



Assessing the Impacts of Extreme Heat Episodes on Vulnerable Populations in North Carolina

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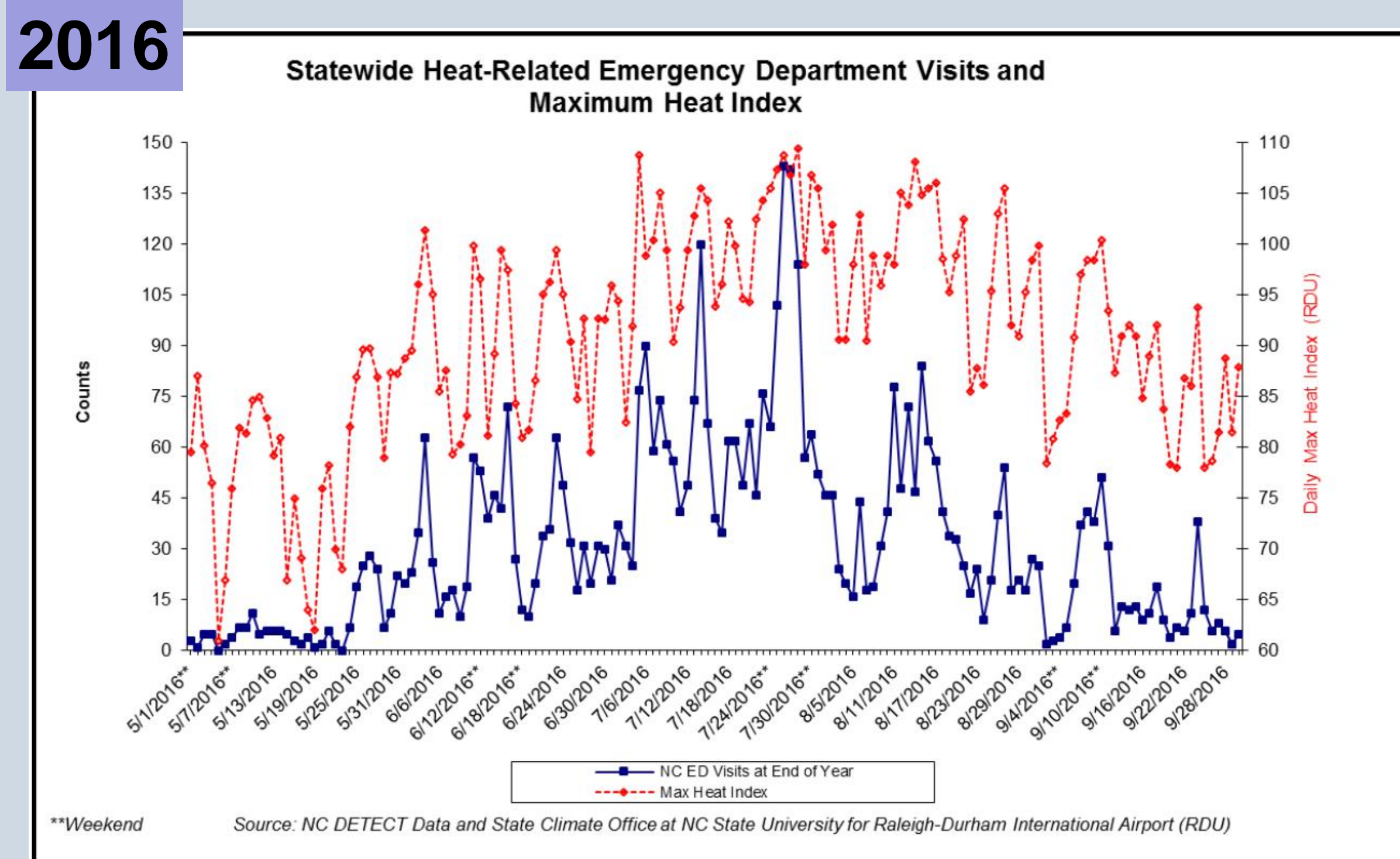
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Overview: Heat is the number one weather-related killer in the US, according to National Weather Service statistics (www.nws.noaa.gov/om/hazstats.shtml). In an effort to determine how extreme heat impacts North Carolinians and to identify vulnerable populations in North Carolina, the NC Department of Health and Human Services has been tracking statewide heat illness data since 2007, using data collected from emergency department visits. These data are sorted by gender and age, and information regarding aggravating factors is collected. Emergency department visits are compared to observed daily maximum heat index values.

How it was done: Inpatient hospitalization data was obtained from the North Carolina Inpatient Hospital Discharge Database (NC State Center for Health Statistics). Discharge data includes demographic and diagnostic information. Emergency department visit data was obtained through the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), created by the North Carolina Division of Public Health, in collaboration with the Carolina Center for Health Informatics in the UNC Department of Emergency Medicine, and collects state-mandated data from all 122 emergency departments in North Carolina. Heat-related illness is captured through a near real-time keyword search for “heat”, “hot”, “hyperthermia”, “heat cramp”, “heat exhaustion”, “heat stroke”, and “sun stroke” in chief complaint or triage notes of emergency department records or a diagnosis code for heat-related illness. These figures present an estimate of the number of emergency department visits for heat-related illness.

