May 2021

Investigating the Potential of a Combined Air Quality-heat Index in Predicting Mortality

Shayna Fever
University of Wisconsin-Milwaukee

INVESTIGATING THE POTENTIAL OF A COMBINED AIR QUALITY-HEAT INDEX IN PREDICTING MORTALITY

by

Shayna Fever

A Thesis Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Master of Science

in Atmospheric Science

at

The University of Wisconsin-Milwaukee

May 2021

ABSTRACT

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Shayna Fever

The University of Wisconsin-Milwaukee, 2021
Under the Supervision of Professor Jon Kahl

Although the development of the Air Quality Index (AQI) has been significant in informing and protecting the public, it may not be entirely reflective of the health effects from exposure to air pollutants. Meteorological factors that are considered in the heat index (HI), temperature and relative humidity, are not considered when calculating the AQI. It may be important to consider certain meteorological factors when assessing the quality of the air because such factors affect the dynamics of air movement as well as the formation of certain pollutants.

Through a series of Quasi-Poisson regression models, we investigated whether the relationship between the AQI and mortality could be strengthened by considering elements of the HI. We found that models that included some form of temperature and relative humidity as explanatory variables exhibited stronger associations to mortality than models that only considered the AQI. These results further support our hypothesis that including elements of the HI when assessing the quality of the air may improve the AQI's skill in predicting mortality. Our analyses revealed that a combined air quality-heat index may have merit; by including the meteorological elements of the heat index in assessing air quality, the relationship between air quality and mortality was strengthened in some cases.

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LIST OF ABBREVIATIONS

WHO	World Health Organization
EPA	Environmental Protection Agency
AQI	Air Quality Index
SO2	Sulfur Dioxide
NO2	Nitrogen Dioxide
CO	Carbon Monoxide
O3	Ozone
PM2.5	Particulate Matter 2.5
PM10	Particulate Matter 10
NAAQS	National Ambient Air Quality Standards
HI	Heat Index
NWS	National Weather Service

RMSE	Root-Mean-Square Error
RR	Relative Risk

ACKNOWLEDGEMENTS

Thank you to Dr. Rosa Cerón-Bretón for kindly providing the dataset used in the present study. I also want to thank my advisor and professors in the program for their guidance and encouragement. I am also appreciative of the support provided to me by my family and friends in my time at UW-Milwaukee.

1. Introduction

Air pollution is a global environmental issue that poses a major threat to public health. Worldwide, approximately 7 million people each year die from exposure to air pollution (WHO, 2018). Many countries monitor the quality of the ambient air using networks that measure air pollutant concentrations.

1.1 Air Quality Index

In order to communicate the quality of the air to the public, in 1976, the United States Environmental Protection Agency (EPA) developed the Air Quality Index (AQI). The AQI was also constructed with the intention to draw attention to the issue of air pollution and to push public officials to take action to control sources of pollution and enhance air quality (U.S. EPA, 2018).

The AQI is based on five criteria air pollutants that are regulated under the Clean Air Act, which was passed to manage air pollution on a national level. These criteria pollutants are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and particulate matter ($PM_{2.5}$ and PM_{10}). The AQI has six categories and each category corresponds to a different level of health concern. High pollutant concentrations, and therefore high AQI values, suggest that exposure to the ambient air may be unhealthy, particularly for sensitive groups. Sensitive groups include those with heart and lung diseases, older adults, and children. Figure 1 shows how the AQI is presented to the public. The AQI is presented in a color-coded chart to simplify the interpretation of the index values in order to help the public understand whether air pollution is reaching unhealthy levels in their community.

Air pollutant concentrations are converted to AQI values using an equation that was derived based on the National Ambient Air Quality Standards (NAAQS) as well as the results of epidemiological studies of air pollutant effects on human health. Time-averaged pollutant concentrations are used in calculating an individual criteria pollutant's AQI value. The highest AQI value among the individual pollutants is deemed the general AQI value for that day (U.S. EPA, 2018).

1.2 Heat Index

Exposure to extreme heat also poses a threat to public health. Exposure to extreme heat can result in heat-related illness, heat-related death, and exacerbate preexisting chronic conditions (Basu and Samet 2002; Kovats et al. 2004; Abrignani et al. 2009; Knowlton et al. 2009). The human-perceived sense of heat is not only dependent on temperature, but on relative humidity as well. In 1979, the heat index (HI) was developed by combining air temperature and relative humidity to posit a human-perceived equivalent temperature (Steadman 1979). The National Weather Service has implemented its own algorithm to determine HI values based on temperature and relative humidity measurements (NWS 2011).

A heat index chart is utilized to communicate the potential danger of extreme heat with the public. Figure 2 shows how the HI is presented to the public. Similar to the AQI, the HI chart is presented to the public in a color-coded manner. The different colors of the HI chart correspond to various categories of HI values with each category corresponding to a different level of danger. The HI is a valuable tool in protecting public health because it can be used to inform the public of dangerous heat conditions.

1.3 Previous Work

Numerous studies have addressed the relationships between air quality and public health measures, and between extreme heat and health. Here we summarize a few relevant examples.

The short-term effects of the criteria air pollutants on health in the metropolitan area of Guadalajara, Mexico were investigated (Cerón-Bretón et al. 2018). The air quality was assessed over a time period of four years in Guadalajara. It was found that higher temperatures influenced ozone concentrations to be higher and lower temperatures influenced the concentration of the other criteria pollutants to be higher. The results of this study demonstrate the effects that temperature can have on air pollutant concentrations. This study also found that the associations between criteria pollutant levels and mortality in Guadalajara were of public concern, which suggests that proper air quality reporting is necessary in protecting public health. The Cerón-Bretón et al. study points out the synergy between air pollutant and heat effects on public health, despite the fact that these risks are communicated to the public separately via the AQI and HI.

The short-term effects of air pollution on mortality in Monterrey, Mexico were reported in a similar study (Cerón-Bretón et al. 2020). Results showed that higher mortality rates were associated with higher pollutant concentrations. This particular study also looked into how these effects could be modified by increased temperatures in climate change scenarios. It was found that a considerable increase in temperatures caused the association between pollutant concentrations and mortality to be stronger. In combination with high pollutant concentrations, rather substantially high temperatures can be associated with increased mortality. The conclusions of this study indicate that considering meteorological factors such as temperature can improve the relationship between air quality and mortality.

Another study analyzed the short-term effects of temperature and ozone pollution on mortality in cities across France during a heatwave (Filleul et al. 2006). It was found that in nine

cities, the joint effects of ozone pollution and high temperatures resulted in a significant increase in the risk of death. The study also noted that correlations between ozone concentrations and temperature were high during the heatwave. This exemplifies just one of the effects that temperature can have on pollution concentrations. The results of this study confirmed that ozone levels have a non-negligible impact in terms of public health, especially in urban areas, and that the consideration of temperature is also imperative in drawing relationships between air quality and measures of health, such as mortality.

Temperature modifying effects on the association between particulate matter and mortality were investigated in a study based in Beijing, China (Zhang et al. 2020). Researchers discovered that all three forms of particulate matter considered, black carbon, $PM_{2.5}$, and PM_{10}, were all significantly associated with daily mortality. High temperatures amplified the effects of particulate matter on respiratory and cardiovascular mortality. These results further indicate that meteorological factors such as temperature influence the effects of air pollution on public health. The authors of this study concluded that controlling the emission of ambient particles during warm months could substantially benefit population health.

Another study based in Tehran, Iran investigated the short-term associations between the AQI and daily mortality (Amini et al. 2019). On days in which the AQI value was just greater than 50, which corresponds to an AQI range categorized as “moderately safe” (Figure 1), a relatively large increase in mortality was observed in Tehran. This observation led conductors of this study to allude that the current AQI may not accurately reflect the health effects of air pollution. They concluded that the AQI health concern categories may need to be revised as such mortality rates observed in Tehran during this time period should not be associated with AQI

values that represent only “moderate” air quality. The conclusions of this study indicate that the current AQI system could be improved.

The studies cited above, conducted in diverse parts of the world with different climate conditions, each noted a negative synergistic effect of air pollution and sensible heat on public health. While separate, simplified indices have been developed to communicate the risks of unhealthful levels of air pollution and extreme heat to the public, a combined index containing elements of both has not been investigated.

1.4 Motivation for this Study

Air quality reporting systems and the use of the AQI have been fundamental in informing the public of local air pollution levels (e.g., Dong et al. 2019). Although the development of the current AQI has been significant in informing and protecting the public, it may not be entirely reflective of the health effects of the criteria air pollutants. In calculating the AQI, meteorological factors that are considered in the HI, temperature and relative humidity, are not considered. It may be important to take into account certain meteorological factors when assessing the quality of the air because such factors affect the dynamics of air movement as well as the formation of certain pollutants.

Exposure to the criteria air pollutants primarily affect the human body’s respiratory and cardiovascular system (Wilson et al. 2005; Stieb et al. 2000). Exposure to extreme heat can also result in adverse respiratory and cardiovascular health effects (e.g., Basu and Samet 2002). Nearly half of Americans live in counties where unhealthful levels of air pollution are consistently reached (American Lung Association, 2020). These counties include regions where both temperature and relative humidity contribute to extreme heat. An enhanced understanding

of how the combination of air pollution and meteorological factors such as temperature and relative humidity affect human health could be a step in further protecting public health.

1.5 Project

The objective of this project is to investigate whether the skill of the general and individual pollutant AQIs in predicting mortality could be improved by considering elements of the HI. In doing so, we used air pollution, meteorological, and mortality data from the metropolitan area of Monterrey, an important industrial center in the state of Nuevo León, Mexico.

In addition to our evaluation of how well the general AQI predicts mortality, we also evaluated how well individual pollutant AQIs predict mortality. We also assessed how incorporating elements from the HI affects the predictive skill of the AQI on mortality. Finally, we developed and assessed whether a combined air quality – heat index has the potential to improve the prediction of mortality. Specifically, the following research questions were addressed: How well does the general AQI predict daily mortality in Monterrey? How well do the individual pollutant AQIs predict daily mortality in Monterrey? Does the consideration of the HI improve the prediction of daily mortality? How well does a combined air quality – heat index predict daily mortality in Monterrey?

2. Data

This study requires meteorological, air quality, and public health data over a long enough period of time from a large enough region to generate a sufficient number of cases to determine meaningful statistics. Data collected from 2012 – 2015 in the metropolitan area of Monterrey,

Nuevo León, Mexico (25.67ºN, 100.30ºW) are used in this project to address our research questions.

2.1 Study Area

Monterrey has a warm-semiarid climate and is the capital of the Mexican state of Nuevo León. The metropolitan area of Monterrey is a sprawling business and industrial center that is comprised of eight municipalities. These municipalities are Cadereyta Jiménez, García, General Escobedo, Guadalupe, Monterrey, Salinas Victoria, San Nicolás de los Garza, and Santa Catarina. Figure 3 shows a map of these municipalities and Table 1 presents relevant statistics. The metropolitan area of Monterrey encompasses 5,407 km^2 of land and its population consists of more than 3.1 million residents. The population of the metropolitan area of Monterrey is comparable to that of the city of Los Angeles, California.

2.2 Mortality Data

This project utilizes mortality data with the cause of death categorized according to the International Classification of Diseases (WHO, 2010) as either respiratory-related (from J00 to J99) or cardiovascular-related (from I00 to I99). Epidemiological data on daily mortality were obtained from the Mexican National Health Information System (www.dgis.salud.gob.mx). We considered mortality data of the demographics that are most vulnerable to the adverse effects of air pollution and extreme heat. The vulnerable population sets considered in this project were identified through the review of relevant literature as described later in section 3.4.

2.3 Pollutant, Temperature, and Relative Humidity Data

The dataset used for the present study, kindly provided by Dr. R. Cerón-Bretón, was that assembled and used in the Cerón-Bretón et al. 2020 study. In addition to mortality data, this

dataset consists of hourly measurements of criteria air pollutant concentrations that were obtained from the Mexican National Environmental Information System through air quality monitoring networks throughout the Monterrey metropolitan area. Figure 4 shows a photo of the monitoring station in San Nicolas de los Garza. Hourly temperature and relative humidity measurements were also collected.

Before it was in our possession, quality control measures were applied to this dataset. All pollutant data were subjected to analysis, excluding pollutant data with less than 75% of complete data during the study period. Any missing hourly values were generated using the Markov Chain Monte Carlo multiple imputation method and the Nonlinear estimation by Iterative Partial Least Square approach using XLSTAT.

Our dataset includes hourly measurements of pollution concentrations and hourly temperature and relative humidity measurements for each municipality during the period 2012–2015. Warm season data, from July–October each year, was exclusively considered in this project to avoid annual cyclical trends in pollution concentrations, temperature, relative humidity, and mortality. Also, synergistic interactions of extreme heat and AQI on mortality would be expected to be most evident in the warm season.

3. Methods

3.1 Calculating AQI Values

According to standard procedure (U.S. EPA, 2018), an AQI value is calculated for each of the criteria air pollutants. The maximum AQI value of the individual pollutants each day is deemed to be the general AQI of the day. It is this general AQI value that is reported as a way to inform the public of the healthfulness of local air quality.

In the present study, calculations for the individual pollutant AQIs were based on the technical documentation for reporting and calculating daily air quality (U.S. EPA, 2018). At all 8 measurement sites, daily max time-averaged concentrations of each individual pollutant were converted to an AQI value. The time over which each pollutant is averaged is displayed in Table 2 which shows the NAAQS set by the EPA. The daily maximum 8-hour average concentrations of O_3 and CO were used in calculating their respective daily AQIs. The daily maximum 1-hour average concentrations of SO_2 and NO_2 were used in calculating their respective daily AQIs. 24-hour average concentrations of $PM_{2.5}$ and PM_{10} were used in calculating their respective daily AQIs.

To transform pollutant concentrations into AQI values, 'breakpoints' are used to define the lower and upper bounds of each AQI category. Using Table 3, we used the two breakpoints that contain the daily max time-averaged concentration of each pollutant concentration. Using Equation 1, we calculated I_p, the daily AQI values for each individual pollutant p at each of the eight municipalities.

$$I_p = \frac{I_{High} - I_{Low}}{BP_{High} - BP_{Low}}\left(C_p - BP_{Low}\right) + I_{Low} \qquad (1)$$

Here, C_p is the daily max time-averaged concentration of individual pollutant p, BP_{High} is the concentration breakpoint that is greater than or equal to C_p, BP_{Low} is the concentration breakpoint that is less than or equal to C_p, I_{High} is the AQI value corresponding to BP_{High}, and I_{Low} is the AQI value corresponding to BP_{Low}.

For each individual pollutant, the highest daily AQI value among the municipalities was used as the individual pollutant's daily AQI value for the metropolitan area of Monterrey. The

highest daily AQI value among the individual pollutants was used as the general AQI of metropolitan Monterrey each day. We concluded that this decision was valid through visual inspections of the trends in the criteria pollutant concentrations in the warm months of our time period among all municipalities. These trends, presented in Figures 5 through 10, show that time-averaged measurements of daily individual pollutant concentrations tend to be similar among the municipalities. Any exceptions, such as periods in 2013 with elevated CO levels in Guadalupe and Cadereyta Jiménez, are only a small subset of the overall number of days in our warm month dataset. $PM_{2.5}$ measurements are only available at two of the eight municipalities, and at only one in 2015. We justified the use of the PM2.5 data because, as mentioned, the daily criteria pollutant concentrations tend to be similar among all the municipalities and because the two municipalities with $PM_{2.5}$ data, Guadalupe and Santa Catarina, tend to be among the most polluted municipalities.

Guadalupe and Santa Catarina are among the most polluted municipalities, but overall, the metropolitan area of Monterrey is generally quite polluted. In Figures 5 through 10, there is also a dashed line on each plot that represents the NAAQS associated with each pollutant. These limits on pollutant concentrations are established by the U.S. EPA and as one can observe by these figures, there are numerous exceedances in NO_2, O_3, $PM_{2.5}$, and PM_{10} concentrations in the metropolitan area of Monterrey.

This project considers daily values of the general AQI as well as daily values of particulate matter ($PM_{2.5}$) AQI and ozone (O_3) AQI to assess the skill of the AQI in predicting mortality. $PM_{2.5}$ is one of the main sources of air pollution in the metropolitan area of Monterrey by cause of vehicle exhaust, industrial emissions, dust resuspension, and unregulated combustion processes (Mancilla and Mendoza 2012; Mancilla et al. 2019). Dominant sources of emissions of

ground-level ozone precursor pollutants are primarily located in the industrial regions within the metropolitan area of Monterrey and the surrounding area (Hernández Paniagua et al. 2017). The decision to assess the predictive skill of $PM_{2.5}$ and O_3 AQI in addition to that of the general AQI was made because for most days in the dataset, the daily $PM_{2.5}$ AQI or O_3 AQI value was the highest AQI value among the individual pollutants and therefore the general AQI for most days in the dataset. During the warm months, the daily $PM_{2.5}$ AQI was deemed to be the general AQI for 46% of the days and the daily O_3 AQI was deemed to be the general AQI for 34% of days in the dataset. The frequency of general pollutant AQI health category occurrence is presented in Table 4. The frequency of elevated AQI values leads one to expect that some of the pollution-mortality relationships described in previous studies in section 1.3 may be apparent in Monterrey.

3.2 Calculating Heat Index Values

We calculated daily HI values at each municipality using each day's highest hourly temperature measurement at each municipality and that hour's measured relative humidity. These calculations were performed using the algorithm developed by the National Weather Service (NWS, 2011). Using Equation 2, we calculated HI, the daily heat index values for each of the eight municipalities.

(2)

$$HI = -42.379 + 2.04901523 * T + 10.14333127 * RH - .22475541 * T * RH - .00683783 * T * T - .05481717 * RH * RH + .00122874 * T * T * RH + .00085282 * T * RH * RH - .00000199 * T * T * RH * RH$$

Here, T is the daily highest hourly temperature in Fahrenheit and RH is the hour's relative humidity measurement in percent.

If the relative humidity is less than 13%, then the following adjustment is subtracted from HI:

$$ADJUSTMENT = \frac{(13 - RH)}{4} * \sqrt{\frac{[17 - |T - 95.|}{17}}$$

If the RH is greater than 85%, then the following adjustment is added to HI:

$$ADJUSTMENT = \frac{RH - 85}{10} * \frac{87 - T}{5}$$

Equation 2 and its adjustments are not appropriate when conditions of temperature and humidity warrant a HI value below 80°F. In those cases, a simpler formula was applied to calculate the daily HI at each municipality:

$$HI = 0.5 * \{T + 61.0 + [(T - 68.0) * 1.2] + (RH * 0.094)\}$$

The highest HI value among the eight municipalities each day was used as the daily HI value. We decided that this decision was valid by visually inspecting the trends in HI values over our time period in the warm months among all municipalities. These trends are presented in Figure 11. These HI trends by municipality show that daily HI values tend to be similar among the municipalities with occasional exceptions such as the peaks in Garcia during September and October 2012. The frequency of HI category occurrence is presented in Figure 12. The high frequency of elevated HI values leads one to expect that some of the heat-mortality relationships described in previous studies in section 1.3 may be apparent in Monterrey.

3.3 Developing the NEW Index

A principal focus of our project was to investigate whether a combined air quality – heat index has the potential to improve the prediction of mortality. The first phase of developing this NEW index involved transforming the existing HI to be scaled similarly to the AQI. This was done in order to make direct comparisons between HI values and AQI values. We developed our NEW index by taking the higher value of the transformed HI value and AQI value each day, just as the general AQI is the highest of the individual pollutant AQI values.

According to the NWS, there are four categories of concern that are related to HI value ranges: caution, extreme caution, danger, extreme danger. These are color-coded in the chart in Figure 2. We paired these HI ranges to the same index breakpoints that are used in AQI ranges: moderate, unhealthy for sensitive groups, unhealthy, and very unhealthy. The HI ranges and corresponding breakpoints are presented in Table 5. Equation 3 was used to convert daily HI values to transformed HI values. We called this transformed heat index, heat index A. Equation 3 is a similar equation to that used to convert pollutant concentrations to AQI values.

$$I_{HI\_A} = \frac{I_{High} - I_{Low}}{BP_{High} - BP_{Low}}(V_{HI} - BP_{Low}) + I_{Low} \qquad (3)$$

Here, I_{HI_A} is the calculated daily heat index A value, V_{HI} is the daily HI value for the metropolitan area of Monterrey, BP_{High} is the breakpoint that is greater than or equal to V_{HI}, BP_{Low} is the breakpoint that is less than or equal to V_{HI}, I_{High} is the HI value corresponding to BP_{High}, and I_{Low} is the HI value corresponding to BP_{Low}.

Constructing a transformed HI in this way resulted in a skewed distribution in which an inordinate number of days were classified as dangerous or extremely dangerous. In order to keep the frequency of the categorization of the transformed HI similar to that of the general, $PM_{2.5}$ and

O_3 AQIs in our warm month dataset, we constructed another version of a transformed HI using daily HI values using Equation 4. In calculating this version of a transformed index, we used breakpoints that correspond to the same HI ranges that are shifted down one category from those in heat index A. We called this version of a transformed heat index, heat index B. The HI ranges and corresponding breakpoints are presented in Table 6.

$$I_{HI\_B} = \frac{I_{High} - I_{Low}}{BP_{High} - BP_{Low}}(V_{HI} - BP_{Low}) + I_{Low} \qquad (4)$$

Here, I_{HI_B} is the calculated daily heat index B value. Like in Equation 3, V_{HI} is the daily HI value for the metropolitan area of Monterrey, BP_{High} is the breakpoint that is greater than or equal to V_{HI}, BP_{Low} is the breakpoint that is less than or equal to V_{HI}. In Equation 4, I_{High} is the HI value corresponding to BP_{High}, and I_{Low} is the HI value corresponding to BP_{Low}.

We developed our NEW index by taking the higher value of the transformed HI value and each form of the AQI value each day. Since we created two versions of a transformed HI, there are two versions of the NEW index. Daily NEW A index values are the higher of daily AQI and heat index A values. Daily NEW B index values are the higher of daily AQI and heat index B values.

3.4 Vulnerable Population Sets

In this project, we considered mortality data of the demographics that are most vulnerable to the adverse effects of air pollution and extreme heat. The vulnerable population sets considered in this project were identified through a review of relevant literature. Some illustrative examples are described in this section.

A time series analysis was conducted in a study to investigate the association between outdoor air pollution and mortality in São Paulo, Brazil (Gouveia and Fletcher 2000). An increase in cardiovascular-related deaths was observed in those above 65 years of age. The increase in the mortality rate for respiratory-related deaths was even higher. Another study examined the associations between air pollution levels and hospital admissions for respiratory diseases in Lanzhou, China (Tao et al. 2014). There was a lagged effect on the increases in hospital admissions due to air pollution. The results of this analysis found significant associations between air pollution levels and respiratory-related illness, especially for women above 65 years of age.

A study that assessed the deaths attributed to extreme heat in the United States between 2006 and 2010 found that during extreme heat events, there was a substantial increase in the death rate for citizens above the age of 75 (Berko et al. 2014). This study also found that the death rate for men was 2.5 times that of women. Another study that focused on heat-mortality relationships considered mortality data from Toronto, Ontario between 1980 and 1996 (Smoyer-Tomic and Rainham 2001). Increasing mortality rates for all ages were observed with increasing measures of temperature and relative humidity. The most significant increase in mortality rates was observed for those above the age of 65.

Based on our literature review and our dataset, we identified 8 population sets that are most vulnerable to the adverse effects of air pollution and extreme heat. Each vulnerable population set is characterized by sex, age, and cause of death. Therefore, these vulnerable sets include:

males, aged 60-74, respiratory-related death

males, aged 75+, respiratory-related death

males, aged 60-74, cardiovascular-related death

males, aged 75+, cardiovascular-related death

females, aged 60-74, respiratory-related death

females, aged 75+, respiratory-related death

females, aged 60-74, cardiovascular-related death

females, aged 75+, cardiovascular-related death

Each death of the dataset was associated with a municipality, but we combined mortality data from all eight municipalities in order to ensure that sample sizes were large enough for our analyses. We also considered a population set that combined data from all vulnerable population sets as well as a population set that included males and females of all ages whose deaths were categorized as either cardiovascular- or respiratory-related.

3.5 Quasi-Poisson Regression

To analyze the relationship of daily warm-month mortality with respect to explanatory variables, a Quasi-Poisson regression model was constructed according to methodology used in previous studies (Cerón-Bretón et al. 2020; Amini et al. 2019; Cerón-Bretón et al. 2018, among many others). The explanatory variables in this project are daily general AQI, daily $PM_{2.5}$ AQI, and daily O_3 AQI values, HI values, and NEW A and NEW B index values. All explanatory variables were normalized by their respective standard deviations. The goal of normalization is to change the values of numeric columns in a dataset to a common scale, without distorting differences in the ranges of values.

The presence of overdispersion in the daily warm-month mortality data led us to use a Quasi-Poisson regression model. In a Quasi-Poisson model, the variance is assumed to be the mean multiplied by a dispersion parameter. Therefore, the Quasi-Poisson model is capable of considering overdispersed mortality data. Equation 5 shows the Quasi-Poisson regression equation.

$$\ln(E_y) = \beta_o + \sum_{i=1}^{n} \beta_i X_i \qquad (5)$$

Here, E_y is expected number of daily deaths, β_o is a constant of the model, β_i are the regression coefficients of each explanatory variable, and X_i are the explanatory variables.

Since the manifestation of the effects of atmospheric pollution and extreme heat on daily mortality is not immediate, we also lagged mortality data (Cerón-Bretón et al. 2020; Amini et al. 2019; Cerón-Bretón et al. 2018). Mortality data was lagged 0-7 days, where the number of deaths each day was associated with the AQI, HI, and NEW index values from the day of, 1 day before, 2 days before, and so on. In order to ensure the robustness of our statistical analyses, we generated 1000 synthetic datasets for each regression model using the bootstrapping method. Details of how the synthetic samples are processed are described below in section 3.6.

For each population set and for each form of the AQI used in this project (general AQI, $PM_{2.5}$ AQI, and O_3 AQI), we performed three Quasi-Poisson regressions. In all regression models, the response variable was mortality data lagged from 0-7 days. The sole explanatory variable in Model 1 was daily AQI. This regression was performed to draw conclusions about how well the AQI predicts mortality (recall that AQI-mortality relationships have been reported in numerous studies). Model 2 used daily AQI and HI values as the explanatory variables to

determine how well considering factors from both the AQI and HI result in predicting mortality (again, previous studies have also noted HI-mortality relationships). The regression model, Model 3, used either daily NEW A or NEW B index values as the sole explanatory variable. The Model 3 regressions were performed to investigate possible relationships between our newly developed indices and mortality.

Model characteristics for each model are presented in Table 7. Each model had several variants and was run on all 10 population sets for different lags. The process for Model 1 is described as follows. Model 1 contained three variants which examined the relationship between daily AQI and daily mortality, between $PM_{2.5}$ AQI and mortality, and between O_3 AQI and mortality. Each variant was run at 8 lags ranging from 0 to 7 days. The Model 1 analysis thus encompassed 240 (3 x 8 x 10) separate regression analyses. Models 2, 3, and 4 each similarly involved 240 separate regressions.

After our initial analyses of the relationship between daily warm-month mortality and the indices considered in this project (Models 1-3), we decided to carry out another series of Quasi-Poisson regressions that used raw predictors as the explanatory variables. These raw predictors consisted of the components of the general AQI and HI: daily maximum time-averaged SO_2, NO_2, O_3, CO, $PM_{2.5}$ and PM_{10} pollutant concentrations as well as the daily maximum measurements of temperature and relative humidity that were used in calculating daily HI. The purpose of performing Model 4, another series of 240 Quasi-Poisson regressions, using the raw predictors as the explanatory variables was to identify which components or combination of components of the AQI or HI contribute the most to mortality rates. Characteristics of Model 4 are presented in Table 7 as well.

We ensured that we guarded against overfitting when comparing the performance of the different regression models. Overfitting a model is when the model describes the random error in the data rather than the relationships between variables. Regression models in this project were trained on the first half of the time series and cross-validated using the respective regression models on the complement portion of the time series. Cross-validation is a technique used to determine how the results of statistical analysis generalize to an independent dataset and it is necessary in estimating the accuracy of the performance of a predictive model, such as those developed in this project.

3.6 Comparing the Models

In order to assess how well each regression model predicted daily warm-month mortality, we did so by considering various statistical measures. After running Model 1, Model 2, and Model 3 on the 1000 bootstrapped datasets, we used relevant outputs produced by the models to calculate root-mean-square error (RMSE) values. RMSE is the standard deviation of the prediction errors of the model. Smaller RMSE values indicate better model performance. Equation 6 shows how the RMSE value of each model at each lag day was computed for each population set.

$$RMSE = \sqrt{\sum_{i=1}^{n} \frac{(\hat{y}_i - y_i)^2}{n}} \qquad (6)$$

Here, n is the number of days in the warm-month dataset, $\hat{y}_i$ is the daily warm-month mortality predicted by the model, y_i is the actual daily warm-month mortality.

For each population set, RMSE values were calculated for each model for each lag day. To determine if the RMSE values of the models were statistically different from one another, we also calculated and plotted 95% confidence intervals of the average RMSE values. We did so by finding the 2.5^{th} and 97.5^{th} percentiles of the 1000 RMSE values. If the confidence intervals overlapped, we did not reject the null hypothesis that the predictive skill of models are the same.

We also calculated interquartile relative risk (RR) values and their 95% confidence intervals associated with each model in the same manner as in previous studies (e.g., Goldberg et al. 2020). RR is another value that we used to quantify the strength of the associations between mortality and the respective explanatory variables of the models. RR is defined in Equation 7 as the percent change in the mean number of daily deaths for an increase in the interquartile ranges of the explanatory variables.

$$RR = \frac{E_{y75}}{E_{y25}} \qquad (7)$$

Here, E_{y75} is the expected number of deaths corresponding to the 75^{th} percentile of the distribution of the model's explanatory variable(s). E_{y25} is the expected number of deaths corresponding to the 25^{th} percentile of the distribution of the model's explanatory variable(s). In calculating RR, we determined by how much modeled mortality changes due to an increase from the 25^{th} to the 75^{th} percentile of each explanatory variable value. The RR of each regression was determined as the average of the individual RRs corresponding to each of the 1000 synthetic regressions performed for each model run. The full range of 1000 RRs was used to determine statistical significance and confidence intervals.

In addition to calculating RMSE and RR values in our analysis, we also found the 90% and 95% spreads of each regression coefficient in Model 4 in order to determine the statistical

significance of each explanatory variable. If the spread of a coefficient straddles zero, then that explanatory variable is not statistically significant and the explanatory variable does not have a significant effect on mortality. If the spread of a regression coefficient does not straddle zero, the Quasi-Poisson regression model suggests that the explanatory variable does have a significant effect on mortality. We chose to determine the statistical significance of each explanatory in Model 4 in order to identify which raw measurements used in calculating the AQI and HI have the most influence on daily mortality.

Besides assessing the relationship between mortality and the various explanatory variables in this study using the statistical measures described above, we also did so through visual inspection. We produced scatterplots of the NEW indices versus mortality data lagged 0-7 days in order to visually observe any associations.

4. Results

In this section, we present our results from the statistical analysis of the relationship between air quality, extreme heat, and mortality. Detailed results from all analyses, including the four models, the three versions of the AQI, the 10 population sets, and the eight lags, are located in the appendix section.

4.1 RMSE Values

In assessing how well each model performs in predicting mortality, we found that none of the models considered in this project performed significantly different from one another. For each population set, root-mean-square error (RMSE) values were calculated for each model for each lag day. RMSE is a standard way to measure the error of a model in predicting quantitative data. In our results, the RMSE values ranged from 0.48 to 4.3, with smallest values

corresponding to the population set of females, aged 60-74 whose death was categorized as respiratory-related and largest values corresponding to the population set of both males and females of all ages whose death was categorized as either cardiovascular or respiratory-related.

Figure 13 is a plot of the RMSE values by Models 1-3 for the population set females, aged 60-74 whose death was categorized as respiratory related for lag day 0 and for which the version of the AQI considered was the daily general AQI. This population set was associated with the lowest RMSE values for all models and for each AQI considered. These small RMSE values therefore indicate a better modeled fit to the data. However, the overlap of the 95% RMSE confidence intervals among the models indicate a lack of difference in predictive skill. This was observed among all the models for every regression of all population sets and versions of the AQI that were considered in this study. The full set of RMSE results are included in the Appendix.

4.2 RR Values

Interquartile relative risk (RR) values and 95% RR confidence intervals that were calculated for each population set for each model also reveal that the strength of the relationship between mortality and the respective model explanatory variables are not statistically different from one another for all lag days and AQIs considered.

Although our RR results are not statistically significantly different from one another, we still investigated whether one model offers any advantages over another model. In observational epidemiology, there has been a trend away from the reliance on statistical significance testing in assessing whether a hypothesized phenomenon has occurred. Researchers in the realm of public health argue that statistical significance testing is not always useful in the analysis or

interpretation of scientific research (Savitz 1993; Wasserstein and Lazar 2016). The motivation behind eliminating statistical significance testing is to encourage those who present and evaluate research to more comprehensively consider the methodologic features that may yield their results. Many of the epidemiological studies cited in this thesis presented non-statistically significant RR results. The studies emphasized the strength of the relationships between environmental predictors and public health outcomes as principal research results rather than solely focusing on statistical significance.

To assess the utility of our results without statistical significance, we compared the average RR values computed at each lag day from each model for each population set. We examined average RR results for models utilizing the general, $PM_{2.5}$, and O_3 AQI. For each type of AQI, models 1-4 were applied to the 10 population sets identified in section 3.4. All models were run at lags ranging from 0-7 days. A sample of these results is shown in Table 8, depicting O_3 AQI results at lag 0 for males aged 75+ whose deaths were categorized as respiratory-related. The full set of RR results consists of 30 such tables; these are included in the Appendix.

Referring to Table 8, there was only one lag, lag day 5, for which Model 1, the model in which its sole explanatory variable is daily O_3 AQI, exhibited the highest average RR values of all the models. For all other lag days, it was Model 2, Model 3, or Model 4 (all models with explanatory variables that encompass some form of relative humidity and temperature) that exhibited the strongest associations between their respective explanatory variables and mortality. This observation reveals that a combined air quality-heat index may have merit in describing the association between environmental factors (air quality and sensible heat) and mortality. In Table 8, we see for all lag days besides lag day 6, Model 3A exhibited larger average RR values than Model 3B, indicating that the relationship between the combination of air quality and extreme

heat and mortality is stronger with the NEW A index as compared to the NEW B index for this particular population set.

RR values greater than 1 demonstrate that a direct relationship between AQI and mortality is present. Tables 9 and 10 include a summary of our RR results by lag day as well as by population subset. Referring to the 'Model RR > 1' column in Tables 9 and 10, there are many entries that indicate the AQI-mortality relationship described in previous studies is also evident in Monterrey. Of the 240 individual Model 1 regressions, in only 12.5% of all cases was the average RR value less than 1. When it was the $PM_{2.5}$ AQI considered in Model 1, there were only two cases in which the Model 1 average RR values were less than 1. When it was the general AQI or O_3 AQI considered, there were several more cases in which the Model 1 average RR values were less than 1. This observation indicates that of the versions of the AQI considered in this project, the $PM_{2.5}$ AQI has the strongest association with mortality.

There were only a few cases in which Model 1, where the sole explanatory variable was the daily general AQI, exhibited stronger associations to mortality than the other models that included some form of temperature and relative humidity as explanatory variables. Referring to the 'Model 2 RR > Model 1 RR' and 'Model 3A or 3B RR > Model 1 RR' columns in Tables 9 and 10, we see that Model 2 and Model 3 exhibited stronger associations to mortality than the Model 1 in many cases. Of all the lag days considered for all the population sets considered for all versions of the AQI considered, Model 1 produced the highest average RR values of all the models and was therefore the best performing model for only 8.3% of the 240 individual cases. For all other cases, it was Model 2, Model 3, or Model 4 that modeled the strongest associations between their respective explanatory variables and mortality. These results demonstrate that the

strength of relationship between AQI and mortality increases when some form of temperature and relative humidity is included.

The strength of the associations between our newly developed air quality-heat index and mortality was dependent on which version of the AQI was considered in deriving NEW index values in Model 3. When the general AQI was considered, the association between the NEW index and mortality was stronger for the NEW A index compared to the NEW B index, but only slightly so. The average RR values produced by Model 3A when the NEW A index was the sole explanatory variable were higher than those produced by the model when the NEW B index was the sole explanatory variable for only 51.3% of cases. There were no population sets, however, in which either NEW index exhibited stronger associations to mortality over the other for all lag days.

The NEW A index also showed stronger associations with mortality when the O_3 AQI was considered in deriving NEW index values, but for more cases than when general AQI was used in calculating NEW index values. The average RR values produced by Model 3A when the NEW A index was the sole explanatory variable were higher than those produced by the model when the NEW B index was the sole explanatory variable for 66.3% of cases when the O_3 AQI was considered. There were two population sets in which the NEW A index was a better predictor of mortality than then NEW B index for all lag days. These population sets were: males, aged 60-74 whose deaths were categorized as cardiovascular-related and males and females, all ages, whose deaths were categorized as either cardiovascular- or respiratory-related.

The opposite was found when it was the daily $PM_{2.5}$ AQI considered in deriving NEW index values. Our results indicate that the NEW B index was a better predictor of mortality than the NEW A index when the $PM_{2.5}$ is considered. The average RR values produced by Model 3B

when the NEW B index was the sole explanatory variable were higher than those produced by the model when the NEW A index was the sole explanatory variable for 81.3% of cases. There were five population sets in which the NEW B index was a better predictor of mortality than then NEW A index for all lag days. Regardless of the details of comparative strengths of the NEW A or NEW B versus mortality relationships, our results suggest that including temperature and humidity variables in some fashion increases the strength of the AQI-mortality relationship in nearly all lags and population subgroups examined.

Regardless of the version of the AQI that was considered in deriving the NEW indices, there were no population sets in which average RR values from Model 3 exhibited stronger associations to mortality than the AQI-only Model 1 for all lag days. It was Model 2, which considers two explanatory variables, AQI and HI as separate explanatory variables rather than in a single, combined index, that more consistently produced the highest average RR values and therefore produced the strongest associations with mortality for most individual cases in this project. Referring to the 'Model 2 RR > Model 1 RR' and 'Model 3A or 3B > Model 1 RR' columns in Tables 9 and 10, it can be observed that Model 2 usually exhibited larger RR values than Model 3A or 3B. When the AQI explanatory variable that was considered in Model 2 was either the daily general AQI or the daily $PM_{2.5}$ AQI, the average RR values produced by Model 2 were higher than those produced by Model 1 for all lag days for the same five population sets. This was also true for four of those five population sets when the version of the AQI that was considered in Model 2 was the O_3 AQI. This means that for those population sets, Model 2 exhibited stronger associations between its explanatory variables and mortality than Model 1 at all lag days.

Model 4, which considered raw pollutant concentrations and temperature and relative humidity measurements as the model explanatory variables, generally exhibited stronger associations between these explanatory variables and mortality than those observed by the AQI-only Model 1. Average RR values produced by Model 4 were usually higher than those produced by Model 1, but not as consistently as Model 2. These results are not shown in Tables 9 and 10. In other words, the lag days in which Model 4 was the best performing model was not consistent among the population sets assessed. The strength of the AQI-mortality relationship improves more with Model 2 than with Model 4. This suggests that the AQI-mortality relationship, which is apparent in the metropolitan area of Monterrey, improves more when temperature and relative humidity is considered (Models 2 & 3) than when all pollutants in addition to temperature and relative humidity (Model 4) are considered. This is further evidence that the idea of a combined air quality-heat index has merit for public health applications.

4.3 Visual Inspection of Associations

In addition to assessing the relationship between our newly developed indices and mortality (Models 3A and 3B) using the statistical measures described above, we also did so through visual inspection. We produced scatterplots of the NEW indices versus mortality data lagged 0-7 days in order to visually observe any associations.

Figure 14 shows scatterplots of our NEW A index and NEW B indices versus lag day 0 daily mortality of males, aged 75+ whose deaths were categorized as respiratory-related. Orange points on the plots indicate days in which the O_3 AQI was higher than the transformed HI and was therefore the daily NEW index value. Blue points on the NEW A index plot indicate days in which the Heat Index A value was higher than the O_3 AQI and was therefore the daily NEW A index value. Green points on the NEW B index plot indicate days in which the Heat Index B

value was higher than the O_3 AQI and was therefore the daily NEW B index value. From the trendlines displayed on the scatterplots in Figure 14, we see that the association between the NEW A index and mortality (left panel) is slightly stronger than that between the NEW B index and mortality (right panel). This is consistent with our analysis of the average RR values produced by Model 3 for this population set at lag day 0: the NEW A index exhibits stronger associations to mortality than the NEW B index for most cases when the version of the AQI considered was the O_3 AQI. From Table 8, the Model 3A and Model 3B average RRs of 1.11 and 1.03 on lag day 0 are both larger than the Model 1 RR of 1.01. The increase in Model 3 RRs, particularly for the NEW A model in this case, illustrates the potential utility of communicating a combination of AQI and extreme heat information to the public, particularly to vulnerable citizens at risk of premature death due to these environmental factors.

Scatterplots of our NEW A and NEW B indices versus lag day 6 daily mortality of males, aged 60-74 whose deaths were categorized as cardiovascular-related are shown in Figure 15. Orange points on the plots indicate days in which the $PM_{2.5}$ AQI was higher than the transformed HI and was therefore the daily NEW index value. Blue points on the NEW A index plot indicate days in which the Heat Index A value was higher than the $PM_{2.5}$ AQI and was therefore the daily NEW A index value. Green points on the NEW B index plot indicate days in which the Heat Index B value was higher than the $PM_{2.5}$ AQI and was therefore the daily NEW B index value. From the trendlines displayed on the scatterplots in Figure 15, we see stronger associations between the NEW B index and mortality (right panel) than between the NEW A index and mortality (left panel). Again, this is consistent with our analysis of the average RR values produced by Model 3 for this population set at lag day 6: the NEW B index exhibits stronger associations to mortality than the NEW A index for most cases when the $PM_{2.5}$ version of the

AQI is considered. In Table 11 (the same run depicted in Figure 15), we see that on lag day 6, the Model 3A and Model 3B have average RR values of 1.07 and 1.15, respectively. Compared to the Model 1 average RR value of 1.12 on lag day 6, both Model 3A and 3B exhibit larger RR values. This means that for this particular population set, the consideration of temperature and relative humidity leads to stronger associations to mortality, but only as defined in the NEW B version of the index.

4.4 Statistical Significance of Regression Coefficients

We determined the statistical significance of each explanatory in Model 4 in order to identify which raw measurements used in calculating the AQI and HI have the most influence on daily mortality. It was found that the $PM_{2.5}$ concentration predictor was statistically significant for two population sets (males, aged 60-74 whose deaths were categorized as cardiovascular-related and males and females, aged 60+ whose deaths were categorized as either cardiovascular- or respiratory-related) for some lag days. When all age mortality was considered, however, the $PM_{2.5}$ predictor in Model 4 was statistically significant with at least 90% confidence on all lag days.

The O_3 concentration predictor was also found to be statistically significant with 90% confidence for a few population sets analyzed in this project (females, aged 75+ whose death was categorized as respiratory-related, males and females, aged 60+ whose deaths were categorized as either cardiovascular- or respiratory-related, and for the all-age mortality population set) for some lag days. The only other pollutant concentration that was found to have a statistically significant effect on mortality was NO_2. The NO_2 predictor in Model 4 had a statistically significant effect on one population set (females, aged 60-74 whose deaths were categorized as cardiovascular-related) for two lag days.

Relative humidity was found to have a statistically significant effect on mortality in only two cases (males, aged 75+ whose death was categorized as respiratory-related on lag day 4 and females, aged 60-74, whose death was categorized as respiratory-related on lag day 6). Temperature was found to have a statistically significant effect on mortality in only one case (females, aged 75+ whose death was categorized as cardiovascular-related on lag day 4). These results further suggest that air quality is associated with mortality in the metropolitan area of Monterrey and while including temperature and relative humidity predictors in our models strengthens associations to mortality, as seen in RR values produced by the models, these results were not generally statistically significant.

5. Conclusions

The objective of this project was to determine if the skill of the AQI in predicting mortality could be improved by considering elements of the HI. In addition to our evaluation of how well the general AQI predicts mortality, we also evaluated how well individual pollutant AQIs predict mortality. We also assessed how incorporating elements from the HI affects the predictive skill of the AQI on mortality. Lastly, we developed and assessed whether a combined air quality-heat index had the potential to improve the prediction of mortality. In this project, we found that by including the meteorological elements of the HI, temperature and relative humidity, in assessing air quality, the strength of the relationship between air quality and mortality was strengthened in some cases.

We believed that the basis of this project was viable based on the results of previous studies that evaluated the relationship between air quality, extreme heat, and mortality (Cerón-Bretón et al. 2018; Filleul et al. 2006; Zhang et al. 2020; Amini et al. 2019). The particular study that incentivized us to pursue this project was the 2020 Cerón-Bretón et al. study that analyzed

the short-term effects of air pollution on mortality in Monterrey, Mexico and the modification of these effects in climate change scenarios. Results indicated that in combination with high pollutant concentrations, an increase in temperature leads to a stronger association between air quality and mortality. Using the same dataset from the 2020 Cerón-Bretón et al. study in our project, we expected our results to yield a similar outcome.

In this section, we discuss the overall conclusions derived from the results of our statistical analyses. We also speculate the reasoning behind the outcome of our results and discuss what can be done for future work in investigating the associations between air quality, extreme heat, and mortality.

5.1 Predictive Skill of the Models

In assessing how well each model performs in predicting mortality, we found that none of the models considered in this project performed significantly different from one another. For each population set, root-mean-square error (RMSE) values were calculated for each model for each lag day. The overlap of the 95% RMSE confidence intervals among the models indicate that the models have the same predictive skill as one another. We speculate that the reason RMSE values do not improve with additional predictors is that many other factors determine mortality besides pollution and extreme heat. These other factors, which include diet, lifestyle, personal health history, alcohol and drug use, and family medical history, apparently overwhelm the ability of air quality and extreme heat variables to skillfully predict mortality.

Interquartile relative risk (RR) values and 95% RR confidence intervals that were calculated for each population set for each model also reveal that the strength of the associations between mortality and the respective model explanatory variables are not statistically different

from one another for all lag days considered. In an attempt to assess the utility of our results without statistical significance, we compared the average RR values computed at each lag day from each model for each population set. For the majority of individual regressions, 87.5% of cases, Model 1 RR values greater than 1 demonstrated that the relationship between AQI and mortality, as described in many other studies, is also evident in Monterrey. There were not many cases in which Model 1, where the sole explanatory variable was the daily general AQI, daily $PM_{2.5}$ AQI, or the daily O_3 AQI, exhibited stronger associations to mortality than the other models that included some form of temperature and relative humidity as explanatory variables. Based on these results, we believe that by including elements of the HI in assessing air quality, there is a stronger association with mortality for most population sets for most lag days. The statistically significant influence of temperature and relative humidity on mortality in some cases also leads us to believe that including elements of the HI when assessing the quality of the air may improve the predictive skill of the AQI.

We found that the strength of the associations between our newly developed air quality-heat index and mortality was dependent on which version of the AQI was considered in deriving NEW index values. Regardless of the version of the AQI that was considered in deriving the NEW indices in Model 3, it was Model 2, which considered two explanatory variables, AQI and HI, that more consistently produced the highest average RR values and therefore described the strongest associations with mortality for most individual cases in this project. These results further support our hypothesis that including elements of the HI when assessing the quality of the air may improve the AQI's skill in predicting mortality.

5.2 Future Work

Based on the results of our project that used air quality, meteorological, and mortality data from the metropolitan area of Monterrey, Mexico, considering meteorological factors such as temperature and relative humidity when evaluating the quality of the air does not significantly improve the skill of the AQI in predicting mortality. The present study, however, may serve as a starting point for future endeavors in investigating associations between air quality, extreme heat, and mortality, and the communication of this information to the public. Suggestions for future research on this topic are described in this section.

In analyzing our results based on average RR values rather than statistical significance, we found that a combined air quality-index has merit. Our results indicate that including elements of the HI when assessing the quality of the air strengthens the relationship between AQI and mortality. In creating our NEW index, the highest of the daily AQI and daily transformed HI value was deemed the daily NEW index value. We speculate that the associations between a combined index and mortality could be improved if the combined index was constructed in a different manner.

Associations between air quality, extreme heat and mortality could vary from those observed in this project if the Quasi-Poisson regression models were constructed in a different manner. In the construction of the models, other air quality and extreme heat variables could be used in place of those considered in this study (e.g., dewpoint temperature instead of relative humidity in Model 4). Mortality data could be managed in a different manner to explore any modeled associations between air quality and public health as well. In the present study, we lagged mortality data from 0 to 7 days. It could be interesting to observe results from an analysis that considers cumulative mortality data, as done in previous studies (Amini et al. 2019).

It could also be interesting to see what a similar analysis to this project yields if conducted for individual years or for individual municipalities. We see in Figure 6 that NO_2 concentrations appear to be generally higher in some years and lower in others. In Figure 7, there is a suggestion of a trend in CO concentrations over the July to October period in certain years. Downward trends in CO concentrations are seen in 2012 and 2015 while upward trends appear in 2014. Trends in O_3 concentrations are also seen in Figure 8. In conducting another project with analyses similar to those presented in this project, one could also detrend the pollutant data before analysis.

We speculate that using an entirely different dataset in investigating the associations of air quality, extreme heat, and mortality may yield different results than those found in the present study. Monterrey has a semi-arid climate, so relative humidity is often not very high. The amplification of the effects of air pollution on mortality by increases in temperature and relative humidity have already been identified in previous studies that have used air quality and meteorological data from areas with warm, temperature climates (Filleul et al. 2006; Zhang et al. 2020). For future research on this topic, using a dataset originating from an urban area with a warm, humid climate may better encompass the effects of extreme heat on mortality since the human-perceived sense of heat is dependent on both temperature and relative humidity.

Monterrey is a sprawling business and industrial center. Recent urban and industrial development has resulted in an increase in residents commuting between municipalities in the metropolitan area of Monterrey (Mancilla and Mendoza 2012; Cerón -Bretón et al. 2020). We speculate that over the time period that the present study considers, residents of Monterrey could have traveled between municipalities after exposure to air pollution and extreme heat. Since the manifestation of the related health effects are not immediate, mortality rates in our dataset may

not be entirely reflective of the true mortality rates for each municipality. In addition to using a dataset originating from an urban area with a warm, humid climate in future research endeavors, it may be worthwhile to consider data from an area in which there is less intercity mobility of the residents.

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*...air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Figure 1 Air Quality Index chart that is used to communicate local air quality to the public. After the United States Environmental Protection Agency 2018 technical documentation for reporting and calculating daily air quality (U.S. EPA 2018).

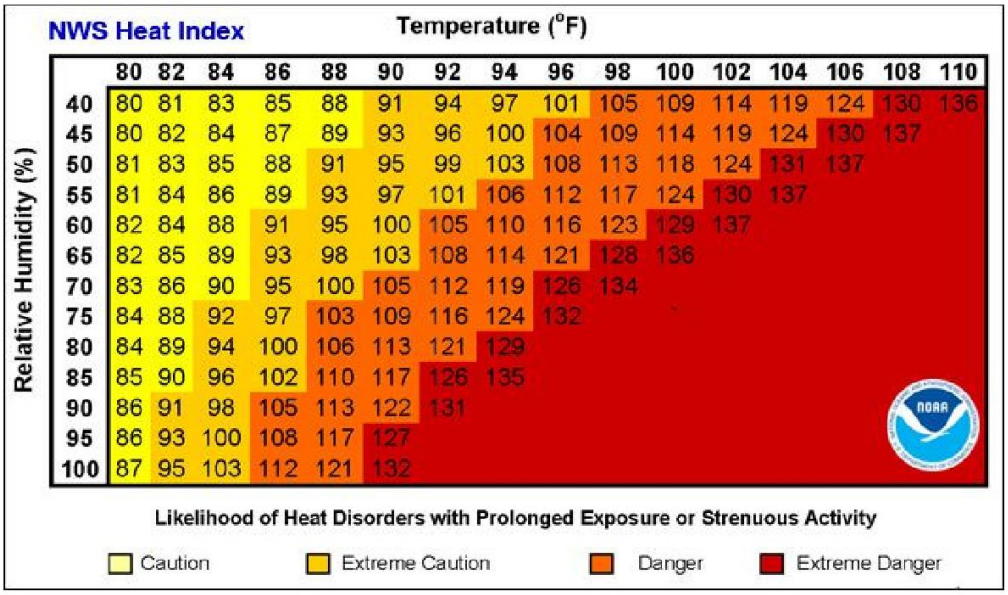

Figure 2 Heat index (HI) chart that is used to communicate the level of concern associated with local HI values. After the National Weather Service 2018 heat safety documentation (NWS 2018).

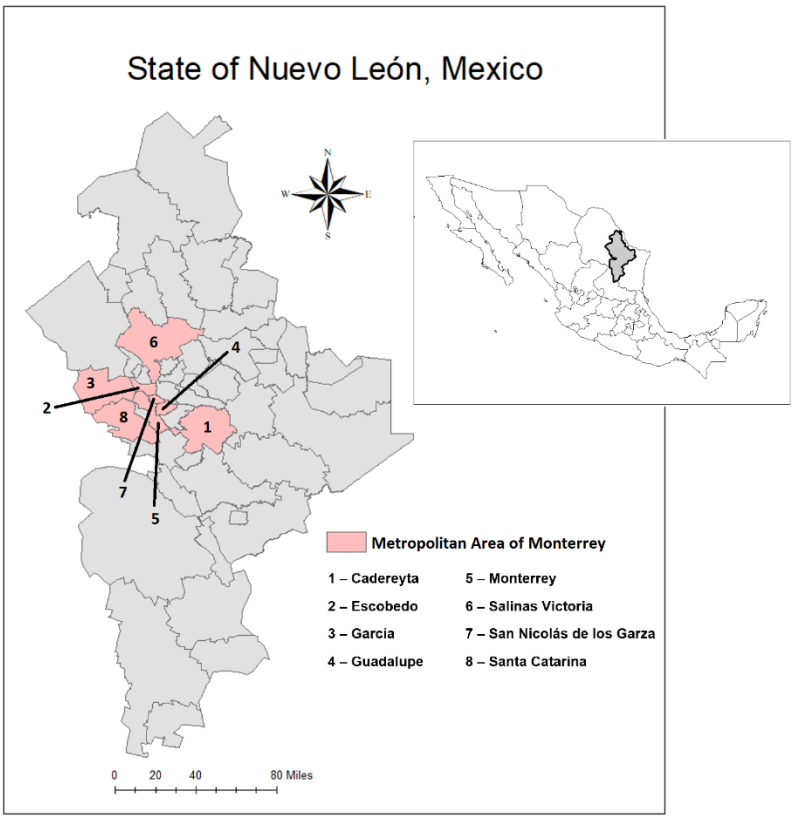

Figure 3 Location of municipalities in the metropolitan area of Monterrey, Nuevo León, Mexico.

Figure 4 Monitoring station in San Nicolas de los Garza.

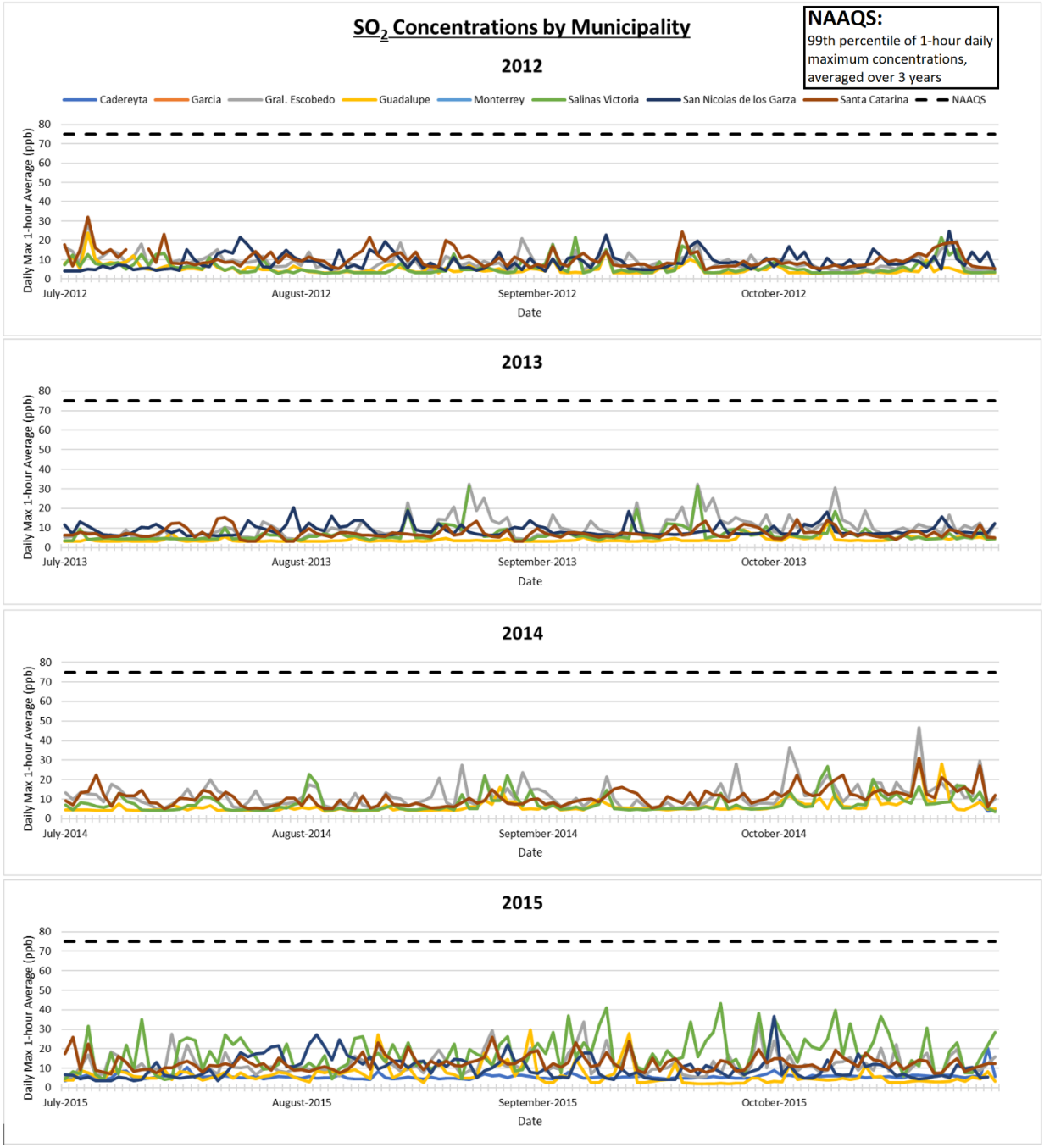

Figure 5 Daily sulfur dioxide concentrations by muncipality.

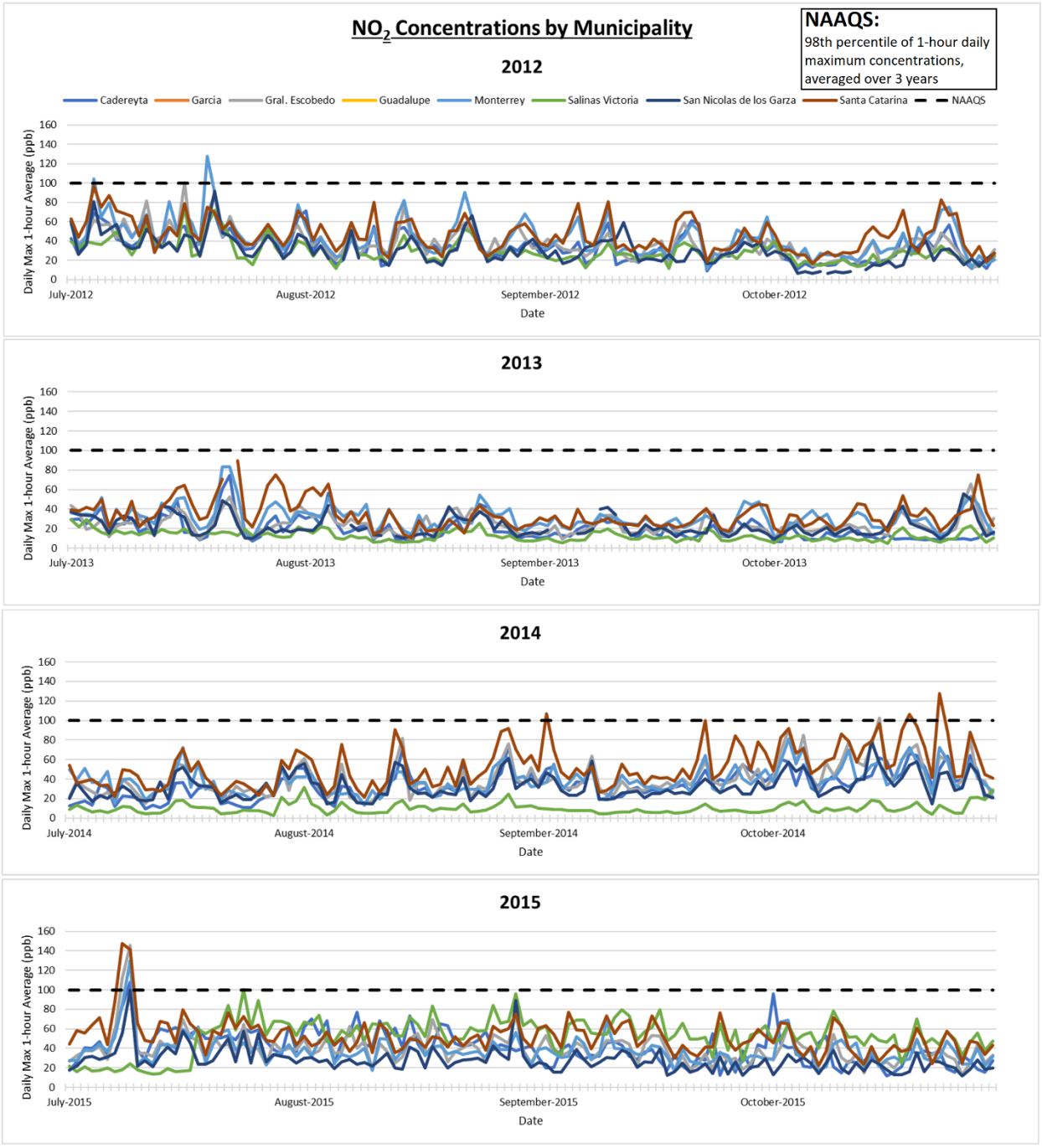

Figure 6 Daily nitrogen dioxide concentrations by muncipality.

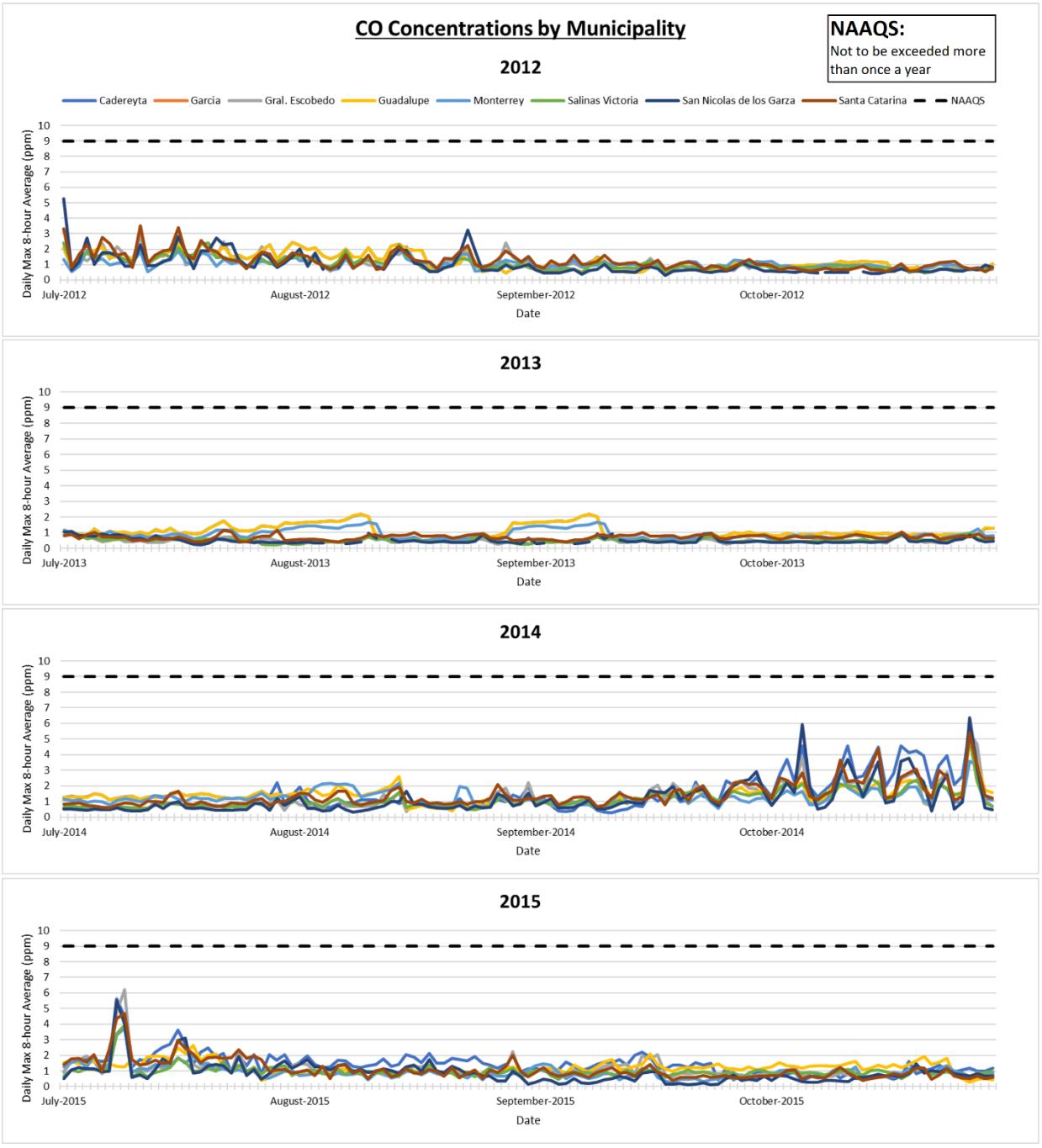

Figure 7 Daily carbon monoxide concentrations by muncipality.

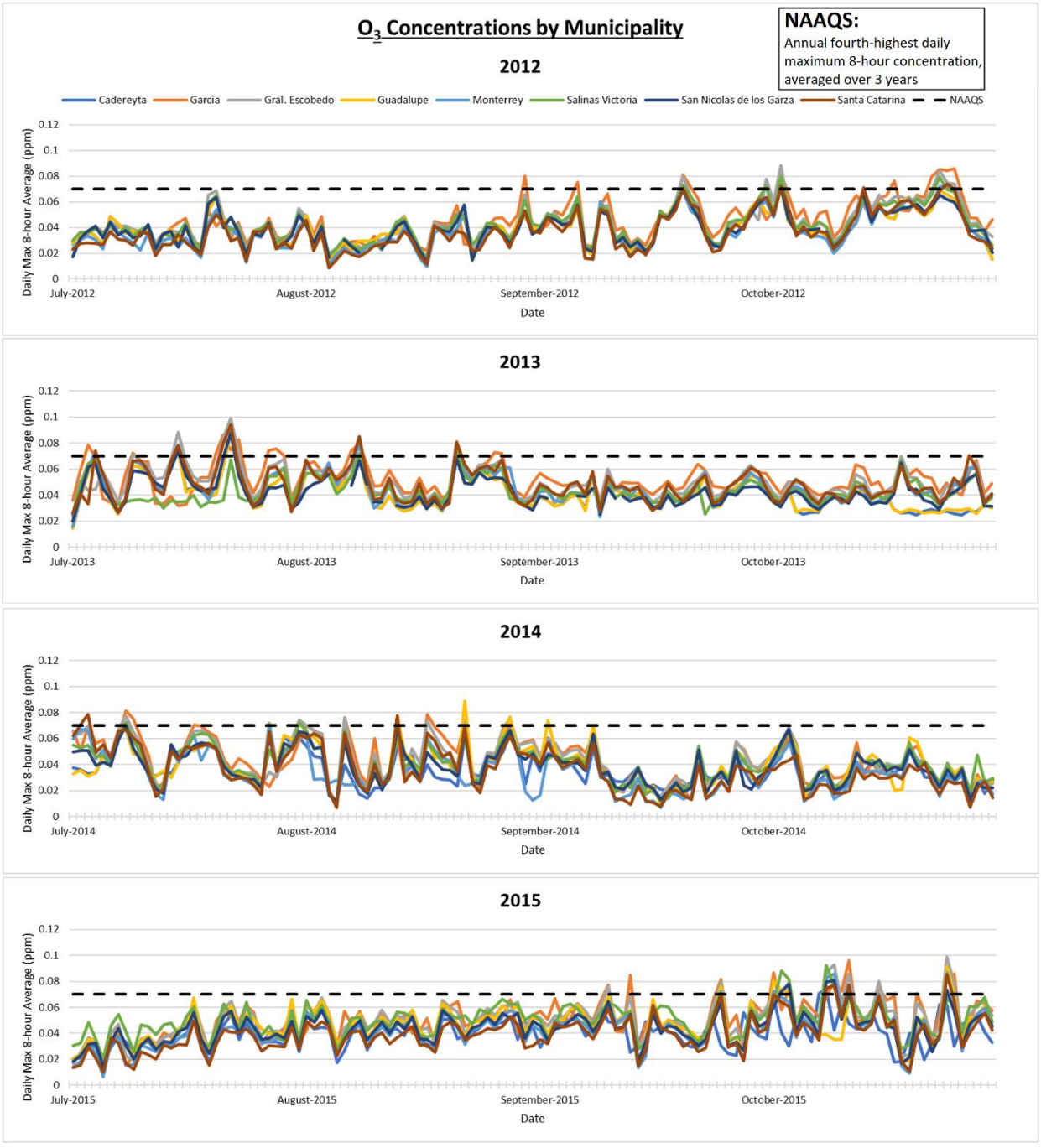

Figure 8 Daily ozone concentrations by muncipality.

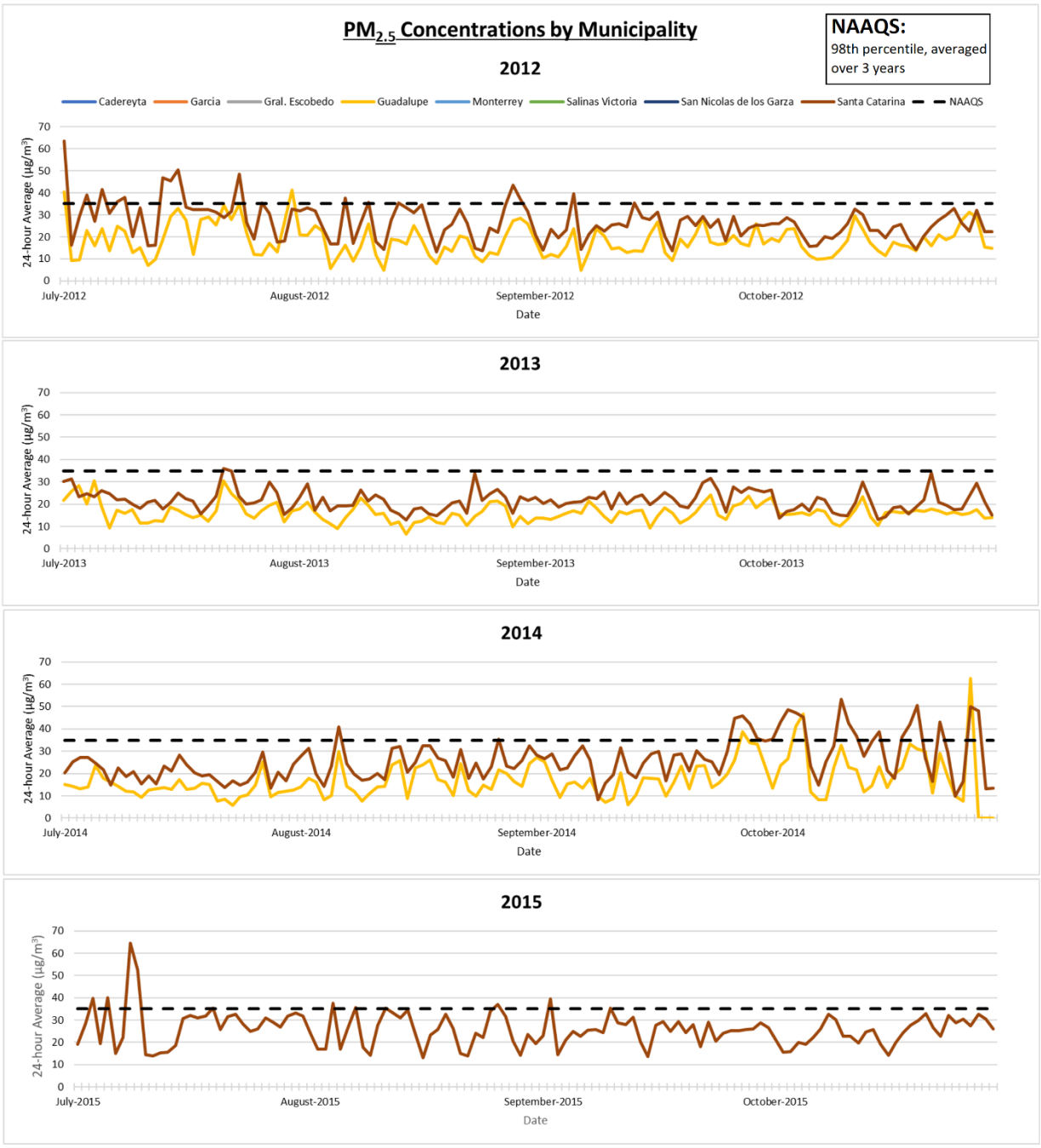

Figure 9 Daily particulate matter ($PM_{2.5}$) concentrations by muncipality.

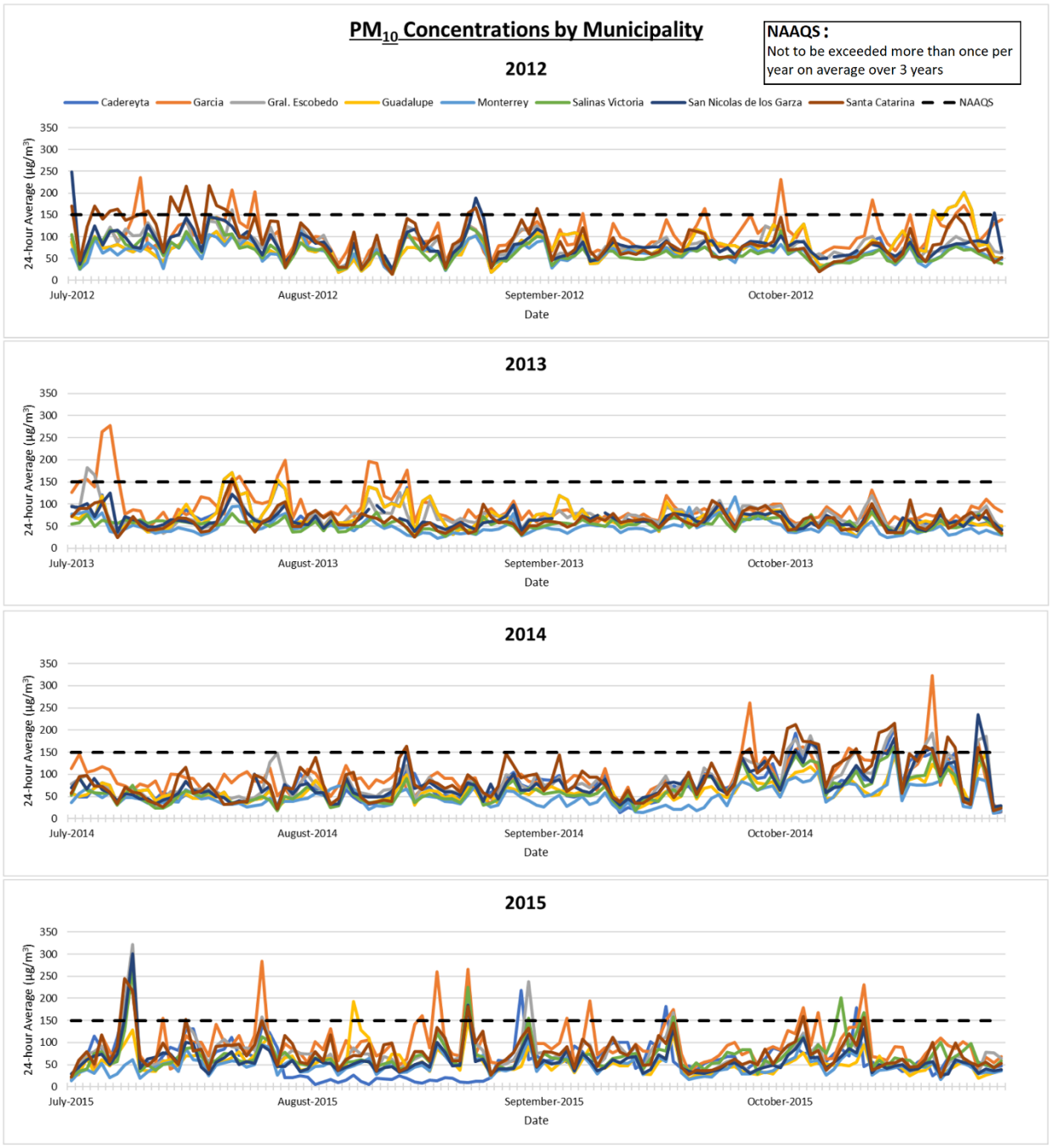

Figure 10 Daily particulate matter (PM_{10}) concentrations by muncipality.

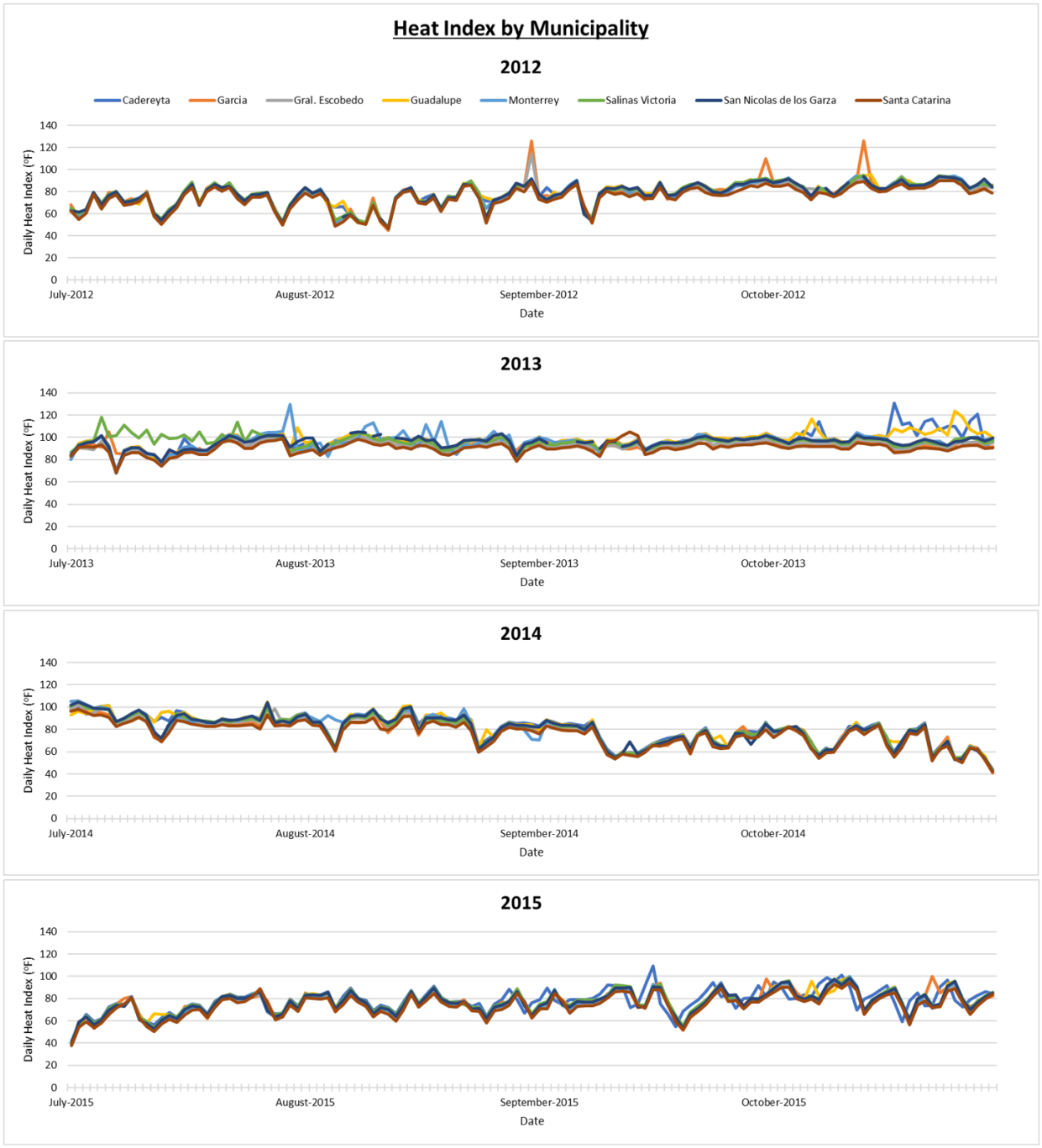

Figure 11 Daily heat index (HI) values by municipality.

