Assessment of Extreme Heat and Hospitalizations to Inform Early Warning Systems

Ambarish Vaidyanathan[1], Shubhayu Saha[1], Ana Vicedo-Cabrera[2], Antonio Gasparrini[3], Nabill Abdurehman[4], Rick Jordan[5], Michelle Hawkins[6], Jeremy Hess[7], Anne Elixhauser[8]

[1]Centers for Disease Control and Prevention, [2]LSHTM, [3]London School of Hygiene & Tropical Medicine, [4]Oak Ridge Institute of Science and Education, [5]Social & Scientific Systems (S3), Inc., [6]National Weather Service, National Oceanic and Atmospheric Administration, [7]Center for Health and the Global Environment, University of Washington, [8]Agency for Healthcare Research and Quality

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Heat early warning systems and action plans use temperature thresholds to trigger warnings and risk communication. In this study, we conduct multi-state analyses, exploring associations between heat and all-cause and cause-specific hospitalizations, to inform the design and development of heat-health early warning systems. We used a two-stage analysis to estimate heat-health risk relationships between heat index and hospitalizations in 1,617 counties in the United States for 2003-2012. The first stage involved a county-level time series quasi-Poisson regression, using a Distributed Lag Non-Linear Model, to estimate heat-health associations. The second stage involved a multivariate random-effects meta-analysis to pool county-specific E-R associations across larger geographic scales, such as by state or climate region. Using results from this two-stage analysis, we identified heat index ranges that correspond with significant heat-attributable burden. We then compared those with the National Oceanic and Atmospheric Administration National Weather Service (NWS) heat alert criteria used during the same time period. Associations between heat index and cause-specific hospitalizations vary widely by geography and health outcome. Heat-attributable burden starts to occur at moderately hot heat index values, which in some regions are below the alert ranges used by the NWS during the study time period. Locally-specific health evidence can beneficially inform and calibrate heat alert criteria. A synchronization of health findings with traditional weather forecasting efforts could be critical in the development of effective heat-health early warning systems.

Public Health | Extreme Heat | Public Policy | Evidence-based Decision-making | Early Warning Systems

Introduction

Extreme heat is an established hazard. Risk for a range of conditions is associated with extreme heat exposure (**1, 2**), including morbidity from heat illness (**3**), electrolyte and renal dysfunction (**4, 5**), and exacerbations of chronic respiratory (**6**) and cardiovascular (**7**) disease, as well as all-cause mortality (**8**). The association between the particular temperatures at which risks are manifested and the magnitude of the effects vary regionally due to acclimatization, air conditioning prevalence, demography, and other factors (**9**).

Successful risk management varies by setting and includes prevention strategies ranging from engineering controls such as air conditioning, management controls such as shifts in work schedules and activity restrictions, and behavioral controls encouraged through heat early warning systems and action plans (**10**). These systems and plans are activities that link forecasts of heat exposure with risk communication and risk reduction activities aimed at reducing exposure and limiting adverse health impacts among the exposed such as cooling centers, neighbor check-ins, and maintenance of air conditioning availability (**11**), that have been linked with reduced morbidity and mortality.

Given variability in temperature thresholds at which risks increase, one central consideration in heat early warning systems is the threshold at which warnings should be issued (**12**). Guidance recommends setting thresholds based on analysis of associations between heat exposure (measured using a variety of metrics) and adverse health effects (**10**). In the United States (U.S.), the National Oceanic and Atmospheric Administration's National Weather Service (NWS) issues excessive heat watch, warning, and heat advisory alerts as weather conditions warrant. While NWS provides guidance to its Weather Forecast Offices (WFOs) on appropriate thresholds for issuing these alerts, WFOs are encouraged to work with local officials to define locally appropriate alert thresholds (**13**). There is no standard protocol for incorporating local epidemiological analyses, as relevant data and expertise may not be locally available. In addition to these constraints, risk assessment has been complicated by a lack of consensus regarding exposure assessment (e.g. which temperature metrics to use), standardization of heat-sensitive health outcomes (e.g. morbidity measures or mortality) and resulting heat attributable health impacts, and standard analytical approaches, despite emerging consensus in the field that best practices include basing thresholds on recent time-series analyses of the relationship between temperature and the best available local health data (**10, 14**). Recent analyses have demonstrated that morbidity impacts, when available, may be most appropriate, as these outcomes are more prevalent than mortality endpoints (**15, 16**).

In many locales in the U.S., this goal remains aspirational. While risks associated with heat exposure in the U.S. have been well characterized for certain at-risk populations and regions (**6, 17, 18, 19**), there have been no comprehensive, national-

Significance

Heat early warning systems and action plans have been shown to reduce risks of heat exposure, and best practice recommends that plans be built around local epidemiologic evidence and emergency management capacity. This evaluation provides useful information for heat early warning system and action plan administrators regarding the temperature ranges at which health impacts are manifest, the morbidity outcomes most sensitive to heat, and alignment between alert thresholds and temperatures at which disease burden is most pronounced. The results suggest opportunities for improvement and for refinement of prevention messaging as well as coordination between meteorological and public health authorities at multiple levels before, during, and after periods of extreme heat.

Reserved for Publication Footnotes

Table 1. State-specific population and heat index distribution with information on heat index values for issuing heat alerts

Climate region	State	Number of counties with population greater than 10,000 people	Average yearly state population (2003-2012)*	Percent of average yearly US population (2003-2012)	Daily maximum heat index (°F) distribution					Median and range of heat index values used for issuing heat alerts
					5th Percentile	25th Percentile	Median	75th Percentile	95th Percentile	
Central	Illinois	87	12.6 M	4.2	62	74	82	91	104	109 (101, 118)
	Indiana	88	6.4 M	2.1	64	75	82	91	103	108 (100, 116)
	Kentucky	99	4.1 M	1.4	67	78	85	93	104	107 (101, 116)
	Missouri	89	5.7 M	1.9	67	79	88	98	109	109 (102, 116)
	West Virginia	44	1.7 M	0.6	64	74	80	87	96	104 (96, 113)
East North Central	Iowa	76	2.8 M	0.9	63	75	83	92	106	110 (98, 120)
Northeast	Maryland	24	5.7 M	1.9	65	75	83	90	100	104 (97, 111)
	New York	61	19.3 M	6.4	61	71	78	84	95	100 (95, 111)
	Rhode Island	5	1.1 M	0.4	59	69	75	83	93	101 (93, 113)
Northwest	Oregon	29	3.7 M	1.2	57	67	74	80	88	90 (82, 101)
South	Kansas	39	2.5 M	0.8	68	80	89	99	109	108 (98, 114)
Southeast	Florida	65	18.3 M	6.1	85	92	96	100	105	109 (107, 111)
	Georgia	127	9.1 M	3.0	76	85	91	97	104	107 (101, 111)
	North Carolina	97	9.1 M	3.0	71	82	88	95	102	107 (102, 112)
	Virginia	115	7.7 M	2.5	67	77	85	92	101	106 (100, 112)
Southwest	Arizona	14	6.1 M	2.0	82	90	96	101	106	104 (96, 109)
	Colorado	38	4.7 M	1.6	61	74	80	84	89	91 (91, 92)
	Utah	20	2.6 M	0.9	59	73	81	85	90	100 (100, 104)
West	California	55	36.5 M	12.1	69	77	82	86	91	92 (86, 97)
	Nevada	10	2.5 M	0.8	73	83	90	94	99	99 (93, 103)
West North Central	Nebraska	27	1.5 M	0.5	65	78	86	95	107	109 (104, 115)
	South Dakota	18	0.6 M	0.2	60	73	82	89	100	106 (100, 112)

*only including counties in the state with population greater than 10,000

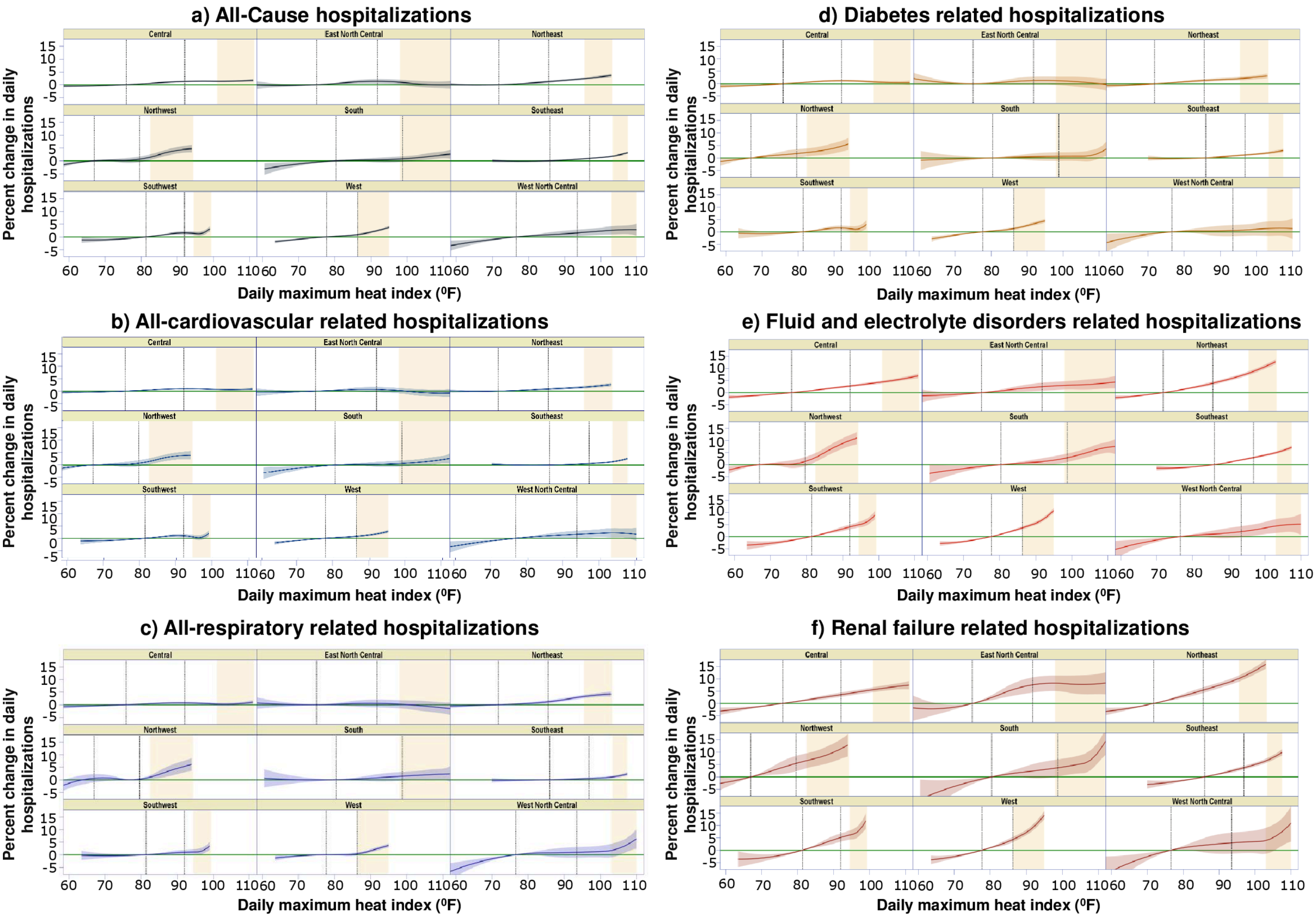

Fig. 1. Overall exposure-response associations for various hospitalization outcomes, by U.S. climate regions

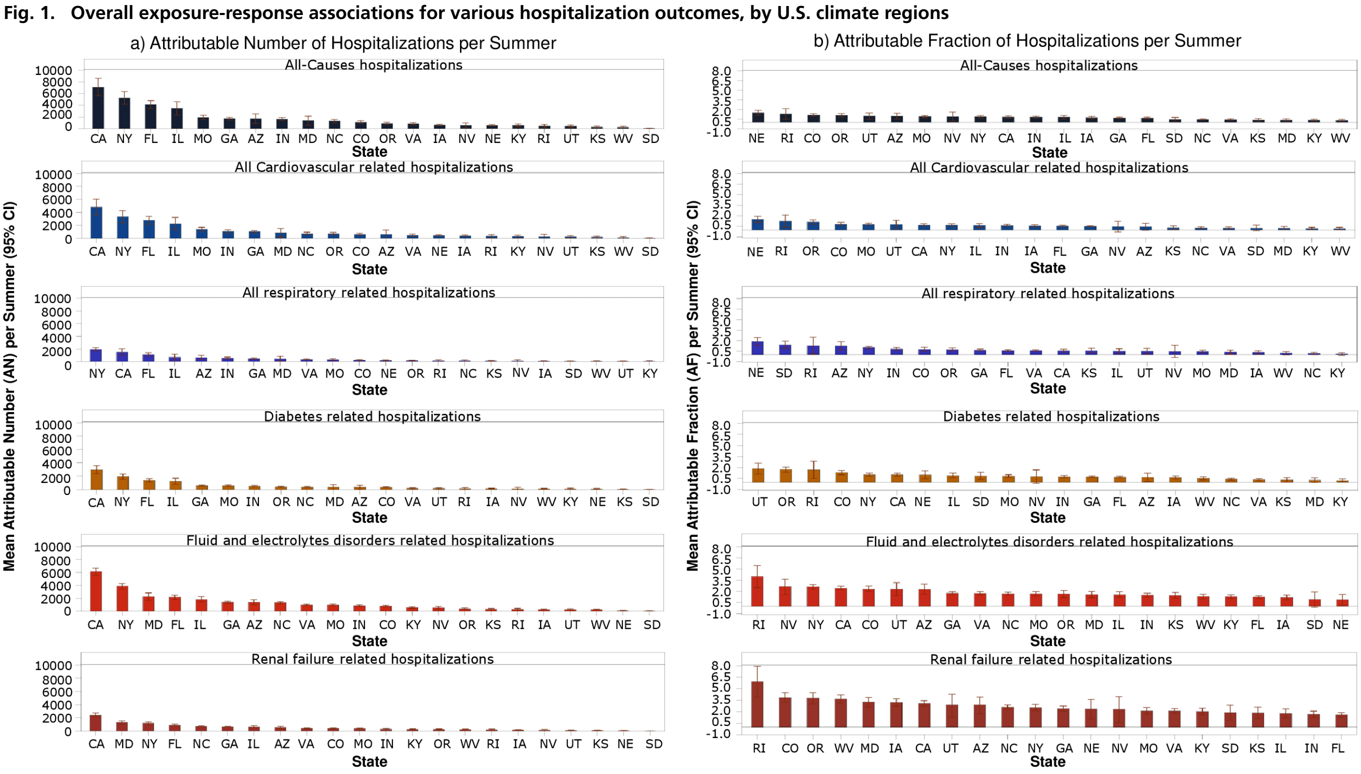

Fig. 2. State-specific attributable fraction and number of hospitalizations above minimum morbidity heat index for a cumulative lag period of 2 days

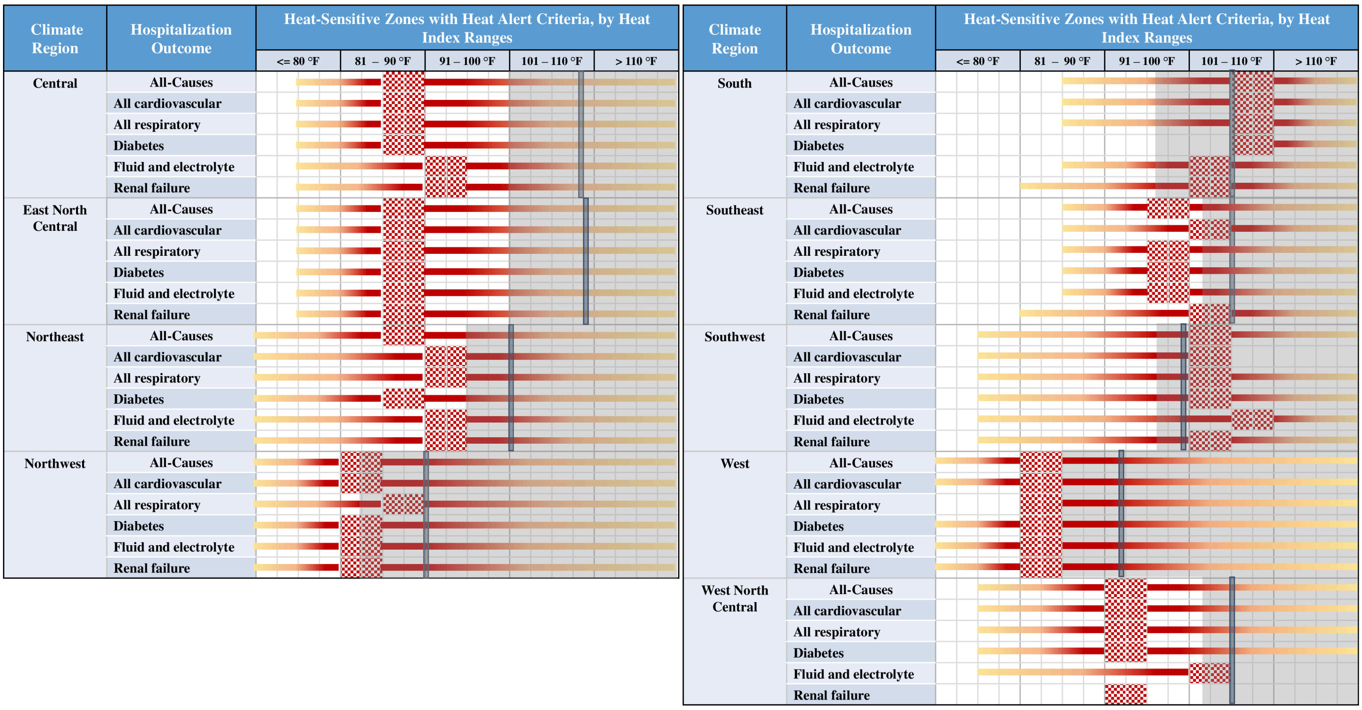

Fig. 3. Region-specific heat-sensitive zones with heat alert criteria

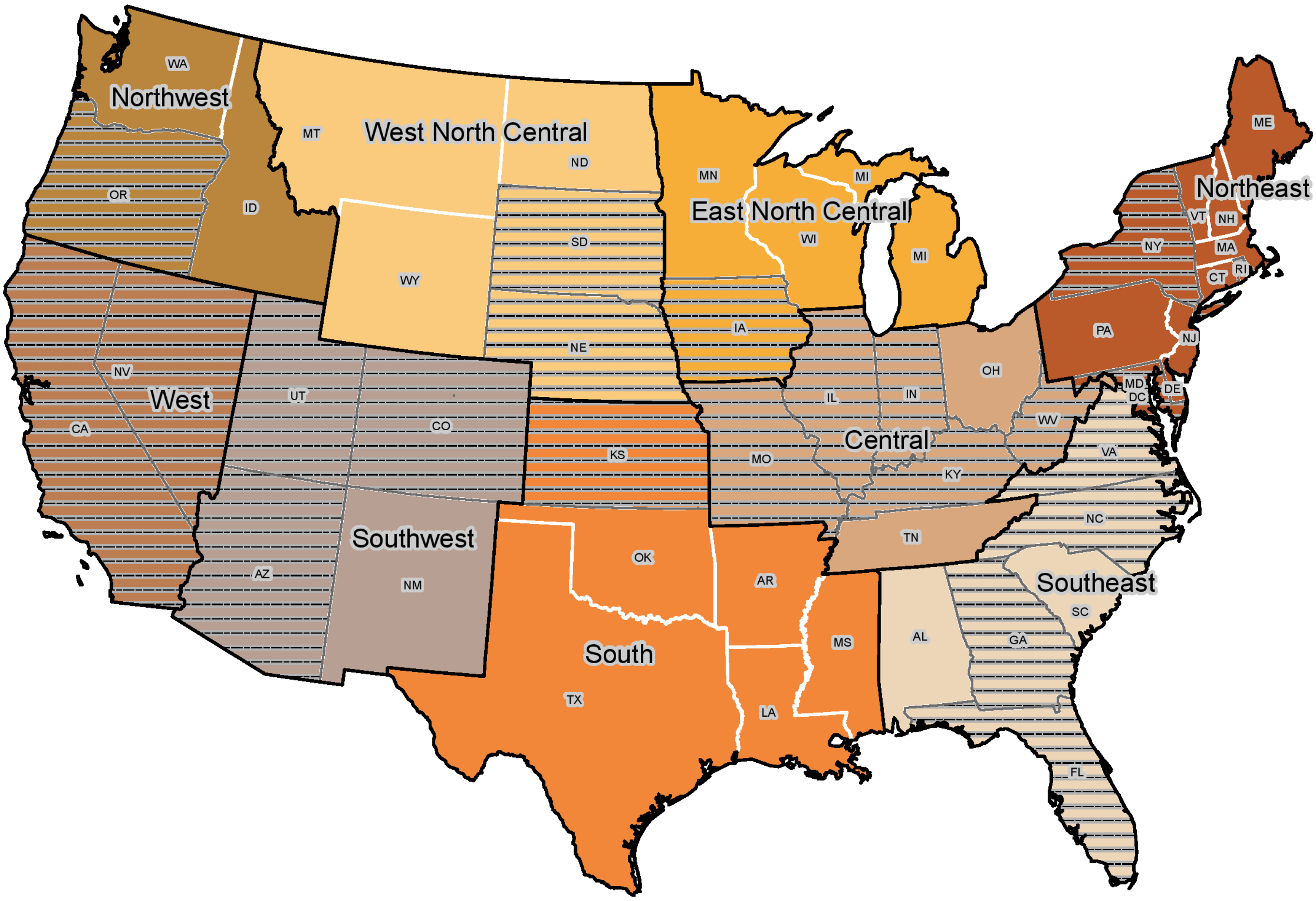

Fig. 4. States with hospitalization data and U.S. climate regions

scale investigations of regional-scale relationships between heat and morbidity-based health outcomes for the general population.