2016 saw 4,847 heat-related emergency department visits, a 43% increase from 2015 (3,376).

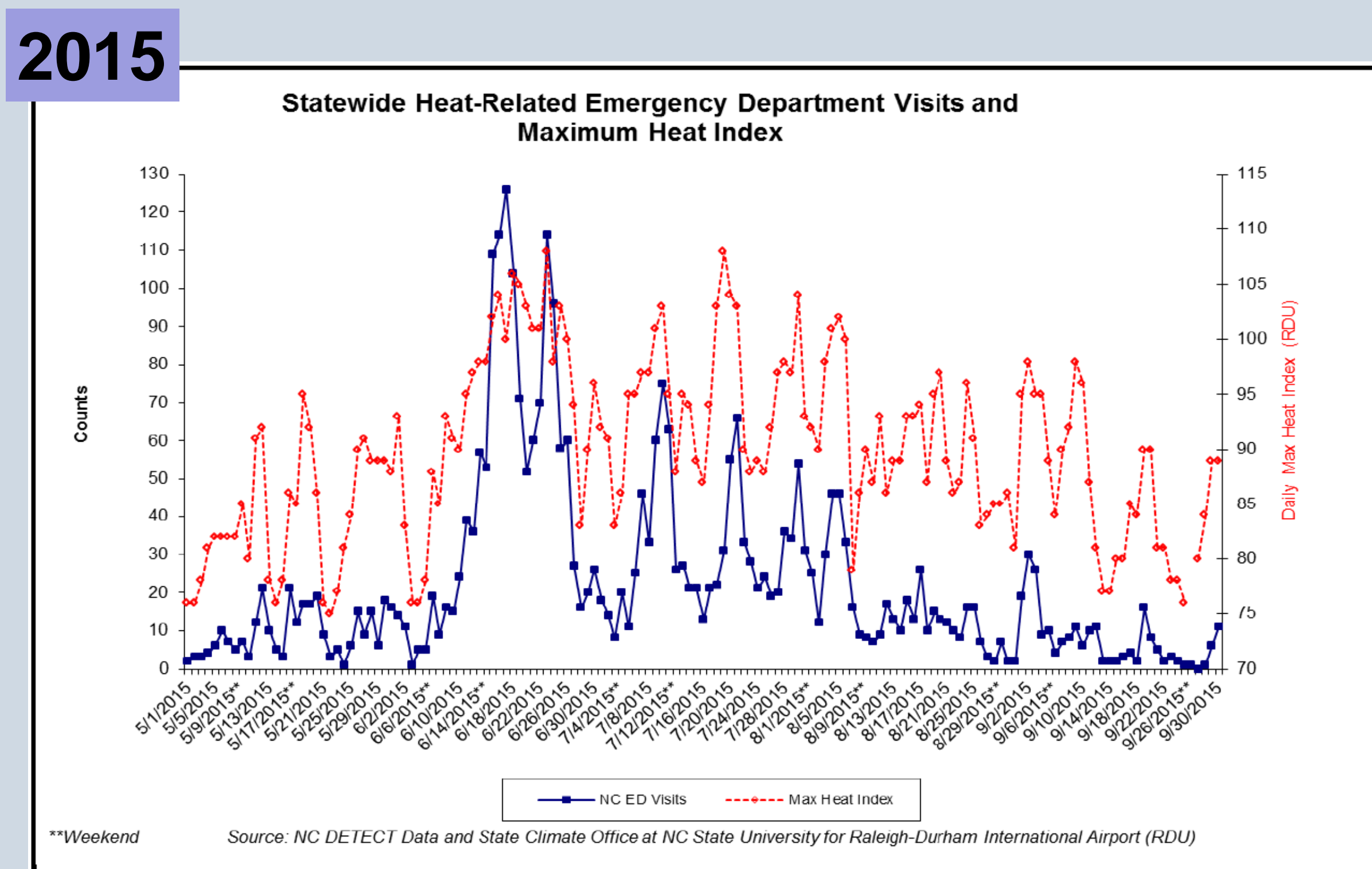


Left: Daily heat-related emergency department visits (blue) and daily maximum heat index values (red) at Raleigh-Durham International Airport (RDU) for 1 May to 30 September 2016.

The number seeking treatment for potential heat-related illnesses rose roughly in tandem with heat index peaks, especially for heat indices over 90°F. Visits peaked during the hottest days in June and July, then dropped in August despite continued high heat indices. This may be a reflection of acclimation, but results are not conclusive.