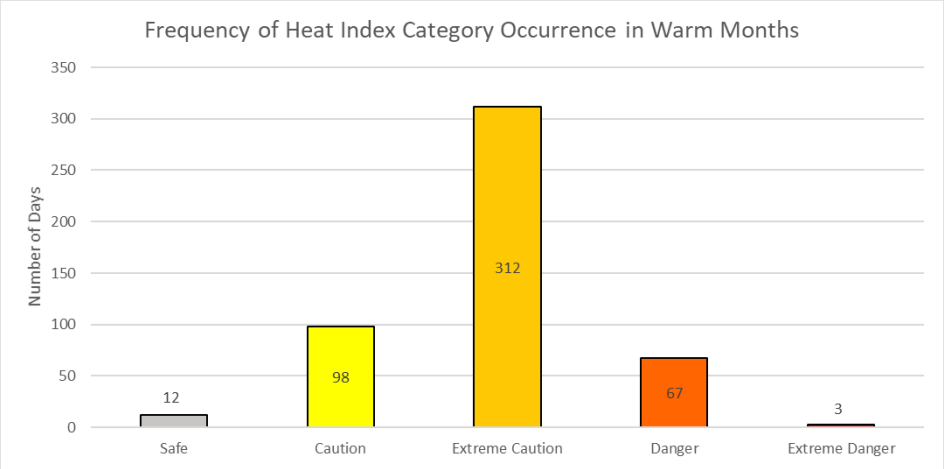

Figure 12 Number of days each level of heat index (HI) health category concern occurred in our warm month dataset.

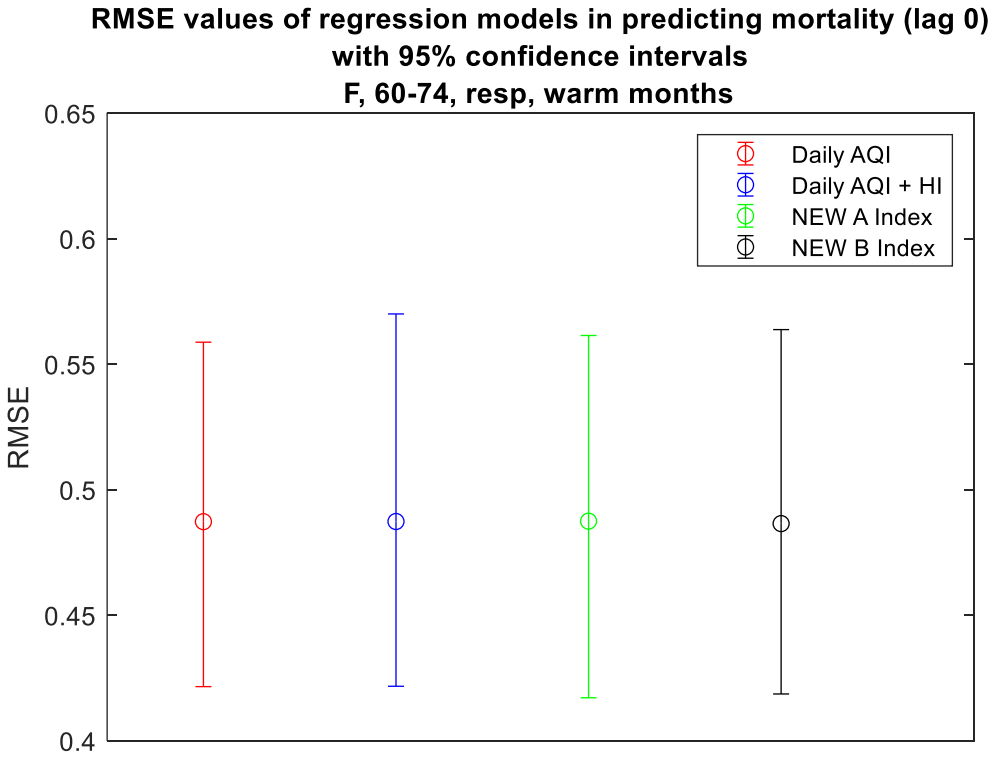

Figure 13 Average RMSE values and their 95% confidence intervals on lag day 0 for the population set females, aged 60-74 whose death was categorized as respiratory-related. The red point and error bars are the RMSE values and 95% confidence intervals for Model 1, the blue point and error bars correspond to Model 2, the green point and error bars correspond to Model 3A, and the black point and error bars correspond to Model 3B.

O_3 AQI – Males, 75+, resp

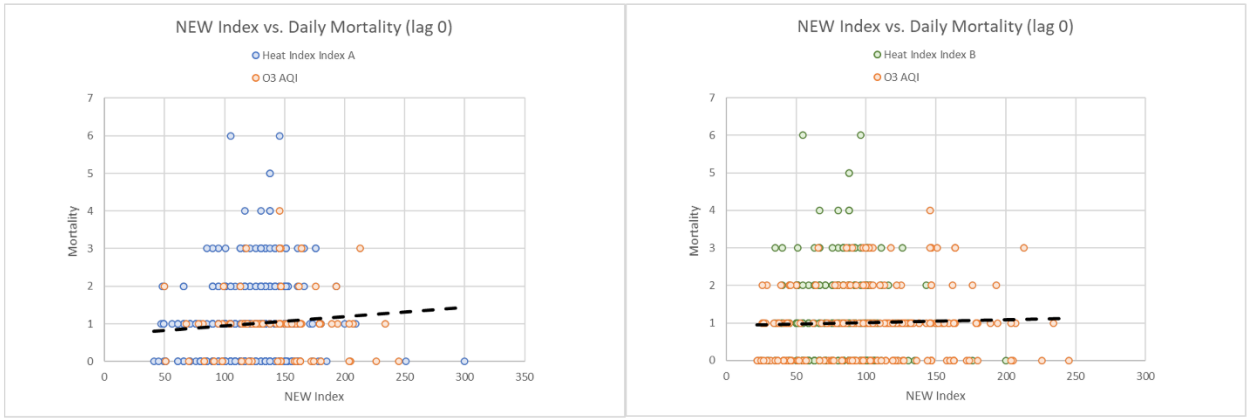

Figure 14 Scatterplots of NEW A index (left) and NEW B index (right) versus daily mortality of males, aged 75+ whose death was categorized as respiratory-related. Orange points indicate days in which the O_3 AQI was higher than the transformed HI. Blue points indicate days in which the heat index A value was higher than the O_3 AQI. Green points indicate days in which the heat index B value was higher than the O_3 AQI.

$PM_{2.5}$ AQI – Males, 60-74, cardio

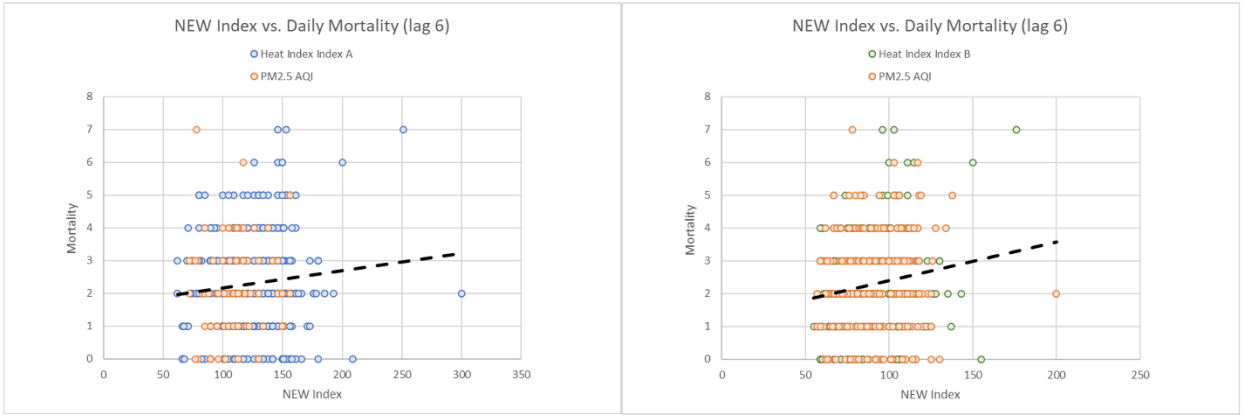

Figure 15 Scatterplots of NEW A index (left) and NEW B index (right) versus daily mortality of males, aged 60-74 whose death was categorized as cardiovascular-related. Orange points indicate days in which the $PM_{2.5}$ AQI was higher than the transformed HI. Blue points indicate days in which the heat index A value was higher than the $PM_{2.5}$ AQI. Green points indicate days in which the heat index B value was higher than the $PM_{2.5}$ AQI.

Table 1 Population, elevation, and surface of each municipality in the metropolitan are of Monterrey, Nuevo León, Mexico (National Institute of Statistics and Geography, 2010).

Municipality	Population (2010)	Elevation (m)	Surface Area (km²)
Cadereyta Jiménez	86,445	360	1,141
García	145,867	697	1,032
Gral. Escobedo	357,937	528	149
Guadalupe	678,006	500	118
Monterrey	1,135,550	678	324
Salinas Victoria	32,660	464	1,667
San Nicolás de los Garza	443,273	512	60
Santa Catarina	268,955	1,222	916
Total	**3,148,693**		**5,407**

Table 2 National Ambient Air Quality Standards for the criteria air pollutants used in calculating the AQI (U.S. EPA, 2014).

Pollutant	Averaging Time	Level	Form
Carbon Monoxide (CO)	8 hours	9 ppm	Not to be exceeded more than once a year
Nitrogen Dioxide (NO_2)	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Ozone (O_3)	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter ($PM_{2.5}$)	24 hours	35 $\mu g/m^3$	98th percentile, averaged over 3 years
Particulate Matter (PM_{10})	24 hours	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Table 3 Individual pollutant concentration breakpoints that are used in calculating pollutant AQI values. After the United States Environmental Protection Agency 2018 technical documentation for reporting and calculating daily air quality. Note: it is generally required to report the AQI based on 8-hour ozone values.

These Breakpoints...							...equal this AQI	...and this category
O_3 (ppm) 8-hour	O_3 (ppm) 1-hour	$PM_{2.5}$ ($\mu g/m^3$) 24-hour	PM_{10} ($\mu g/m^3$) 24-hour	CO (ppm) 8-hour	SO_2 (ppb) 1-hour	NO_2 (ppb) 1-hour	AQI	
0.000 - 0.054		0.0 – 12.0	0 - 54	0.0 - 4.4	0 - 35	0 - 53	0 - 50	Good
0.055 - 0.070		12.1 – 35.4	55 - 154	4.5 - 9.4	36 - 75	54 - 100	51 - 100	Moderate
0.071 - 0.085	0.125 - 0.164	35.5 – 55.4	155 - 254	9.5 - 12.4	76 - 185	101 - 360	101 - 150	Unhealthy for Sensitive Groups
0.086 - 0.105	0.165 - 0.204	55.5 - 150.4	255 - 354	12.5 - 15.4	186 - 304	361 - 649	151 - 200	Unhealthy
0.106 - 0.200	0.205 - 0.404	150.5 - 250.4	355 - 424	15.5 - 30.4	305 - 604	650 - 1249	201 - 300	Very unhealthy
	0.405 - 0.504	250.5 - 350.4	425 - 504	30.5 - 40.4	605 - 804	1250 - 1649	301 - 400	Hazardous
	0.505 - 0.604	350.5 - 500.4	505 - 604	40.5 - 50.4	805 - 1004	1650 - 2049	401 - 500	Hazardous

Table 4 Number of days each individual pollutant AQI was the highest among all the pollutant AQI and was therefore deemed the daily general AQI. Note: There were 17 days in the warm month dataset in which two pollutants had the same individual pollutant AQI as the general AQI. Either individual pollutant in this case could be deemed the daily general AQI.

AQI Health Category	Number of Days Each Pollutant AQI was the General AQI in Warm Month Dataset					
	SO_2	NO_2	CO	O_3	$PM_{2.5}$	PM_{10}
Moderate	0	1	0	51	**170**	84
Unhealthy - Sensitive Groups	1	0	0	75	**80**	6
Unhealthy	0	0	0	**33**	0	0
Very Unhealthy	0	0	0	**8**	0	0

Table 5 Heat index A index ranges and corresponding breakpoints. Breakpoints are used in calculating transformed heat index A values.

HI values (°F)	Heat Index A ($I_{HI\ A}$) Range	Concern
($BP_{Low} - BP_{High}$)	($I_{low} - I_{high}$)	
< 80	0-50	No concern
80-90	51-100	Caution
91-103	101-150	Extreme caution
104-124	151-200	Danger
125-137	201-300	Extreme danger

Table 6 Heat index B index ranges and corresponding breakpoints. Breakpoints are used in calculating transformed heat index B values.

HI values (°F)	Heat Index B ($I_{HI\ B}$) Range	Concern
($BP_{Low} - BP_{High}$)	($I_{low} - I_{high}$)	
< 80	0	No concern
80-90	0-50	Caution
91-103	51-100	Extreme caution
104-124	101-150	Danger
125-137	151-200	Extreme danger

Table 7 Characteristics of the Quasi-Poisson regression models.

	Explanatory Variables	Response Variable
Model 1	- Daily AQI (general, $PM_{2.5}$ or O_3)	Daily mortality of population set (lagged from 0-7 days)
Model 2	- Daily AQI (general, $PM_{2.5}$, or O_3) - Daily HI	
Model 3	- Daily NEW index values (either NEW A or B)	

Model 4	- Daily max time-averaged concentrations of:
	  - SO2
	  - NO2
	  - CO
	  - O3
	  - PM2.5
	  - PM10
	- Daily maximum measurements of:
	  - Temperature
	  - Relative humidity	

Table 8 Average RR values exhibited by each model when the version of the AQI considered was the O_3 AQI for the population set males, aged 75+ whose deaths were categorized as respiratory-related.

Relative Risk Values O3 AQI – Males, 75+, respiratory-related death					
Lag	**Model 1**	**Model 2**	**Model 3A**	**Model 3B**	**Model 4**
0	1.01	1.10	1.11	1.03	1.14
1	1.08	1.14	1.11	1.07	1.40
2	0.94	1.03	1.06	1.00	1.28
3	1.07	1.15	1.11	1.07	1.26
4	1.09	1.15	1.15	1.10	1.51
5	1.02	0.99	1.02	1.01	0.80
6	1.00	1.01	0.99	1.01	0.73
7	1.03	1.07	1.06	1.02	0.98

Table 9 Summary of relative risk (RR) results by lag day. Note: There were 30 individual regression runs for each lag day (1 lag day x 10 population sets x 3 versions of the AQI).

Of 30 regression runs for each lag day, number of cases in which…			
Lag	**Model 1 RR > 1**	**Model 3A or 3B RR > Model 1 RR**	**Model 2 RR > Model 1 RR**
0	25	22	25
1	30	6	19
2	27	11	23
3	27	18	25
4	25	11	24
5	24	13	23
6	26	17	26
7	26	12	23

Table 10 Summary of relative risk (RR) results by population set. Note: There were 24 individual regression runs for each population set (1 population set x 8 lag days x 3 versions of the AQI).

Of 24 regression runs for each population set, number of cases in which…			
Population Set	**Model 1 RR > 1**	**Model 3A or 3B RR > Model 1 RR**	**Model 2 RR > Model 1 RR**
Males, 60-74, cardio	24	16	24
Males, 75+, cardio	24	11	21
Males, 60-74, resp	14	9	10
Males, 75+, resp	20	20	20
Females, 60-74, cardio	20	8	3
Females, 75+, cardio	24	11	24
Females, 60-74, resp	17	8	15
Females, 75+, resp	20	14	23
Males + Females, 60+, cardio + resp	24	7	24
Males + Females, all ages, cardio + resp	24	8	24

Table 11 Average RR values exhibited by each model when the version of the AQI considered was the $PM_{2.5}$ AQI for the population set males, aged 60-74 whose death was categorized as cardiovascular-related.

Relative Risk Values $PM_{2.5}$ AQI – Males, 60-74, cardiovassecular-related death					
Lag	**Model 1**	**Model 2**	**Model 3A**	**Model 3B**	**Model 4**
0	1.04	1.09	1.06	1.07	1.15
1	1.08	1.12	1.04	1.07	1.08
2	1.13	1.17	1.06	1.11	1.12
3	1.10	1.17	1.07	1.14	1.07
4	1.06	1.11	1.04	1.09	1.00
5	1.14	1.20	1.09	1.17	1.29
6	1.13	1.17	1.07	1.15	1.21
7	1.10	1.15	1.07	1.13	1.24

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Appendix A:

General AQI Full Results

The documents that follow include full results for regression runs that consider the general AQI.

Each production run corresponds to one of the ten population sets analyzed in this project as described in section 3.4.

Each production run consists of RMSE plots for each lag day, a table of RMSE values and their 95% confidence intervals for each lag day, a table of RMSE values and their 95% confidence intervals, and scatterplots of NEW indices versus mortality of the population set.

The model results in the plots and tables are those described in section 3.5.

‘AQI’ refers to Model 1, the model in which the sole explanatory variable of the regression model was daily general AQI values.

‘AQI + HI’ refers to Model 2, the model in which the explanatory variables were daily general AQI values and HI values.

‘NEW A’ refers to Model 3A, the model in which the sole explanatory variable was the NEW A index where the version of the AQI considered was the general AQI.

‘NEW B’ refers to Model 3B, the model in which the sole explanatory variable was the NEW B index where the version of the AQI considered was the general AQI.

‘RAW’ refers to Model 4, the model in which the explanatory variables are pollutant concentrations of the criteria pollutants and temperature and relative humidity measurements.

Production Run:

M, 60-74, cardio, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

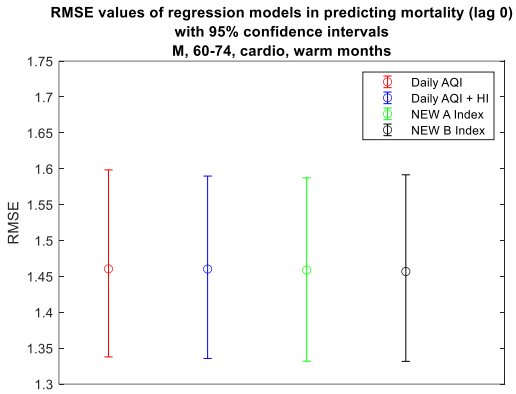
(how I originally defined the transformed HI in our NEW index)

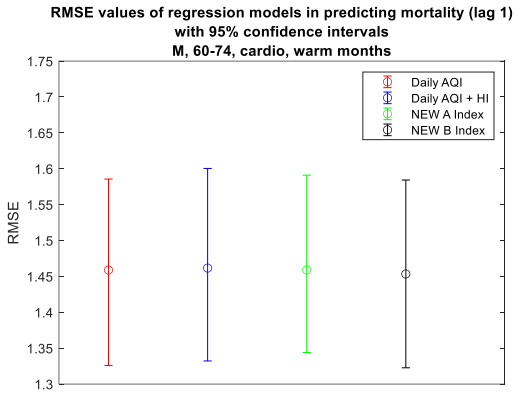
B

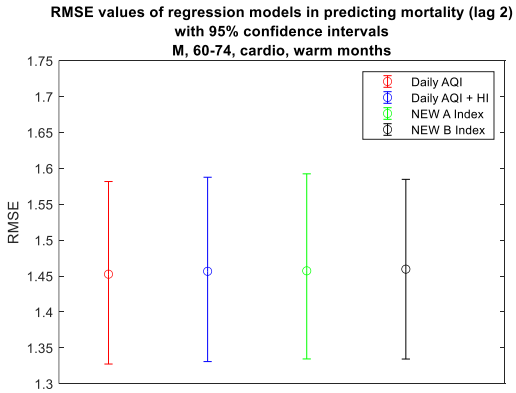
(transformed HI shifted down one category)

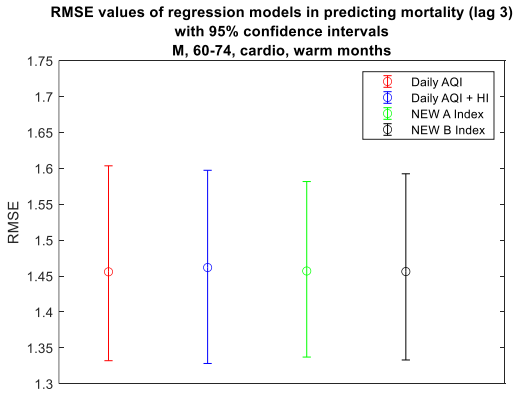
HI_Index Breakpoints

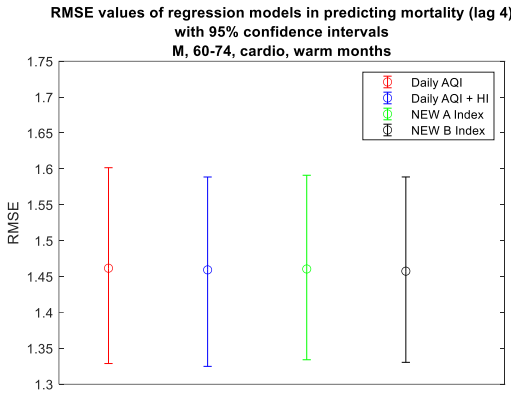
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

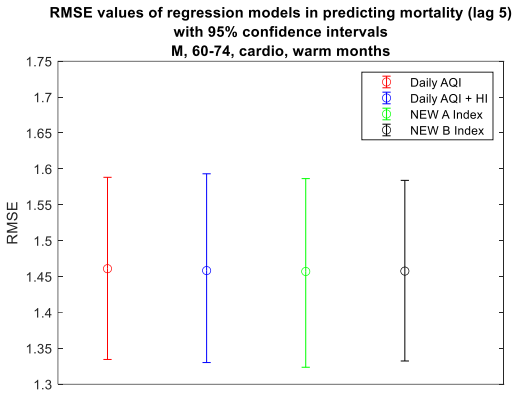


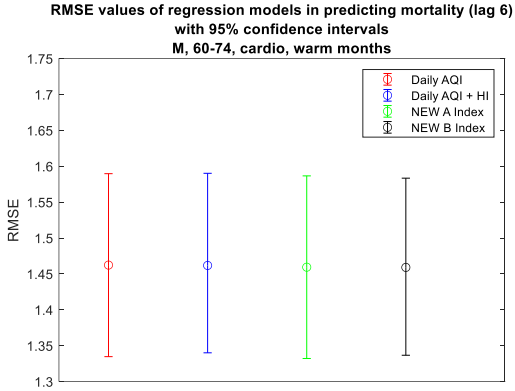


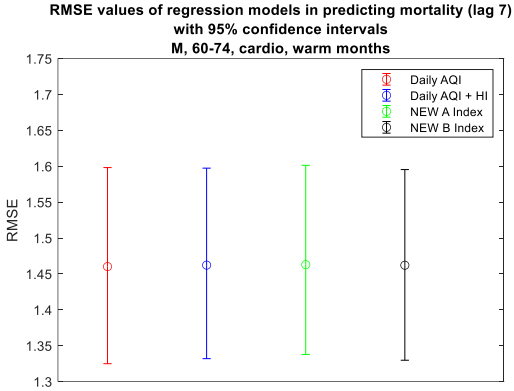





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.4605 +/-0.13029	1.4603 +/-0.12704	1.4588 +/-0.12771	1.4568 +/-0.12995
1	1.4588 +/-0.12991	1.4616 +/-0.1341	1.459 +/-0.12353	1.4534 +/-0.1308
2	1.4526 +/-0.12713	1.4566 +/-0.1284	1.4573 +/-0.12895	1.4596 +/-0.12517
3	1.4559 +/-0.13575	1.4619 +/-0.13458	1.4571 +/-0.12226	1.4563 +/-0.1297
4	1.4616 +/-0.13641	1.4593 +/-0.13192	1.4605 +/-0.12852	1.4575 +/-0.12914
5	1.4609 +/-0.12689	1.4583 +/-0.13149	1.4571 +/-0.1314	1.4576 +/-0.12583
6	1.4623 +/-0.12745	1.4618 +/-0.12504	1.4593 +/-0.1272	1.459 +/-0.12336
7	1.4602 +/-0.13662	1.4622 +/-0.13271	1.4628 +/-0.13176	1.462 +/-0.13283

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0106 +/-0.086679	1.0598 +/-0.129	1.0419 +/-0.10113	1.0246 +/-0.078692	1.1661 +/-0.39108
1	1.0621 +/-0.095551	1.0996 +/-0.13692	1.0447 +/-0.096787	1.0549 +/-0.083406	1.0834 +/-0.32803
2	1.0916 +/-0.09816	1.1379 +/-0.14804	1.0542 +/-0.096739	1.0689 +/-0.086329	1.114 +/-0.38633
3	1.0718 +/-0.09812	1.1334 +/-0.13457	1.0757 +/-0.10171	1.0822 +/-0.096296	1.0747 +/-0.35454
4	1.0582 +/-0.098751	1.0931 +/-0.13405	1.0534 +/-0.10204	1.0527 +/-0.09045	1.0076 +/-0.34401
5	1.0356 +/-0.090236	1.0898 +/-0.12452	1.0599 +/-0.096798	1.0499 +/-0.082854	1.2878 +/-0.4117
6	1.0464 +/-0.086252	1.088 +/-0.12888	1.0654 +/-0.10743	1.0624 +/-0.087596	1.2049 +/-0.40167
7	1.01 +/-0.097799	1.055 +/-0.13688	1.0371 +/-0.1022	1.0269 +/-0.08524	1.252 +/-0.4084

AQI Regression: AQI predictor statistically significant on lag day 2 with 90% confidence.

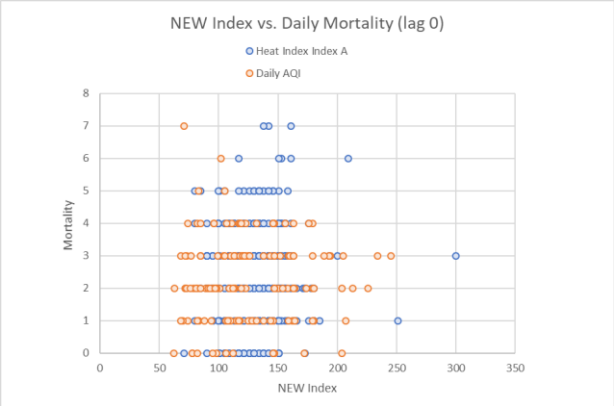
AQI+HI Regression: AQI predictor statistically significant on lag day 2 with 90% confidence.

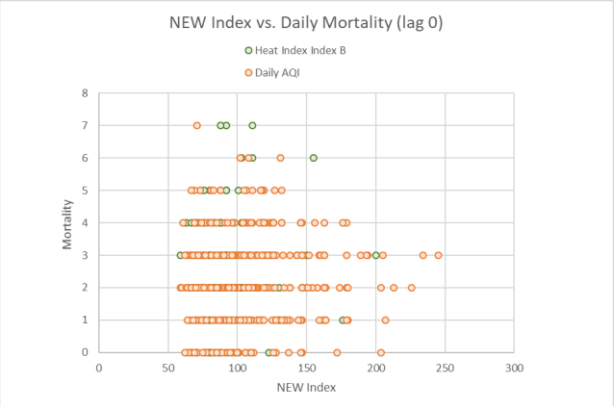
NEW A Regression: No statistically significant predictors.

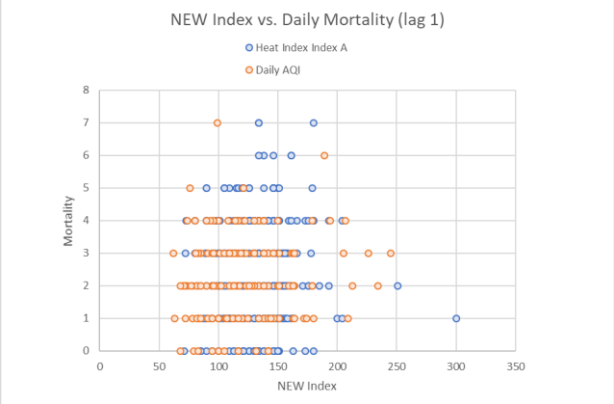
NEW B Regression: New B index predictor statistically significant on lag day 3 with 90% confidence.

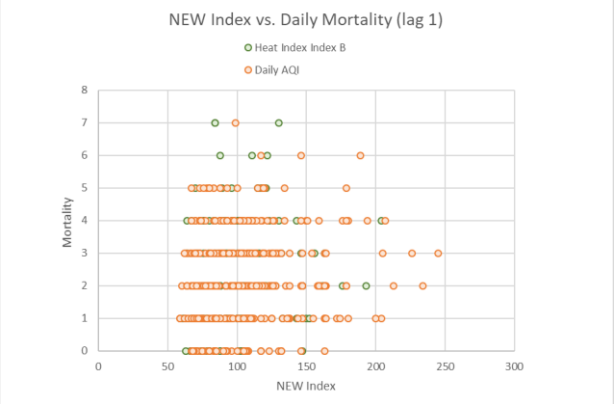
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence, PM2.5 predictor statistically significant on lag days 2, 5, 6, and 7 with 90% confidence.

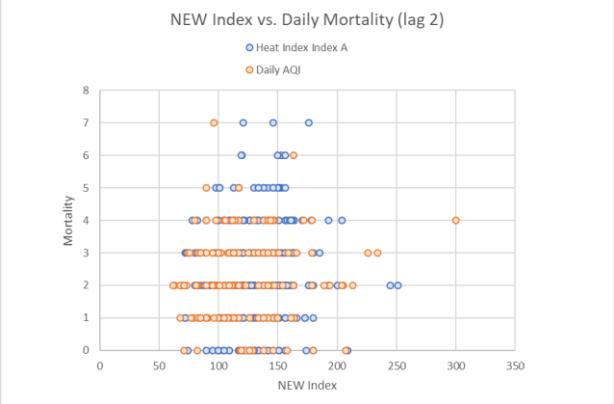
NEW Index vs. Daily Mortality Plots (for M, 60-74, cardio, warm months)

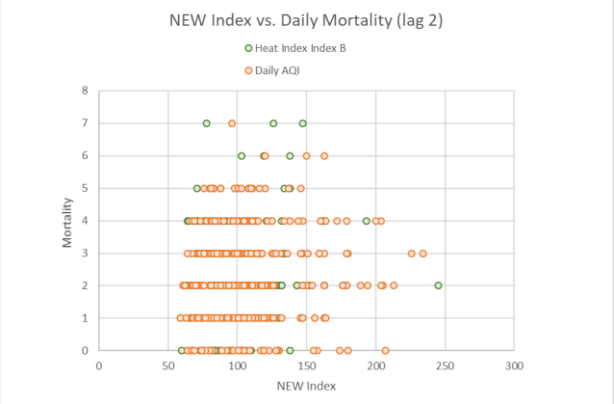


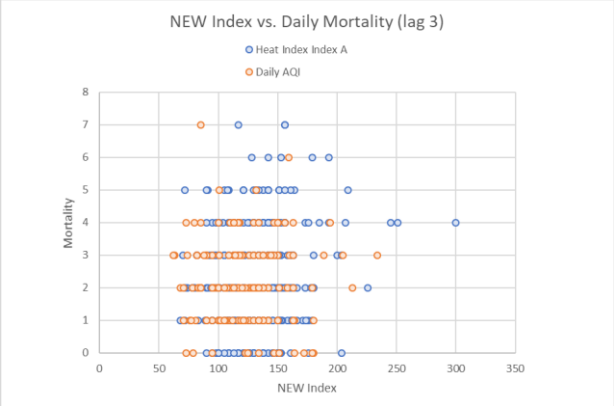


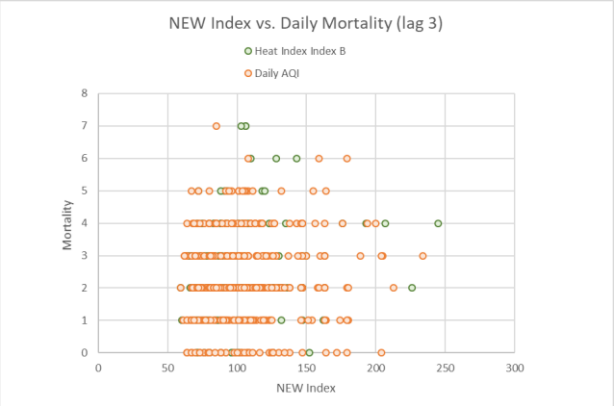


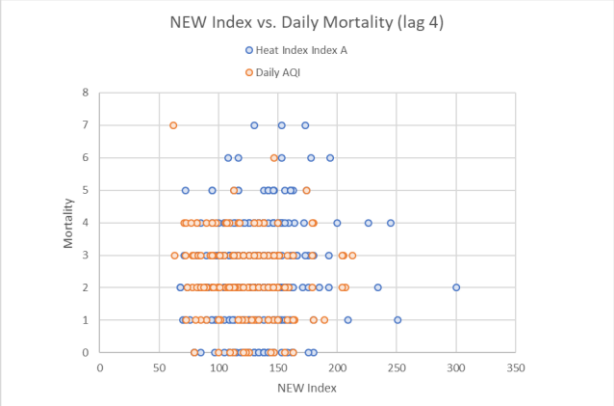


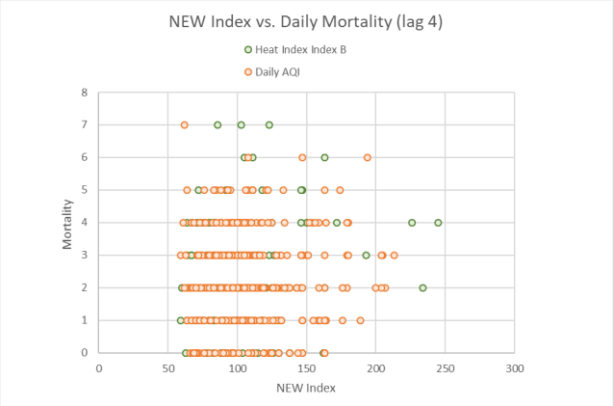


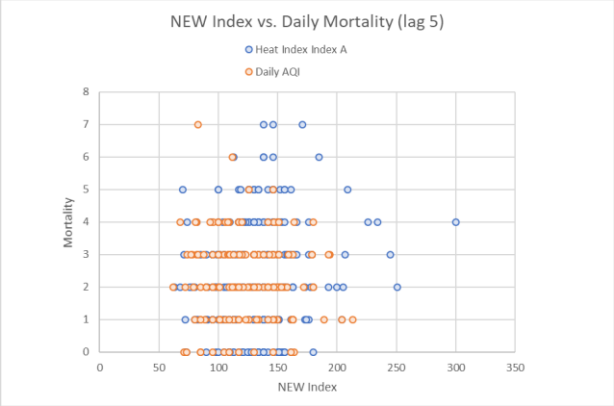


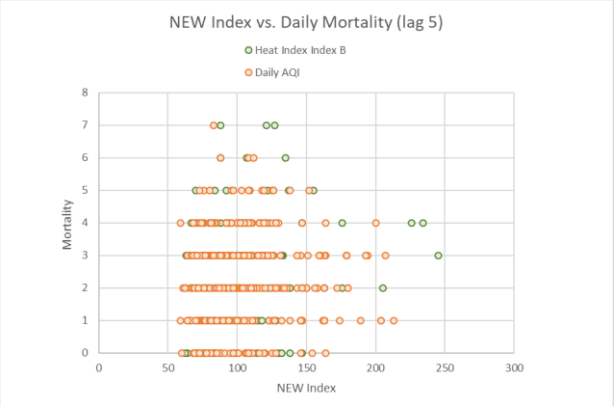

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

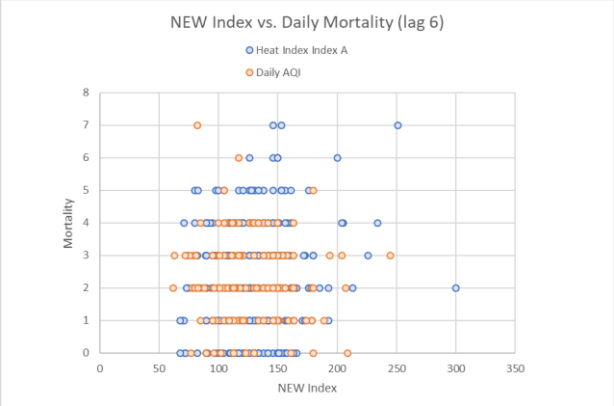

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

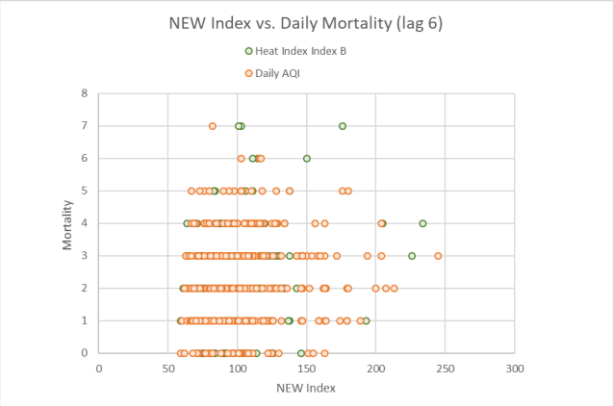

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

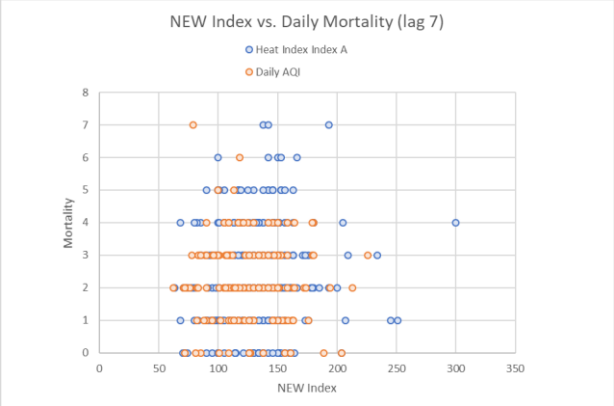

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

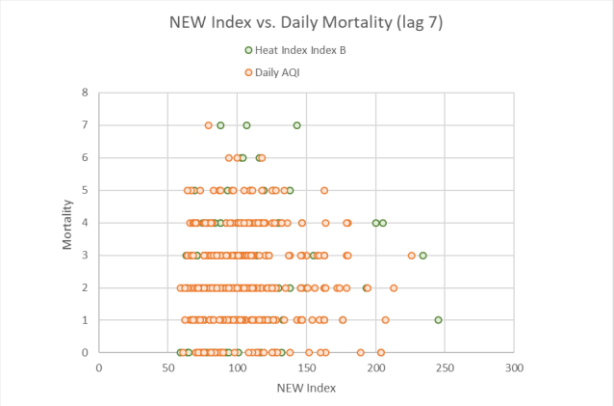

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300

Production Run:

M, 75+, cardio, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

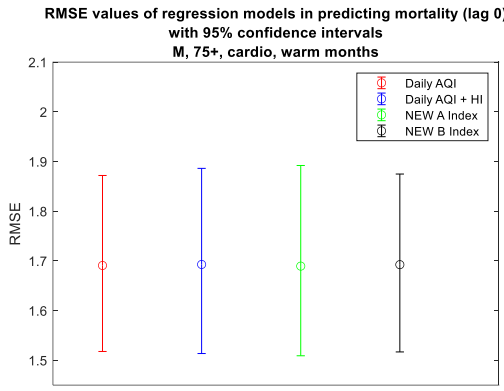
(how I originally defined the transformed HI in our NEW index)

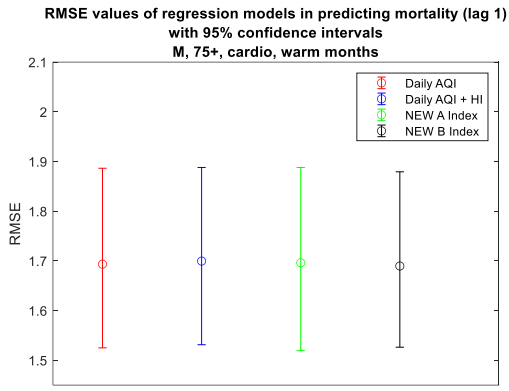
B

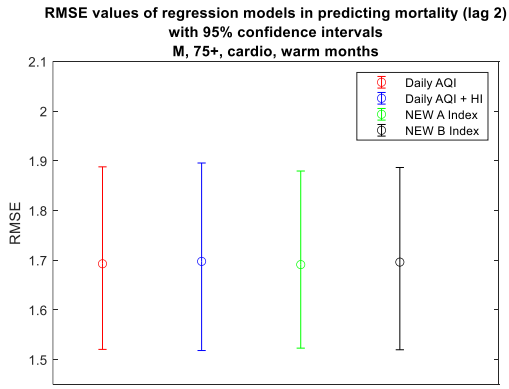
(transformed HI shifted down one category)

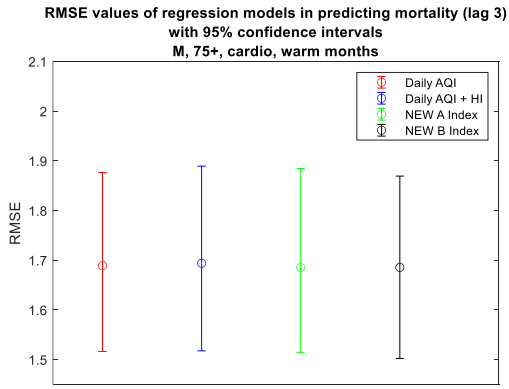
HI_Index Breakpoints

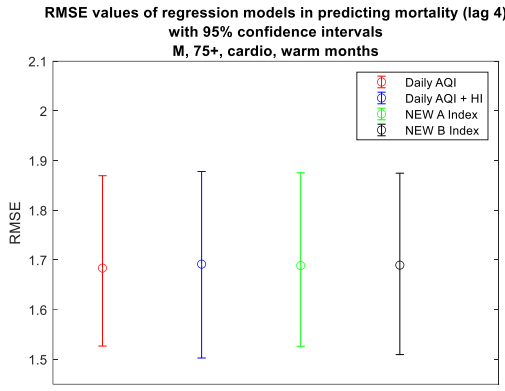
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

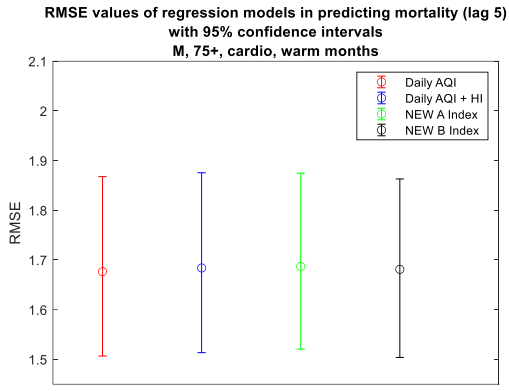


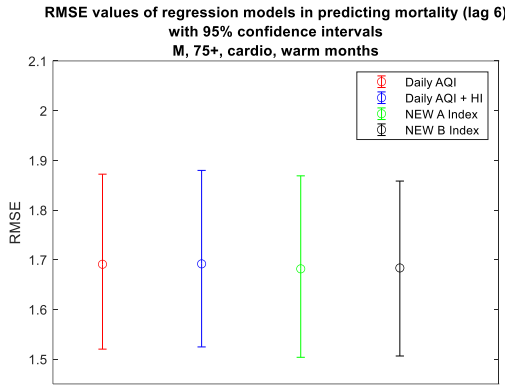


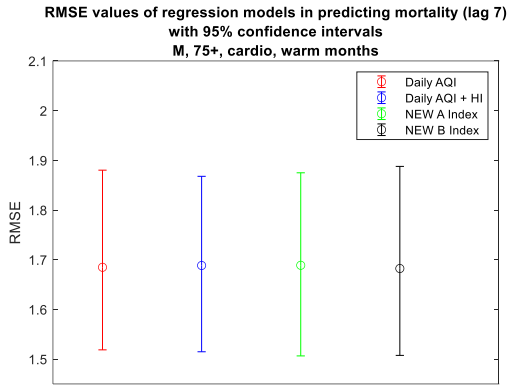





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.6907 +/-0.17709	1.6928 +/-0.1863	1.6894 +/-0.19146	1.6924 +/-0.17899
1	1.6934 +/-0.18073	1.6996 +/-0.17832	1.6962 +/-0.18427	1.6896 +/-0.17649
2	1.693 +/-0.18368	1.6978 +/-0.18869	1.6913 +/-0.17821	1.6963 +/-0.1834
3	1.689 +/-0.18007	1.6939 +/-0.18585	1.6852 +/-0.18502	1.6856 +/-0.18353
4	1.6836 +/-0.17139	1.6916 +/-0.18768	1.6887 +/-0.17455	1.6896 +/-0.18254
5	1.6766 +/-0.18055	1.684 +/-0.18099	1.687 +/-0.17712	1.6812 +/-0.17956
6	1.6908 +/-0.17604	1.6917 +/-0.17761	1.6816 +/-0.1826	1.6834 +/-0.17601
7	1.6848 +/-0.1808	1.6884 +/-0.17653	1.6888 +/-0.18424	1.6823 +/-0.19017

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0249 +/-0.095586	1.0368 +/-0.14099	1.0226 +/-0.11413	1.026 +/-0.098214	1.0129 +/-0.35072
1	1.0303 +/-0.095166	1.0301 +/-0.12972	0.99007 +/-0.094151	1.013 +/-0.088739	0.9405 +/-0.31366
2	1.0354 +/-0.097604	1.0733 +/-0.13738	1.0284 +/-0.10227	1.0279 +/-0.082742	0.88266 +/-0.26723
3	1.0498 +/-0.092718	1.0957 +/-0.13796	1.0527 +/-0.096983	1.0465 +/-0.076908	1.1225 +/-0.39133
4	1.0504 +/-0.094577	1.0813 +/-0.14262	1.0354 +/-0.093085	1.0465 +/-0.090711	1.0044 +/-0.32831
5	1.0918 +/-0.10312	1.1059 +/-0.13809	1.0619 +/-0.10564	1.0732 +/-0.08936	1.0982 +/-0.35279
6	1.0412 +/-0.086846	1.0645 +/-0.11096	1.0567 +/-0.088424	1.046 +/-0.078519	1.0677 +/-0.34062
7	1.0615 +/-0.092113	1.0699 +/-0.12062	1.0288 +/-0.091296	1.0481 +/-0.08061	1.1529 +/-0.39318

AQI Regression: General AQI predictor statistically significant on lag day 5 with 90% confidence.

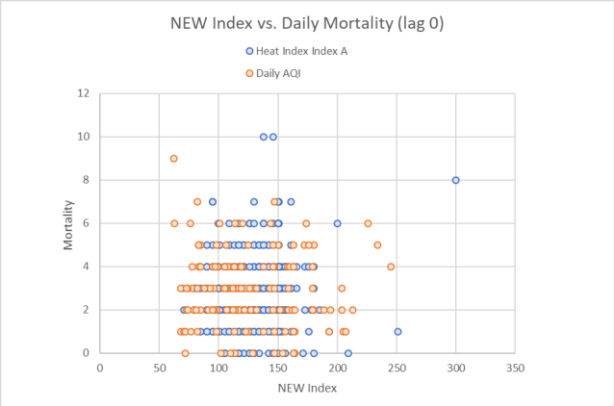
AQI+HI Regression: No statistically significant predictors.

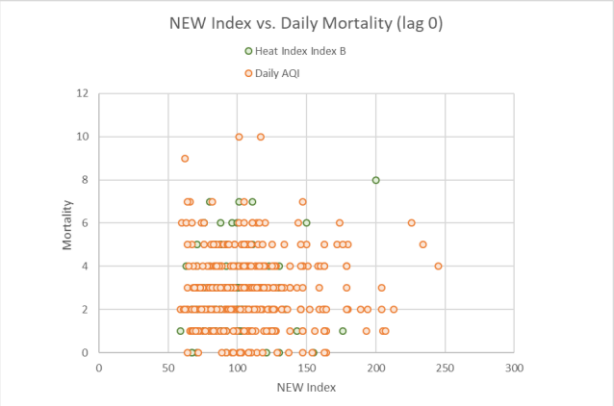
NEW A Regression: No statistically significant predictors.

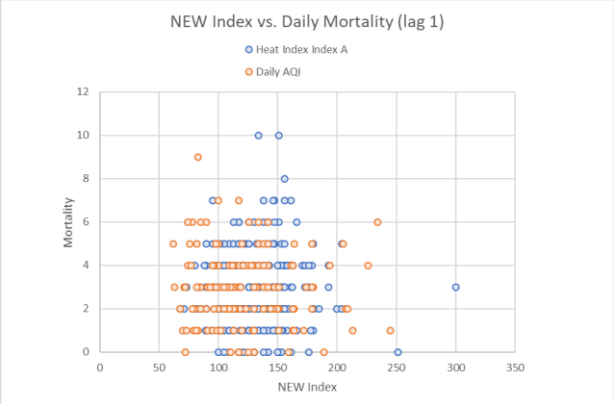
NEW B Regression: No statistically significant predictors.

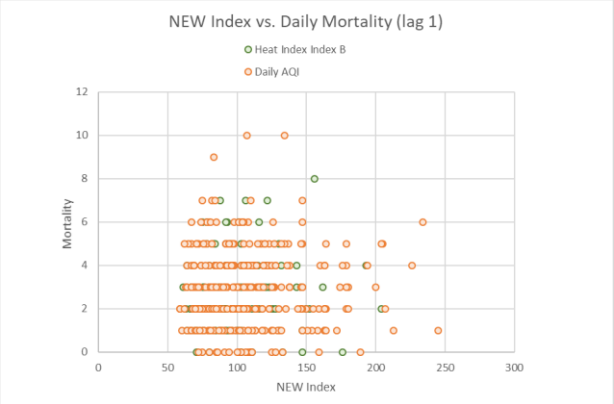
RAW Regression: No statistically significant predictors.

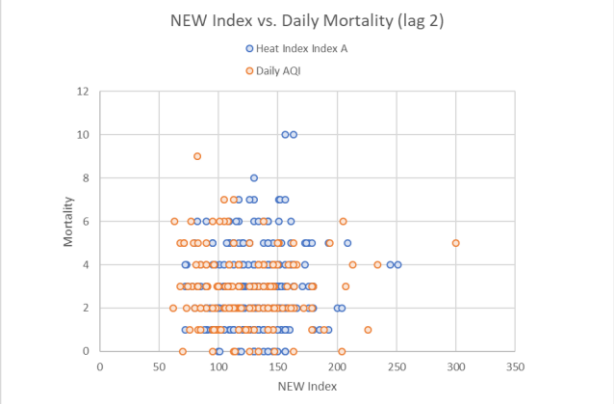
NEW Index vs. Daily Mortality Plots (for M, 75+, cardio, warm months)

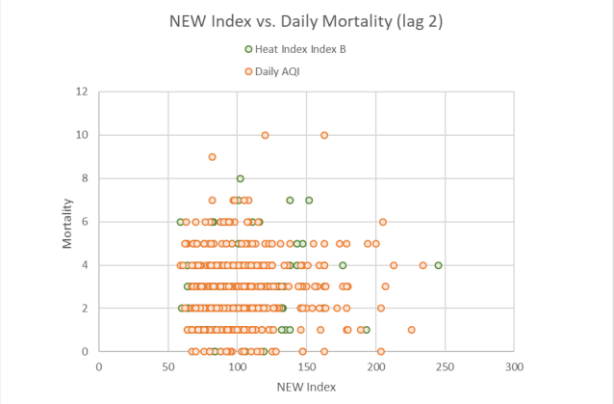


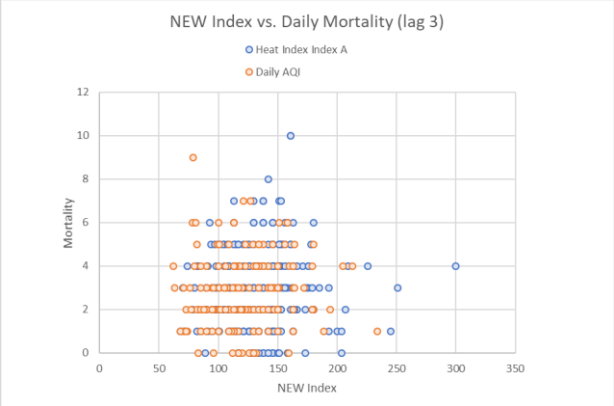


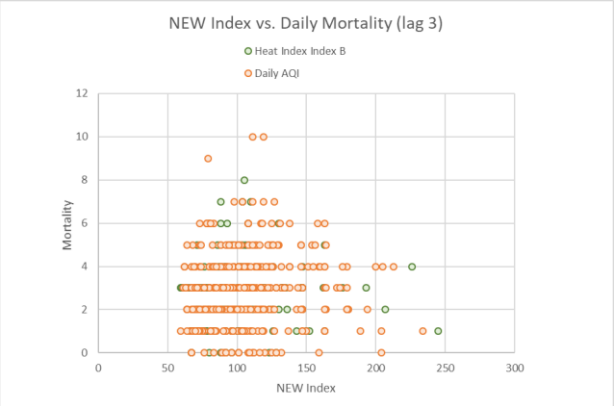


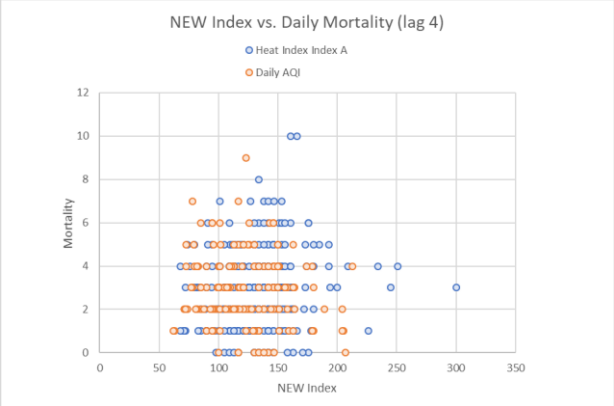


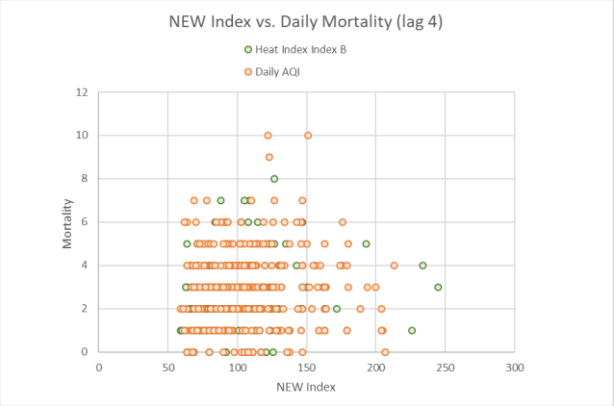


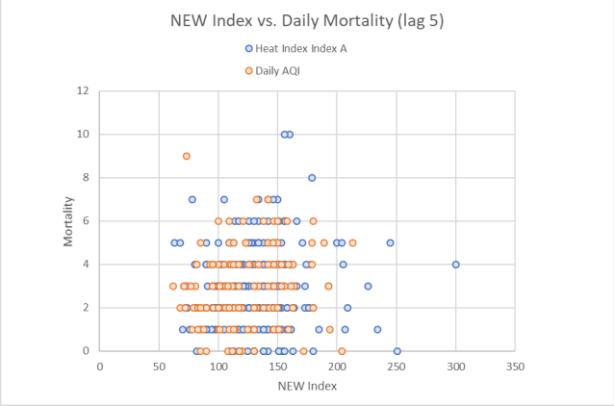


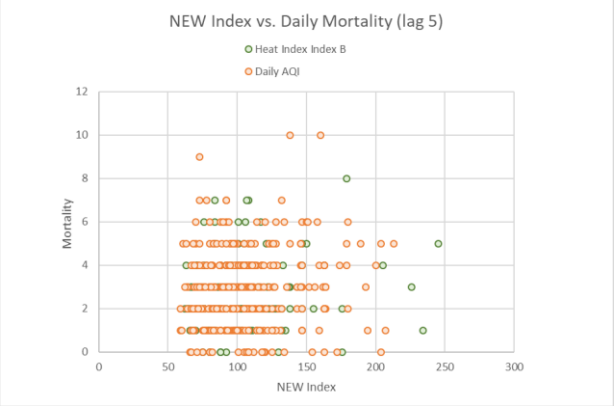

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

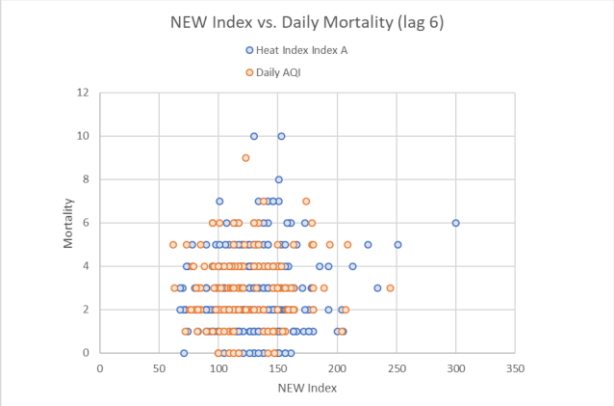

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

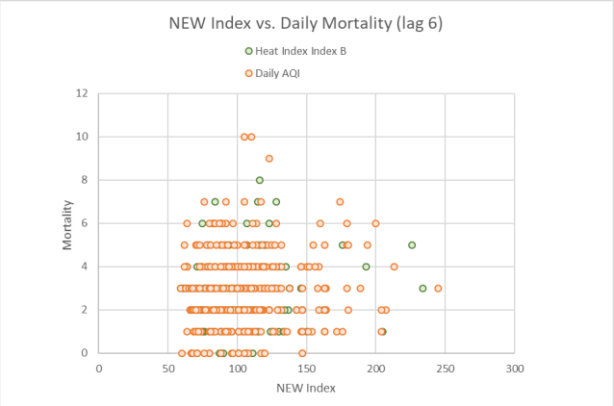

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

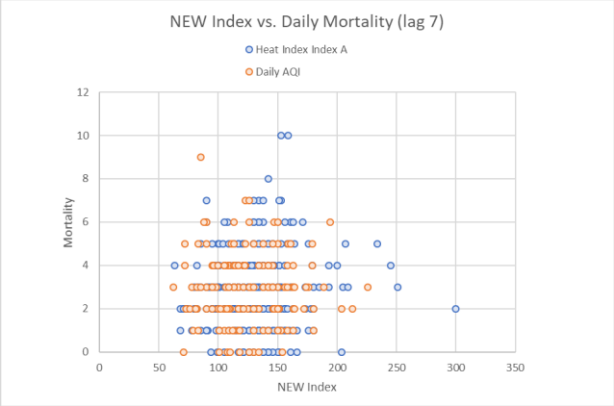

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

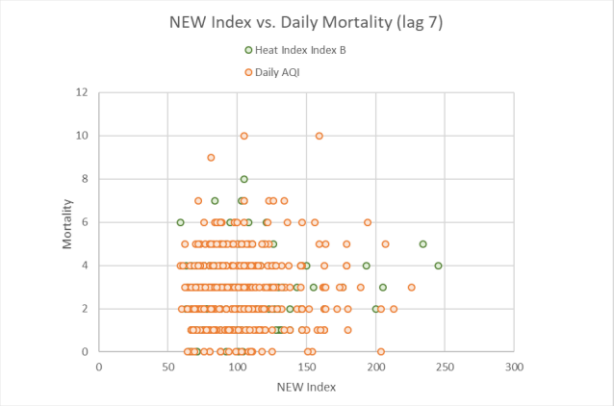

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300

Production Run:

M, 60-74, resp, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

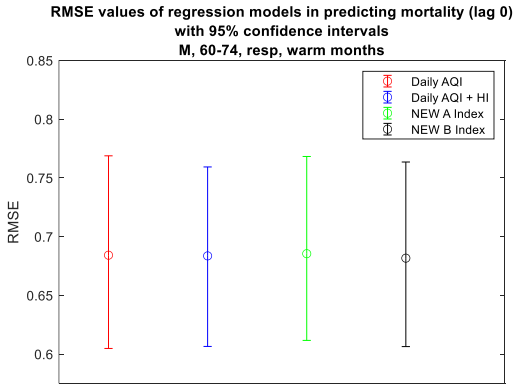
A

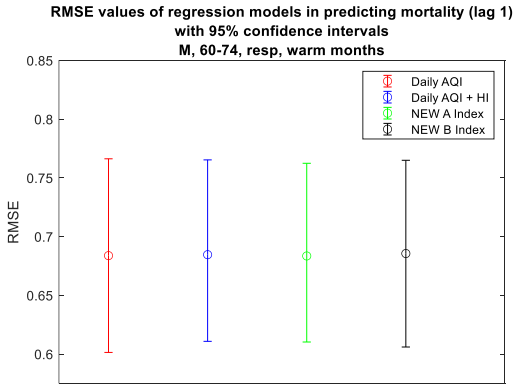
(how I originally defined the transformed HI in our NEW index)

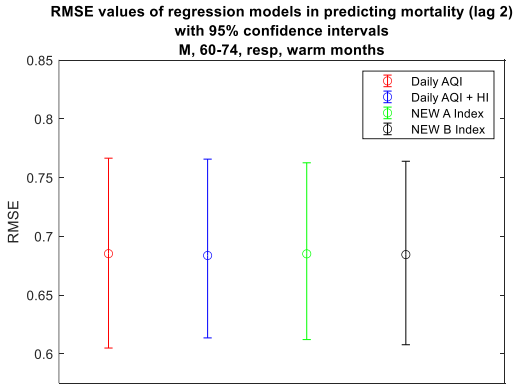
B

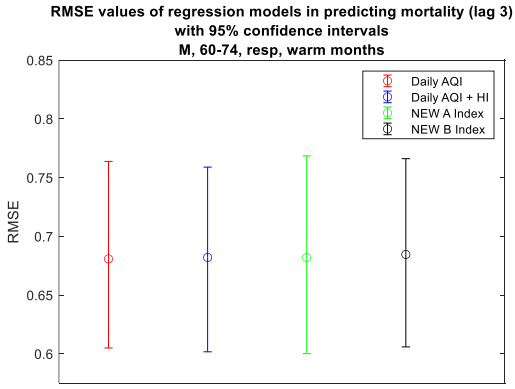
(transformed HI shifted down one category)

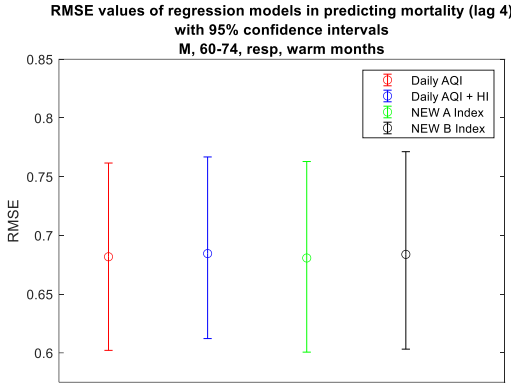
HI_Index Breakpoints		
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

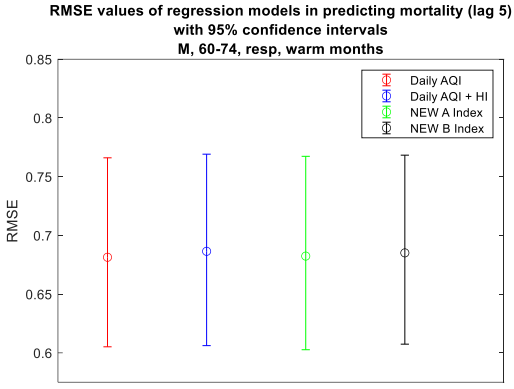


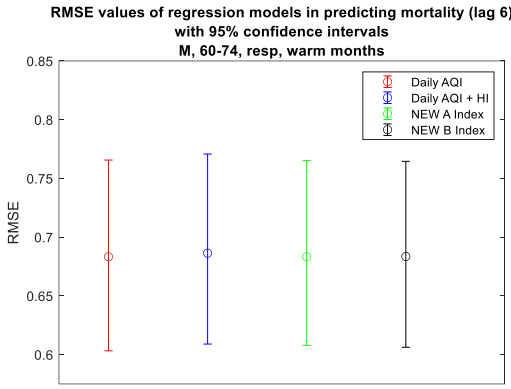


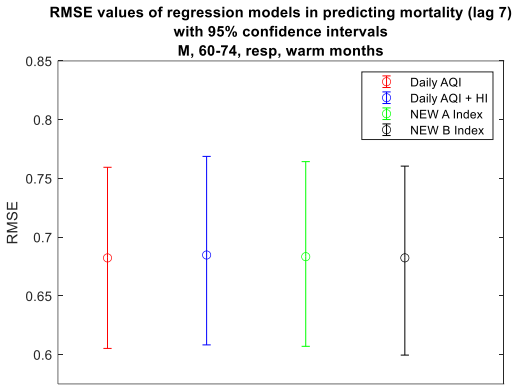





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.68415 +/-0.082005	0.68356 +/-0.076406	0.68543 +/-0.078294	0.68163 +/-0.078576
1	0.68378 +/-0.082431	0.6846 +/-0.077247	0.68349 +/-0.076082	0.68557 +/-0.079485
2	0.68521 +/-0.080824	0.68366 +/-0.076097	0.68507 +/-0.075259	0.68443 +/-0.07811
3	0.68079 +/-0.07942	0.68199 +/-0.078615	0.68198 +/-0.08418	0.68456 +/-0.080133
4	0.6818 +/-0.079749	0.68452 +/-0.077317	0.68076 +/-0.081137	0.68384 +/-0.084057
5	0.68138 +/-0.080452	0.68644 +/-0.081498	0.68237 +/-0.082336	0.68511 +/-0.080457
6	0.68328 +/-0.081209	0.68634 +/-0.080902	0.68326 +/-0.07864	0.68353 +/-0.079134
7	0.68232 +/-0.07711	0.68478 +/-0.080241	0.68336 +/-0.078618	0.68236 +/-0.080449

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	0.88672 +/-0.23717	0.90707 +/-0.33404	0.9091 +/-0.21587	0.87402 +/-0.22403	1.1724 +/-1.0009
1	1.0772 +/-0.26987	1.0838 +/-0.35686	1.0093 +/-0.2662	1.0445 +/-0.24534	1.6039 +/-1.2895
2	1.0518 +/-0.25186	0.93895 +/-0.29886	0.94461 +/-0.25826	0.99724 +/-0.23799	1.1537 +/-0.95036
3	1.1432 +/-0.25488	1.0611 +/-0.32739	0.98976 +/-0.24724	1.0717 +/-0.23181	1.6597 +/-1.3106
4	0.94632 +/-0.26502	0.90406 +/-0.30185	0.88833 +/-0.22734	0.91145 +/-0.25108	1.3981 +/-1.1123
5	0.97647 +/-0.22383	0.98372 +/-0.29358	0.98999 +/-0.23007	0.96318 +/-0.19143	0.99314 +/-0.79421
6	1.0611 +/-0.24556	1.0808 +/-0.31407	1.0431 +/-0.25415	1.0678 +/-0.22524	1.0466 +/-0.85006
7	0.95673 +/-0.2206	0.95907 +/-0.28711	0.94769 +/-0.21785	0.94881 +/-0.20415	0.90835 +/-0.82287

AQI Regression: No statistically significant predictors.

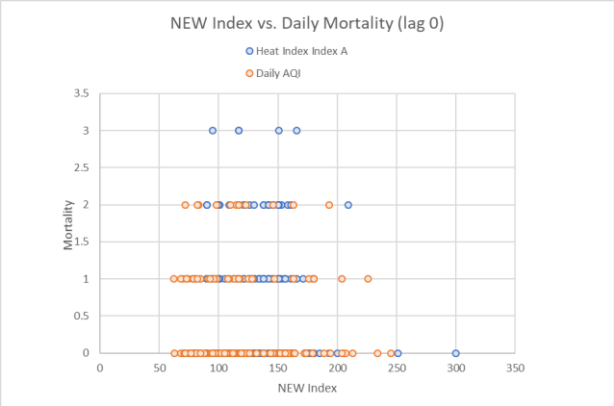
AQI+HI Regression: No statistically significant predictors.

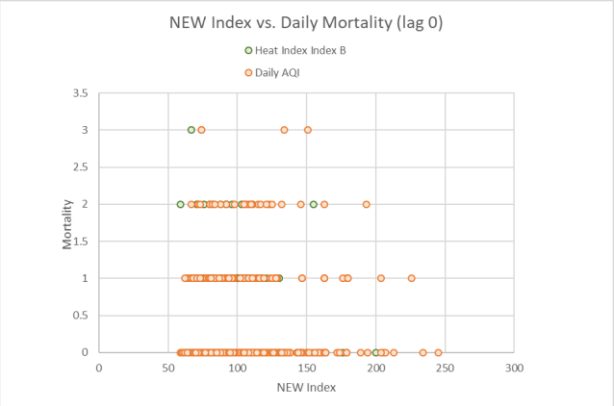
NEW A Regression: No statistically significant predictors.

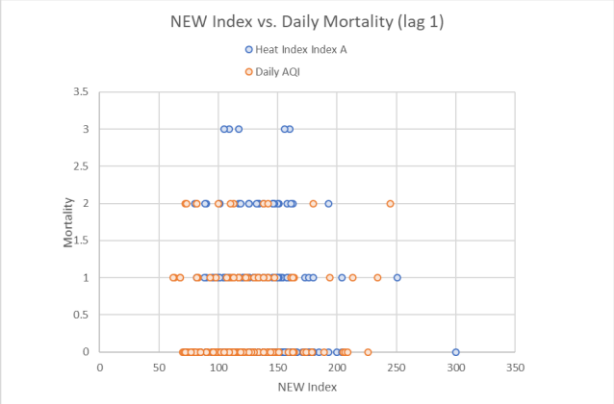
NEW B Regression: No statistically significant predictors.

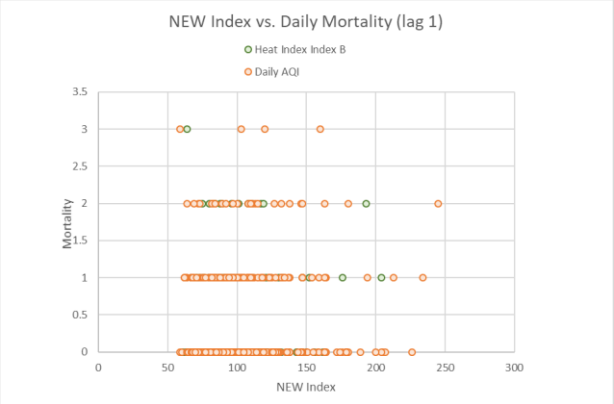
RAW Regression: No statistically significant predictors.

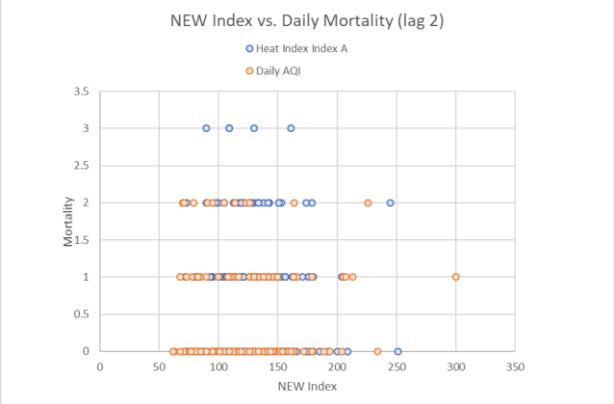
NEW Index vs. Daily Mortality Plots (for M, 60-74, resp, warm months)

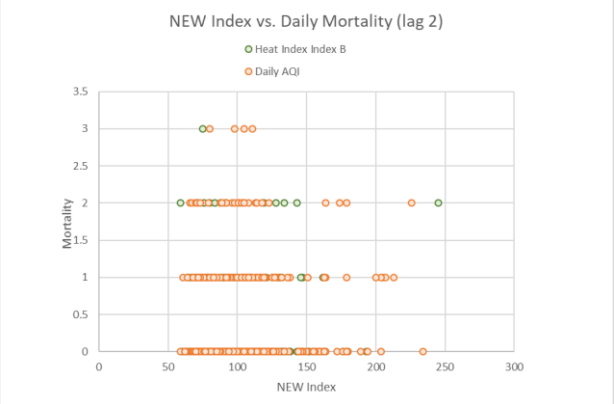


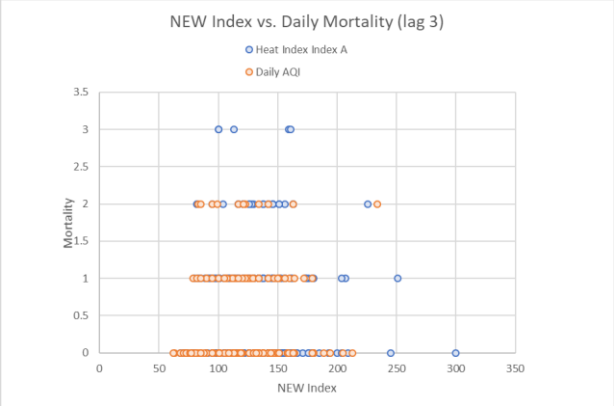


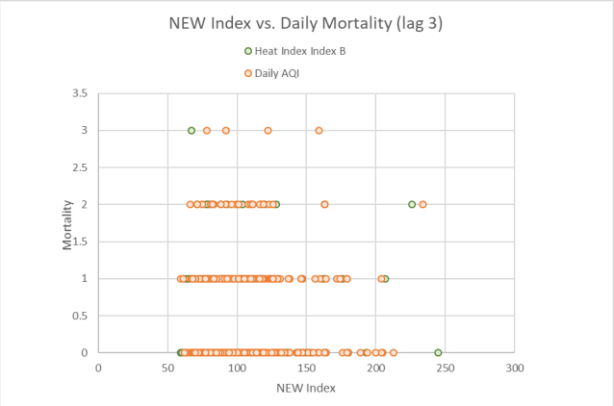


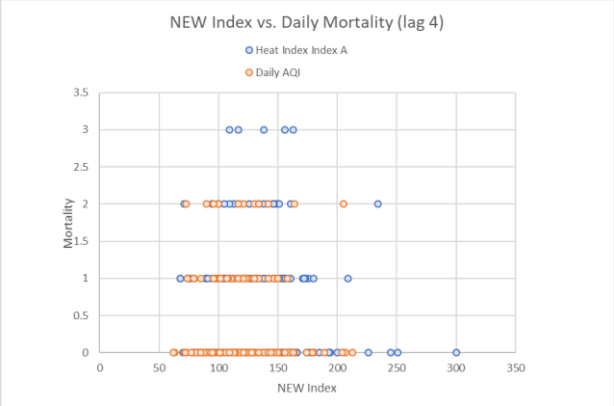


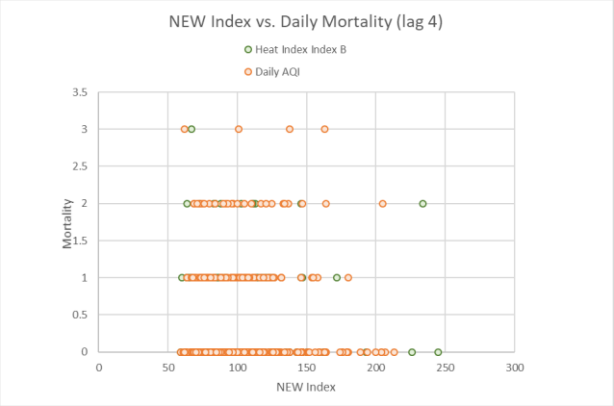


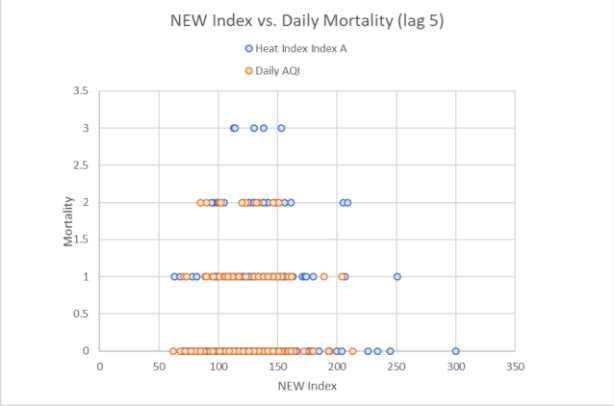


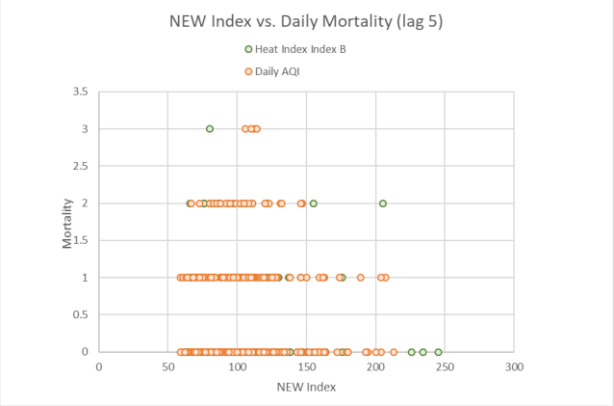

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

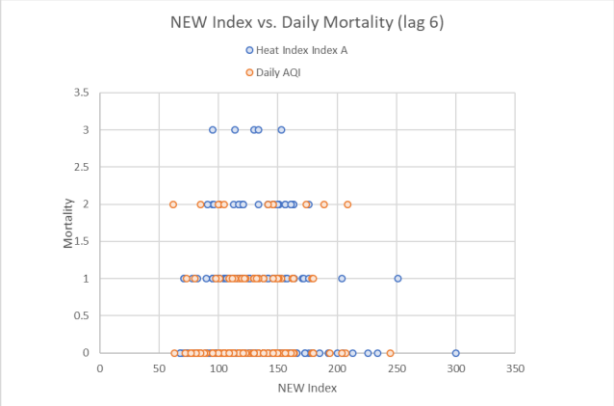

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

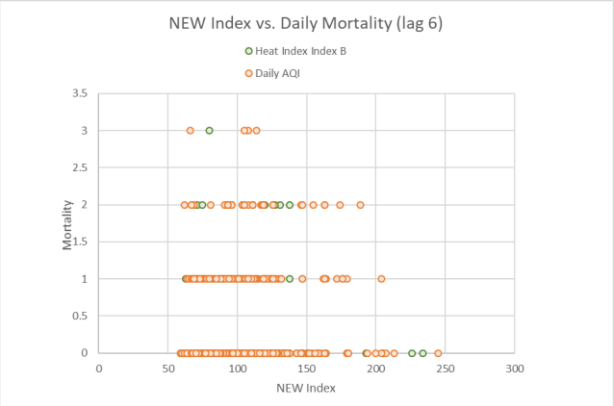

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

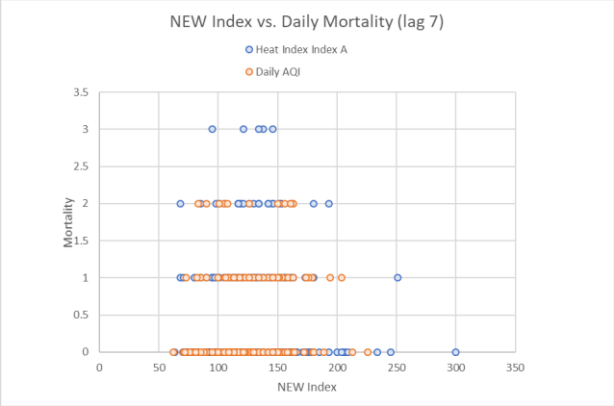

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

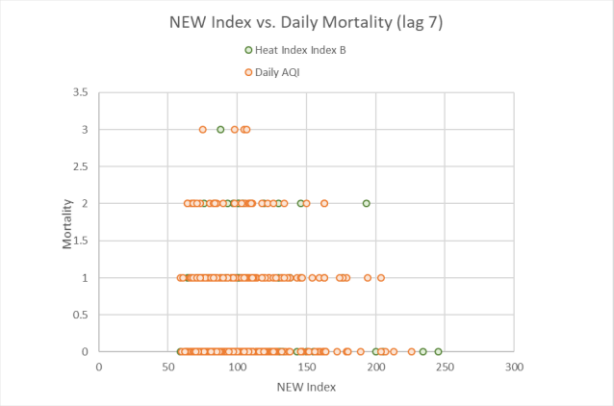

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300

Production Run:

M, 75+, resp, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

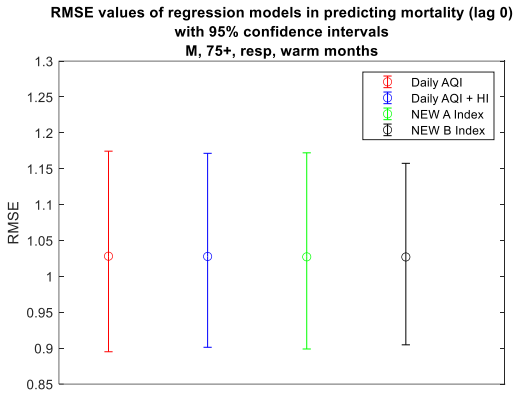
(how I originally defined the transformed HI in our NEW index)

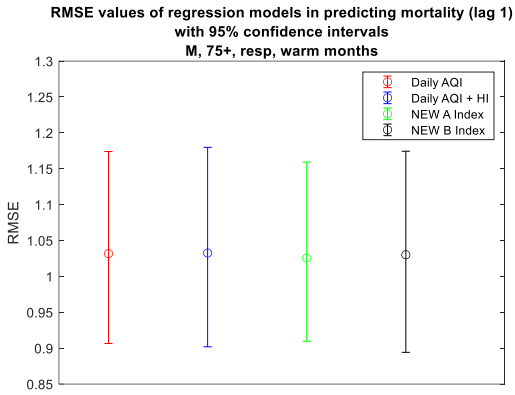
B

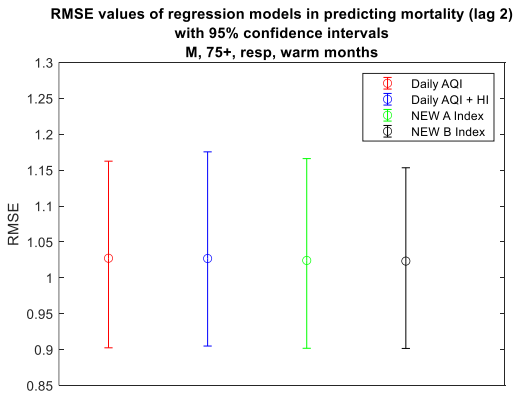
(transformed HI shifted down one category)

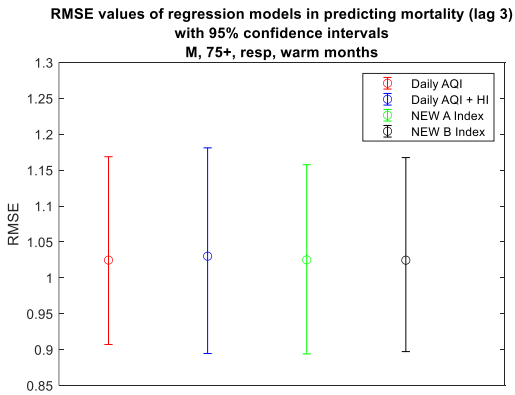
HI_Index Breakpoints

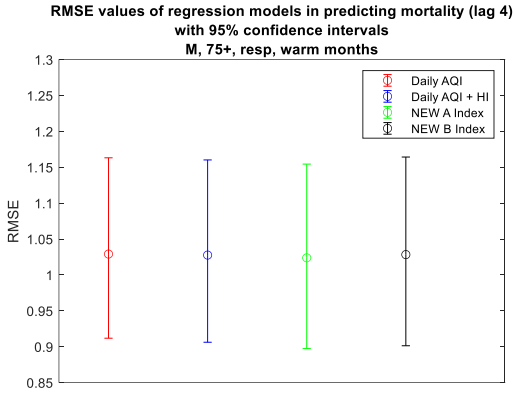
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

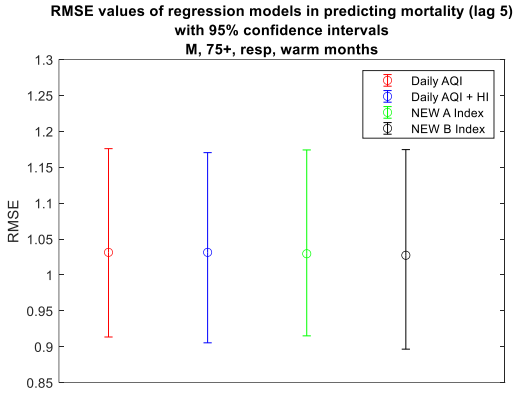









RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
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Daily AQI + HI
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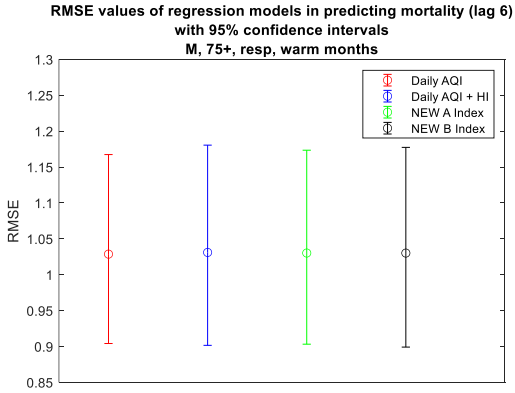
RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
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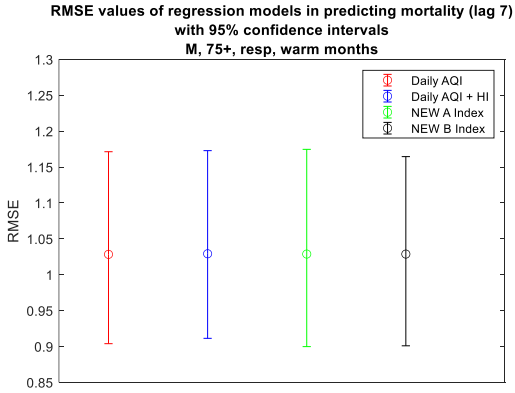
0.85


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.0282 +/-0.13973	1.0278 +/-0.13512	1.0273 +/-0.13664	1.0271 +/-0.12643
1	1.0317 +/-0.13376	1.0326 +/-0.13894	1.0258 +/-0.12486	1.0302 +/-0.1401
2	1.0273 +/-0.13001	1.0269 +/-0.13527	1.0242 +/-0.13212	1.0233 +/-0.12586
3	1.0246 +/-0.13079	1.0301 +/-0.14327	1.0251 +/-0.13178	1.0246 +/-0.13514
4	1.0291 +/-0.12566	1.0277 +/-0.127	1.0238 +/-0.12851	1.0283 +/-0.13147
5	1.0314 +/-0.13121	1.0314 +/-0.13248	1.0295 +/-0.1295	1.0274 +/-0.13901
6	1.0287 +/-0.13162	1.0311 +/-0.13946	1.0303 +/-0.13512	1.0302 +/-0.13912
7	1.0284 +/-0.13372	1.0292 +/-0.13076	1.0288 +/-0.13742	1.0288 +/-0.13178

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	0.97054 +/-0.14886	1.0713 +/-0.21028	1.1 +/-0.16419	0.98119 +/-0.13213	1.1489 +/-0.65782
1	1.0563 +/-0.15018	1.1373 +/-0.22772	1.1052 +/-0.15137	1.0687 +/-0.13968	1.403 +/-0.78912
2	0.98858 +/-0.13585	1.0717 +/-0.21165	1.0539 +/-0.16086	0.99891 +/-0.12502	1.2676 +/-0.72259
3	1.036 +/-0.15785	1.1331 +/-0.22569	1.0926 +/-0.16956	1.0508 +/-0.14646	1.2569 +/-0.69263
4	1.0737 +/-0.17877	1.1347 +/-0.23539	1.1458 +/-0.19356	1.089 +/-0.15596	1.5156 +/-0.78878
5	1.0257 +/-0.18938	0.98906 +/-0.2109	1.0283 +/-0.1653	1.0215 +/-0.16081	0.80326 +/-0.4694
6	1.0279 +/-0.14444	1.0229 +/-0.18729	1.0173 +/-0.14808	1.0308 +/-0.13196	0.73596 +/-0.42841
7	1.0085 +/-0.16844	1.0525 +/-0.23774	1.077 +/-0.19424	1.004 +/-0.15103	1.0021 +/-0.5988

AQI Regression: No statistically significant predictors.