Moreover, most assessments have estimated average health risks for combined endpoints across an entire summertime heat exposure spectrum, ignoring the known differential sensitivity of certain outcomes to specific temperature ranges (**15, 20**). As a result, a clear, consistent nationwide assessment of adverse health impacts associated with heat exposure in the U.S. has been elusive, complicating the work of setting appropriate local warning thresholds. This disconnect has the potential to compromise the efficacy of heat risk communication, and to limit the public health utility of related activities such as surveillance for heat-related illness.

In this study, we performed multi-state analyses to explore relationships between extreme heat and hospitalizations, covering a majority of the U.S. population. The hospitalizations data that are used for this study are a census of all hospital admissions, regardless of age or insurance provider. Specifically, our objectives for this assessment were as follows: 1) to explore the relationship between heat index (**21**), which is a heat metric that combines the effect of humidity and temperature, and hospitalizations across heat index ranges observed during summer months; 2) to develop exposure-response (E-R) associations for all-cause and cause-specific hospitalizations, including cardiovascular, respiratory, diabetic, renal, and fluid and electrolyte illnesses; 3) to synthesize heat-attributable burden—adverse health impacts in terms of fractions and numbers, and 4) to identify heat index ranges, stratified by U.S. climate region (**22**) that correspond with significant adverse health impacts, and to compare those against current NWS heat alert criteria for those same regions.

Results

Our assessment examined approximately 50 million inpatient hospitalization records, covering 1,617 counties across 22 states for the summer months of 2003-2012, to model the relationship between heat index and adverse health outcomes. This multistate hospitalization database accounts for every single patient treated as an inpatient in hospitals, regardless of any age criteria or the type of insurance used to pay for services. We provide a state-specific summary of population coverage and number of counties included in this assessment in **Table 1**. Also in **Table 1**, we show the population-weighted distribution of daily maximum heat index and the range of values for which heat alerts are typically issued. We provide the crude rates of summertime hospitalizations from all causes and for specific outcomes in the supplemental section (**See SI Appendix, Table S1**) for this article. The states considered for this assessment accounted for 55.1% of the U.S. total population and are spread out across all nine U.S. climate regions. We excluded 390 counties for population size of less than 10,000 though this exclusion only reduced the sample size of inpatient hospitalization records by 0.6%.

For most states, the median heat alert criteria fell between the 95th and 99th percentile summertime heat index distribution. While most of the states in the same climate region share a similar temperature climatology, we found significant intra-regional variability in the Southwest climate region; (e.g. comparing Arizona with Colorado and Utah). However, this variation was mostly due to the high summertime heat index values prevalent in metropolitan areas of Phoenix, Arizona and surrounding areas.

For this analysis, associations between heat index and hospitalization outcomes during summer months were assessed through a two-stage time-series analysis. Non-linear and delayed associations were estimated for each county, and then pooled at state and climate region level through a meta-regression analysis. Risk estimates for hospitalizations are reported in terms of mean percent change (and 95% CI) in daily hospitalizations for heat index above the Minimum Morbidity Heat Index (MMHI). The MMHI corresponds to the heat index value above which heat-related morbidity risk starts to increase. County-specific maps of MMHI for each hospitalization outcome are provided in the supplemental section of this article (**See SI Appendix, Figure S1**). In **Figure 1,** we present the mean percent change (and 95% CI) in daily hospitalizations observed for summertime heat index values for each climate region. Comparing across health outcomes, we found that the largest increases in slope of the overall E-R associations were observed for outcomes such as renal failure, and fluid and electrolyte related disorders; cardiovascular, respiratory and diabetes related illnesses showed a steady but much lower percent increase in daily hospitalizations for a unit change in heat index values. For all-cause hospitalizations, we found statistically significant E-R associations for most states over a wide-range of heat index values, however the effect sizes were much smaller when compared to renal failure, and fluid and electrolyte disorders related hospitalizations. Also noteworthy were the findings on the varying risk sensitivity of cause-specific health outcomes to moderately high heat index values, indicating that the health burden from heat exposure is apparent below heat alert thresholds (denoted by golden bands in **Figure 1**).

Figure 1: Overall exposure-response associations for various hospitalization outcomes, by U.S. climate regions[*]

[*]Percent change in risk estimated from the minimum morbidity heat index for a cumulative lag period of 2 days

We present the state-specific heat-attributable adverse health impacts, i.e., the heat attributable fraction (AF) and attributable number (AN) per summer, in **Figure 2** for each hospitalization outcome considered in this assessment. We summarize the mean and 95% confidence interval (CI) for AF and AN across all heat index values above the MMHI.

Figure 2: State-specific attributable fraction and number of hospitalizations above minimum morbidity heat index for a cumulative lag period of 2 days

For most states, AFs associated with renal failure and fluid and electrolyte related disorders showed a much greater sensitivity to heat index values above MMHI than other health outcomes; Within each state and for a given hospitalization outcome, the county level variation in AF was minimal; however, significant county-level differences were observed between hospitalization outcomes (**See SI Appendix, Figure S2**). County level maps for cardiovascular and respiratory diseases, as well as hospitalizations for all causes, showed a similar pattern with most counties having a mean AF that is lesser than or equal to 1.3%. For renal failure and fluid and electrolyte related disorders, mean AFs were significantly higher than for other outcomes, with some counties having mean AFs greater than 3%. For diabetes-related hospitalizations, regional differences were observed with mean AFs greater for counties in Northwest, Southwest, and West but relatively lower for counties in other regions. The spatial patterns of mean ANs (**See SI Appendix, Figure S3**) reflect location-specific baseline numbers for each hospitalization outcome, which are mostly driven by population sizes. Essentially, areas with high risk and small population sizes have comparable burden to areas with low risk but a fairly substantial population. Moreover, for a given location, heat-attributable adverse health impacts are distributed unevenly across summertime heat index values. Summary of AF (**See SI Appendix, Table S2**) and AN (**See SI Appendix, Table S3**) by heat index ranges for each hospitalization outcome and by state are provided in the supplemental section of this article. In most states, AFs and ANs correspond well with person-days of exposure observed under each heat index range.

In **Figure 3**, we translate information gleaned from aforementioned results on heat-attributable adverse health impacts into a one-dimensional heat chart. In doing so, we identify “heat-sensitive zones,” based on heat index ranges at which positively significant adverse health impacts (AFs/ANs) are observed for different climate regions and health outcomes considered in this assessment. The chart also offers a comparison between heat index ranges used for issuing alerts and those associated with peak adverse health impacts. Evidently, in colder regions of the U.S., e.g., the Central Region, a large proportion of adverse health impacts tend to occur at moderate heat index ranges—well below the heat index values used by some WFOs at the time of this study for issuing alerts. In warmer regions of the U.S., e.g., the South Region, heat index ranges that are sensitive to adverse health impacts overlap with those used for issuing alerts. However, in certain regions, e.g., the Southwest Region, peak adverse health impacts are observed at heat index ranges that are above the median heat alert criteria.

Figure 3: Region-specific heat-sensitive zones with heat alert criteria

Discussion

Our assessment is novel in scope, scale, and has implications for current and future risk management related to heat exposure. Prior assessments that have tried to identify heat alert thresholds based on heat-health risk relationships are either city-specific or for communities covering a few states (**23, 24**). This study's novelty lies in the comprehensive assessment of heat exposure on various morbidity outcomes, including those that are less well characterized in published literature. In addition, we use a nationally consistent study design that employed a systematic modeling framework to link exposure to fine-scale, cause-specific hospitalizations to characterize adverse health impacts for the general population across climatologically diverse locations. We generated overall E-R associations and attributable health risk / burden estimates based on the census of all hospital admissions for the states included in this assessment, representing all climatic regions of the U.S., providing a firm basis to demonstrate prevailing heat-attributable health impacts at various public health decision making scales. We showed the importance of assessing multiple health outcomes, as risk sensitivity (slope) and magnitude of cause-specific E-R associations tend to differ across outcomes. We also identified a systematic dissociation in some geographic areas between the temperatures at which heat alerts are issued and the temperatures at which peak impacts are observed.

This misalignment in some geographic areas between the temperatures at which health burdens become significant and temperatures at which alerts are issued raises critical questions. Following the methodology of issuing heat alerts based on the extremity of heat index distribution regardless of differential population sensitivity, could generally fail to account for a large proportion of heat-attributable adverse health impacts observed at moderately hot conditions. This may be an important consideration, especially among those populations residing in cooler regions, with no structural adaptations such as air conditioning. While it is likely that there should be better alignment between alert thresholds and regional heat epidemiology, it is not clear exactly where warning thresholds should be set. There are a number of issues to consider, including the potential for warning fatigue (**18**). Conversely, in warmer locations, peak heat-attributable burden occurs past the median temperature for heat alerts, yet the burden curves generally show a monotonic rise above these threshold temperatures, raising questions about the effectiveness of current intervention strategies, heat alert messaging, and related activities. Potentially, this highlights inherent communication challenges in delivering actionable risk information and prevention guidelines to various stakeholders, including vulnerable populations. Additional research regarding specific protective measures and appropriate timing for risk reduction measures is needed to inform future risk management decisions.

Our results show promise for the use of regionally-specific health evidence to inform and calibrate heat alert protocols (**24**). Further, graduated heat alert protocols may help warn for low, moderate, and peak adverse health impacts. Such graduated alerts, such as the air quality index (**25**), are currently used to identify areas impacted by poor air quality. In addition to empirical alignment of warnings with risks, such recalibrated heat alerts and more specific messaging might improve message relevance and facilitate better stakeholder engagement (**26**). In addition, web-enabled resources detailing individual preventative options (**27**), especially at low and moderately high temperatures, coupled with graduated community-level interventions, such as opening cooling shelters (**28**) during more extreme situations like heat waves, could potentially minimize heat-related adverse health impacts more effectively. These initiatives could strengthen heat preparedness and response capabilities, but require additional coordination across various local, state, and federal agencies.

There are some limitations to our assessment. Although our analysis included hospitalizations for more than 1200 counties covering 55% of the total U.S. population, E-R associations may not fully characterize the underlying heat-health relationship in areas that are sparsely populated or in regions where certain key states are omitted. While adding more counties would improve population coverage and generalizability of the findings, data access limitations prevented inclusion of additional counties. Another limitation is the identification of state- and region-level heat index ranges that are used for issuing alerts. Our primary goal was to explore the discrepancy between heat index values used for issuing alerts and those that are associated with significant heat attributable health burden for the time period used in this assessment; however, heat alert criteria, which are set by WFOs, are occasionally revised and sometimes changed based on epidemiologic evidence (**23**). Further, this assessment does not present any evidence on how some of the population-level health risks can be modified by individual risk factors (age, race, occupational status) or by community-level factors (poverty, density, land use and land cover). We plan to address these considerations in future work. Despite including robust daily, county-level environmental predictors in our time-series analyses, our results may be affected by residual confounding (**29**), especially should there be an omitted or misspecfied confounder that fluctuates over time in a manner similar to heat index. Further, exposure misclassification could result from using modeled data sources, especially in areas where modeled estimates of heat metrics do not comport well with those derived from station based measurements. Lastly, relying on ambient weather data may also misrepresent true exposures, particularly in regions where prevalence of air conditioning is higher (**30**).

Heat-related illnesses are preventable (**31**) adverse health outcomes. Heat early warning systems and action plans have been shown to reduce risks of heat exposure, and best practice recommends that plans be built around local epidemiologic evidence and emergency management capacity. Our evaluation provides useful information for heat early warning system and action plan administrators regarding the temperature ranges at which health impacts are manifest, the morbidity outcomes most sensitive to heat, and alignment between alert thresholds and temperatures at which disease burden is most pronounced. The results suggest opportunities for improvement and for refinement of prevention messaging as well as coordination between meteorological and public health authorities at multiple levels before, during, and after extreme heat events. Improving risk management related to extreme heat involves multiple stakeholders and input from a range of disciplines. Our results could be a starting point for enhanced dialogue among various stakeholders involved in heat-health activities and for enhanced collaboration among various organizations, including those that facilitated our access to high resolution health data and expertise on weather forecasting and statistical modeling. Furthering these collaborations to develop a community of practice for systematically assessing and disseminating weather-related health impacts could strengthen preparedness and response capacity, increase public awareness, and potentially reduce the substantial burden of disease associated with extreme heat.

Materials and Methods

Meteorological data

Hourly meteorological predictions from the North American Land Data Assimilation System Phase 2 (NLDAS) model (**32**), available for temperature, humidity, and other weather parameters at 0.125 degrees grid resolution. The hourly gridded data were made available to the Centers for Disease Control and Prevention as part of an interagency agreement with the National Aeronautics and Space Administration. We first calculated hourly heat index using hourly temperature and humidity information at a grid level. The heat index formula, which was obtained from NWS' weather prediction center website (https://www.wpc.ncep.noaa.gov/html/heatindex_equation.shtml). This formula was a refinement of the regression equation presented by Rothfusz (**33**). Furthermore, we used a multi-stage geo-imputation approach to convert grid-level meteorological data to county-level estimates. We first calculated the population within each NLDAS grid cell using 2010 population estimates by U.S. Census blocks. We then converted NLDAS grid polygons with population information to centroids and related all the grid cell centroids to the counties in the conterminous U.S. based on a containment relationship. If a county did not have a grid cell centroid within its boundary, we assigned a grid cell centroid closest to the county boundary. Finally, we created a population-weighted average from all the grid cell centroids to obtain county-level estimates of daily maximum heat index, for the summer months (May 1 through September 30) and for years 2003-2012. We used daily maximum heat index as the primary exposure metric in this health risk assessment.

In addition, we obtained data on heat alerts (excessive heat warnings, watches, and heat advisories) from NWS for 2007-12. This dataset contained information on the WFO and the warning area within that WFO jurisdiction for which alerts were issued, as well as the date of alerts. We also gathered information on the geographical boundaries for warning areas within WFO, which changed over time during 2007-2012. Since the warning areas do not spatially align with county boundaries, we used spatial analysis techniques to reconcile boundary differences. First, we related the centroid of each U.S. Census block to the warning areas, and created a census-block level alert database with date information. Subsequently, we aggregated this block-level dataset to counties, and created a daily, county-level heat alert dataset. Further, we merged this alert database with county-level daily maximum heat index information. We used the resulting county-level linked database to summarize median, 5th and 95th percentile heat index values used for issuing alerts by state and climate region. Our intent was to capture the most common range of heat index values used for issuing alerts within each state or climate region, knowing that heat alerts are specific to area served by the WFO and are seldom issued to cover large geographic areas.

Hospitalization data

We accessed hospitalizations data for 22 states (Arizona [AZ], California [CA], Colorado [CO], Florida [FL], Georgia [GA], Iowa [IA], Illinois [IL], Indiana [IN], Kansas [KS], Kentucky [KY], Maryland [MD], Missouri [MO], North Carolina [NC], Nebraska [NE], Nevada[NV], New York [NY], Oregon [OR], Rhode Island [RI], South Dakota [SD], Utah [UT], Virginia [VA], West Virginia [WV]) spread out across 9 U.S. climate regions (Central, East North Central, Northeast, Northwest, South, Southeast, Southwest, West, West North Central) from the Agency for Health Research and Quality (AHRQ) Healthcare Cost Utilization Project (HCUP) (**34**) for the years 2003–2012. These are inpatient records for all patients visiting a hospital in these states. **Figure 4** provides a map summary of the states with hospitalization data and their relationship to climate regions; a description of these regions is available from the NCEI (www.ncdc.noaa.gov/monitoring-references/maps/us-climate-regions.php). Using the Clinical Classification Software (CCS) developed by AHRQ (https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp), we selected daily patient records for all available diagnoses combined and for the following illnesses based on the principal or secondary diagnoses: cardiovascular (CCS: 98-101, 106-110, 115) (**7, 35**), respiratory-related (CCS: 122, 127-128) (**6, 35, 36**), diabetes (CCS: 49-50), renal failure (CCS: 157) and electrolyte imbalance (CCS: 55) (**5, 36**). We summarized the extracted patient records for these conditions for the summer months to obtain counts by county of residence and day.

Figure 4: States with hospitalization data and U.S. climate regions

Statistical Analysis

We conducted a two-stage analysis (**37**) to estimate E-R relationships for all-cause and cause-specific hospitalizations across states and climatic regions. The theory and development of methods for modeling overall E-R associations, conducting meta-analysis, and estimating attributable risk from distributed lag models are articulated in several research articles published in scientific journals (**37, 38, 39, 40, 49**). A succinct summary of various aspects of our statistical analyses is provided below:

Assessment of the exposure-response (E-R) associations: county-level time series analyses (first stage)

The first stage involved a county-level time series quasi-Poisson regression using a Distributed Lag Non-Linear Model (DLNM) for the summer months (May 1 through September 30) to estimate location-specific heat index-morbidity associations. This class of models can describe complex non-linear and lagged dependencies through the combination of two functions specified in a cross-basis term of the exposure variable, defining both exposure-response association and the lag-response distribution (**38**).