Male	3,555 (73%)
Female	1,290 (27%)

(Gender unknown in 2 cases)



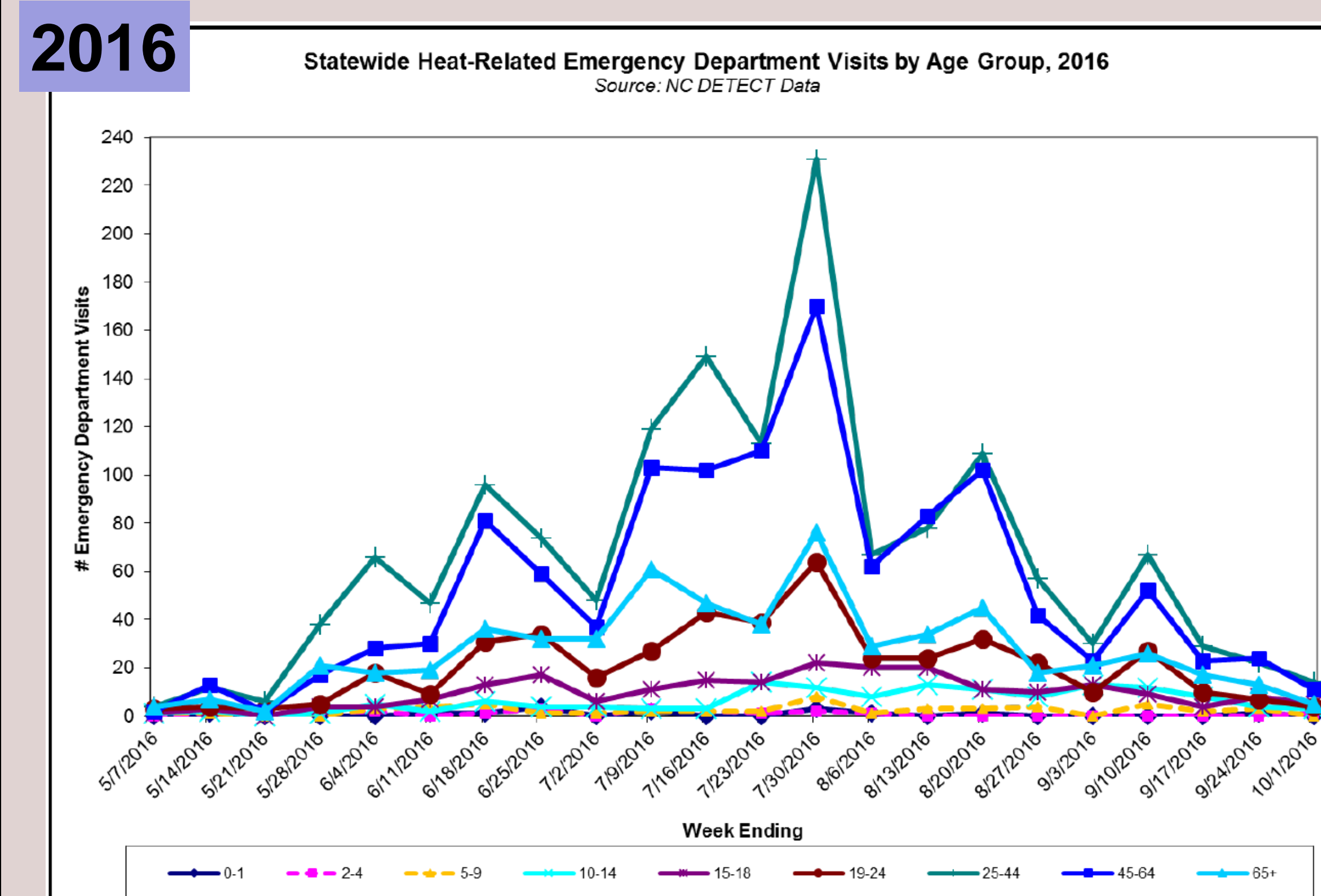
Left: Daily heat-related emergency department visits (blue) and daily maximum heat index values (red) at Raleigh-Durham International Airport (RDU) for 1 May to 30 September 2015.

Male	2,479 (73%)
Female	897 (27%)

Frequently-noted aggravating factors:

- Working outside (e.g., construction, roofing, landscaping, agriculture, and firefighting)
- Recreation (e.g., yard work, student athletics, and outdoor exercise and sports such as running or playing football, baseball, or tennis)
- Living and/or working in a building without air conditioning

