

A Comparison Study of Heat Related Emergency 911 Calls: Phoenix, Arizona and Chicago Illinois; 2003 to 2006



Donna A. Hartz^{1*}, Chona Sister³, Wen-Ching Chuang²
Arizona State University

¹School of Geographical Sciences; ²School of Sustainability; ³Global Institute of Sustainability *Presenting Author

Data and Methods Used:

- 911 Calls identified as heat related from City of Chicago and Phoenix Fire Department 2003 - 2006: time and location data only
- Climate Data: Federal Aviation Administration Automated Surface Observing Systems (ASOS) station located at Midway International Airport in Chicago, Illinois and National Weather Service ASOS station at Phoenix Sky Harbor Airport
- Heat index was calculated using temperature and relative humidity data – highest heat index for each day was extracted as “maximum heat index” however, if temperature was <80°F then maximum air temperature was used in lieu of maximum heat index
- Data matrices included climate data (maximum and minimum temperature, maximum heat index); climate means; date and time of HRD; day of week
- Statistical analyses: SPSS

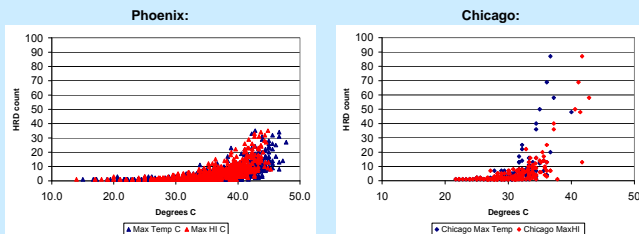
Overview:

This study details the climate thresholds related to “heat related dispatches” (HRD) – emergency 911 calls from two areas similar in population size: the City of Chicago, Illinois and 12 cities of metropolitan Phoenix, Arizona for the years 2003 through 2006. These HRD were identified by emergency responders as “heat” related. HRD counts and climate characteristics vary considerably between these two cities. While Phoenix experiences a longer HRD season, and many more HRD, Chicago experienced spikes in HRD more than double that of Phoenix. Comparisons are made between climate and the HRD counts and spikes. Although extreme heat events are responsible for more deaths in the United States than floods, hurricanes and tornados combined, few receive publicity until extreme events occur, such as the 2003 heat wave in Europe (>35,000 deaths) or the Chicago heat wave of 1995 (~465 deaths). Lesser publicized are the countless thousands who fall victim each year to non-fatal health emergencies and illnesses directly attributed to heat. With projections of increased frequency and intensity of heat waves, the most recent IPCC report calls for more research on health impacts of climate, particularly heat induced. Regional temperature increases could exacerbate the already increased heat caused by urbanization. With 50% of the world’s population now urban, understanding heat related illnesses in respect to the specifics of climate, social demographics and spatial distributions is imperative. This information can support better preparation for heat related emergency situations with regards to planning for response capacity and placement of emergency resources and personnel.

Conclusions:

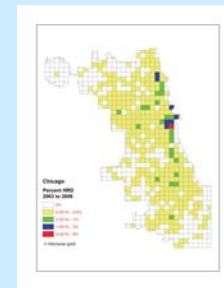
- Phoenix HRD: more calls, higher means; HRD begin earlier and end later in the year
- Chicago’s HRD rapidly rises (spikes) after 4 to 5 days of maximum temperature and heat index exceeding normal maximum temperature
- Phoenix does not experience these huge spikes in HRD
- Phoenix’s HRD thresholds for rapidly rising HRD
 - Very similar for maximum temperature or heat index
 - around 35C to 38C
- Chicago’s HRD thresholds for rapidly rising HRD:
 - About 28C to 30C for maximum temperature
 - About 32C to 35C for maximum heat index
- Chicago’s 2006 heat wave had a many fold increase in HRD when the MaxT, and especially heat index, rose more than 5C higher than the normal MaxT
- Phoenix’s 2006 heat wave experienced relatively moderate increases in HRD
- Chicago’s heat wave had much higher than normal maximum temperature and heat index than experienced in Phoenix’s 2006 heat wave: might account for Chicago’s higher HRD

Maximum Temperature and Maximum Heat Index (Days with HRD) 2003 - 2006



Phoenix’s HRD calls do not spike like Chicago’s. Statistically, heat index plays a much more significant role in HRD in Chicago, than in Phoenix. However, heat index is also the strongest predictor for Phoenix.

Heat Related Emergency Dispatch (911 call) Data:		
	Chicago	Metro Phoenix
Population Served	City of Chicago ~2.8 Million	12 Cities ~ 2.7
HRD (2003 – 2006)	1118	4206
Most Occur During	May through Sept (2 exceptions: Jan 04 & Oct 05)	March through Oct (many exceptions)
Mean # HRD (June - August)	2.9 per day	8.5 per day
% Days with HRD (Jun – Aug)	47%	99%
% Days with HRD (May – Sept)	32%	92%
% Days with HRD having 1 or 2	49%	37%
Highest HRD Count	87	35



In both cities the downtown, central business districts have the highest concentrations of HRD

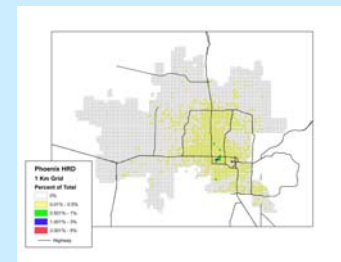


TABLE 1: Phoenix’s Maximum Temperature and Heat Index is higher than Chicago’s on days with a similar number of HRD. However, the temperature and heat index difference from normal is much higher in Chicago

HRD Range	HRD count	Mean HRD	Mean Max T C	Mean HI C	Max T diff from Norm Max T	Max HI diff from Norm Max T
Chicago HRD						
1 to 4	134	1.7	29.2	29.3	1.3	1.4
5 to 9	34	6.5	31.9	32.4	3.8	4.3
10 to 20	17	13.2	33.8	34.9	5.5	6.7
>20	9	48.3	35.4	39.0	6.3	9.9
Phoenix HRD						
1 to 4	418	2.0	34.4	32.5	1.9	0.0
5 to 9	209	7.4	40.1	38.6	2.0	0.2
10 to 20	103	13.0	42.4	40.7	3.3	1.6
>20	22	26.5	44.3	42.7	4.5	2.9

Heat Wave(s) of 2006 : Chicago: July 13 to Aug 3 Phoenix: July 11 to 26

During their heat waves Chicago’s Maximum Temperature and Heat Index were much higher than Phoenix’s when compared to their “normal maximum temperature” – possibly accounting for Chicago’s huge spikes in HRD