The model formula is as follows:

$$\log(E(y_t)) = \alpha + s(x_{t,i};\theta) + PM_{t,i} + Ozone_{t,i} + DOW_i + factor(year_i) + ns(DOY_i, df = 4) + ns(date_i, df = 2)$$

where $y_{t,i}$ is the number of hospitalizations in day t and county i. The cross-basis term of heat index $\left(s(x_{t,i};\boldsymbol{\theta})\right)$ is a bi-dimensional function s and coefficients $\boldsymbol{\theta}$ which defines an exposure-lag-response risk surface accounting for 2 days of lag. It included a natural cubic B-spline function with internal knots at 50th and 90th percentile of the county-specific heat index distribution in the E-R dimension, and a strata function defining two levels in lag 0 and lag 1-2. This simplified the computational demands of our modeling approach, and at the same time captured the main association and the potential harvesting. However, we considered modeling overall E-R associations by fitting a natural spline with two internal knots equally-spaced on the log-scale for various lag periods, ranging from 0 to 7 days. State-specific lag-response relationships between heat index and various health outcomes considered in this assessment are provided in the supplemental section (**See SI Appendix, Figure S4-S9**) of this article. While, the most appropriate cumulative lag period varied by state, a 2-day period seemed the most sensitive across most states and health outcomes. And perusing previously published literature (**41, 42, 43, 44, 45**) reiterated that a 2-day cumulative lag period for exploring delayed effects of heat exposure on hospitalizations was appropriate. The main model also included a linear function of daily 24-hr average fine particulate matter concentration ($PM_{t,i}$), average 8-hr ozone daily maximum concentration ($Ozone_{t,i}$), indicators for day of the week (DOW_i), indicator for year $\left(factor\left(year_i\right)\right)$, natural cubic B-spline of the day of the year with four degrees of freedom to control for seasonality $\left(ns\left(DOY_i, df = 4\right)\right)$ and natural cubic B-spline of the time with 2 degrees of freedom for long-term trends $\left(ns\left(date_i, df = 2\right)\right)$. Each bi-dimensional function was reduced to uni-dimensional overall cumulative E-R curves, which were then used as input for the second-stage pooled analysis. We excluded counties with an average population of less than 10,000 people for the analysis period to avoid model convergence issues resulting from small sample size.

Assessment of the exposure-response (E-R) associations: pooled analyses to generate state and county-level summaries (second stage)

Our second stage involved a multivariate random-effects meta-analysis[30,31] to pool the county-specific uni-dimensional overall cumulative E-R associations generated in the first stage across larger geographic scales, such as by state or climate region. The meta-analytic model included a geographic scale factor (indicator for climate region or state) used for predicting E-R associations. We evaluated for residual heterogeneity in the meta-analytic model by examining the Cochran Q test results and I^2 statistic (**39, 46**). We then used the fitted meta-analytical model to derive the best linear unbiased prediction (BLUP) of the overall cumulative exposure-response association in each county (**37**). BLUP-based predictions allow sparsely populated areas, which are typically characterized by imprecise effect estimates, to borrow information from largely populated neighboring areas that share similar characteristics (**38, 39**). County-specific MMHI (**47, 48**), which corresponds to a minimum morbidity percentile between the 25th and the 75th percentiles of the summertime heat index distribution, was derived from the BLUPs of the overall cumulative exposure-response association in each location.

Estimation of the heat-attributable adverse health impacts

The MMHI was used as the reference point for estimating the number and fraction of hospitalizations attributable heat (AN, AF). AN was calculated as the sum of all hospitalizations in days with heat index values higher than the estimated MMHI in a specific county. AF corresponded to the ratio of AN by the the total number of hospitalizations. (**49**). We calculated empirical confidence limits using Monte Carlo simulations (n = 2000), assuming a multivariate normal distribution of the BLUP-based predictions. We also calculated ANs and AFs, by 5 °F increments in heat index, for each hospitalization outcome considered in this assessment. **Figure 3** combines this attributable burden information with the heat index ranges used for issuing heat alerts. First, heat-sensitive zones were derived using region-specific heat-attributable burden information for all outcomes considered in this assessment, and are denoted in **Figure 3** as "horizontal bars"—shaded in a yellow (low burden) to red (high burden) color gradient. The operating range for this heat-sensitive zone is the heat index values over which the attributable burden is statistically significant. In addition, heat index ranges that are associated with peak burden were identified by "red-checkered boxes." Lastly, the heat index range used for issuing heat alerts (denoted by "shaded gray area") and median heat alert criteria (denoted by "gray vertical bar") were juxtaposed with region-specific heat-sensitive zones.

All primary statistical analyses were performed with R software (version 3.0.3) using the packages *dlnm* and *mvmeta*. We used SAS v9.4 and ArcGIS 9.3 for descriptive analysis and for creating displays.

Article Information

Author Contributions:

· Concept and design: Vaidyanathan, Gasparrini, Saha, and Elixhauser

· Acquisition, analysis, or interpretation of data: Vaidyanathan, Abdurehman, and Jordan

· Drafting of manuscript: Vaidyanathan

· Critical revision of the manuscript: Hess, Elixhauser, Hawkins, Vicedo-Cabrera, Gasparrini

· Statistical analysis: Vaidyanathan, Vicedo-Cabrera, Gasparrini

· Administrative, technical, or material support: Vaidyanathan, Elixhauser, Hess, Jordan, and Gasparrini

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Table S1: State-specific crude rates for hospitalization outcomes

Climate region	State	Average yearly state population (2003-2012)	Summertime (May - Sep) crude rate for hospitalizations (per 10,000)					
			All-causes	All cardiovascular related	All respiratory related	Diabetes related	Fluid and Electrolyte disorders related	Renal failure related
Central	Illinois	12.7 M	338	271	113	106	92	28
	Indiana	6.4 M	309	254	115	108	89	28
	Kentucky	4.3 M	377	304	151	123	104	33
	Missouri	5.9 M	366	297	130	121	103	30
	West Virginia	1.8 M	446	364	179	150	117	39
East North Central	Iowa	3. M	287	230	95	88	81	21
Northeast	Maryland	5.7 M	660	534	224	219	249	70
	New York	19.3 M	305	247	98	98	76	24
	Rhode Island	1.1 M	310	252	111	94	74	34
Northwest	Oregon	3.7 M	215	169	69	65	62	20
South	Kansas	2.8 M	272	214	87	86	88	22
Southeast	Florida	18.3 M	321	265	106	105	95	31
	Georgia	9.3 M	262	213	83	88	86	29
	North Carolina	9.1 M	298	238	95	94	85	31
	Virginia	7.8 M	244	195	79	77	74	25
Southwest	Arizona	6.1 M	283	216	88	87	98	30
	Colorado	4.8 M	204	154	69	56	71	21
	Utah	2.6 M	160	112	42	41	46	14
West	California	36.5 M	232	185	73	79	68	22
	Nevada	2.6 M	249	197	84	76	79	25
West North Central	Nebraska	1.8 M	248	190	76	67	64	19
	South Dakota	0.8 M	243	189	85	73	75	18

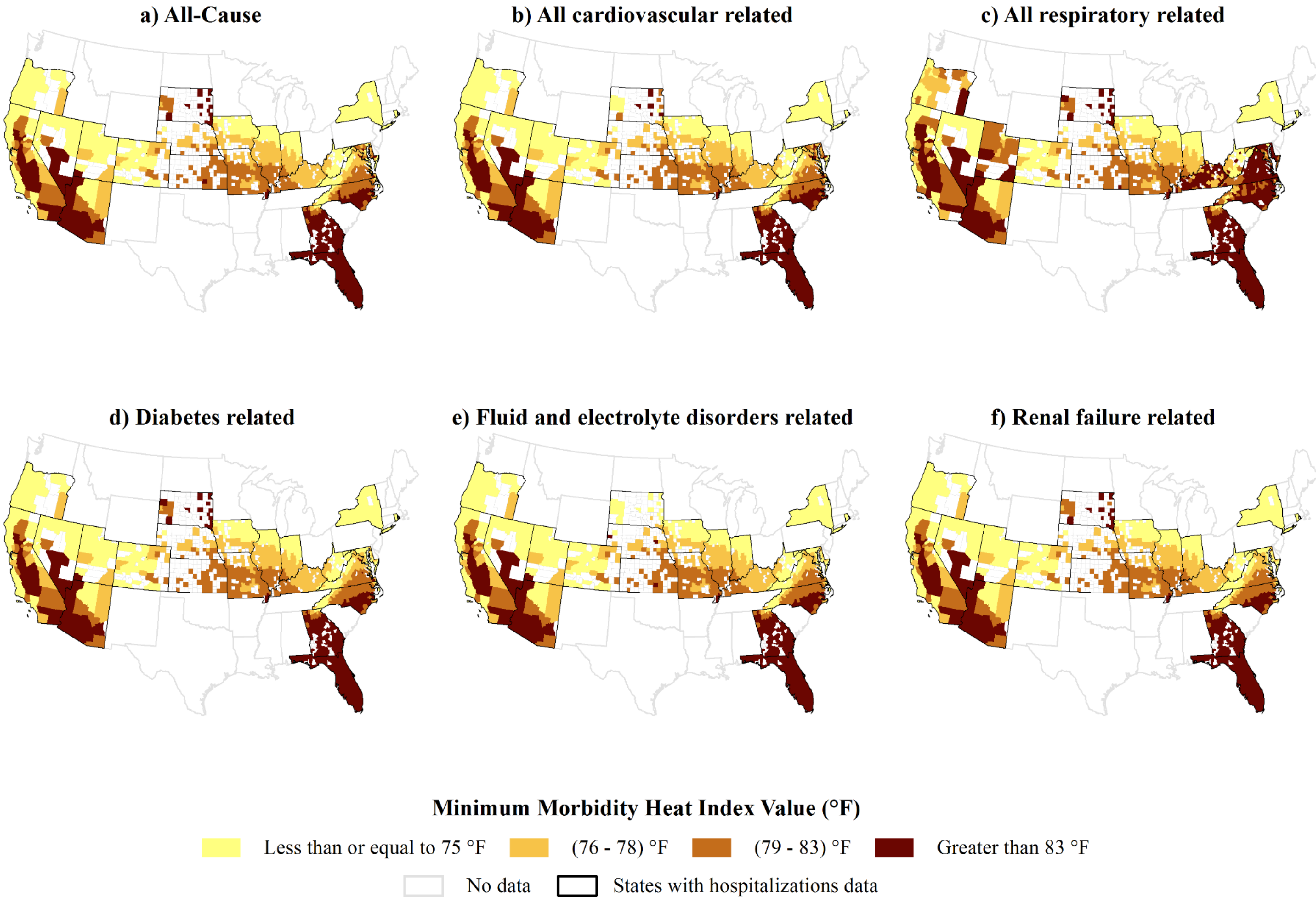

Figure S1: County-level minimum morbidity heat index (MMHI) (°F), by hospitalization outcomes

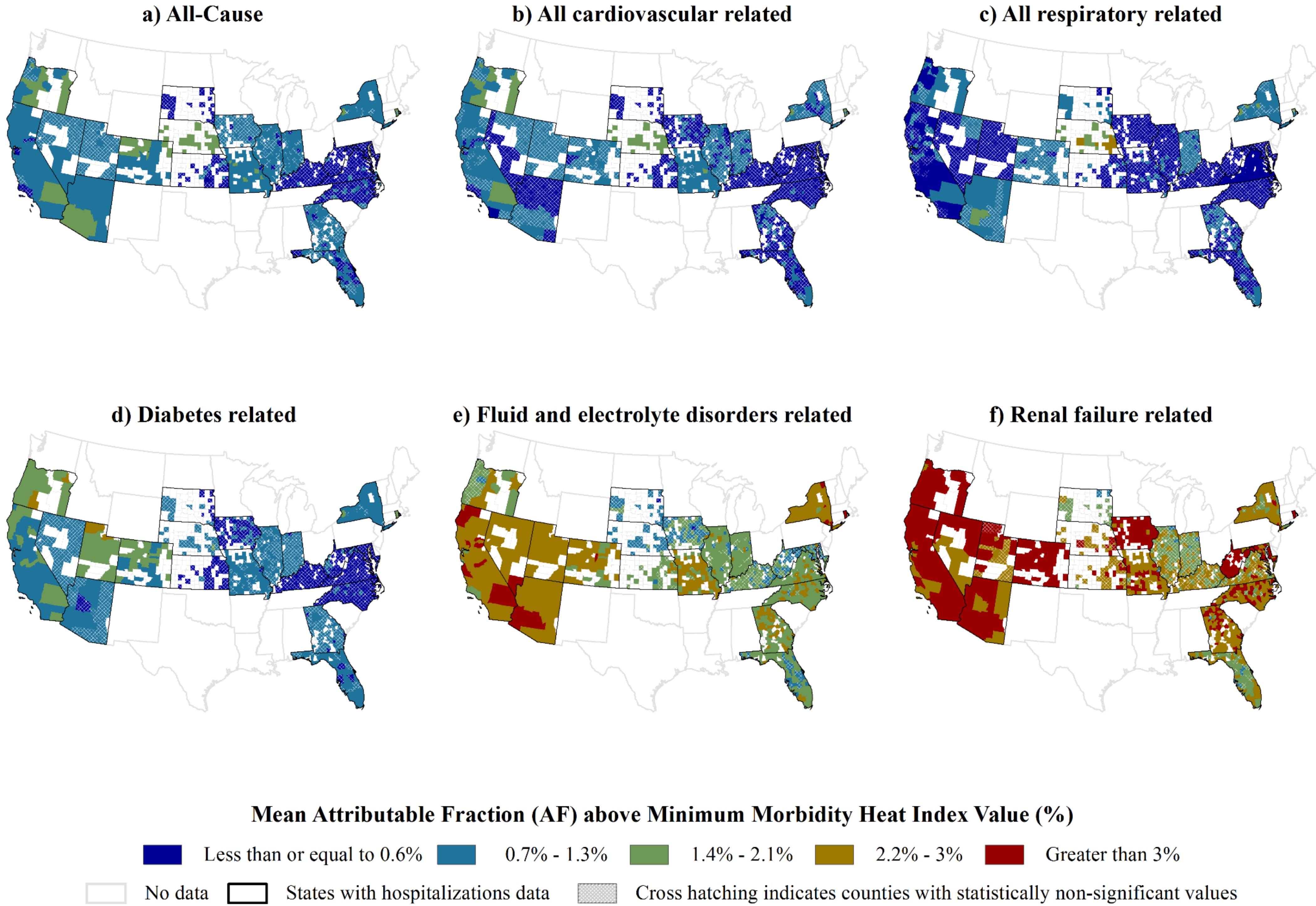

Figure S2: County-level mean attributable fraction (%) above MMHI for a cumulative 2-day lag period, by hospitalization outcomes

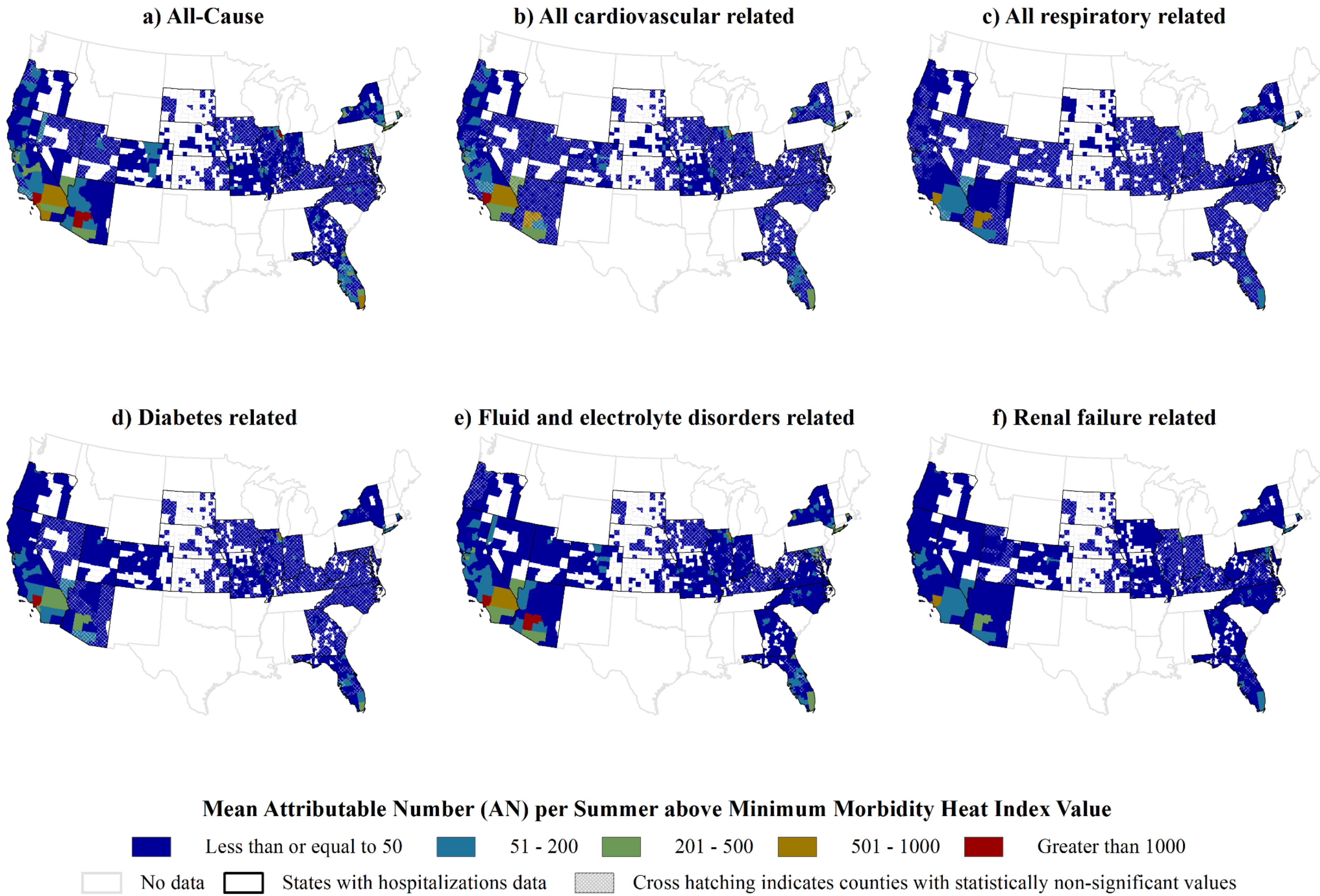

Figure S3: County-level mean attributable number per summer above MMHI for a cumulative 2-day lag period, by hospitalization outcomes