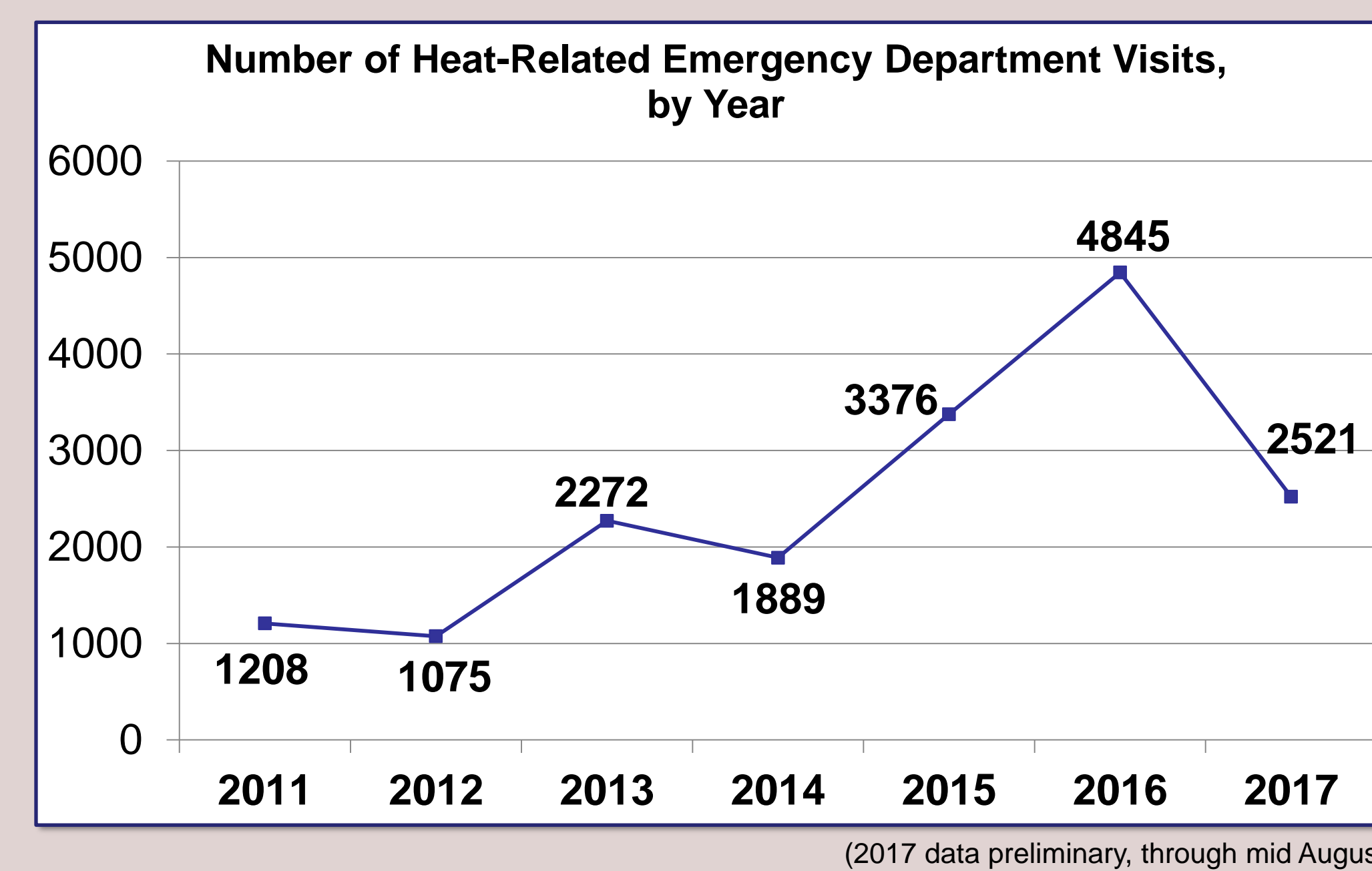
Number of emergency department visits for heat-related illness was highest among 25-64 year olds. Around 25% of those 65 or older resulted in hospitalization.



