent, so occasionally sent in batches every few days.
- Timing with current heat health warning system
- Requires daily person time – not a fully automated system

Key Lessons

- Stakeholder engagement
- Successful data sharing
- Significant “up front” work with the data
- Communications

Ongoing work & next steps…

- Addition of other geospatial data (e.g. air conditioning use, socioeconomic status)
- Geospatial analysis using Moran's I statistic
- Further examination of days when 911 calls increased but a heat alert was not called

Comments and questions?

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