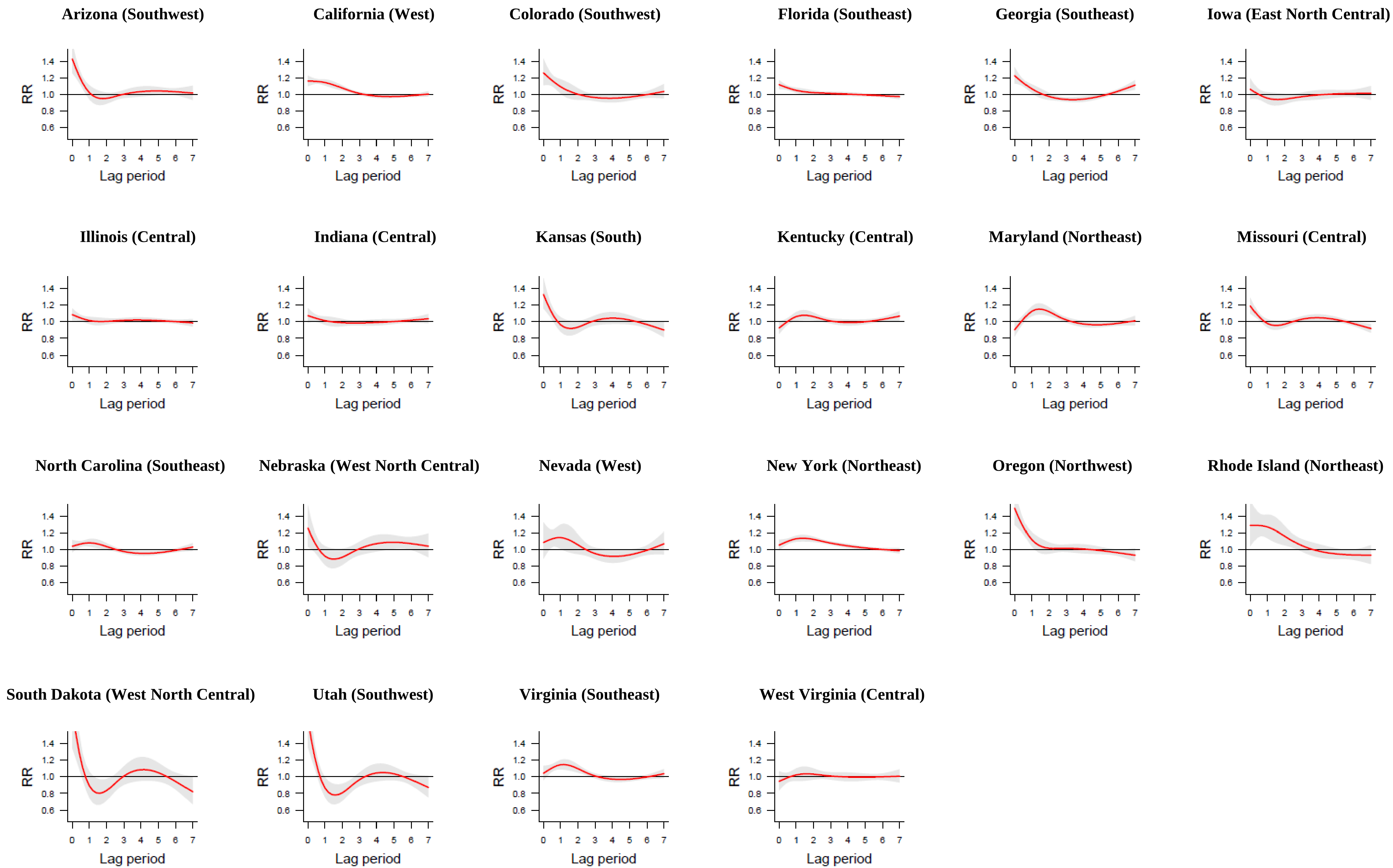

Figure S4: Lag-Response relationship between heat index and hospitalizations from all causes, by state

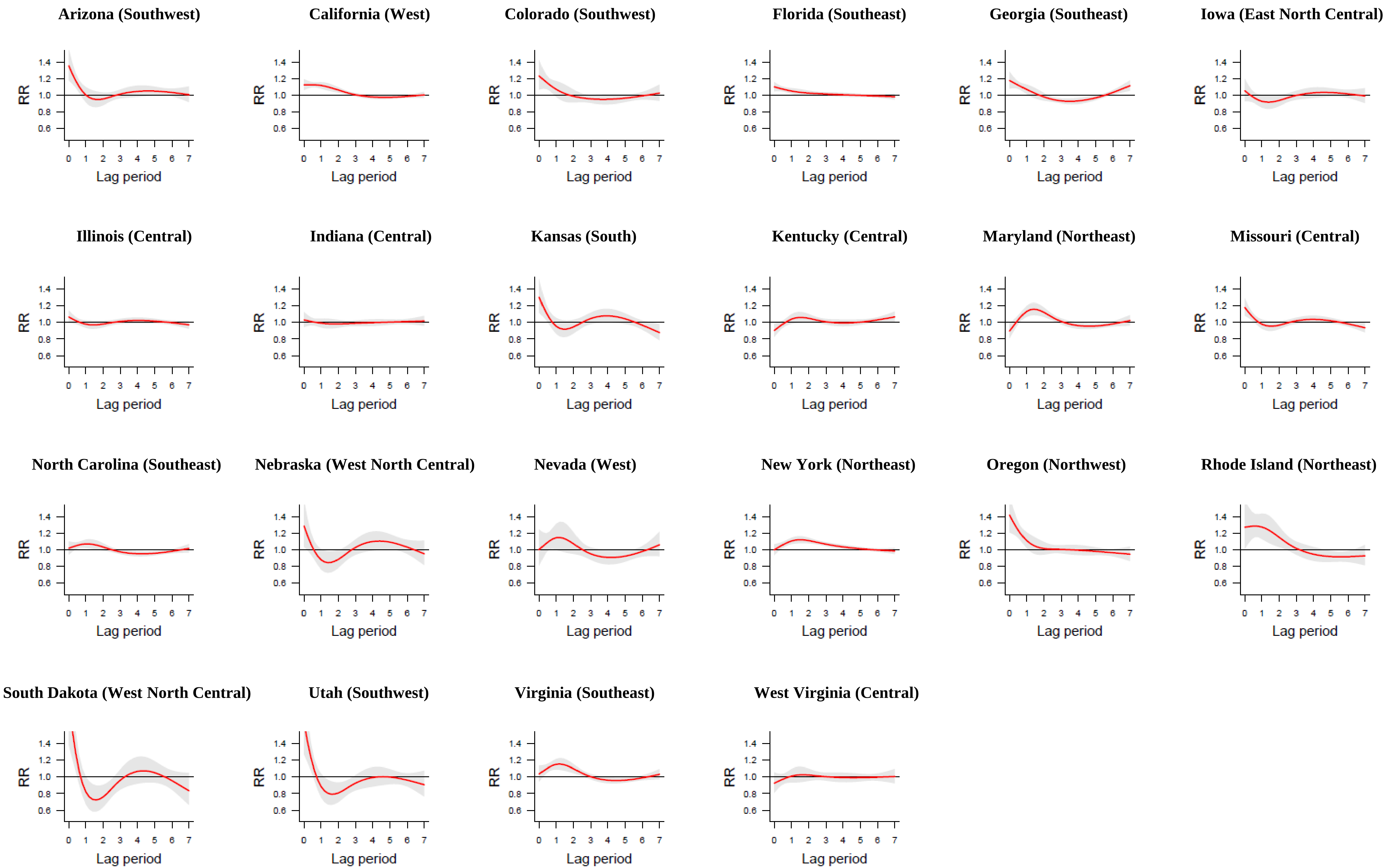

Figure S5: Lag-Response relationship between heat index and cardiovascular related hospitalizations, by state

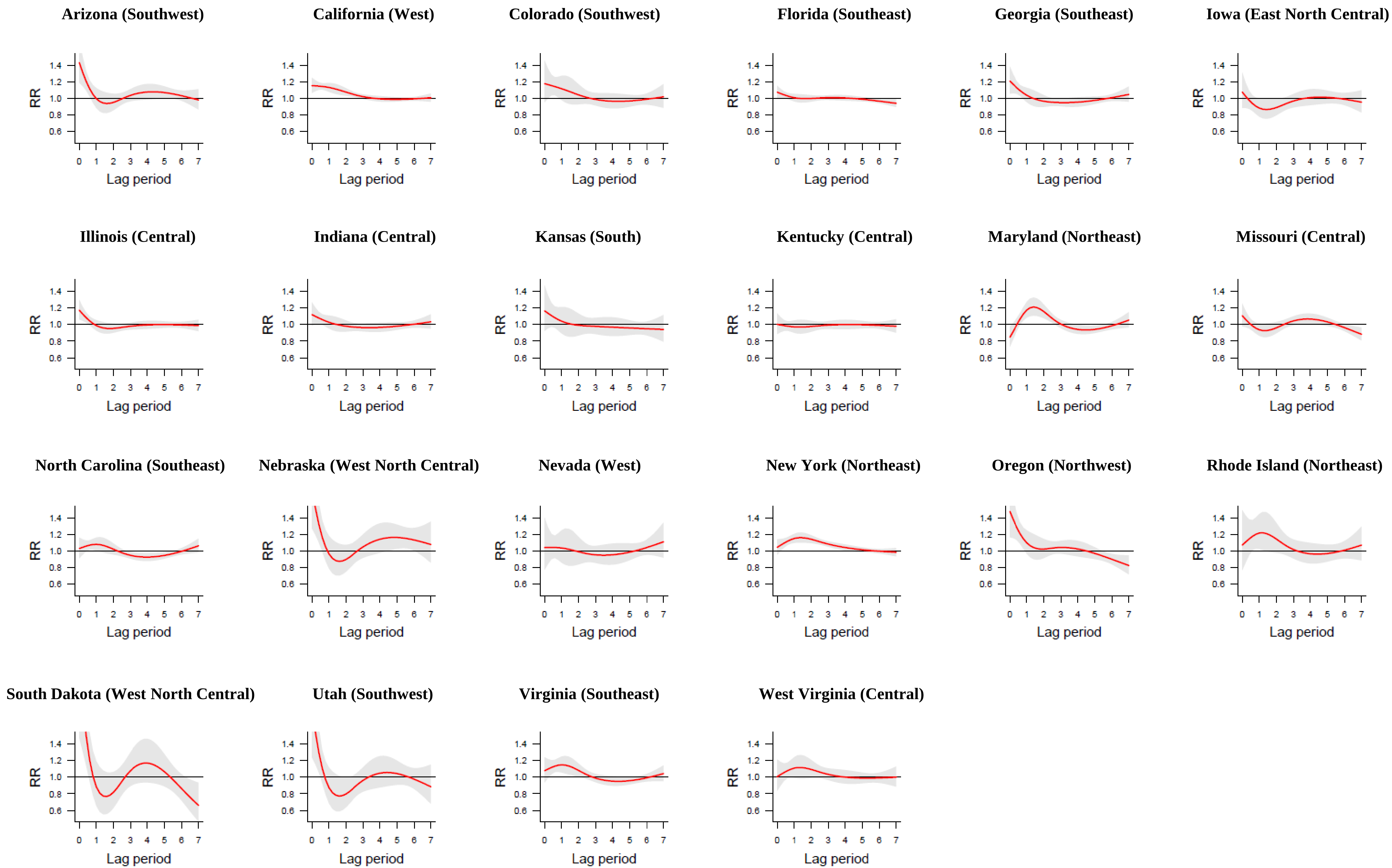

Figure S6 Lag-Response relationship between heat index and respiratory related hospitalizations, by state

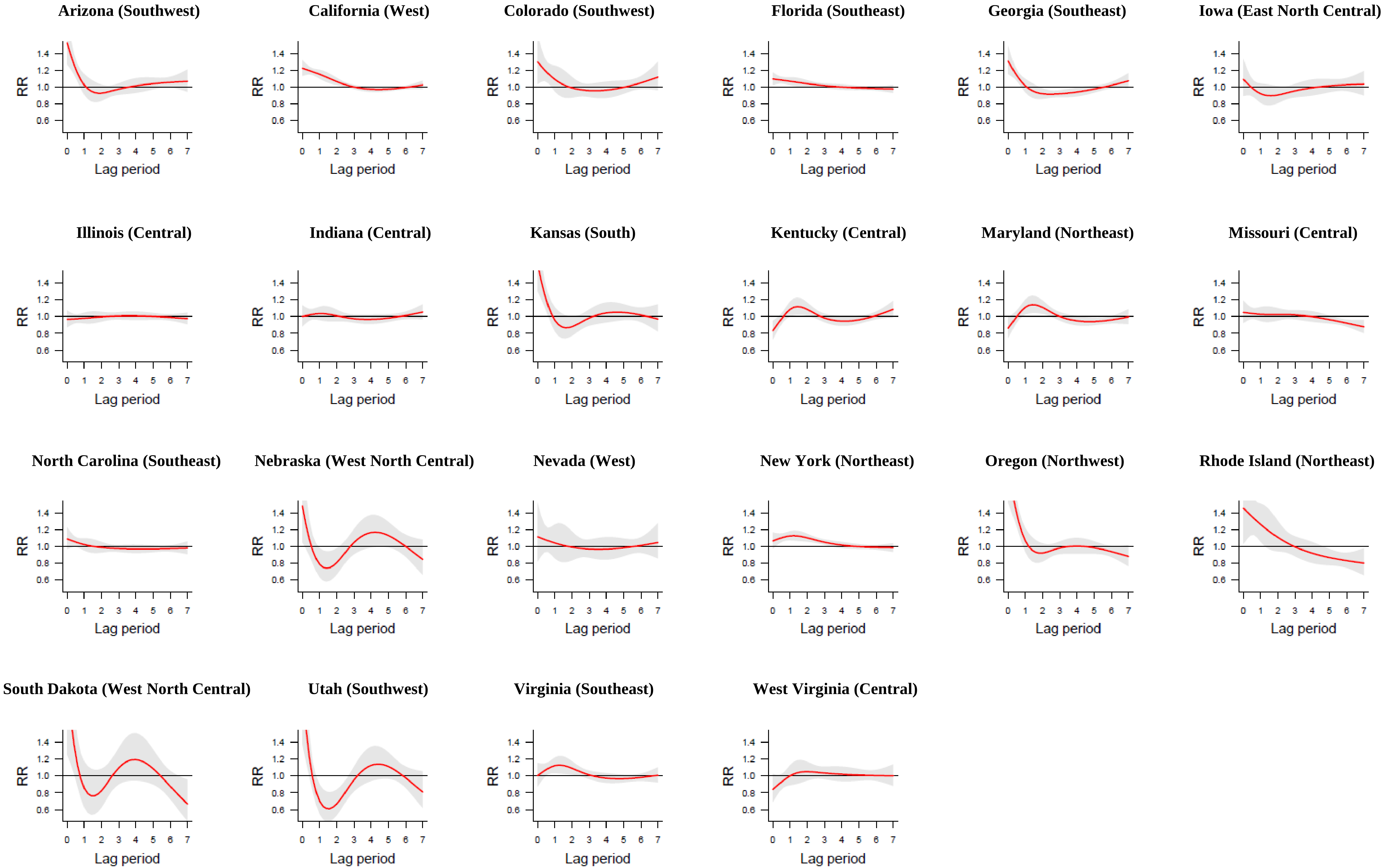

Figure S7: Lag-Response relationship between heat index and diabetes related hospitalizations, by state

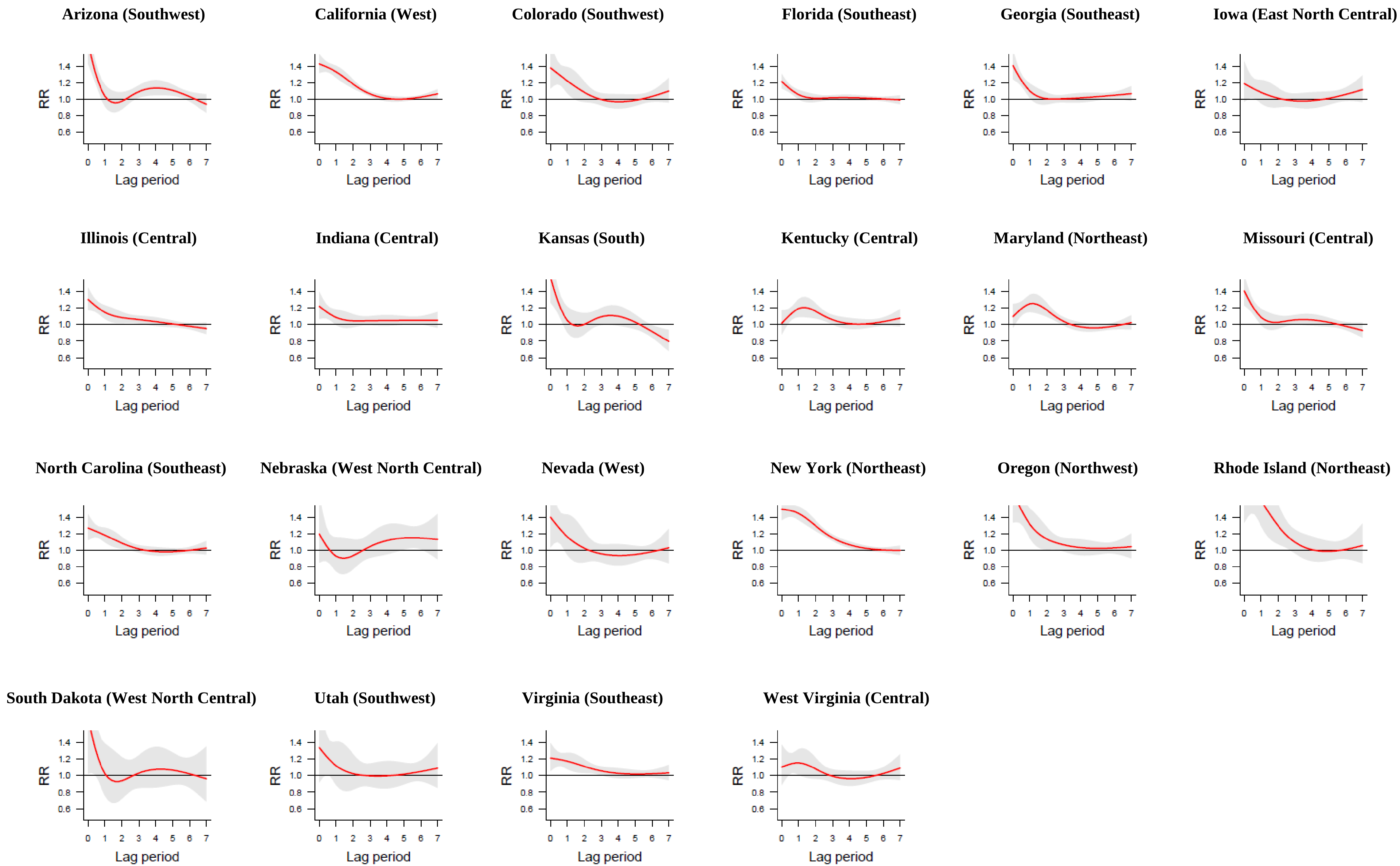

Figure S8: Lag-Response relationship between heat index and fluid and electrolyte disorders related hospitalizations, by state