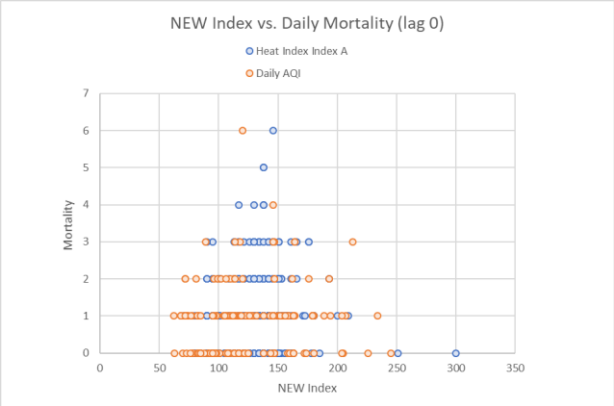
AQI+HI Regression: No statistically significant predictors.

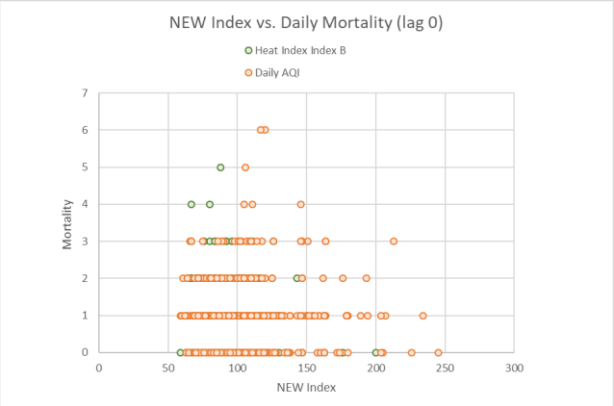
NEW A Regression: No statistically significant predictors.

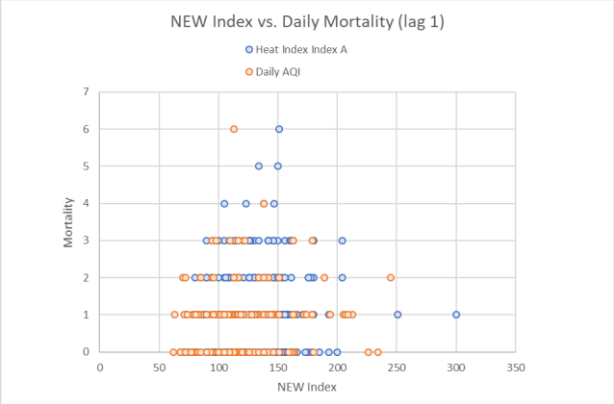
NEW B Regression: No statistically significant predictors.

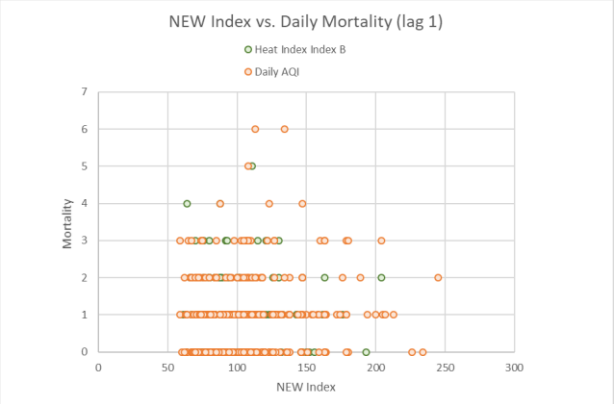
RAW Regression: Relative humidity predictor statistically significant on lag day 4 with 90% confidence.

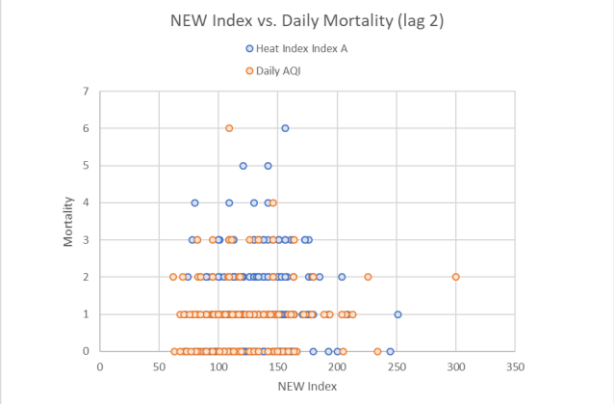
NEW Index vs. Daily Mortality Plots (for M, 75+, resp, warm months)

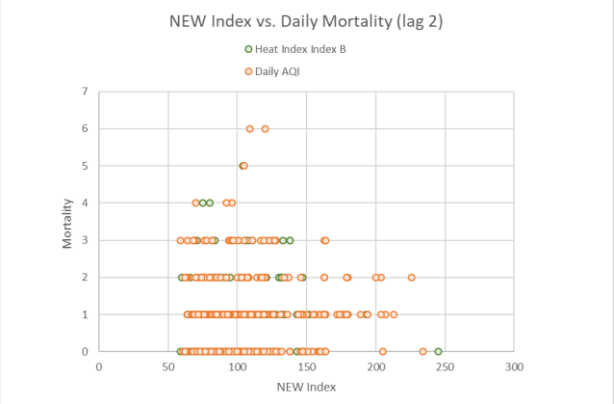


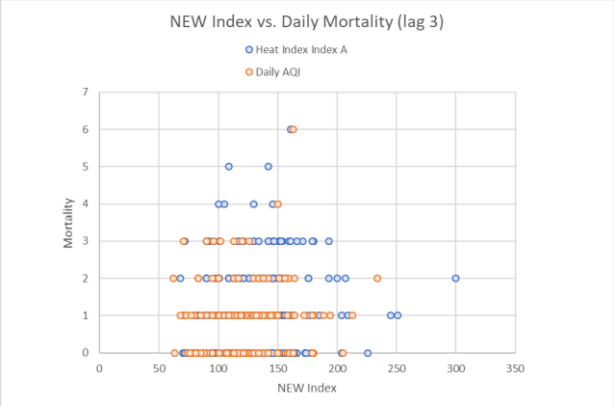


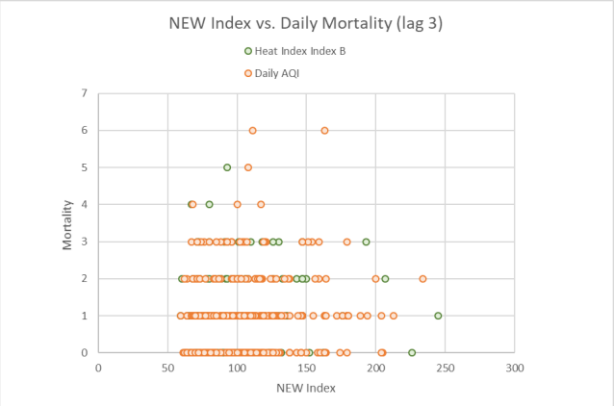


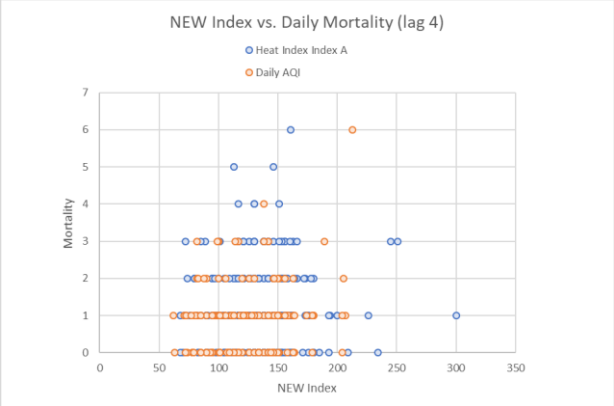


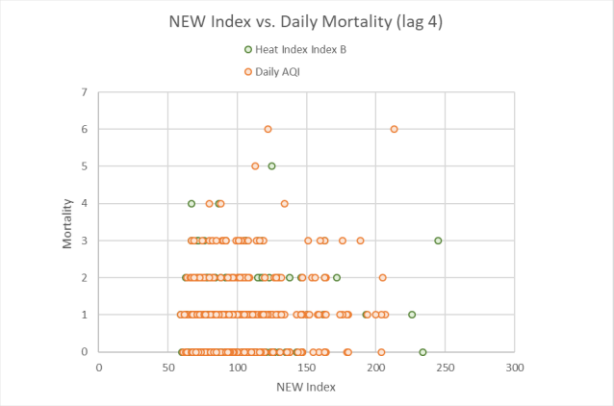


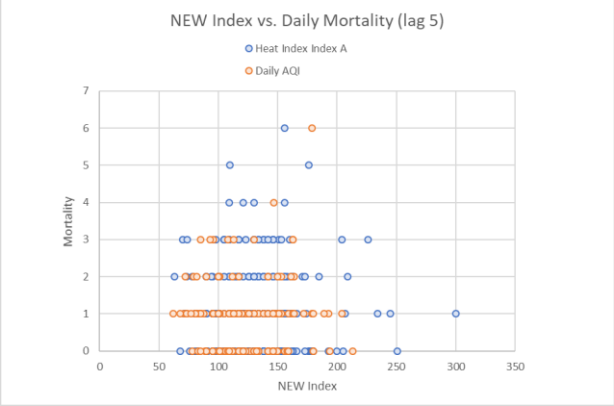


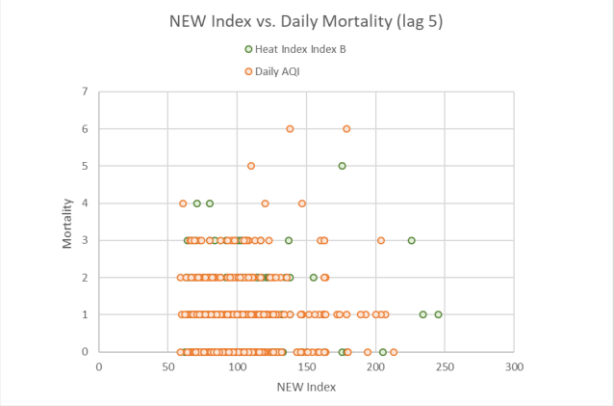

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

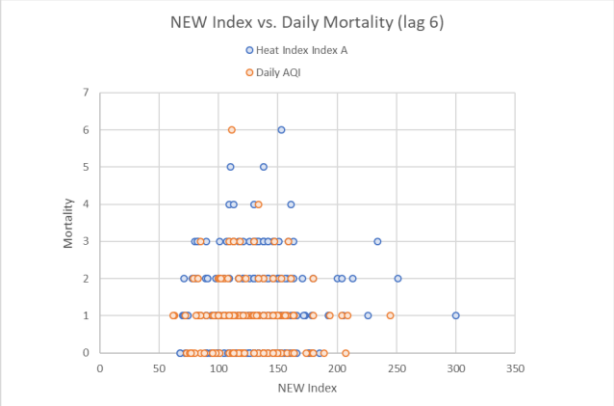

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

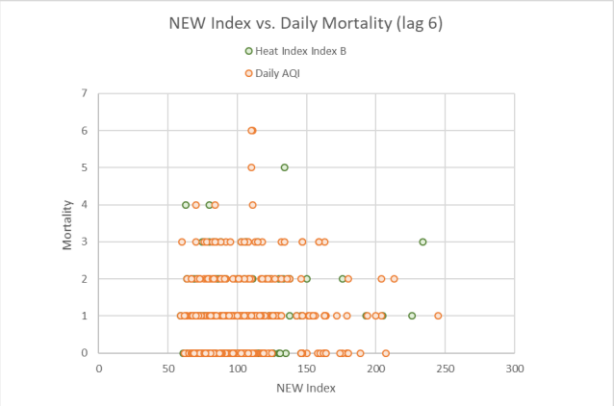

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

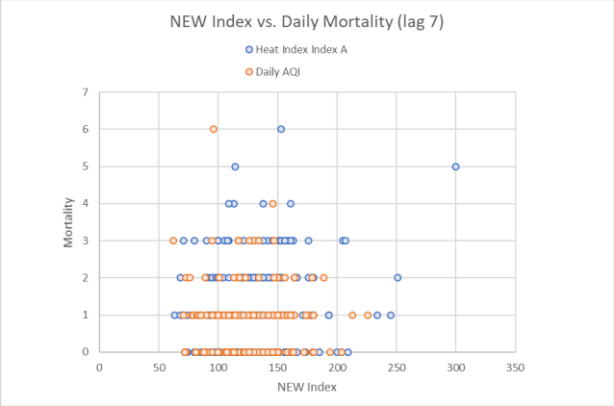

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

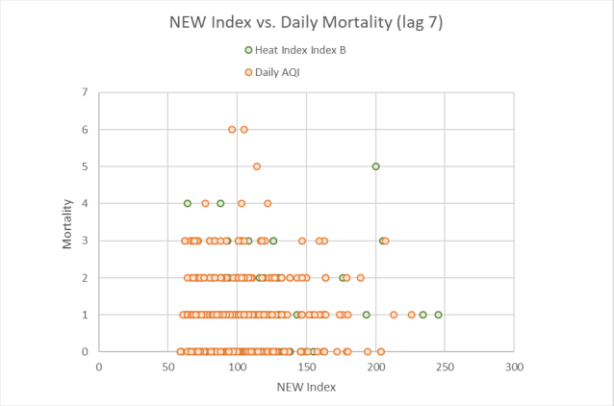

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300

Production Run:

F, 60-74, cardio, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

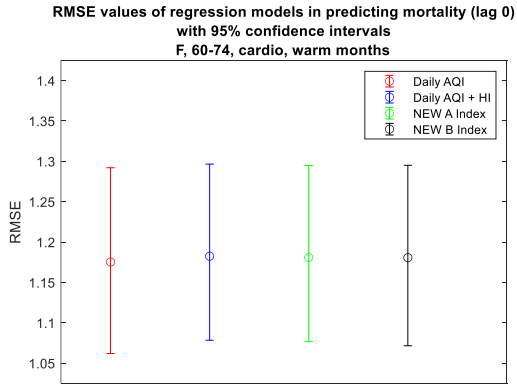
(how I originally defined the transformed HI in our NEW index)

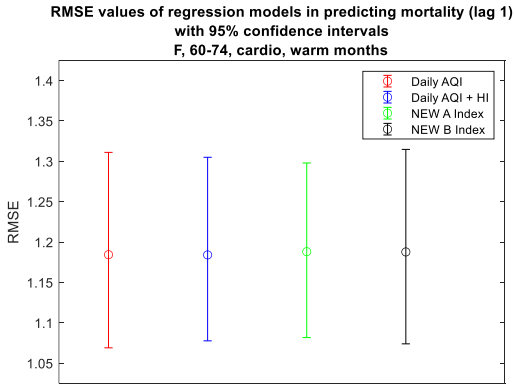
B

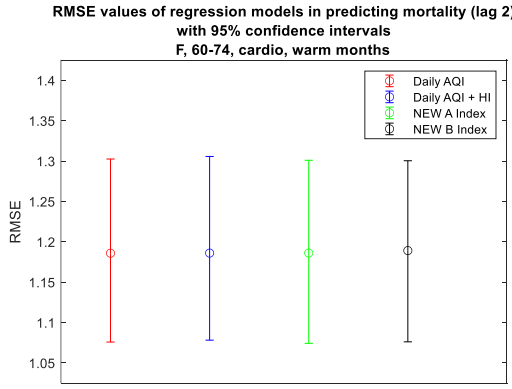
(transformed HI shifted down one category)

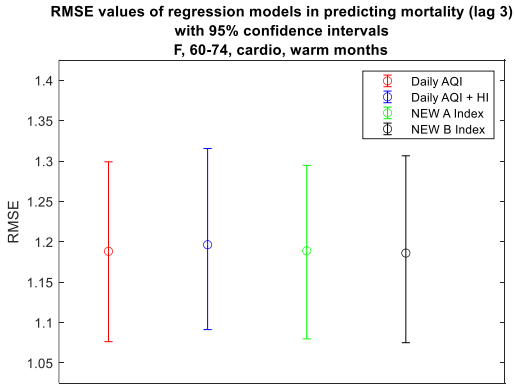
HI_Index Breakpoints

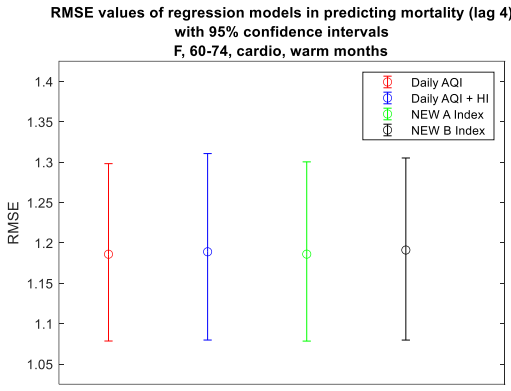
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

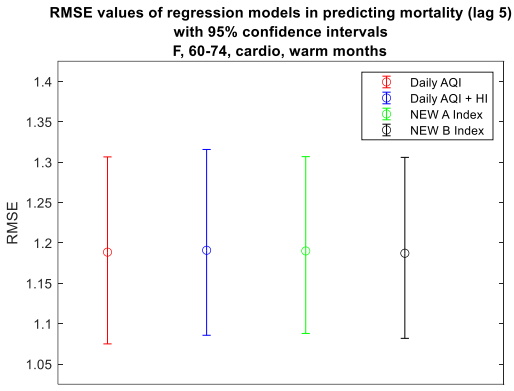


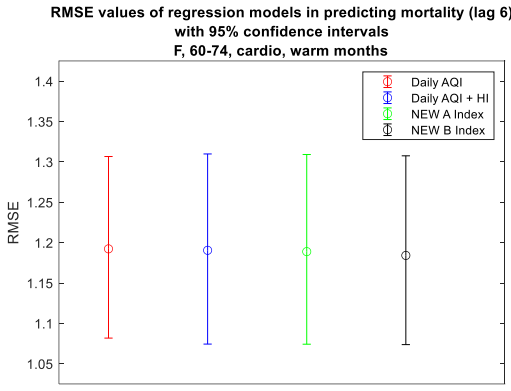


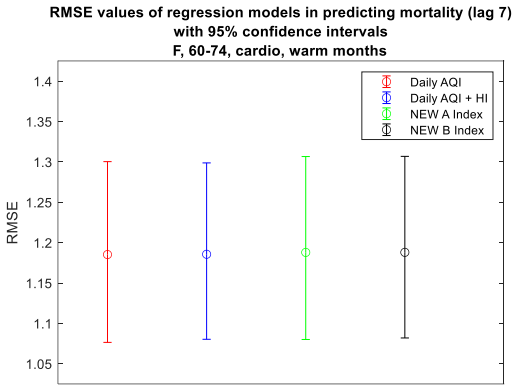





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.1753 +/-0.11503	1.1825 +/-0.10907	1.181 +/-0.1089	1.1807 +/-0.11174
1	1.1844 +/-0.12103	1.1841 +/-0.11366	1.1881 +/-0.1081	1.1878 +/-0.1204
2	1.1859 +/-0.11334	1.186 +/-0.11375	1.1861 +/-0.11335	1.1891 +/-0.11214
3	1.1882 +/-0.11134	1.1964 +/-0.11212	1.1889 +/-0.10744	1.1861 +/-0.11572
4	1.186 +/-0.10983	1.189 +/-0.11546	1.1861 +/-0.11098	1.1912 +/-0.11275
5	1.1885 +/-0.11578	1.1909 +/-0.11505	1.19 +/-0.10949	1.1872 +/-0.11206
6	1.1923 +/-0.11244	1.1905 +/-0.11773	1.1889 +/-0.11746	1.1842 +/-0.1169
7	1.1852 +/-0.11193	1.1856 +/-0.10922	1.1879 +/-0.11327	1.188 +/-0.11244

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.1133 +/-0.12906	1.1219 +/-0.18027	1.095 +/-0.14395	1.1004 +/-0.1141	1.4861 +/-0.59181
1	1.081 +/-0.13889	1.0793 +/-0.17762	1.0418 +/-0.13994	1.0734 +/-0.12418	1.2168 +/-0.53726
2	1.002 +/-0.13879	0.99159 +/-0.17748	0.98339 +/-0.1213	1.0157 +/-0.12296	0.99133 +/-0.47045
3	0.9932 +/-0.13839	0.98331 +/-0.19021	0.99945 +/-0.13586	0.99519 +/-0.12482	0.83331 +/-0.35704
4	1.0577 +/-0.12971	1.0357 +/-0.17611	0.99043 +/-0.12411	1.0259 +/-0.11699	1.0582 +/-0.47839
5	1.0641 +/-0.13307	1.0232 +/-0.16206	1.021 +/-0.13918	1.0562 +/-0.12821	0.87951 +/-0.3886
6	0.99896 +/-0.12839	0.98307 +/-0.16004	0.99988 +/-0.13512	0.98432 +/-0.1221	0.85147 +/-0.38597
7	1.066 +/-0.13544	1.0281 +/-0.16865	0.99539 +/-0.12897	1.0248 +/-0.12968	0.90891 +/-0.45525

AQI Regression: No statistically significant predictors.

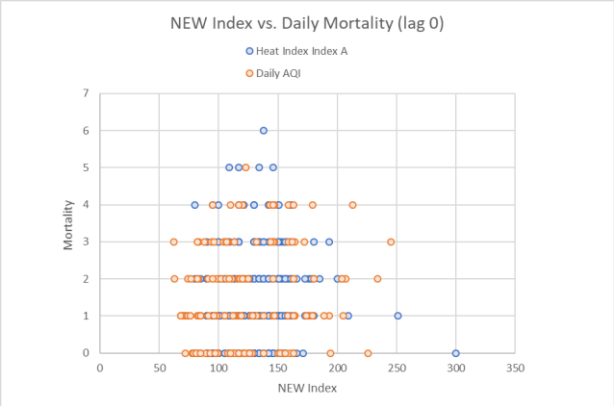
AQI+HI Regression: General AQI predictor statistically significant on lag day 0 with 90% confidence.

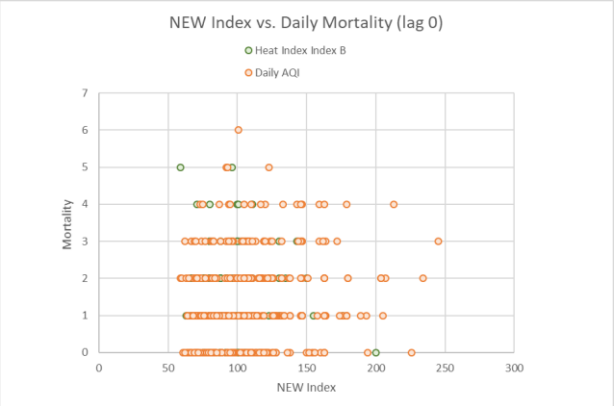
NEW A Regression: No statistically significant predictors.

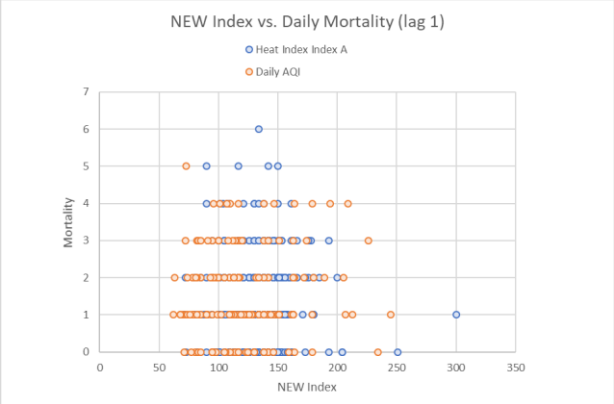
NEW B Regression: NEW B predictor statistically significant on lag day 0 with 90% confidence.

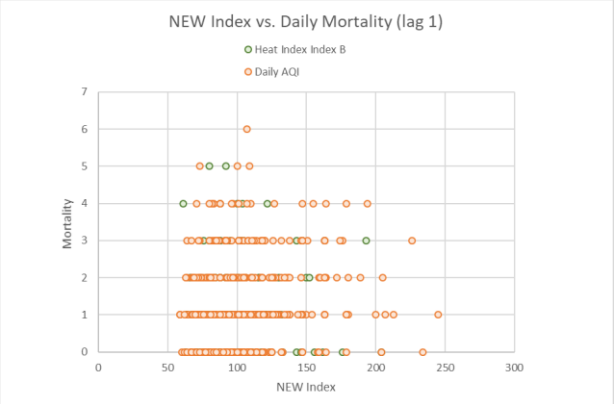
RAW Regression: NO2 predictor statistically significant on lag day 0 with 90% confidence.

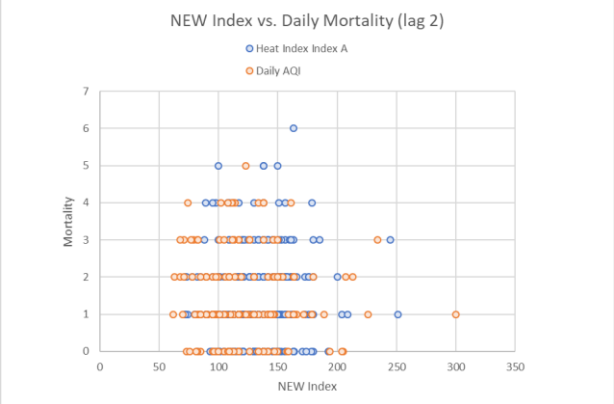
NEW Index vs. Daily Mortality Plots (for F, 60-74, cardio, summer)

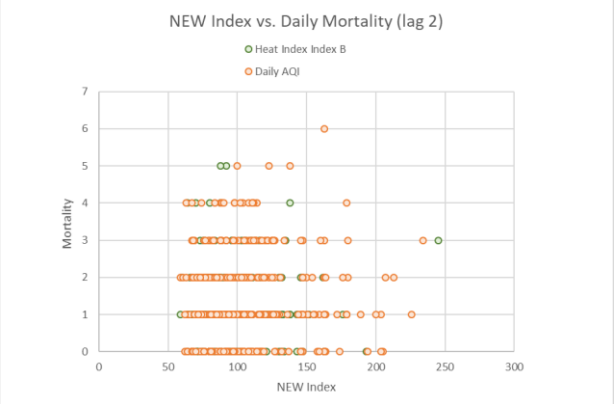


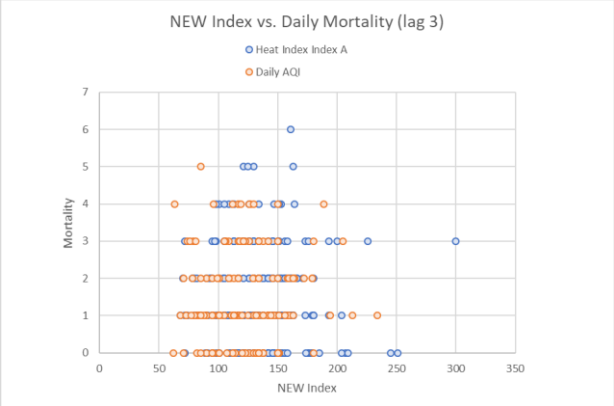


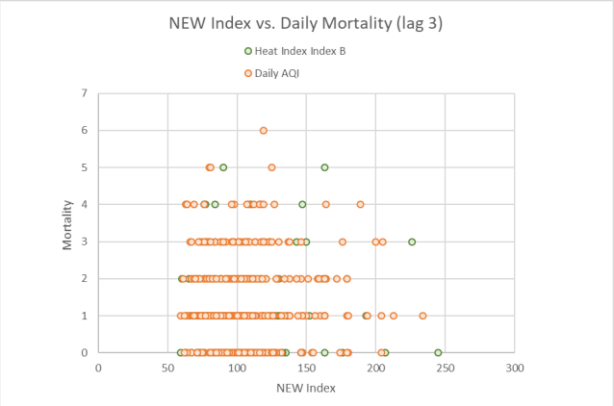


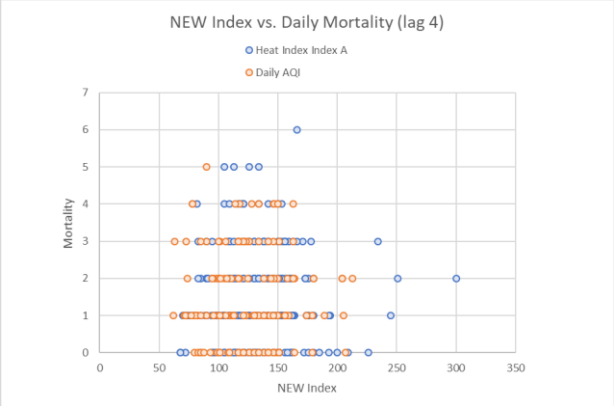


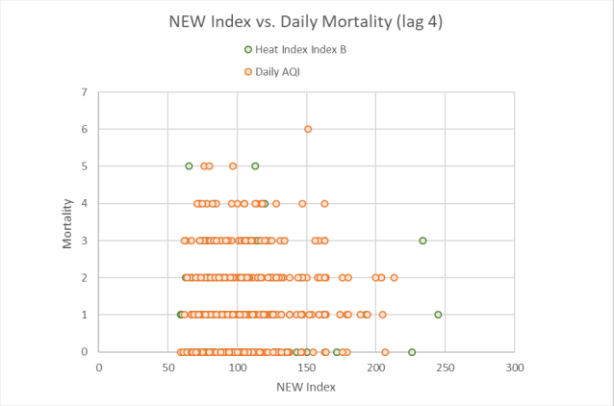


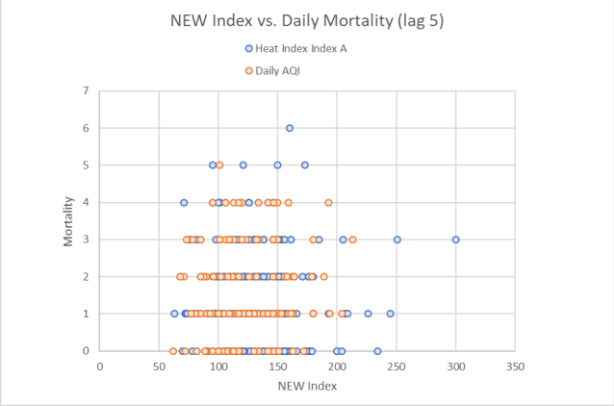


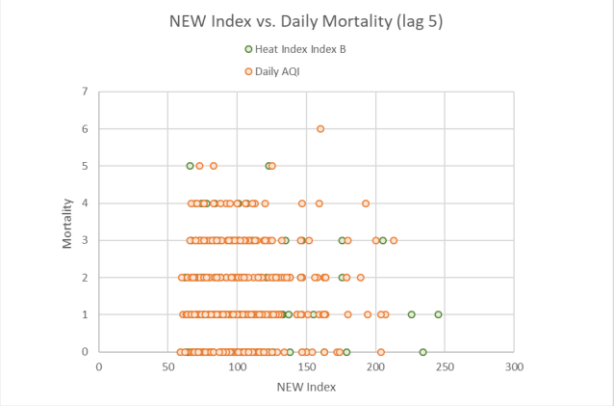

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

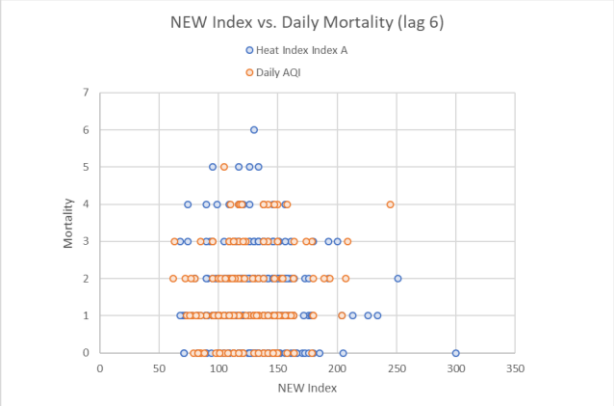

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

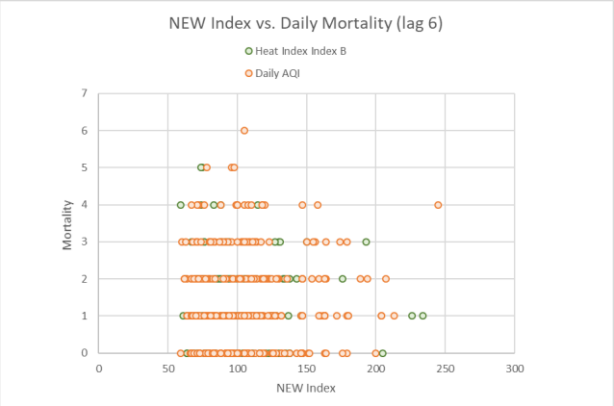

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

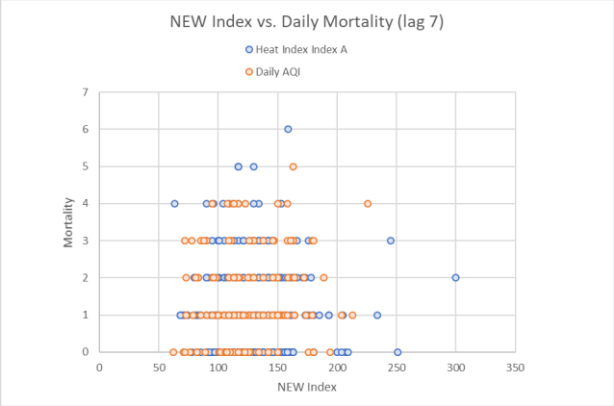

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

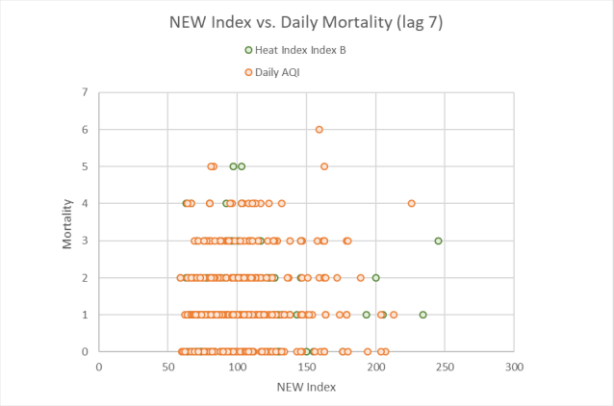

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300

Production Run:

F, 75+, cardio, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

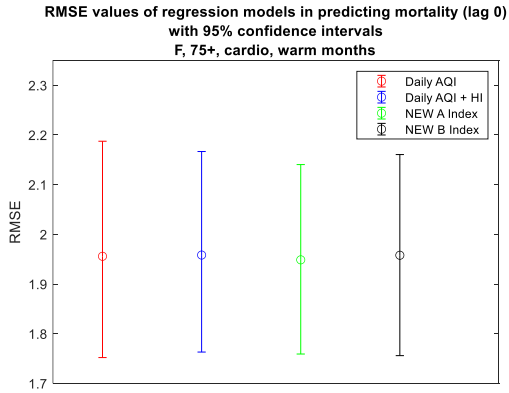
(how I originally defined the transformed HI in our NEW index)

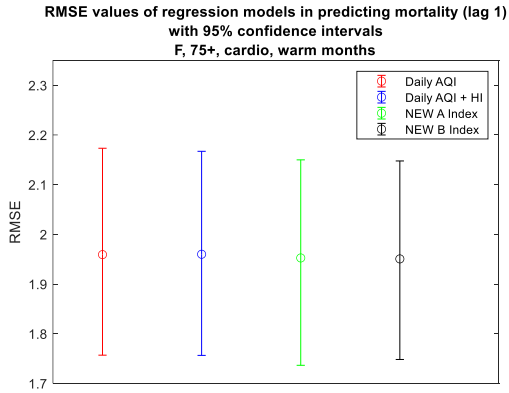
B

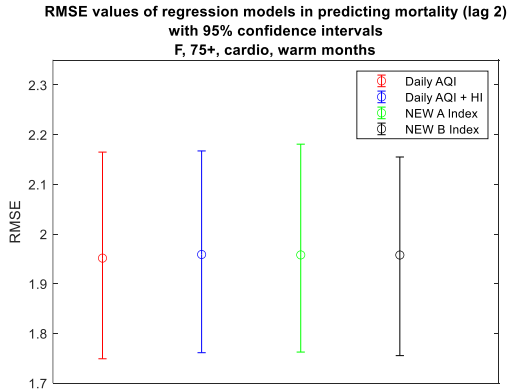
(transformed HI shifted down one category)

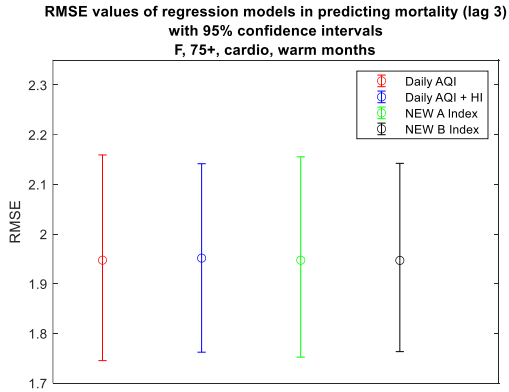
HI_Index Breakpoints

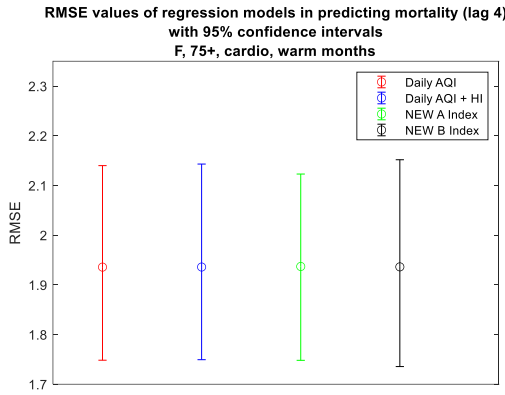
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

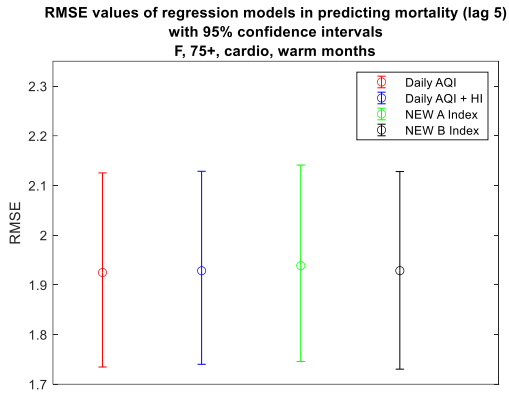


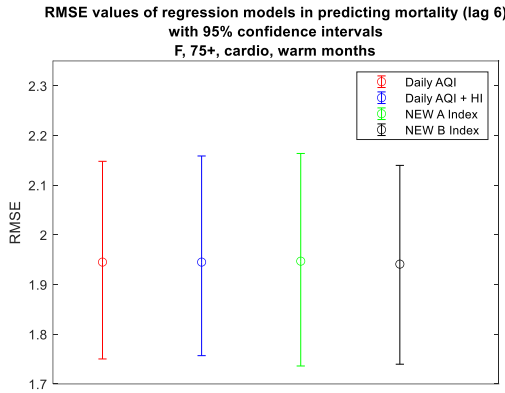


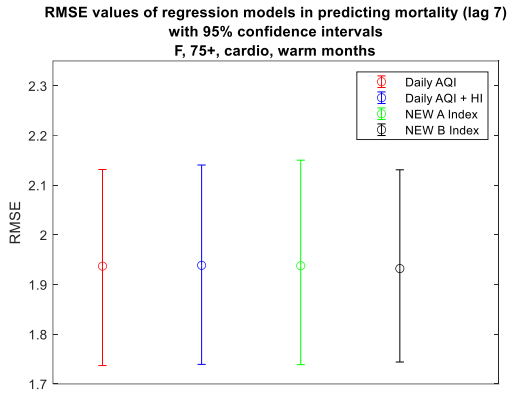





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.9558 +/-0.21768	1.9583 +/-0.20178	1.9487 +/-0.19062	1.9579 +/-0.20232
1	1.9592 +/-0.2082	1.9599 +/-0.20534	1.9525 +/-0.20672	1.9505 +/-0.19975
2	1.9515 +/-0.20794	1.9589 +/-0.20302	1.958 +/-0.20918	1.9578 +/-0.19987
3	1.9474 +/-0.20699	1.9516 +/-0.18963	1.9473 +/-0.20158	1.9469 +/-0.18947
4	1.9357 +/-0.19579	1.9358 +/-0.19684	1.9369 +/-0.18745	1.9361 +/-0.2081
5	1.9248 +/-0.1953	1.9284 +/-0.19422	1.9385 +/-0.1976	1.9285 +/-0.19883
6	1.9452 +/-0.19887	1.9452 +/-0.20092	1.9471 +/-0.21385	1.9411 +/-0.20006
7	1.9371 +/-0.19727	1.9387 +/-0.20062	1.9378 +/-0.20575	1.9322 +/-0.1934

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0313 +/-0.11207	1.0746 +/-0.13469	1.0623 +/-0.10496	1.0298 +/-0.094765	1.0873 +/-0.33178
1	1.0633 +/-0.10158	1.1011 +/-0.14677	1.0637 +/-0.1092	1.0497 +/-0.085132	1.0503 +/-0.32287
2	1.0654 +/-0.10833	1.1094 +/-0.13586	1.0681 +/-0.10939	1.0529 +/-0.092639	1.1895 +/-0.35186
3	1.069 +/-0.10942	1.1252 +/-0.14745	1.068 +/-0.10332	1.0654 +/-0.093609	1.216 +/-0.34758
4	1.0968 +/-0.10351	1.1522 +/-0.13877	1.0998 +/-0.097948	1.0852 +/-0.088802	1.3366 +/-0.41948
5	1.1052 +/-0.099616	1.1324 +/-0.12495	1.074 +/-0.096828	1.1015 +/-0.087674	1.2463 +/-0.35357
6	1.0781 +/-0.10498	1.0956 +/-0.13125	1.0466 +/-0.10526	1.0647 +/-0.10017	1.0266 +/-0.30649
7	1.0873 +/-0.09994	1.1266 +/-0.13961	1.0836 +/-0.10673	1.0696 +/-0.089458	1.2546 +/-0.3525

AQI Regression: General AQI predictor statistically significant on lag days 4 and 7 with 90% confidence and on lag day 5 with 95% confidence.

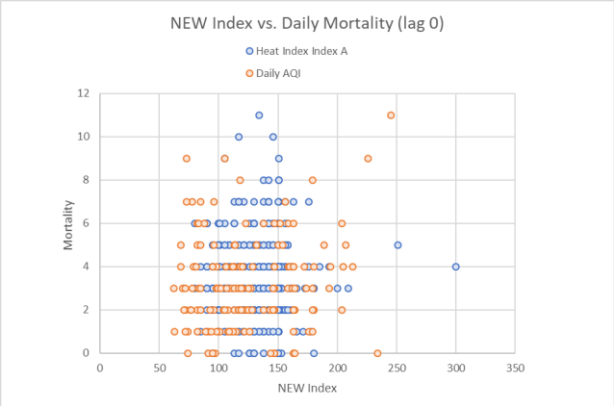
AQI+HI Regression: General AQI predictor statistically significant on lag day 4 with 90% confidence and on lag day 5 with 95% confidence.

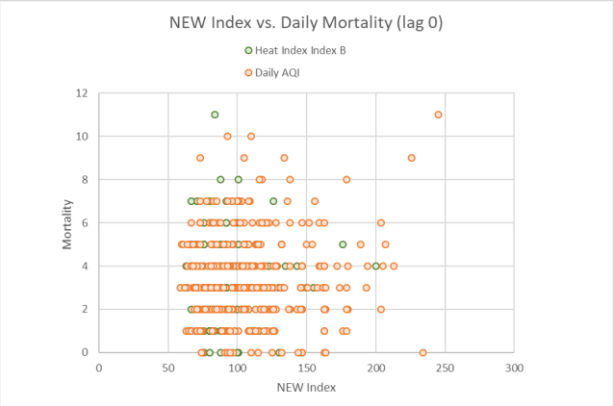
NEW A Regression: NEW-A index predictor statistically significant on lag day 7 with 90% confidence and on lag day 4 with 95% confidence.

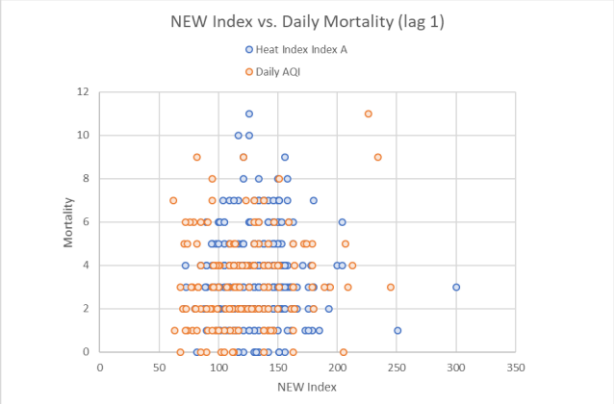
NEW B Regression: NEW-B index predictor statistically significant on lag day 4 with 90% confidence and on lag day 5 with 95% confidence.

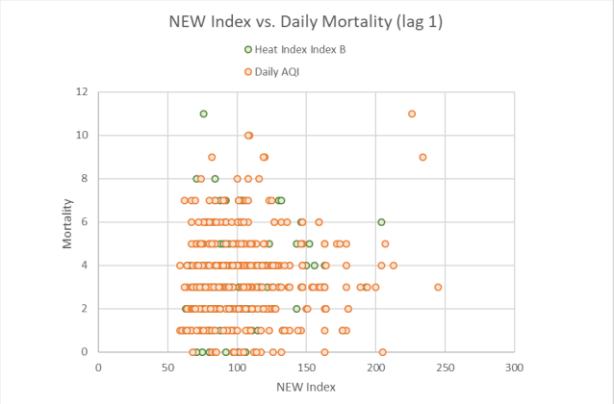
RAW Regression: No statistically significant predictors.

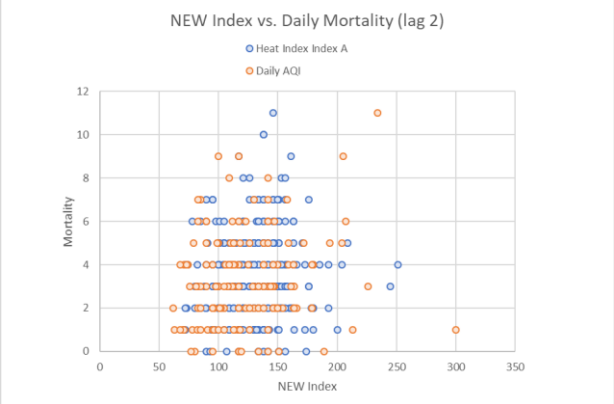
NEW Index vs. Daily Mortality Plots (for F, 75+, cardio, warm months)

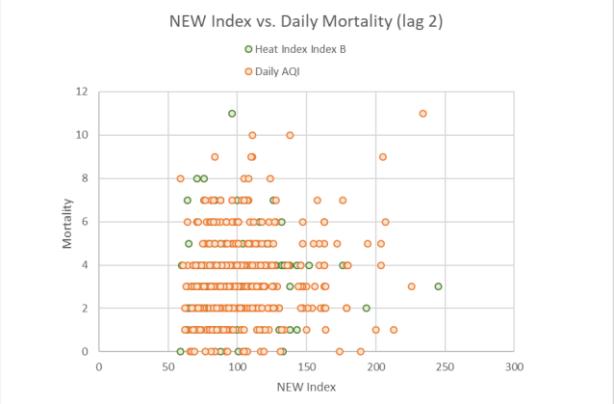


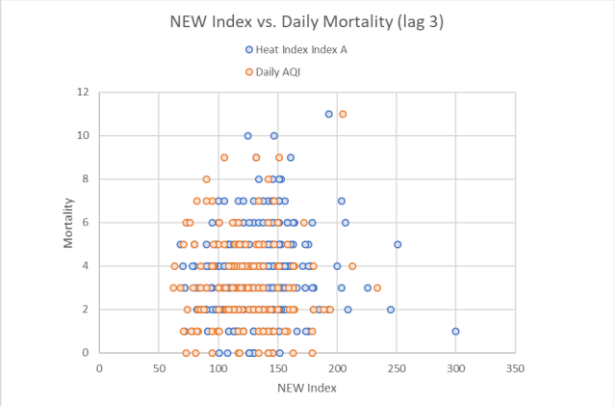


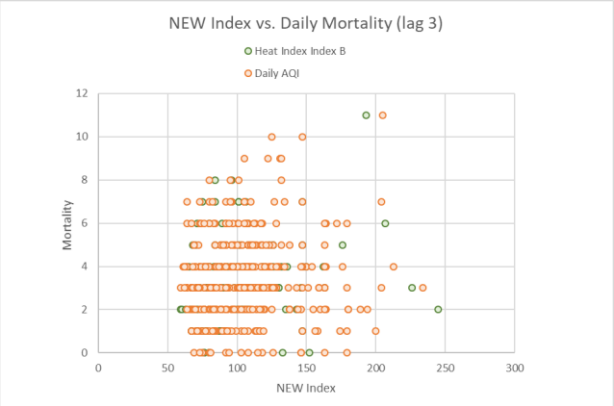


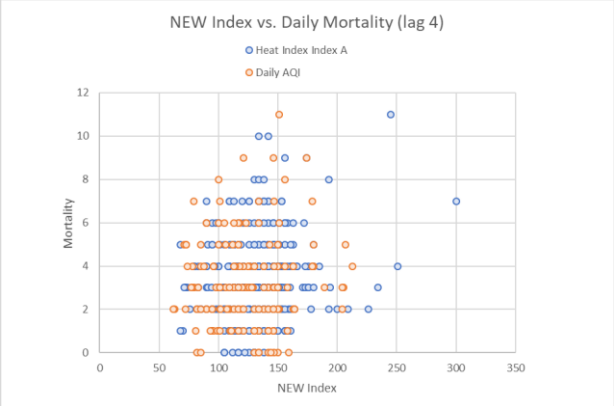


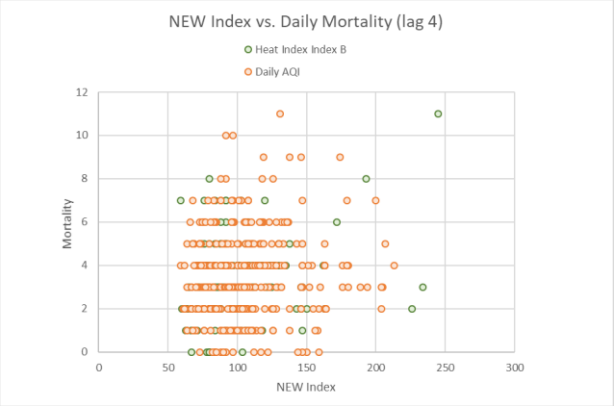


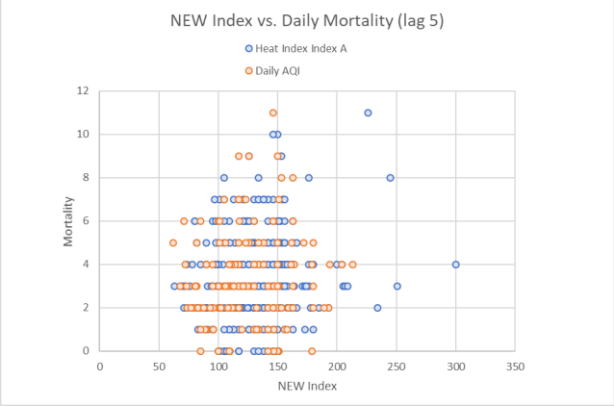


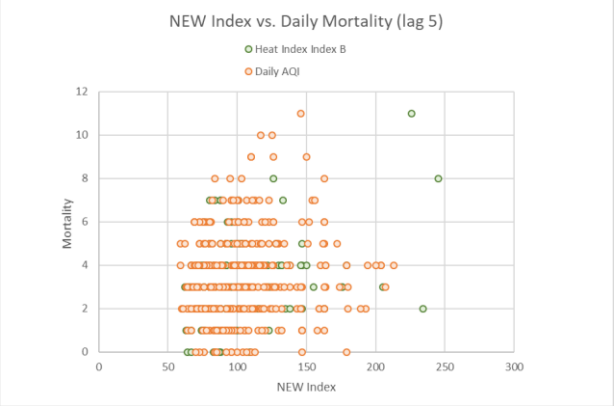

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

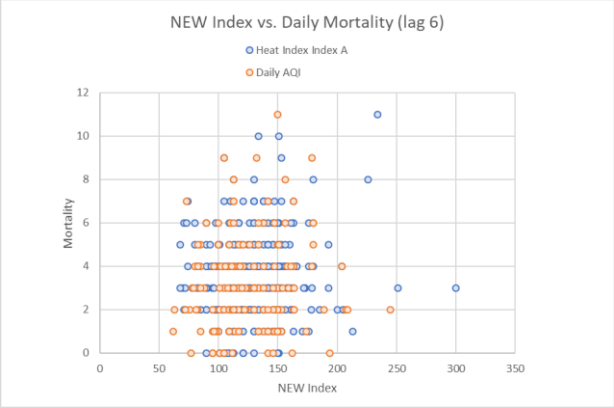

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

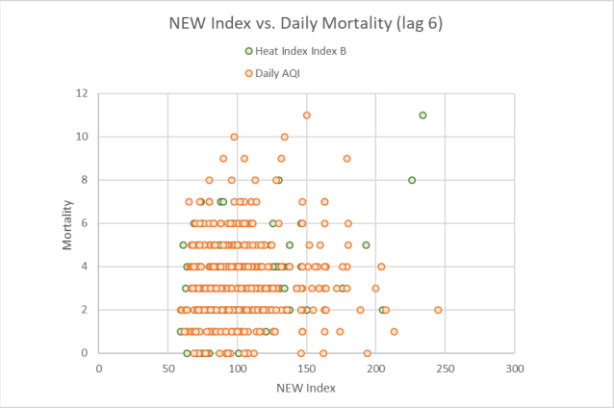

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

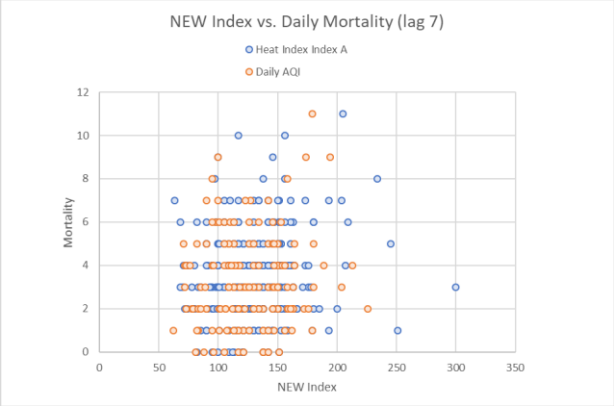

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

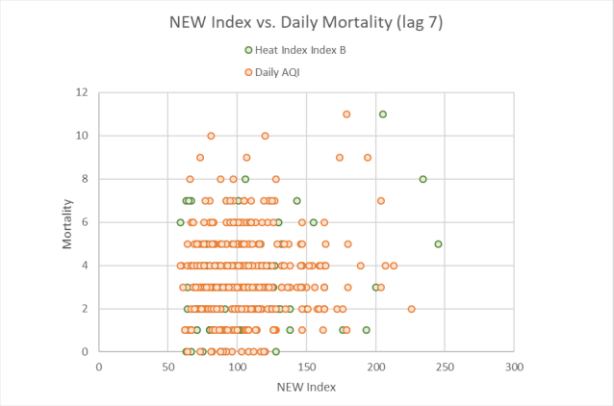

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300

Production Run:

F, 60-74, resp, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

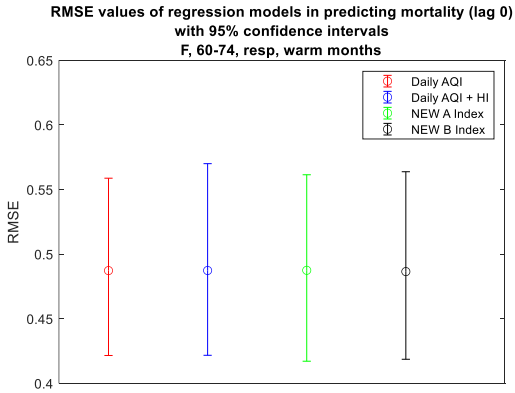
(how I originally defined the transformed HI in our NEW index)

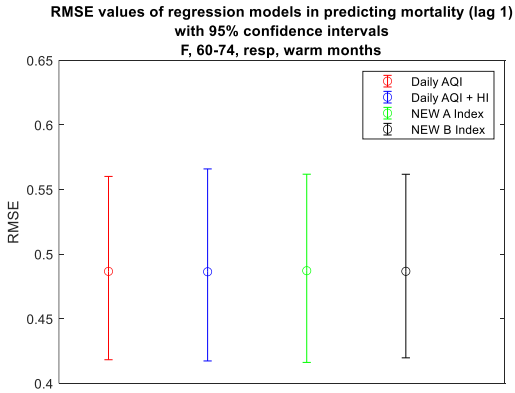
B

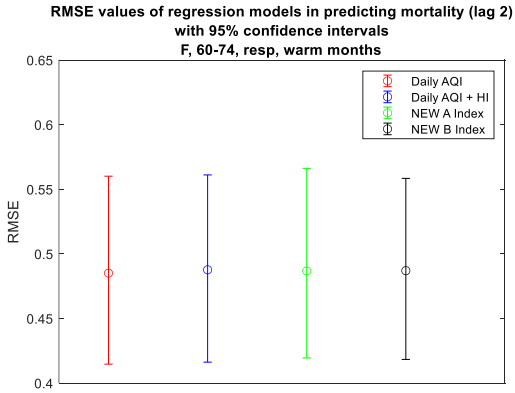
(transformed HI shifted down one category)

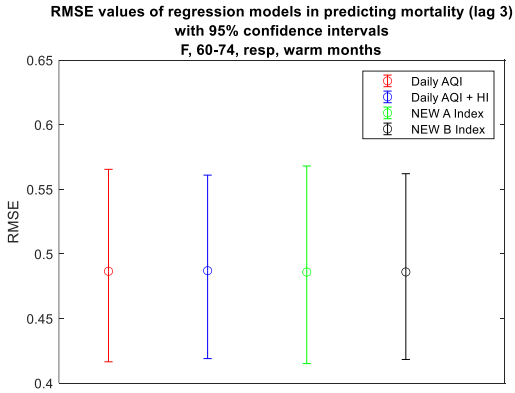
HI_Index Breakpoints

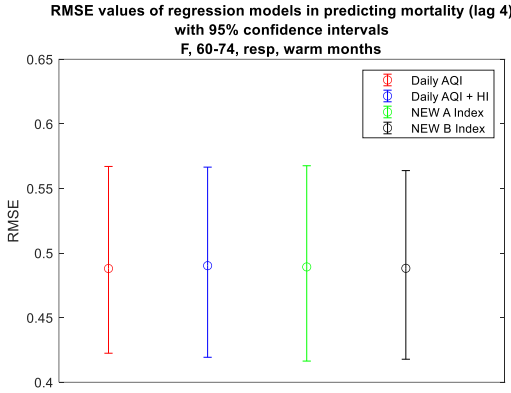
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

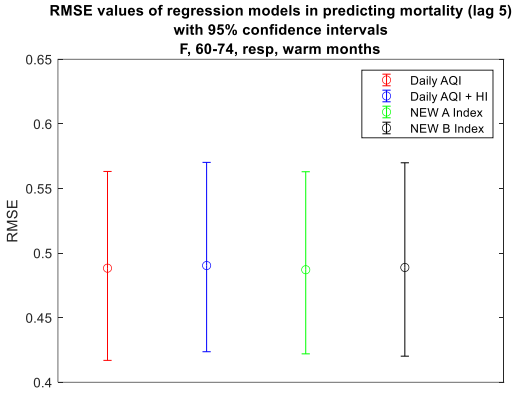


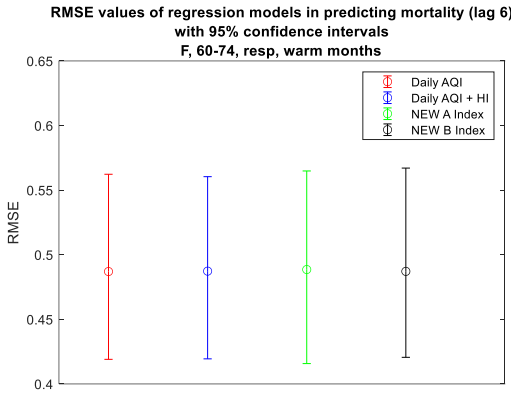


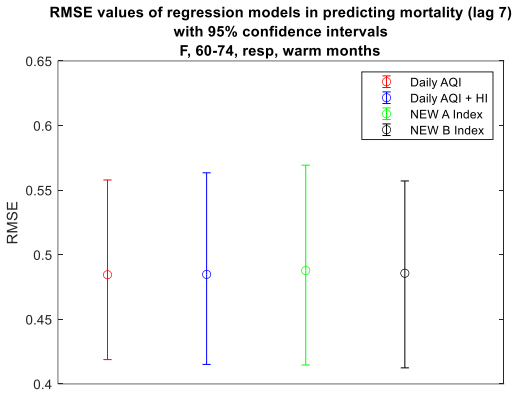





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.48732 +/-0.068607	0.48738 +/-0.074161	0.48752 +/-0.07216	0.48654 +/-0.072576
1	0.48671 +/-0.070945	0.48642 +/-0.074318	0.48722 +/-0.072834	0.48675 +/-0.071043
2	0.48512 +/-0.072732	0.48771 +/-0.072458	0.48677 +/-0.073389	0.48704 +/-0.070069
3	0.48658 +/-0.07449	0.487 +/-0.070997	0.48597 +/-0.076473	0.48604 +/-0.071892
4	0.488 +/-0.072281	0.4902 +/-0.073587	0.48924 +/-0.075594	0.48817 +/-0.072999
5	0.48825 +/-0.073115	0.4903 +/-0.07328	0.48706 +/-0.070471	0.48881 +/-0.074842
6	0.487 +/-0.071623	0.4873 +/-0.070507	0.48855 +/-0.074546	0.48712 +/-0.073238
7	0.48452 +/-0.069519	0.4848 +/-0.074154	0.48777 +/-0.077326	0.48569 +/-0.072335

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	0.9841 +/-0.31503	0.90554 +/-0.40254	0.94187 +/-0.31578	0.96408 +/-0.29591	0.80877 +/-0.91316
1	1.0683 +/-0.35252	1.0179 +/-0.45788	1.0207 +/-0.35068	1.0615 +/-0.31564	1.41 +/-1.4571
2	1.0732 +/-0.34853	1.1193 +/-0.45477	1.0156 +/-0.33541	1.0288 +/-0.31278	1.3538 +/-1.7189
3	1.18 +/-0.34234	1.295 +/-0.53514	1.1482 +/-0.38499	1.1541 +/-0.30778	1.1771 +/-1.2118
4	0.94712 +/-0.31981	1.075 +/-0.45086	1.0342 +/-0.33545	0.98341 +/-0.28931	1.3011 +/-1.3469
5	0.97041 +/-0.30461	0.98139 +/-0.42357	0.97773 +/-0.33603	0.99149 +/-0.27367	0.57378 +/-0.70941
6	1.0926 +/-0.30547	1.1064 +/-0.4175	0.97899 +/-0.30116	1.0369 +/-0.2589	2.0438 +/-2.4793
7	1.2303 +/-0.33467	1.2039 +/-0.48971	1.0328 +/-0.32802	1.1483 +/-0.28271	2.2072 +/-3.3636

AQI Regression: No statistically significant predictors.

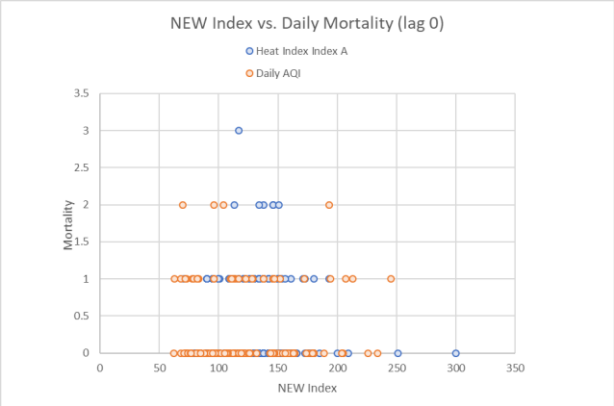
AQI+HI Regression: No statistically significant predictors.

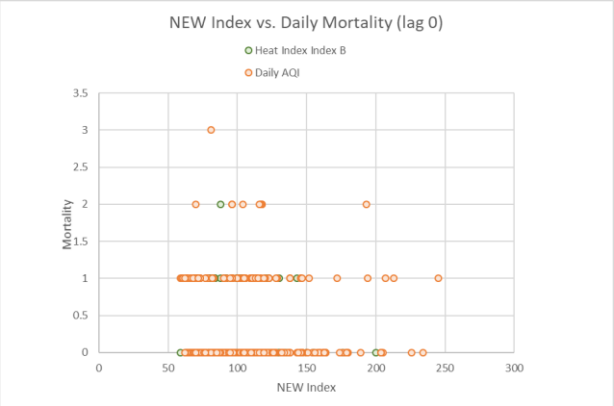
NEW A Regression: No statistically significant predictors.

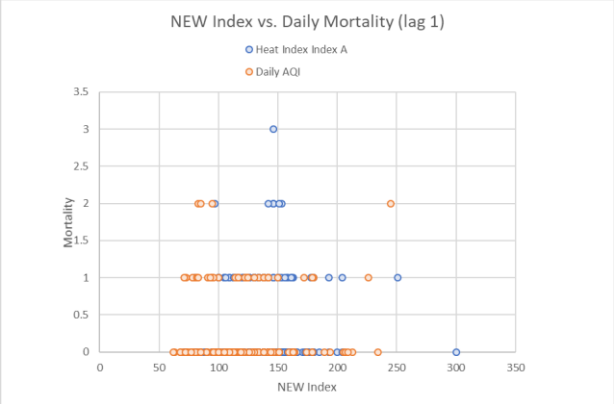
NEW B Regression: No statistically significant predictors.

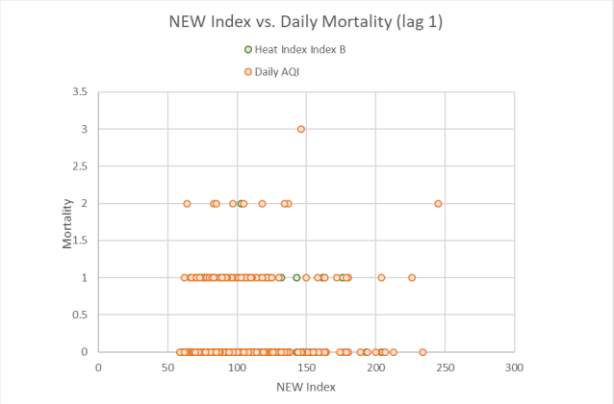
RAW Regression: Relative humidity predictor statistically significant on lag day 6 with 90% confidence.