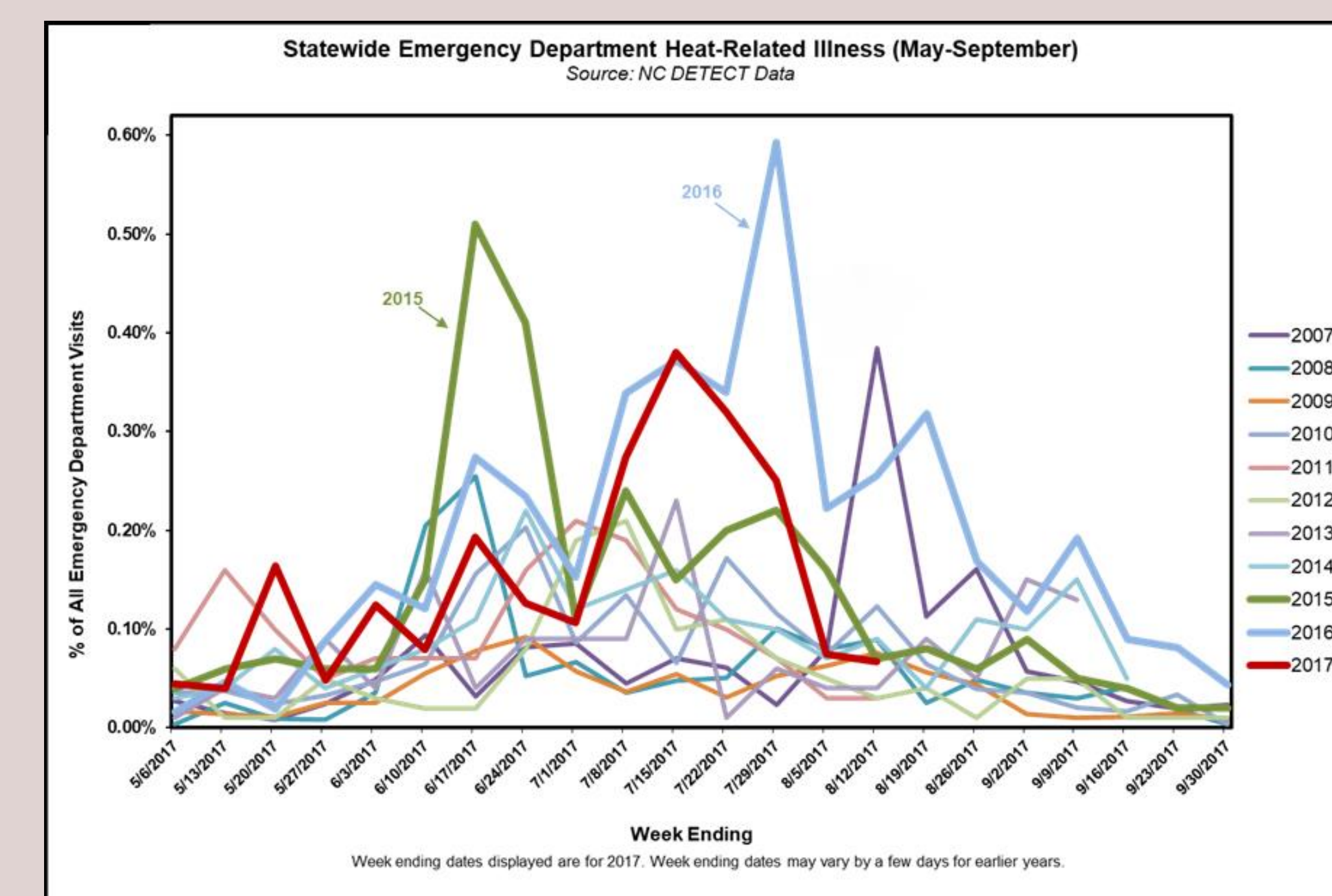
Age group (yrs)	N (%)
0-14	254 (5)
15-18	259 (5)
19-24	534 (11)
25-34	916 (19)
35-44	801 (17)
45-54	769 (16)
55-64	602 (12)
65+	712 (15)
Total	4,847

The 25-64 year old age group accounts for 53.3% of North Carolina's population, but made up 78.4% of heat-related emergency department visits in 2016.

Heat-related emergency department visits in NC have shown an increasing trend in recent years.