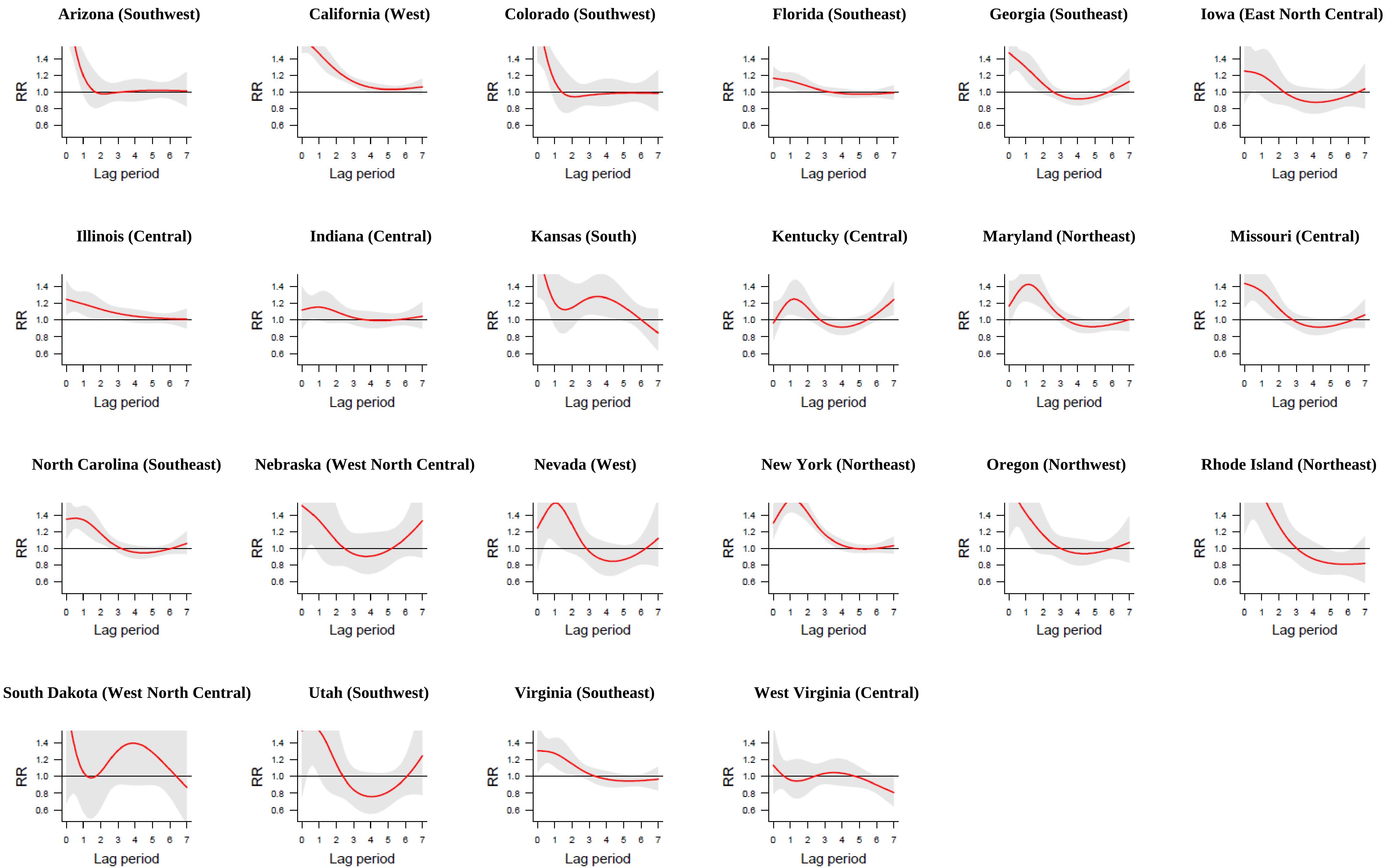

Figure S9: Lag-Response relationship between heat index and renal failure related hospitalizations, by state

Table S2: State-specific mean (95% CI) attributable fraction (AF) of hospitalizations for a cumulative lag period of 2 days, by heat index ranges

Climate region	State	Heat Index index range	Frequency by days of exposure (%)		Mean and (95CI) Attributable Fraction (AF) per Summer					
					All-Cause	All cardiovascular related	All respiratory related	Diabetes related	Fluid and electrolyte disorders related	Renal failure related
			Person-Days	County-Days	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)
Central	Illinois	(71-75)°F	13	10	-0.00 (-0.00, -0.00)	-0.00 (-0.01, -0.00)	-0.00 (-0.01, -0.00)	-0.01 (-0.01, -0.00)	-0.01 (-0.01, -0.00)	-0.02 (-0.02, -0.01)
		(76-80)°F	17	15	0.06 (0.03, 0.09)	0.05 (0.02, 0.08)	0.04 (0.00, 0.08)	0.10 (0.06, 0.13)	0.09 (0.05, 0.13)	0.12 (0.06, 0.18)
		(81-85)°F	15	15	0.13 (0.08, 0.19)	0.12 (0.06, 0.18)	0.08 (0.00, 0.17)	0.21 (0.13, 0.28)	0.21 (0.13, 0.30)	0.24 (0.11, 0.36)
		(86-90)°F	13	15	0.18 (0.11, 0.24)	0.15 (0.08, 0.22)	0.11 (0.02, 0.20)	0.25 (0.16, 0.34)	0.29 (0.20, 0.39)	0.33 (0.18, 0.48)
		(91-95)°F	10	12	0.17 (0.11, 0.22)	0.14 (0.08, 0.19)	0.10 (0.04, 0.16)	0.19 (0.13, 0.26)	0.30 (0.23, 0.37)	0.34 (0.22, 0.45)
		(96-100)°F	7	9	0.14 (0.10, 0.17)	0.11 (0.07, 0.14)	0.08 (0.05, 0.12)	0.12 (0.08, 0.16)	0.28 (0.23, 0.33)	0.32 (0.23, 0.40)
		(101-105)°F	4	6	0.09 (0.07, 0.11)	0.06 (0.04, 0.09)	0.06 (0.03, 0.08)	0.05 (0.03, 0.08)	0.22 (0.19, 0.25)	0.26 (0.19, 0.32)
		(106-110)°F	3	4	0.06 (0.04, 0.07)	0.03 (0.02, 0.05)	0.04 (0.02, 0.05)	0.02 (-0.00, 0.04)	0.19 (0.16, 0.21)	0.22 (0.16, 0.27)
	Indiana	(71-75)°F	12	12	-0.02 (-0.02, -0.02)	-0.02 (-0.02, -0.02)	-0.03 (-0.03, -0.02)	-0.02 (-0.03, -0.01)	-0.04 (-0.04, -0.03)	-0.03 (-0.04, -0.02)
		(76-80)°F	19	18	0.06 (0.05, 0.07)	0.06 (0.05, 0.07)	0.07 (0.06, 0.09)	0.06 (0.05, 0.08)	0.09 (0.07, 0.11)	0.08 (0.05, 0.10)
		(81-85)°F	15	15	0.15 (0.12, 0.17)	0.14 (0.11, 0.16)	0.18 (0.14, 0.22)	0.15 (0.11, 0.19)	0.21 (0.16, 0.25)	0.19 (0.12, 0.25)
		(86-90)°F	14	14	0.22 (0.18, 0.26)	0.19 (0.15, 0.23)	0.25 (0.19, 0.30)	0.22 (0.16, 0.27)	0.32 (0.25, 0.39)	0.31 (0.20, 0.41)
		(91-95)°F	11	12	0.19 (0.16, 0.23)	0.16 (0.12, 0.19)	0.19 (0.14, 0.24)	0.18 (0.14, 0.22)	0.33 (0.27, 0.39)	0.36 (0.26, 0.45)
		(96-100)°F	8	8	0.13 (0.11, 0.16)	0.09 (0.06, 0.11)	0.09 (0.06, 0.12)	0.11 (0.08, 0.14)	0.28 (0.23, 0.32)	0.34 (0.26, 0.41)
		(101-105)°F	4	4	0.07 (0.05, 0.08)	0.03 (0.02, 0.05)	0.03 (0.01, 0.04)	0.05 (0.03, 0.06)	0.19 (0.17, 0.22)	0.26 (0.20, 0.31)
		(106-110)°F	2	3	0.03 (0.03, 0.04)	0.01 (0.00, 0.02)	0.02 (0.01, 0.03)	0.02 (0.01, 0.03)	0.14 (0.12, 0.15)	0.18 (0.14, 0.22)
	Kentucky	(71-75)°F	10	10	-0.03 (-0.03, -0.02)	-0.02 (-0.03, -0.02)	0.00 (-0.02, 0.03)	-0.05 (-0.06, -0.05)	-0.05 (-0.06, -0.04)	-0.07 (-0.08, -0.06)
		(76-80)°F	16	17	0.01 (0.00, 0.01)	0.01 (0.00, 0.01)	0.03 (-0.00, 0.05)	0.01 (0.00, 0.01)	0.01 (0.01, 0.02)	0.02 (0.02, 0.03)
		(81-85)°F	15	15	0.06 (0.04, 0.08)	0.06 (0.04, 0.07)	0.04 (0.02, 0.07)	0.08 (0.06, 0.10)	0.14 (0.10, 0.17)	0.20 (0.16, 0.25)
		(86-90)°F	16	17	0.11 (0.07, 0.15)	0.10 (0.06, 0.13)	0.05 (0.01, 0.09)	0.12 (0.08, 0.16)	0.27 (0.21, 0.33)	0.41 (0.31, 0.50)
		(91-95)°F	15	15	0.11 (0.06, 0.15)	0.08 (0.03, 0.12)	0.01 (-0.04, 0.07)	0.09 (0.04, 0.15)	0.34 (0.26, 0.41)	0.54 (0.41, 0.66)
		(96-100)°F	10	9	0.05 (0.02, 0.09)	0.02 (-0.02, 0.06)	-0.02 (-0.06, 0.01)	0.03 (-0.01, 0.06)	0.27 (0.21, 0.32)	0.44 (0.34, 0.53)
		(101-105)°F	5	5	0.02 (0.00, 0.04)	-0.00 (-0.02, 0.02)	-0.03 (-0.05, -0.01)	-0.01 (-0.03, 0.01)	0.19 (0.16, 0.23)	0.32 (0.25, 0.38)
		(106-110)°F	3	3	0.02 (0.01, 0.03)	0.00 (-0.01, 0.02)	-0.01 (-0.03, 0.00)	-0.00 (-0.02, 0.01)	0.14 (0.12, 0.17)	0.20 (0.14, 0.25)
	Missouri	(71-75)°F	7	7	-0.02 (-0.03, -0.02)	-0.01 (-0.02, -0.01)	-0.01 (-0.02, -0.00)	-0.01 (-0.02, -0.00)	-0.03 (-0.04, -0.02)	-0.04 (-0.05, -0.02)
		(76-80)°F	13	13	-0.01 (-0.01, -0.01)	-0.01 (-0.01, -0.01)	-0.01 (-0.01, -0.00)	-0.01 (-0.01, -0.00)	-0.01 (-0.02, -0.01)	-0.02 (-0.02, -0.01)
		(81-85)°F	14	14	0.05 (0.04, 0.06)	0.04 (0.03, 0.05)	0.03 (0.02, 0.05)	0.04 (0.02, 0.05)	0.06 (0.04, 0.08)	0.07 (0.04, 0.10)
		(86-90)°F	15	15	0.14 (0.11, 0.16)	0.13 (0.10, 0.15)	0.09 (0.05, 0.13)	0.11 (0.08, 0.15)	0.16 (0.11, 0.21)	0.18 (0.10, 0.26)
		(91-95)°F	13	13	0.20 (0.16, 0.24)	0.19 (0.15, 0.22)	0.12 (0.07, 0.17)	0.18 (0.13, 0.22)	0.27 (0.20, 0.34)	0.31 (0.20, 0.42)
		(96-100)°F	11	11	0.22 (0.18, 0.26)	0.20 (0.16, 0.24)	0.12 (0.06, 0.16)	0.21 (0.16, 0.25)	0.38 (0.31, 0.44)	0.45 (0.34, 0.56)
		(101-105)°F	9	9	0.19 (0.16, 0.22)	0.16 (0.13, 0.20)	0.07 (0.04, 0.11)	0.19 (0.15, 0.22)	0.42 (0.37, 0.48)	0.53 (0.45, 0.62)
		(106-110)°F	7	6	0.16 (0.13, 0.19)	0.13 (0.10, 0.16)	0.04 (0.01, 0.06)	0.16 (0.13, 0.19)	0.45 (0.40, 0.50)	0.62 (0.52, 0.71)
	West Virginia	(71-75)°F	16	16	-0.00 (-0.01, 0.01)	-0.00 (-0.01, 0.01)	-0.01 (-0.03, 0.02)	0.01 (-0.01, 0.02)	-0.00 (-0.02, 0.01)	-0.02 (-0.04, 0.01)
		(76-80)°F	21	22	0.12 (0.09, 0.14)	0.10 (0.07, 0.13)	0.07 (0.01, 0.12)	0.19 (0.15, 0.22)	0.16 (0.11, 0.22)	0.53 (0.46, 0.61)
		(81-85)°F	16	16	0.13 (0.09, 0.17)	0.11 (0.07, 0.15)	0.06 (0.01, 0.12)	0.23 (0.18, 0.28)	0.27 (0.19, 0.34)	0.85 (0.75, 0.96)
		(86-90)°F	15	15	0.10 (0.04, 0.15)	0.06 (0.01, 0.11)	0.03 (-0.03, 0.10)	0.17 (0.11, 0.23)	0.35 (0.25, 0.45)	1.05 (0.90, 1.20)
		(91-95)°F	10	9	0.01 (-0.03, 0.05)	-0.02 (-0.06, 0.03)	0.00 (-0.04, 0.05)	0.02 (-0.03, 0.07)	0.27 (0.20, 0.35)	0.73 (0.60, 0.84)
		(96-100)°F	4	4	-0.03 (-0.05, -0.00)	-0.04 (-0.06, -0.02)	-0.00 (-0.03, 0.02)	-0.05 (-0.08, -0.03)	0.15 (0.11, 0.19)	0.35 (0.27, 0.43)
		(101-105)°F	2	1	-0.00 (-0.01, 0.01)	-0.01 (-0.02, -0.00	0.02 (0.01, 0.03)	-0.02 (-0.03, -0.01)	0.08 (0.06, 0.10)	0.14 (0.09, 0.18)
		(106-110)°F	1	0	0.01 (0.01, 0.01)	0.01 (0.00, 0.01)	0.02 (0.01, 0.02)	0.01 (0.00, 0.01)	0.03 (0.02, 0.04)	0.04 (0.01, 0.06)
East North Central	Iowa	(71-75)°F	11	11	-0.02 (-0.02, -0.01)	-0.02 (-0.02, -0.01)	-0.00 (-0.01, 0.00)	0.00 (-0.00, 0.01)	-0.02 (-0.03, -0.01)	-0.05 (-0.06, -0.04)
		(76-80)°F	15	16	0.05 (0.04, 0.06)	0.05 (0.04, 0.05)	0.02 (0.01, 0.03)	0.02 (0.01, 0.04)	0.06 (0.04, 0.07)	0.16 (0.14, 0.18)
		(81-85)°F	16	16	0.16 (0.13, 0.19)	0.14 (0.11, 0.16)	0.08 (0.03, 0.12)	0.11 (0.07, 0.15)	0.17 (0.12, 0.22)	0.51 (0.43, 0.58)
		(86-90)°F	14	14	0.23 (0.18, 0.27)	0.18 (0.14, 0.23)	0.11 (0.05, 0.18)	0.18 (0.12, 0.23)	0.25 (0.17, 0.33)	0.72 (0.60, 0.82)
		(91-95)°F	10	10	0.17 (0.13, 0.20)	0.13 (0.10, 0.17)	0.08 (0.03, 0.13)	0.15 (0.11, 0.20)	0.24 (0.17, 0.30)	0.68 (0.57, 0.77)
		(96-100)°F	8	7	0.11 (0.08, 0.14)	0.08 (0.05, 0.11)	0.05 (0.01, 0.09)	0.11 (0.08, 0.15)	0.21 (0.15, 0.27)	0.56 (0.47, 0.65)
		(101-105)°F	5	5	0.05 (0.03, 0.07)	0.02 (0.00, 0.04)	0.01 (-0.02, 0.03)	0.06 (0.04, 0.09)	0.17 (0.13, 0.21)	0.39 (0.32, 0.45)
		(106-110)°F	3	3	0.02 (0.00, 0.03)	0.00 (-0.01, 0.02)	-0.02 (-0.03, -0.00)	0.02 (0.00, 0.04)	0.13 (0.10, 0.15)	0.27 (0.21, 0.32)
Northeast	Maryland	(71-75)°F	12	13	0.00 (-0.02, 0.03)	0.01 (-0.03, 0.06)	0.04 (-0.02, 0.10)	-0.02 (-0.03, -0.00)	-0.03 (-0.04, -0.02)	-0.07 (-0.08, -0.05)
		(76-80)°F	17	18	0.01 (-0.01, 0.03)	0.02 (-0.03, 0.06)	0.04 (-0.01, 0.10)	0.03 (0.01, 0.05)	0.06 (0.04, 0.08)	0.14 (0.11, 0.17)
		(81-85)°F	17	17	0.05 (0.01, 0.09)	0.04 (-0.00, 0.08)	0.04 (-0.02, 0.09)	0.09 (0.02, 0.15)	0.21 (0.13, 0.29)	0.49 (0.36, 0.60)
		(86-90)°F	16	15	0.08 (0.02, 0.14)	0.06 (0.01, 0.12)	0.05 (-0.03, 0.12)	0.11 (0.01, 0.19)	0.34 (0.23, 0.46)	0.75 (0.56, 0.91)
		(91-95)°F	13	12	0.10 (0.03, 0.16)	0.07 (0.01, 0.13)	0.08 (-0.01, 0.15)	0.07 (-0.02, 0.16)	0.43 (0.31, 0.54)	0.88 (0.69, 1.05)
		(96-100)°F	7	6	0.06 (0.03, 0.10)	0.04 (0.01, 0.08)	0.07 (0.02, 0.11)	0.01 (-0.04, 0.05)	0.30 (0.24, 0.36)	0.58 (0.47, 0.68)
		(101-105)°F	3	3	0.04 (0.02, 0.06)	0.03 (0.01, 0.05)	0.04 (0.02, 0.06)	0.01 (-0.02, 0.03)	0.19 (0.16, 0.23)	0.37 (0.31, 0.44)
		(106-110)°F	1	1	0.02 (0.01, 0.02)	0.02 (0.01, 0.02)	0.01 (0.00, 0.02)	0.01 (0.00, 0.02)	0.08 (0.07, 0.10)	0.15 (0.13, 0.18)
	New York	(71-75)°F	19	22	0.05 (0.04, 0.07)	0.05 (0.03, 0.07)	0.06 (0.02, 0.11)	0.06 (0.05, 0.08)	0.13 (0.10, 0.16)	0.09 (0.06, 0.12)
		(76-80)°F	20	20	0.14 (0.10, 0.18)	0.12 (0.09, 0.17)	0.15 (0.10, 0.20)	0.18 (0.14, 0.22)	0.36 (0.30, 0.43)	0.29 (0.20, 0.38)