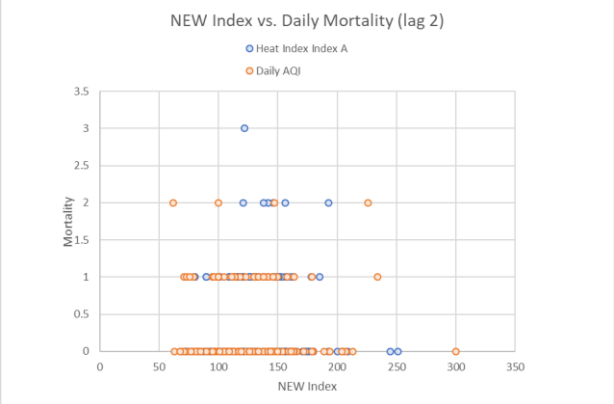
NEW Index vs. Daily Mortality Plots (for F, 60-74, resp, warm months)

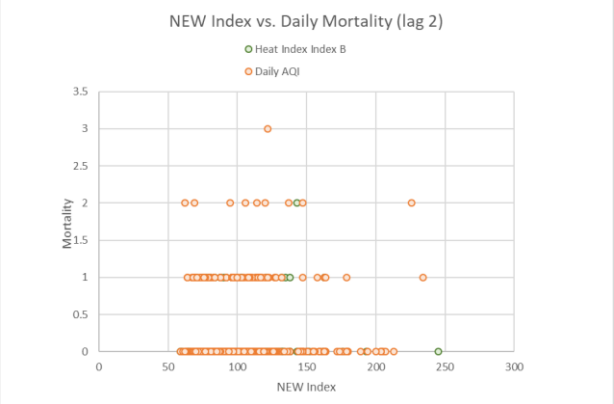


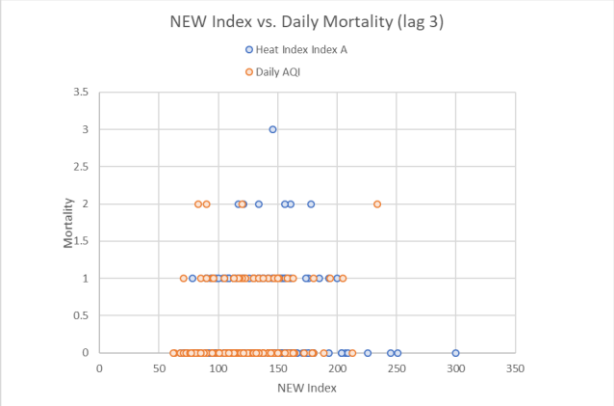


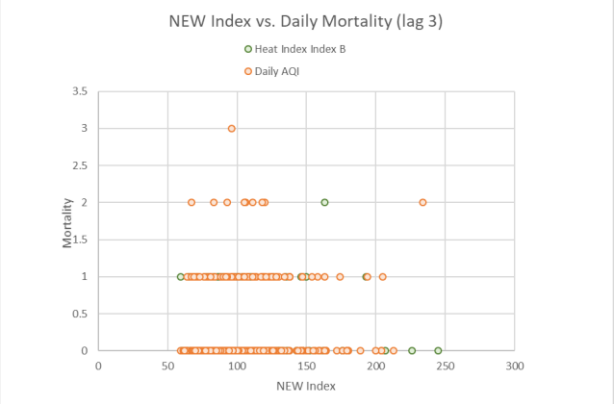


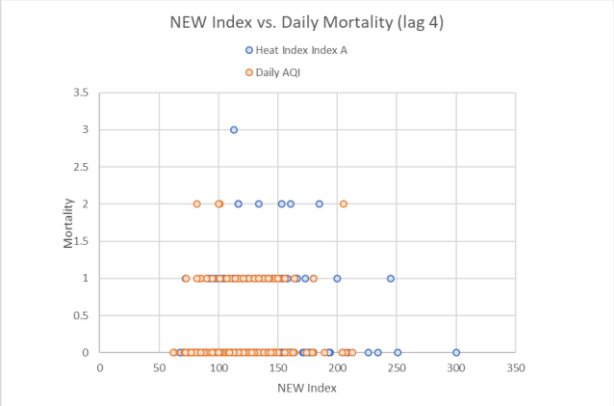


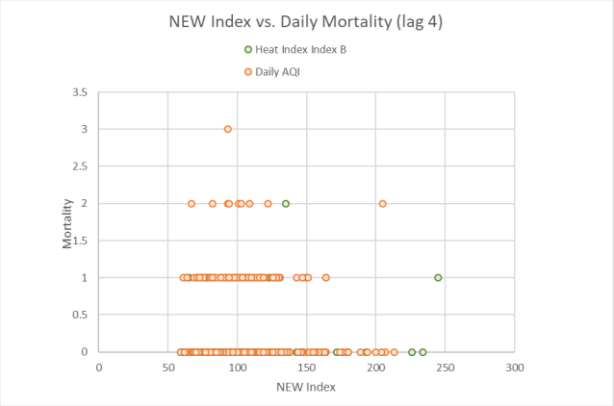


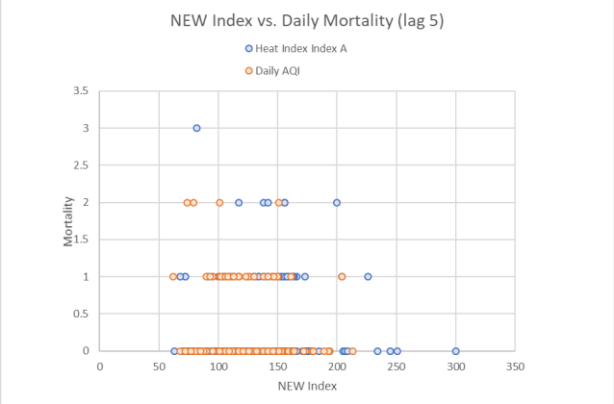


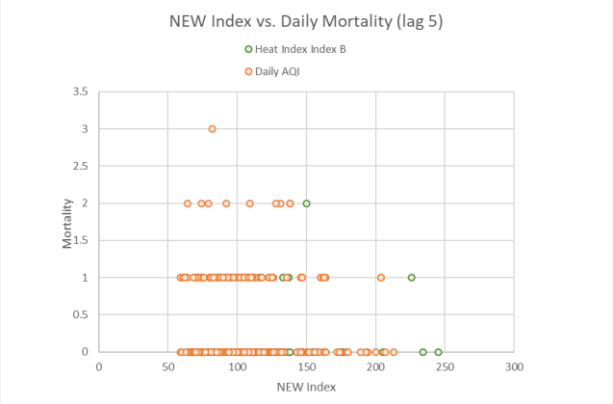

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

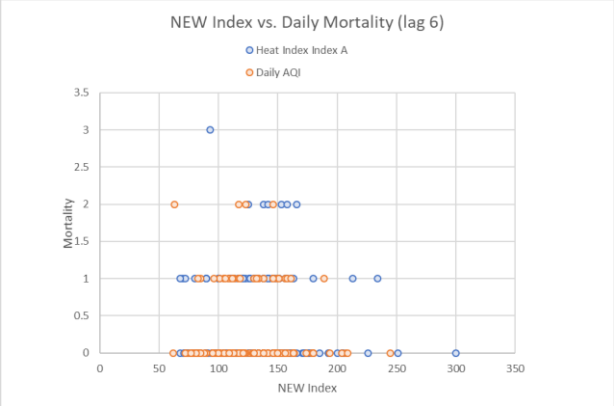

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

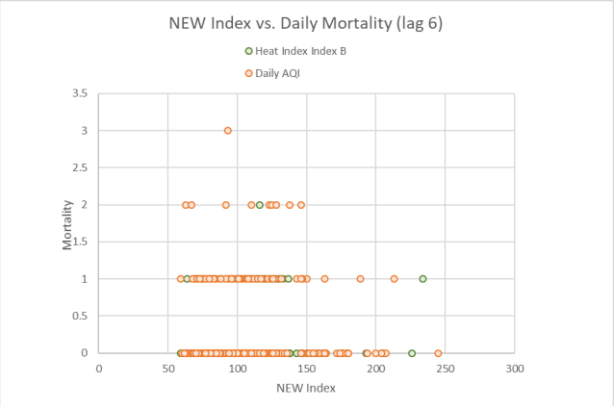

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

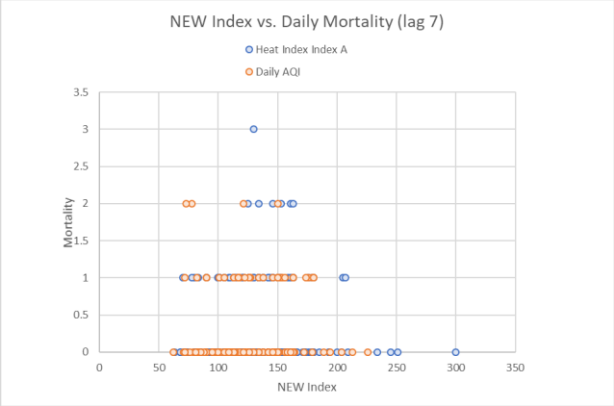

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

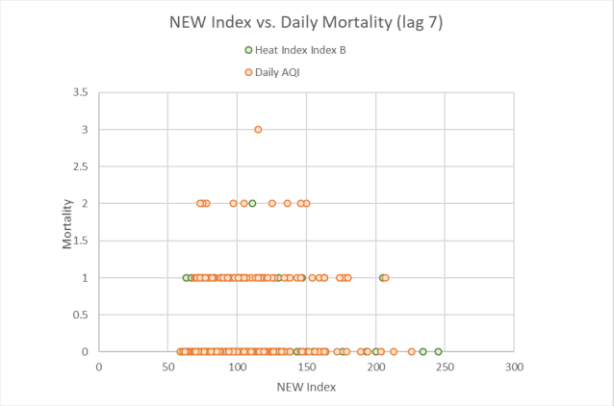

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300

Production Run:

F, 75+, resp, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

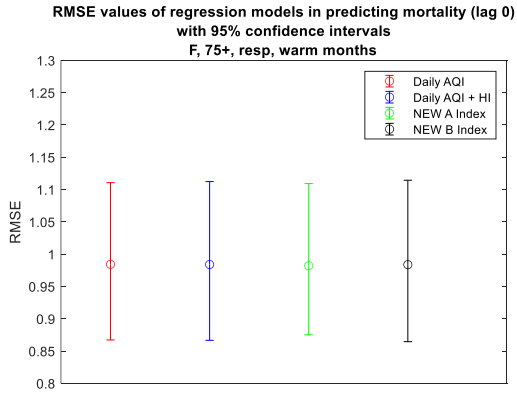
(how I originally defined the transformed HI in our NEW index)

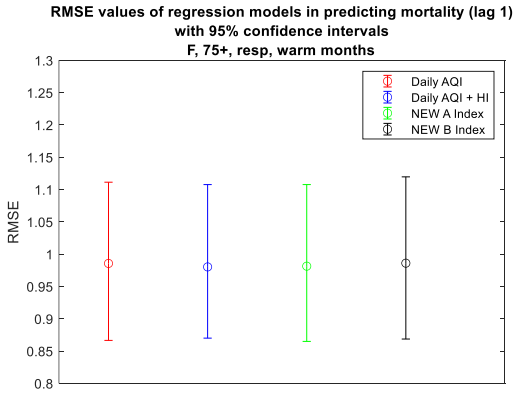
B

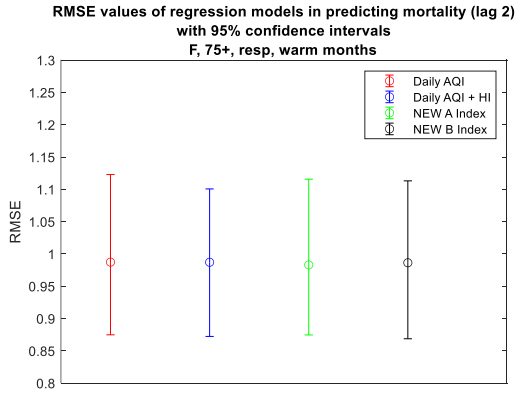
(transformed HI shifted down one category)

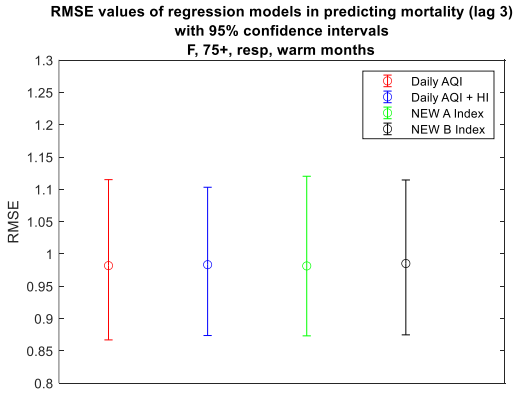
HI_Index Breakpoints

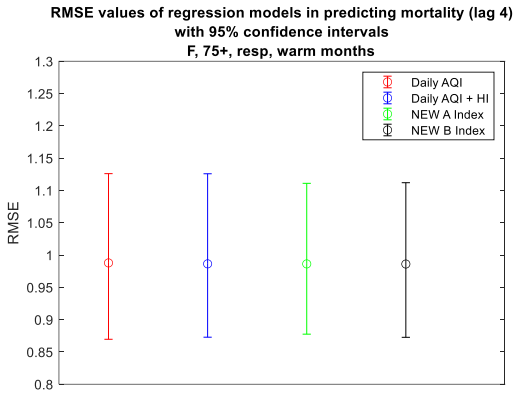
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

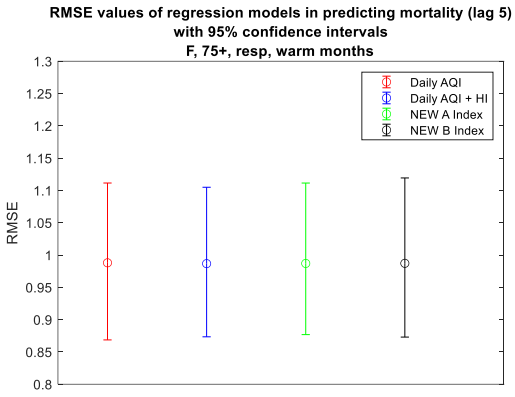


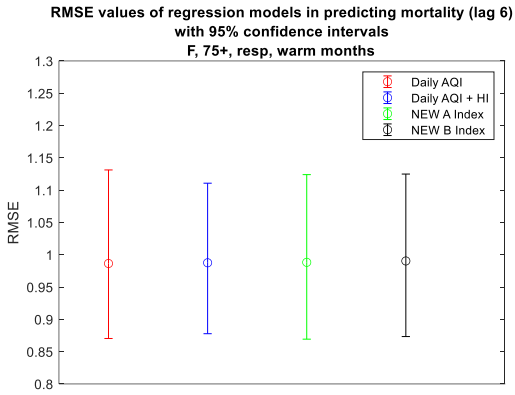


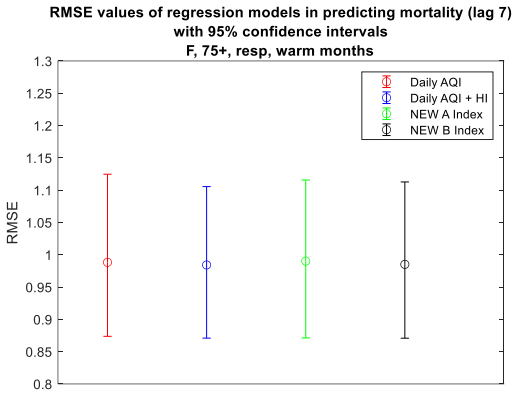





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.98433 +/-0.12172	0.98404 +/-0.12288	0.98215 +/-0.11704	0.98384 +/-0.12496
1	0.9857 +/-0.12244	0.9803 +/-0.11884	0.98145 +/-0.12139	0.9861 +/-0.12553
2	0.98732 +/-0.12404	0.98711 +/-0.11416	0.98296 +/-0.12056	0.98632 +/-0.12222
3	0.98189 +/-0.12405	0.98335 +/-0.11476	0.98141 +/-0.12353	0.98517 +/-0.11987
4	0.98778 +/-0.1282	0.98634 +/-0.1265	0.98623 +/-0.11675	0.98603 +/-0.11967
5	0.98795 +/-0.12143	0.98665 +/-0.11575	0.98695 +/-0.11731	0.98712 +/-0.12317
6	0.98644 +/-0.13044	0.98757 +/-0.11649	0.98825 +/-0.12736	0.99036 +/-0.12577
7	0.98823 +/-0.12547	0.98418 +/-0.11727	0.99011 +/-0.12221	0.98511 +/-0.12094

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0087 +/-0.18462	1.1369 +/-0.25868	1.115 +/-0.18311	1.0349 +/-0.14804	1.0733 +/-0.65847
1	1.0406 +/-0.1721	1.1106 +/-0.21813	1.0694 +/-0.15807	1.0481 +/-0.14456	0.86519 +/-0.53473
2	1.0428 +/-0.15722	1.0582 +/-0.21864	1.0239 +/-0.16257	1.0224 +/-0.14679	1.0596 +/-0.59249
3	1.0207 +/-0.15421	1.0776 +/-0.23555	1.0264 +/-0.16508	1.0144 +/-0.14659	1.3788 +/-0.80083
4	1.0517 +/-0.16292	1.0832 +/-0.23252	1.0071 +/-0.16065	1.0266 +/-0.15183	1.0145 +/-0.62569
5	0.96311 +/-0.13938	0.98023 +/-0.19002	0.98285 +/-0.16469	0.96327 +/-0.13457	0.82333 +/-0.40973
6	1.0553 +/-0.15691	1.0971 +/-0.20352	1.0481 +/-0.16204	1.0402 +/-0.1358	0.84751 +/-0.50667
7	1.0052 +/-0.16144	1.0564 +/-0.22051	1.0402 +/-0.17165	0.99542 +/-0.14527	1.1715 +/-0.70714

AQI Regression: No statistically significant predictors.

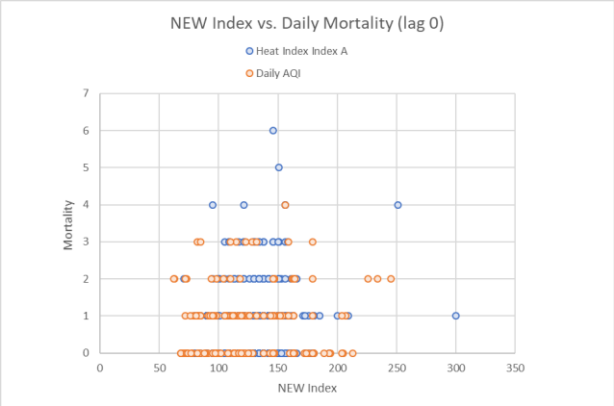
AQI+HI Regression: No statistically significant predictors.

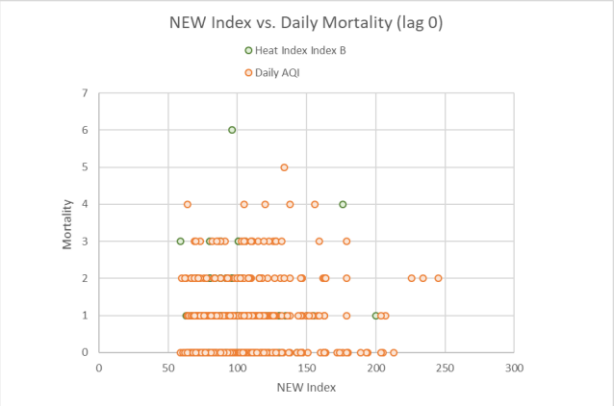
NEW A Regression: No statistically significant predictors.

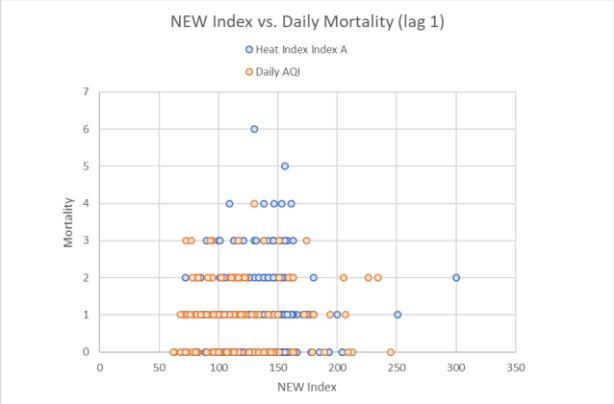
NEW B Regression: No statistically significant predictors.

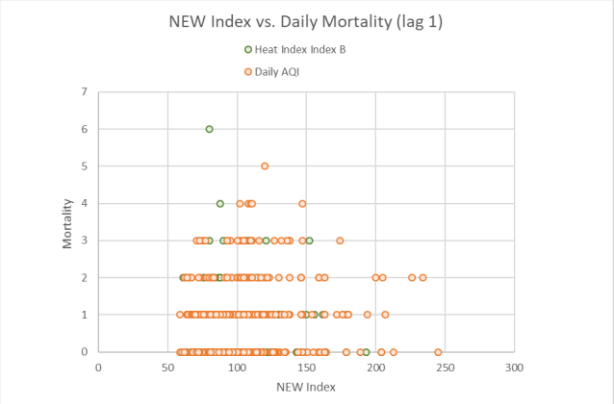
RAW Regression: O3 predictor statistically significant on lag day 2 with 95% confidence.

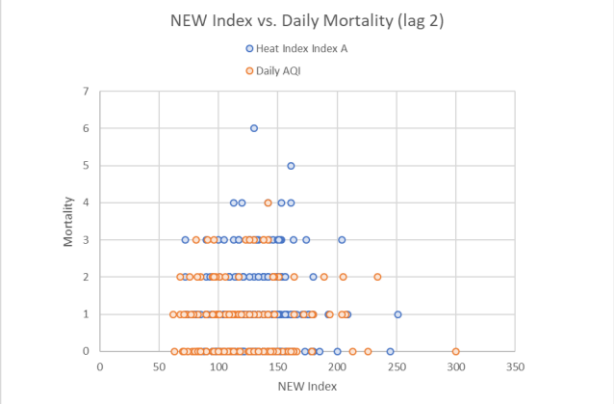
NEW Index vs. Daily Mortality Plots (for F, 75+, resp, warm months)

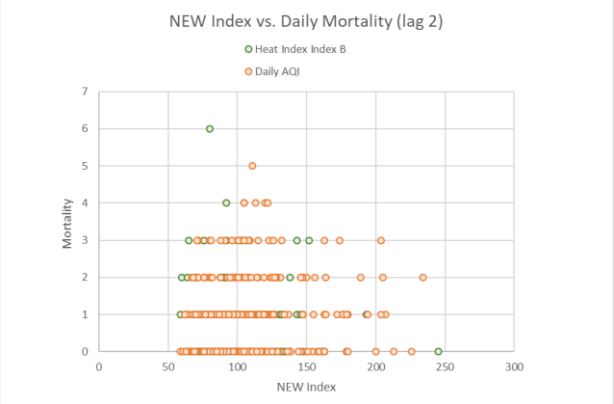


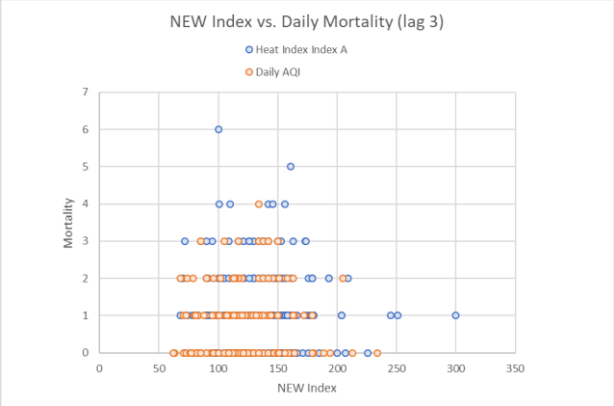


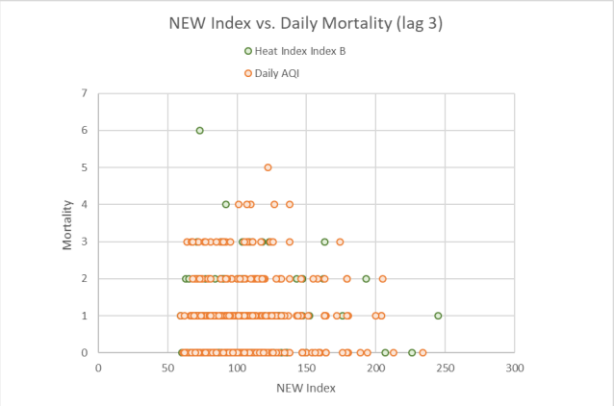


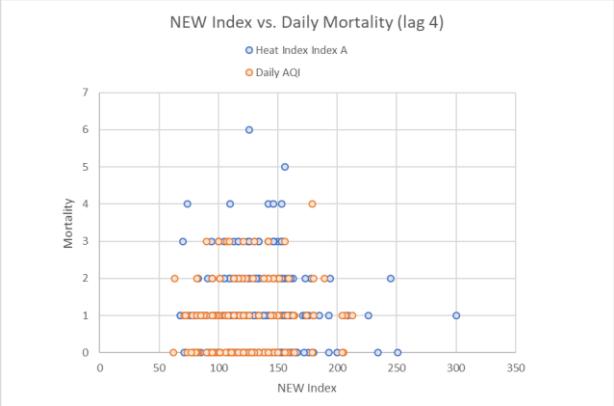


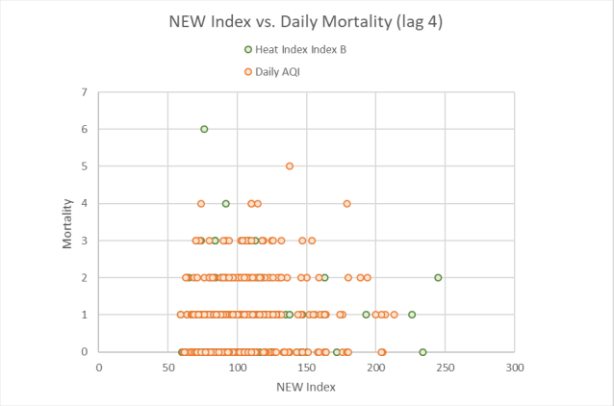


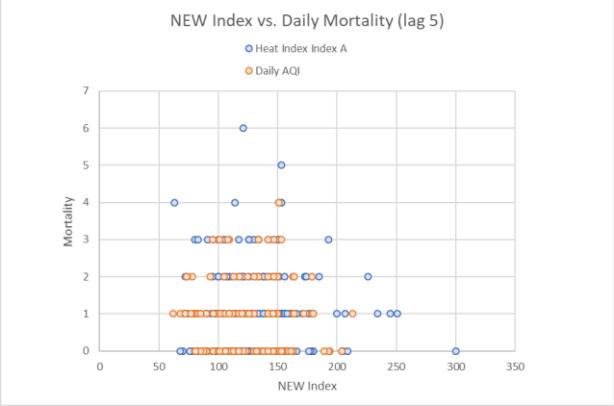


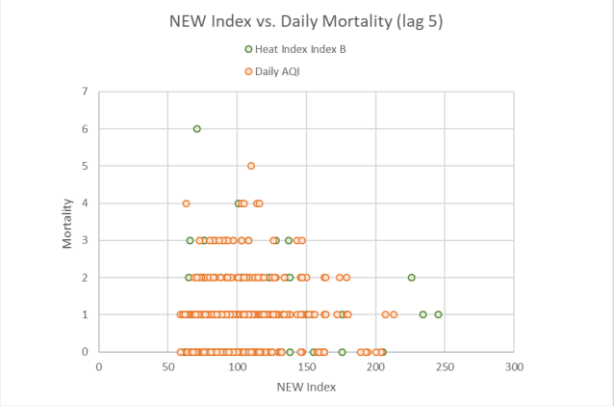

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
Daily AQI
Mortality
NEW Index

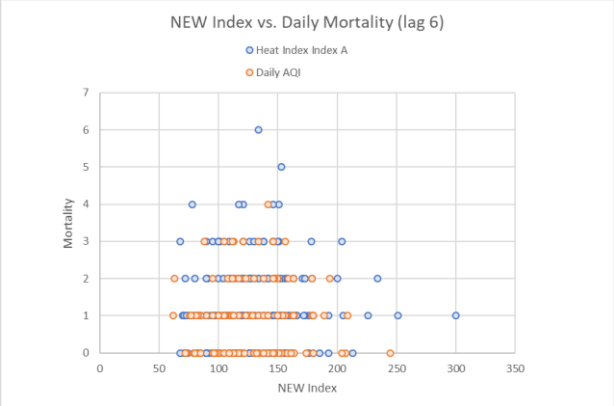

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
Daily AQI
Mortality
NEW Index

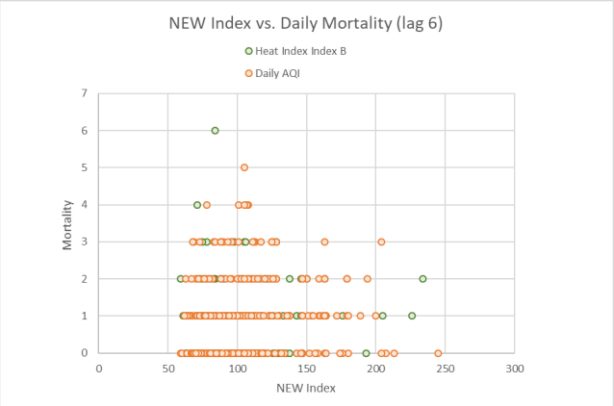

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
Daily AQI
Mortality
NEW Index

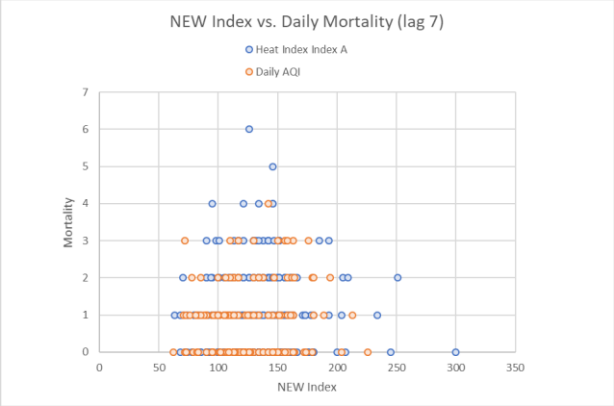

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
Daily AQI
Mortality
NEW Index

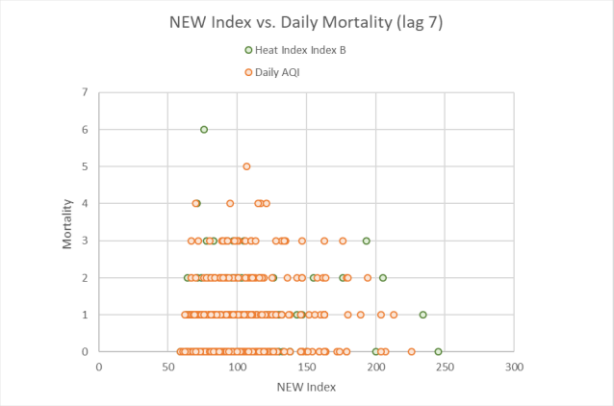

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
Daily AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
Daily AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300

Production Run:

M & F, 60+, cardio & resp, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

A

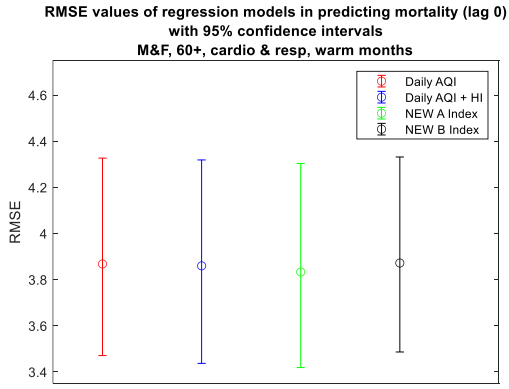
(how I originally defined the transformed HI in our NEW index)

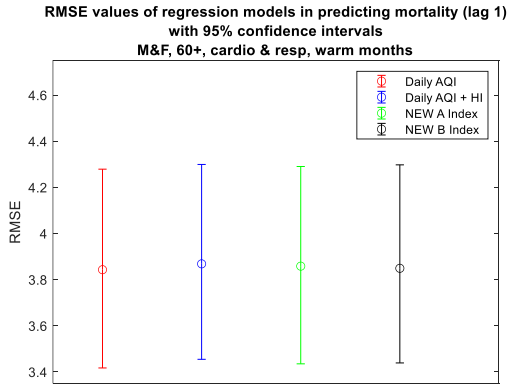
B

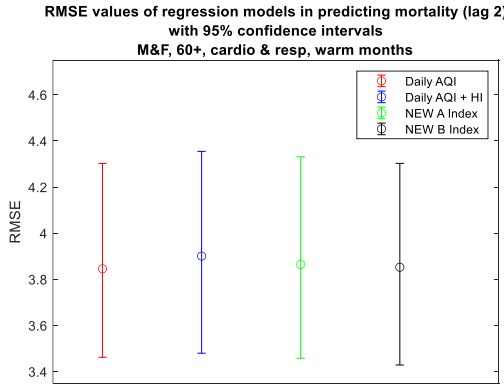
(transformed HI shifted down one category)

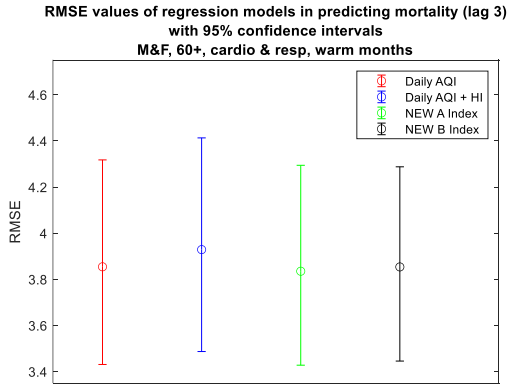
HI_Index Breakpoints

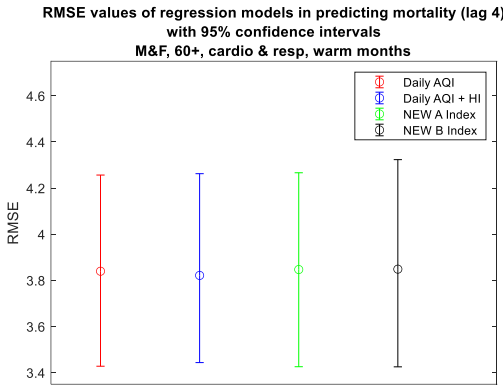
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

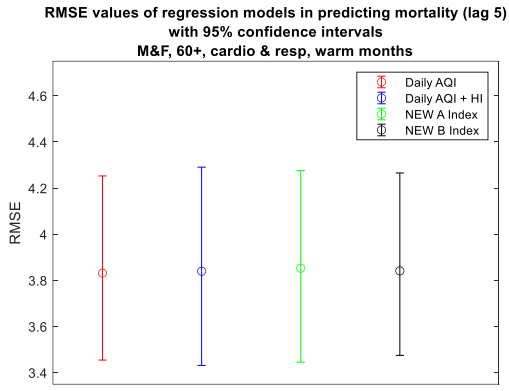


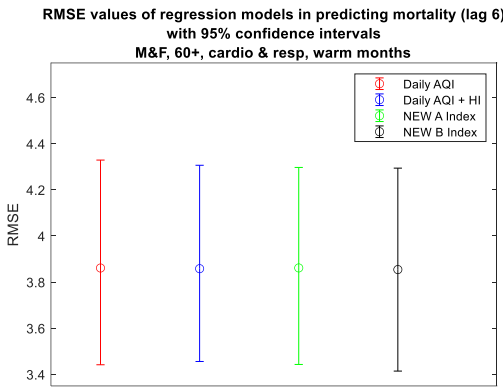


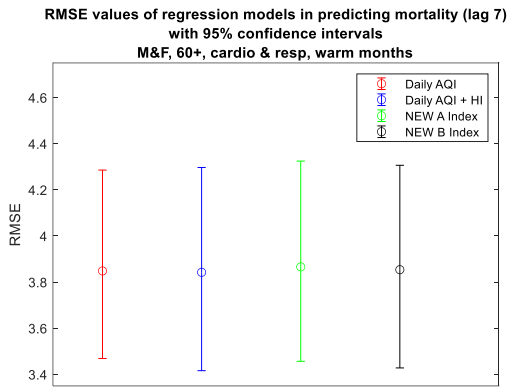





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	3.8677 +/-0.42793	3.8594 +/-0.44091	3.8328 +/-0.44219	3.8717 +/-0.42263
1	3.8428 +/-0.4308	3.8682 +/-0.42229	3.8581 +/-0.42766	3.8489 +/-0.42928
2	3.8456 +/-0.42018	3.9006 +/-0.43739	3.8641 +/-0.4365	3.8523 +/-0.43701
3	3.8542 +/-0.44334	3.9287 +/-0.463	3.835 +/-0.4332	3.8536 +/-0.42101
4	3.8397 +/-0.41432	3.8215 +/-0.40942	3.8471 +/-0.42033	3.8487 +/-0.44903
5	3.8315 +/-0.39901	3.8397 +/-0.42965	3.8527 +/-0.41506	3.8412 +/-0.39528
6	3.8612 +/-0.44358	3.8583 +/-0.42522	3.8615 +/-0.42698	3.8545 +/-0.43983
7	3.8485 +/-0.40832	3.8425 +/-0.44034	3.8661 +/-0.43395	3.8539 +/-0.43915

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0227 +/-0.048292	1.0602 +/-0.068921	1.0503 +/-0.048462	1.0268 +/-0.043262	1.1038 +/-0.17556
1	1.0554 +/-0.045617	1.0793 +/-0.064442	1.0399 +/-0.049656	1.0449 +/-0.039127	1.0602 +/-0.17448
2	1.0489 +/-0.050221	1.0796 +/-0.069976	1.0357 +/-0.048518	1.0375 +/-0.040599	1.0591 +/-0.17397
3	1.0537 +/-0.053665	1.1025 +/-0.072267	1.0559 +/-0.053189	1.0539 +/-0.046787	1.1199 +/-0.19388
4	1.0594 +/-0.052326	1.0957 +/-0.070589	1.0522 +/-0.050903	1.0536 +/-0.044919	1.1219 +/-0.18935
5	1.0611 +/-0.05472	1.075 +/-0.068142	1.0466 +/-0.048096	1.0574 +/-0.047512	1.0514 +/-0.16784
6	1.0479 +/-0.048817	1.0669 +/-0.065126	1.0426 +/-0.054083	1.0465 +/-0.043817	0.99382 +/-0.16652
7	1.05 +/-0.048405	1.0767 +/-0.068639	1.0437 +/-0.050311	1.0396 +/-0.044794	1.1325 +/-0.18147

AQI Regression: AQI predictor statistically significant on lag day 6 with 90% confidence and on lag days 1, 2, 3, 4, 5, and 7 with 95% confidence.

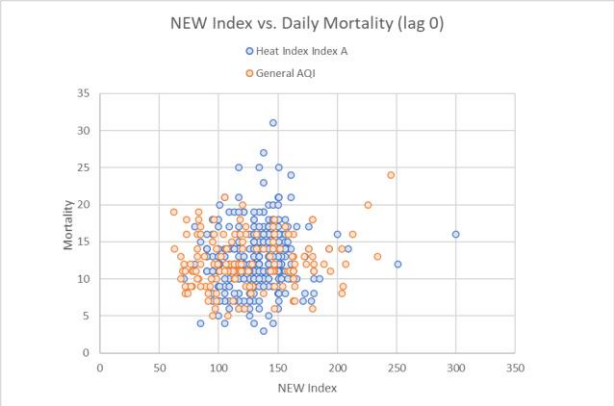
AQI+HI Regression: HI predictor statistically significant on lag days 0 and 3 with 95% confidence. AQI predictor statistically significant on lag days 2, 3, 6, and 7 with 90% confidence and on lag days 1, 4, and 5 with 95% confidence.

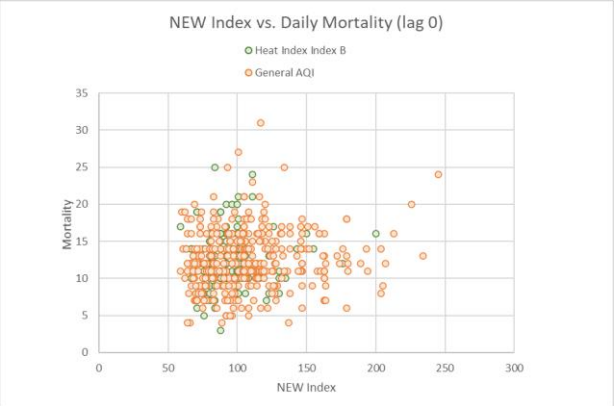
NEW A Regression: NEW A index predictor statistically significant on lag days 1, 5, 6, and 7 with 90% confidence and on lag days 0, 3, and 4 with 95% confidence.

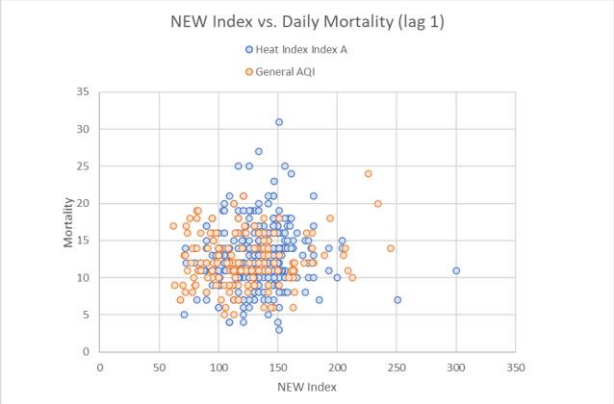
NEW B Regression: NEW B index predictor statistically significant on lag days 2 and 7 with 90% confidence and on lag days 1, 3, 4, 5, and 6 with 95% confidence.

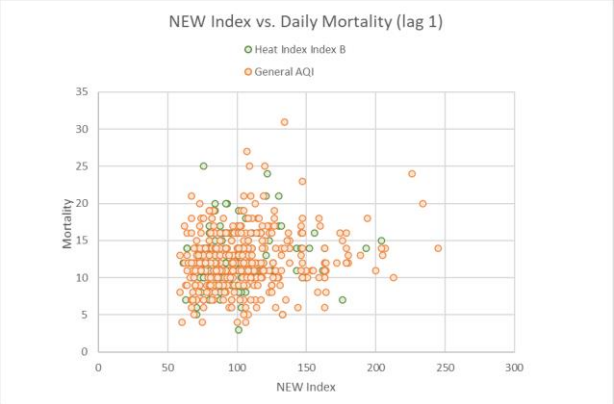
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence. PM2.5 predictor statistically significant on lag day 0 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence.

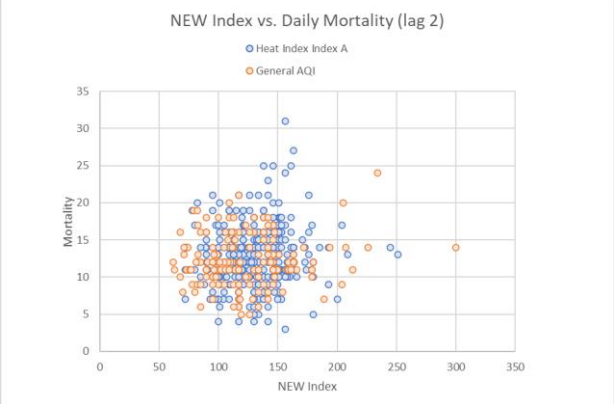
NEW Index vs. Daily Mortality Plots (for M & F, 60+, cardio & resp, warm months)

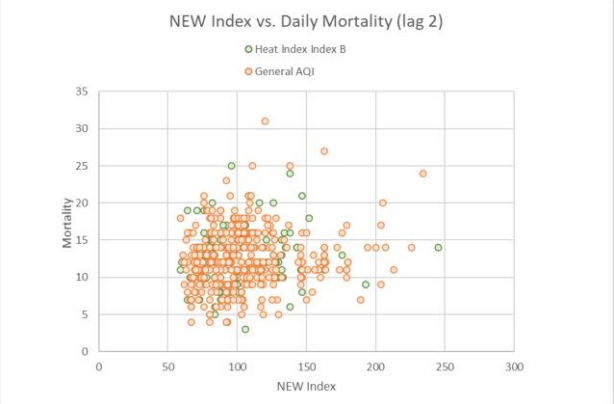


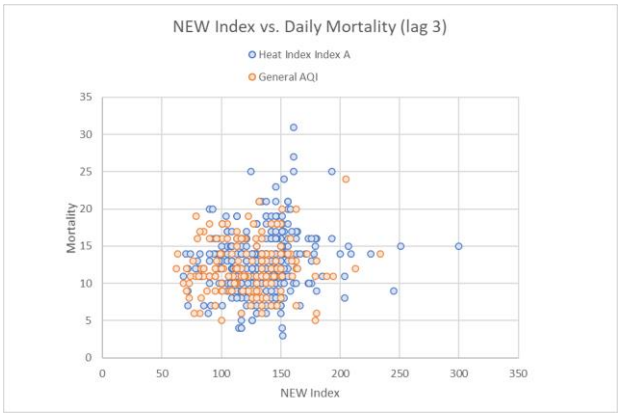


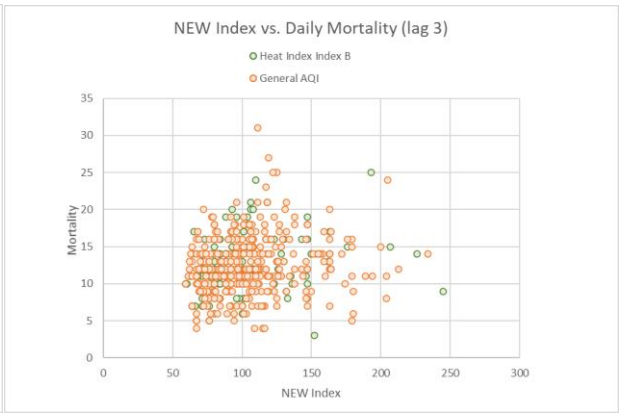


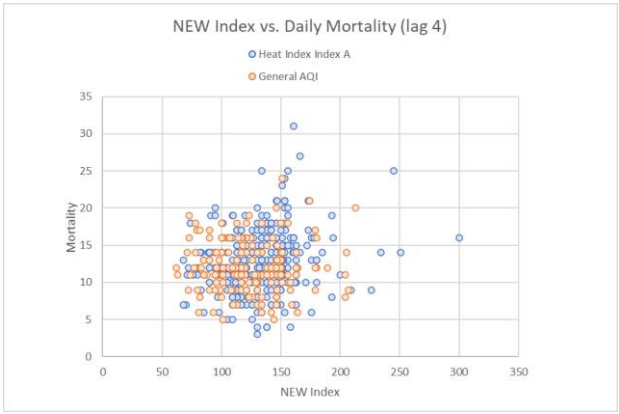


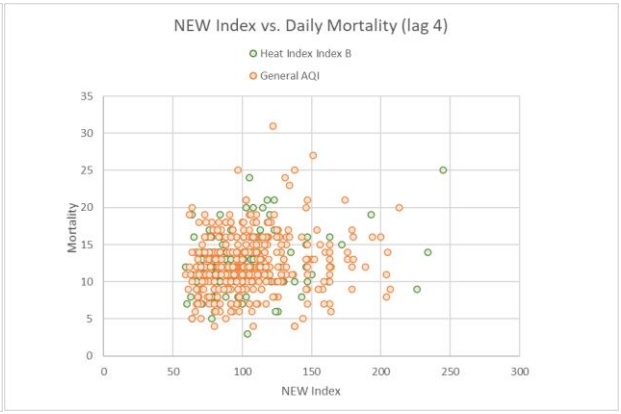


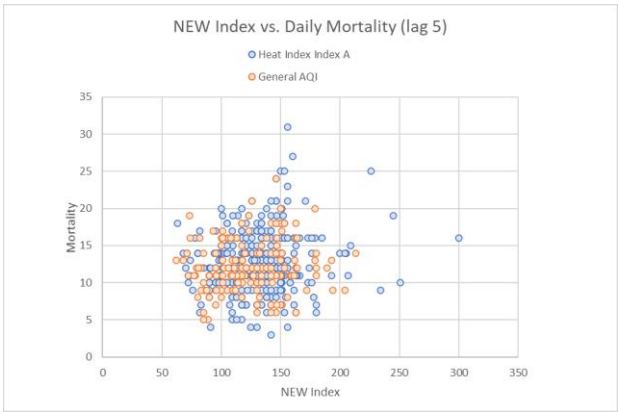


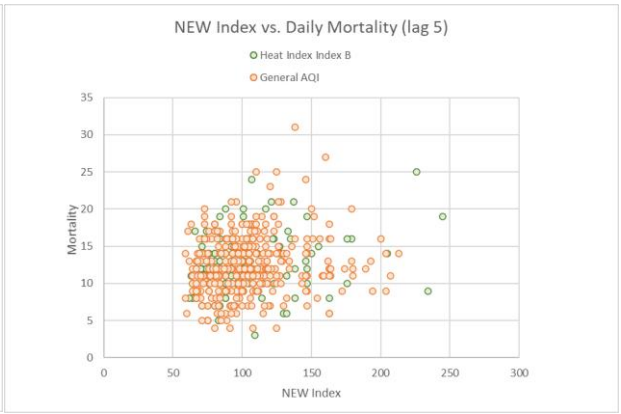

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350

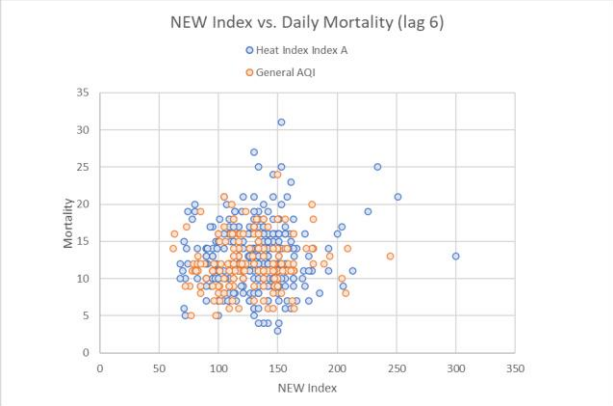

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300

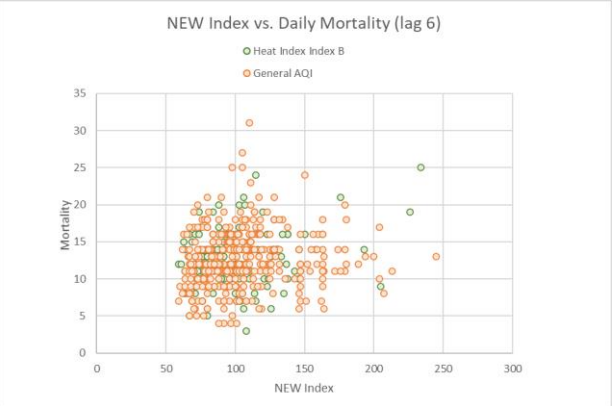

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350

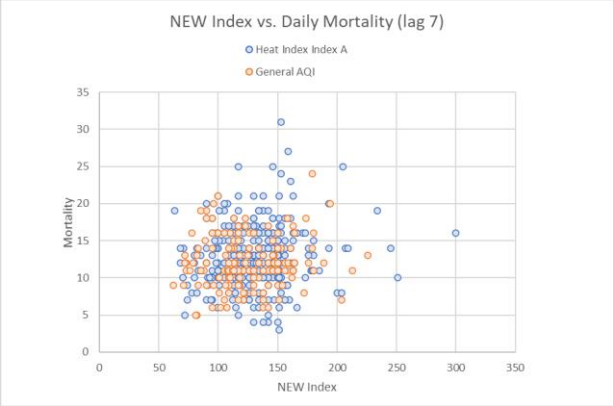

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300

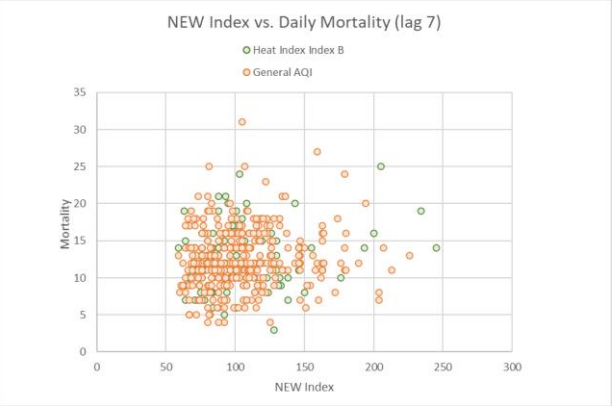

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300

Production Run:

M & F, all ages, cardio & resp, warm months (General AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily general AQI as the only predictor,
Blue = Daily general AQI and HI as the predictors,
Green = NEW A index (highest of daily general AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily general AQI and HI-B) as the predictor:

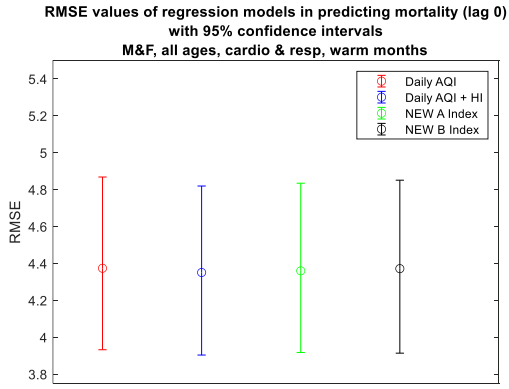
A

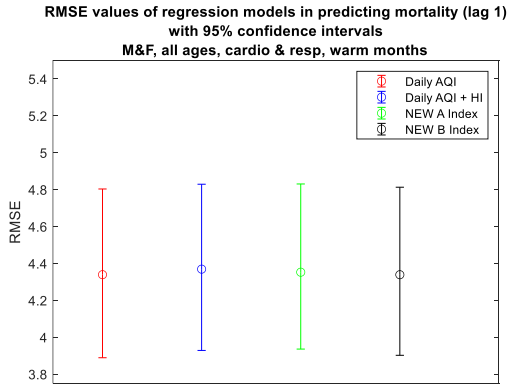
(how I originally defined the transformed HI in our NEW index)

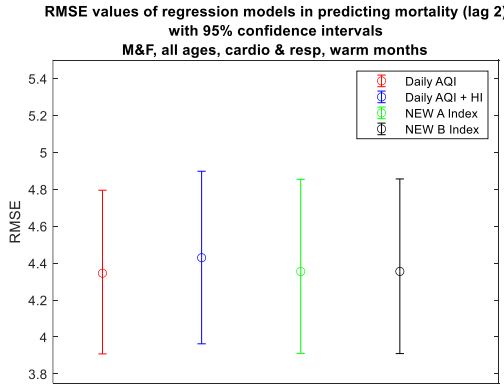
B

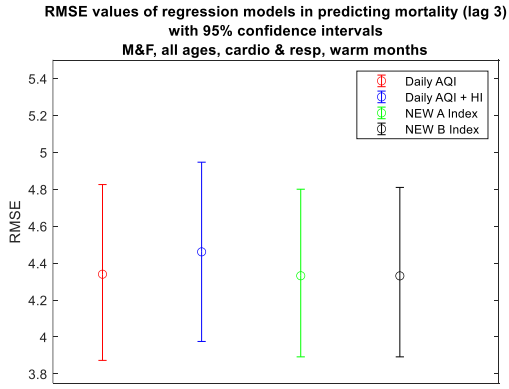
(transformed HI shifted down one category)

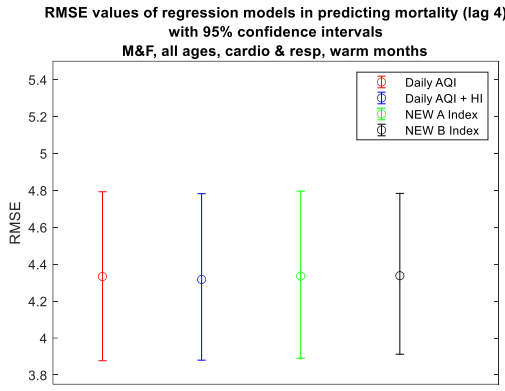
HI_Index Breakpoints		
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

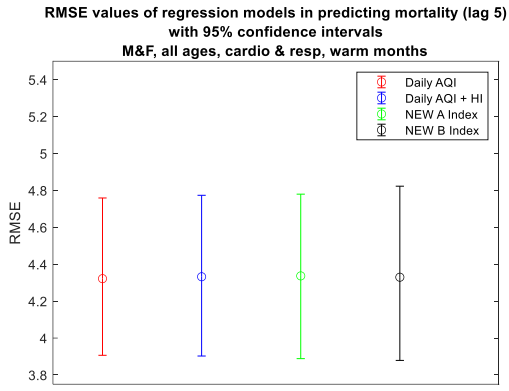


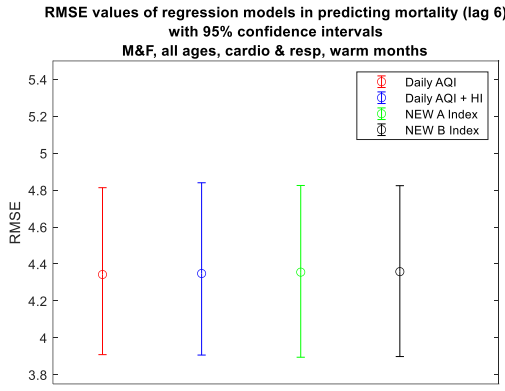


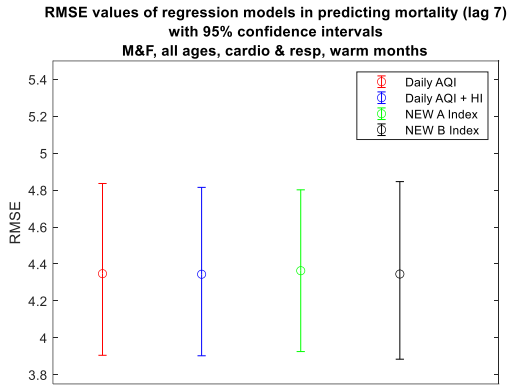





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	4.3737 +/-0.46788	4.3509 +/-0.45787	4.3599 +/-0.45855	4.3718 +/-0.46855
1	4.3391 +/-0.45714	4.369 +/-0.45026	4.3524 +/-0.44728	4.3388 +/-0.45535
2	4.3456 +/-0.44344	4.4295 +/-0.46745	4.3548 +/-0.47154	4.3553 +/-0.47307
3	4.3401 +/-0.47629	4.4612 +/-0.48563	4.3317 +/-0.45412	4.3311 +/-0.45902
4	4.3334 +/-0.45773	4.3176 +/-0.45096	4.3357 +/-0.45264	4.3377 +/-0.4358
5	4.3219 +/-0.42618	4.3322 +/-0.43542	4.3369 +/-0.44555	4.3297 +/-0.47196
6	4.343 +/-0.45231	4.3483 +/-0.46675	4.3557 +/-0.4653	4.3585 +/-0.46288
7	4.3474 +/-0.46542	4.3444 +/-0.45623	4.3635 +/-0.43816	4.3455 +/-0.48109

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0237 +/-0.048329	1.055 +/-0.05896	1.0426 +/-0.04804	1.0277 +/-0.038865	1.0929 +/-0.16355
1	1.0518 +/-0.044319	1.0734 +/-0.0629	1.0376 +/-0.046501	1.0449 +/-0.038396	1.0188 +/-0.15799
2	1.0408 +/-0.043677	1.0723 +/-0.059675	1.0333 +/-0.043954	1.0354 +/-0.039341	1.0502 +/-0.1526
3	1.0505 +/-0.049371	1.0964 +/-0.06741	1.053 +/-0.045493	1.0498 +/-0.04166	1.0989 +/-0.15644
4	1.0519 +/-0.046503	1.0852 +/-0.060922	1.0495 +/-0.046534	1.0477 +/-0.043235	1.1207 +/-0.16616
5	1.0566 +/-0.046373	1.0696 +/-0.058276	1.0441 +/-0.046192	1.0548 +/-0.040509	1.0249 +/-0.15752
6	1.0459 +/-0.044768	1.0627 +/-0.059243	1.0339 +/-0.048578	1.0411 +/-0.041484	0.9813 +/-0.14779
7	1.0451 +/-0.047354	1.0676 +/-0.062044	1.0401 +/-0.047037	1.039 +/-0.040808	1.1081 +/-0.1545

AQI Regression: AQI predictor statistically significant on lag days 2 and 7 with 90% confidence and on lag days 1, 3, 4, 5, and 6 with 95% confidence.

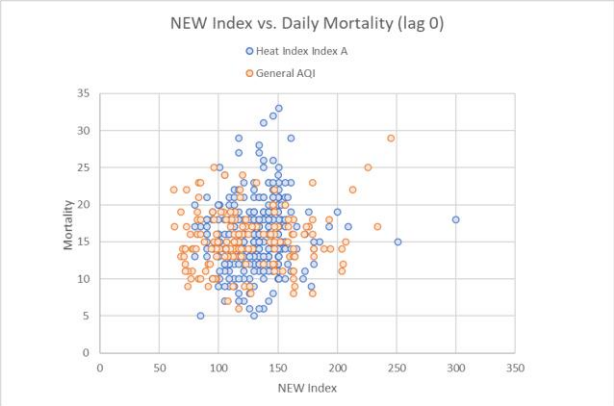
AQI+HI Regression: HI predictor statistically significant on lag days 0 and 4 with 90% confidence and on lag day 3 with 95% confidence. AQI predictor statistically significant on lag days 4 and 7 with 90% confidence and on lag days 1, 5, and 6 with 95% confidence.

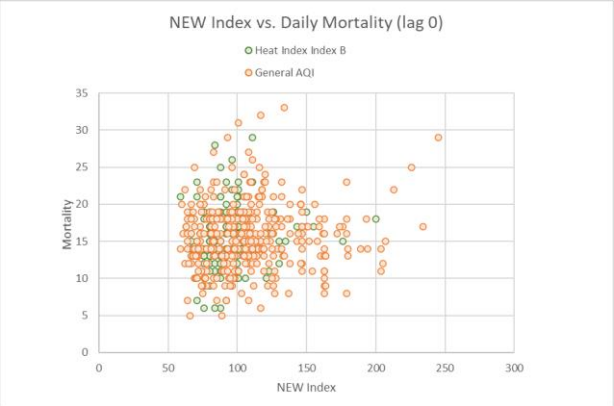
NEW A Regression: NEW A index predictor statistically significant on lag days 0, 1, and 7 with 90% confidence and on lag days 3, 4, and 5 with 95% confidence.

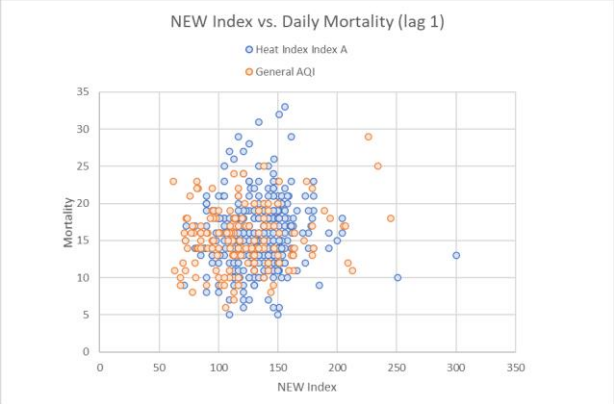
NEW B Regression: NEW B index predictor statistically significant on lag days 2 and 6 with 90% confidence and on lag days 1, 3, 4, 5, and 7 with 95% confidence.

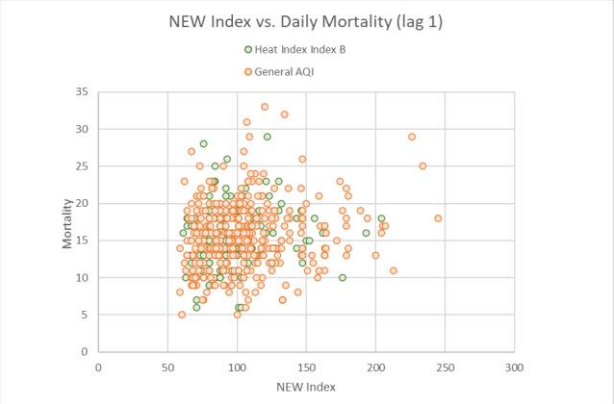
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence. PM2.5 predictor statistically significant on lag days 0 and 2 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence.

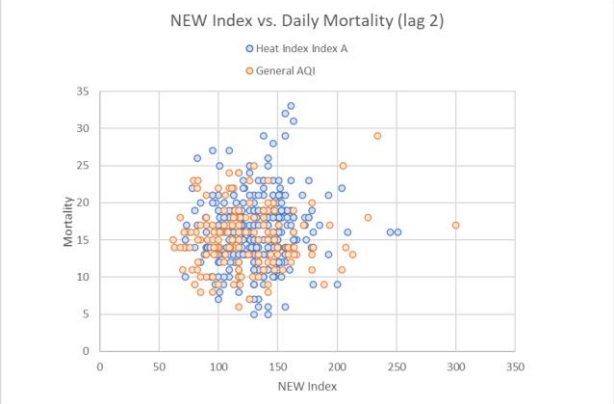
NEW Index vs. Daily Mortality Plots (for M & F, all ages, cardio & resp, warm months)

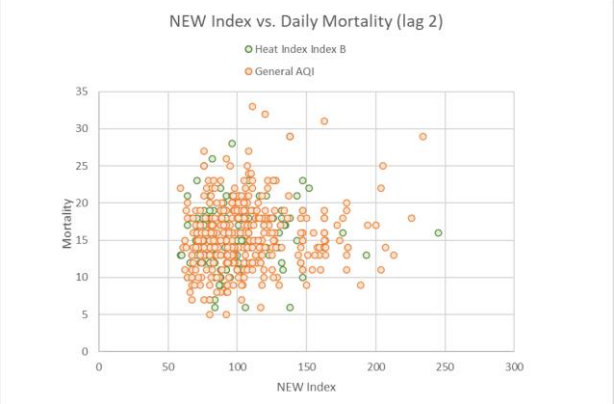


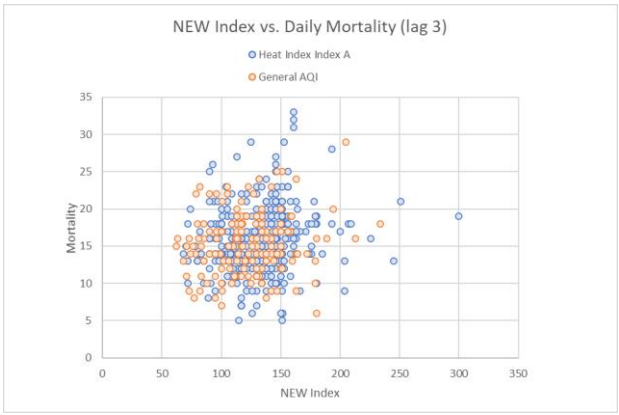


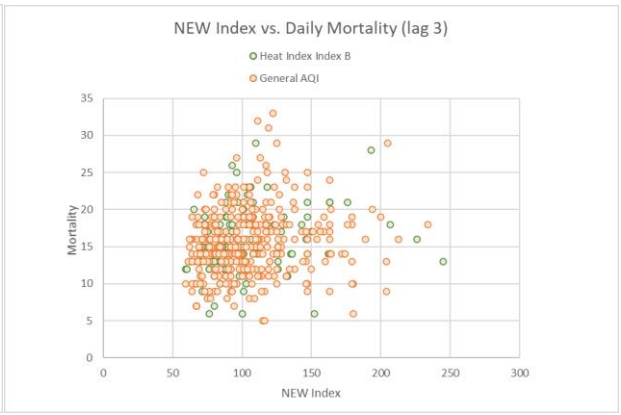


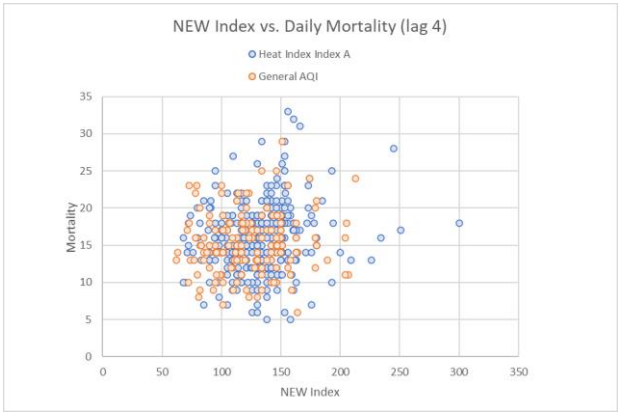







NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
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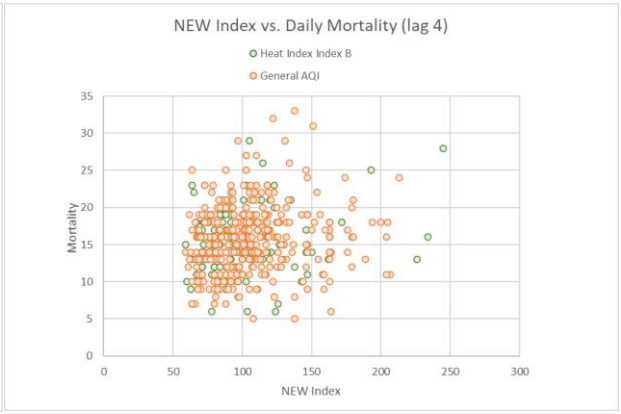
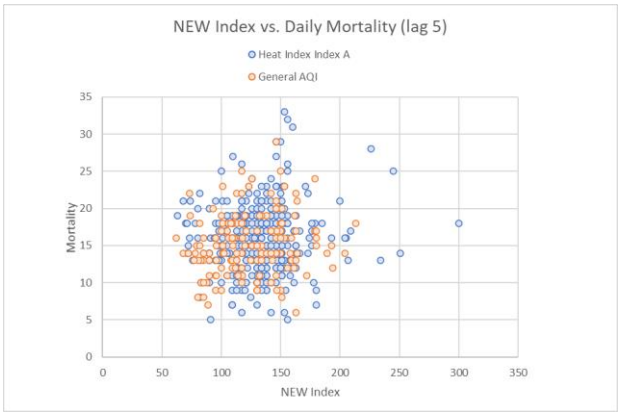
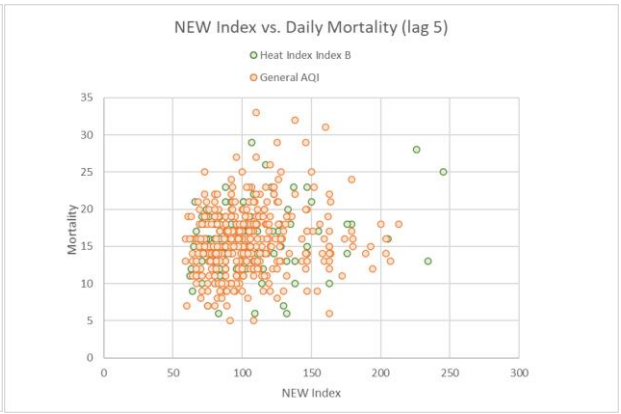
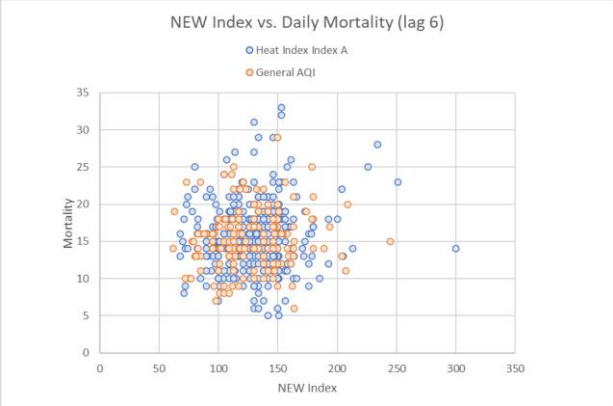
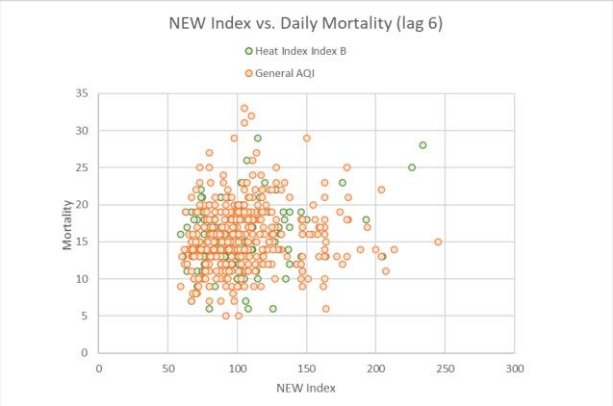
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
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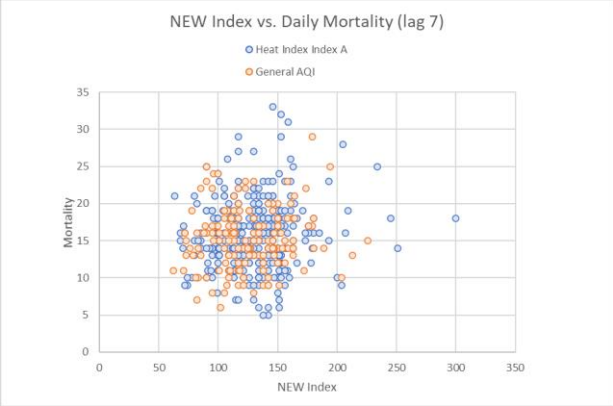
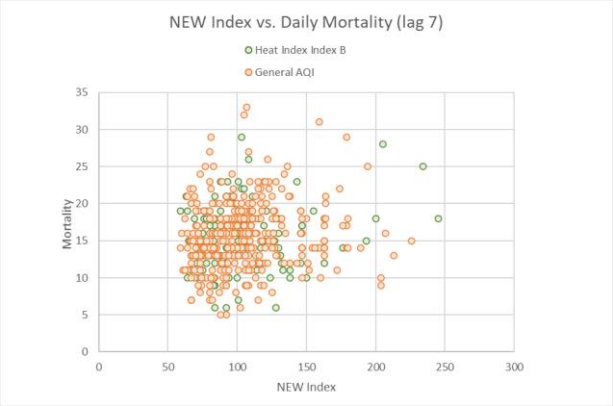
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
General AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
General AQI
Mortality
NEW Index
0
5
10
15
20
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50
100
150
200
250
300

Appendix B:

PM2.5 AQI Full Results

The documents that follow include full results for regression runs that consider the $PM_{2.5}$ AQI.

Each production run corresponds to one of the ten population sets analyzed in this project as described in section 3.4.

Each production run consists of RMSE plots for each lag day, a table of RMSE values and their 95% confidence intervals for each lag day, a table of RMSE values and their 95% confidence intervals, and scatterplots of NEW indices versus mortality of the population set.

The model results in the plots and tables are those described in section 3.5.

'AQI' refers to Model 1, the model in which the sole explanatory variable of the regression model was daily $PM_{2.5}$ AQI values.

'AQI + HI' refers to Model 2, the model in which the explanatory variables were daily $PM_{2.5}$ AQI values and HI values.

'NEW A' refers to Model 3A, the model in which the sole explanatory variable was the NEW A index where the version of the AQI considered was the $PM_{2.5}$ AQI.

'NEW B' refers to Model 3B, the model in which the sole explanatory variable was the NEW B index where the version of the AQI considered was the $PM_{2.5}$ AQI.

'RAW' refers to Model 4, the model in which the explanatory variables are pollutant concentrations of the criteria pollutants and temperature and relative humidity measurements.

Production Run:

M, 60-74, cardio, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

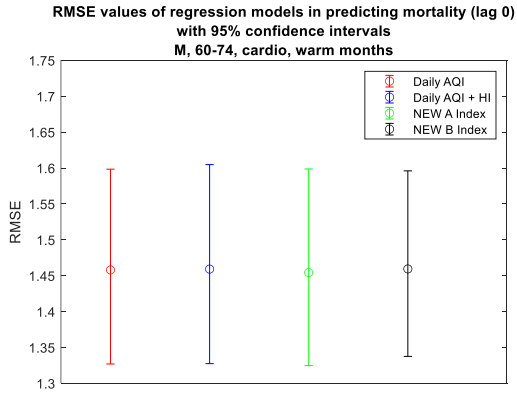
(how I originally defined the transformed HI in our NEW index)

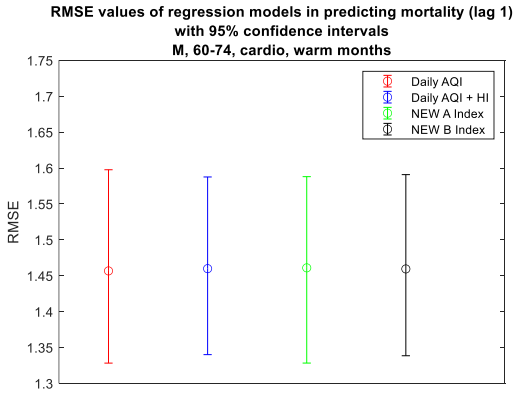
B

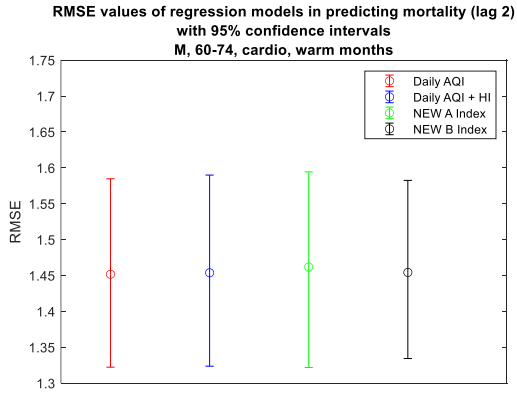
(transformed HI shifted down one category)

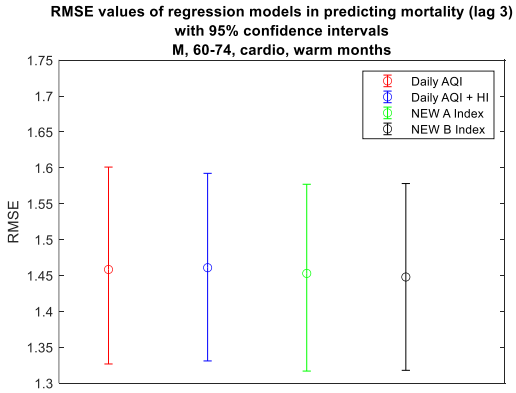
HI_Index Breakpoints

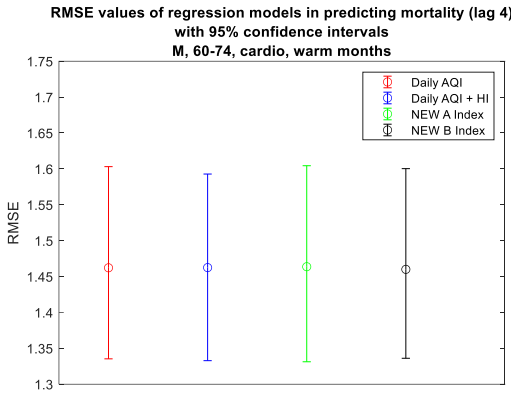
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

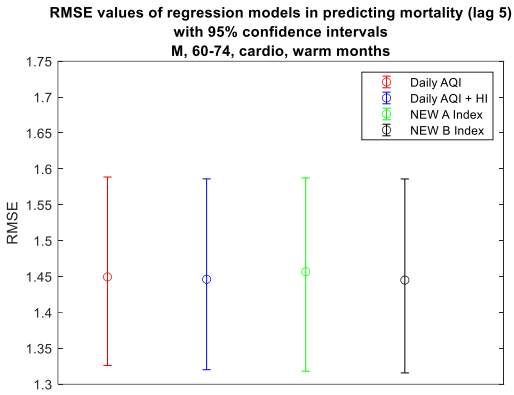


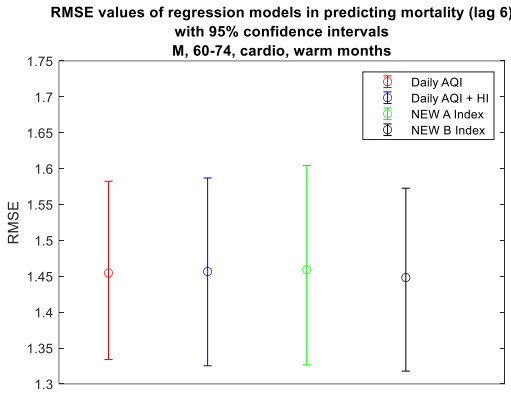


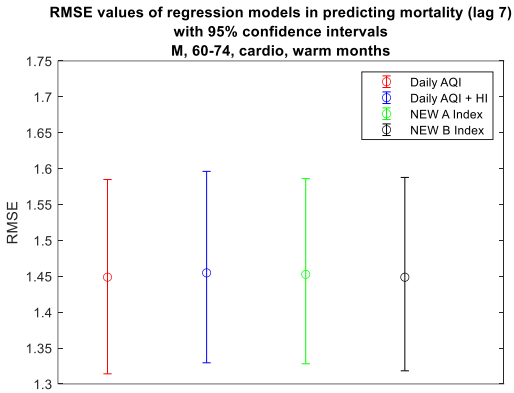





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.4581 +/-0.13568	1.4592 +/-0.13865	1.4544 +/-0.13695	1.4595 +/-0.12924
1	1.4567 +/-0.1347	1.4599 +/-0.12376	1.461 +/-0.12986	1.4595 +/-0.12617
2	1.4516 +/-0.13122	1.4537 +/-0.13313	1.4618 +/-0.13625	1.4542 +/-0.12408
3	1.4583 +/-0.13715	1.4608 +/-0.13068	1.4528 +/-0.13013	1.4478 +/-0.13011
4	1.4622 +/-0.13389	1.4625 +/-0.13	1.4637 +/-0.13656	1.46 +/-0.13211
5	1.4495 +/-0.13127	1.4462 +/-0.13293	1.4566 +/-0.13468	1.4451 +/-0.13512
6	1.4546 +/-0.12421	1.4566 +/-0.13081	1.4592 +/-0.13898	1.4483 +/-0.1274
7	1.4488 +/-0.13538	1.4548 +/-0.13335	1.4527 +/-0.12896	1.4487 +/-0.13471

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0412 +/-0.12745	1.0905 +/-0.15806	1.0587 +/-0.11052	1.0718 +/-0.12266	1.1458 +/-0.41637
1	1.0841 +/-0.12777	1.1244 +/-0.18808	1.0425 +/-0.11152	1.0671 +/-0.13407	1.078 +/-0.34268
2	1.1267 +/-0.13269	1.172 +/-0.15916	1.06 +/-0.096607	1.1097 +/-0.12789	1.1204 +/-0.39054
3	1.1 +/-0.12845	1.1672 +/-0.17856	1.0664 +/-0.10631	1.137 +/-0.12425	1.074 +/-0.34763
4	1.0647 +/-0.12501	1.1054 +/-0.16837	1.0412 +/-0.11509	1.085 +/-0.13251	1.0011 +/-0.33517
5	1.1401 +/-0.13286	1.2025 +/-0.15753	1.0944 +/-0.10659	1.1691 +/-0.12022	1.2933 +/-0.4401
6	1.1253 +/-0.12983	1.1699 +/-0.16198	1.0659 +/-0.12035	1.1456 +/-0.14416	1.2112 +/-0.40603
7	1.0998 +/-0.12303	1.1498 +/-0.17165	1.0742 +/-0.10762	1.1339 +/-0.13081	1.2388 +/-0.40012

AQI Regression: PM2.5 AQI predictor statistically significant on lag days 2 and 6 with 90% confidence and on lag day 5 with 95% confidence.

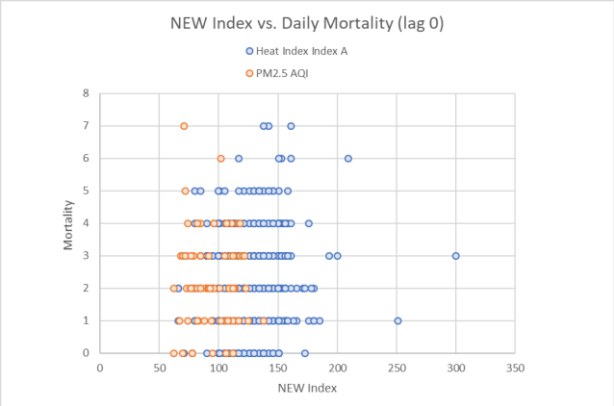
AQI+HI Regression: PM2.5 AQI predictor statistically significant on lag days 2, 5, 6, and 7 with 90% confidence.

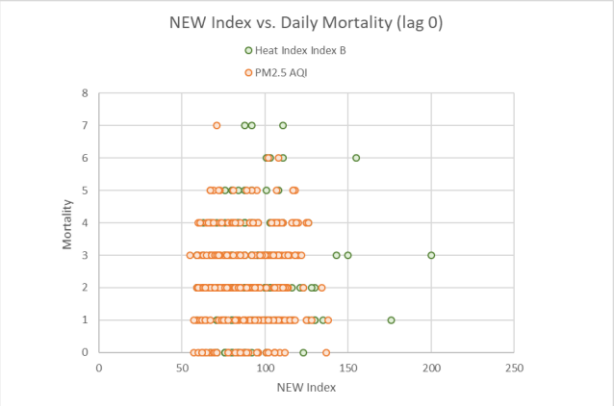
NEW A Regression: NEW A predictor statistically significant on lag day 5 with 90% confidence.

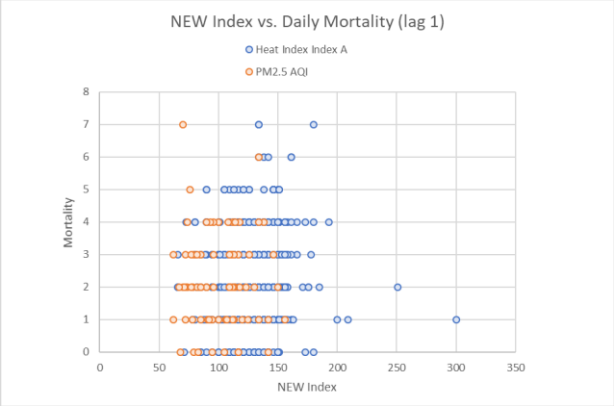
NEW B Regression: NEW B predictor statistically significant on lag day 2 with 90% confidence and on lag days 3, 5, 6 and 7 with 95% confidence.

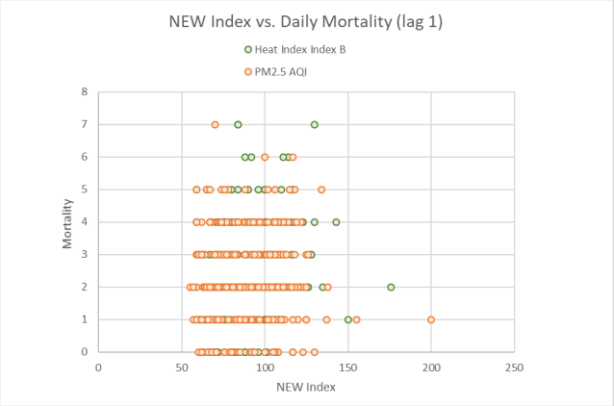
RAW Regression: PM2.5 predictor statistically significant on lag days 5 and 6 with 90% confidence.