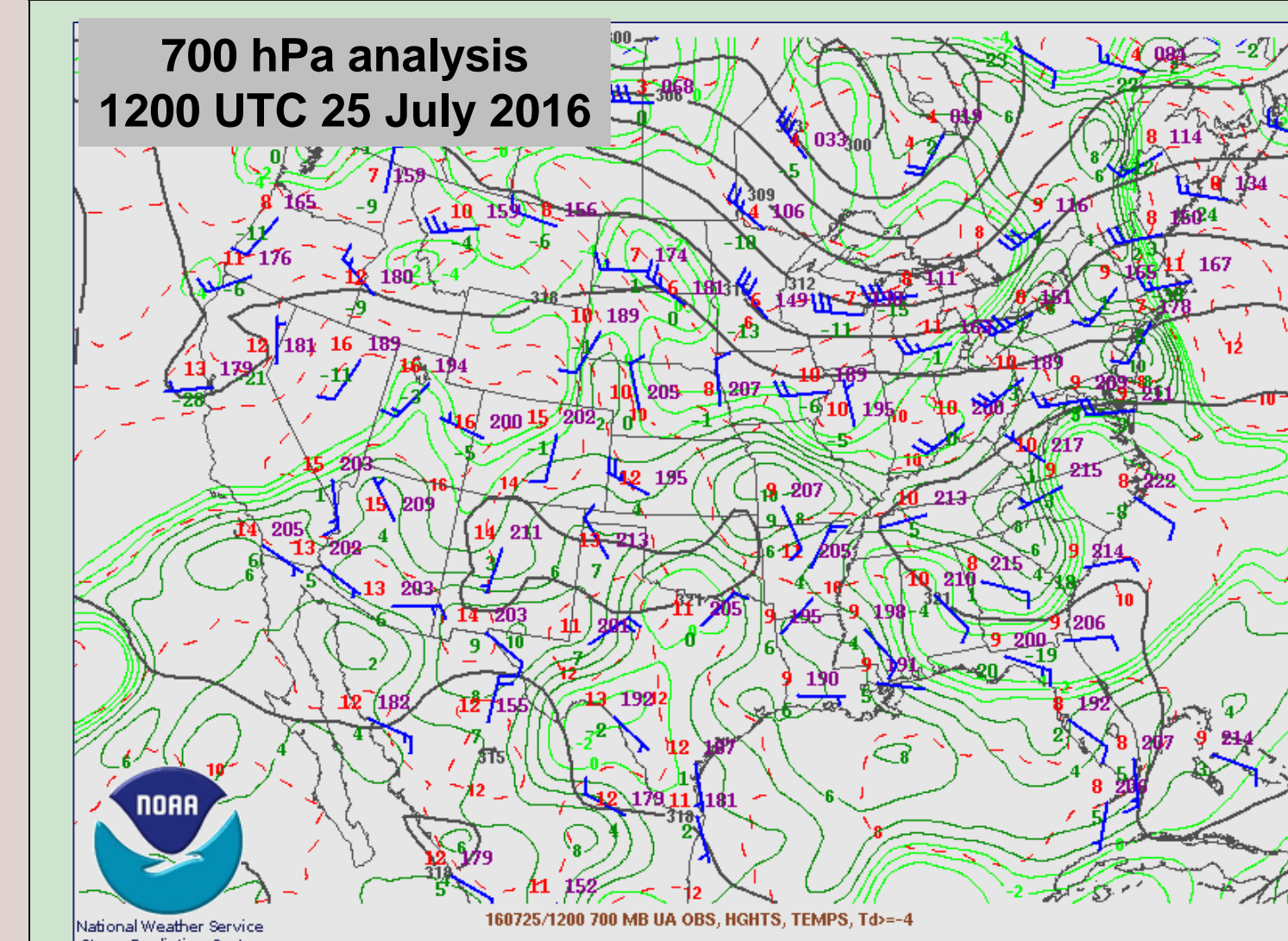
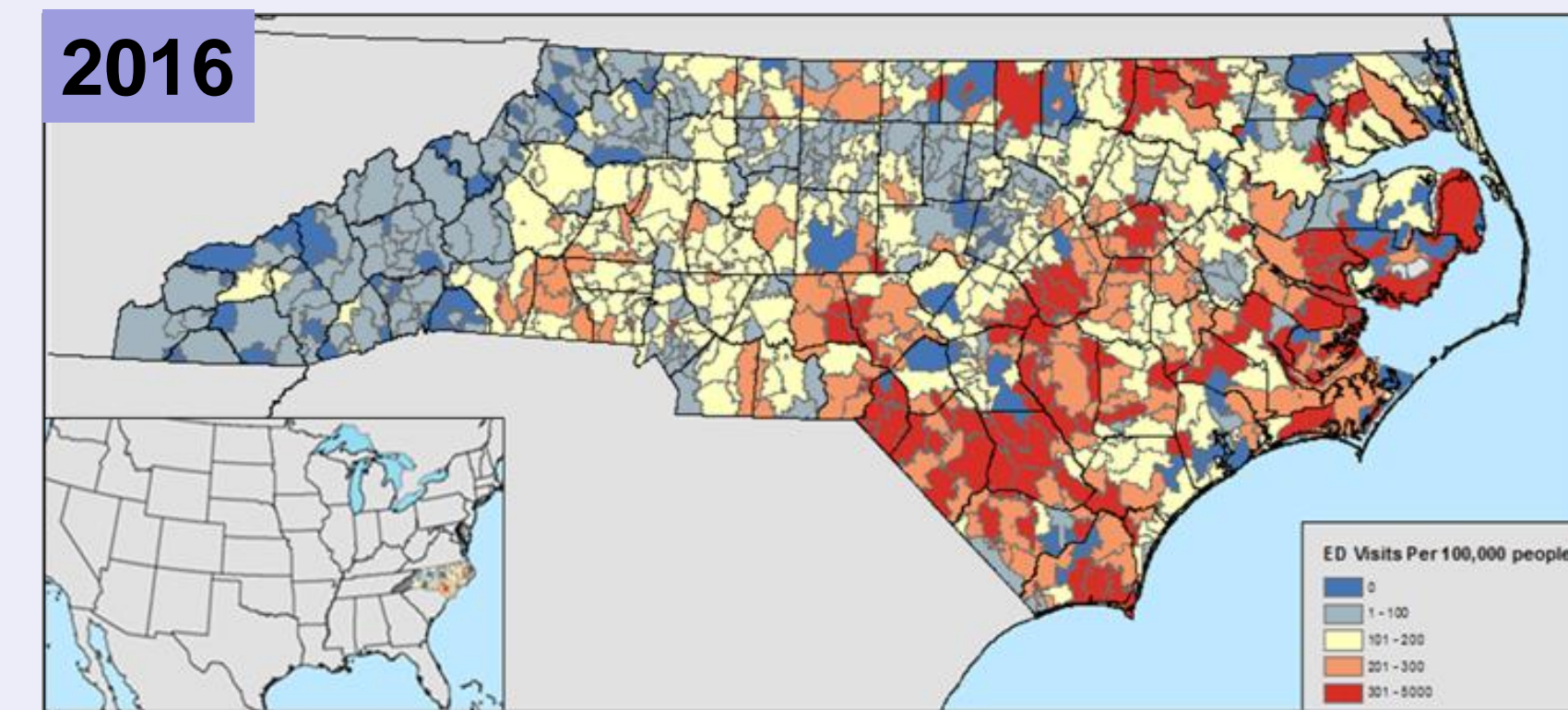


It must be noted that there may be differences in how certain health care officials designate heat illness data in discharge data, including for those individuals for which the heat illness exacerbates an underlying condition. These deviations may result in small errors in the numbers of those seeking heat illness-related care.