Climate region	State	Heat Index index range	Frequency by days of expsoure (%) Person-Days	Frequency by days of expsoure (%) County-Days	All-Cause Mean AF (95%CI) (%)	All cardiovascular related Mean AF (95%CI) (%)	All respiratory related Mean AF (95%CI) (%)	Diabetes related Mean AF (95%CI) (%)	Fluid and electrolyte disorders related Mean AF (95%CI) (%)	Renal failure related Mean AF (95%CI) (%)
		Mean and (95CI) Attributable Fraction (AF) per Summer								
		(81-85)°F	14	11	0.17 (0.12, 0.22)	0.14 (0.09, 0.19)	0.18 (0.13, 0.23)	0.22 (0.16, 0.28)	0.47 (0.39, 0.54)	0.42 (0.32, 0.52)
		(86-90)°F	11	8	0.19 (0.15, 0.24)	0.15 (0.10, 0.20)	0.22 (0.18, 0.26)	0.23 (0.18, 0.29)	0.57 (0.50, 0.64)	0.56 (0.46, 0.67)
		(91-95)°F	7	5	0.16 (0.13, 0.19)	0.11 (0.08, 0.15)	0.20 (0.18, 0.22)	0.17 (0.14, 0.21)	0.49 (0.44, 0.53)	0.50 (0.43, 0.57)
		(96-100)°F	3	2	0.11 (0.09, 0.13)	0.07 (0.05, 0.09)	0.14 (0.12, 0.15)	0.11 (0.09, 0.13)	0.35 (0.33, 0.38)	0.39 (0.34, 0.44)
		(101-105)°F	1	1	0.05 (0.04, 0.05)	0.03 (0.02, 0.04)	0.05 (0.05, 0.06)	0.04 (0.04, 0.05)	0.16 (0.15, 0.17)	0.19 (0.17, 0.21)
		(106-110)°F	0	0	0.02 (0.02, 0.03)	0.02 (0.01, 0.02)	0.02 (0.02, 0.02)	0.02 (0.02, 0.03)	0.09 (0.08, 0.09)	0.11 (0.09, 0.12)
	Rhode Island	(71-75)°F	20	21	0.07 (-0.02, 0.16)	0.06 (-0.03, 0.16)	0.10 (-0.03, 0.24)	0.11 (-0.02, 0.23)	0.27 (0.10, 0.43)	0.44 (0.26, 0.63)
		(76-80)°F	22	22	0.21 (-0.04, 0.45)	0.18 (-0.07, 0.43)	0.25 (-0.12, 0.61)	0.30 (-0.05, 0.64)	0.76 (0.32, 1.19)	1.28 (0.72, 1.83)
		(81-85)°F	11	10	0.22 (0.04, 0.40)	0.20 (0.01, 0.39)	0.22 (-0.06, 0.49)	0.29 (0.02, 0.55)	0.72 (0.38, 1.05)	1.18 (0.71, 1.64)
		(86-90)°F	9	9	0.30 (0.13, 0.48)	0.28 (0.09, 0.47)	0.27 (0.02, 0.52)	0.38 (0.12, 0.62)	0.88 (0.55, 1.19)	1.28 (0.84, 1.71)
		(91-95)°F	6	5	0.29 (0.17, 0.40)	0.27 (0.15, 0.39)	0.24 (0.07, 0.39)	0.33 (0.16, 0.50)	0.74 (0.54, 0.94)	0.93 (0.62, 1.22)
		(96-100)°F	2	2	0.17 (0.11, 0.22)	0.16 (0.10, 0.22)	0.13 (0.05, 0.21)	0.19 (0.11, 0.27)	0.41 (0.31, 0.51)	0.52 (0.36, 0.67)
		(101-105)°F	1	1	0.06 (0.04, 0.08)	0.06 (0.04, 0.08)	0.04 (0.01, 0.07)	0.08 (0.05, 0.11)	0.15 (0.12, 0.18)	0.23 (0.16, 0.29)
		(106-110)°F	0	0	0.03 (0.02, 0.04)	0.03 (0.01, 0.04)	0.02 (-0.00, 0.04)	0.03 (0.01, 0.05)	0.08 (0.05, 0.10)	0.09 (0.06, 0.13)
Northwest	Oregon	(71-75)°F	19	15	0.11 (0.05, 0.17)	0.12 (0.06, 0.18)	0.08 (0.02, 0.14)	0.24 (0.16, 0.32)	0.11 (0.01, 0.21)	0.56 (0.41, 0.71)
		(76-80)°F	18	16	0.18 (0.08, 0.27)	0.20 (0.10, 0.30)	0.04 (-0.02, 0.11)	0.40 (0.28, 0.52)	0.21 (0.04, 0.36)	0.98 (0.72, 1.21)
		(81-85)°F	14	14	0.35 (0.26, 0.43)	0.35 (0.26, 0.43)	0.19 (0.12, 0.25)	0.50 (0.39, 0.59)	0.50 (0.36, 0.63)	1.06 (0.84, 1.25)
		(86-90)°F	6	7	0.27 (0.23, 0.31)	0.26 (0.22, 0.30)	0.20 (0.16, 0.24)	0.32 (0.27, 0.36)	0.44 (0.37, 0.51)	0.64 (0.53, 0.74)
		(91-95)°F	2	3	0.15 (0.13, 0.16)	0.13 (0.12, 0.15)	0.13 (0.11, 0.15)	0.17 (0.15, 0.19)	0.26 (0.23, 0.29)	0.34 (0.28, 0.39)
		(96-100)°F	1	1	0.05 (0.05, 0.06)	0.05 (0.04, 0.05)	0.05 (0.04, 0.06)	0.07 (0.06, 0.07)	0.10 (0.09, 0.11)	0.12 (0.10, 0.14)
		(101-105)°F	0	0	0.02 (0.02, 0.02)	0.02 (0.01, 0.02)	0.03 (0.02, 0.03)	0.04 (0.03, 0.04)	0.05 (0.04, 0.06)	0.08 (0.05, 0.09)
		(106-110)°F	0	0	0.00 (0.00, 0.01)	0.00 (0.00, 0.01)	0.01 (0.00, 0.01)	0.01 (0.01, 0.01)	0.01 (0.01, 0.02)	0.02 (0.01, 0.03)
South	Kansas	(71-75)°F	7	7	-0.05 (-0.07, -0.03)	-0.05 (-0.07, -0.04)	0.00 (-0.02, 0.02)	-0.02 (-0.04, 0.00)	-0.04 (-0.09, -0.00)	-0.15 (-0.19, -0.11)
		(76-80)°F	11	11	-0.02 (-0.05, 0.01)	-0.02 (-0.03, -0.01)	-0.00 (-0.01, 0.01)	-0.01 (-0.02, 0.00)	-0.00 (-0.06, 0.05)	-0.06 (-0.08, -0.04)
		(81-85)°F	14	14	0.02 (-0.01, 0.05)	0.02 (0.01, 0.03)	0.01 (-0.01, 0.03)	0.01 (-0.00, 0.03)	0.06 (-0.00, 0.12)	0.08 (0.05, 0.11)
		(86-90)°F	14	15	0.04 (0.00, 0.08)	0.04 (0.00, 0.08)	0.04 (-0.01, 0.09)	0.04 (-0.00, 0.09)	0.11 (0.05, 0.17)	0.19 (0.10, 0.29)
		(91-95)°F	14	14	0.05 (0.01, 0.09)	0.05 (-0.02, 0.11)	0.08 (-0.01, 0.17)	0.07 (-0.01, 0.15)	0.16 (0.09, 0.23)	0.28 (0.11, 0.46)
		(96-100)°F	13	13	0.08 (0.03, 0.13)	0.07 (0.00, 0.14)	0.13 (0.04, 0.21)	0.08 (-0.01, 0.16)	0.28 (0.20, 0.36)	0.39 (0.18, 0.59)
		(101-105)°F	10	11	0.13 (0.08, 0.17)	0.11 (0.05, 0.17)	0.15 (0.09, 0.22)	0.07 (0.00, 0.14)	0.43 (0.35, 0.51)	0.48 (0.29, 0.67)
		(106-110)°F	8	7	0.15 (0.10, 0.19)	0.13 (0.08, 0.18)	0.15 (0.10, 0.20)	0.09 (0.03, 0.14)	0.49 (0.41, 0.57)	0.66 (0.46, 0.84)
Southeast	Florida	(71-75)°F	0	1	-0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.01)	-0.00 (-0.01, 0.00)	-0.01 (-0.01, -0.01)	-0.01 (-0.02, -0.01)
		(76-80)°F	2	2	-0.01 (-0.02, -0.01)	-0.00 (-0.01, 0.00)	0.00 (-0.01, 0.02)	-0.01 (-0.02, -0.00)	-0.04 (-0.05, -0.03)	-0.06 (-0.07, -0.04)
		(81-85)°F	4	4	-0.03 (-0.04, -0.02)	-0.02 (-0.02, -0.01)	-0.01 (-0.03, 0.00)	-0.03 (-0.04, -0.01)	-0.07 (-0.09, -0.06)	-0.09 (-0.11, -0.08)
		(86-90)°F	11	12	-0.04 (-0.05, -0.03)	-0.03 (-0.04, -0.01)	-0.03 (-0.05, -0.02	-0.04 (-0.05, -0.02)	-0.10 (-0.11, -0.08)	-0.13 (-0.15, -0.11)
		(91-95)°F	27	25	0.04 (0.02, 0.06)	0.03 (0.01, 0.04)	0.05 (0.03, 0.07)	0.04 (0.02, 0.06)	0.09 (0.06, 0.11)	0.11 (0.07, 0.15)
		(96-100)°F	33	31	0.30 (0.23, 0.37)	0.22 (0.15, 0.29)	0.30 (0.21, 0.39)	0.29 (0.21, 0.37)	0.58 (0.47, 0.69)	0.72 (0.57, 0.87)
		(101-105)°F	19	19	0.34 (0.29, 0.39)	0.28 (0.22, 0.33)	0.21 (0.16, 0.26)	0.36 (0.31, 0.40)	0.64 (0.56, 0.71)	0.84 (0.72, 0.97)
		(106-110)°F	4	5	0.10 (0.08, 0.11)	0.08 (0.07, 0.09)	0.05 (0.04, 0.06)	0.11 (0.10, 0.12)	0.16 (0.14, 0.18)	0.23 (0.18, 0.26)
	Georgia	(71-75)°F	3	3	-0.01 (-0.02, -0.01)	-0.01 (-0.01, 0.00)	0.00 (-0.01, 0.01)	-0.01 (-0.02, -0.00)	-0.02 (-0.03, -0.02)	-0.06 (-0.08, -0.05)
		(76-80)°F	8	7	-0.02 (-0.03, -0.01)	-0.01 (-0.03, 0.01)	-0.01 (-0.02, 0.00)	-0.02 (-0.04, -0.01)	-0.05 (-0.06, -0.04)	-0.10 (-0.11, -0.08)
		(81-85)°F	12	11	-0.01 (-0.02, 0.00)	-0.00 (-0.02, 0.02)	-0.00 (-0.01, 0.00)	-0.01 (-0.02, -0.01)	-0.02 (-0.03, -0.02)	-0.04 (-0.04, -0.03)
		(86-90)°F	20	18	0.04 (0.02, 0.06)	0.03 (0.01, 0.04)	0.05 (0.03, 0.07)	0.06 (0.04, 0.08)	0.12 (0.09, 0.15)	0.13 (0.08, 0.17)
		(91-95)°F	22	22	0.14 (0.11, 0.18)	0.09 (0.07, 0.12)	0.16 (0.10, 0.21)	0.19 (0.14, 0.23)	0.41 (0.33, 0.48)	0.44 (0.33, 0.55)
		(96-100)°F	18	20	0.25 (0.21, 0.28)	0.17 (0.14, 0.21)	0.22 (0.17, 0.27)	0.27 (0.22, 0.31)	0.62 (0.55, 0.69)	0.85 (0.74, 0.97)
		(101-105)°F	10	12	0.23 (0.21, 0.25)	0.18 (0.15, 0.20)	0.17 (0.14, 0.19)	0.21 (0.19, 0.23)	0.52 (0.47, 0.56)	0.83 (0.75, 0.91)
		(106-110)°F	3	4	0.10 (0.09, 0.11)	0.08 (0.07, 0.09)	0.06 (0.05, 0.07)	0.09 (0.08, 0.10)	0.22 (0.20, 0.24)	0.36 (0.31, 0.40)
	North Carolina	(71-75)°F	8	10	-0.00 (-0.01, 0.00)	0.01 (-0.00, 0.02)	0.00 (-0.02, 0.02)	-0.02 (-0.03, -0.00)	-0.05 (-0.06, -0.04)	-0.09 (-0.10, -0.08)
		(76-80)°F	12	14	0.00 (-0.01, 0.01)	0.01 (-0.00, 0.02)	0.02 (-0.01, 0.05)	-0.01 (-0.02, 0.00)	-0.02 (-0.04, -0.01)	-0.05 (-0.07, -0.04)
		(81-85)°F	14	14	0.02 (0.01, 0.04)	0.02 (0.00, 0.03)	0.03 (-0.00, 0.07)	0.02 (0.01, 0.03)	0.07 (0.05, 0.09)	0.11 (0.09, 0.13)
		(86-90)°F	18	17	0.07 (0.05, 0.09)	0.04 (0.02, 0.06)	0.04 (0.01, 0.07)	0.08 (0.05, 0.10)	0.23 (0.19, 0.27)	0.36 (0.31, 0.41)
		(91-95)°F	19	17	0.12 (0.09, 0.16)	0.08 (0.04, 0.11)	0.03 (-0.00, 0.05)	0.13 (0.09, 0.18)	0.43 (0.36, 0.50)	0.66 (0.56, 0.75)
		(96-100)°F	14	12	0.13 (0.10, 0.15)	0.08 (0.05, 0.11)	0.01 (-0.01, 0.03)	0.12 (0.08, 0.15)	0.51 (0.45, 0.56)	0.76 (0.67, 0.84)
		(101-105)°F	7	6	0.09 (0.07, 0.10)	0.06 (0.04, 0.08)	0.01 (-0.00, 0.02)	0.07 (0.05, 0.09)	0.38 (0.34, 0.40)	0.57 (0.51, 0.63)
		(106-110)°F	2	2	0.05 (0.04, 0.05)	0.04 (0.03, 0.04)	0.02 (0.01, 0.03)	0.04 (0.03, 0.05)	0.18 (0.16, 0.20)	0.30 (0.26, 0.33)
	Virginia	(71-75)°F	11	12	-0.00 (-0.01, 0.01)	0.01 (-0.00, 0.02)	0.09 (0.06, 0.13)	-0.01 (-0.03, 0.00)	-0.05 (-0.06, -0.04)	-0.05 (-0.06, -0.04)
		(76-80)°F	16	17	0.01 (0.00, 0.02)	0.01 (-0.00, 0.03)	0.12 (0.07, 0.17)	0.01 (-0.01, 0.02)	0.04 (0.03, 0.05)	0.04 (0.03, 0.05)
		(81-85)°F	16	16	0.04 (0.02, 0.06)	0.03 (0.01, 0.05)	0.07 (0.04, 0.10)	0.03 (0.01, 0.05)	0.18 (0.15, 0.21)	0.20 (0.16, 0.23)
		(86-90)°F	17	17	0.09 (0.05, 0.12)	0.06 (0.03, 0.09)	0.04 (0.03, 0.05)	0.05 (0.02, 0.09)	0.36 (0.30, 0.42)	0.41 (0.32, 0.48)
		(91-95)°F	14	13	0.10 (0.06, 0.13)	0.06 (0.03, 0.10)	0.04 (0.03, 0.05)	0.08 (0.04, 0.11)	0.43 (0.36, 0.49)	0.50 (0.41, 0.58)