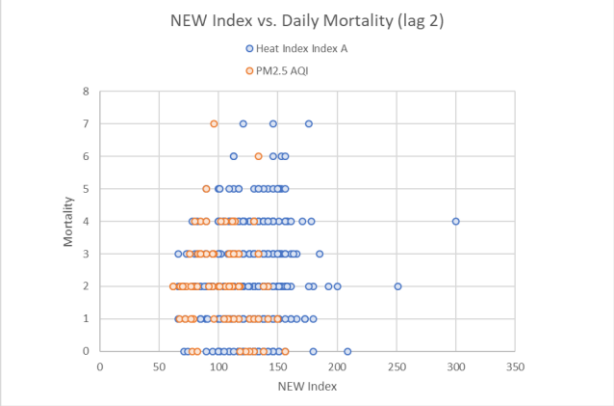
NEW Index vs. Daily Mortality Plots (for M, 60-74, cardio, warm months)

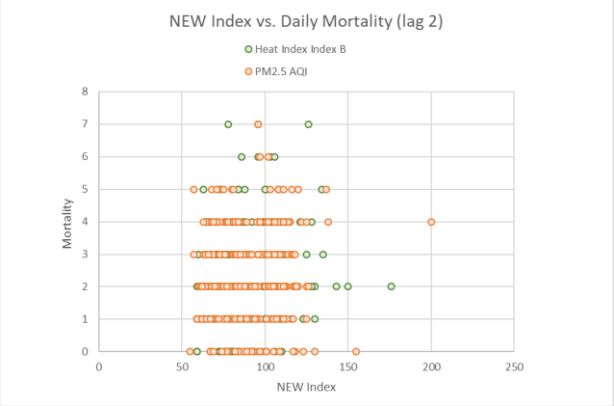


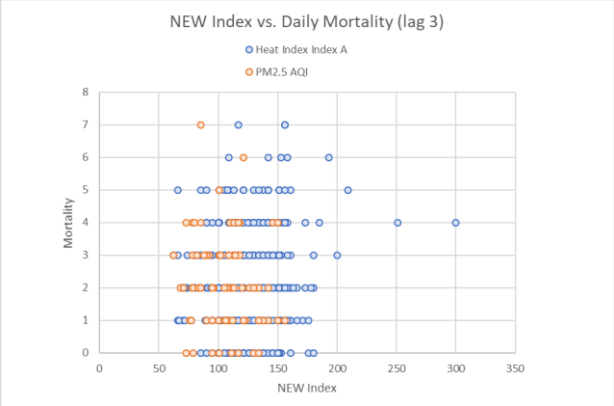


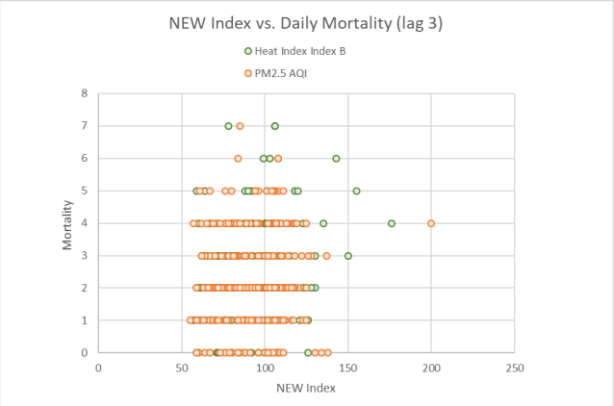


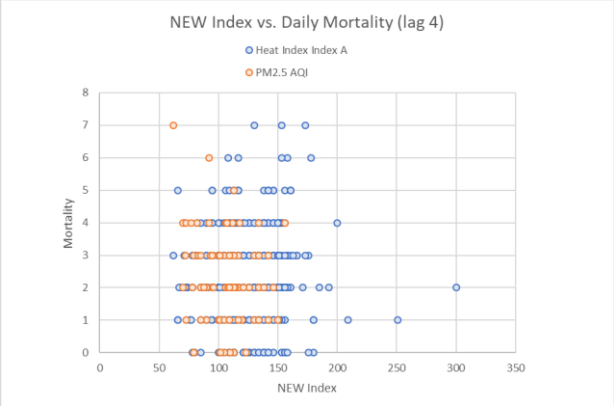


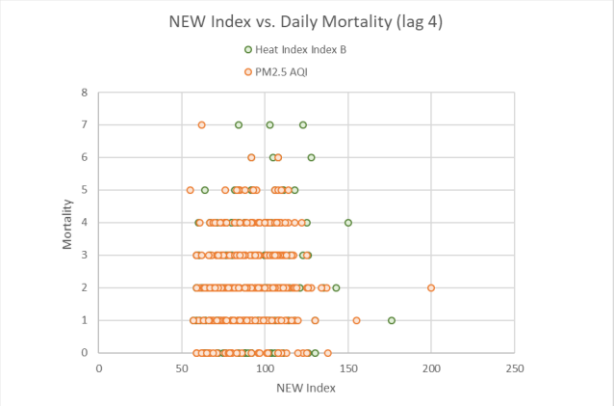


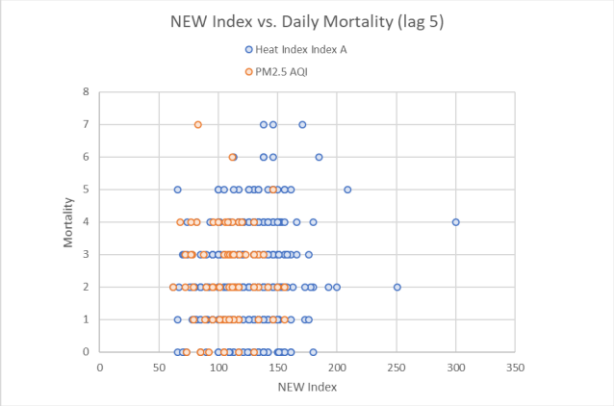


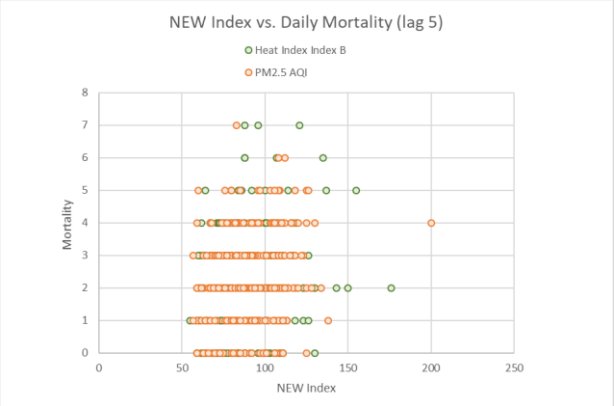

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

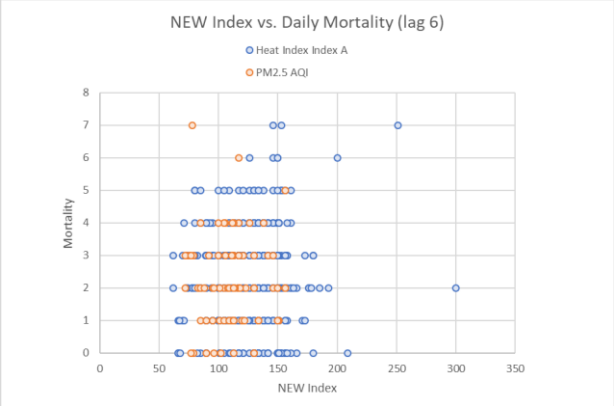

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

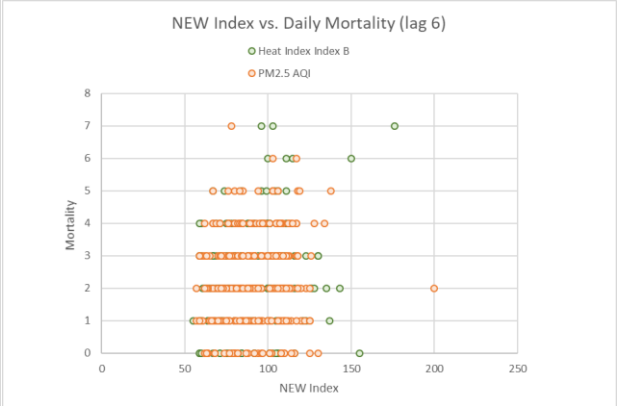

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

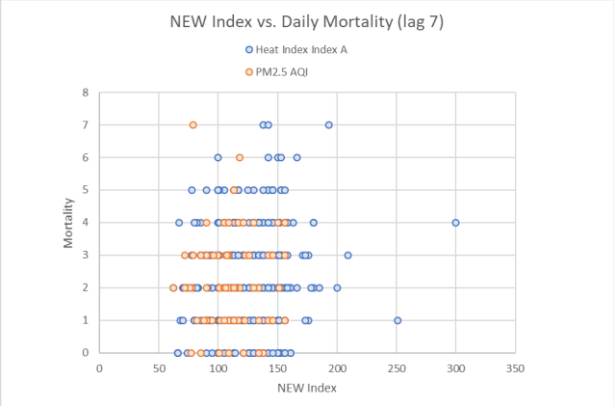

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

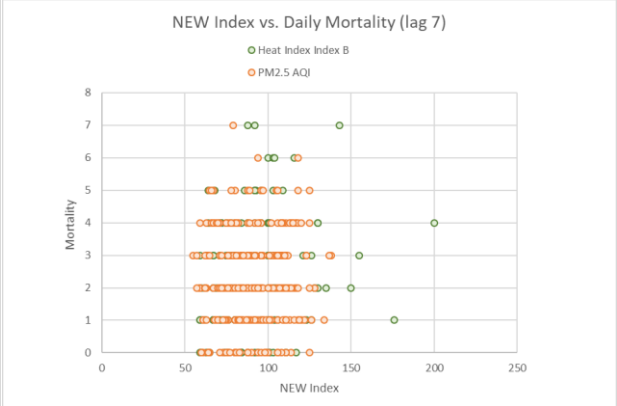

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250

Production Run:

M, 75+, cardio, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

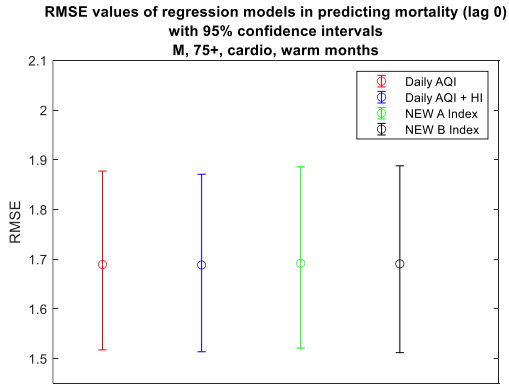
(how I originally defined the transformed HI in our NEW index)

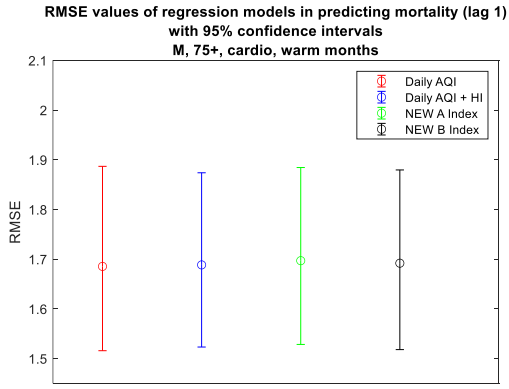
B

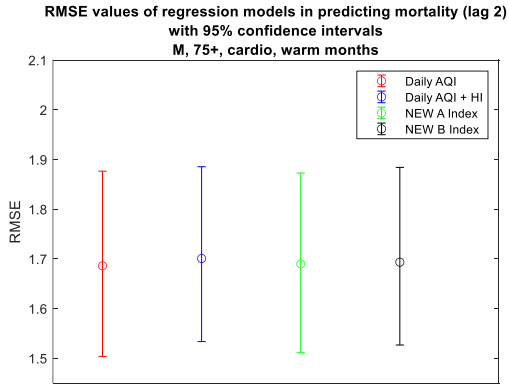
(transformed HI shifted down one category)

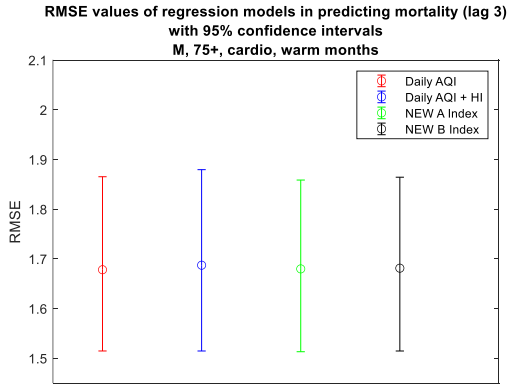
HI_Index Breakpoints

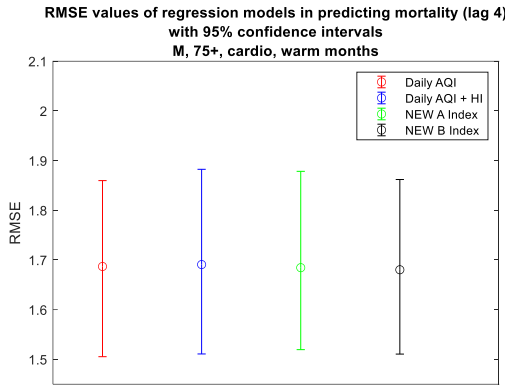
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

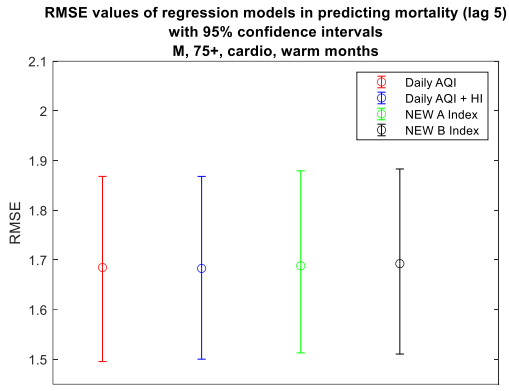


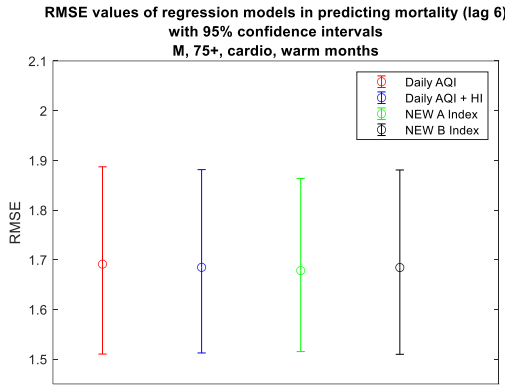


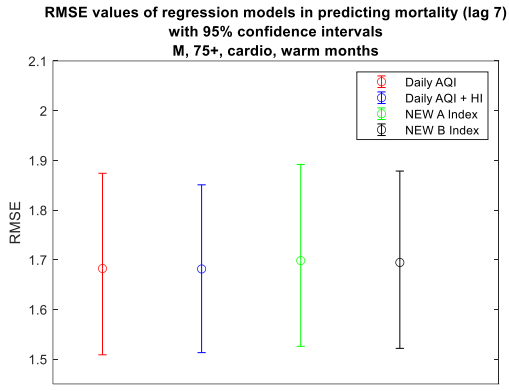





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.6893 +/-0.17992	1.6883 +/-0.17863	1.6918 +/-0.1824	1.6906 +/-0.18801
1	1.6854 +/-0.1855	1.6885 +/-0.17534	1.697 +/-0.178	1.6919 +/-0.18076
2	1.6861 +/-0.18634	1.7008 +/-0.17592	1.6898 +/-0.1809	1.6934 +/-0.17874
3	1.6782 +/-0.17532	1.6873 +/-0.18246	1.6799 +/-0.17274	1.6813 +/-0.17487
4	1.6869 +/-0.17718	1.6908 +/-0.18579	1.6845 +/-0.1794	1.6803 +/-0.17566
5	1.6848 +/-0.18635	1.683 +/-0.18391	1.6883 +/-0.18321	1.6926 +/-0.18622
6	1.6911 +/-0.18842	1.6846 +/-0.18449	1.6782 +/-0.17424	1.6843 +/-0.18548
7	1.6823 +/-0.18264	1.6814 +/-0.16884	1.6982 +/-0.18295	1.6944 +/-0.17837

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0647 +/-0.13142	1.0761 +/-0.1771	1.0226 +/-0.12203	1.0545 +/-0.13685	1.0058 +/-0.34525
1	1.0898 +/-0.12646	1.0843 +/-0.16397	0.9986 +/-0.09626	1.0427 +/-0.11528	0.93146 +/-0.30709
2	1.033 +/-0.12091	1.0782 +/-0.17087	1.0335 +/-0.097786	1.04 +/-0.11221	0.87375 +/-0.27572
3	1.1068 +/-0.12207	1.1529 +/-0.18476	1.0707 +/-0.098417	1.1092 +/-0.10924	1.1186 +/-0.38377
4	1.0908 +/-0.12953	1.1202 +/-0.17259	1.0677 +/-0.10427	1.1007 +/-0.12599	1.0087 +/-0.32261
5	1.0736 +/-0.11429	1.0883 +/-0.15371	1.0421 +/-0.099995	1.0365 +/-0.10682	1.1151 +/-0.37127
6	1.0639 +/-0.12107	1.0904 +/-0.1452	1.0515 +/-0.092004	1.0777 +/-0.11328	1.0681 +/-0.32207
7	1.1036 +/-0.12461	1.1189 +/-0.14443	1.0189 +/-0.090168	1.0699 +/-0.1111	1.1509 +/-0.38074

AQI Regression: PM2.5 AQI predictor statistically significant on lag day 3 with 90% confidence.

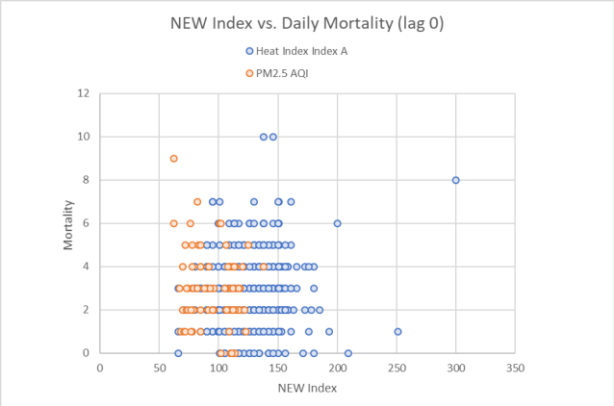
AQI+HI Regression: PM2.5 AQI predictor statistically significant of lag day 7 with 90% confidence.

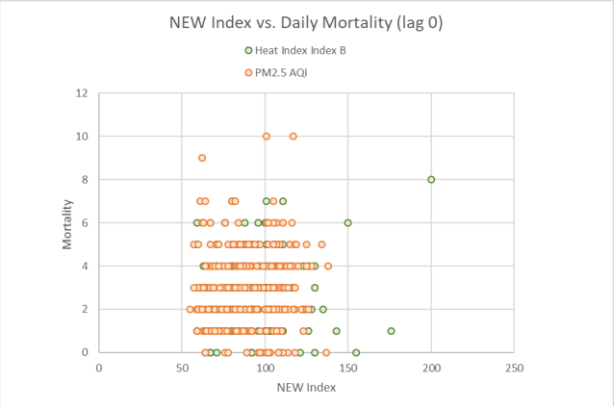
NEW A Regression: No statistically significant predictors.

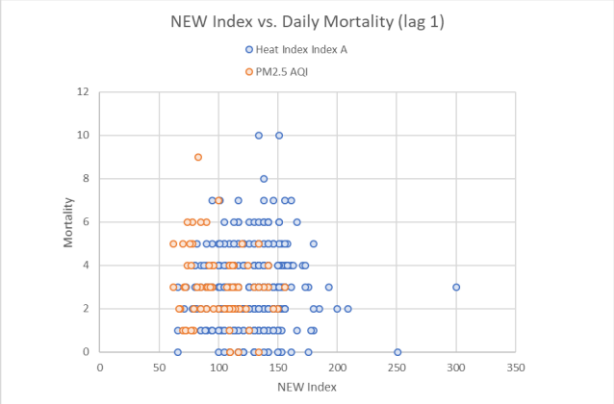
NEW B Regression: NEW B index predictor statistically significant on lag day 4 with 90% confidence and on lag day 3 with 95% confidence.

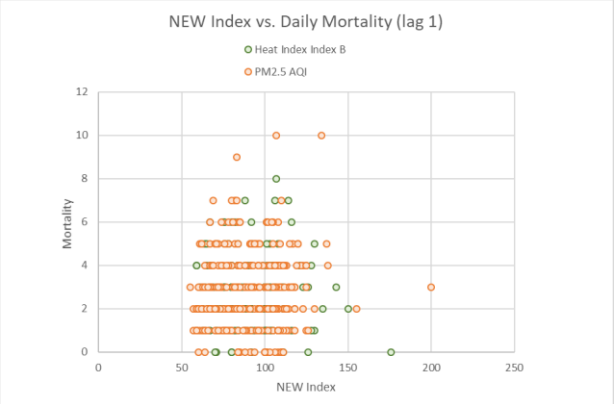
RAW Regression: No statistically significant predictors.

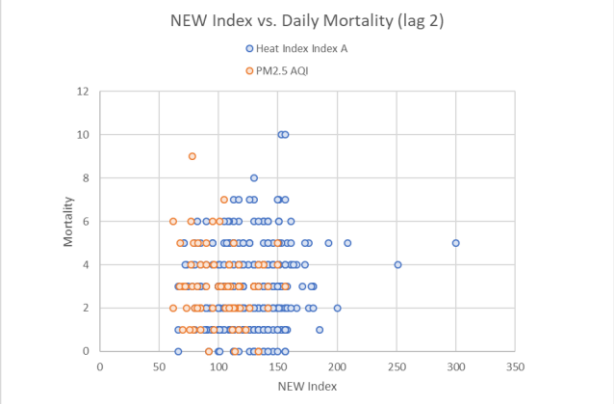
NEW Index vs. Daily Mortality Plots (for M, 75+, cardio, warm months)

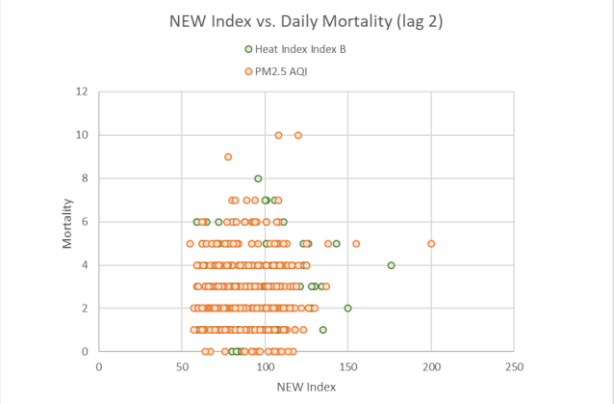


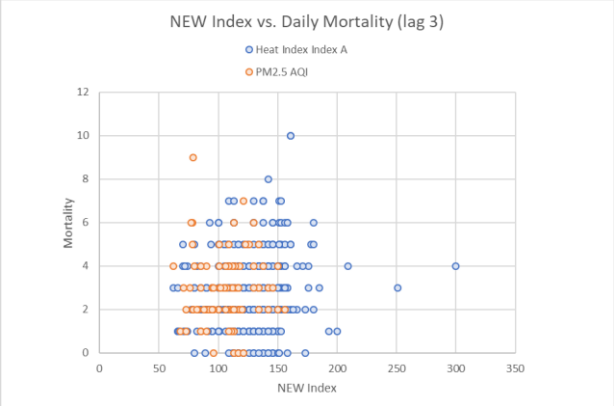


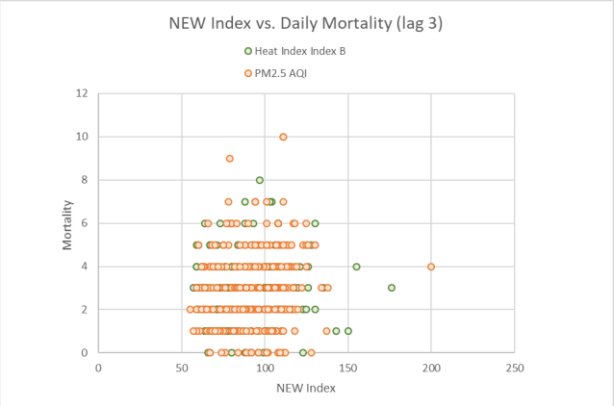


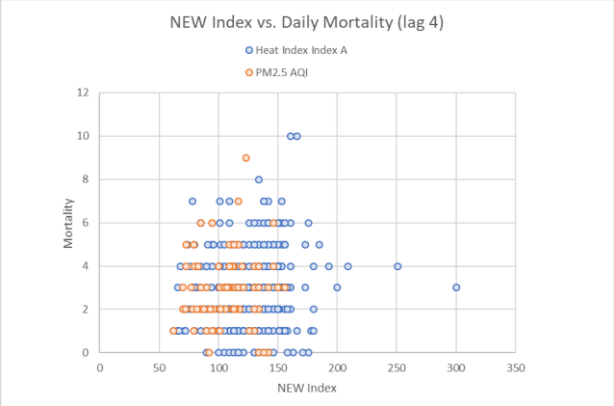


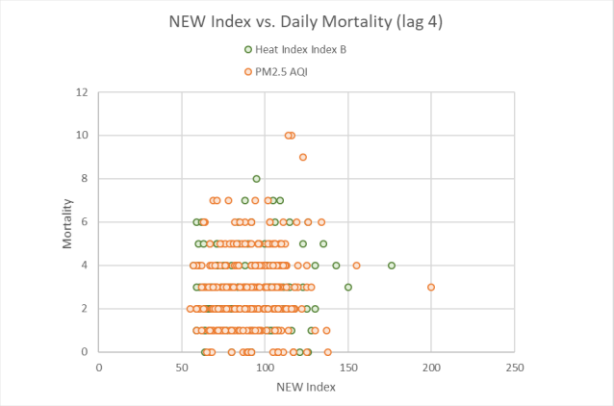


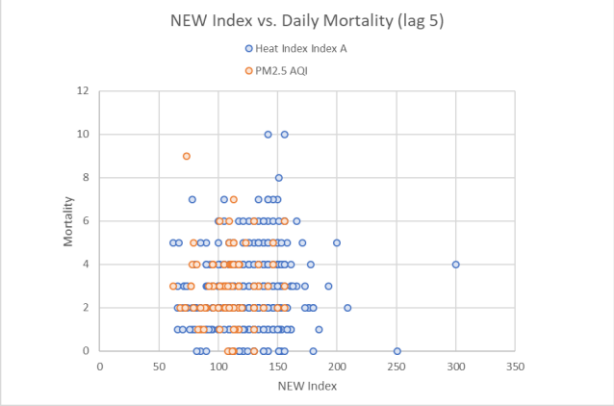


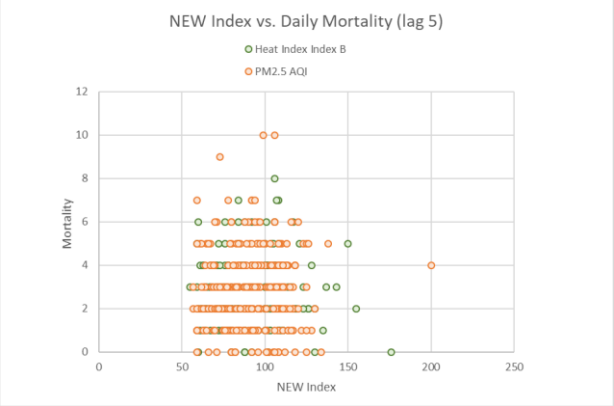

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

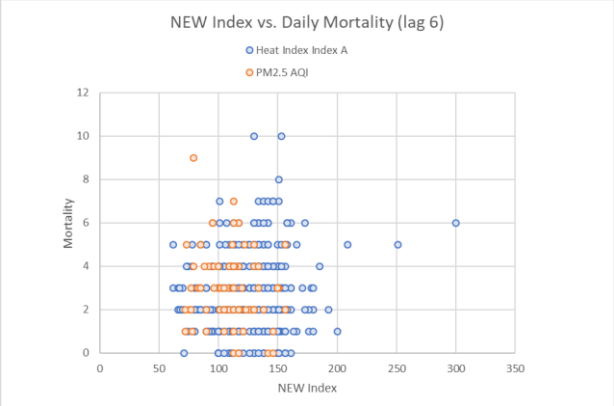

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

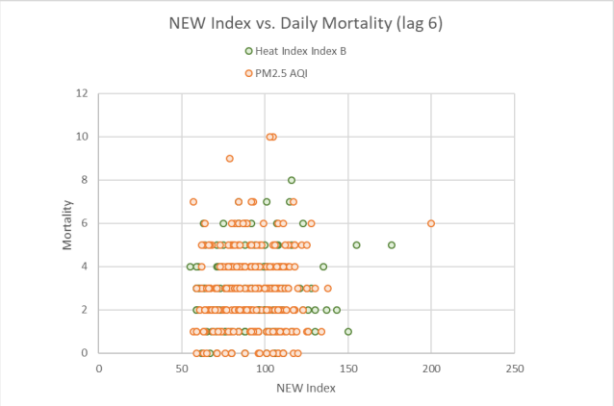

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

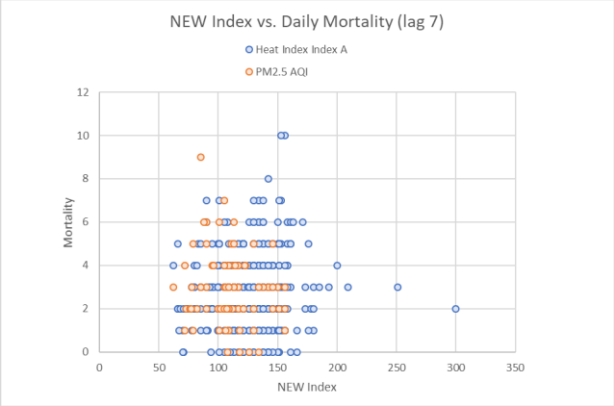

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

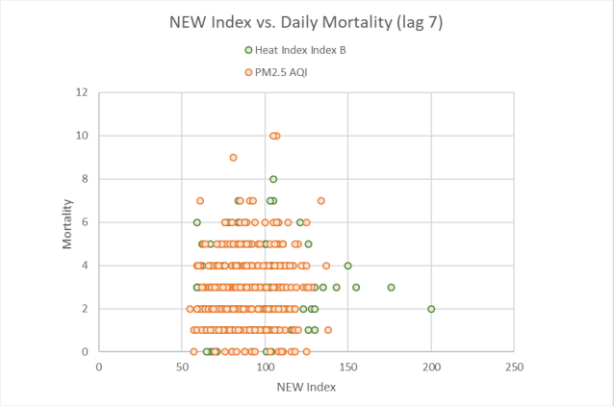

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250

Production Run:

M, 60-74, resp, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

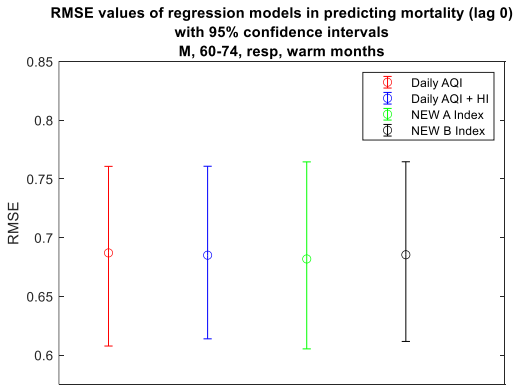
(how I originally defined the transformed HI in our NEW index)

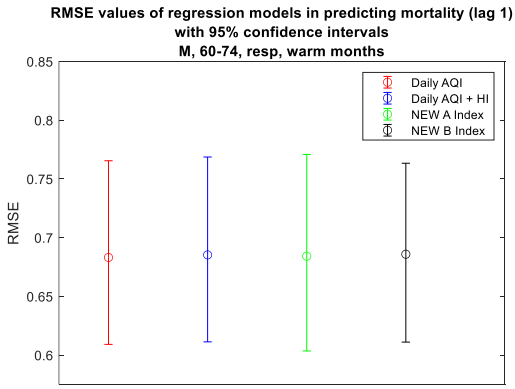
B

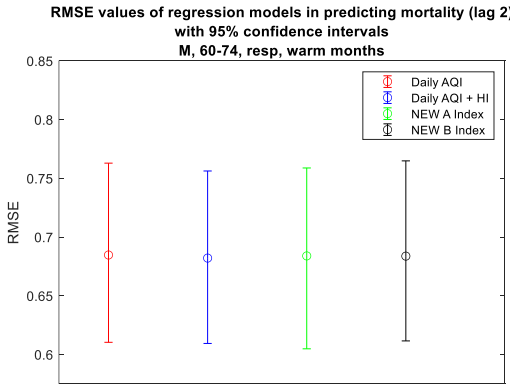
(transformed HI shifted down one category)

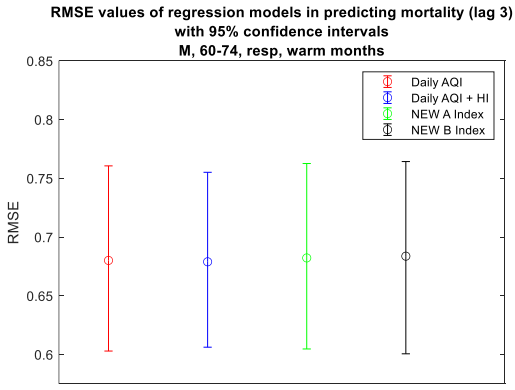
HI_Index Breakpoints

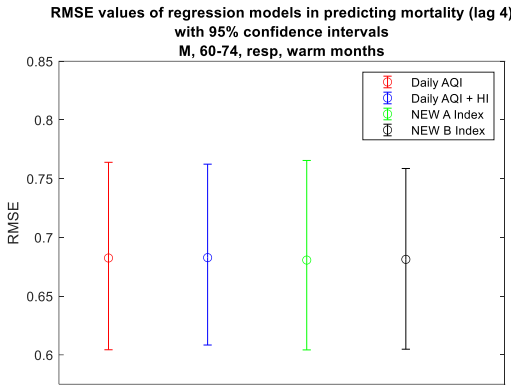
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

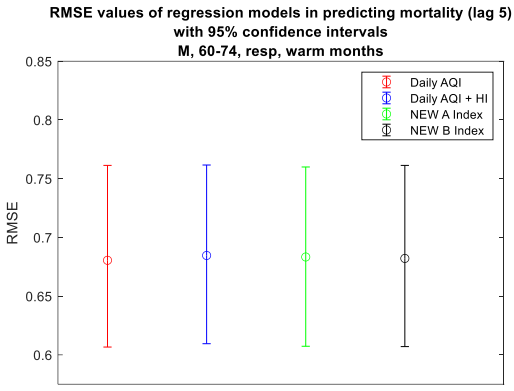


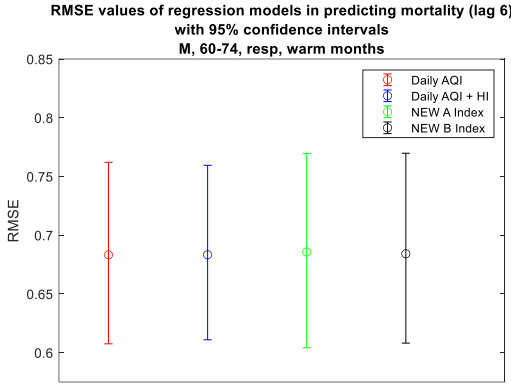







RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
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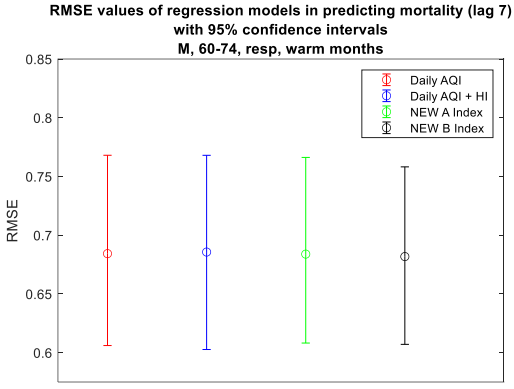
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.68702 +/-0.076485	0.68505 +/-0.073469	0.68186 +/-0.079601	0.68544 +/-0.076489
1	0.68311 +/-0.078171	0.68532 +/-0.078685	0.68423 +/-0.083653	0.6859 +/-0.07614
2	0.6847 +/-0.076269	0.68208 +/-0.073417	0.68393 +/-0.076986	0.68375 +/-0.076642
3	0.68009 +/-0.078831	0.67893 +/-0.074455	0.68221 +/-0.078946	0.68371 +/-0.08184
4	0.68246 +/-0.079798	0.68277 +/-0.076987	0.68069 +/-0.08065	0.68129 +/-0.076931
5	0.68049 +/-0.07733	0.6846 +/-0.076067	0.68332 +/-0.076324	0.68209 +/-0.077133
6	0.68325 +/-0.077233	0.68337 +/-0.074277	0.68573 +/-0.082734	0.68418 +/-0.080819
7	0.68429 +/-0.081	0.68564 +/-0.082668	0.68389 +/-0.079019	0.6818 +/-0.075556

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0068 +/-0.31931	0.99728 +/-0.40573	0.98548 +/-0.25208	0.96535 +/-0.30169	1.1942 +/-1.0241
1	1.0204 +/-0.3182	1.002 +/-0.38768	0.96169 +/-0.2248	0.94168 +/-0.27726	1.6352 +/-1.4062
2	1.0105 +/-0.3176	0.91273 +/-0.37086	0.86075 +/-0.21411	0.86114 +/-0.26057	1.1455 +/-0.96993
3	1.1695 +/-0.32889	1.0969 +/-0.41983	0.91255 +/-0.22229	0.97637 +/-0.2688	1.681 +/-1.4711
4	0.98161 +/-0.29314	0.93219 +/-0.35635	0.94548 +/-0.22344	0.89518 +/-0.26195	1.3908 +/-1.0896
5	1.0262 +/-0.30214	1.0303 +/-0.38336	1.0041 +/-0.24126	0.98096 +/-0.28541	0.96426 +/-0.83176
6	1.0091 +/-0.29097	1.0301 +/-0.36509	1.0186 +/-0.25262	1.0279 +/-0.31836	1.0557 +/-0.9463
7	0.89125 +/-0.28368	0.88784 +/-0.33966	0.97682 +/-0.22239	0.90541 +/-0.27028	0.94334 +/-0.8185

AQI Regression: No statistically significant predictors.

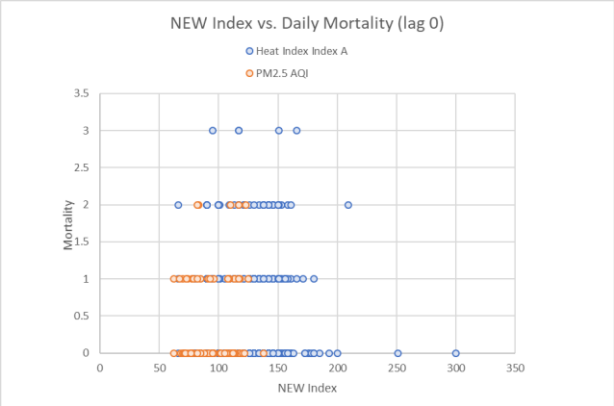
AQI+HI Regression: No statistically significant predictors.

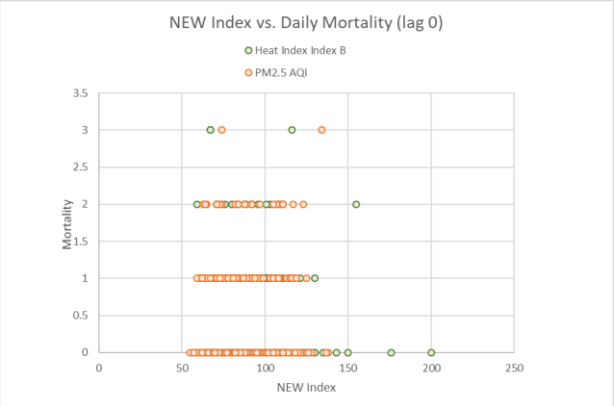
NEW A Regression: No statistically significant predictors.

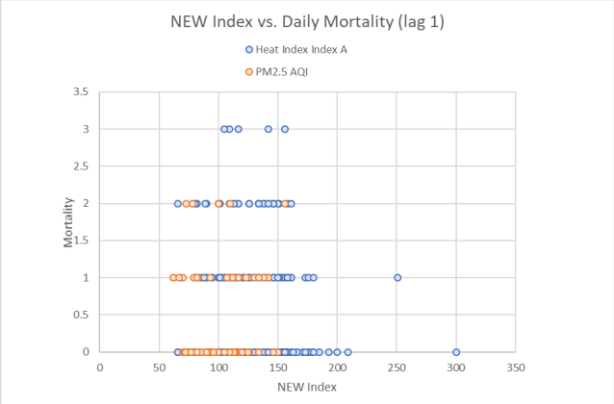
NEW B Regression: No statistically significant predictors.

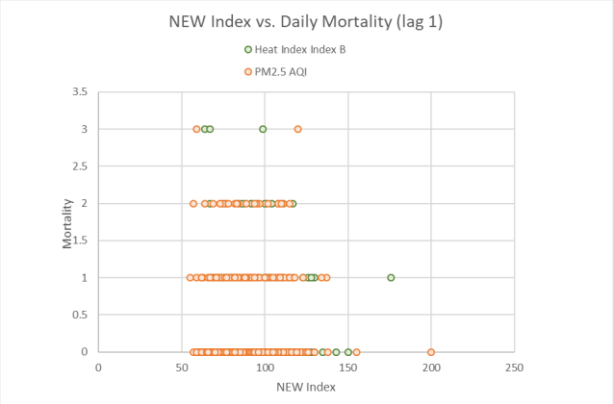
RAW Regression: No statistically significant predictors.

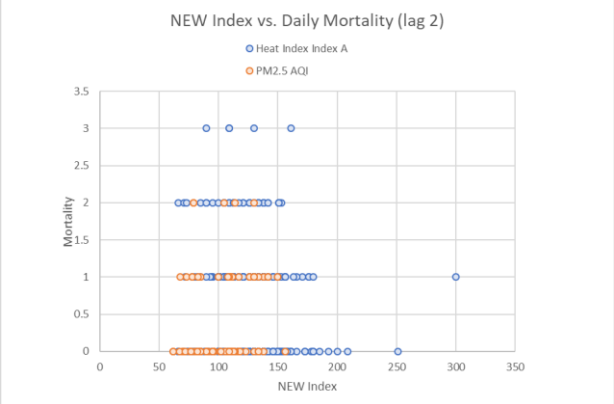
NEW Index vs. Daily Mortality Plots (for M, 60-74, resp, warm months)

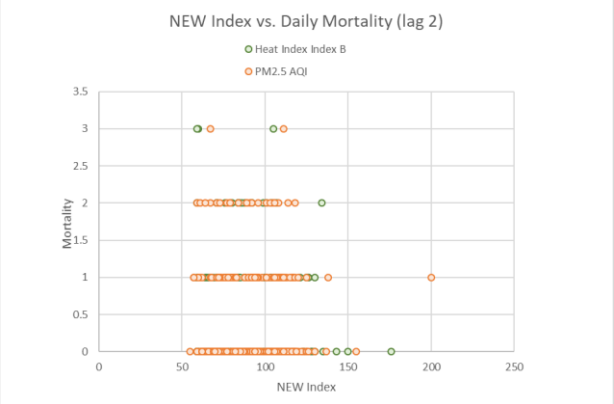


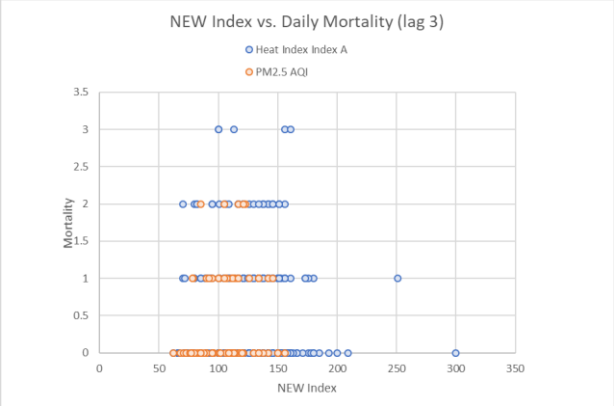


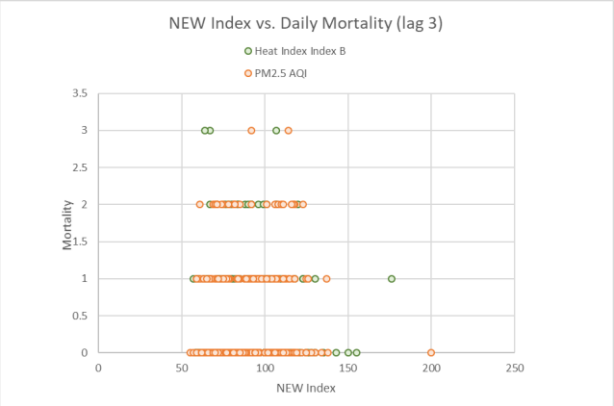


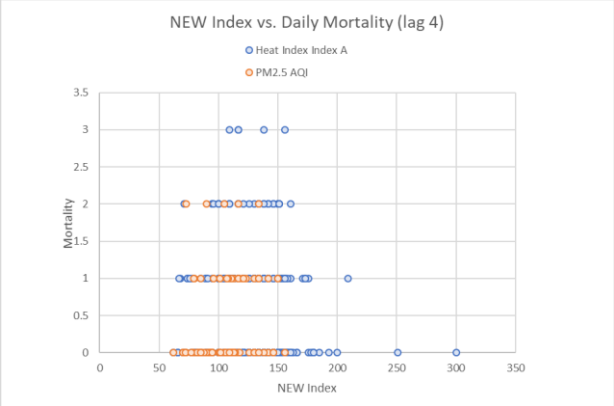


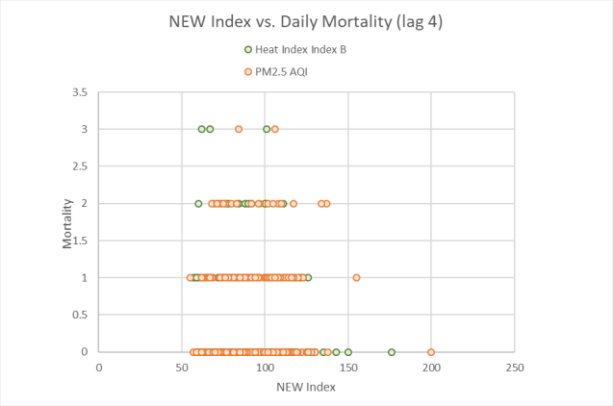


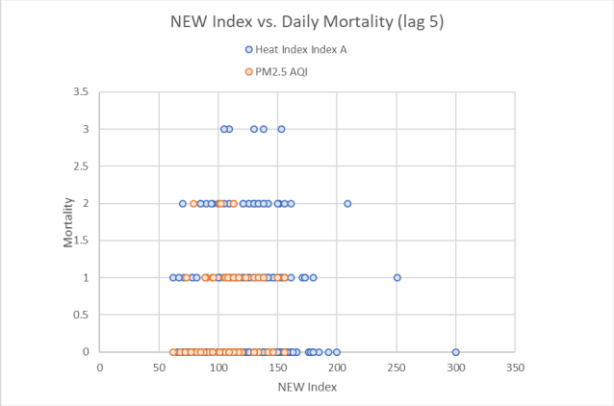


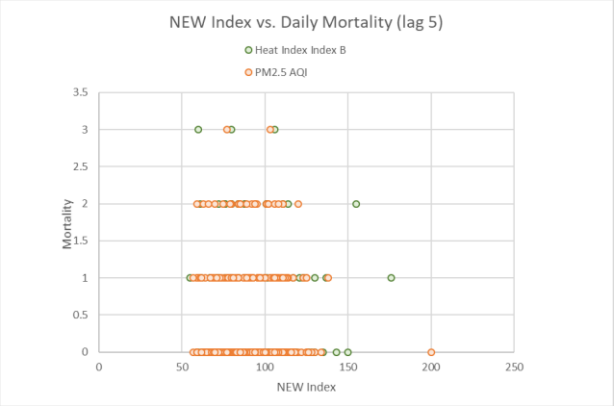

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

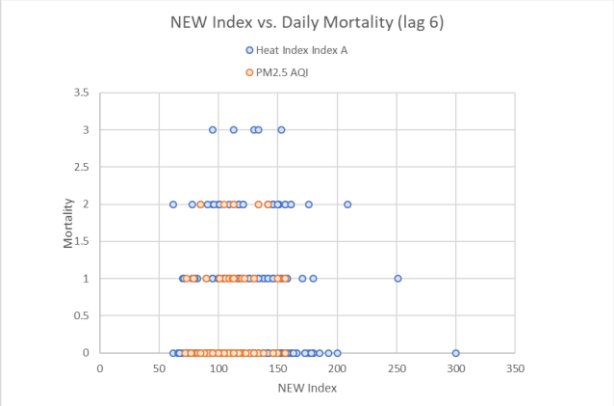

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

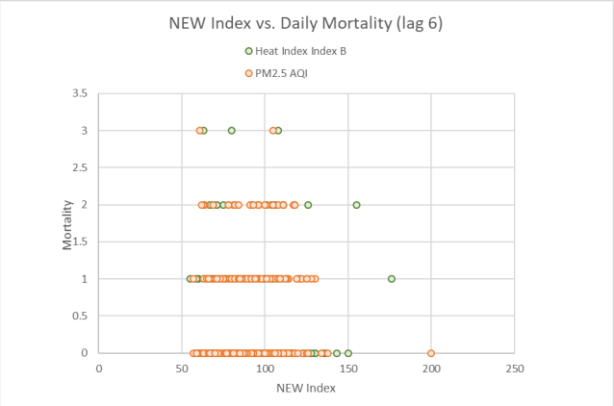

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

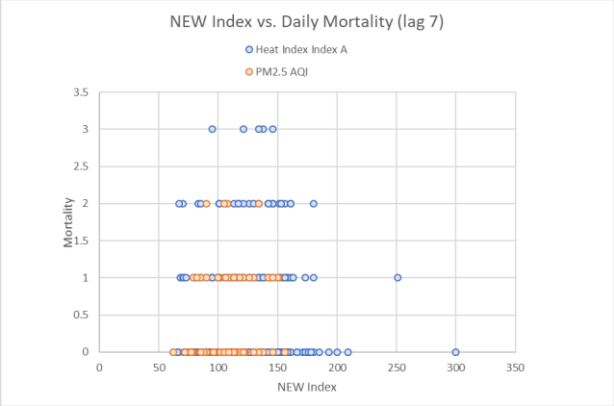

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

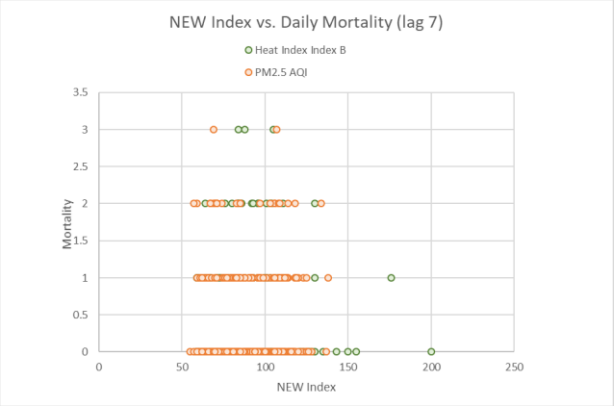

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250

Production Run:

M, 75+, resp, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

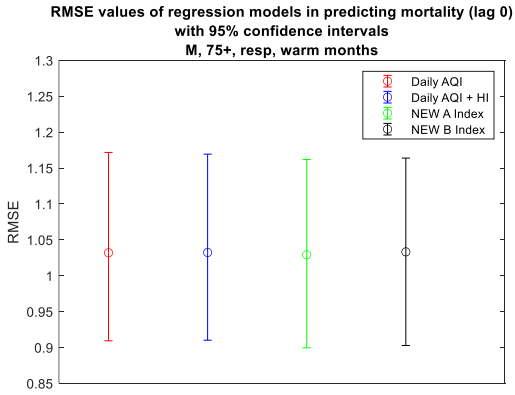
(how I originally defined the transformed HI in our NEW index)

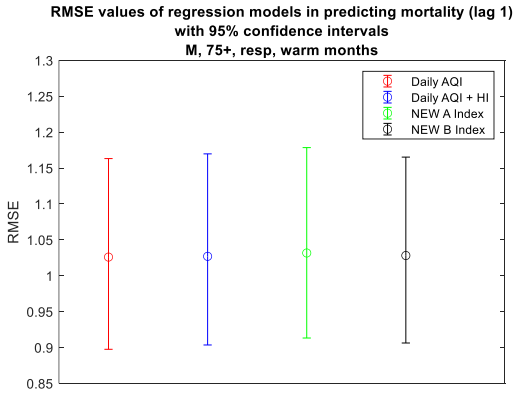
B

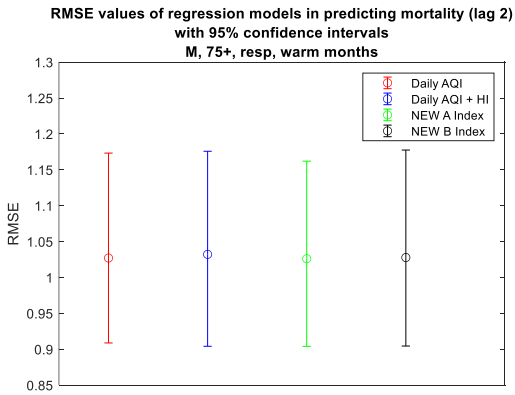
(transformed HI shifted down one category)

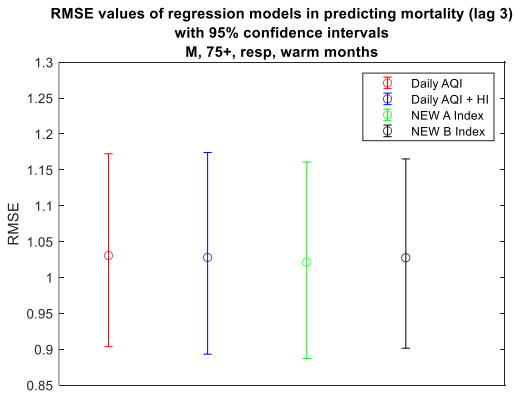
HI_Index Breakpoints

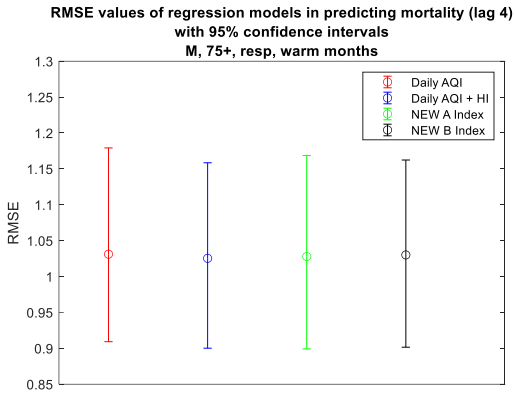
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

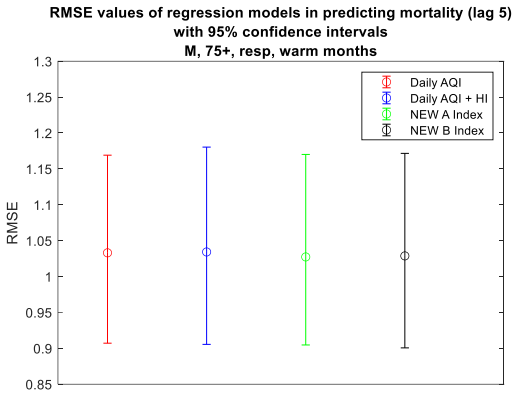


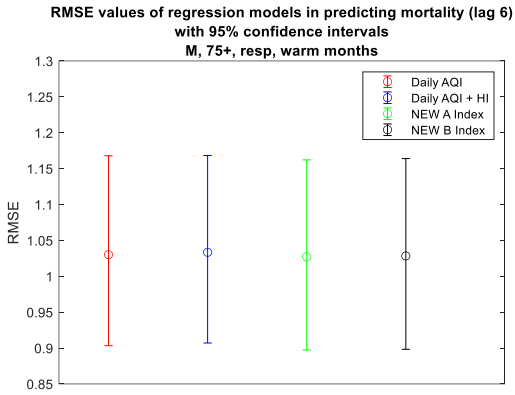


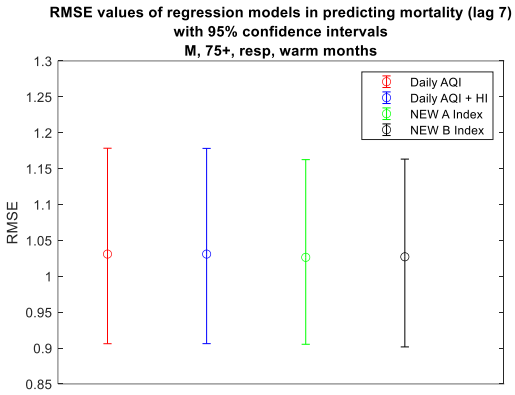





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.032 +/-0.13121	1.0323 +/-0.12961	1.0292 +/-0.13118	1.0333 +/-0.13055
1	1.026 +/-0.13286	1.027 +/-0.13313	1.0317 +/-0.13264	1.0282 +/-0.1295
2	1.0271 +/-0.13224	1.0322 +/-0.13584	1.0261 +/-0.12899	1.0278 +/-0.13653
3	1.0305 +/-0.13435	1.0278 +/-0.1405	1.0212 +/-0.13679	1.0274 +/-0.13186
4	1.0311 +/-0.13498	1.0253 +/-0.12917	1.0279 +/-0.13469	1.0301 +/-0.1304
5	1.0331 +/-0.13097	1.0342 +/-0.13742	1.0273 +/-0.13272	1.0288 +/-0.1355
6	1.0301 +/-0.1323	1.0334 +/-0.13063	1.0272 +/-0.13249	1.0283 +/-0.13286
7	1.0309 +/-0.13618	1.0309 +/-0.13601	1.0264 +/-0.12861	1.0271 +/-0.13082

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0384 +/-0.22286	1.1545 +/-0.31582	1.1276 +/-0.18348	1.0574 +/-0.219	1.1392 +/-0.64531
1	1.1565 +/-0.2745	1.2404 +/-0.33372	1.0922 +/-0.15609	1.12 +/-0.21643	1.3959 +/-0.77364
2	1.0004 +/-0.21742	1.0784 +/-0.30644	1.0844 +/-0.15437	1.0496 +/-0.19836	1.2776 +/-0.72659
3	1.0195 +/-0.19294	1.1176 +/-0.26853	1.0928 +/-0.16388	1.0855 +/-0.19878	1.257 +/-0.6922
4	1.0566 +/-0.24061	1.1419 +/-0.30849	1.0898 +/-0.17023	1.0849 +/-0.21733	1.505 +/-0.8118
5	1.0468 +/-0.21838	1.0093 +/-0.25889	0.96991 +/-0.13956	0.98157 +/-0.19153	0.80424 +/-0.46164
6	1.0452 +/-0.22351	1.046 +/-0.25225	1.0289 +/-0.14167	1.0349 +/-0.19289	0.73118 +/-0.39724
7	1.0858 +/-0.22719	1.1337 +/-0.29668	1.0979 +/-0.1994	1.065 +/-0.23008	0.97803 +/-0.59142

AQI Regression: No statistically significant predictors.

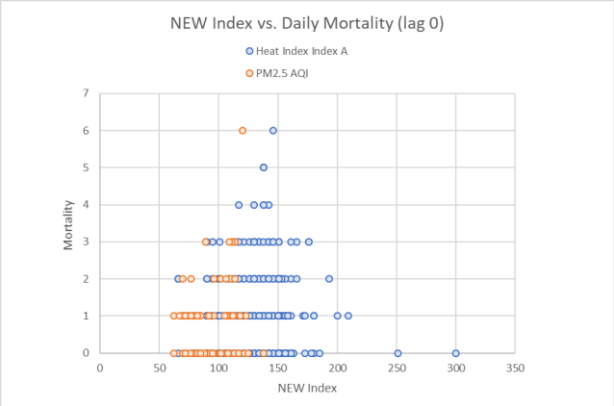
AQI+HI Regression: No statistically significant predictors.

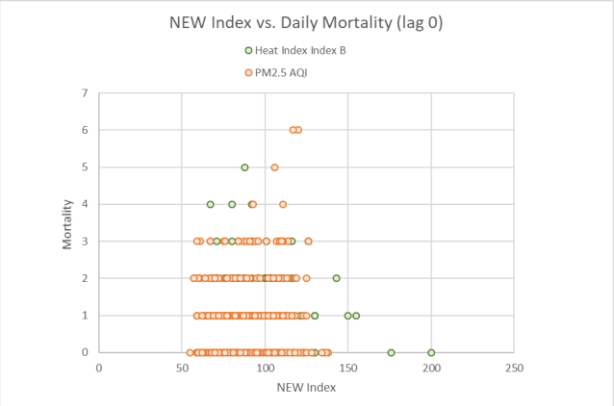
NEW A Regression: No statistically significant predictors.

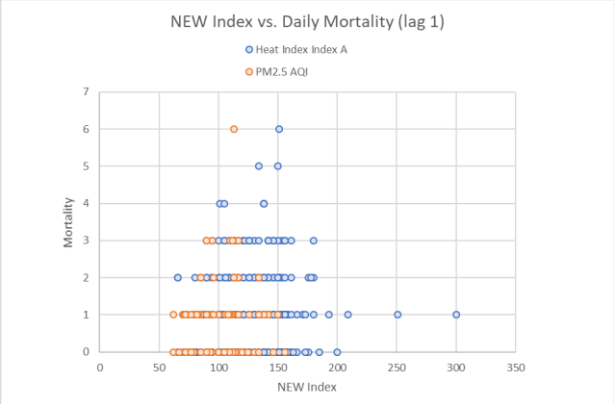
NEW B Regression: No statistically significant predictors.

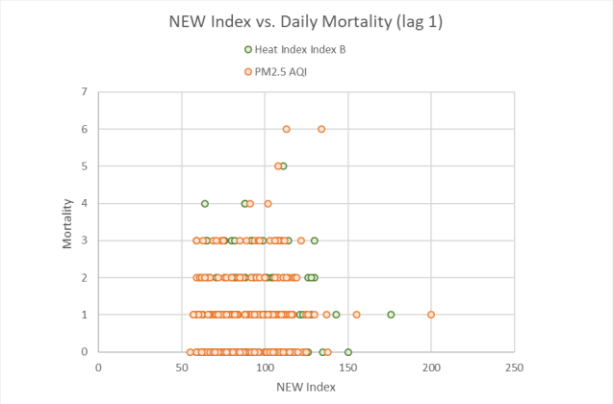
RAW Regression: Relative humidity predictor statistically significant on lag day 4 with 90% confidence.

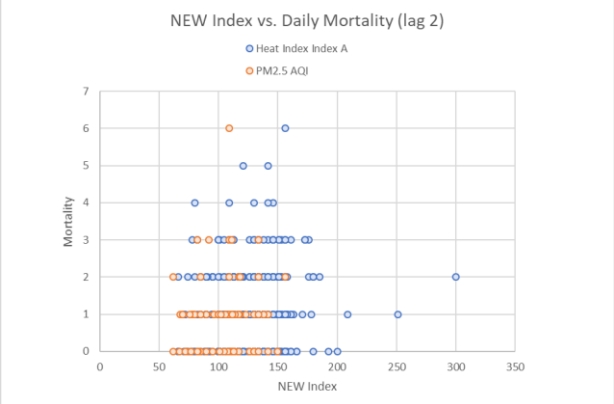
NEW Index vs. Daily Mortality Plots (for M, 75+, resp, warm months)

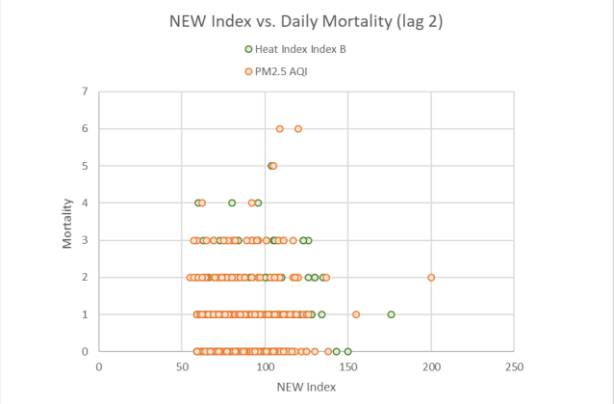


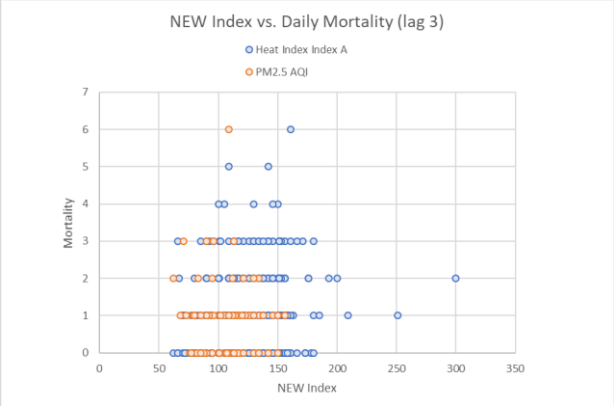


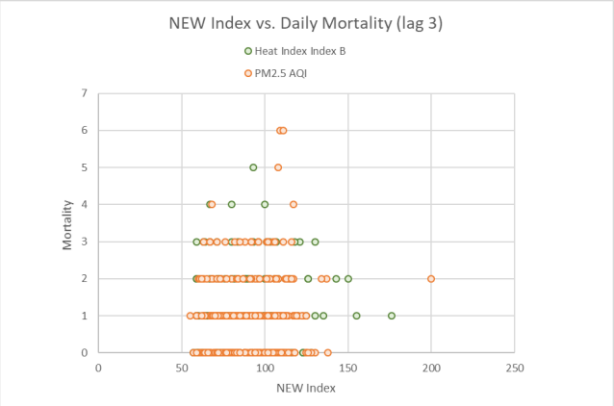


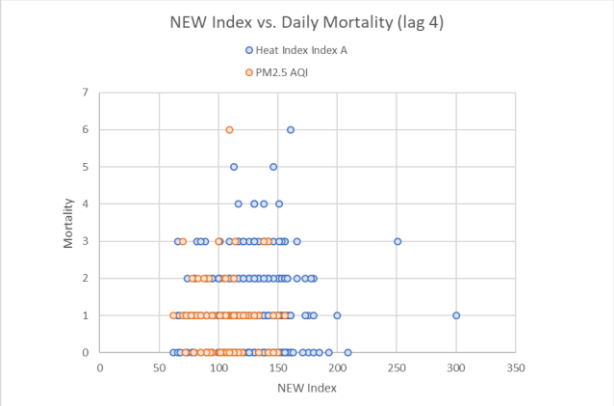


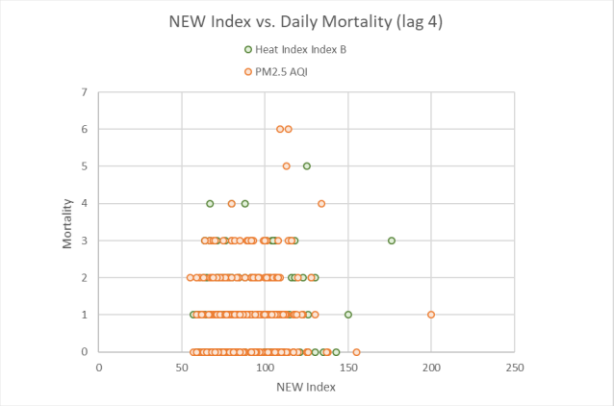


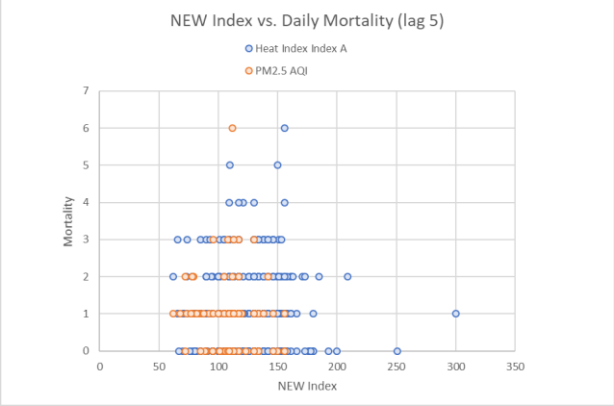


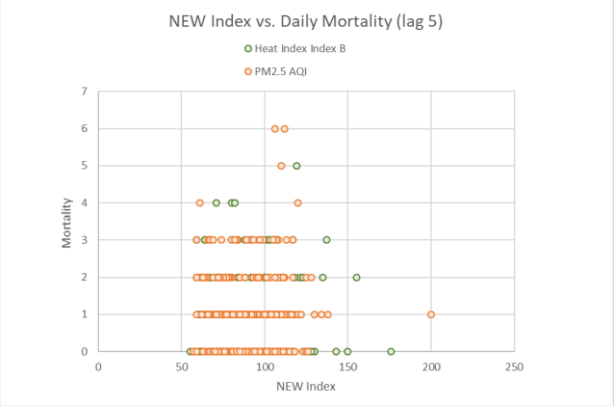

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

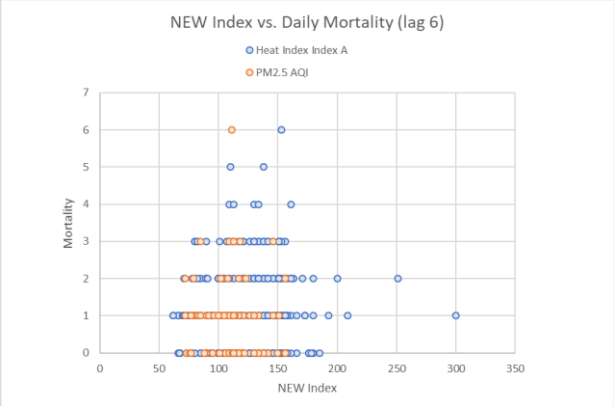

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

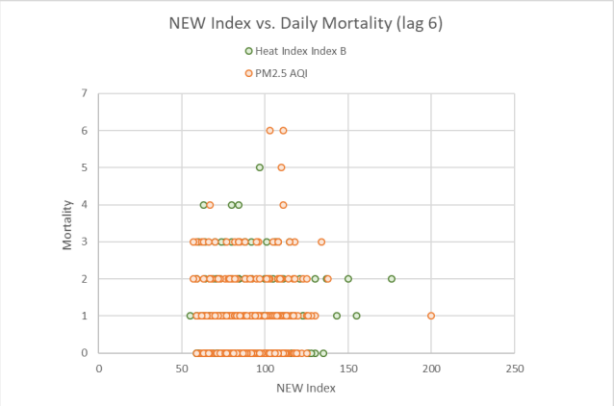

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350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PM2.5 AQI
Mortality
NEW Index
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1
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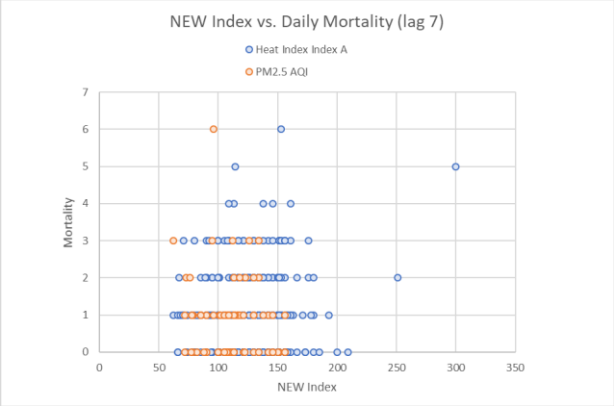
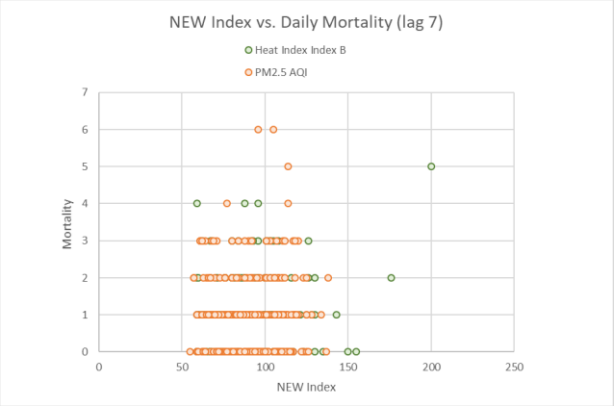

NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250

Production Run:

F, 60-74, cardio, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

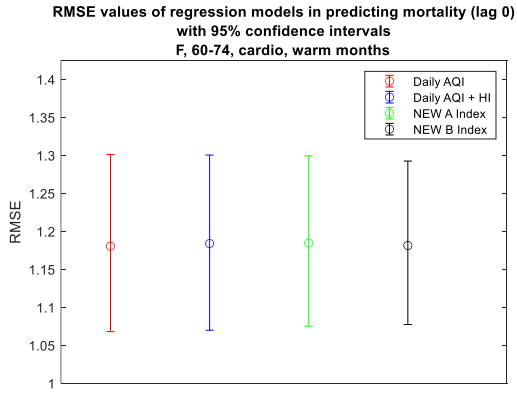
(how I originally defined the transformed HI in our NEW index)

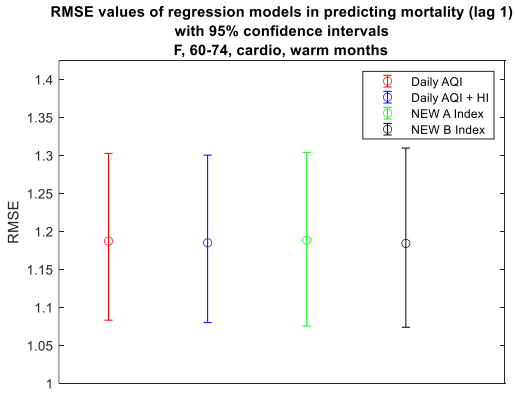
B

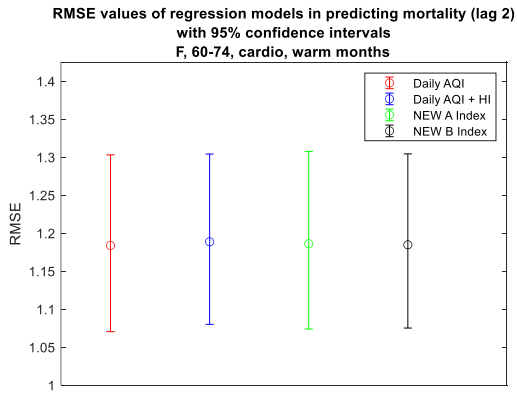
(transformed HI shifted down one category)

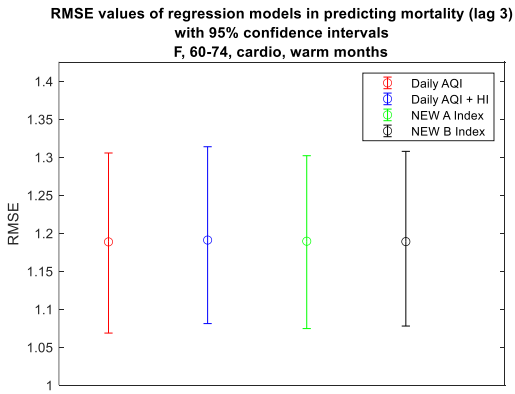
HI_Index Breakpoints

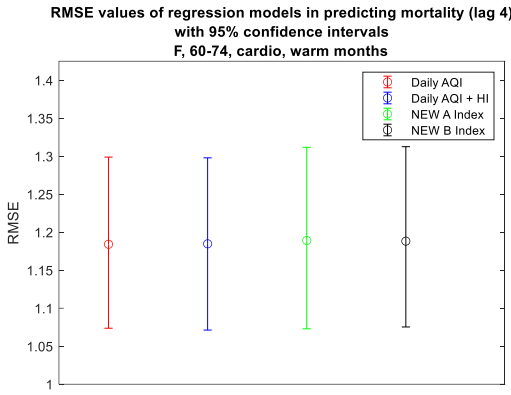
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

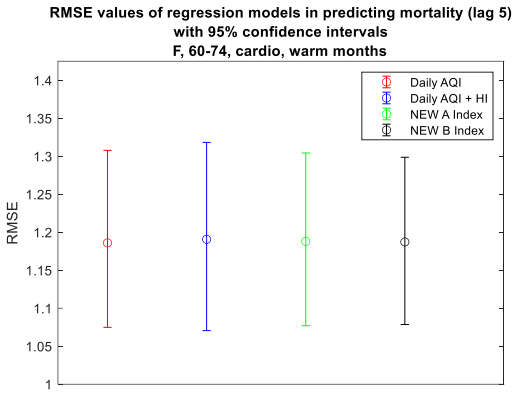


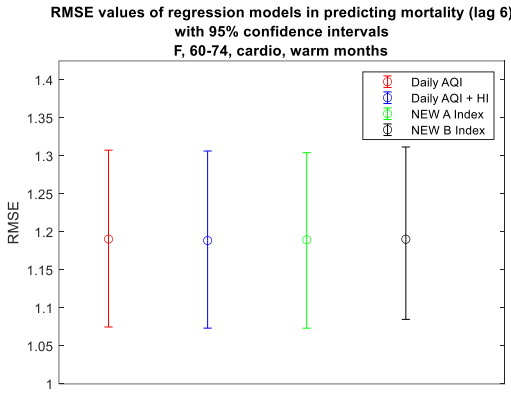


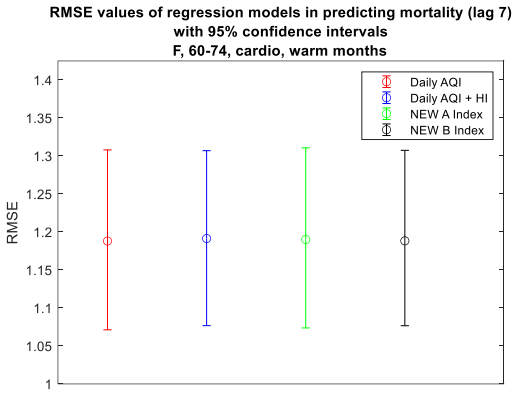





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.1805 +/-0.1165	1.1841 +/-0.11526	1.1846 +/-0.11205	1.1815 +/-0.10753
1	1.1871 +/-0.10975	1.185 +/-0.11017	1.1883 +/-0.1143	1.1842 +/-0.11787
2	1.1837 +/-0.11628	1.1886 +/-0.11203	1.1861 +/-0.11687	1.1846 +/-0.11458
3	1.1885 +/-0.11847	1.1909 +/-0.11635	1.1894 +/-0.11373	1.1888 +/-0.11494
4	1.1841 +/-0.11258	1.1848 +/-0.11331	1.1891 +/-0.11944	1.1882 +/-0.11862
5	1.186 +/-0.11646	1.1907 +/-0.12383	1.1879 +/-0.11361	1.1872 +/-0.11005
6	1.1906 +/-0.11633	1.1887 +/-0.11653	1.1896 +/-0.1155	1.1904 +/-0.11343
7	1.188 +/-0.11837	1.1913 +/-0.11511	1.1901 +/-0.11852	1.1883 +/-0.11539

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.1001 +/-0.18173	1.1156 +/-0.22078	1.0367 +/-0.14116	1.11 +/-0.16793	1.4793 +/-0.67066
1	1.0692 +/-0.17942	1.0632 +/-0.20361	1.0108 +/-0.13597	1.0892 +/-0.16782	1.2342 +/-0.55842
2	1.0627 +/-0.19072	1.0413 +/-0.2145	0.99989 +/-0.13423	1.062 +/-0.1577	0.99469 +/-0.45462
3	1.0276 +/-0.17085	1.0153 +/-0.21653	0.99343 +/-0.13493	1.0061 +/-0.17162	0.81997 +/-0.34294
4	1.1088 +/-0.16671	1.0839 +/-0.20384	1.0004 +/-0.13761	1.0608 +/-0.1667	1.0677 +/-0.54183
5	1.057 +/-0.17609	1.0263 +/-0.19177	0.9951 +/-0.13159	1.0503 +/-0.1671	0.8706 +/-0.37195
6	1.064 +/-0.17115	1.0508 +/-0.20037	0.98112 +/-0.1335	0.99976 +/-0.16791	0.85647 +/-0.38061
7	1.0377 +/-0.17661	1.0136 +/-0.19521	0.98075 +/-0.12966	0.99428 +/-0.16052	0.90098 +/-0.42063

AQI Regression: No statistically significant predictors.

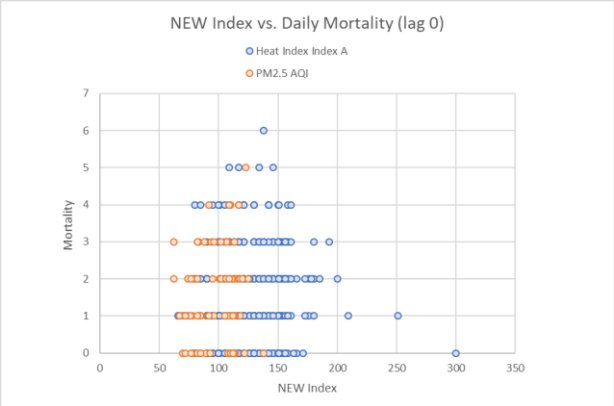
AQI+HI Regression: No statistically significant predictors.

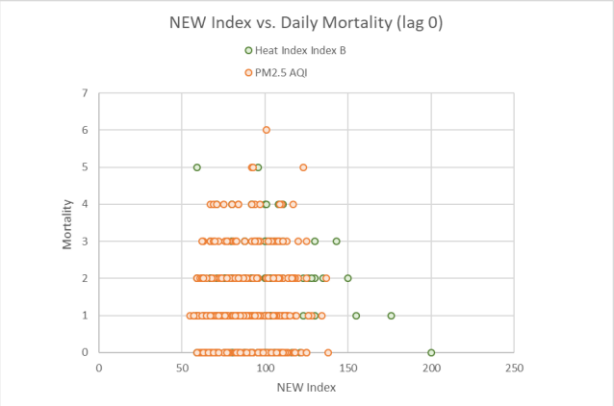
NEW A Regression: No statistically significant predictors.

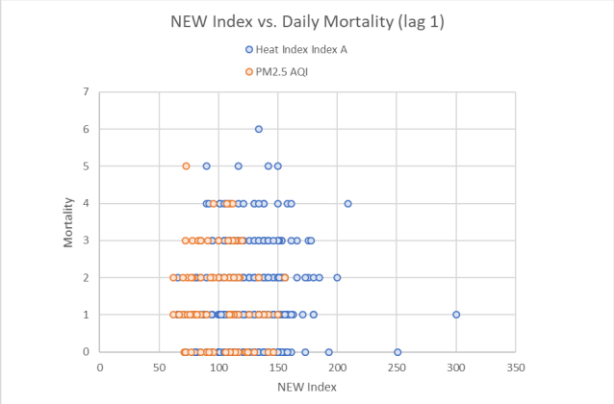
NEW B Regression: No statistically significant predictors.