Each year saw a surge in heat-related emergency department visits which corresponded with heat waves. In 2016, 567 emergency department visits occurred during the 24-28 July heat wave (12% of all visits in just 3% of the period of study). In 2015, the 15-24 June heat wave resulted in 916 visits (27% of all visits in just 7% of the period of study).

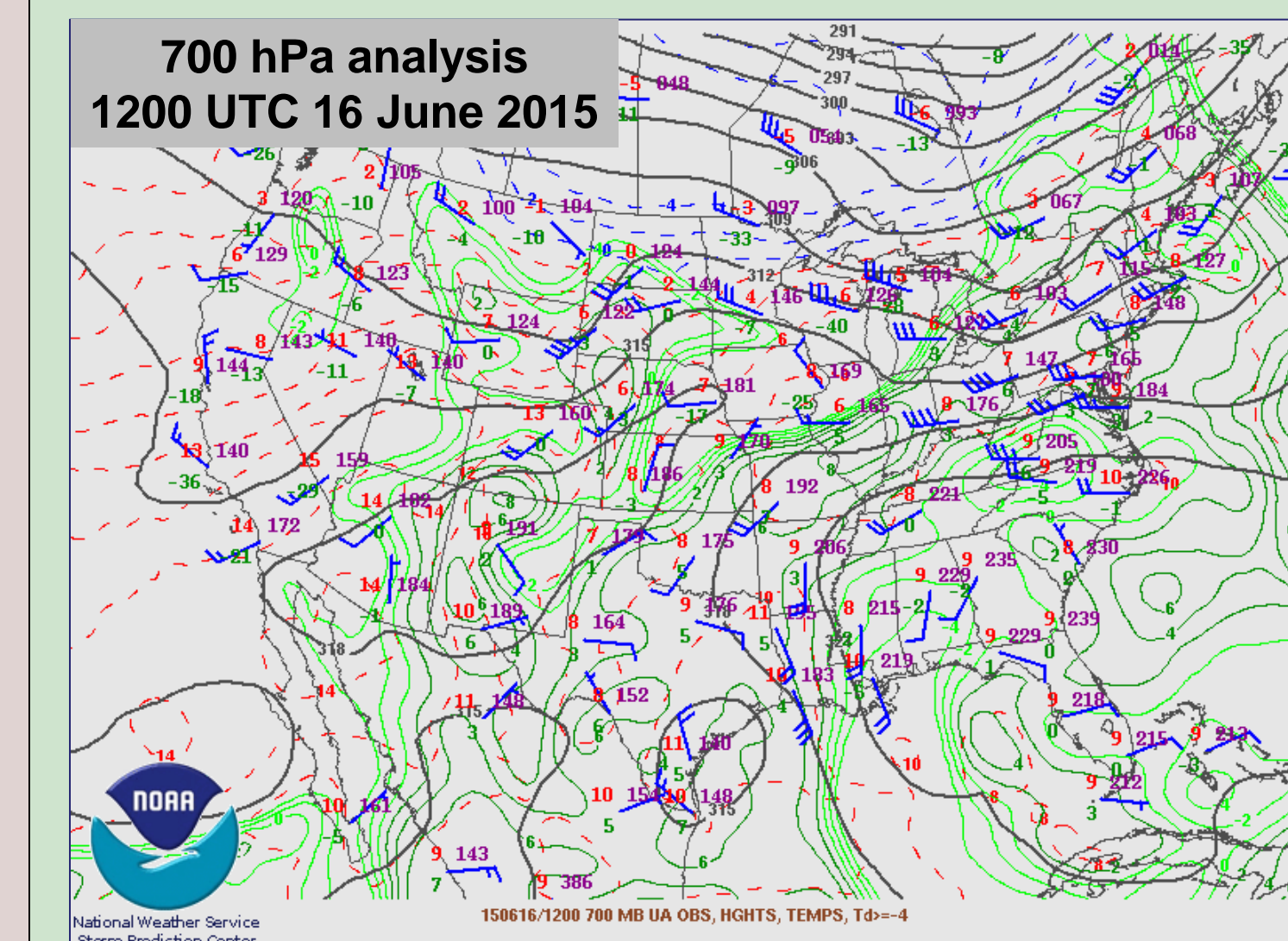
In 2016, the percentage of heat-related emergency room visits was much higher in rural parts of the NC Coastal Area, Coastal Plain, Sandhills, and far northern Piedmont. This may be a reflection of the agricultural and other outdoor workers living in these areas.