Climate region	State	Heat Index index range	Frequency by days of expsoure (%)		Mean and (95CI) Attributable Fraction (AF) per Summer					
					All-Cause	All cardiovascular related	All respiratory related	Diabetes related	Fluid and electrolyte disorders related	Renal failure related
			Person-Days	County-Days	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)	Mean AF (95%CI) (%)
		(96-100)°F	10	9	0.09 (0.06, 0.12)	0.05 (0.02, 0.08)	0.07 (0.06, 0.09)	0.09 (0.06, 0.12)	0.41 (0.35, 0.45)	0.49 (0.42, 0.56)
		(101-105)°F	5	4	0.07 (0.06, 0.09)	0.04 (0.03, 0.06)	0.09 (0.08, 0.10)	0.08 (0.07, 0.10)	0.28 (0.25, 0.30)	0.35 (0.30, 0.39)
		(106-110)°F	2	1	0.05 (0.05, 0.06)	0.05 (0.04, 0.05)	0.06 (0.05, 0.06)	0.05 (0.04, 0.05)	0.12 (0.11, 0.14)	0.18 (0.15, 0.20)
Southwest	Arizona	(71-75)°F	1	4	-0.02 (-0.02, -0.01)	-0.02 (-0.03, -0.01)	-0.00 (-0.01, 0.01)	-0.02 (-0.03, -0.01)	-0.03 (-0.04, -0.02)	-0.03 (-0.05, -0.02)
		(76-80)°F	5	11	-0.06 (-0.09, -0.03)	-0.07 (-0.10, -0.03)	0.01 (-0.05, 0.06)	-0.07 (-0.13, -0.02)	-0.10 (-0.15, -0.06)	-0.11 (-0.19, -0.04)
		(81-85)°F	9	21	-0.04 (-0.07, -0.01)	-0.05 (-0.09, -0.02)	0.01 (-0.04, 0.06)	-0.06 (-0.11, -0.01)	-0.06 (-0.11, -0.02)	-0.07 (-0.13, -0.01)
		(86-90)°F	14	19	-0.01 (-0.05, 0.03)	-0.02 (-0.06, 0.02)	0.02 (-0.03, 0.07)	-0.03 (-0.09, 0.02)	-0.02 (-0.07, 0.04)	-0.03 (-0.10, 0.05)
		(91-95)°F	19	16	0.13 (0.08, 0.18)	0.09 (0.03, 0.15)	0.11 (0.04, 0.19)	0.09 (0.03, 0.16)	0.22 (0.14, 0.30)	0.24 (0.12, 0.35)
		(96-100)°F	18	12	0.28 (0.18, 0.39)	0.18 (0.07, 0.29)	0.28 (0.14, 0.41)	0.23 (0.11, 0.36)	0.55 (0.39, 0.71)	0.61 (0.37, 0.83)
		(101-105)°F	20	9	0.44 (0.20, 0.67)	0.25 (0.00, 0.49)	0.51 (0.21, 0.81)	0.38 (0.08, 0.67)	0.96 (0.62, 1.31)	1.17 (0.64, 1.65)
		(106-110)°F	11	4	0.27 (0.12, 0.43)	0.10 (-0.07, 0.28)	0.31 (0.14, 0.49)	0.17 (-0.01, 0.35)	0.79 (0.55, 1.02)	1.12 (0.71, 1.52)
	Colorado	(71-75)°F	12	14	-0.00 (-0.01, 0.01)	-0.00 (-0.01, 0.01)	-0.00 (-0.01, 0.01)	-0.00 (-0.02, 0.01)	-0.01 (-0.03, 0.00)	-0.03 (-0.05, -0.01)
		(76-80)°F	22	21	0.18 (0.14, 0.23)	0.14 (0.09, 0.19)	0.12 (0.05, 0.20)	0.17 (0.11, 0.24)	0.31 (0.23, 0.39)	0.54 (0.43, 0.65)
		(81-85)°F	26	19	0.43 (0.33, 0.53)	0.32 (0.22, 0.43)	0.28 (0.15, 0.42)	0.46 (0.32, 0.58)	0.79 (0.63, 0.95)	1.40 (1.14, 1.67)
		(86-90)°F	17	11	0.37 (0.29, 0.45)	0.25 (0.17, 0.34)	0.23 (0.12, 0.32)	0.46 (0.35, 0.56)	0.84 (0.69, 0.97)	1.37 (1.11, 1.62)
		(91-95)°F	5	5	0.15 (0.12, 0.19)	0.11 (0.07, 0.14)	0.11 (0.07, 0.15)	0.21 (0.16, 0.26)	0.36 (0.30, 0.42)	0.51 (0.39, 0.63)
		(96-100)°F	0	1	0.03 (0.02, 0.03)	0.02 (0.01, 0.03)	0.03 (0.02, 0.03)	0.04 (0.03, 0.05)	0.05 (0.04, 0.06)	0.06 (0.04, 0.09)
		(101-105)°F	0	0	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
		(106-110)°F	0	0	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
	Utah	(71-75)°F	10	11	0.00 (-0.00, 0.01)	0.00 (-0.00, 0.01)	0.09 (-0.05, 0.23)	0.01 (0.00, 0.02)	0.01 (-0.00, 0.02)	0.01 (-0.00, 0.02)
		(76-80)°F	20	24	0.16 (0.08, 0.24)	0.14 (0.05, 0.22)	0.09 (-0.03, 0.22)	0.29 (0.17, 0.40)	0.32 (0.17, 0.45)	0.36 (0.14, 0.57)
		(81-85)°F	27	26	0.37 (0.15, 0.58)	0.32 (0.06, 0.55)	0.05 (0.00, 0.09)	0.74 (0.40, 1.06)	0.82 (0.41, 1.20)	0.97 (0.32, 1.55)
		(86-90)°F	18	13	0.33 (0.14, 0.51)	0.24 (0.02, 0.45)	0.18 (-0.01, 0.36)	0.62 (0.33, 0.90)	0.85 (0.51, 1.17)	1.10 (0.49, 1.63)
		(91-95)°F	5	4	0.10 (0.04, 0.16)	0.08 (0.01, 0.15)	0.07 (0.01, 0.13)	0.15 (0.06, 0.24)	0.27 (0.16, 0.38)	0.39 (0.20, 0.54)
		(96-100)°F	1	1	0.02 (-0.00, 0.04)	0.02 (-0.01, 0.04)	0.01 (-0.01, 0.03)	0.03 (0.00, 0.07)	0.05 (0.02, 0.08)	0.06 (-0.00, 0.11)
		(101-105)°F	0	0	0.00 (-0.00, 0.01)	0.00 (-0.00, 0.01)	0.00 (0.00, 0.00)	0.00 (-0.01, 0.01)	0.01 (-0.00, 0.02)	0.01 (-0.00, 0.02)
		(106-110)°F	0	0	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)	0.00 (0.00, 0.00)
West	California	(71-75)°F	14	11	-0.01 (-0.03, 0.01)	-0.01 (-0.03, 0.01)	-0.01 (-0.04, 0.01)	-0.03 (-0.05, -0.01)	-0.01 (-0.04, 0.01)	-0.01 (-0.05, 0.02)
		(76-80)°F	24	15	0.15 (0.08, 0.22)	0.13 (0.06, 0.20)	0.07 (-0.02, 0.16)	0.17 (0.08, 0.25)	0.43 (0.34, 0.53)	0.50 (0.36, 0.64)
		(81-85)°F	21	17	0.24 (0.15, 0.33)	0.20 (0.11, 0.29)	0.17 (0.06, 0.26)	0.31 (0.21, 0.41)	0.73 (0.62, 0.84)	0.93 (0.76, 1.09)
		(86-90)°F	11	14	0.15 (0.13, 0.18)	0.13 (0.10, 0.16)	0.11 (0.09, 0.14)	0.20 (0.17, 0.22)	0.45 (0.41, 0.49)	0.60 (0.54, 0.66)
		(91-95)°F	8	12	0.12 (0.09, 0.14)	0.10 (0.07, 0.13)	0.07 (0.04, 0.10)	0.14 (0.11, 0.17)	0.33 (0.29, 0.37)	0.41 (0.35, 0.46)
		(96-100)°F	6	8	0.10 (0.08, 0.12)	0.08 (0.06, 0.10)	0.07 (0.05, 0.09)	0.13 (0.10, 0.15)	0.28 (0.25, 0.31)	0.36 (0.31, 0.40)
		(101-105)°F	3	4	0.06 (0.05, 0.07)	0.05 (0.04, 0.06)	0.06 (0.05, 0.06)	0.08 (0.07, 0.09)	0.17 (0.16, 0.19)	0.23 (0.21, 0.25)
		(106-110)°F	1	1	0.03 (0.03, 0.03)	0.02 (0.02, 0.03)	0.03 (0.03, 0.03)	0.04 (0.04, 0.04)	0.08 (0.08, 0.09)	0.11 (0.09, 0.12)
	Nevada	(71-75)°F	4	9	-0.03 (-0.05, -0.01)	-0.03 (-0.05, -0.00)	0.00 (-0.03, 0.04)	-0.03 (-0.07, 0.01)	-0.05 (-0.08, -0.02)	-0.03 (-0.08, 0.02)
		(76-80)°F	11	22	-0.01 (-0.08, 0.06)	-0.02 (-0.09, 0.05)	0.02 (-0.08, 0.12)	-0.02 (-0.12, 0.07)	0.02 (-0.10, 0.14)	0.09 (-0.07, 0.25)
		(81-85)°F	16	24	0.04 (-0.04, 0.13)	0.02 (-0.07, 0.11)	0.06 (-0.06, 0.18)	0.02 (-0.09, 0.13)	0.17 (0.01, 0.33)	0.24 (0.04, 0.44)
		(86-90)°F	17	13	0.10 (0.05, 0.14)	0.06 (0.01, 0.10)	0.05 (-0.01, 0.11)	0.08 (0.03, 0.14)	0.28 (0.20, 0.36)	0.26 (0.15, 0.37)
		(91-95)°F	18	7	0.17 (-0.04, 0.38)	0.11 (-0.11, 0.33)	0.04 (-0.26, 0.34)	0.20 (-0.09, 0.49)	0.48 (0.16, 0.79)	0.33 (-0.20, 0.84)
		(96-100)°F	19	4	0.36 (0.03, 0.71)	0.20 (-0.17, 0.57)	0.17 (-0.27, 0.59)	0.34 (-0.12, 0.79)	1.03 (0.52, 1.52)	0.81 (-0.03, 1.60)
		(101-105)°F	7	1	0.23 (0.08, 0.38)	0.12 (-0.05, 0.29)	0.13 (-0.05, 0.31)	0.18 (-0.03, 0.37)	0.65 (0.41, 0.87)	0.59 (0.13, 0.99)
		(106-110)°F	1	0	0.03 (-0.01, 0.06)	0.02 (-0.02, 0.06)	-0.00 (-0.06, 0.05)	0.03 (-0.03, 0.08)	0.08 (0.01, 0.14)	0.06 (-0.08, 0.17)
West North Central	Nebraska	(71-75)°F	8	8	-0.11 (-0.12, -0.09)	-0.11 (-0.13, -0.09)	-0.18 (-0.20, -0.15)	-0.09 (-0.12, -0.06)	-0.11 (-0.14, -0.08)	-0.23 (-0.28, -0.18)
		(76-80)°F	12	13	0.01 (0.01, 0.01)	0.01 (0.01, 0.01)	0.01 (0.01, 0.02)	0.01 (0.00, 0.01)	0.00 (-0.01, 0.01)	0.01 (0.00, 0.02)
		(81-85)°F	18	18	0.20 (0.16, 0.24)	0.21 (0.17, 0.26)	0.31 (0.24, 0.38)	0.17 (0.10, 0.24)	0.07 (-0.01, 0.15)	0.37 (0.23, 0.50)
		(86-90)°F	15	15	0.30 (0.22, 0.39)	0.32 (0.24, 0.41)	0.45 (0.32, 0.58)	0.25 (0.13, 0.38)	0.05 (-0.11, 0.20)	0.52 (0.25, 0.78)
		(91-95)°F	12	13	0.34 (0.25, 0.44)	0.36 (0.26, 0.45)	0.46 (0.31, 0.59)	0.26 (0.12, 0.39)	0.11 (-0.07, 0.28)	0.55 (0.24, 0.84)
		(96-100)°F	10	9	0.32 (0.23, 0.41)	0.32 (0.23, 0.41)	0.36 (0.24, 0.49)	0.21 (0.08, 0.33)	0.22 (0.05, 0.37)	0.46 (0.17, 0.73)
		(101-105)°F	7	7	0.26 (0.19, 0.32)	0.25 (0.17, 0.32)	0.24 (0.14, 0.32)	0.14 (0.04, 0.23)	0.31 (0.18, 0.43)	0.33 (0.09, 0.55)
		(106-110)°F	5	4	0.17 (0.12, 0.23)	0.15 (0.09, 0.21)	0.22 (0.14, 0.29)	0.09 (0.00, 0.16)	0.27 (0.15, 0.38)	0.37 (0.12, 0.60)
	South Dakota	(71-75)°F	11	11	0.07 (-0.03, 0.17)	0.01 (-0.09, 0.09)	0.27 (0.09, 0.44)	0.10 (-0.07, 0.26)	0.01 (-0.01, 0.02)	0.15 (-0.18, 0.46)
		(76-80)°F	15	15	0.06 (-0.04, 0.15)	0.01 (-0.08, 0.10)	0.25 (0.09, 0.41)	0.11 (-0.04, 0.26)	0.09 (-0.02, 0.18)	0.13 (-0.17, 0.40)
		(81-85)°F	17	17	0.03 (-0.02, 0.08)	0.01 (-0.07, 0.10)	0.12 (0.03, 0.21)	0.06 (-0.03, 0.14)	0.21 (-0.01, 0.44)	0.07 (-0.06, 0.19)
		(86-90)°F	14	14	0.03 (-0.00, 0.06)	0.03 (-0.06, 0.13)	0.07 (0.02, 0.11)	0.06 (0.00, 0.11)	0.24 (-0.04, 0.50)	0.18 (0.01, 0.33)
		(91-95)°F	10	10	0.07 (0.01, 0.12)	0.06 (-0.03, 0.15)	0.16 (0.07, 0.24)	0.14 (0.04, 0.23)	0.15 (-0.08, 0.34)	0.40 (0.11, 0.65)
		(96-100)°F	6	6	0.09 (0.03, 0.14)	0.07 (-0.01, 0.14)	0.20 (0.11, 0.29)	0.17 (0.07, 0.27)	0.10 (-0.09, 0.27)	0.41 (0.17, 0.62)
		(101-105)°F	3	4	0.08 (0.03, 0.13)	0.06 (-0.00, 0.11)	0.18 (0.10, 0.26)	0.14 (0.06, 0.22)	0.06 (-0.05, 0.17)	0.32 (0.13, 0.48)
		(106-110)°F	2	2	0.07 (0.03, 0.10)	0.04 (-0.01, 0.08)	0.14 (0.08, 0.20)	0.10 (0.04, 0.16)	0.10 (0.01, 0.18)	0.25 (0.08, 0.39)

Table S3: State-specific mean (95% CI) attributable number (AN) of hospitalizations for a cumulative lag period of 2 days, by heat index ranges

Climate region	State	Heat Index index range	Frequency by days of expsoure (%)		Mean and (95CI) Attributable Number (AN) per Summer					
					All-Cause	All cardiovascular related	All respiratory related	Diabetes related	Fluid and electrolyte disorders related	Renal failure related
			Person-Days	County-Days	Mean AN (95%CI)	Mean AN (95%CI)	Mean AN (95%CI)	Mean AN (95%CI)	Mean AN (95%CI)	Mean AN (95%CI)
Central	Illinois	(71-75)°F	13	10	-12 (-21, -3)	-11 (-19, -3)	-7 (-11, -2)	-8 (-12, -4)	-8 (-12, -4)	-6 (-7, -4)
		(76-80)°F	17	15	251 (137, 370)	179 (80, 279)	54 (1, 108)	127 (77, 177)	108 (63, 155)	41 (21, 62)
		(81-85)°F	15	15	571 (322, 816)	406 (204, 617)	117 (6, 236)	275 (175, 378)	245 (150, 342)	83 (39, 126)
		(86-90)°F	13	15	750 (452, 1037)	522 (281, 765)	151 (25, 282)	332 (219, 451)	341 (231, 453)	117 (63, 170)
		(91-95)°F	10	12	709 (476, 924)	469 (282, 657)	143 (58, 232)	259 (179, 342)	352 (266, 434)	118 (78, 157)
		(96-100)°F	7	9	588 (438, 733)	362 (230, 488)	119 (65, 172)	163 (112, 214)	326 (266, 381)	113 (82, 142)
		(101-105)°F	4	6	381 (292, 471)	211 (130, 292)	80 (48, 110)	71 (38, 104)	254 (215, 291)	91 (67, 112)
		(106-110)°F	3	4	247 (183, 310)	117 (60, 172)	55 (31, 77)	25 (-2, 51)	214 (185, 242)	77 (58, 94)
	Indiana	(71-75)°F	12	12	-39 (-46, -31)	-32 (-38, -25)	-19 (-24, -15)	-14 (-18, -10)	-22 (-25, -18)	-5 (-7, -3)
		(76-80)°F	19	18	120 (97, 145)	95 (74, 115)	54 (42, 66)	44 (33, 54)	50 (37, 62)	13 (8, 18)
		(81-85)°F	15	15	288 (234, 342)	221 (176, 266)	131 (102, 160)	104 (79, 127)	117 (89, 144)	33 (20, 45)
		(86-90)°F	14	14	422 (346, 501)	310 (244, 376)	180 (139, 222)	149 (113, 183)	181 (140, 220)	55 (36, 73)
		(91-95)°F	11	12	377 (309, 445)	251 (193, 311)	139 (105, 172)	125 (96, 153)	189 (153, 223)	63 (45, 80)
		(96-100)°F	8	8	256 (208, 305)	141 (99, 185)	67 (45, 88)	74 (56, 93)	159 (133, 182)	59 (47, 72)
		(101-105)°F	4	4	129 (102, 158)	51 (25, 77)	21 (9, 32)	32 (20, 43)	110 (95, 125)	46 (36, 55)
		(106-110)°F	2	3	68 (51, 84)	21 (5, 36)	16 (9, 23)	16 (9, 23)	78 (68, 87)	32 (25, 38)
	Kentucky	(71-75)°F	10	10	-40 (-48, -31)	-27 (-35, -19)	2 (-13, 16)	-28 (-32, -23)	-21 (-25, -17)	-9 (-11, -8)
		(76-80)°F	16	17	10 (5, 16)	8 (3, 12)	17 (-2, 33)	4 (2, 6)	6 (4, 9)	3 (2, 4)
		(81-85)°F	15	15	98 (68, 126)	70 (47, 93)	28 (11, 44)	41 (30, 53)	58 (45, 72)	27 (21, 34)
		(86-90)°F	16	17	172 (114, 227)	119 (74, 165)	31 (4, 58)	60 (39, 82)	116 (88, 142)	55 (41, 67)
		(91-95)°F	15	15	165 (94, 235)	96 (38, 154)	9 (-24, 42)	46 (19, 74)	145 (110, 177)	72 (55, 89)
		(96-100)°F	10	9	85 (30, 137)	27 (-19, 72)	-15 (-39, 7)	13 (-7, 32)	114 (89, 138)	59 (45, 72)
		(101-105)°F	5	5	37 (8, 66)	-6 (-30, 19)	-19 (-31, -8)	-4 (-14, 6)	83 (70, 97)	43 (34, 51)
		(106-110)°F	3	3	31 (11, 50)	1 (-17, 19)	-8 (-16, 0)	-2 (-10, 6)	61 (50, 71)	27 (19, 33)
	Missouri	(71-75)°F	7	7	-49 (-61, -37)	-25 (-35, -14)	-9 (-16, -2)	-7 (-14, -1)	-17 (-23, -11)	-7 (-9, -4)
		(76-80)°F	13	13	-23 (-28, -18)	-13 (-18, -10)	-5 (-7, -2)	-4 (-7, -2)	-8 (-10, -6)	-3 (-4, -2)
		(81-85)°F	14	14	104 (81, 125)	74 (54, 92)	23 (12, 34)	27 (17, 36)	35 (24, 45)	12 (8, 17)
		(86-90)°F	15	15	284 (222, 344)	214 (163, 262)	66 (35, 94)	79 (53, 102)	96 (66, 124)	32 (18, 45)
		(91-95)°F	13	13	415 (331, 494)	315 (247, 378)	90 (49, 127)	122 (88, 153)	160 (119, 197)	54 (35, 73)
		(96-100)°F	11	11	461 (374, 540)	339 (269, 406)	86 (46, 122)	143 (109, 173)	221 (180, 258)	79 (59, 98)
		(101-105)°F	9	9	404 (337, 468)	279 (222, 336)	55 (27, 79)	130 (106, 153)	248 (216, 279)	93 (78, 108)
		(106-110)°F	7	6	335 (280, 387)	217 (167, 264)	27 (8, 45)	111 (91, 129)	264 (235, 291)	108 (91, 123)
	West Virginia	(71-75)°F	16	16	-1 (-8, 6)	-2 (-8, 5)	-2 (-10, 6)	2 (-1, 5)	-1 (-4, 3)	-1 (-3, 0)
		(76-80)°F	21	22	90 (66, 112)	64 (43, 83)	21 (5, 38)	49 (39, 59)	34 (22, 44)	37 (32, 42)
		(81-85)°F	16	16	104 (72, 135)	70 (43, 96)	20 (3, 37)	60 (46, 73)	55 (39, 70)	59 (52, 66)
		(86-90)°F	15	15	74 (33, 114)	40 (4, 73)	11 (-11, 31)	45 (28, 61)	72 (52, 93)	72 (62, 83)
		(91-95)°F	10	9	8 (-22, 40)	-11 (-38, 17)	1 (-14, 15)	5 (-7, 18)	56 (41, 72)	50 (42, 58)
		(96-100)°F	4	4	-20 (-36, -3)	-27 (-41, -12)	-1 (-8, 7)	-13 (-20, -7)	32 (23, 40)	24 (19, 30)
		(101-105)°F	2	1	-4 (-11, 4)	-8 (-15, -2)	5 (2, 9)	-5 (-9, -2)	17 (13, 21)	9 (6, 12)
		(106-110)°F	1	0	7 (4, 10)	4 (2, 7)	6 (4, 7)	2 (1, 4)	7 (5, 9)	3 (1, 4)
East North Central	Iowa	(71-75)°F	11	11	-12 (-16, -9)	-10 (-13, -8)	-1 (-3, 1)	1 (-0, 3)	-5 (-7, -3)	-3 (-4, -2)
		(76-80)°F	15	16	42 (35, 49)	30 (24, 36)	6 (2, 9)	6 (3, 9)	13 (9, 17)	10 (8, 11)
		(81-85)°F	16	16	130 (108, 152)	89 (70, 107)	21 (9, 32)	27 (17, 36)	40 (28, 51)	30 (26, 35)
		(86-90)°F	14	14	183 (148, 215)	120 (92, 146)	30 (13, 47)	44 (31, 58)	58 (40, 76)	43 (36, 49)
		(91-95)°F	10	10	138 (109, 165)	86 (63, 109)	22 (8, 35)	38 (27, 49)	54 (39, 69)	40 (34, 46)
		(96-100)°F	8	7	90 (66, 113)	51 (30, 71)	13 (2, 23)	28 (19, 37)	49 (35, 62)	34 (28, 39)
		(101-105)°F	5	5	39 (22, 55)	15 (0, 29)	2 (-5, 8)	15 (9, 22)	39 (29, 48)	23 (19, 27)
		(106-110)°F	3	3	15 (4, 26)	2 (-8, 11)	-5 (-9, -0)	5 (0, 9)	29 (22, 35)	16 (13, 19)
Northeast	Maryland	(71-75)°F	12	13	18 (-60, 97)	44 (-86, 170)	52 (-23, 129)	-20 (-35, -6)	-47 (-63, -33)	-27 (-33, -21)
		(76-80)°F	17	18	46 (-21, 110)	47 (-86, 177)	56 (-17, 133)	34 (12, 56)	87 (57, 119)	56 (44, 67)
		(81-85)°F	17	17	179 (38, 320)	118 (-15, 243)	46 (-28, 115)	109 (30, 186)	302 (190, 410)	193 (144, 237)
		(86-90)°F	16	15	317 (78, 543)	193 (19, 362)	63 (-42, 155)	132 (16, 240)	487 (327, 647)	295 (222, 358)
		(91-95)°F	13	12	366 (115, 610)	208 (28, 386)	100 (-7, 195)	85 (-26, 193)	602 (442, 768)	349 (272, 414)
		(96-100)°F	7	6	231 (97, 365)	125 (18, 228)	85 (30, 135)	7 (-48, 63)	426 (342, 514)	229 (187, 269)
		(101-105)°F	3	3	142 (75, 209)	85 (30, 138)	48 (22, 73)	7 (-22, 36)	274 (226, 321)	147 (121, 172)
		(106-110)°F	1	1	68 (42, 93)	49 (28, 69)	15 (4, 25)	17 (5, 28)	119 (98, 138)	61 (50, 71)
	New York	(71-75)°F	19	22	314 (225, 407)	232 (157, 309)	120 (39, 199)	119 (85, 150)	191 (150, 231)	42 (26, 58)
		(76-80)°F	20	20	820 (601, 1036)	593 (415, 785)	284 (186, 382)	338 (258, 418)	537 (442, 632)	135 (94, 175)
		(81-85)°F	14	11	990 (715, 1277)	669 (435, 906)	338 (249, 426)	412 (306, 518)	690 (580, 800)	196 (147, 242)