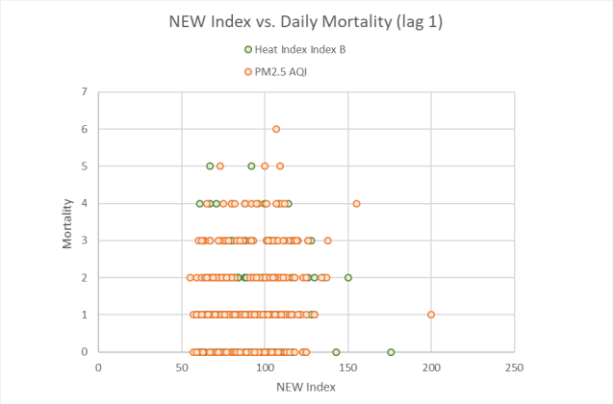
RAW Regression: NO2 predictor statistically significant on lag days 0 and 1 with 90% confidence.

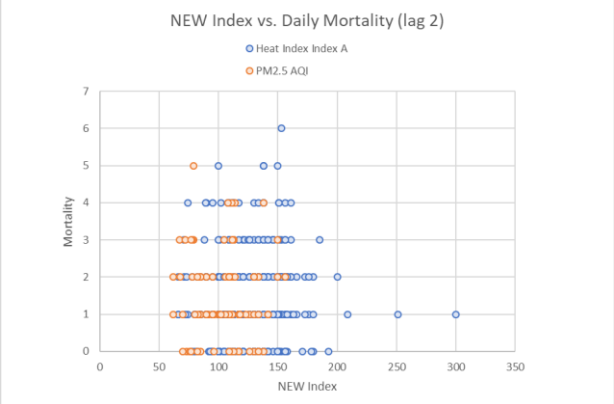
NEW Index vs. Daily Mortality Plots (for F, 60-74, cardio, warm months)

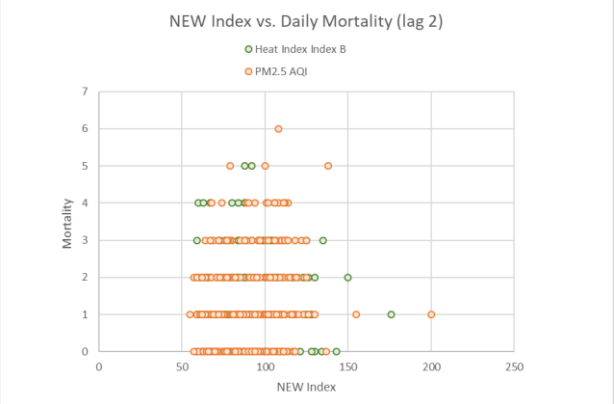


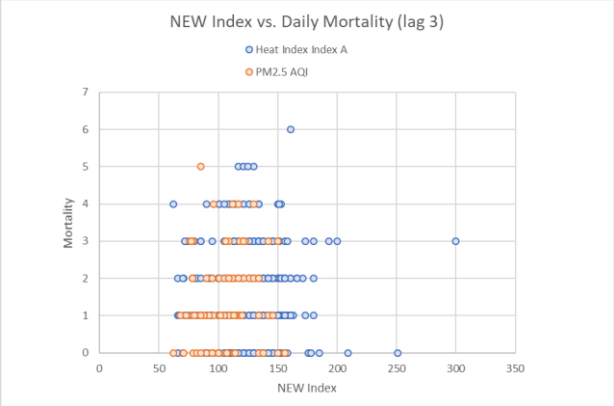


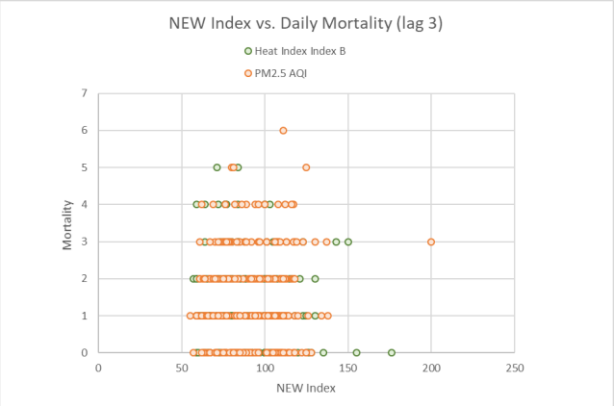


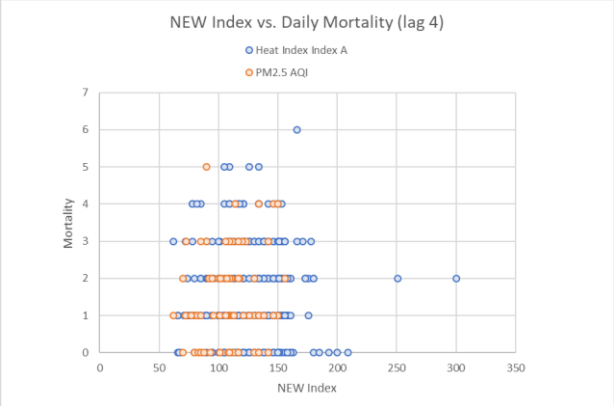


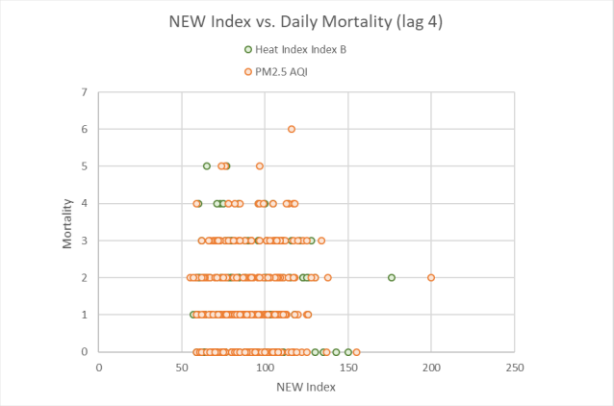


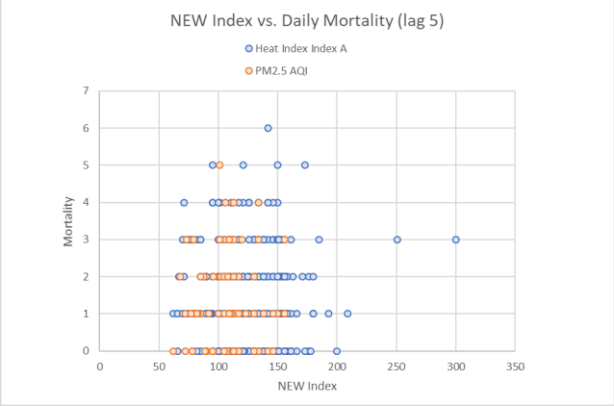


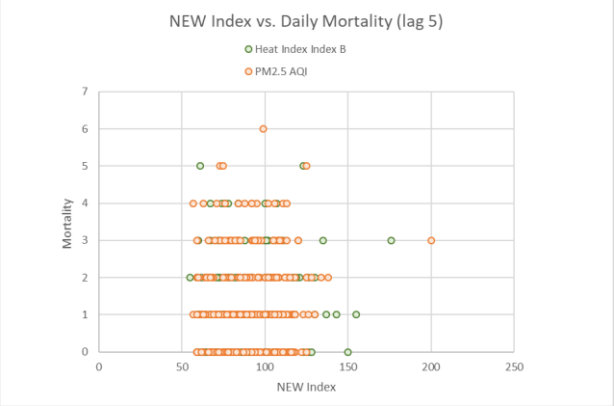

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

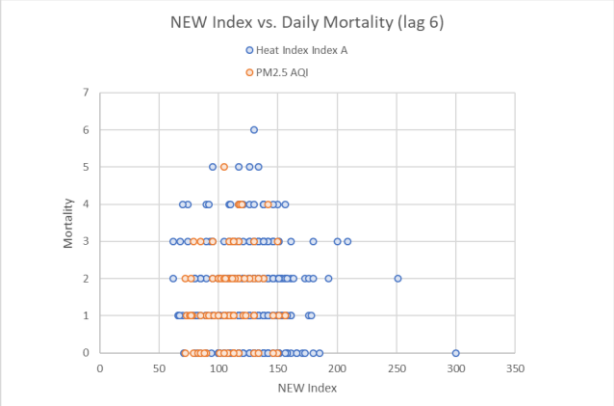

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

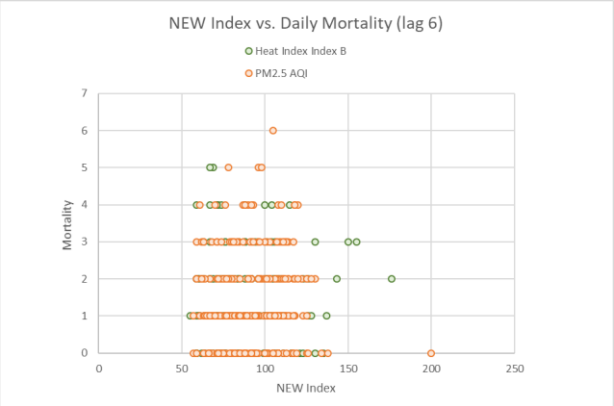

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

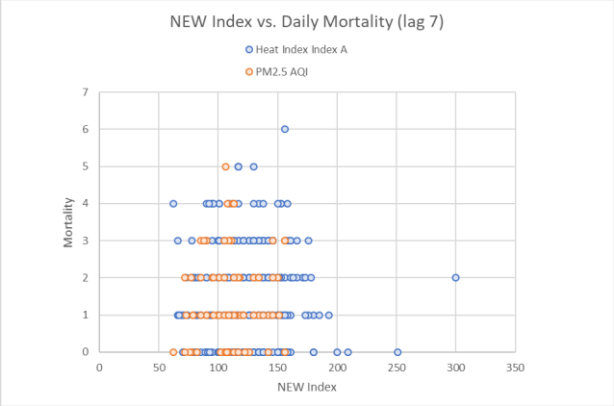

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

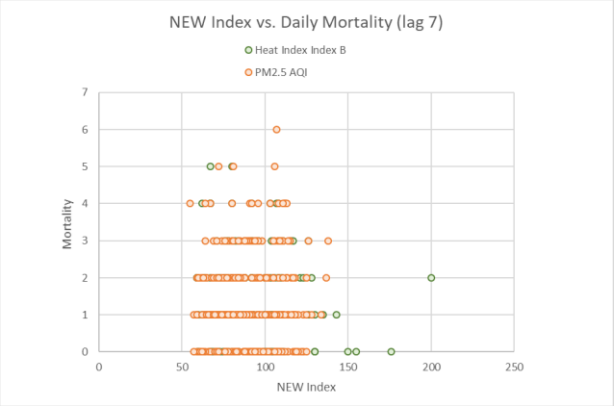

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250

Production Run:

F, 75+, cardio, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

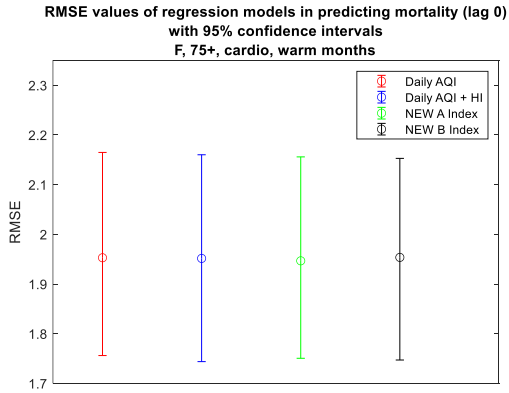
(how I originally defined the transformed HI in our NEW index)

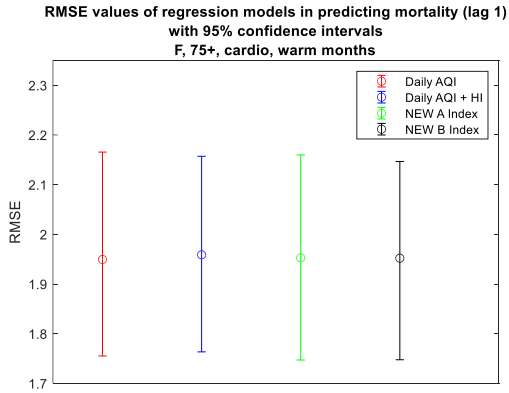
B

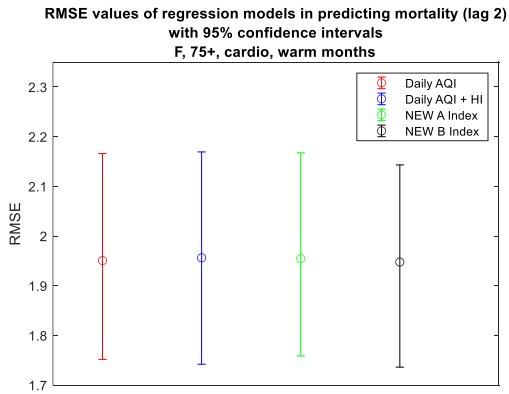
(transformed HI shifted down one category)

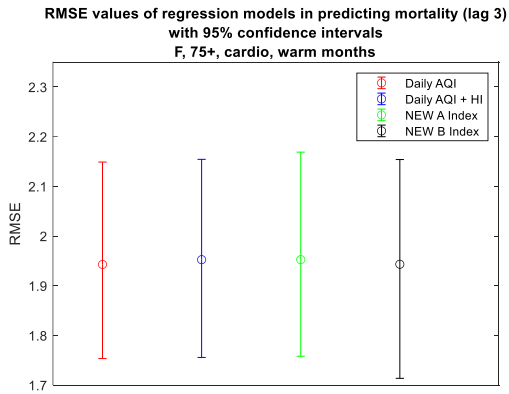
HI_Index Breakpoints

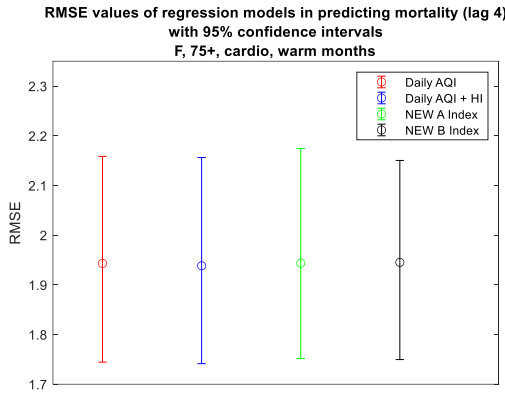
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

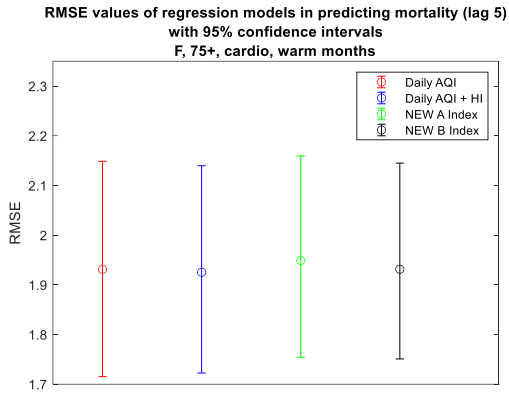


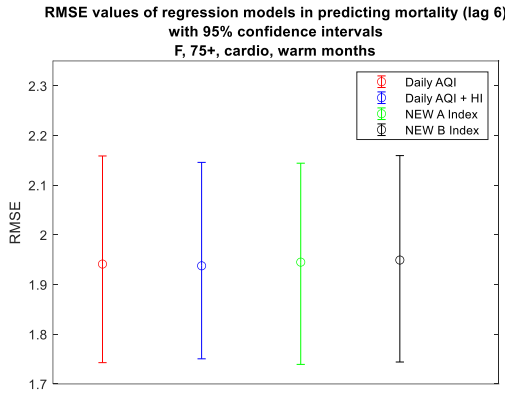


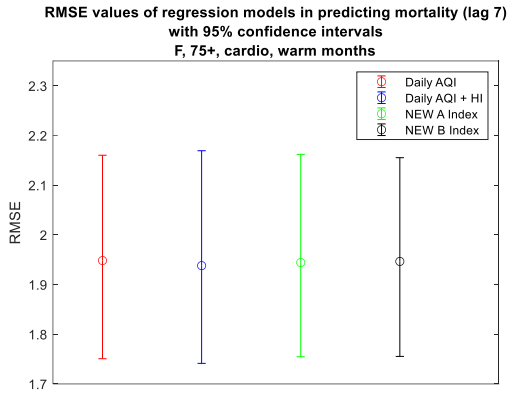





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
2.3
2.2
2.1
2
1.9
1.8
1.7

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.9528 +/-0.20438	1.9515 +/-0.20814	1.9467 +/-0.20264	1.9535 +/-0.20289
1	1.9494 +/-0.20511	1.9587 +/-0.19682	1.9526 +/-0.20637	1.9521 +/-0.19948
2	1.9507 +/-0.20717	1.9563 +/-0.21364	1.9543 +/-0.20441	1.9477 +/-0.2035
3	1.9428 +/-0.19773	1.9525 +/-0.19934	1.9526 +/-0.20537	1.9432 +/-0.22016
4	1.9431 +/-0.20705	1.9383 +/-0.20742	1.9436 +/-0.21126	1.9452 +/-0.20034
5	1.9312 +/-0.21665	1.9252 +/-0.20857	1.9489 +/-0.20261	1.9314 +/-0.19706
6	1.9412 +/-0.20797	1.9377 +/-0.19765	1.9451 +/-0.20244	1.9493 +/-0.2077
7	1.9483 +/-0.20475	1.9381 +/-0.21396	1.9443 +/-0.20363	1.9465 +/-0.19996

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.064 +/-0.12117	1.111 +/-0.15672	1.06 +/-0.095326	1.0554 +/-0.10361	1.0932 +/-0.34483
1	1.0791 +/-0.11079	1.1161 +/-0.15051	1.0426 +/-0.093632	1.0449 +/-0.099185	1.0442 +/-0.31545
2	1.0877 +/-0.11408	1.1385 +/-0.15442	1.0596 +/-0.09701	1.0682 +/-0.11601	1.1959 +/-0.35125
3	1.1076 +/-0.11496	1.1697 +/-0.16137	1.063 +/-0.090031	1.1075 +/-0.1059	1.2077 +/-0.34654
4	1.0897 +/-0.10982	1.1557 +/-0.14237	1.079 +/-0.084724	1.0886 +/-0.1032	1.3353 +/-0.41157
5	1.1103 +/-0.11366	1.1394 +/-0.14123	1.0443 +/-0.077911	1.1202 +/-0.1101	1.2355 +/-0.34885
6	1.0926 +/-0.11529	1.1166 +/-0.13927	1.0295 +/-0.090377	1.0611 +/-0.11302	1.0272 +/-0.30236
7	1.0924 +/-0.111	1.1405 +/-0.13898	1.0492 +/-0.10364	1.0828 +/-0.12372	1.2521 +/-0.3342

AQI Regression: PM2.5 AQI predictor statistically significant on lag days 3, 4, 5, and 6 with 90% confidence.

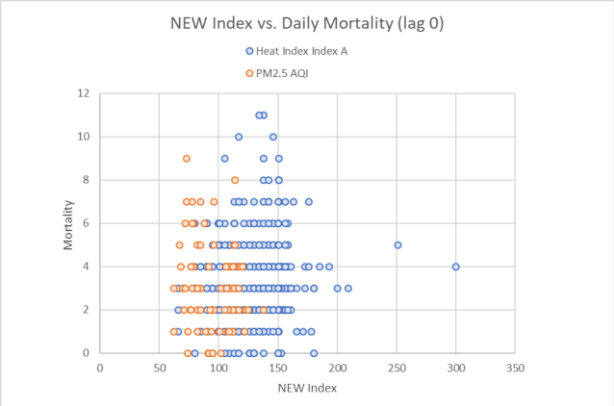
AQI+HI Regression: HI predictor statistically significant on lag day 4 with 90% confidence. PM2.5 AQI predictor statistically significant on lag days 5 and 6 with 90% confidence.

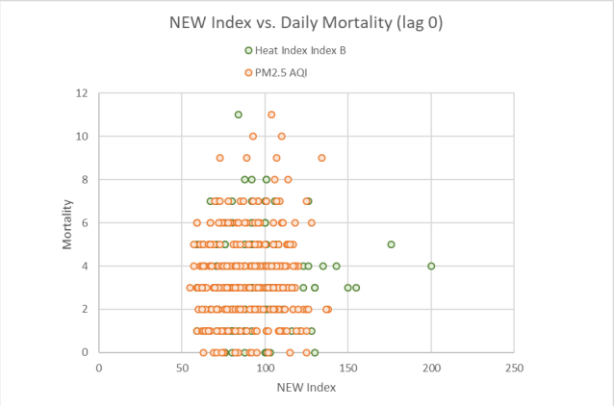
NEW A Regression: NEW A index predictor statistically significant on lag day 4 with 90% confidence.

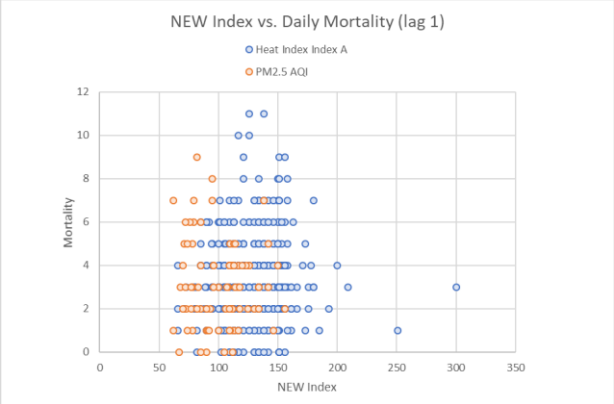
NEW B Regression: NEW B index predictor statistically significant on lag day 4 with 90% confidence and on lag days 3 and 5 with 95% confidence.

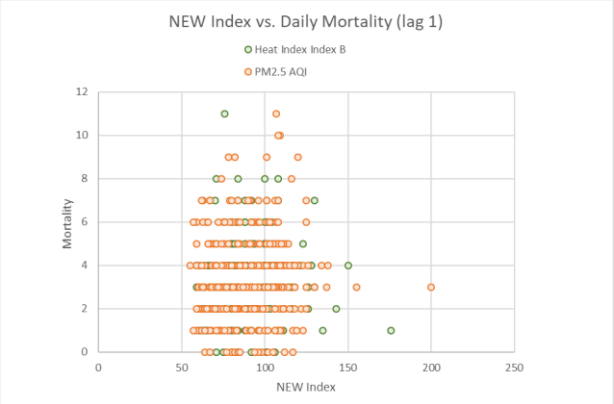
RAW Regression: PM2.5 predictor statistically significant on lag day 3 with 90% confidence. Temperature predictor statistically significant on lag day 4 with 90% confidence.

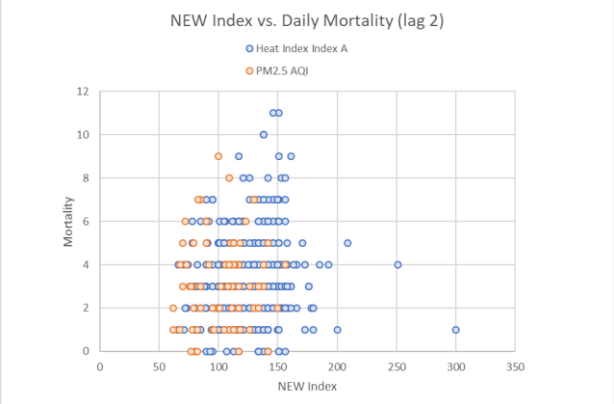
NEW Index vs. Daily Mortality Plots (for F, 75+, cardio, warm months)

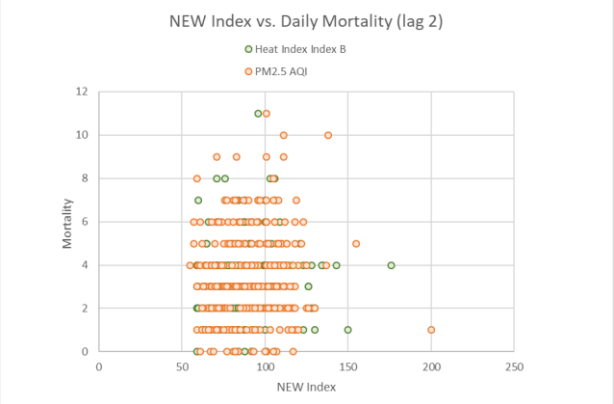


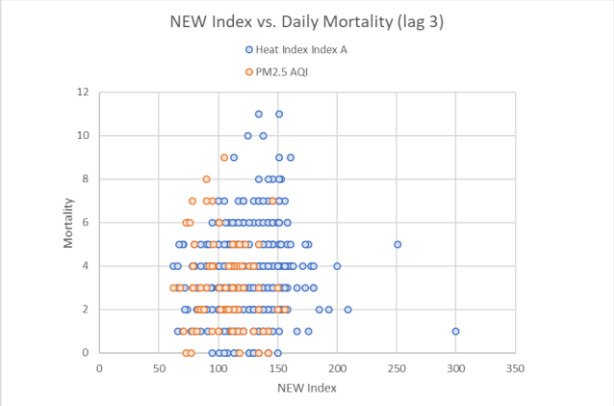


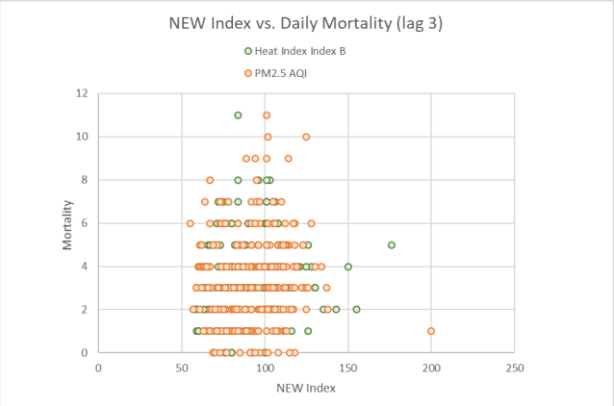


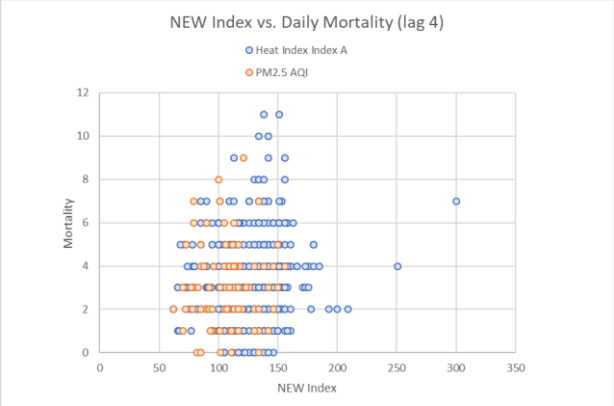


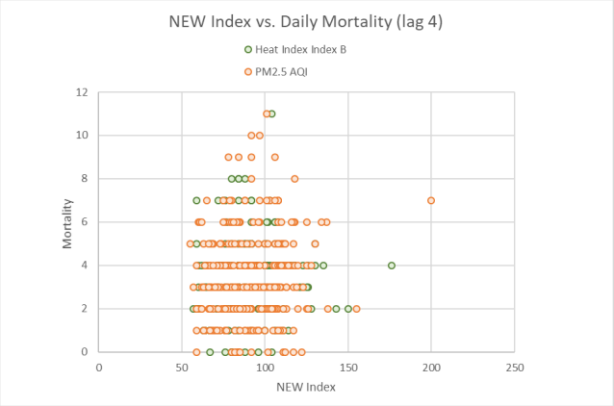


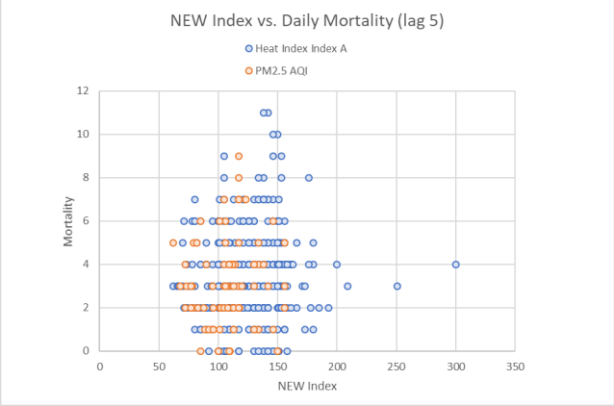


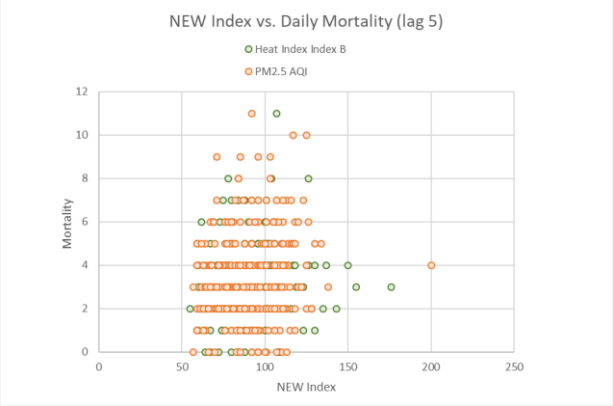

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

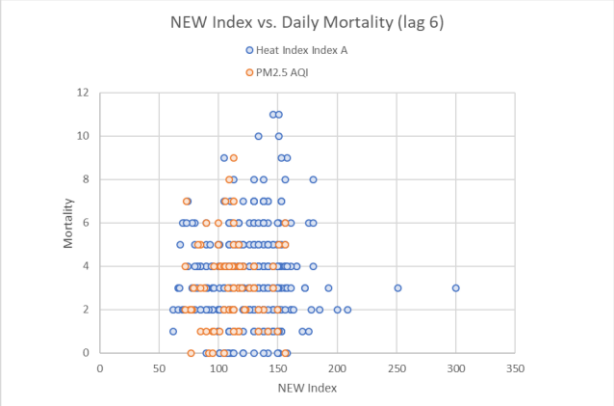

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

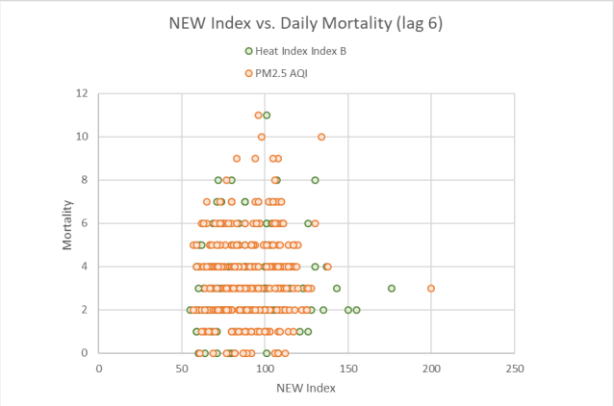

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

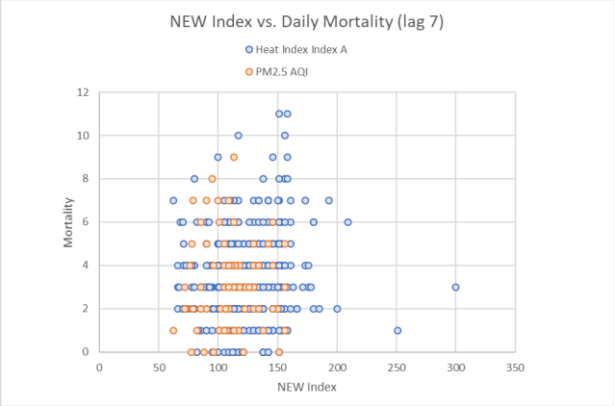

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

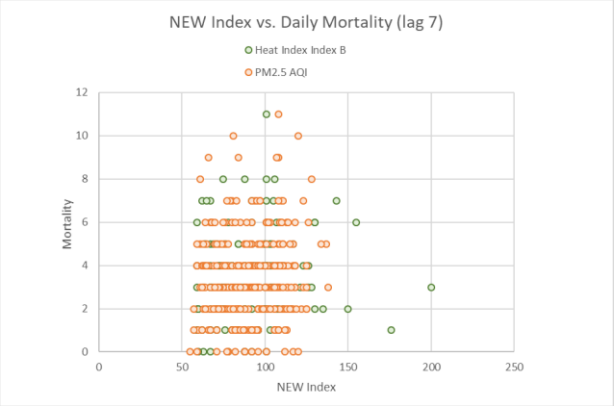

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250

Production Run:

F, 60-74, resp, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

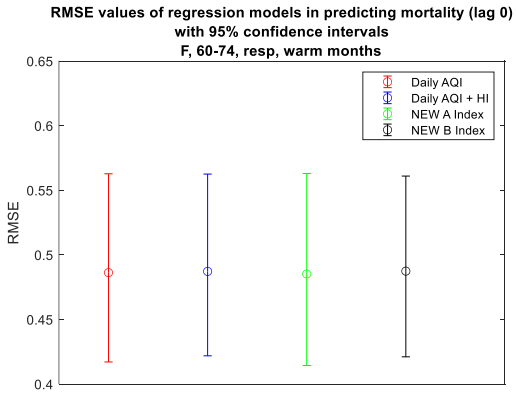
(how I originally defined the transformed HI in our NEW index)

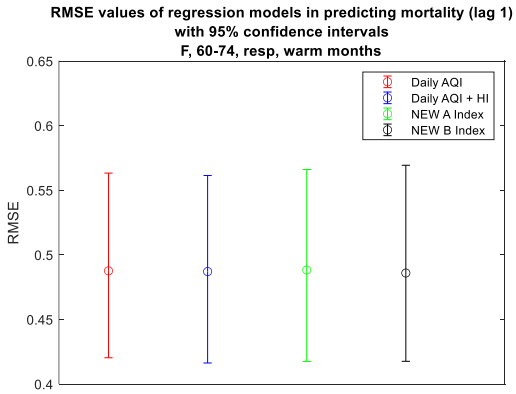
B

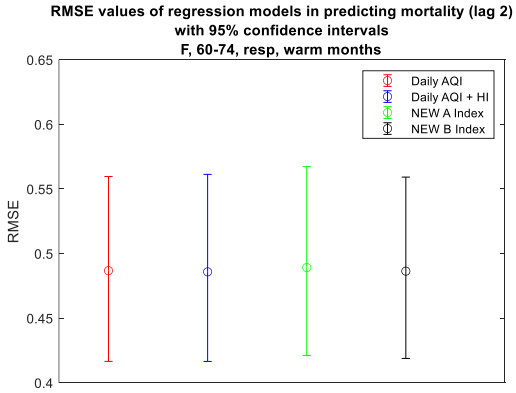
(transformed HI shifted down one category)

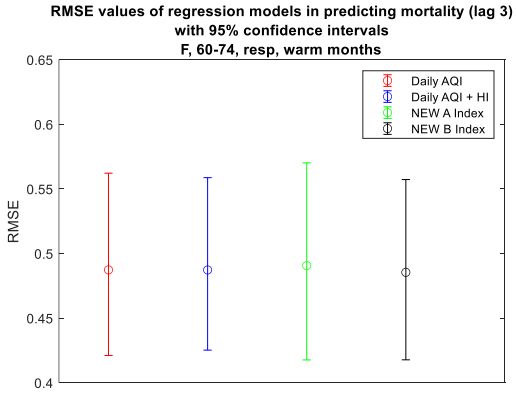
HI_Index Breakpoints

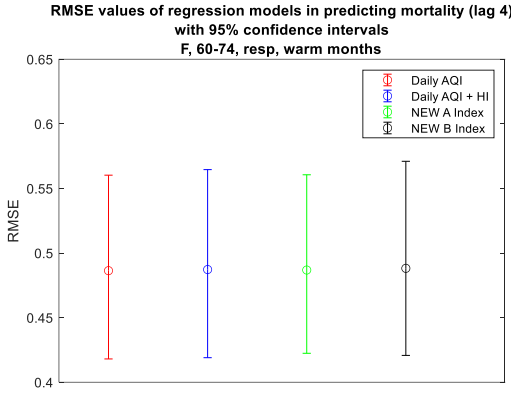
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

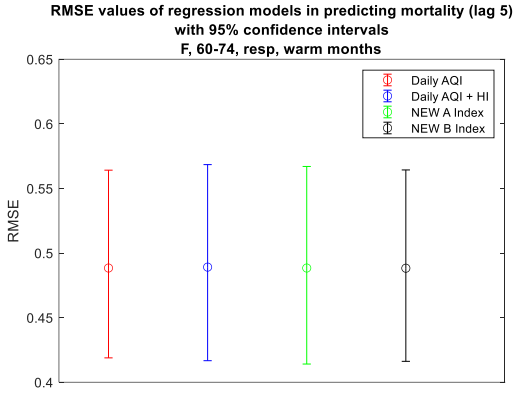


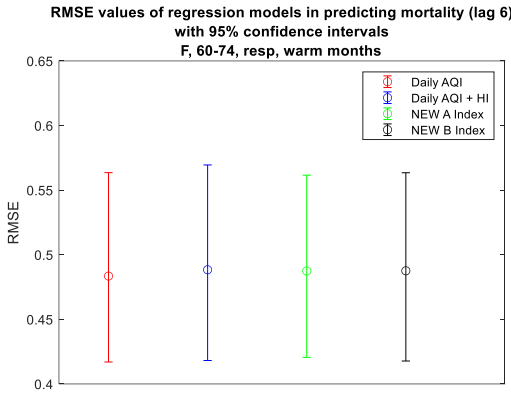


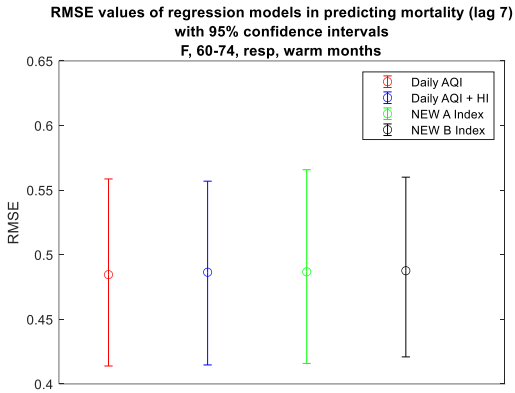





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.48625 +/-0.072826	0.48721 +/-0.070335	0.48523 +/-0.074319	0.4874 +/-0.069953
1	0.48763 +/-0.071465	0.48708 +/-0.072567	0.48829 +/-0.074262	0.48596 +/-0.075872
2	0.4868 +/-0.071555	0.48588 +/-0.072397	0.48921 +/-0.07306	0.48641 +/-0.07018
3	0.48739 +/-0.070562	0.48733 +/-0.066751	0.49068 +/-0.076266	0.48547 +/-0.069765
4	0.48633 +/-0.071114	0.4872 +/-0.072785	0.48682 +/-0.069086	0.48814 +/-0.075122
5	0.48838 +/-0.072635	0.48907 +/-0.075885	0.48837 +/-0.076458	0.48824 +/-0.07407
6	0.48347 +/-0.07328	0.48838 +/-0.075674	0.48744 +/-0.070506	0.48756 +/-0.07286
7	0.4846 +/-0.072385	0.48645 +/-0.07111	0.4868 +/-0.074938	0.48762 +/-0.069553

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.1297 +/-0.48271	1.0197 +/-0.53118	0.9339 +/-0.31907	1.0338 +/-0.41406	0.79833 +/-0.85106
1	1.1893 +/-0.50208	1.1255 +/-0.63632	0.95442 +/-0.30673	1.1023 +/-0.4309	1.4355 +/-1.6289
2	1.1734 +/-0.50418	1.2539 +/-0.73978	1.0791 +/-0.36395	1.0812 +/-0.47063	1.3426 +/-1.6776
3	1.2277 +/-0.4627	1.3631 +/-0.67979	1.1419 +/-0.36858	1.2404 +/-0.47721	1.1685 +/-1.346
4	1.139 +/-0.40727	1.2975 +/-0.5883	1.1244 +/-0.37067	1.239 +/-0.45552	1.3245 +/-1.3548
5	1.0597 +/-0.42099	1.0596 +/-0.53099	1.0027 +/-0.36809	1.1108 +/-0.42037	0.58733 +/-0.76787
6	1.2984 +/-0.56235	1.3083 +/-0.61946	1.0386 +/-0.33496	1.2352 +/-0.52559	2.037 +/-2.37
7	1.3131 +/-0.51935	1.2982 +/-0.66482	1.0337 +/-0.32194	1.141 +/-0.4351	2.1631 +/-3.6618

AQI Regression: No statistically significant predictors.

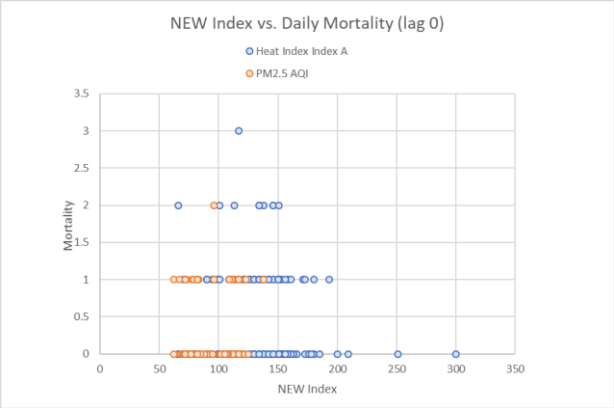
AQI+HI Regression: No statistically significant predictors.

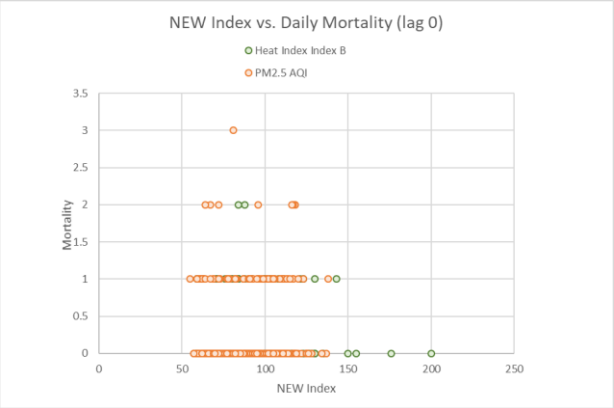
NEW A Regression: No statistically significant predictors.

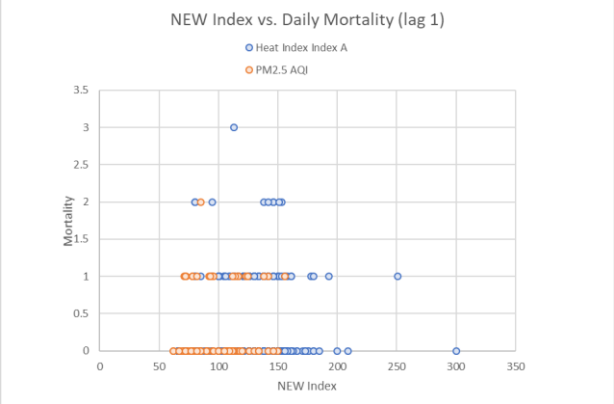
NEW B Regression: No statistically significant predictors.

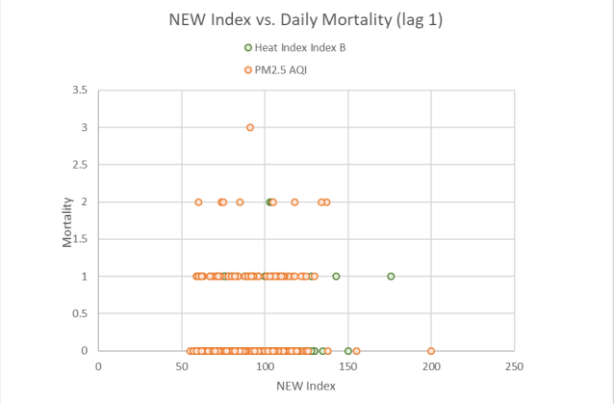
RAW Regression: Relative humidity predictor statistically significant on lag day 6 with 90% confidence.

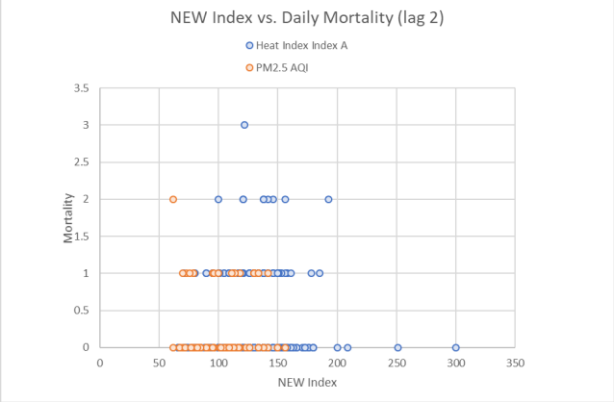
NEW Index vs. Daily Mortality Plots (for F, 60-74, resp, warm months)

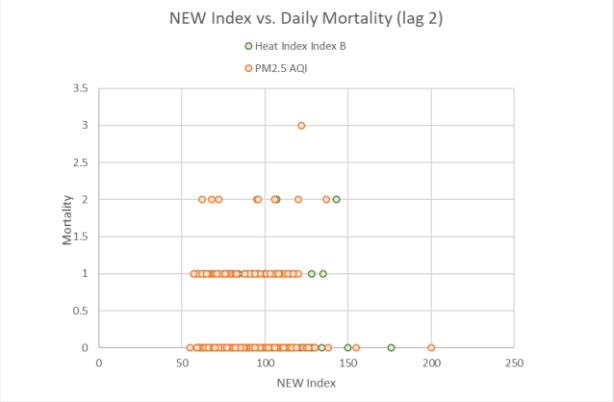


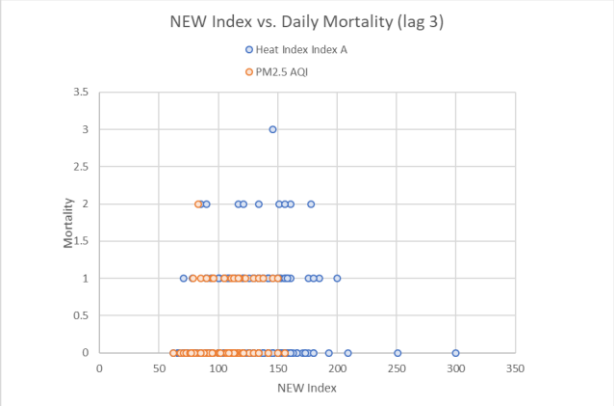


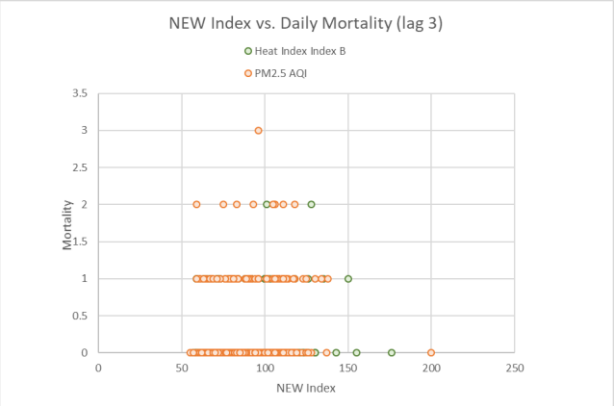


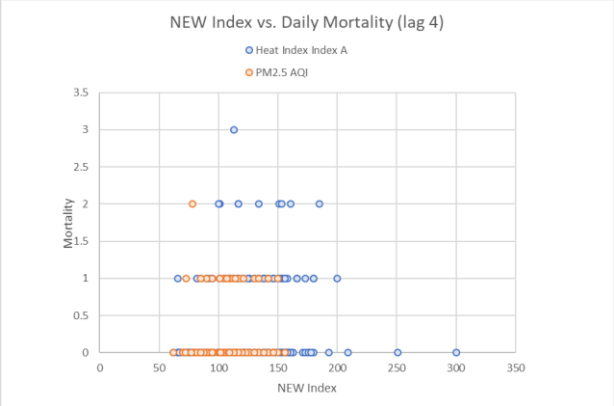


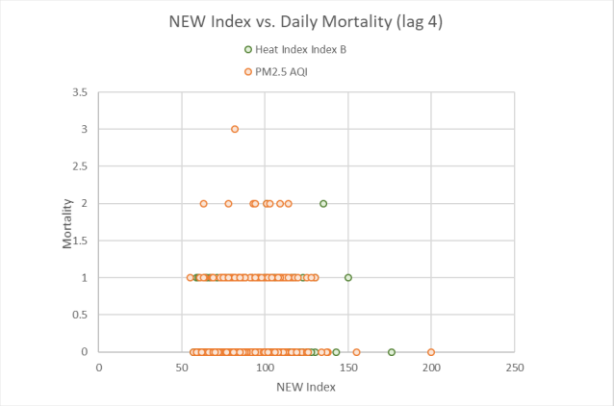


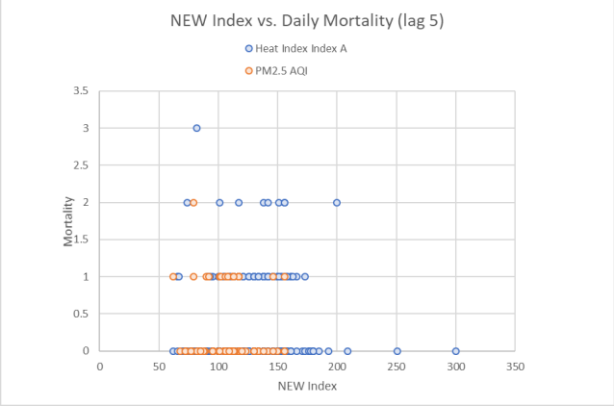


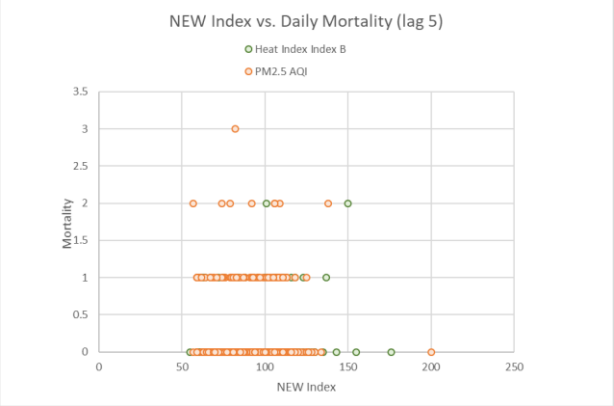

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

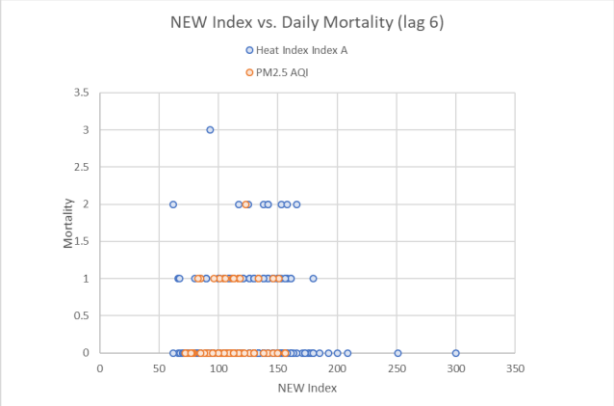

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

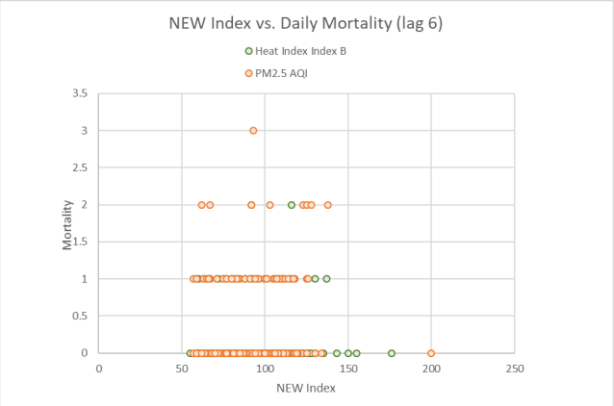

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

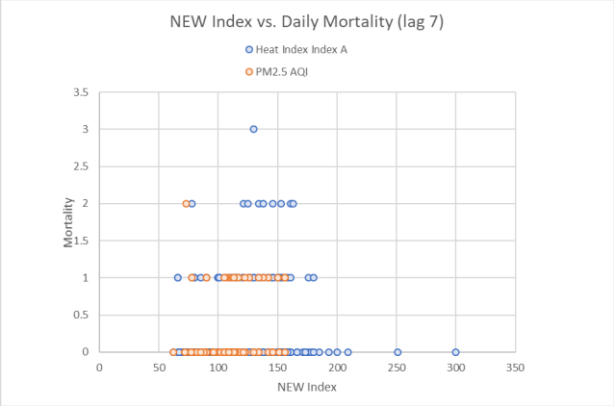

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

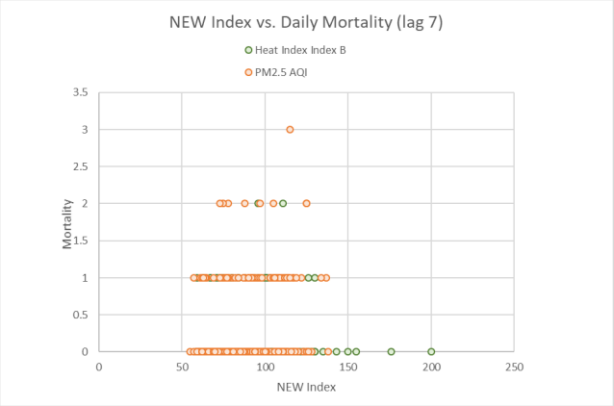

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250

Production Run:

F, 75+, resp, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

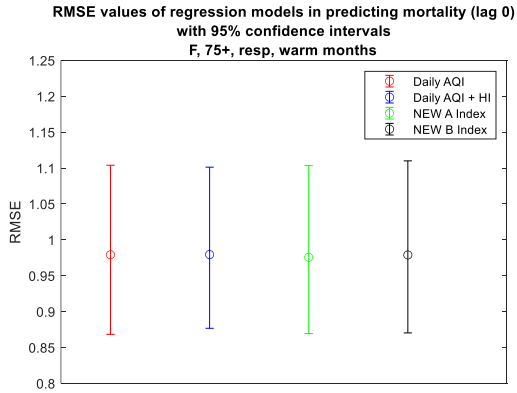
A

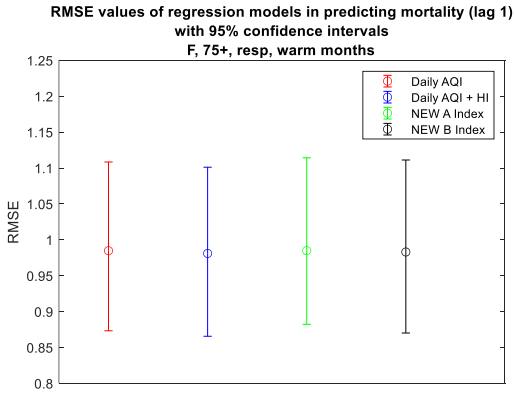
(how I originally defined the transformed HI in our NEW index)

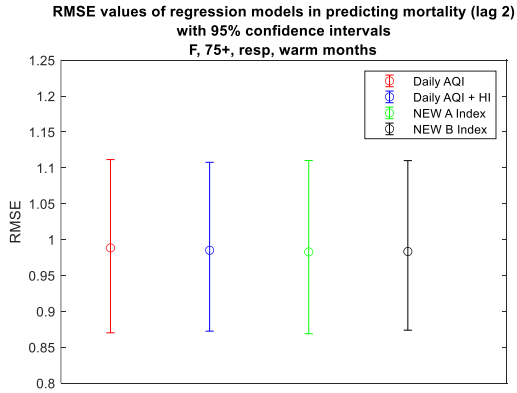
B

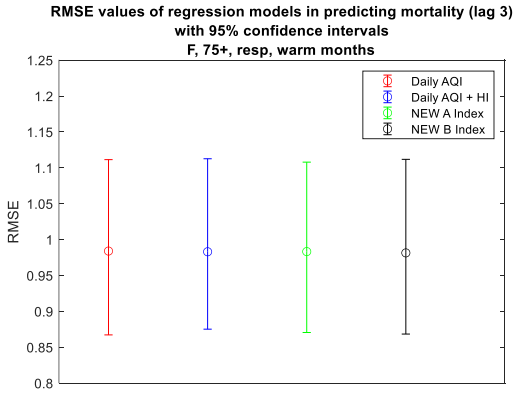
(transformed HI shifted down one category)

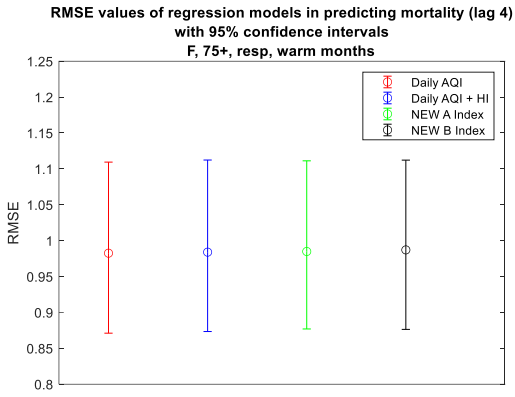
HI_Index Breakpoints		
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

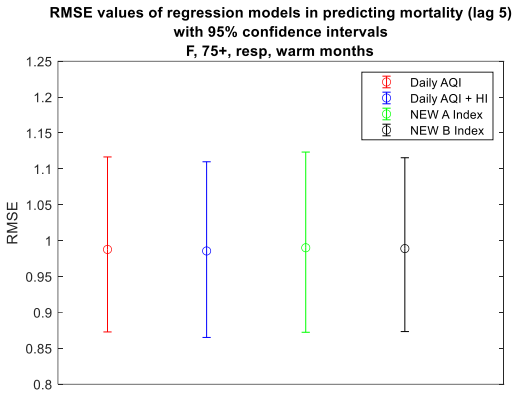


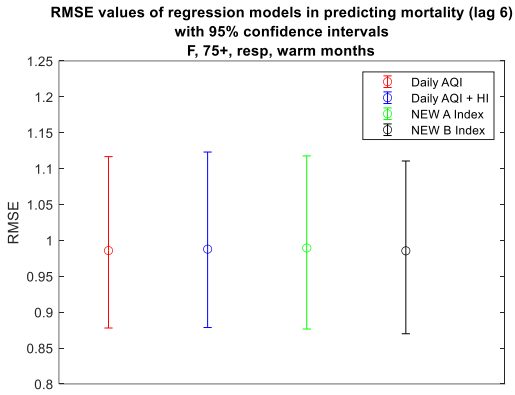


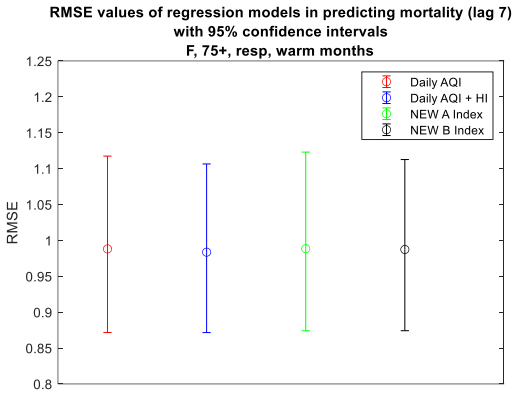





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.97918 +/-0.1178	0.9795 +/-0.11224	0.97567 +/-0.11695	0.97893 +/-0.11985
1	0.98483 +/-0.11759	0.98107 +/-0.11776	0.98494 +/-0.116	0.98307 +/-0.12052
2	0.98841 +/-0.12066	0.98509 +/-0.11761	0.98282 +/-0.12068	0.98337 +/-0.11811
3	0.98398 +/-0.12209	0.98301 +/-0.11872	0.98326 +/-0.11867	0.98144 +/-0.12171
4	0.98255 +/-0.11916	0.98398 +/-0.11947	0.98492 +/-0.11713	0.98712 +/-0.11791
5	0.98775 +/-0.1219	0.98564 +/-0.12237	0.99012 +/-0.12553	0.98895 +/-0.12109
6	0.9858 +/-0.11939	0.9878 +/-0.12224	0.98942 +/-0.12061	0.98543 +/-0.12034
7	0.98815 +/-0.12284	0.98358 +/-0.11746	0.98843 +/-0.12445	0.98733 +/-0.11924

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.142 +/-0.25852	1.2652 +/-0.3447	1.175 +/-0.19135	1.1321 +/-0.23875	1.0559 +/-0.63593
1	1.0277 +/-0.21131	1.1202 +/-0.28944	1.0986 +/-0.16261	1.0745 +/-0.19942	0.86463 +/-0.52345
2	1.005 +/-0.19745	1.0225 +/-0.26206	0.98766 +/-0.16429	0.97169 +/-0.18014	1.0651 +/-0.61406
3	1.0767 +/-0.21576	1.1415 +/-0.28331	1.0543 +/-0.16277	1.0846 +/-0.20352	1.3505 +/-0.78869
4	1.0932 +/-0.21689	1.1328 +/-0.26947	1.0565 +/-0.15891	1.0688 +/-0.18918	0.99469 +/-0.58275
5	1.0635 +/-0.21746	1.0764 +/-0.26153	1.0149 +/-0.17104	1.0218 +/-0.21053	0.82232 +/-0.36563
6	1.0969 +/-0.2207	1.1477 +/-0.28654	1.063 +/-0.15444	1.105 +/-0.18476	0.84297 +/-0.48223
7	1.0843 +/-0.25222	1.1413 +/-0.28292	1.0708 +/-0.16066	1.0801 +/-0.22073	1.174 +/-0.70056

AQI Regression: No statistically significant predictors.

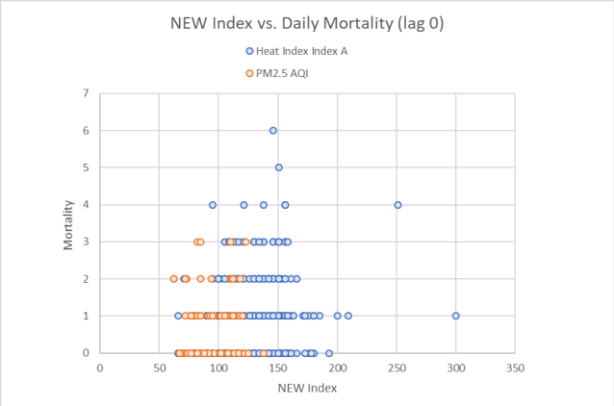
AQI+HI Regression: No statistically significant predictors.

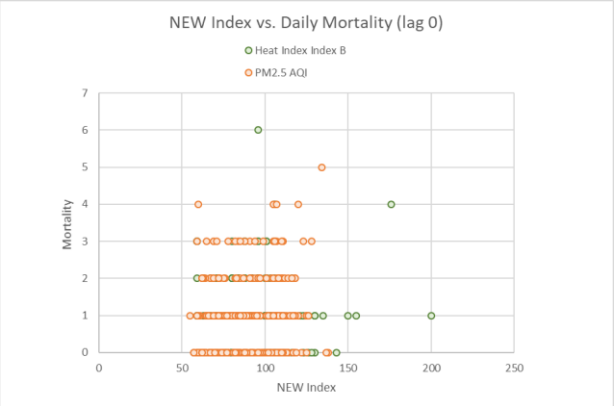
NEW A Regression: NEW A index predictor statistically significant on lag day 0 with 90% confidence.

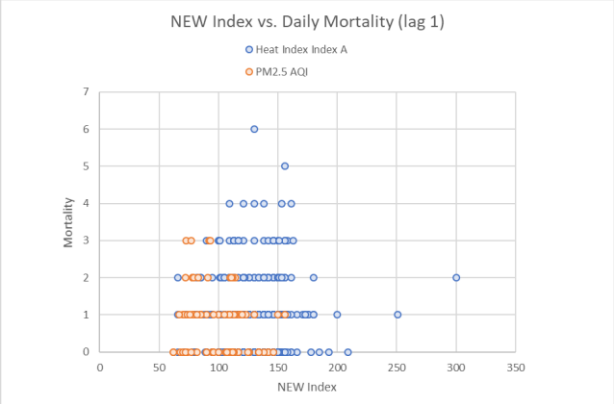
NEW B Regression: No statistically significant predictors.

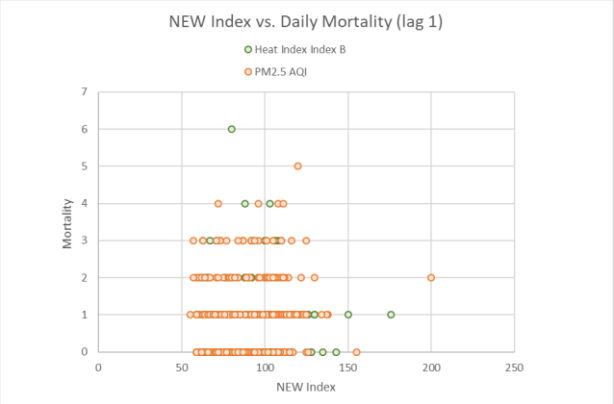
RAW Regression: O3 predictor statistically significant on lag day 2 with 90% confidence. Temperature predictor statistically significant on lag day 3 with 90% confidence.

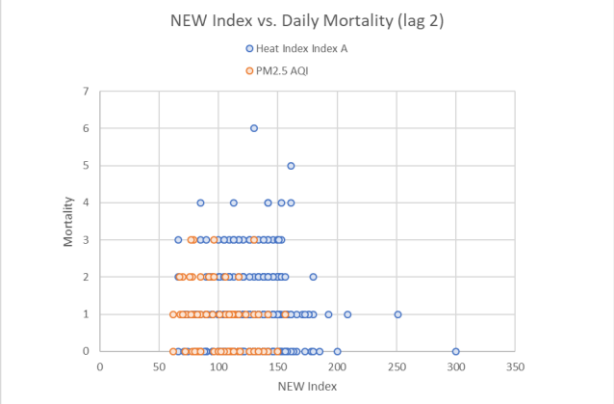
NEW Index vs. Daily Mortality Plots (for F, 75+, resp, warm months)

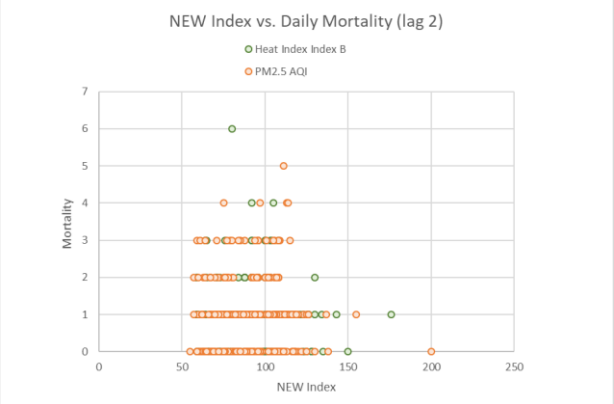


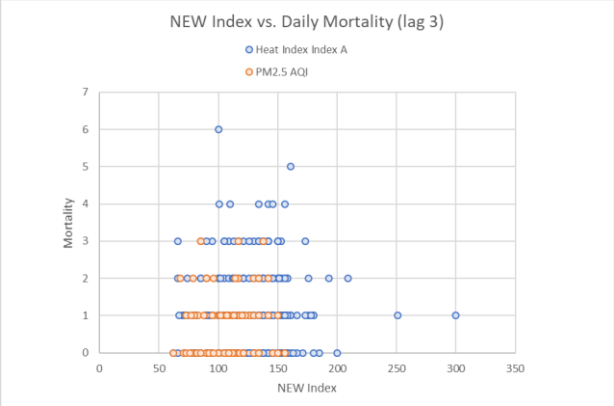


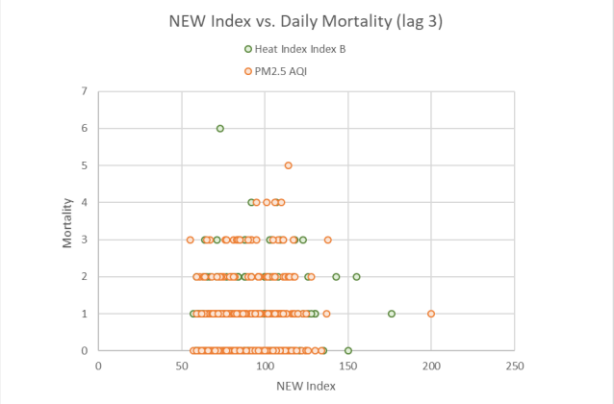


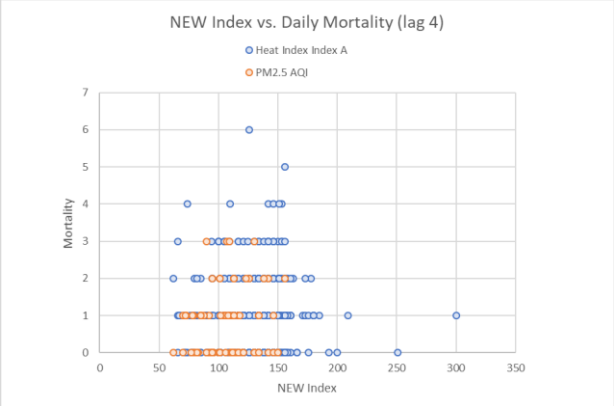


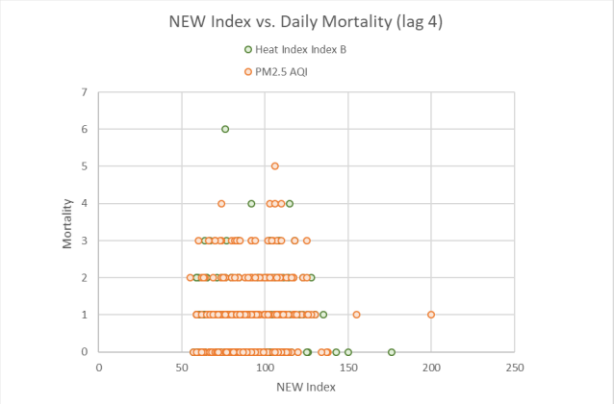


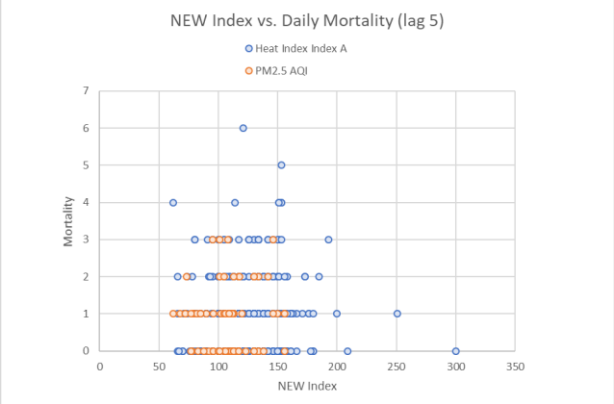


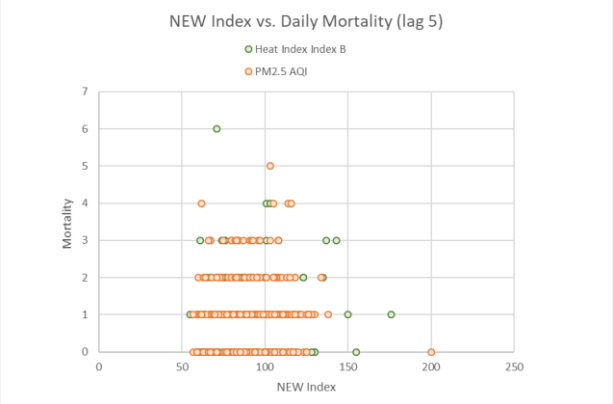

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

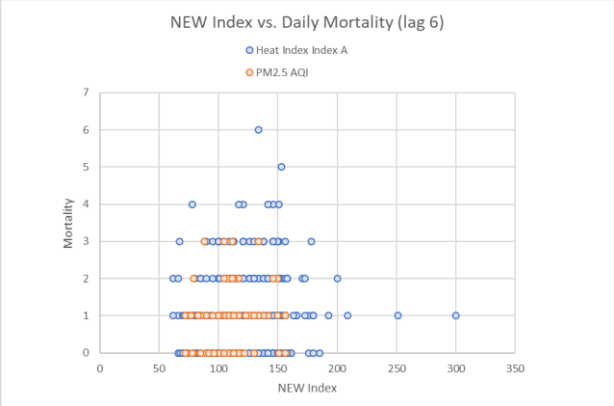

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

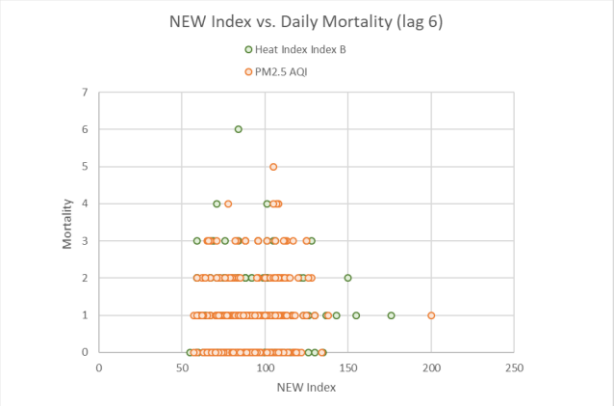

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

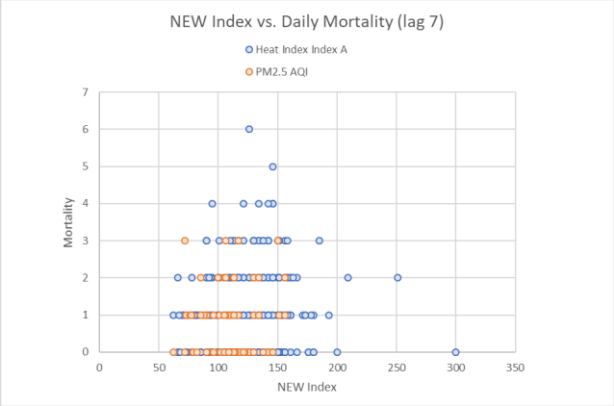

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

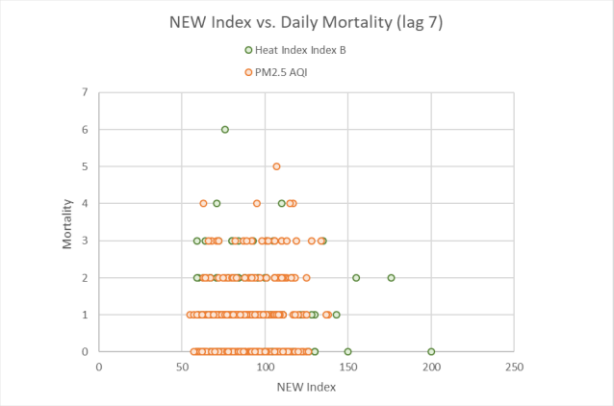

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250

Production Run:

M & F, 60+, cardio & resp, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

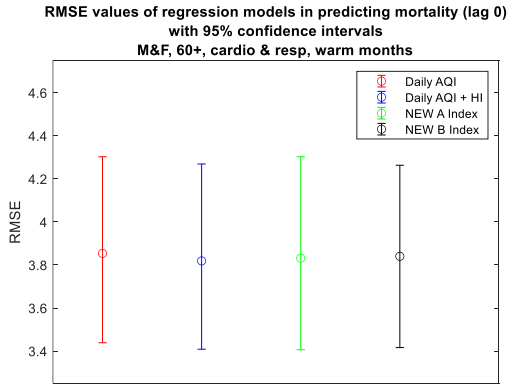
(how I originally defined the transformed HI in our NEW index)

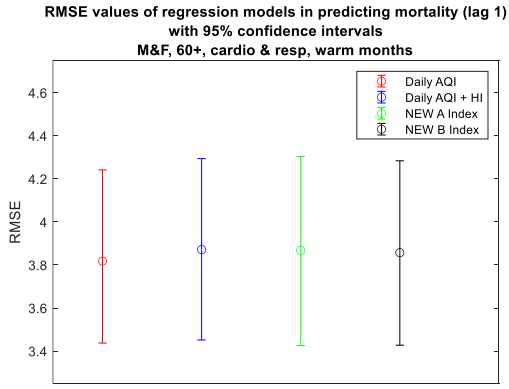
B

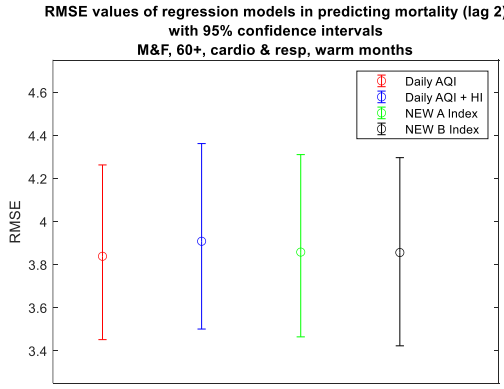
(transformed HI shifted down one category)

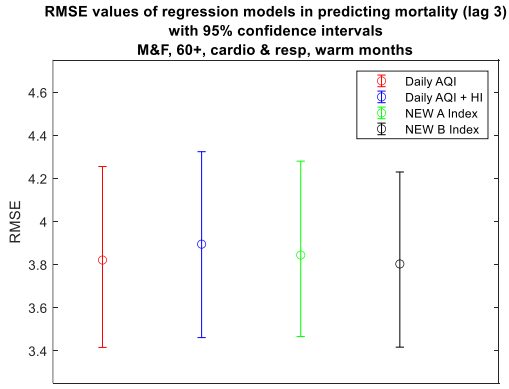
HI_Index Breakpoints

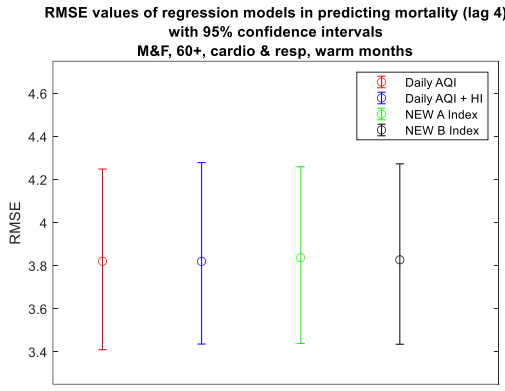
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

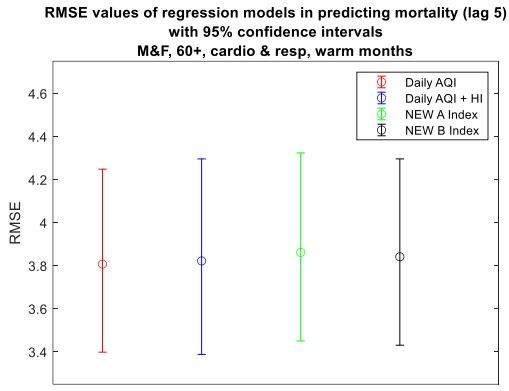


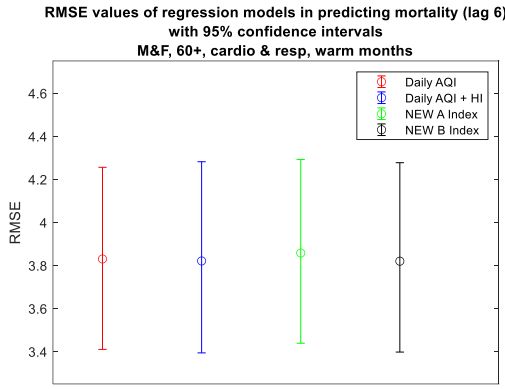


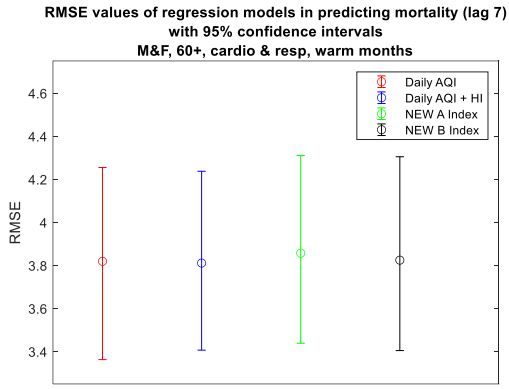





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	3.8537 +/-0.43195	3.8188 +/-0.43011	3.8316 +/-0.44818	3.8401 +/-0.42334
1	3.8179 +/-0.40206	3.8714 +/-0.42123	3.868 +/-0.43904	3.8574 +/-0.42819
2	3.8391 +/-0.40563	3.9088 +/-0.43065	3.8584 +/-0.42318	3.8565 +/-0.43694
3	3.8215 +/-0.42004	3.8954 +/-0.43168	3.8447 +/-0.40723	3.8034 +/-0.40676
4	3.8212 +/-0.41941	3.8205 +/-0.42136	3.8378 +/-0.41036	3.8277 +/-0.41883
5	3.8079 +/-0.42491	3.8225 +/-0.45398	3.8622 +/-0.43666	3.8419 +/-0.43268
6	3.8303 +/-0.4229	3.8211 +/-0.44388	3.8581 +/-0.4268	3.8201 +/-0.43967
7	3.8195 +/-0.44614	3.8113 +/-0.41538	3.8574 +/-0.43588	3.8249 +/-0.45012

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0622 +/-0.070413	1.1048 +/-0.089544	1.0551 +/-0.049832	1.0657 +/-0.06249	1.1023 +/-0.18703
1	1.0827 +/-0.074374	1.1063 +/-0.085823	1.0315 +/-0.051693	1.056 +/-0.075289	1.061 +/-0.17438
2	1.0657 +/-0.067043	1.096 +/-0.08492	1.0356 +/-0.051968	1.0522 +/-0.06317	1.0562 +/-0.16824
3	1.0911 +/-0.064396	1.1406 +/-0.084074	1.0551 +/-0.049661	1.0934 +/-0.05641	1.1212 +/-0.18916
4	1.0785 +/-0.067343	1.1199 +/-0.087174	1.0546 +/-0.050117	1.0789 +/-0.064074	1.124 +/-0.19071
5	1.0865 +/-0.068298	1.1045 +/-0.076523	1.036 +/-0.047838	1.0775 +/-0.060857	1.0533 +/-0.16873
6	1.0851 +/-0.060157	1.108 +/-0.077972	1.0365 +/-0.048984	1.0732 +/-0.058977	1.0001 +/-0.1674
7	1.0832 +/-0.063783	1.1102 +/-0.082414	1.0397 +/-0.053095	1.0708 +/-0.062379	1.1344 +/-0.19046

AQI Regression: PM2.5 AQI predictor statistically significant on lag day 0 with 90% confidence and on lag days 1-7 with 95% confidence.