Date (2016)	RDU High	RDU Low
24-Jul	95	74
25-Jul	96	77
26-Jul	97	75
27-Jul	95	76

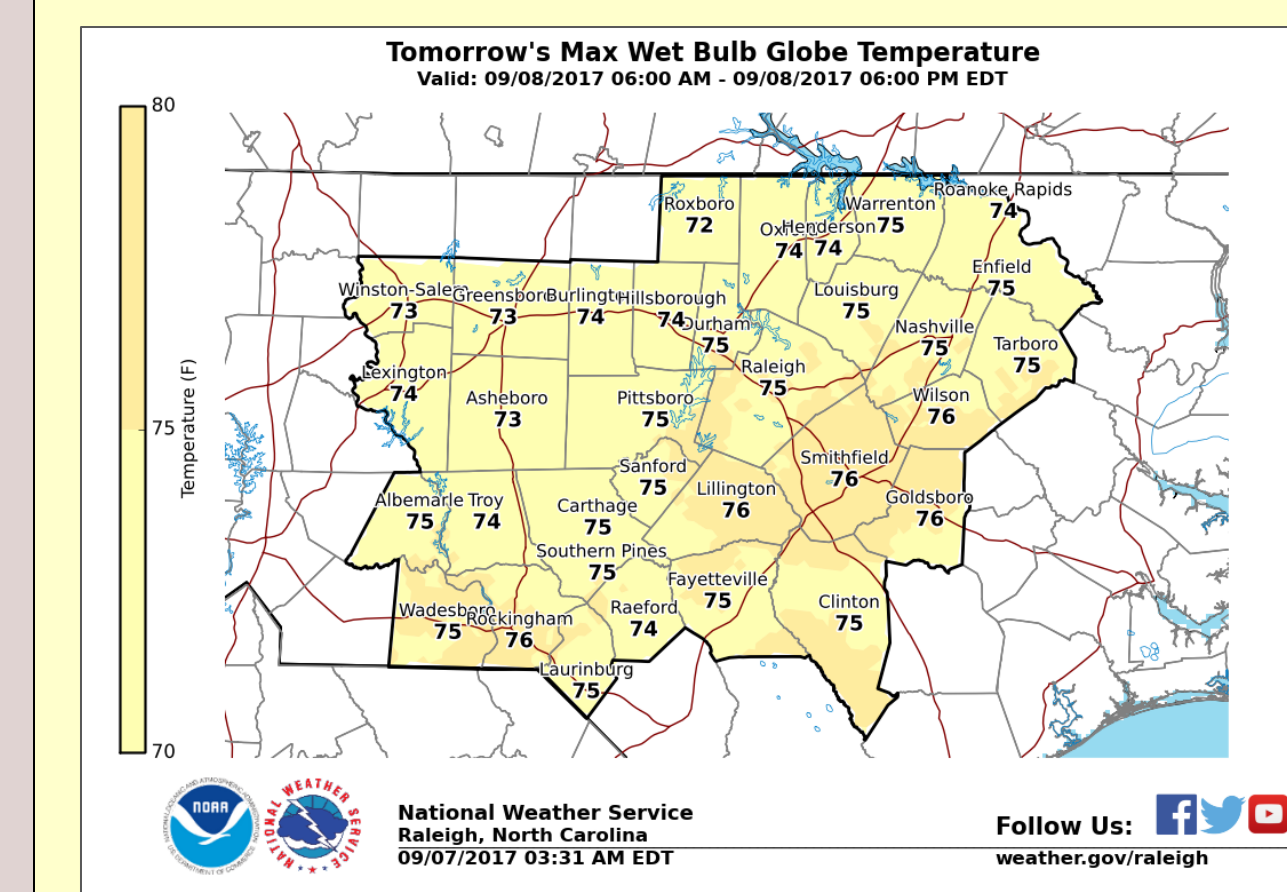
Daily maximum heat index: 105-109°F

While these two hot periods led to a surge in emergency department visits, the temperatures and heat indices were not extreme. Nevertheless, the surface and upper air patterns were consistent with past heat wave events in NC.



Date (2015)	RDU High	RDU Low
15-Jun	99	72
16-Jun	100	73
17-Jun	96	74
18-Jun	98	72
19-Jun	95	72
20-Jun	96	71
21-Jun	95	73
22-Jun	96	70
23-Jun	98	76
24-Jun	95	74

Daily maximum heat index: 98-108°F



NWS Raleigh is introducing experimental forecasts for wet bulb globe temperature (WBGT). WBGT is a measure of heat stress in direct sunlight, which is based on temperature, humidity, wind speed, sun angle, and cloud cover (solar radiation). This differs from the heat index, which is based only on temperature and humidity and is calculated for shady areas. NWS Raleigh plans to conduct verification of WBGT forecasts, with the goal of expanding its use among vulnerable populations such as student-athletes.

Goals and Future Work

- Continued analysis of heat illness-related emergency department visits, including statistical analysis and correlation with heat index and wet bulb globe temperature
- Use of data to expand outreach and shape heat safety campaigns, particularly for vulnerable populations
- Application of data to predict emergency room visits (experimental tool under development at <http://convergence.unc.edu/>)
- Ensure communication of information to local officials to prompt appropriate community action

References: Carolina Demography, University of North Carolina, Chapel Hill (<http://demography.cpc.unc.edu/resources/data-tables/>); Case study of August 2007 Carolina Heat Wave (<http://www4.ncsu.edu/~nwsfo/storage/cases/20070809/>); North Carolina Department of Public Health (<http://publichealth.nc.gov/chronicdiseaseandinjury/heat.htm>); NOAA Storm Prediction Center (<http://www.spc.noaa.gov>). Appreciation goes to many others who have collected and analyzed data at the NCDHHS.