		(86-90)°F	11	8	1140 (855, 1425)	708 (470, 940)	416 (344, 485)	440 (336, 549)	840 (731, 944)	260 (211, 308)
		(91-95)°F	7	5	943 (758, 1131)	547 (393, 705)	374 (336, 411)	329 (264, 396)	718 (649, 783)	233 (200, 265)
		(96-100)°F	3	2	634 (528, 738)	351 (260, 443)	257 (234, 279)	208 (174, 245)	518 (480, 556)	179 (156, 201)
		(101-105)°F	1	1	269 (231, 305)	148 (117, 181)	101 (91, 110)	83 (70, 97)	241 (225, 256)	87 (77, 97)
		(106-110)°F	0	0	132 (110, 154)	73 (55, 91)	39 (32, 46)	40 (30, 50)	129 (120, 140)	49 (42, 56)
	Rhode Island	(71-75)°F	20	21	23 (-7, 53)	17 (-9, 42)	12 (-3, 29)	11 (-2, 23)	21 (8, 34)	16 (9, 23)
		(76-80)°F	22	22	67 (-12, 146)	49 (-19, 116)	29 (-14, 72)	30 (-5, 64)	59 (25, 93)	45 (26, 65)
		(81-85)°F	11	10	72 (13, 131)	54 (2, 104)	26 (-7, 57)	29 (2, 55)	57 (30, 82)	42 (25, 58)
		(86-90)°F	9	9	99 (42, 156)	76 (25, 125)	32 (2, 61)	37 (12, 62)	69 (43, 93)	46 (30, 61)
		(91-95)°F	6	5	94 (57, 132)	73 (40, 106)	28 (9, 46)	33 (16, 49)	58 (42, 74)	33 (22, 43)
		(96-100)°F	2	2	55 (37, 73)	43 (27, 59)	15 (6, 24)	19 (11, 27)	32 (24, 40)	19 (13, 24)
		(101-105)°F	1	1	21 (15, 27)	16 (10, 21)	5 (2, 8)	8 (4, 10)	12 (9, 14)	8 (6, 10)
		(106-110)°F	0	0	10 (6, 14)	8 (4, 11)	2 (-1, 4)	3 (1, 5)	6 (4, 8)	3 (2, 4)
Northwest	Oregon	(71-75)°F	19	15	87 (41, 131)	77 (38, 114)	20 (5, 36)	59 (39, 77)	25 (1, 47)	41 (30, 51)
		(76-80)°F	18	16	142 (65, 215)	127 (63, 186)	11 (-5, 28)	97 (67, 126)	48 (8, 84)	71 (52, 88)
		(81-85)°F	14	14	276 (208, 339)	220 (164, 271)	48 (30, 65)	120 (95, 142)	117 (83, 146)	77 (61, 91)
		(86-90)°F	6	7	214 (182, 244)	161 (135, 186)	51 (40, 62)	76 (65, 86)	102 (86, 118)	46 (38, 53)
		(91-95)°F	2	3	116 (103, 128)	84 (73, 95)	33 (28, 37)	41 (36, 46)	60 (53, 67)	25 (21, 28)
		(96-100)°F	1	1	42 (37, 46)	29 (25, 33)	13 (11, 15)	16 (14, 18)	24 (20, 26)	9 (7, 11)
		(101-105)°F	0	0	16 (13, 19)	10 (7, 13)	6 (5, 8)	9 (7, 10)	11 (9, 13)	6 (4, 7)
		(106-110)°F	0	0	3 (2, 5)	2 (1, 3)	2 (1, 2)	2 (2, 3)	3 (2, 4)	2 (1, 2)
South	Kansas	(71-75)°F	7	7	-34 (-49, -19)	-28 (-34, -21)	1 (-3, 5)	-4 (-9, 0)	-10 (-19, -1)	-8 (-10, -6)
		(76-80)°F	11	11	-14 (-33, 5)	-11 (-14, -8)	-0 (-2, 2)	-2 (-4, -0)	-1 (-14, 11)	-3 (-4, -2)
		(81-85)°F	14	14	13 (-8, 34)	11 (5, 18)	2 (-2, 6)	3 (-0, 7)	13 (-1, 27)	4 (3, 6)
		(86-90)°F	14	15	27 (3, 52)	22 (3, 40)	8 (-3, 19)	9 (-0, 19)	24 (10, 38)	11 (5, 16)
		(91-95)°F	14	14	33 (4, 62)	24 (-8, 56)	18 (-1, 36)	14 (-2, 31)	35 (19, 51)	16 (6, 25)
		(96-100)°F	13	13	55 (22, 88)	38 (2, 73)	27 (8, 46)	16 (-2, 34)	62 (44, 80)	22 (10, 33)
		(101-105)°F	10	11	85 (55, 115)	57 (25, 87)	33 (19, 48)	15 (0, 29)	94 (77, 111)	27 (16, 37)
		(106-110)°F	8	7	99 (70, 127)	68 (42, 93)	32 (21, 42)	19 (7, 30)	107 (89, 124)	36 (26, 46)
Southeast	Florida	(71-75)°F	0	1	-10 (-22, 1)	1 (-10, 13)	7 (-2, 16)	-4 (-13, 4)	-16 (-21, -11)	-8 (-11, -5)
		(76-80)°F	2	2	-64 (-98, -31)	-15 (-50, 21)	8 (-17, 32)	-23 (-47, -1)	-70 (-87, -55)	-32 (-39, -25)
		(81-85)°F	4	4	-161 (-210, -114)	-74 (-119, -32)	-23 (-50, 3)	-52 (-80, -23)	-128 (-151, -107)	-53 (-60, -46)
		(86-90)°F	11	12	-242 (-304, -181)	-125 (-181, -71)	-64 (-93, -35)	-75 (-104, -44)	-166 (-196, -138)	-71 (-82, -61)
		(91-95)°F	27	25	240 (144, 333)	141 (70, 215)	97 (49, 145)	80 (44, 118)	154 (104, 200)	62 (41, 83)
		(96-100)°F	33	31	1784 (1370, 2175)	1090 (752, 1413)	588 (402, 764)	556 (402, 709)	1012 (818, 1196)	407 (323, 492)
		(101-105)°F	19	19	2004 (1706, 2286)	1352 (1088, 1596)	417 (313, 512)	686 (589, 774)	1107 (971, 1235)	477 (406, 547)
		(106-110)°F	4	5	563 (496, 626)	407 (349, 459)	100 (79, 121)	219 (195, 240)	278 (241, 315)	128 (103, 150)
	Georgia	(71-75)°F	3	3	-27 (-41, -13)	-10 (-27, 5)	3 (-4, 10)	-9 (-16, -2)	-19 (-25, -13)	-17 (-20, -15)
		(76-80)°F	8	7	-49 (-72, -27)	-18 (-51, 12)	-5 (-14, 3)	-19 (-28, -11)	-41 (-51, -32)	-25 (-29, -22)
		(81-85)°F	12	11	-21 (-43, 1)	-4 (-38, 31)	-2 (-7, 2)	-8 (-12, -4)	-20 (-24, -15)	-10 (-11, -8)
		(86-90)°F	20	18	98 (56, 140)	54 (24, 84)	38 (19, 56)	48 (32, 65)	96 (72, 120)	34 (22, 46)
		(91-95)°F	22	22	345 (255, 431)	182 (131, 229)	119 (77, 159)	151 (114, 188)	320 (263, 374)	116 (88, 145)
		(96-100)°F	18	20	587 (492, 676)	336 (266, 399)	167 (129, 203)	213 (176, 248)	488 (429, 542)	227 (196, 257)
		(101-105)°F	10	12	554 (498, 608)	343 (293, 389)	127 (108, 146)	170 (149, 189)	408 (372, 440)	222 (200, 241)
		(106-110)°F	3	4	235 (214, 255)	151 (134, 168)	47 (38, 55)	71 (62, 80)	175 (159, 189)	96 (84, 106)
	North Carolina	(71-75)°F	8	10	-8 (-29, 13)	13 (-7, 34)	2 (-18, 20)	-13 (-22, -4)	-39 (-47, -31)	-26 (-29, -23)
		(76-80)°F	12	14	8 (-24, 40)	20 (-10, 49)	17 (-11, 45)	-6 (-15, 2)	-19 (-30, -9)	-14 (-19, -10)
		(81-85)°F	14	14	65 (27, 104)	40 (5, 73)	30 (-2, 60)	19 (10, 27)	53 (40, 67)	31 (24, 37)
		(86-90)°F	18	17	186 (125, 242)	92 (45, 141)	35 (7, 63)	65 (44, 88)	177 (147, 207)	101 (86, 114)
		(91-95)°F	19	17	331 (233, 422)	164 (90, 238)	23 (-2, 47)	113 (74, 152)	333 (278, 386)	184 (157, 209)
		(96-100)°F	14	12	341 (259, 420)	176 (112, 241)	7 (-11, 25)	102 (69, 132)	391 (345, 434)	211 (186, 233)
		(101-105)°F	7	6	238 (197, 280)	132 (97, 168)	8 (-3, 20)	61 (46, 76)	290 (265, 312)	159 (143, 174)
		(106-110)°F	2	2	128 (109, 146)	77 (61, 93)	18 (10, 25)	34 (26, 42)	139 (124, 152)	83 (72, 93)
	Virginia	(71-75)°F	11	12	-4 (-20, 13)	8 (-7, 23)	57 (35, 79)	-7 (-15, 1)	-30 (-35, -25)	-10 (-11, -8)
		(76-80)°F	16	17	24 (1, 46)	19 (-1, 39)	74 (45, 102)	4 (-6, 14)	22 (15, 28)	7 (5, 10)
		(81-85)°F	16	16	78 (44, 109)	45 (17, 71)	43 (25, 59)	16 (3, 28)	101 (83, 117)	38 (31, 45)
		(86-90)°F	17	17	159 (96, 218)	89 (39, 137)	23 (15, 30)	31 (9, 52)	206 (169, 238)	78 (62, 92)
		(91-95)°F	14	13	185 (118, 248)	93 (39, 144)	24 (20, 28)	45 (23, 65)	244 (205, 278)	95 (78, 111)
		(96-100)°F	10	9	169 (117, 219)	72 (28, 113)	45 (37, 52)	54 (38, 69)	232 (202, 258)	94 (80, 107)
		(101-105)°F	5	4	135 (107, 161)	66 (42, 88)	54 (46, 61)	48 (40, 57)	158 (141, 172)	67 (58, 76)
		(106-110)°F	2	1	98 (89, 108)	72 (63, 80)	34 (31, 37)	28 (24, 32)	71 (64, 78)	34 (29, 38)
Southwest	Arizona	(71-75)°F	1	4	-33 (-43, -24)	-26 (-34, -18)	-2 (-7, 4)	-12 (-18, -7)	-19 (-24, -14)	-6 (-10, -4)
		(76-80)°F	5	11	-103 (-158, -49)	-87 (-133, -41)	4 (-27, 34)	-38 (-69, -8)	-60 (-87, -34)	-21 (-36, -7)
		(81-85)°F	9	21	-77 (-129, -24)	-71 (-114, -30)	3 (-23, 31)	-31 (-57, -6)	-37 (-64, -12)	-13 (-25, -2)

		(86-90)°F	14	19	-17 (-81, 45)	-29 (-79, 22)	10 (-19, 40)	-18 (-48, 9)	-9 (-41, 22)	-5 (-18, 9)
		(91-95)°F	19	16	222 (133, 313)	118 (45, 192)	59 (19, 100)	51 (17, 83)	132 (85, 178)	44 (22, 64)
		(96-100)°F	18	12	491 (306, 673)	242 (88, 388)	150 (75, 223)	125 (57, 192)	328 (232, 423)	114 (69, 155)
		(101-105)°F	20	9	756 (354, 1158)	325 (6, 641)	278 (115, 435)	202 (42, 356)	576 (370, 782)	217 (120, 307)
		(106-110)°F	11	4	470 (201, 735)	134 (-92, 365)	169 (75, 265)	91 (-7, 187)	471 (327, 608)	209 (132, 283)
	Colorado	(71-75)°F	12	14	-2 (-10, 6)	-1 (-8, 5)	-0 (-4, 4)	-1 (-4, 2)	-4 (-9, 1)	-3 (-5, -1)
		(76-80)°F	22	21	178 (133, 224)	102 (65, 138)	40 (17, 63)	46 (29, 63)	105 (79, 131)	54 (43, 65)
		(81-85)°F	26	19	416 (322, 512)	234 (159, 313)	92 (49, 137)	121 (86, 155)	265 (212, 321)	140 (114, 167)
		(86-90)°F	17	11	355 (276, 433)	184 (121, 247)	74 (40, 104)	122 (92, 150)	283 (234, 329)	137 (111, 162)
		(91-95)°F	5	5	149 (117, 180)	78 (51, 105)	35 (21, 48)	55 (42, 68)	123 (101, 142)	51 (39, 63)
		(96-100)°F	0	1	26 (21, 32)	15 (10, 20)	8 (5, 11)	10 (7, 13)	18 (13, 22)	6 (4, 9)
		(101-105)°F	0	0	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)
		(106-110)°F	0	0	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)
	Utah	(71-75)°F	10	11	1 (-1, 3)	1 (-1, 2)	9 (-5, 25)	1 (0, 2)	1 (-0, 2)	0 (-0, 1)
		(76-80)°F	20	24	66 (32, 97)	41 (15, 65)	10 (-4, 24)	31 (18, 42)	37 (20, 53)	13 (5, 21)
		(81-85)°F	27	26	153 (61, 237)	92 (19, 160)	5 (0, 10)	78 (42, 111)	97 (49, 141)	36 (12, 57)
		(86-90)°F	18	13	137 (59, 210)	71 (7, 129)	20 (-1, 39)	65 (34, 94)	101 (60, 138)	41 (18, 60)
		(91-95)°F	5	4	43 (17, 67)	23 (2, 44)	7 (1, 14)	16 (6, 25)	32 (19, 45)	14 (8, 20)
		(96-100)°F	1	1	8 (-1, 17)	4 (-4, 12)	1 (-1, 4)	4 (0, 7)	6 (2, 10)	2 (-0, 4)
		(101-105)°F	0	0	2 (-1, 4)	1 (-1, 3)	0 (0, 0)	0 (-1, 1)	1 (-0, 2)	0 (-0, 1)
		(106-110)°F	0	0	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)
West	California	(71-75)°F	14	11	-104 (-255, 47)	-87 (-216, 47)	-31 (-96, 36)	-95 (-158, -27)	-35 (-103, 31)	-12 (-41, 17)
		(76-80)°F	24	15	1247 (672, 1842)	881 (406, 1368)	189 (-53, 425)	500 (245, 737)	1075 (836, 1312)	390 (280, 500)
		(81-85)°F	21	17	2037 (1281, 2765)	1382 (739, 1990)	443 (161, 699)	910 (610, 1182)	1811 (1524, 2088)	728 (594, 859)
		(86-90)°F	11	14	1279 (1061, 1510)	874 (686, 1056)	305 (229, 380)	565 (478, 646)	1118 (1020, 1215)	471 (423, 521)
		(91-95)°F	8	12	977 (764, 1201)	685 (499, 862)	185 (106, 263)	405 (315, 496)	825 (728, 919)	321 (278, 363)
		(96-100)°F	6	8	842 (668, 1006)	571 (426, 709)	178 (131, 227)	364 (301, 430)	690 (614, 764)	280 (245, 313)
		(101-105)°F	3	4	542 (459, 624)	350 (280, 422)	153 (135, 172)	244 (215, 272)	432 (391, 471)	181 (162, 199)
		(106-110)°F	1	1	260 (232, 289)	165 (140, 191)	78 (70, 86)	113 (102, 123)	203 (187, 219)	83 (74, 91)
	Nevada	(71-75)°F	4	9	-17 (-30, -4)	-13 (-25, -2)	0 (-7, 8)	-6 (-13, 1)	-11 (-17, -4)	-2 (-5, 1)
		(76-80)°F	11	22	-8 (-50, 35)	-10 (-46, 28)	4 (-18, 25)	-4 (-23, 13)	3 (-21, 27)	6 (-4, 16)
		(81-85)°F	16	24	28 (-27, 81)	8 (-37, 53)	12 (-13, 37)	4 (-17, 24)	34 (2, 66)	15 (3, 28)
		(86-90)°F	17	13	61 (35, 88)	29 (6, 51)	10 (-2, 23)	16 (6, 27)	57 (41, 72)	16 (9, 23)
		(91-95)°F	18	7	106 (-23, 240)	54 (-55, 168)	9 (-55, 73)	38 (-17, 94)	96 (32, 159)	21 (-13, 53)
		(96-100)°F	19	4	229 (16, 448)	99 (-86, 283)	36 (-58, 127)	66 (-24, 153)	206 (103, 304)	51 (-2, 101)
		(101-105)°F	7	1	147 (51, 241)	59 (-26, 143)	28 (-10, 65)	34 (-5, 71)	129 (83, 175)	37 (8, 62)
		(106-110)°F	1	0	18 (-5, 41)	10 (-10, 29)	-1 (-12, 10)	5 (-5, 16)	16 (2, 28)	4 (-5, 11)
West North Central	Nebraska	(71-75)°F	8	8	-39 (-46, -33)	-31 (-36, -26)	-20 (-23, -17)	-9 (-12, -6)	-11 (-14, -8)	-6 (-8, -5)
		(76-80)°F	12	13	3 (2, 4)	3 (2, 4)	2 (1, 2)	1 (0, 1)	0 (-1, 1)	0 (0, 0)
		(81-85)°F	18	18	73 (58, 90)	60 (47, 73)	36 (28, 44)	17 (10, 24)	7 (-1, 15)	10 (6, 14)
		(86-90)°F	15	15	113 (83, 144)	93 (69, 117)	51 (37, 66)	25 (12, 37)	4 (-11, 19)	15 (7, 22)
		(91-95)°F	12	13	128 (93, 161)	102 (74, 129)	52 (36, 68)	26 (12, 39)	11 (-7, 27)	15 (7, 24)
		(96-100)°F	10	9	119 (87, 151)	92 (65, 117)	42 (28, 55)	21 (8, 33)	21 (5, 35)	13 (5, 20)
		(101-105)°F	7	7	96 (70, 120)	70 (49, 90)	27 (17, 37)	14 (4, 23)	30 (17, 41)	9 (3, 16)
		(106-110)°F	5	4	64 (44, 84)	44 (26, 60)	25 (16, 33)	9 (0, 16)	25 (14, 36)	11 (3, 17)
	South Dakota	(71-75)°F	11	11	10 (-5, 25)	1 (-10, 11)	14 (5, 22)	4 (-3, 11)	0 (-0, 1)	2 (-2, 5)
		(76-80)°F	15	15	8 (-5, 21)	1 (-9, 11)	13 (4, 21)	5 (-2, 11)	4 (-1, 8)	1 (-2, 4)
		(81-85)°F	17	17	4 (-3, 11)	2 (-7, 11)	6 (1, 11)	2 (-1, 6)	9 (-1, 19)	1 (-1, 2)
		(86-90)°F	14	14	4 (-1, 8)	4 (-7, 14)	3 (1, 5)	2 (0, 5)	11 (-2, 22)	2 (0, 4)
		(91-95)°F	10	10	10 (1, 17)	7 (-3, 16)	8 (3, 12)	6 (2, 10)	6 (-4, 15)	4 (1, 7)
		(96-100)°F	6	6	12 (4, 20)	8 (-1, 15)	10 (6, 15)	7 (3, 12)	5 (-4, 12)	4 (2, 7)
		(101-105)°F	3	4	11 (4, 18)	6 (-0, 12)	9 (5, 13)	6 (2, 10)	3 (-2, 7)	3 (1, 5)
		(106-110)°F	2	2	10 (4, 15)	4 (-1, 9)	7 (4, 10)	4 (2, 7)	4 (0, 8)	3 (1, 4)