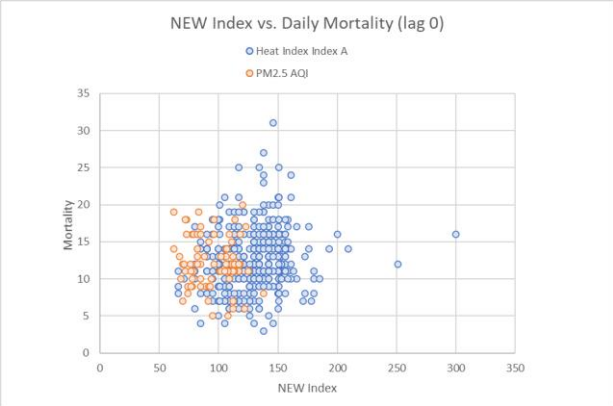
AQI+HI Regression: PM2.5 AQI predictor statistically significant on lag days 0 and 2 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence. HI predictor statistically significant on lag day 4 with 90% confidence and on lag days 0 and 3 with 95% confidence.

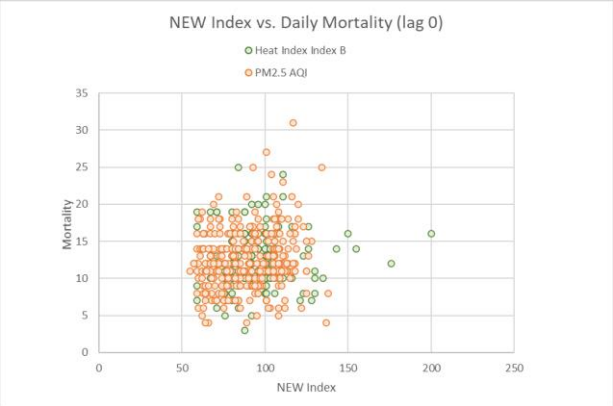
NEW A Regression: NEW A index predictor statistically significant on lag days 0, 3, and 4 with 95% confidence.

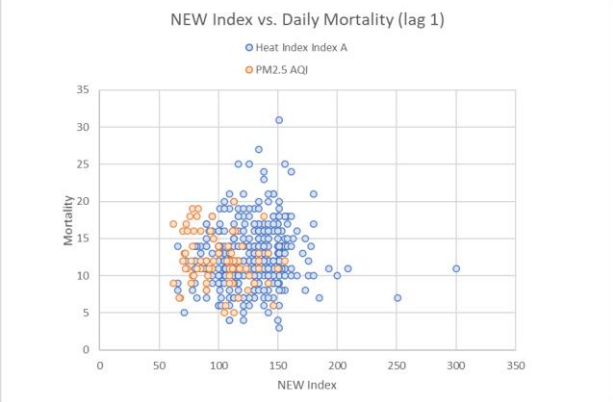
NEW B Regression: NEW B index predictor statistically significant on lag days 1 and 2 with 90% confidence and on lag days 0, 3, 4, 5, 6, and 7 with 95% confidence.

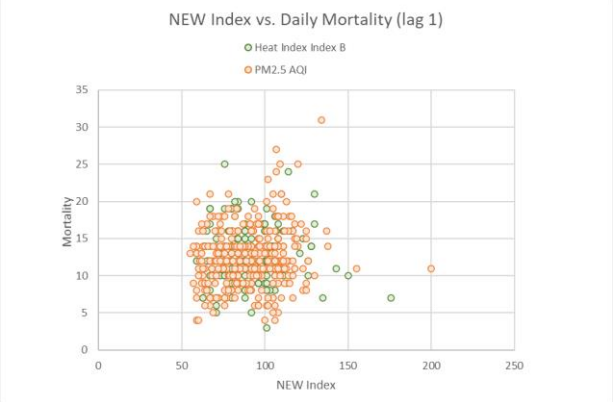
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence. PM2.5 predictor statistically significant on lag day 0 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence.

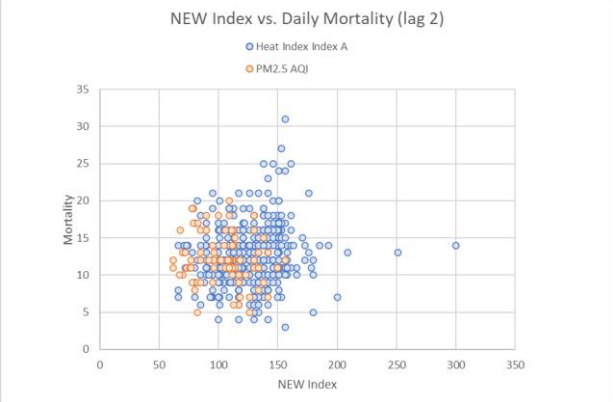
NEW Index vs. Daily Mortality Plots (for M & F, 60+, cardio & resp, warm months)

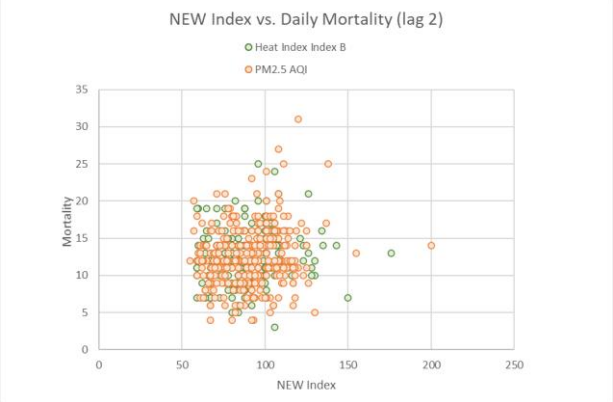


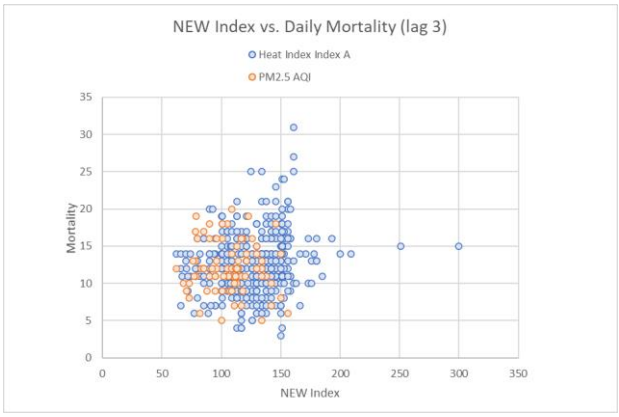


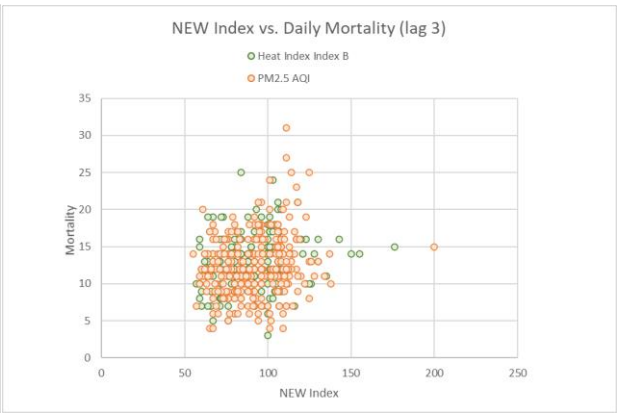


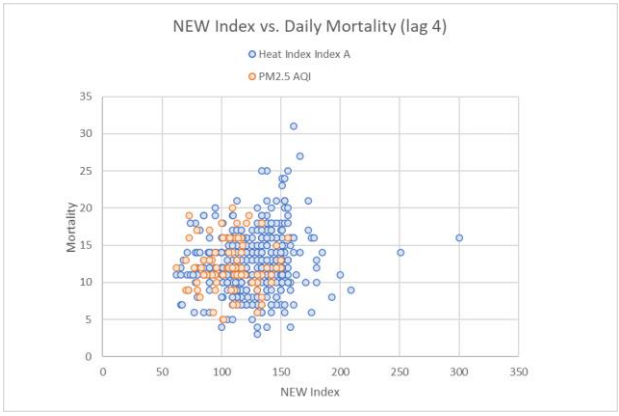


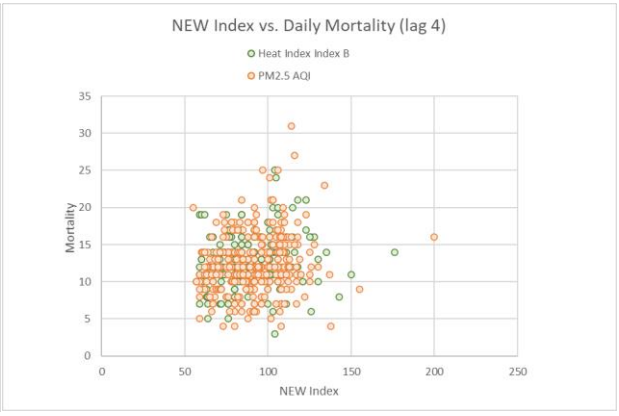


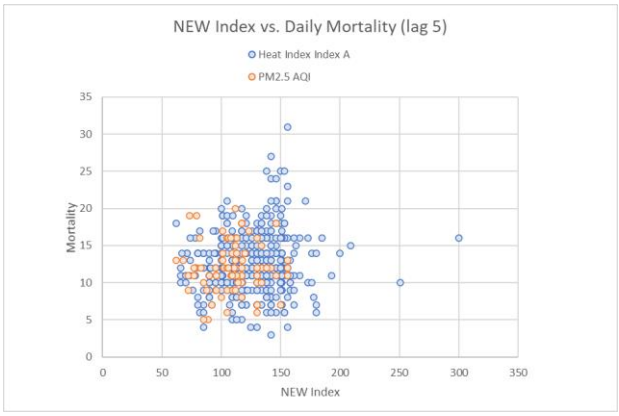


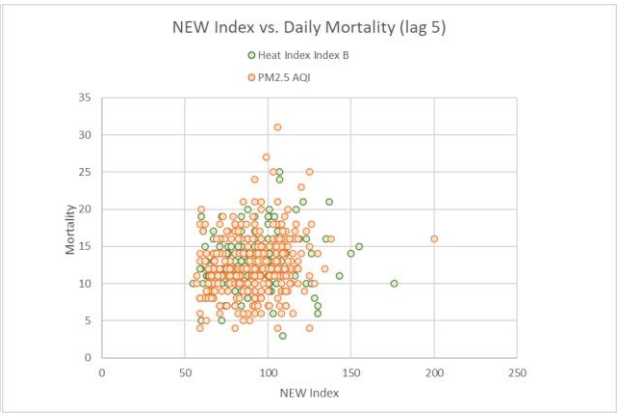

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

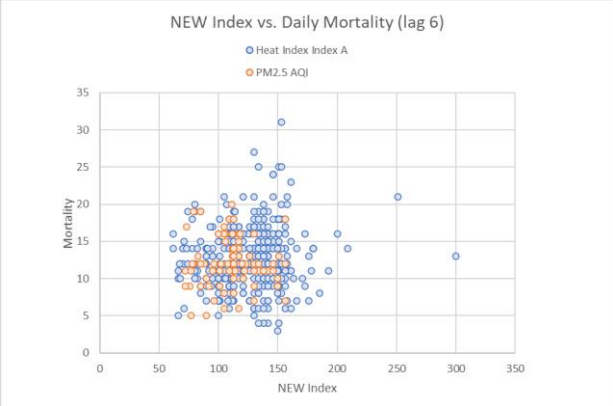

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

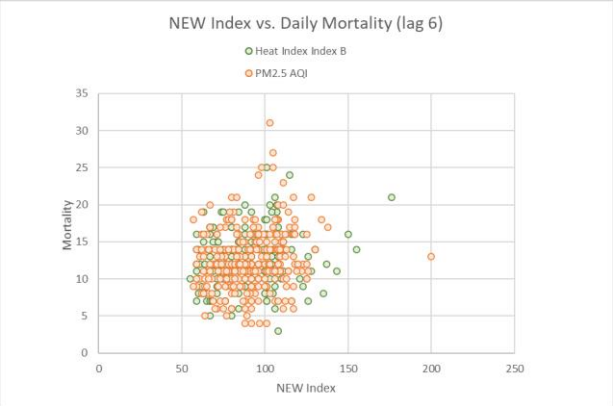

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

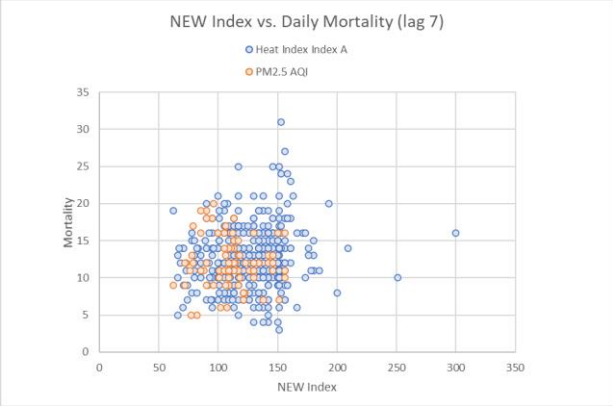

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

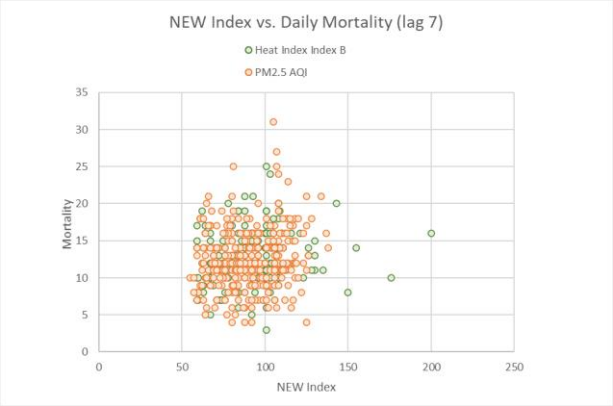

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250

Production Run:

M & F, all ages, cardio & resp, warm months (PM2.5 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily PM2.5 AQI as the only predictor,
Blue = Daily PM2.5 AQI and HI as the predictors,
Green = NEW A index (highest of daily PM2.5 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily PM2.5 AQI and HI-B) as the predictor:

A

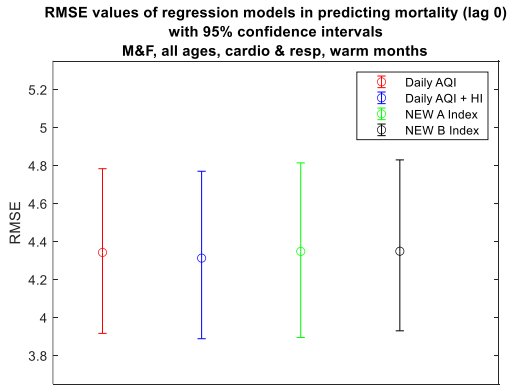
(how I originally defined the transformed HI in our NEW index)

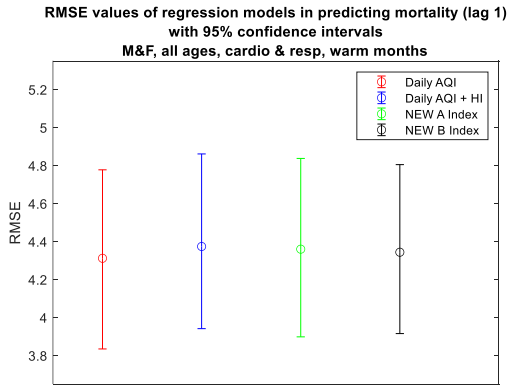
B

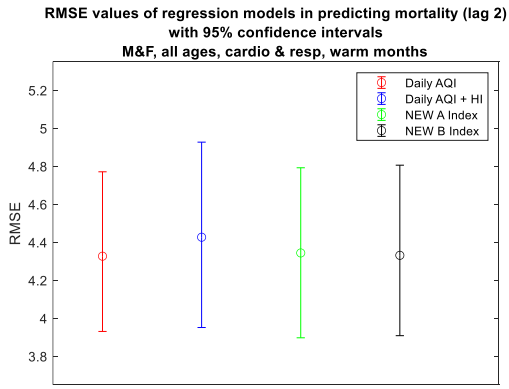
(transformed HI shifted down one category)

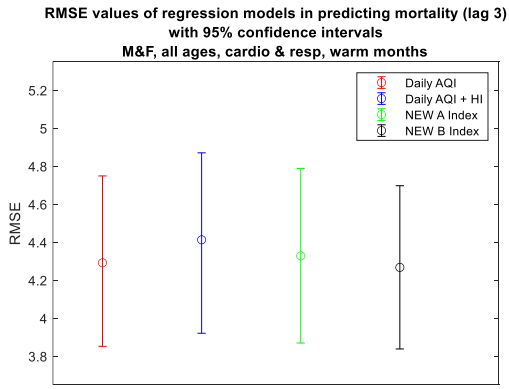
HI_Index Breakpoints

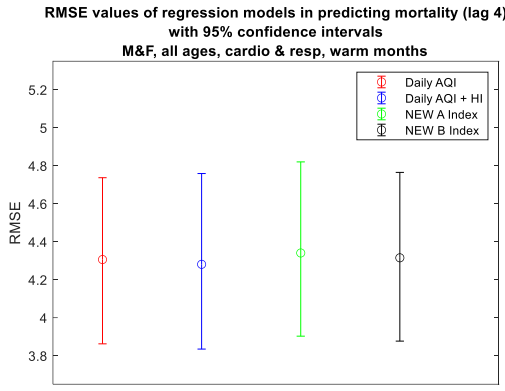
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

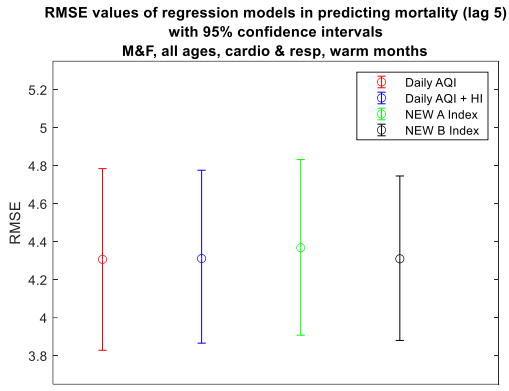


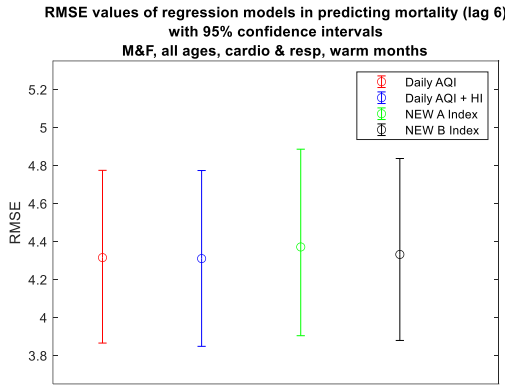


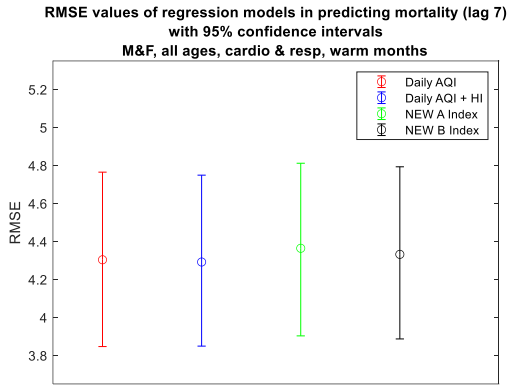





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	4.3427 +/-0.43345	4.3129 +/-0.44072	4.3483 +/-0.45949	4.3493 +/-0.4498
1	4.312 +/-0.47137	4.3741 +/-0.45978	4.36 +/-0.46952	4.3439 +/-0.44462
2	4.3268 +/-0.42013	4.4268 +/-0.48782	4.3439 +/-0.44745	4.3314 +/-0.44866
3	4.292 +/-0.44841	4.4131 +/-0.47484	4.3284 +/-0.45945	4.2678 +/-0.42966
4	4.3062 +/-0.43717	4.281 +/-0.46196	4.3407 +/-0.45861	4.3153 +/-0.44399
5	4.307 +/-0.47803	4.3115 +/-0.4551	4.3685 +/-0.46213	4.3102 +/-0.43271
6	4.3149 +/-0.45458	4.3098 +/-0.46269	4.371 +/-0.49082	4.3316 +/-0.47884
7	4.3035 +/-0.45897	4.2917 +/-0.44991	4.364 +/-0.45428	4.332 +/-0.45301

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.064 +/-0.061614	1.101 +/-0.079543	1.0453 +/-0.041658	1.0644 +/-0.053498	1.0898 +/-0.16159
1	1.0776 +/-0.060742	1.1031 +/-0.081035	1.0279 +/-0.046558	1.0575 +/-0.059562	1.0146 +/-0.15859
2	1.0659 +/-0.055733	1.0988 +/-0.073651	1.0376 +/-0.04431	1.0608 +/-0.055254	1.045 +/-0.15252
3	1.0858 +/-0.056831	1.1332 +/-0.077792	1.0527 +/-0.041217	1.0937 +/-0.050394	1.1028 +/-0.15764
4	1.0845 +/-0.060167	1.121 +/-0.073089	1.0539 +/-0.047009	1.0824 +/-0.056257	1.1209 +/-0.17567
5	1.0811 +/-0.055759	1.0976 +/-0.074775	1.0363 +/-0.044027	1.076 +/-0.056917	1.024 +/-0.14954
6	1.0779 +/-0.055777	1.0978 +/-0.069877	1.0305 +/-0.044535	1.0686 +/-0.051159	0.98197 +/-0.13239
7	1.0801 +/-0.057995	1.108 +/-0.068263	1.0367 +/-0.045594	1.0706 +/-0.052281	1.1093 +/-0.15359

AQI Regression: PM2.5 AQI predictor statistically significant on all lag days 0-7 with 95% confidence.

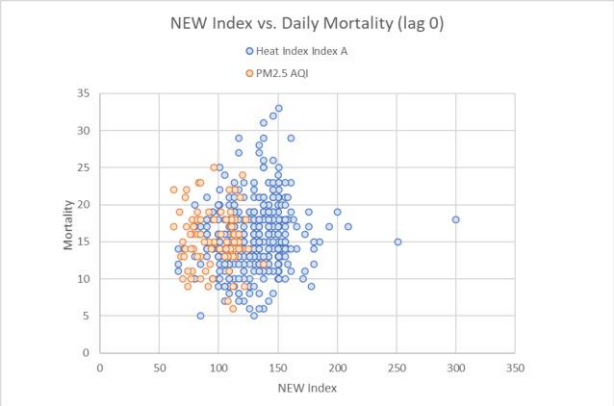
AQI+HI Regression: PM2.5 AQI predictor statistically significant on lag day 2 with 90% confidence and on lag days 0, 1, 3, 4, 5, 6, and 7 with 95% confidence. HI predictor statistically significant on lag days 0, 2, and 4 with 90% confidence and on lag day 3 with 95% confidence.

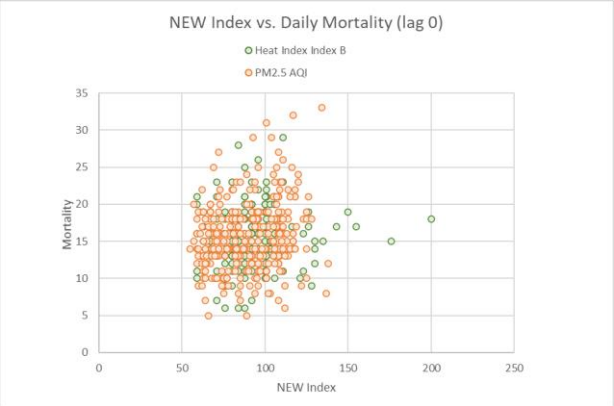
NEW A Regression: NEW A index predictor statistically significant on lag days 2 and 5 with 90% confidence and on lag days 0, 3, and 4 with 95% confidence.

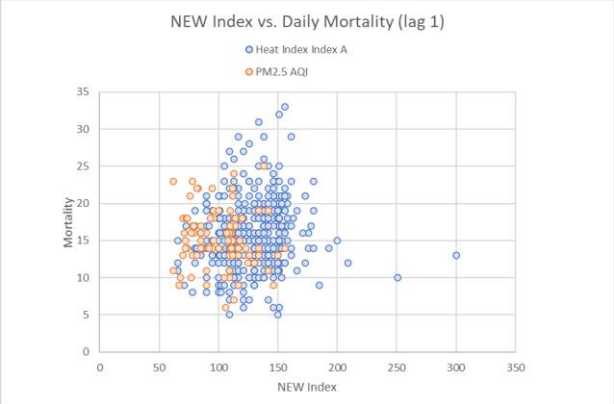
NEW B Regression: NEW B index predictor statistically significant on all lag days 0-7 with 95% confidence.

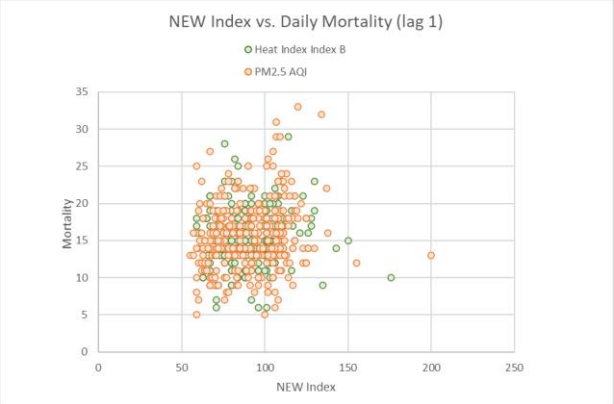
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence. PM2.5 predictor statistically significant on lag days 0 and 2 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence.

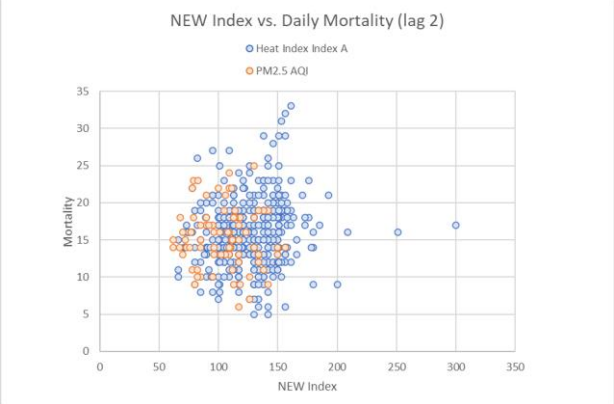
NEW Index vs. Daily Mortality Plots (for M & F, all ages, cardio & resp, warm months)

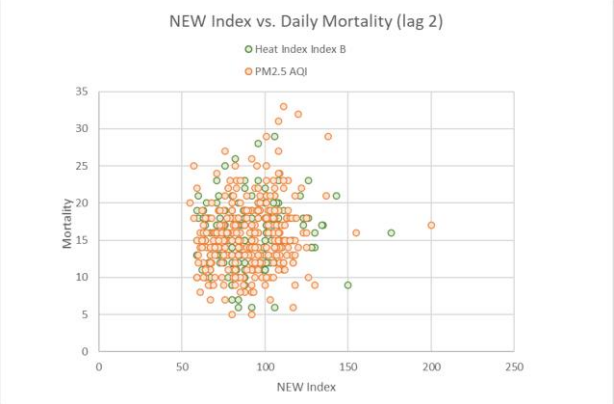


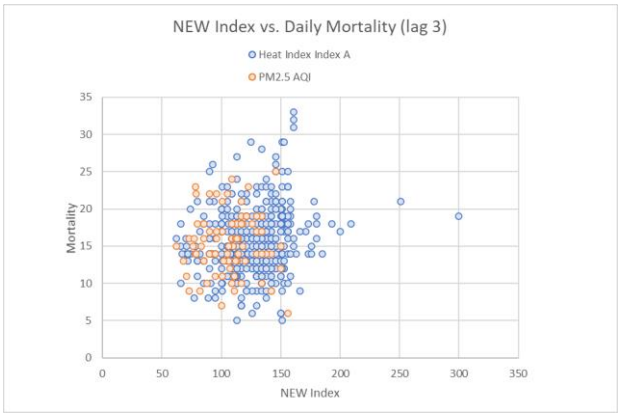


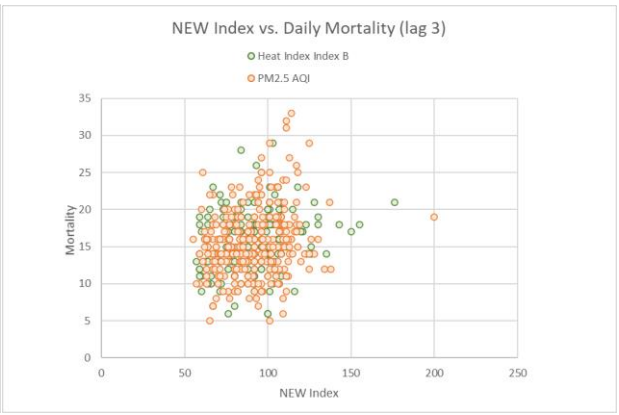


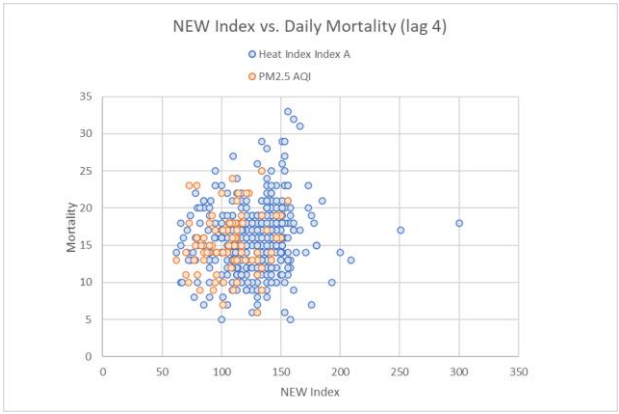


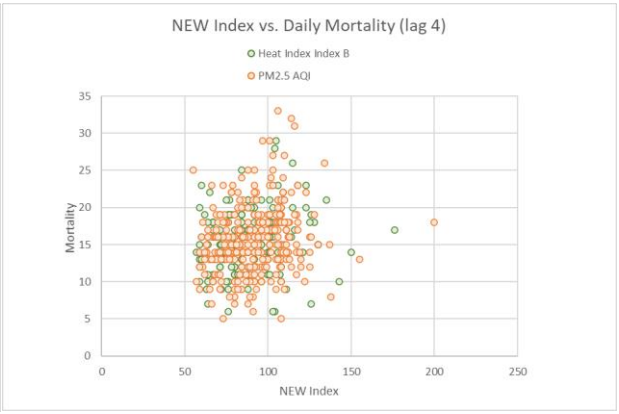


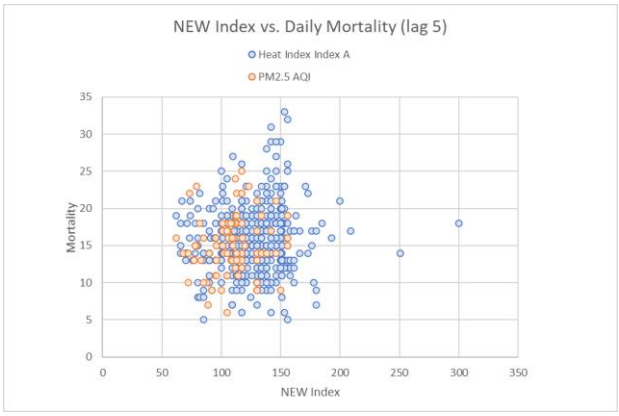


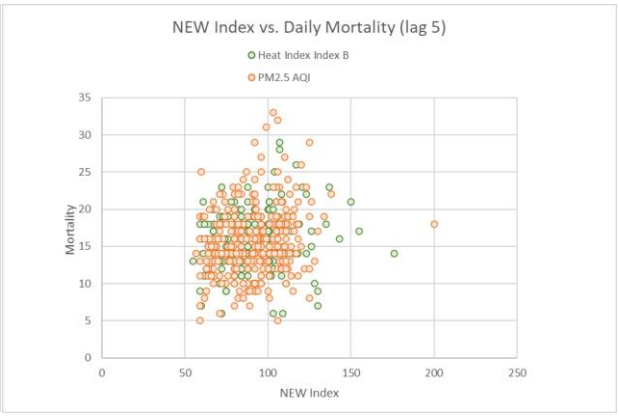

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

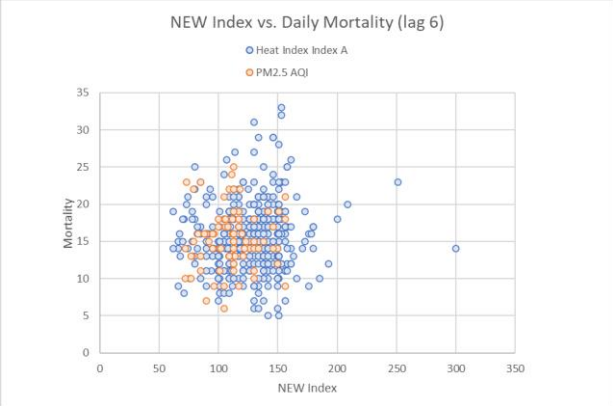

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

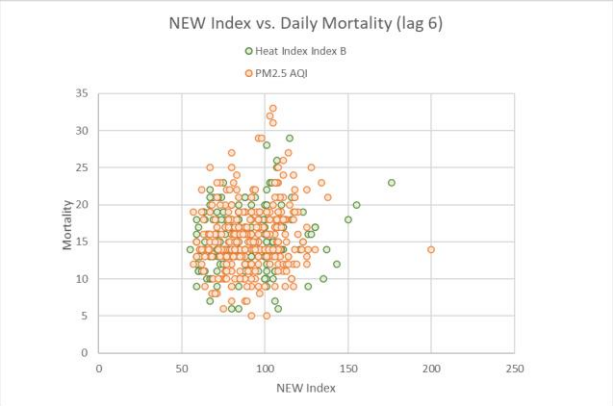

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index

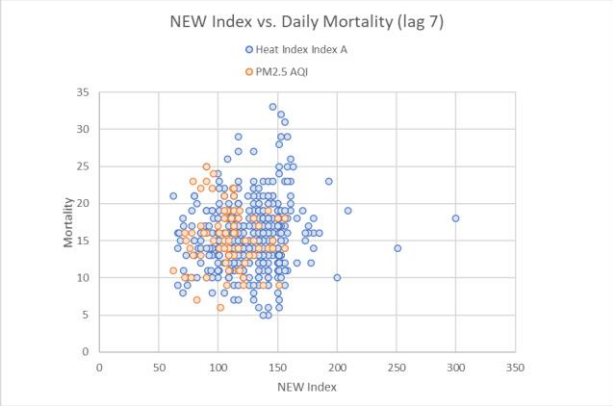

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index

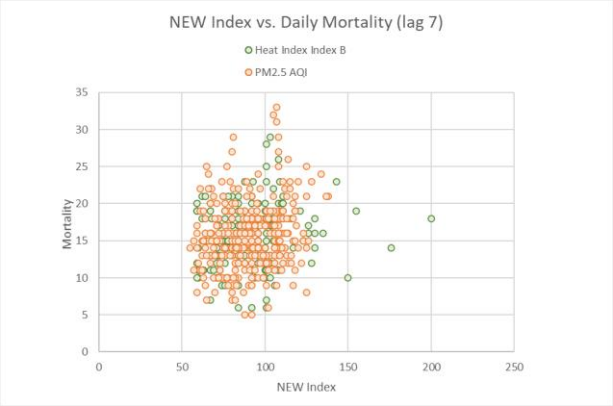

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
PM2.5 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250

Appendix C:

O3 AQI Full Results

The documents that follow include full results for regression runs that consider the O_3 AQI.

Each production run corresponds to one of the ten population sets analyzed in this project as described in section 3.4.

Each production run consists of RMSE plots for each lag day, a table of RMSE values and their 95% confidence intervals for each lag day, a table of RMSE values and their 95% confidence intervals, and scatterplots of NEW indices versus mortality of the population set.

The model results in the plots and tables are those described in section 3.5.

'AQI' refers to Model 1, the model in which the sole explanatory variable of the regression model was daily O_3 AQI values.

'AQI + HI' refers to Model 2, the model in which the explanatory variables were daily O_3 AQI values and HI values.

'NEW A' refers to Model 3A, the model in which the sole explanatory variable was the NEW A index where the version of the AQI considered was the O_3 AQI.

'NEW B' refers to Model 3B, the model in which the sole explanatory variable was the NEW B index where the version of the AQI considered was the O_3 AQI.

'RAW' refers to Model 4, the model in which the explanatory variables are pollutant concentrations of the criteria pollutants and temperature and relative humidity measurements.

Production Run:

M, 60-74, cardio, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

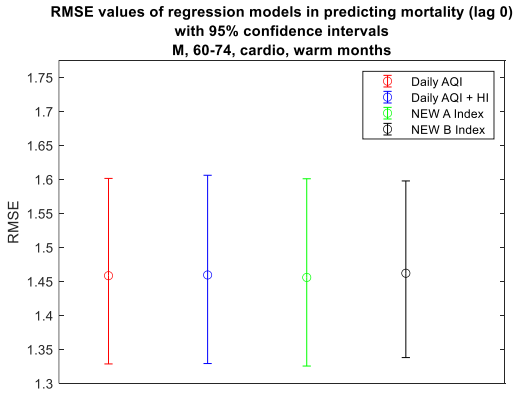
(how I originally defined the transformed HI in our NEW index)

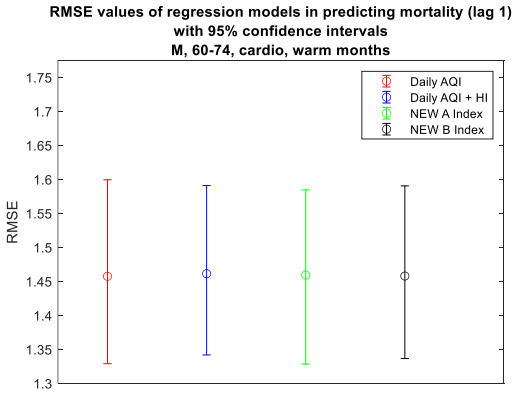
B

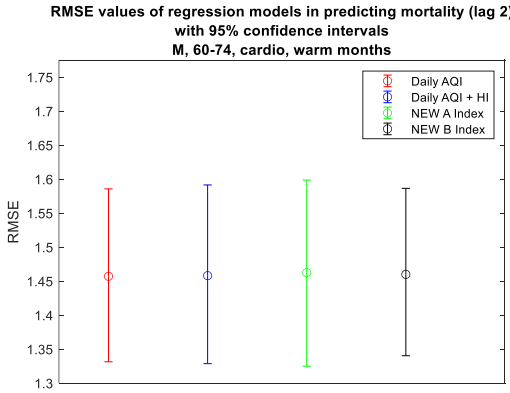
(transformed HI shifted down one category)

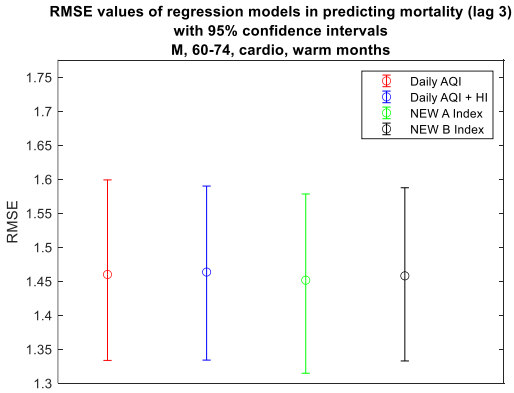
HI_Index Breakpoints

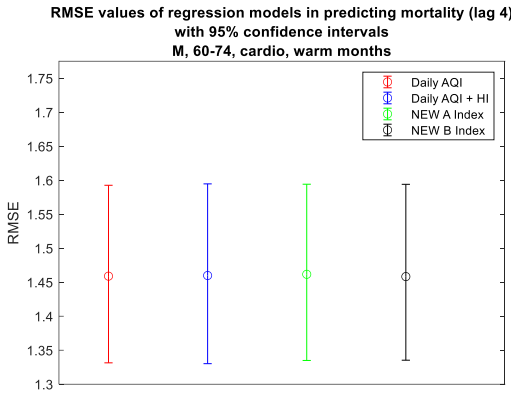
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

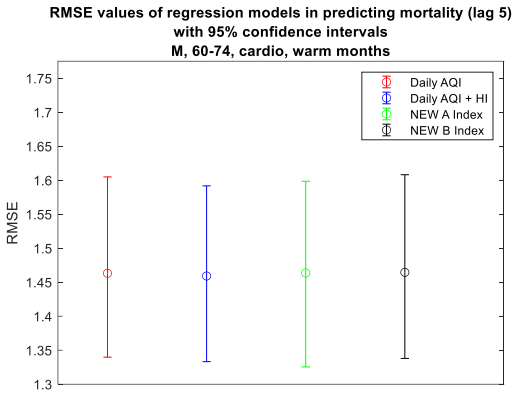


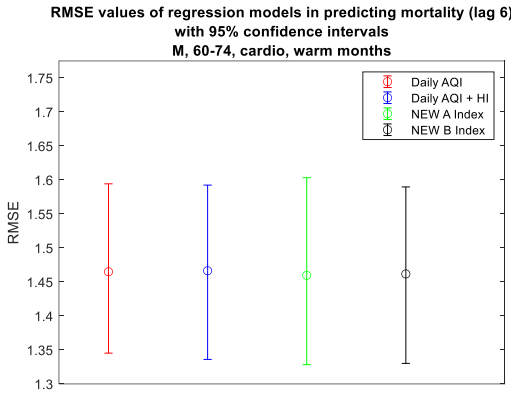


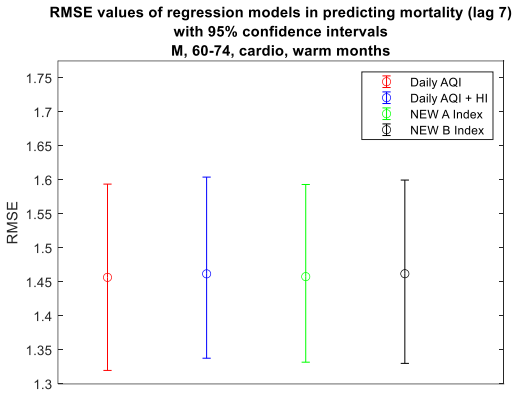





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 60-74, cardio, warm months
RMSE
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.4584 +/-0.13642	1.4594 +/-0.13844	1.4558 +/-0.13771	1.462 +/-0.12989
1	1.4575 +/-0.13524	1.4614 +/-0.12456	1.4593 +/-0.12806	1.4579 +/-0.12697
2	1.4571 +/-0.12714	1.4581 +/-0.13141	1.4626 +/-0.13688	1.4599 +/-0.1231
3	1.4598 +/-0.13273	1.4633 +/-0.12796	1.4513 +/-0.13182	1.4577 +/-0.12736
4	1.4589 +/-0.13056	1.4599 +/-0.1322	1.4616 +/-0.12959	1.4583 +/-0.12933
5	1.4631 +/-0.13256	1.4591 +/-0.12925	1.4636 +/-0.13651	1.4645 +/-0.13507
6	1.465 +/-0.12451	1.4664 +/-0.12815	1.4597 +/-0.13745	1.4618 +/-0.12976
7	1.4567 +/-0.137	1.4619 +/-0.13317	1.4578 +/-0.13066	1.4621 +/-0.13479

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0178 +/-0.090093	1.0592 +/-0.12558	1.0383 +/-0.10034	1.0235 +/-0.073615	1.1458 +/-0.41637
1	1.0579 +/-0.094446	1.0887 +/-0.13682	1.0494 +/-0.10185	1.0465 +/-0.078333	1.078 +/-0.34268
2	1.073 +/-0.099797	1.111 +/-0.13923	1.0519 +/-0.10023	1.0409 +/-0.079878	1.1204 +/-0.39054
3	1.061 +/-0.10258	1.121 +/-0.14701	1.0799 +/-0.10192	1.0572 +/-0.085979	1.074 +/-0.34763
4	1.0761 +/-0.10494	1.1001 +/-0.13239	1.0545 +/-0.1143	1.0499 +/-0.086496	1.0011 +/-0.33517
5	1.035 +/-0.09898	1.0817 +/-0.12373	1.0497 +/-0.1056	1.029 +/-0.076484	1.2933 +/-0.4401
6	1.0218 +/-0.088458	1.0592 +/-0.12369	1.0565 +/-0.11162	1.0365 +/-0.076894	1.2112 +/-0.40603
7	1.0105 +/-0.10167	1.0465 +/-0.13042	1.0367 +/-0.11268	1.007 +/-0.081456	1.2388 +/-0.40012

AQI Regression: No statistically significant predictors.

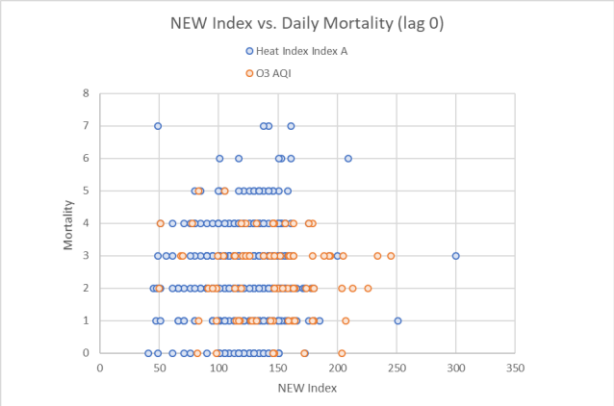
AQI+HI Regression: No statistically significant predictors.

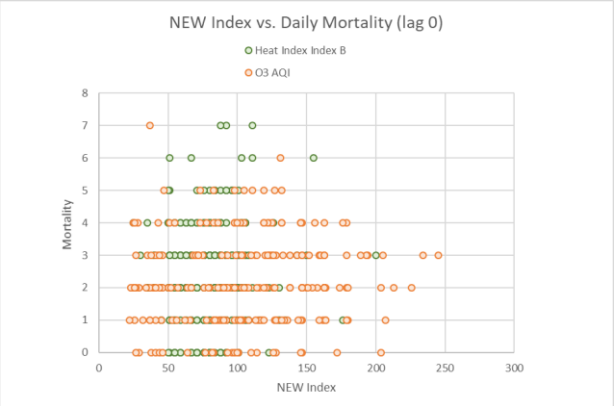
NEW A Regression: No statistically significant predictors.

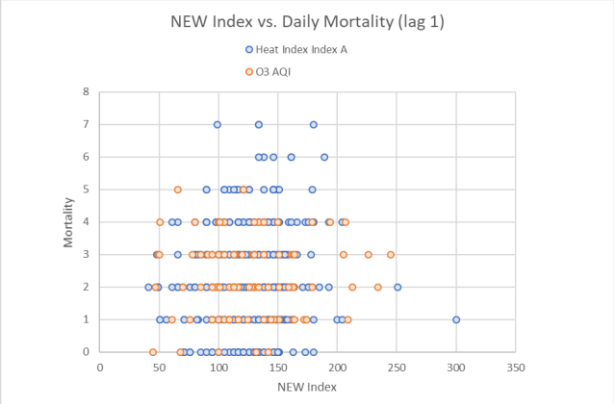
NEW B Regression: No statistically significant predictors.

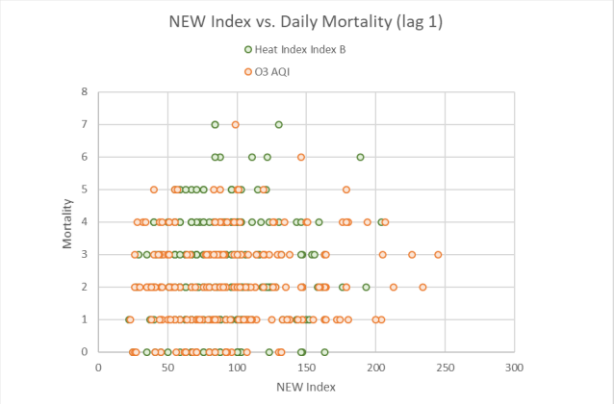
RAW Regression: PM2.5 predictor statistically significant on lag days 5 and 6 with 90% confidence.

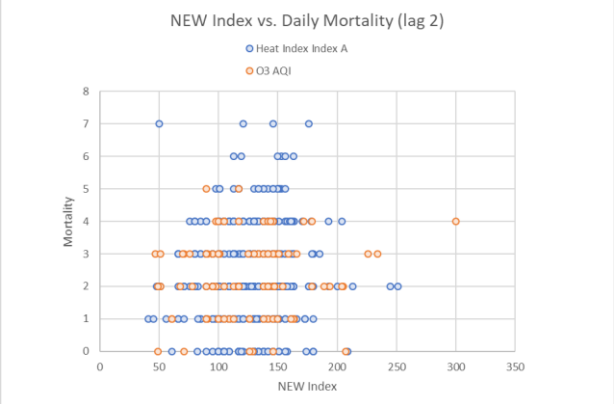
NEW Index vs. Daily Mortality Plots (for M, 60-74, cardio, warm months)

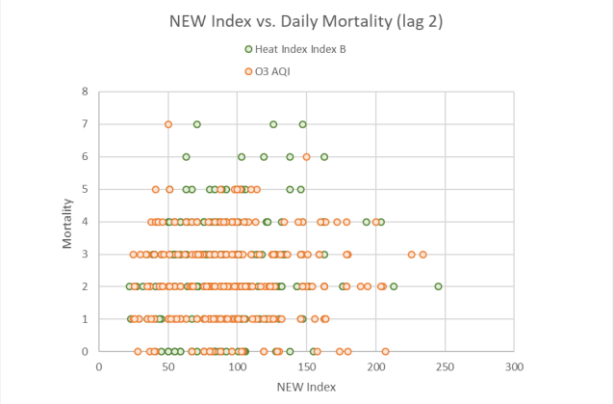


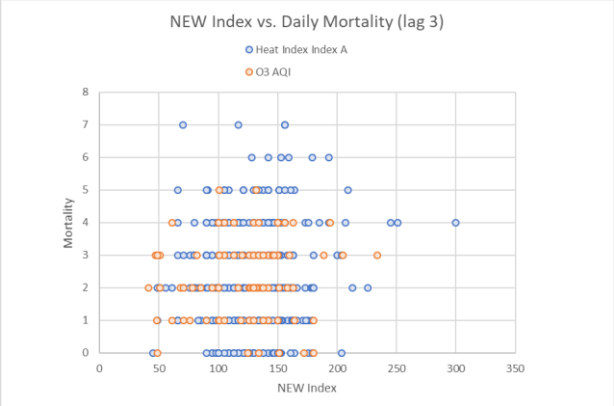


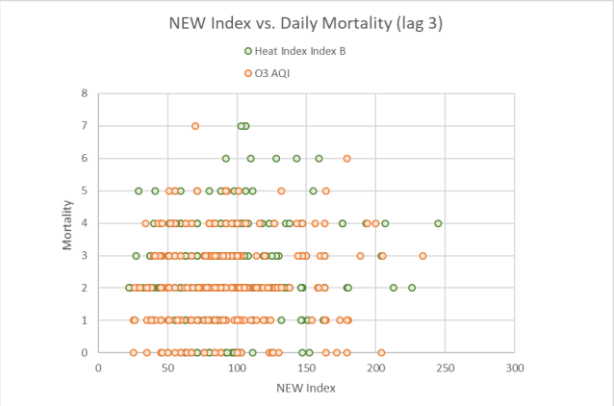


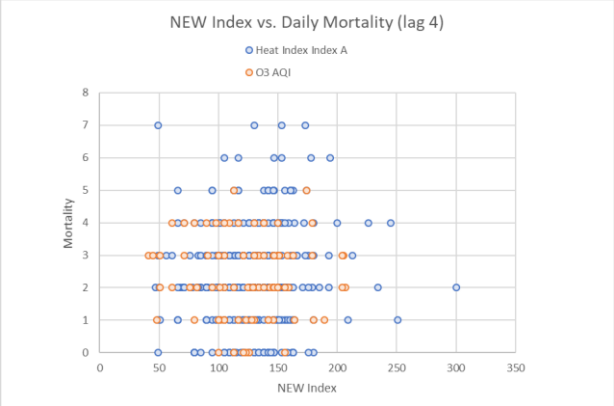


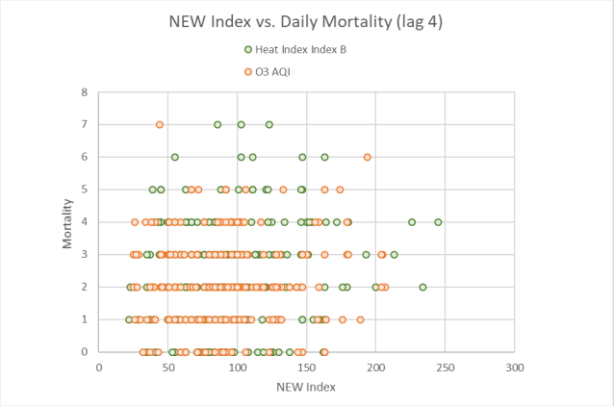


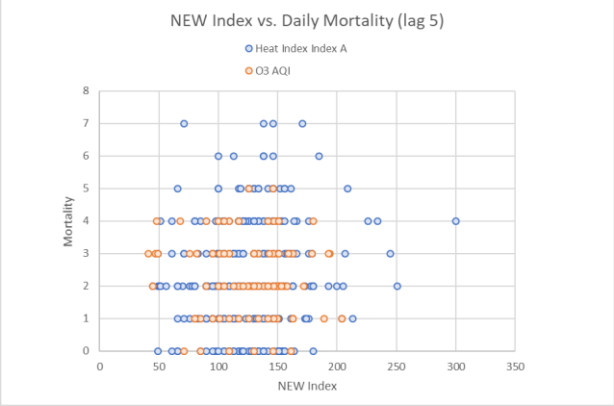


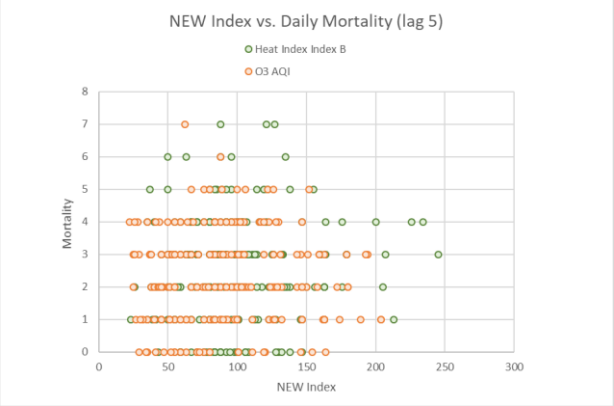

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

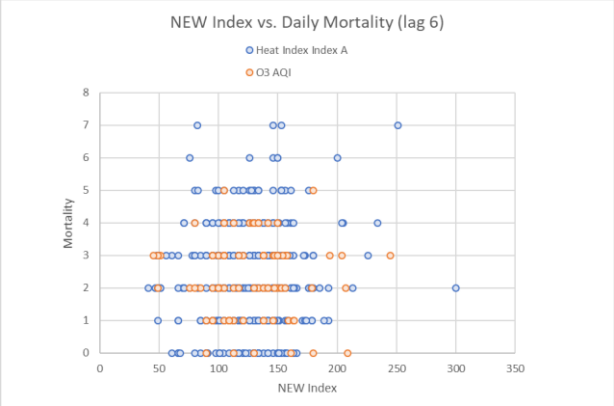

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

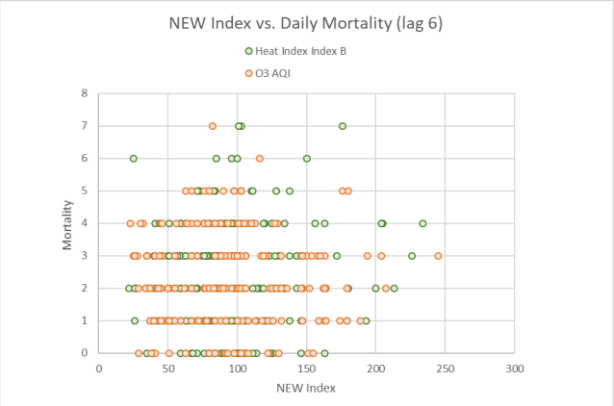

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

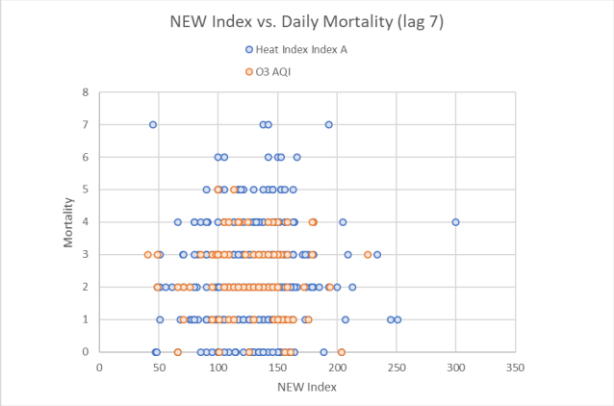

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

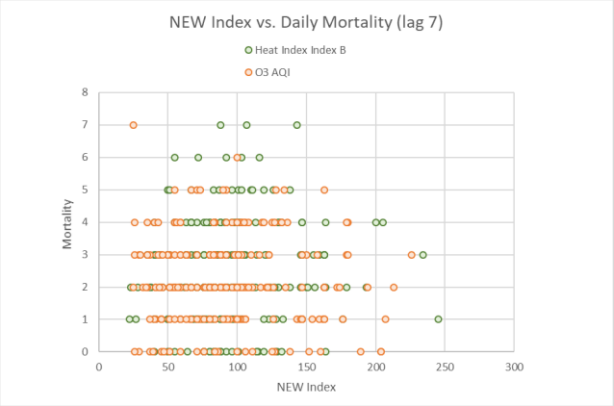

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index

Production Run:

M, 75+, cardio, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

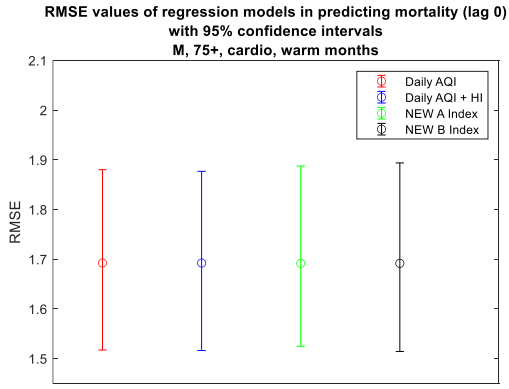
(how I originally defined the transformed HI in our NEW index)

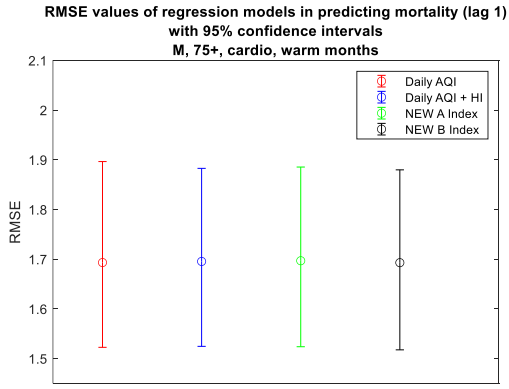
B

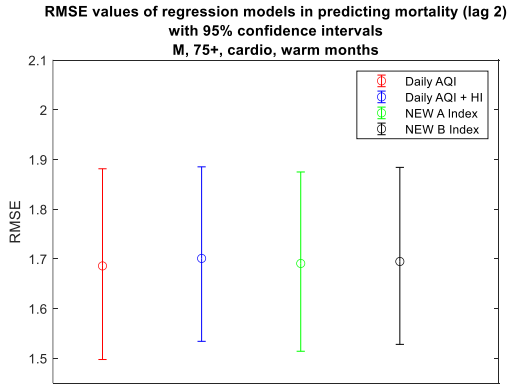
(transformed HI shifted down one category)

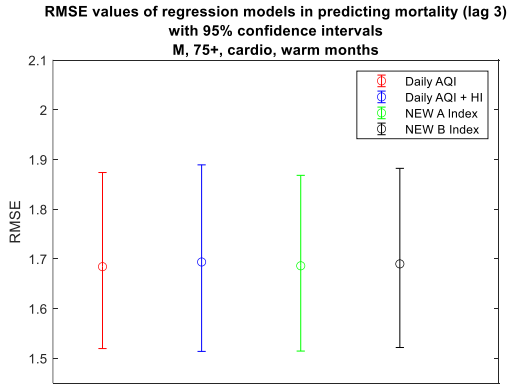
HI_Index Breakpoints

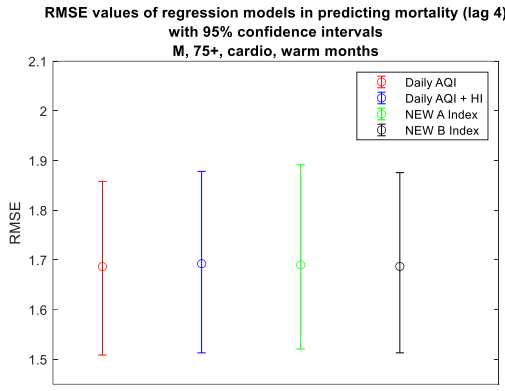
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

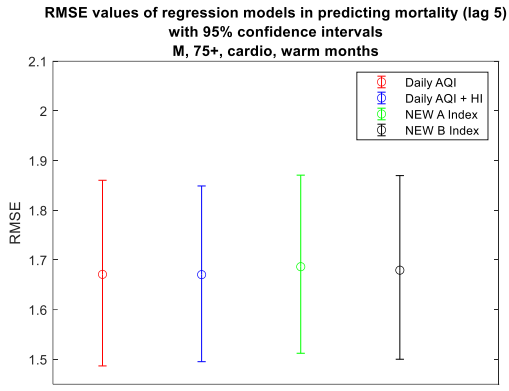


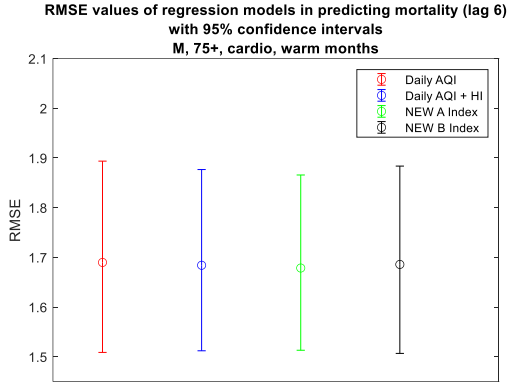


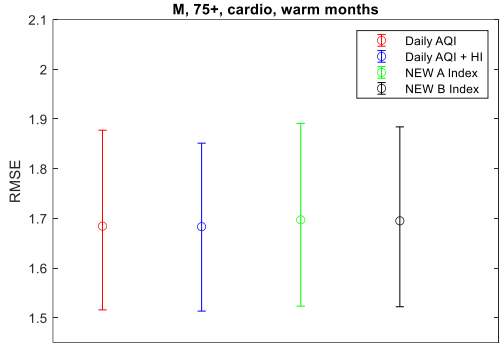





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 75+, cardio, warm months
RMSE
2.1
2
1.9
1.8
1.7
1.6
1.5
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.6923 +/-0.18139	1.6922 +/-0.18031	1.6916 +/-0.1813	1.6915 +/-0.18971
1	1.6932 +/-0.18692	1.6954 +/-0.1791	1.6968 +/-0.1808	1.6929 +/-0.18111
2	1.6859 +/-0.19194	1.701 +/-0.17557	1.6908 +/-0.18039	1.6948 +/-0.1781
3	1.6844 +/-0.17714	1.6937 +/-0.1877	1.6861 +/-0.17683	1.6899 +/-0.18027
4	1.6866 +/-0.17474	1.6925 +/-0.18258	1.6902 +/-0.1852	1.687 +/-0.18135
5	1.6711 +/-0.1868	1.6705 +/-0.17681	1.6865 +/-0.17922	1.6795 +/-0.18479
6	1.6898 +/-0.19247	1.6841 +/-0.18236	1.6786 +/-0.17635	1.6858 +/-0.18848
7	1.6843 +/-0.18077	1.6833 +/-0.16896	1.6971 +/-0.18394	1.6951 +/-0.18098

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0167 +/-0.095806	1.025 +/-0.12791	1.0291 +/-0.11834	1.0184 +/-0.084619	1.0058 +/-0.34525
1	1.0154 +/-0.10347	1.0141 +/-0.11567	0.98668 +/-0.09763	1.0005 +/-0.080854	0.93146 +/-0.30709
2	1.021 +/-0.094079	1.0657 +/-0.13762	1.0265 +/-0.096263	1.0241 +/-0.080609	0.87375 +/-0.27572
3	1.0558 +/-0.094331	1.0992 +/-0.1433	1.0378 +/-0.1033	1.0409 +/-0.079577	1.1186 +/-0.38377
4	1.0751 +/-0.11055	1.0948 +/-0.14062	1.0229 +/-0.10398	1.0433 +/-0.081326	1.0087 +/-0.32261
5	1.1173 +/-0.10542	1.1191 +/-0.13161	1.0562 +/-0.10938	1.0858 +/-0.085478	1.1151 +/-0.37127
6	1.0591 +/-0.096036	1.0757 +/-0.11059	1.0518 +/-0.091631	1.0447 +/-0.075882	1.0681 +/-0.32207
7	1.0734 +/-0.097925	1.0768 +/-0.12185	1.0281 +/-0.092802	1.0415 +/-0.082484	1.1509 +/-0.38074

AQI Regression: O3 AQI predictor statistically significant on lag day 5 with 95% confidence.

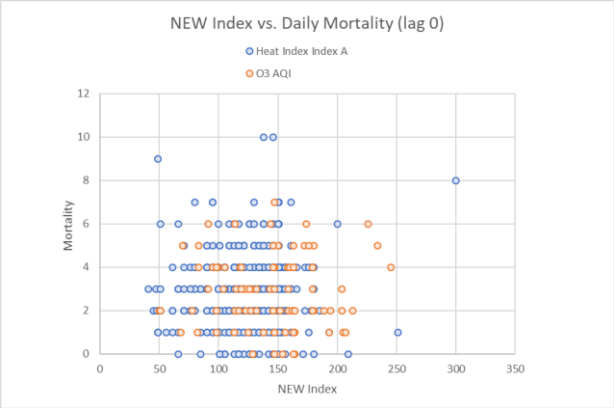
AQI+HI Regression: O3 AQI predictor statistically significant on lag day 5 with 95% confidence.

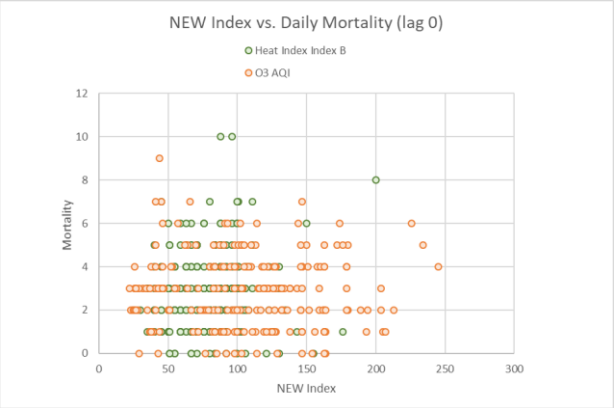
NEW A Regression: No statistically significant predictors.

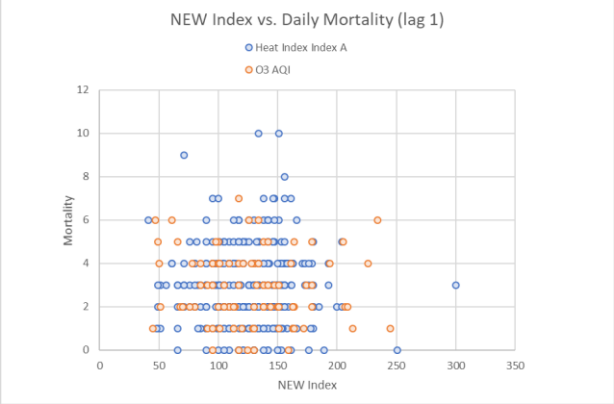
NEW B Regression: NEW B index statistically significant on lag day 5 with 95% confidence.

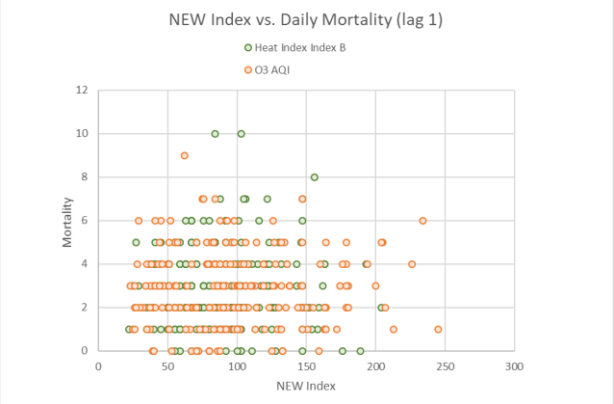
RAW Regression: No statistically significant predictors.

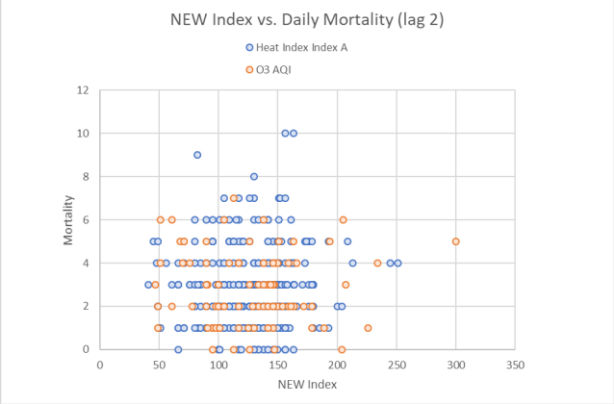
NEW Index vs. Daily Mortality Plots (for M, 75+, cardio, warm months)

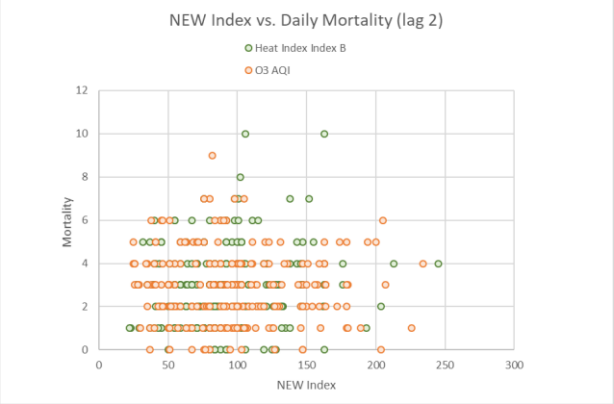


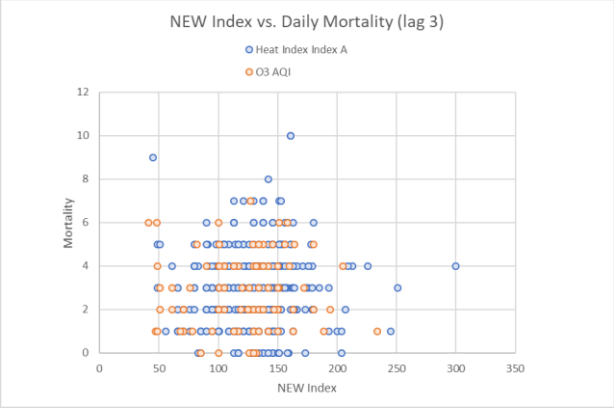


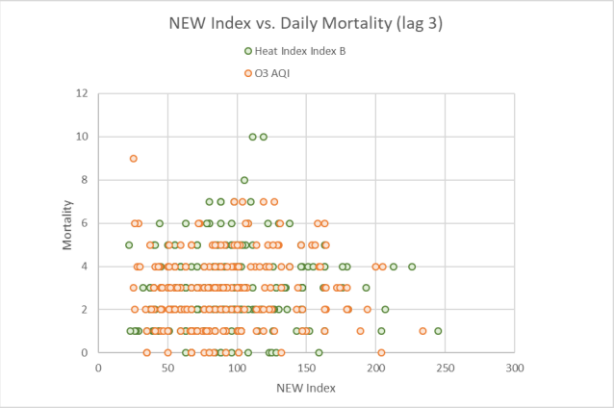


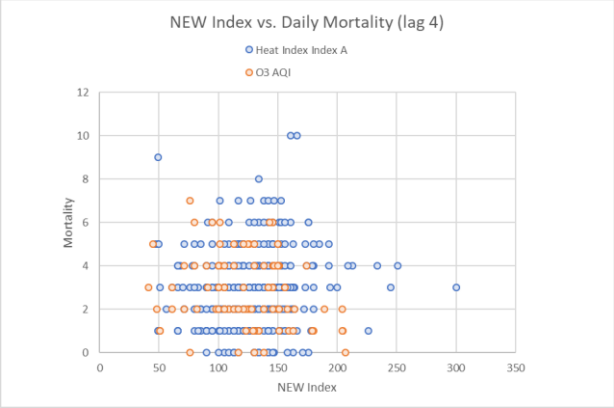


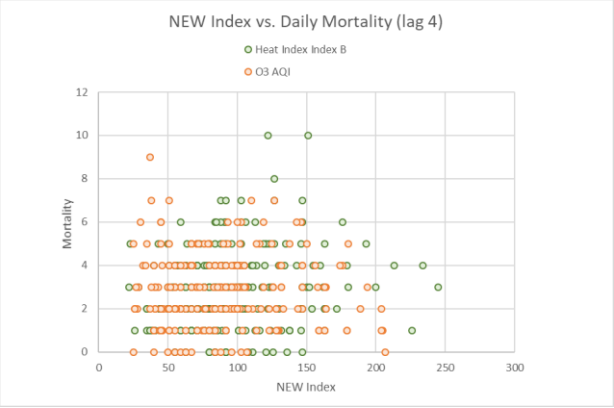


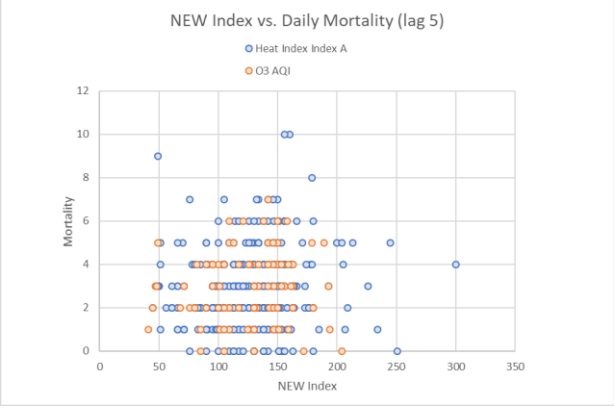


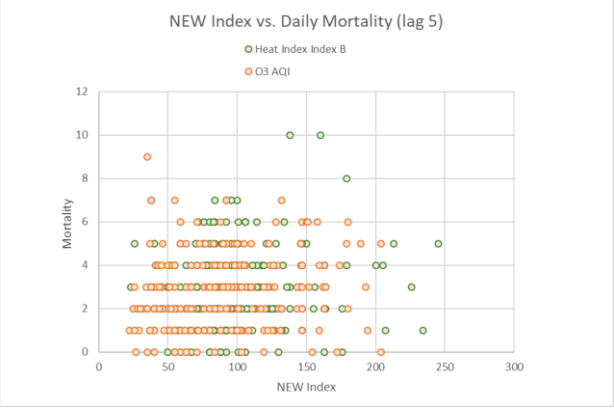

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

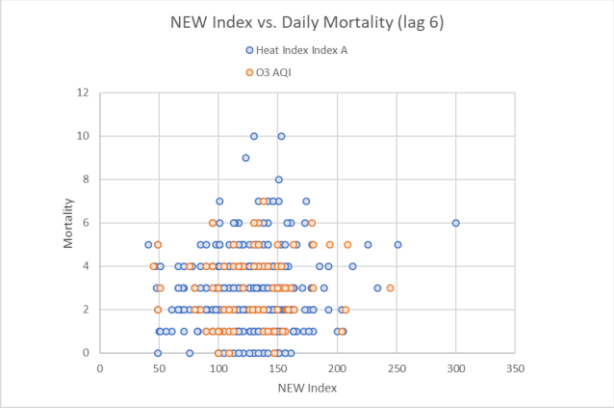

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

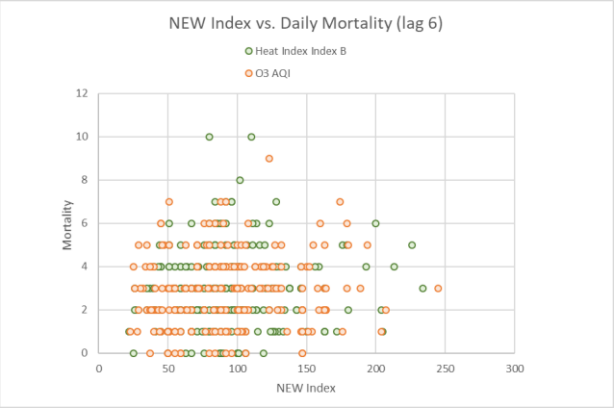

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

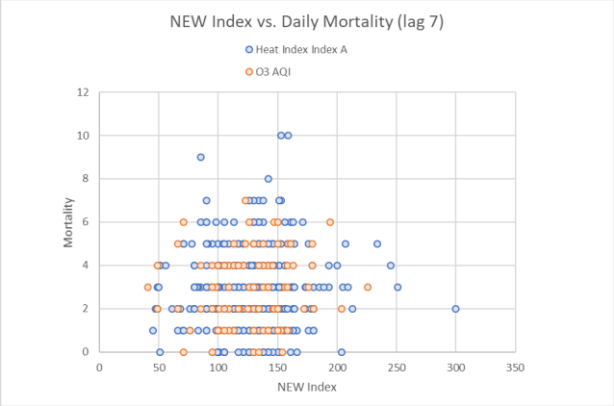

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

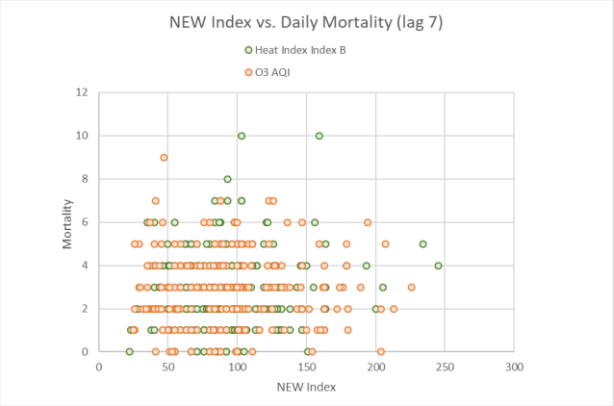

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index

Production Run:

M, 60-74, resp, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

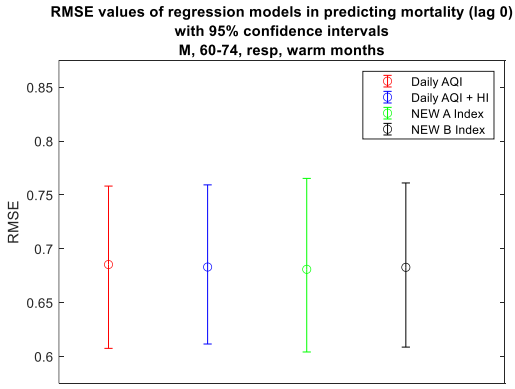
(how I originally defined the transformed HI in our NEW index)

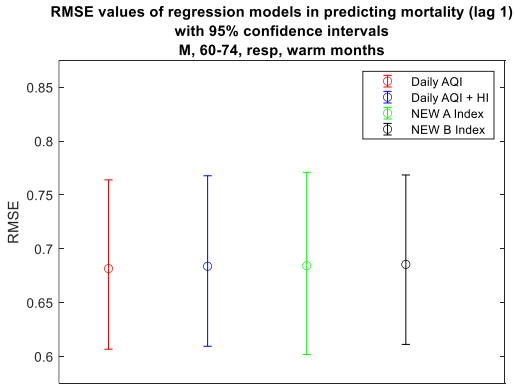
B

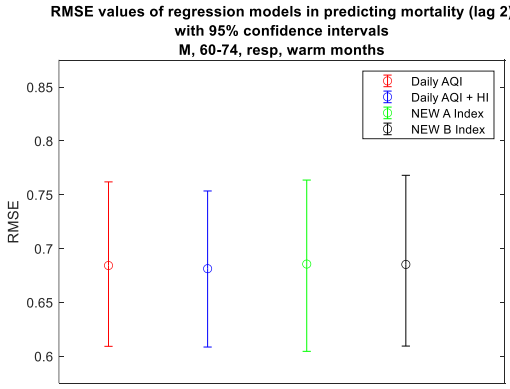
(transformed HI shifted down one category)

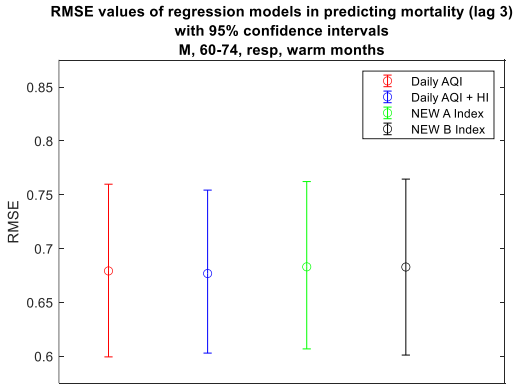
HI_Index Breakpoints

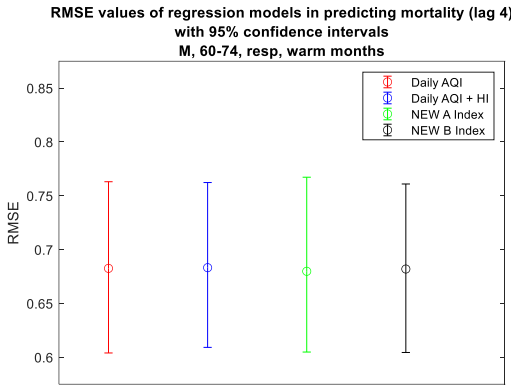
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

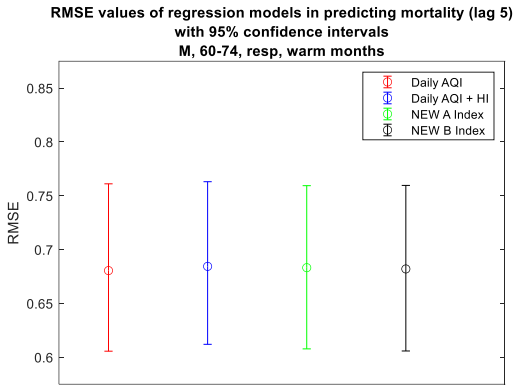


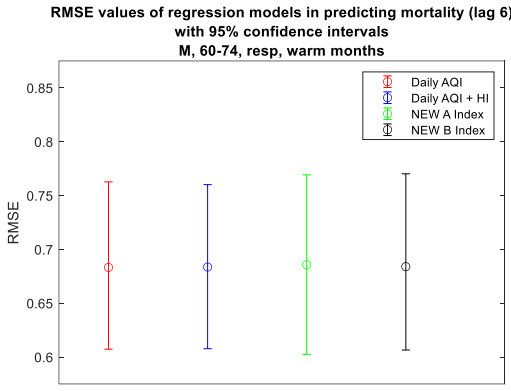


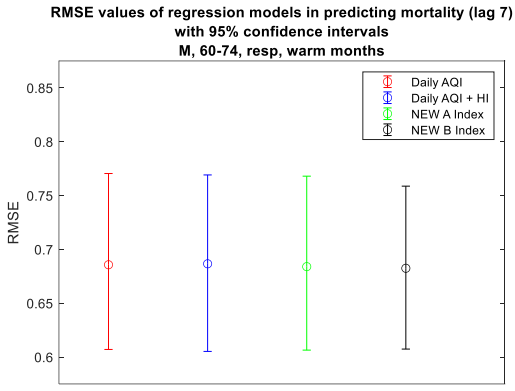





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 60-74, resp, warm months
RMSE
0.85
0.8
0.75
0.7
0.65
0.6
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.68541 +/-0.075365	0.68308 +/-0.073901	0.68096 +/-0.080615	0.6828 +/-0.07623
1	0.68165 +/-0.078661	0.68377 +/-0.079189	0.68436 +/-0.084576	0.68557 +/-0.078686
2	0.68423 +/-0.076366	0.68129 +/-0.072477	0.68558 +/-0.07954	0.68525 +/-0.079303
3	0.6792 +/-0.080197	0.6768 +/-0.075693	0.68301 +/-0.077707	0.68285 +/-0.081715
4	0.68259 +/-0.079524	0.68324 +/-0.076551	0.67987 +/-0.081189	0.68198 +/-0.078248
5	0.68054 +/-0.077727	0.68443 +/-0.075524	0.68324 +/-0.07579	0.68205 +/-0.076891
6	0.68322 +/-0.07771	0.68356 +/-0.076197	0.68571 +/-0.083371	0.68394 +/-0.081851
7	0.6857 +/-0.081706	0.6866 +/-0.081953	0.68394 +/-0.080779	0.68244 +/-0.075662

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	0.87493 +/-0.25938	0.89418 +/-0.29175	0.92045 +/-0.22223	0.86926 +/-0.195	1.1942 +/-1.0241
1	1.1448 +/-0.27679	1.1078 +/-0.3376	1.0309 +/-0.24669	1.0877 +/-0.2083	1.6352 +/-1.4062
2	1.0586 +/-0.2736	0.96355 +/-0.29367	0.96056 +/-0.24169	1.0115 +/-0.221	1.1455 +/-0.96993
3	1.1746 +/-0.27515	1.089 +/-0.31929	1.0042 +/-0.25971	1.0824 +/-0.21081	1.681 +/-1.4711
4	0.99972 +/-0.2583	0.94756 +/-0.30527	0.90035 +/-0.23062	0.94462 +/-0.21496	1.3908 +/-1.0896
5	0.96851 +/-0.24322	0.97622 +/-0.29076	0.98682 +/-0.21886	0.98069 +/-0.18052	0.96426 +/-0.83176
6	1.0352 +/-0.26047	1.0486 +/-0.31251	1.0554 +/-0.25653	1.0536 +/-0.21135	1.0557 +/-0.9463
7	0.98317 +/-0.24544	0.97489 +/-0.29246	0.99186 +/-0.2126	0.99393 +/-0.18874	0.94334 +/-0.8185

AQI Regression: No statistically significant predictors.

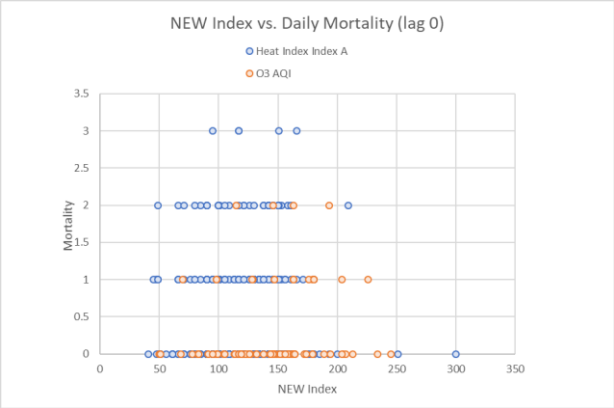
AQI+HI Regression: No statistically significant predictors.

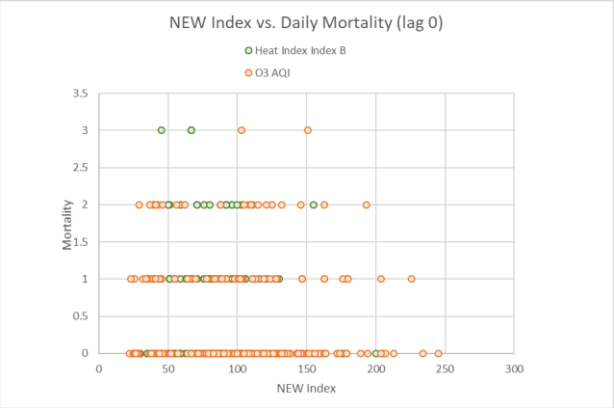
NEW A Regression: No statistically significant predictors.

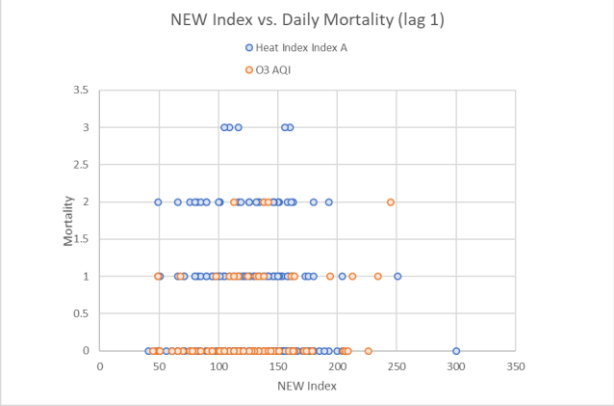
NEW B Regression: No statistically significant predictors.

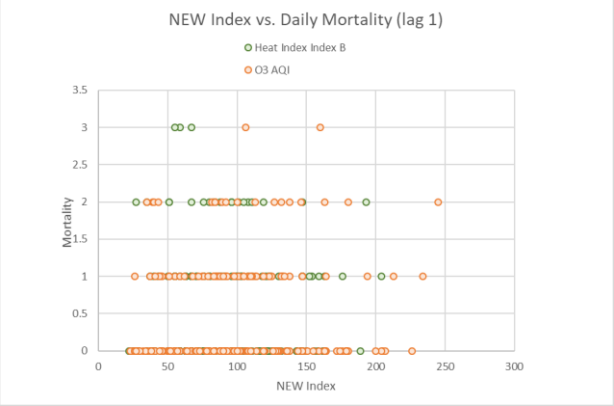
RAW Regression: No statistically significant predictors.

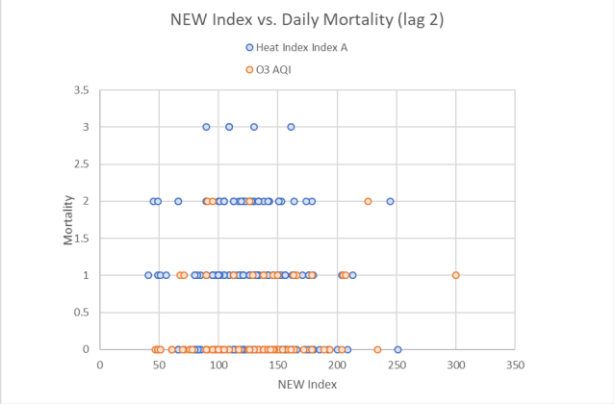
NEW Index vs. Daily Mortality Plots (for M, 60-74, resp, warm months)

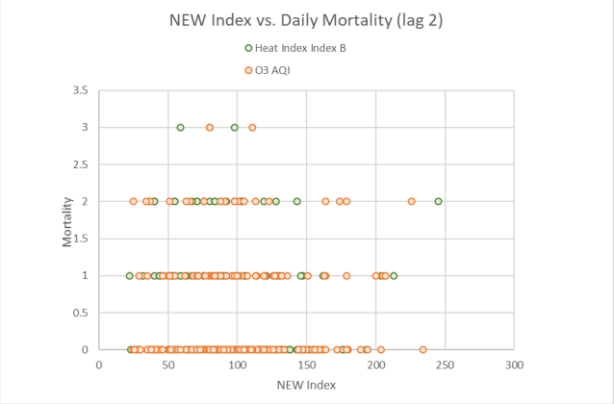


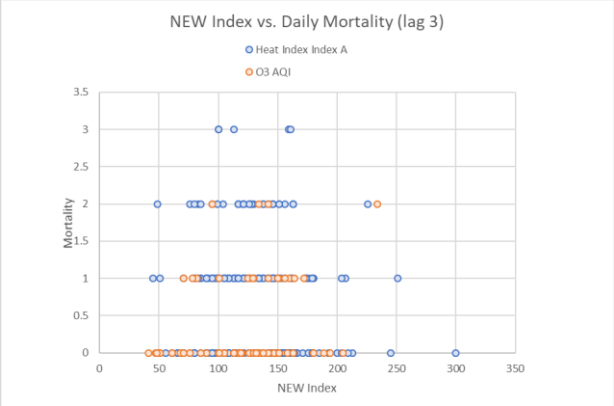


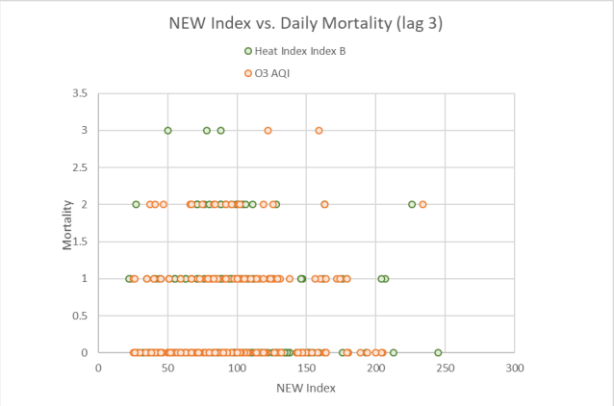


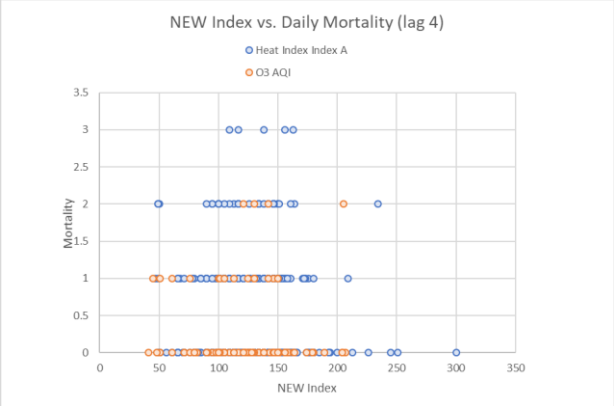


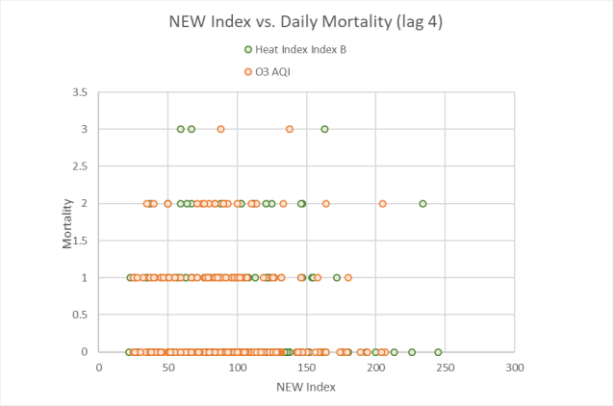


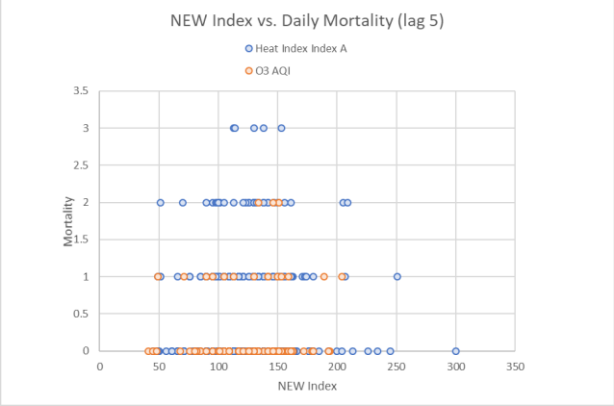


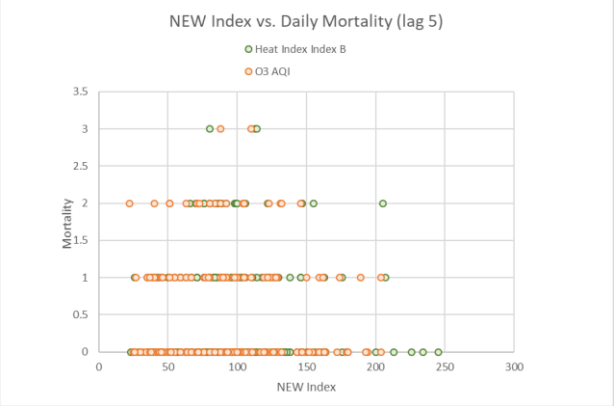

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

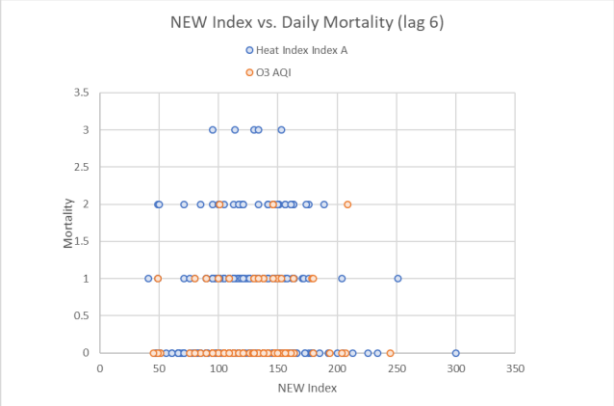

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

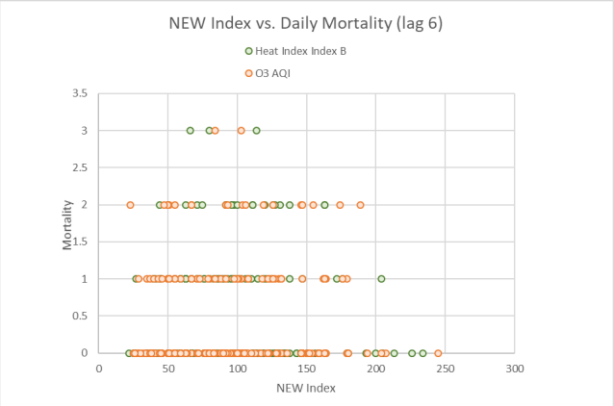

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

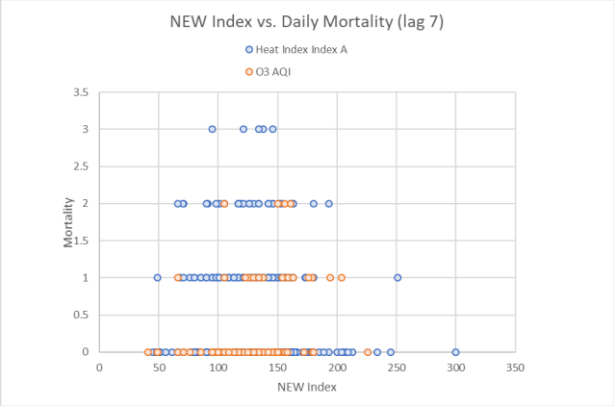

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

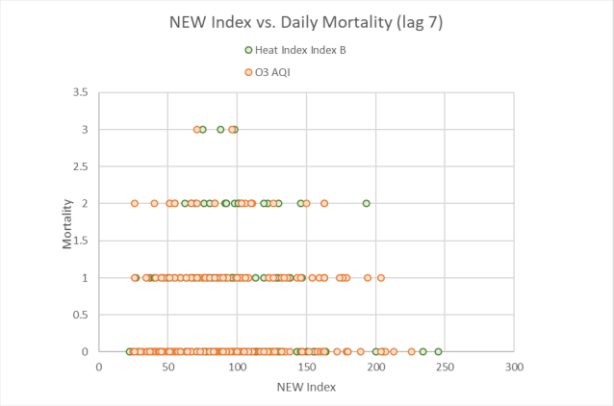

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300

Production Run:

M, 75+, resp, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

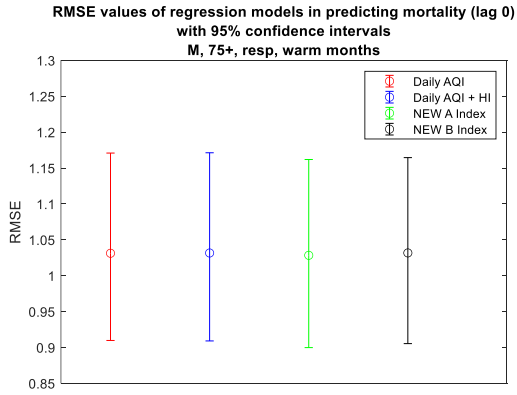
(how I originally defined the transformed HI in our NEW index)

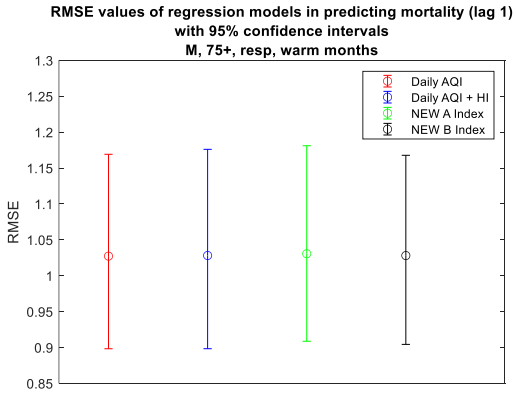
B

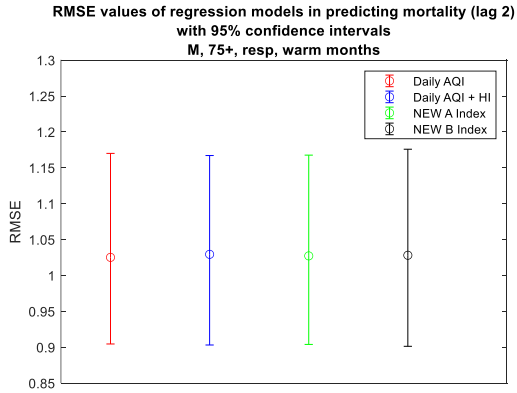
(transformed HI shifted down one category)

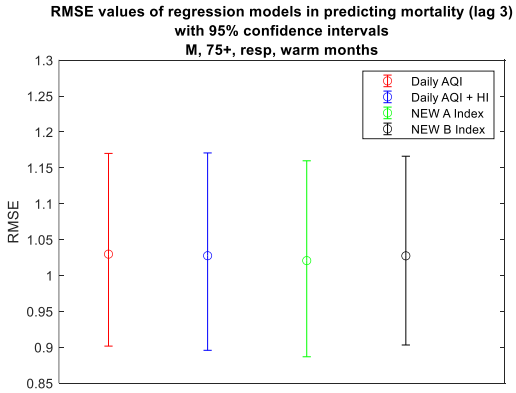
HI_Index Breakpoints

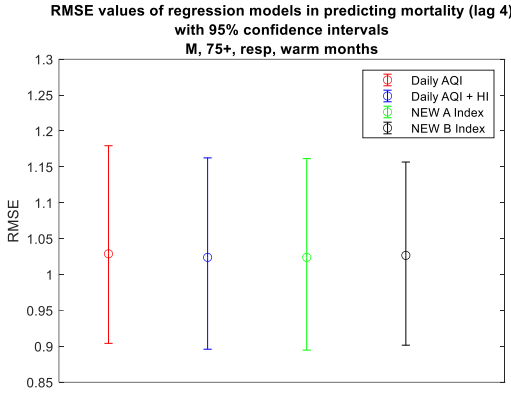
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

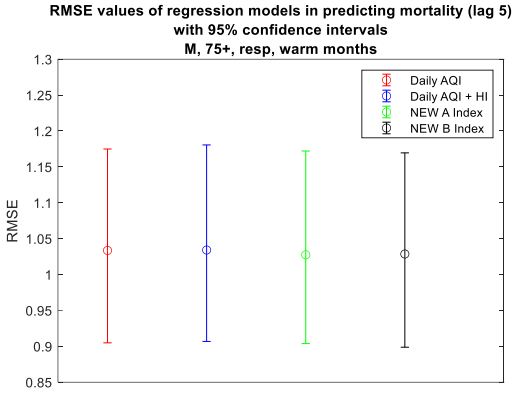


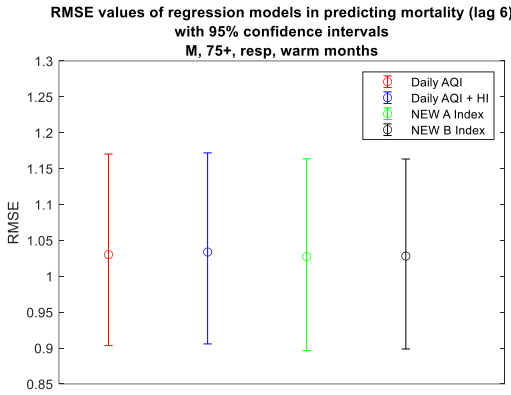


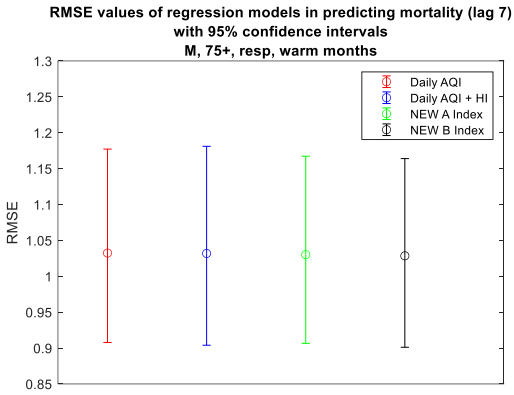





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M, 75+, resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.0313 +/-0.13055	1.0317 +/-0.13107	1.0284 +/-0.13103	1.0318 +/-0.12957
1	1.0273 +/-0.13547	1.0282 +/-0.13888	1.0307 +/-0.1362	1.0281 +/-0.13173
2	1.0252 +/-0.13276	1.0294 +/-0.13198	1.0273 +/-0.13186	1.0281 +/-0.13729
3	1.0297 +/-0.13424	1.0275 +/-0.13749	1.0207 +/-0.13652	1.0273 +/-0.13149
4	1.0289 +/-0.13768	1.0239 +/-0.13329	1.0239 +/-0.13338	1.0267 +/-0.12759
5	1.0336 +/-0.135	1.0342 +/-0.13687	1.0275 +/-0.13417	1.0286 +/-0.13539
6	1.0302 +/-0.13341	1.0338 +/-0.13305	1.0275 +/-0.13364	1.0282 +/-0.13234
7	1.0324 +/-0.13472	1.0318 +/-0.13857	1.0301 +/-0.13037	1.0285 +/-0.13144

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0053 +/-0.161	1.1005 +/-0.21373	1.1125 +/-0.1729	1.0281 +/-0.12777	1.1392 +/-0.64531
1	1.0826 +/-0.16773	1.1426 +/-0.23397	1.1061 +/-0.15939	1.0675 +/-0.13984	1.3959 +/-0.77364
2	0.94473 +/-0.15109	1.0293 +/-0.21189	1.0631 +/-0.16476	1.0033 +/-0.12111	1.2776 +/-0.72659
3	1.0685 +/-0.17659	1.1509 +/-0.22549	1.1077 +/-0.17498	1.0709 +/-0.13995	1.257 +/-0.6922
4	1.0941 +/-0.19605	1.1529 +/-0.23238	1.1522 +/-0.18649	1.0963 +/-0.14769	1.505 +/-0.8118
5	1.0243 +/-0.18751	0.99469 +/-0.20613	1.0207 +/-0.17275	1.0108 +/-0.1533	0.80424 +/-0.46164
6	0.99902 +/-0.16415	1.0068 +/-0.19721	0.98772 +/-0.14861	1.0094 +/-0.13227	0.73118 +/-0.39724
7	1.025 +/-0.16106	1.0689 +/-0.23689	1.0625 +/-0.23026	1.0225 +/-0.14784	0.97803 +/-0.59142

AQI Regression: No statistically significant predictors.

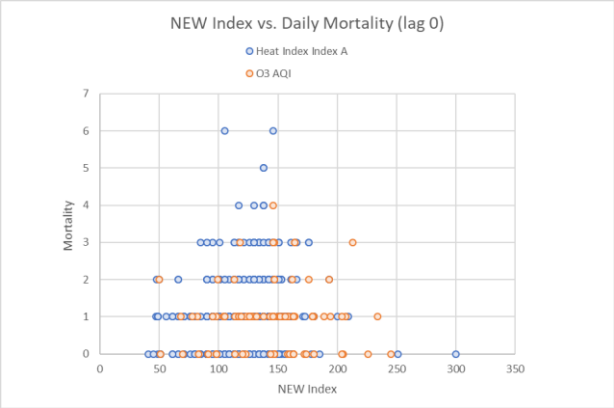
AQI+HI Regression: No statistically significant predictors.

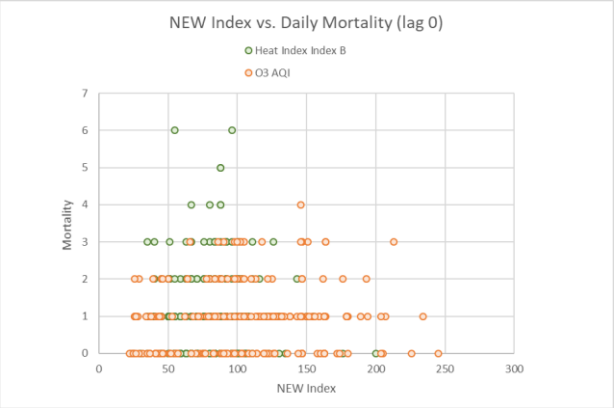
NEW A Regression: NEW A index predictor statistically significant on lag day 4 with 90% confidence.

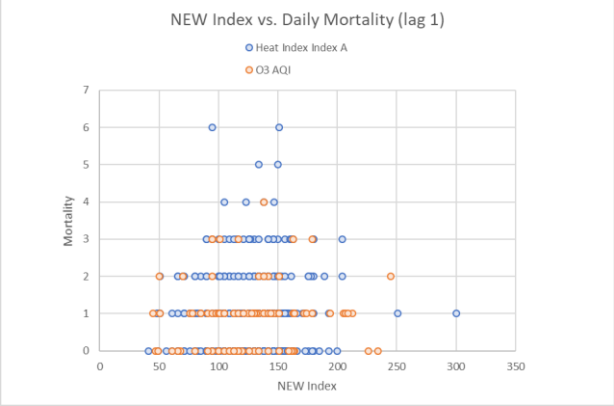
NEW B Regression: No statistically significant predictors.

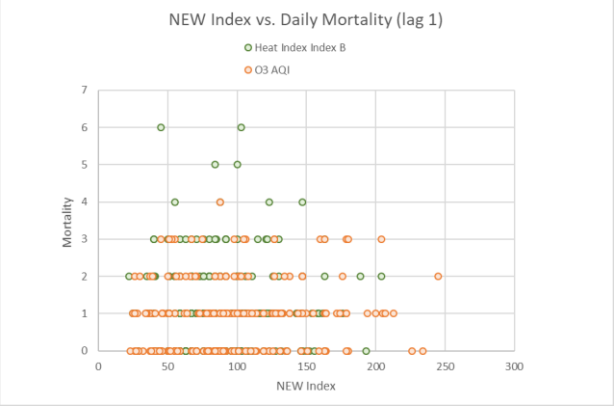
RAW Regression: Relative humidity predictor statistically significant on lag day 4 with 90% confidence.

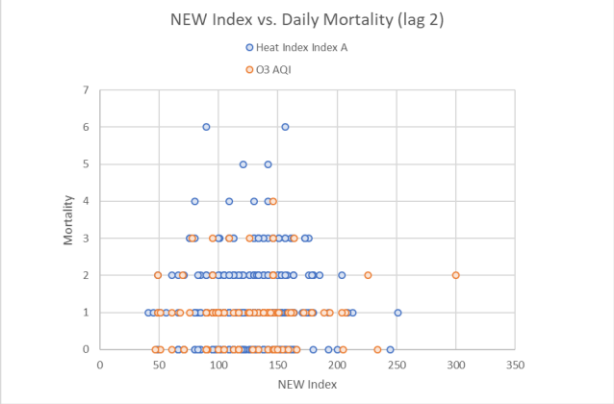
NEW Index vs. Daily Mortality Plots (for M, 75+, resp, warm months)

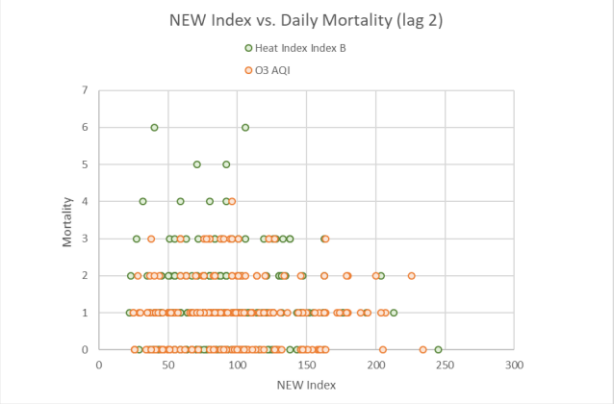


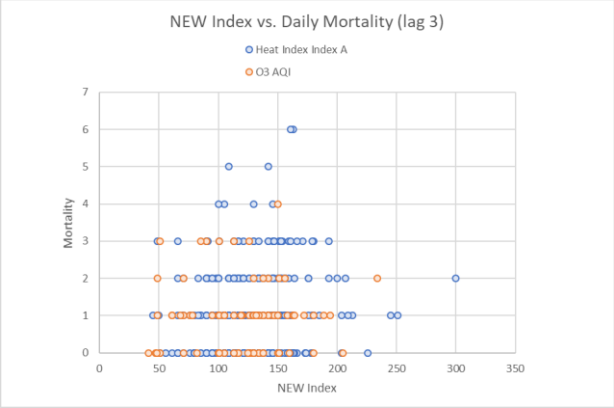


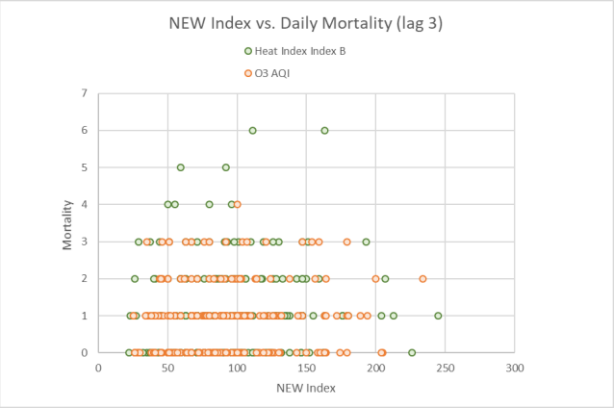


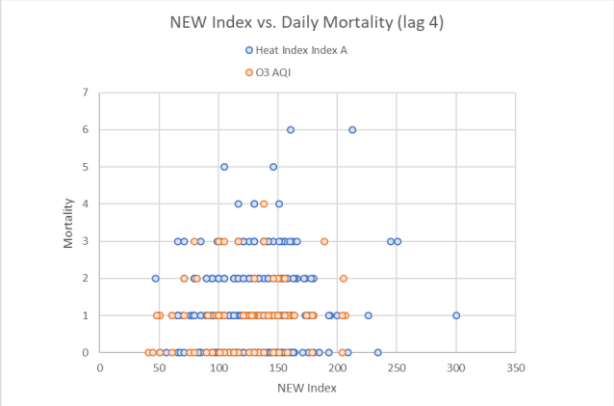


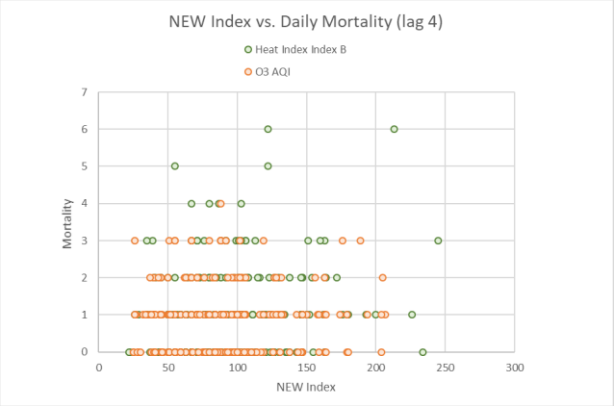


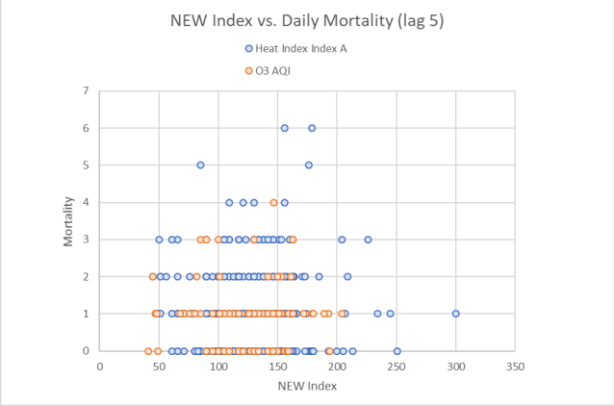


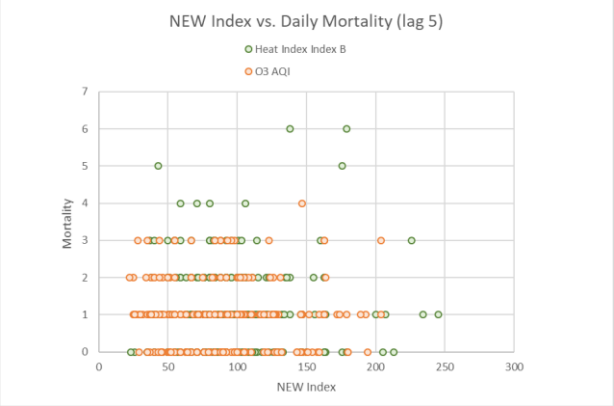

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

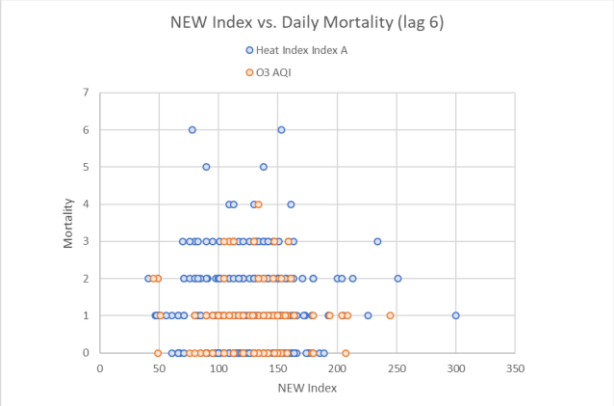

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

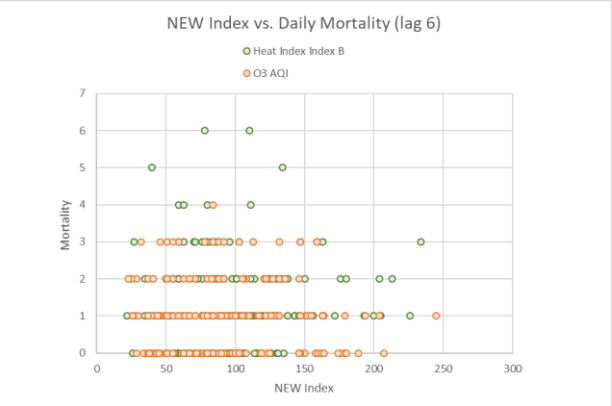

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

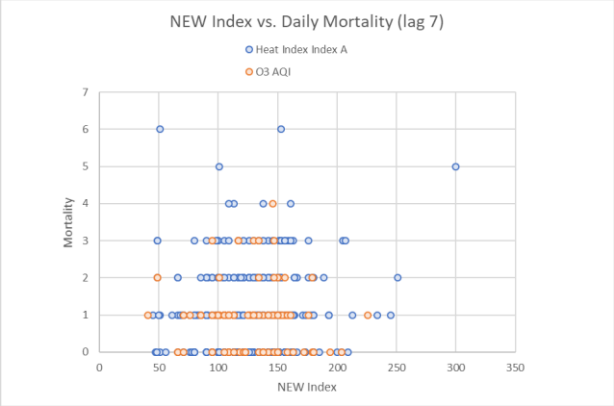

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

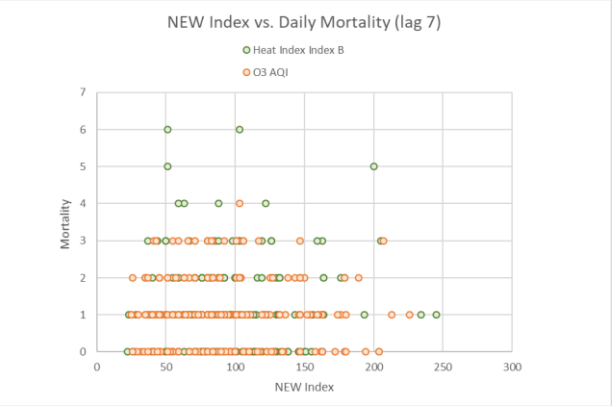

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300

Production Run:

F, 60-74, cardio, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

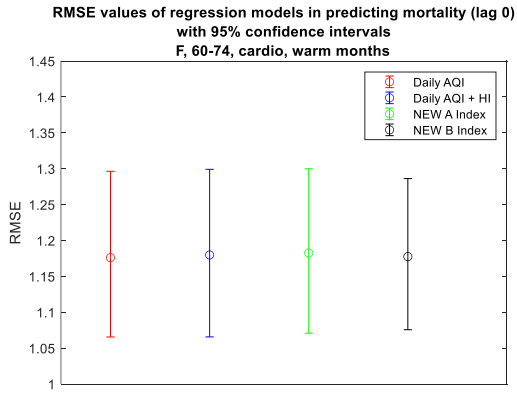
(how I originally defined the transformed HI in our NEW index)

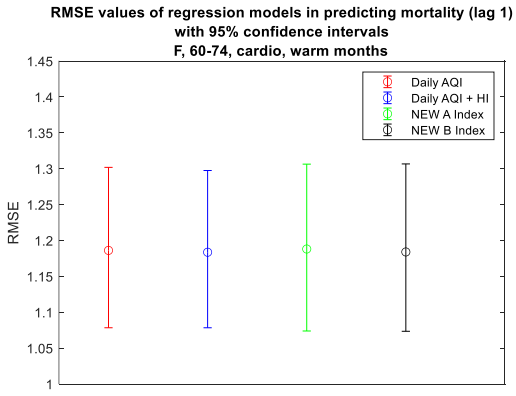
B

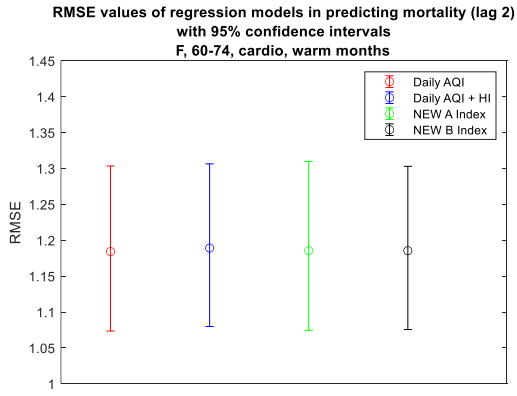
(transformed HI shifted down one category)

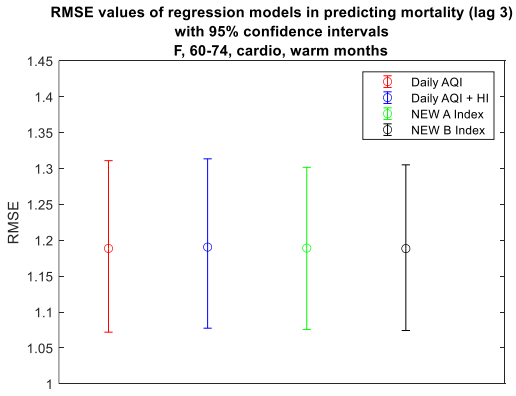
HI_Index Breakpoints

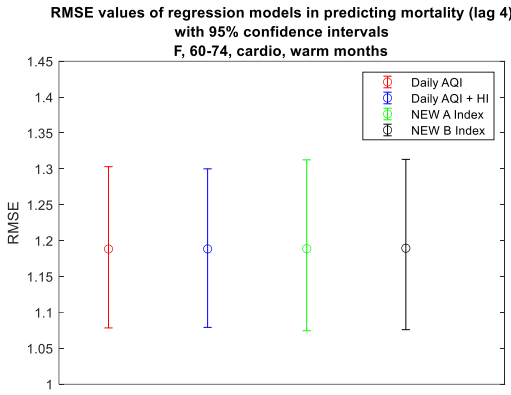
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

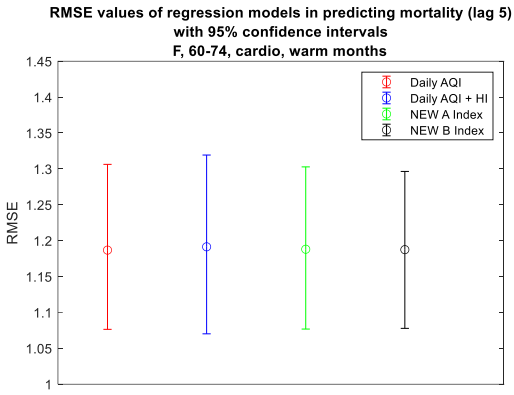


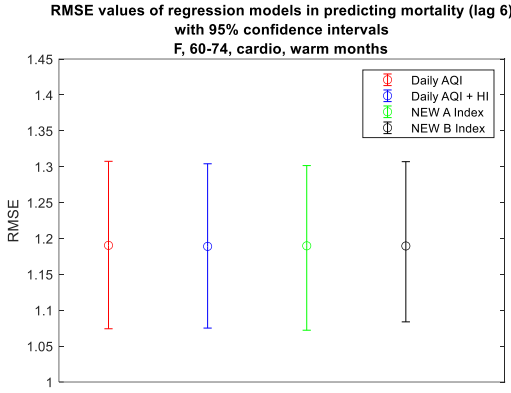


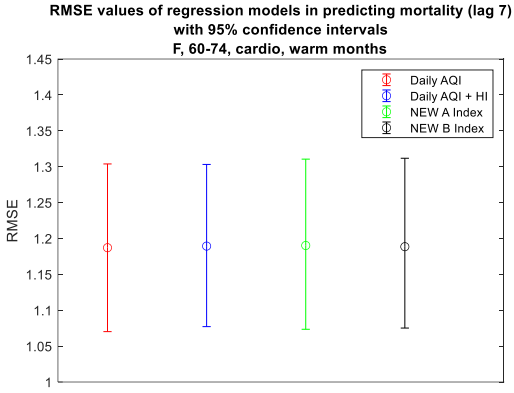





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 60-74, cardio, warm months
RMSE
1.45
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.1762 +/-0.11542	1.1799 +/-0.11674	1.1827 +/-0.11452	1.1776 +/-0.10529
1	1.1862 +/-0.11173	1.1836 +/-0.10955	1.1882 +/-0.11623	1.184 +/-0.11658
2	1.1844 +/-0.11502	1.1892 +/-0.11329	1.1855 +/-0.11759	1.1855 +/-0.11366
3	1.1886 +/-0.11948	1.1905 +/-0.11797	1.189 +/-0.11291	1.1885 +/-0.11541
4	1.1884 +/-0.11233	1.1885 +/-0.11045	1.1888 +/-0.11905	1.1895 +/-0.11865
5	1.1868 +/-0.11493	1.1914 +/-0.12454	1.188 +/-0.11297	1.1875 +/-0.10932
6	1.1904 +/-0.11664	1.1889 +/-0.11445	1.1898 +/-0.11468	1.1895 +/-0.11159
7	1.1871 +/-0.1168	1.1893 +/-0.11298	1.1902 +/-0.11852	1.1885 +/-0.11828

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.1171 +/-0.14607	1.117 +/-0.18624	1.072 +/-0.143	1.0931 +/-0.11222	1.4793 +/-0.67066
1	1.0735 +/-0.14247	1.0628 +/-0.17389	1.0287 +/-0.14341	1.049 +/-0.1107	1.2342 +/-0.55842
2	1.0169 +/-0.13556	1.0067 +/-0.1745	0.97749 +/-0.1322	1.0101 +/-0.10963	0.99469 +/-0.45462
3	0.98532 +/-0.1392	0.9875 +/-0.17637	0.9791 +/-0.14329	0.98195 +/-0.12142	0.81997 +/-0.34294
4	1.0134 +/-0.13152	0.99353 +/-0.17895	0.98817 +/-0.13285	1.0021 +/-0.11386	1.0677 +/-0.54183
5	1.0308 +/-0.14707	0.99903 +/-0.15133	1.0138 +/-0.13227	1.0261 +/-0.11689	0.8706 +/-0.37195
6	0.95609 +/-0.13434	0.95318 +/-0.14587	1.0002 +/-0.13909	0.96916 +/-0.11916	0.85647 +/-0.38061
7	1.0582 +/-0.14859	1.0287 +/-0.16722	0.99272 +/-0.13928	1.02 +/-0.12842	0.90098 +/-0.42063

AQI Regression: O3 AQI predictor statistically significant on lag day 0 with 90% confidence.

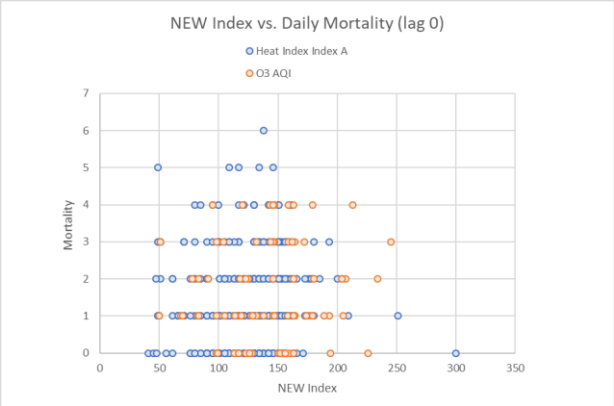
AQI+HI Regression: O3 AQI predictor statistically significant on lag day 0 with 90% confidence.

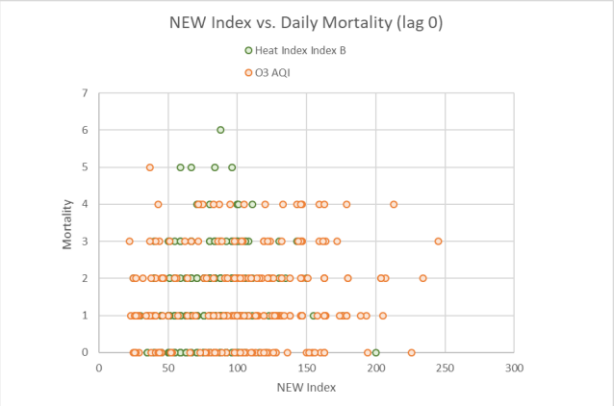
NEW A Regression: No statistically significant predictors.

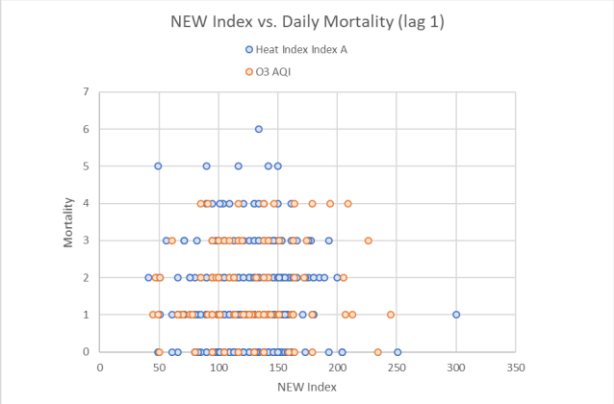
NEW B Regression: NEW B index predictor statistically significant on lag day 0 with 90% confidence.

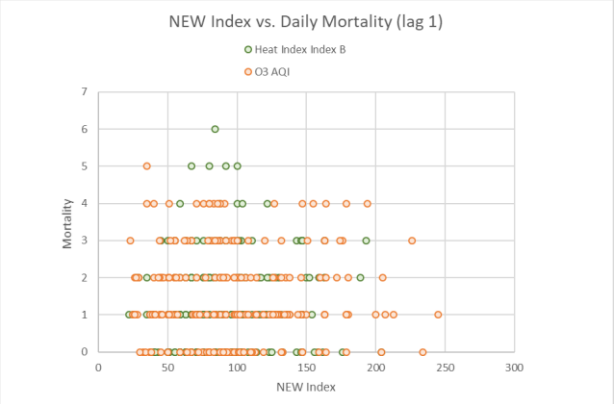
RAW Regression: NO2 predictor statistically significant on lag days 0 and 1 with 90% confidence.

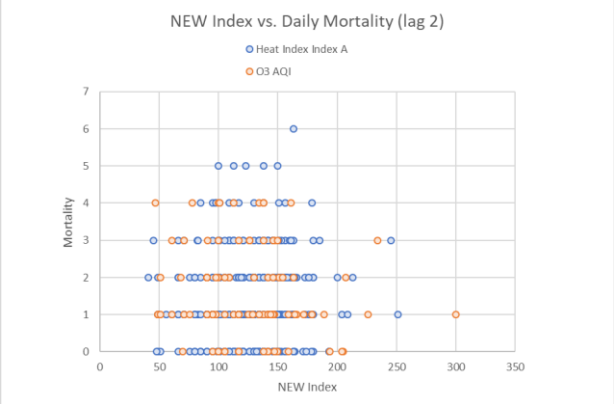
NEW Index vs. Daily Mortality Plots (for F, 60-74, cardio, warm months)

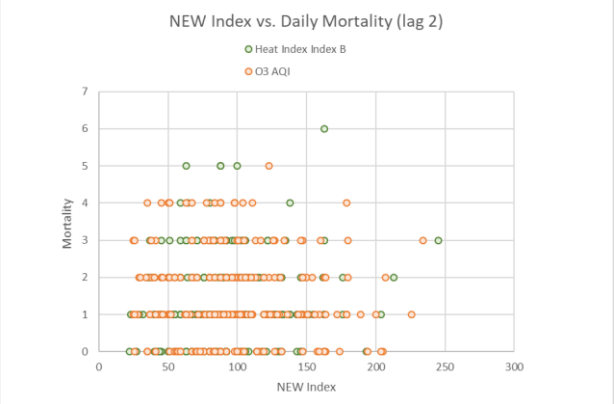


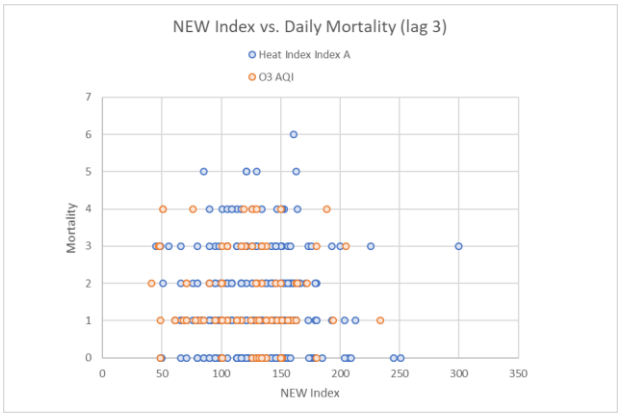


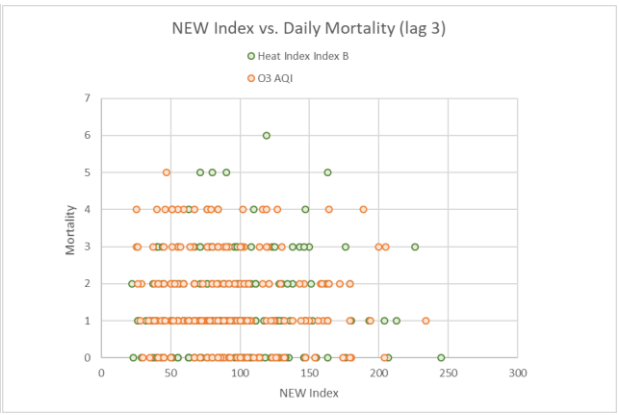


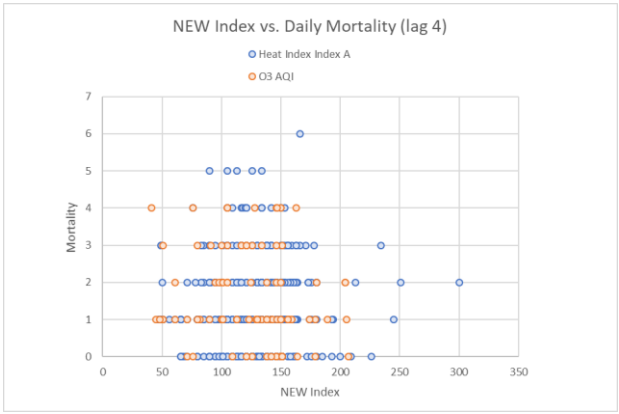


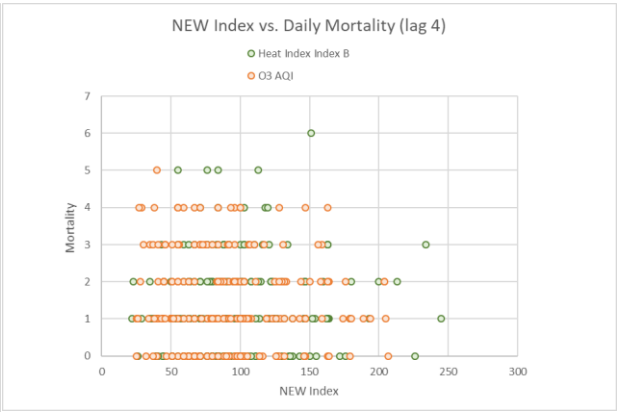


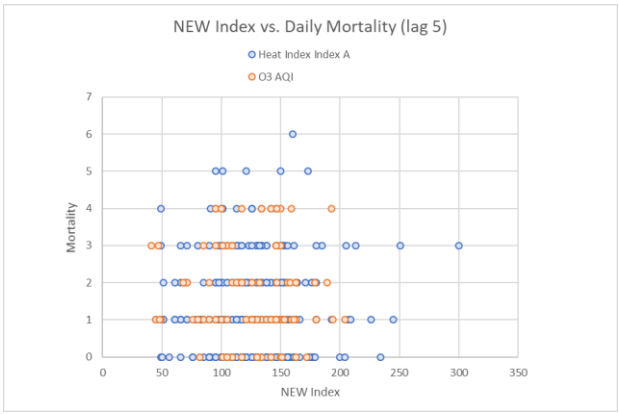


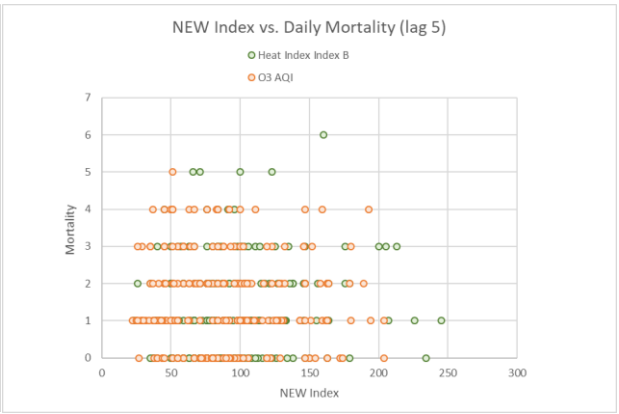

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

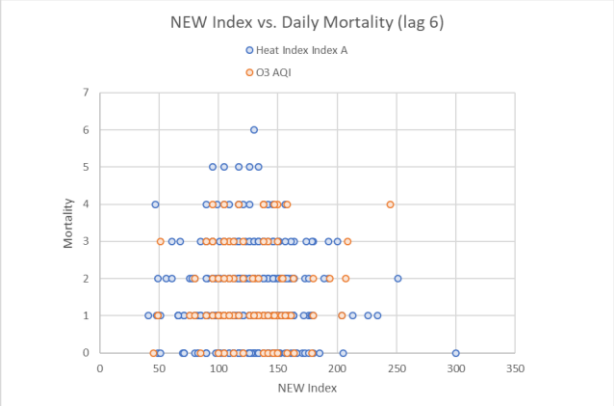

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

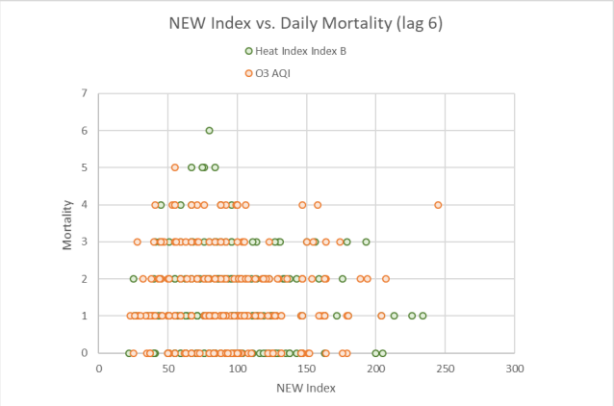

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

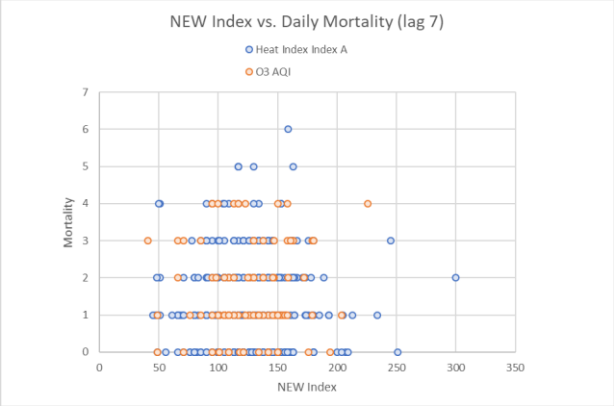

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

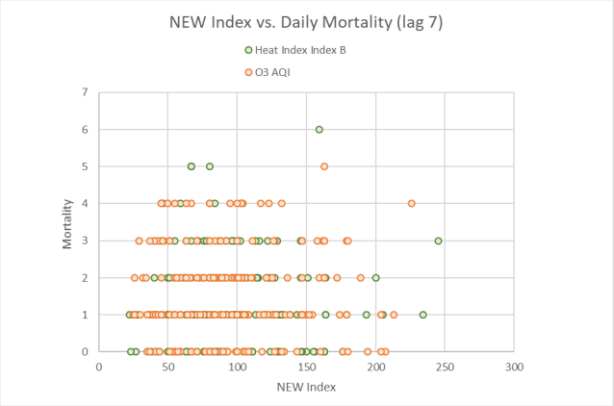

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300

Production Run:

F, 75+, cardio, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

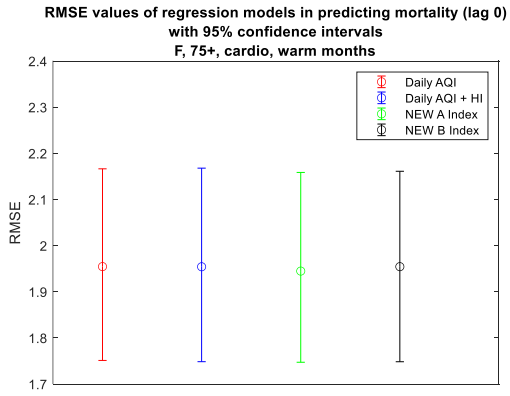
(how I originally defined the transformed HI in our NEW index)

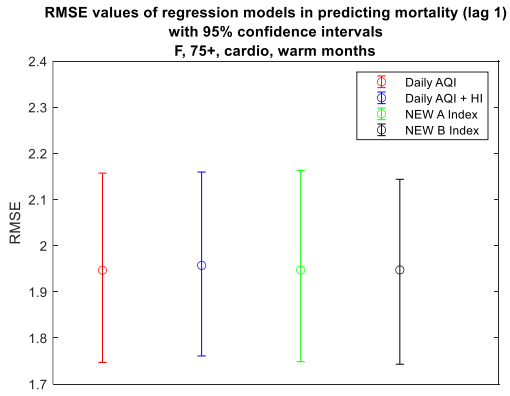
B

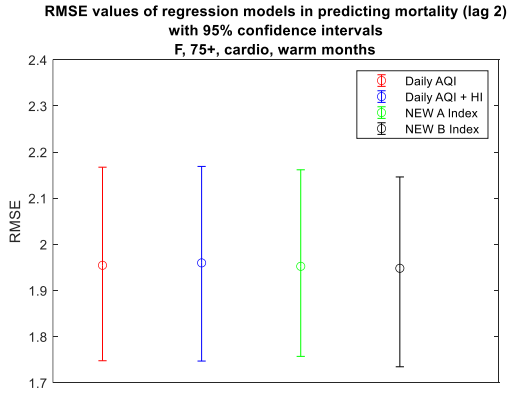
(transformed HI shifted down one category)

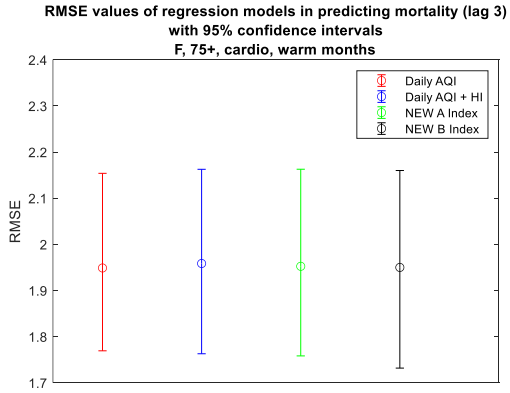
HI_Index Breakpoints

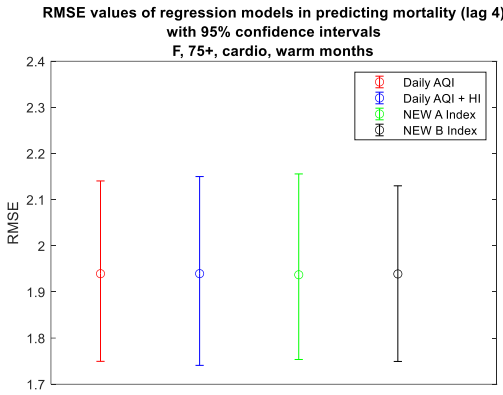
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

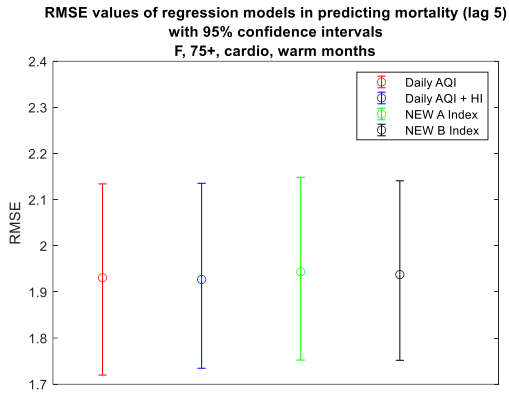


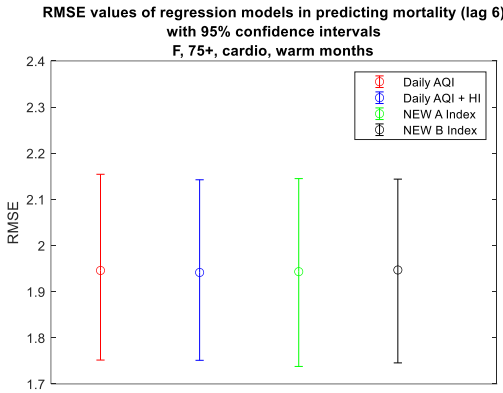


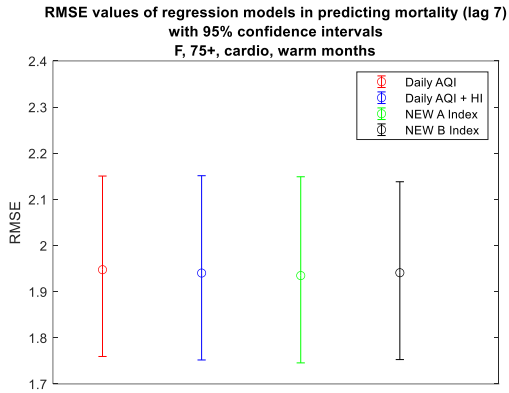





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 75+, cardio, warm months
RMSE
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	1.9546 +/-0.20765	1.9542 +/-0.20971	1.9448 +/-0.20568	1.9544 +/-0.20639
1	1.9468 +/-0.20518	1.9571 +/-0.19925	1.9469 +/-0.20727	1.9473 +/-0.20036
2	1.9546 +/-0.20973	1.9599 +/-0.21091	1.9524 +/-0.20219	1.9482 +/-0.2057
3	1.9488 +/-0.19231	1.9585 +/-0.19987	1.9524 +/-0.20227	1.95 +/-0.21411
4	1.9395 +/-0.19547	1.9396 +/-0.20459	1.9372 +/-0.20108	1.939 +/-0.19032
5	1.9307 +/-0.20713	1.927 +/-0.20039	1.9437 +/-0.19802	1.9375 +/-0.19451
6	1.9459 +/-0.20131	1.9416 +/-0.19563	1.9434 +/-0.20353	1.947 +/-0.19912
7	1.9476 +/-0.19551	1.9403 +/-0.19967	1.9349 +/-0.2017	1.941 +/-0.19269

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0436 +/-0.11116	1.0808 +/-0.13541	1.0723 +/-0.11344	1.0481 +/-0.087793	1.0932 +/-0.34483
1	1.0835 +/-0.099967	1.1072 +/-0.13589	1.0693 +/-0.10526	1.0573 +/-0.079887	1.0442 +/-0.31545
2	1.0602 +/-0.10665	1.1022 +/-0.13673	1.0673 +/-0.10482	1.0449 +/-0.084042	1.1959 +/-0.35125
3	1.0699 +/-0.11152	1.1196 +/-0.14382	1.0675 +/-0.10533	1.0508 +/-0.086597	1.2077 +/-0.34654
4	1.0833 +/-0.1013	1.1324 +/-0.12567	1.1009 +/-0.098574	1.0799 +/-0.082967	1.3353 +/-0.41157
5	1.0926 +/-0.10098	1.1096 +/-0.11969	1.073 +/-0.094669	1.0705 +/-0.084792	1.2355 +/-0.34885
6	1.0655 +/-0.10479	1.0787 +/-0.13033	1.045 +/-0.10586	1.0529 +/-0.08957	1.0272 +/-0.30236
7	1.0748 +/-0.10658	1.1078 +/-0.12968	1.0954 +/-0.11561	1.0705 +/-0.089842	1.2521 +/-0.3342

AQI Regression: O3 AQI predictor statistically significant on lag days 1 and 4 with 90% confidence.

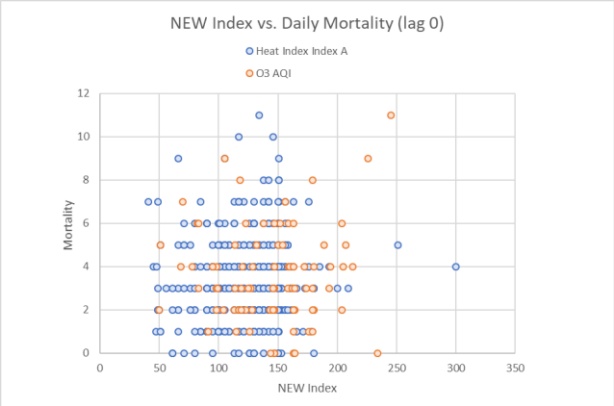
AQI+HI Regression: No statistically significant predictors.

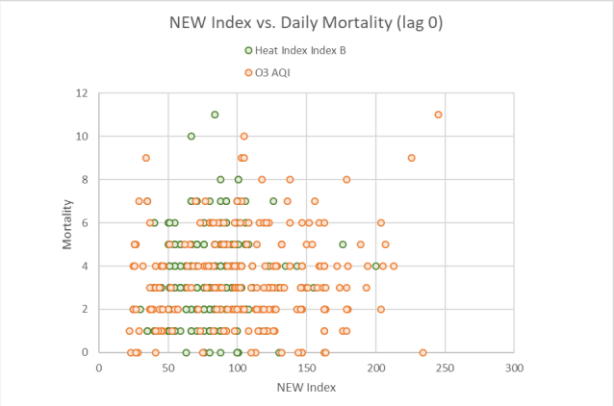
NEW A Regression: NEW A index predictor statistically significant on lag day 7 with 90% confidence and on lag day 4 with 95% confidence.

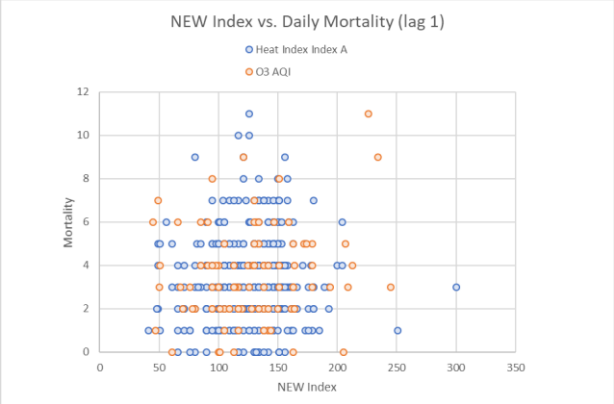
NEW B Regression: NEW B index predictor statistically significant on lag days 4 and 5 with 90% confidence.

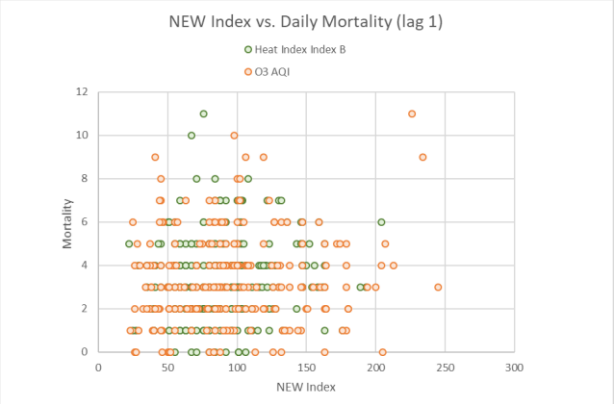
RAW Regression: PM2.5 predictor statistically significant on lag day 3 with 90% confidence. Temperature predictor statistically significant on lag day 4 with 90% confidence.

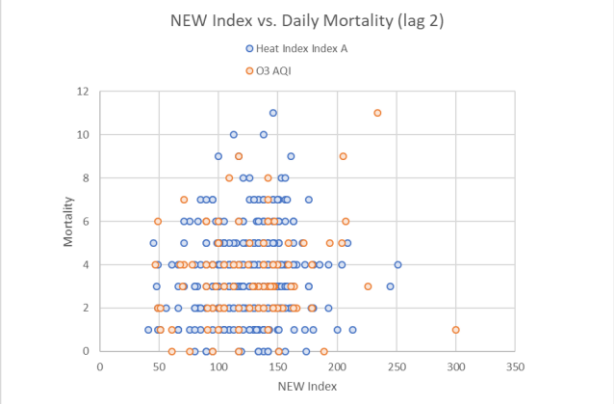
NEW Index vs. Daily Mortality Plots (for F, 75+, cardio, warm months)

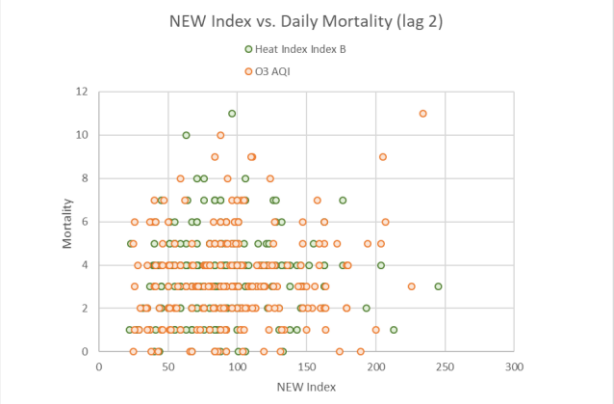


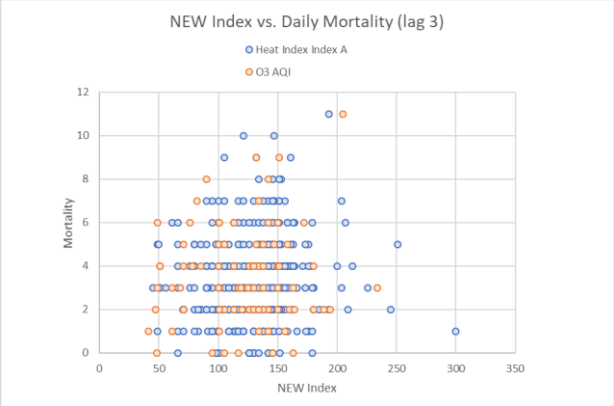


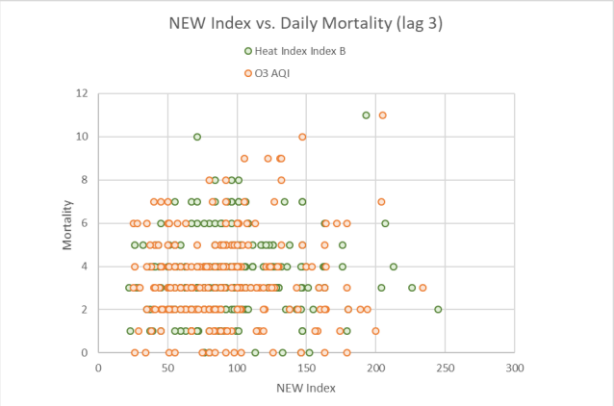


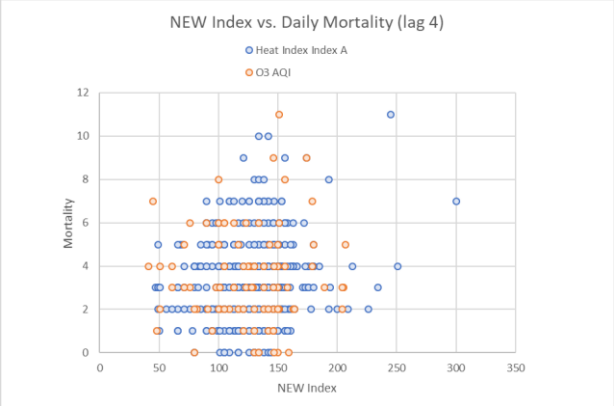


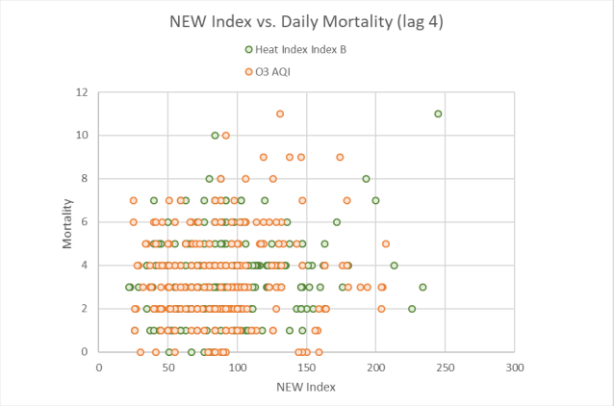


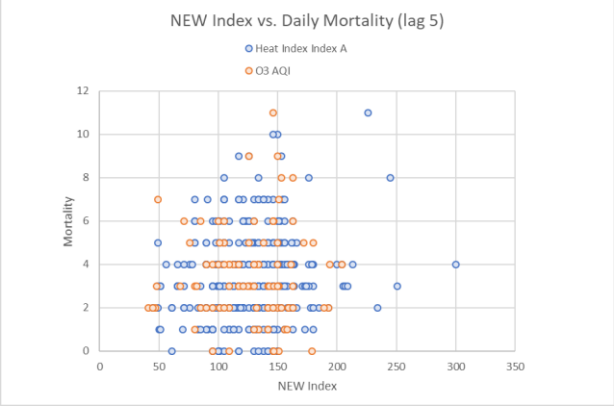


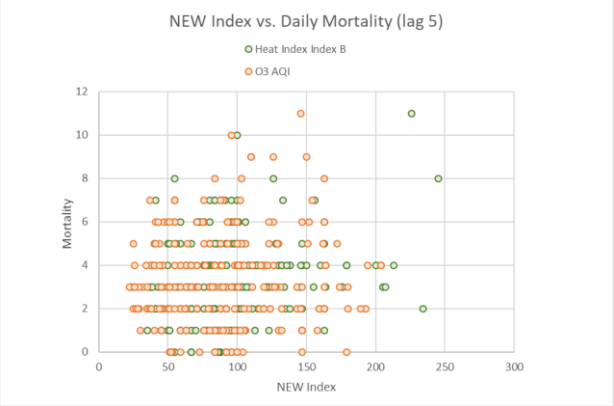

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

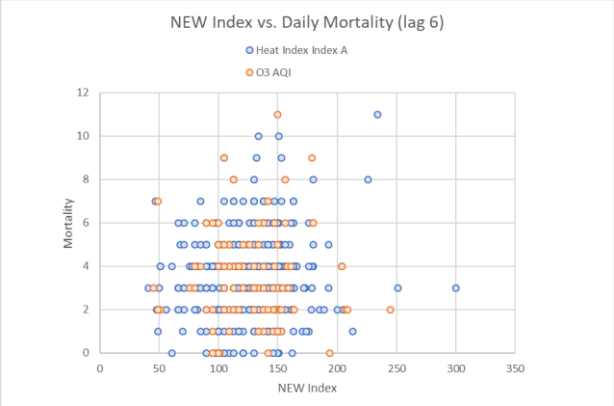

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

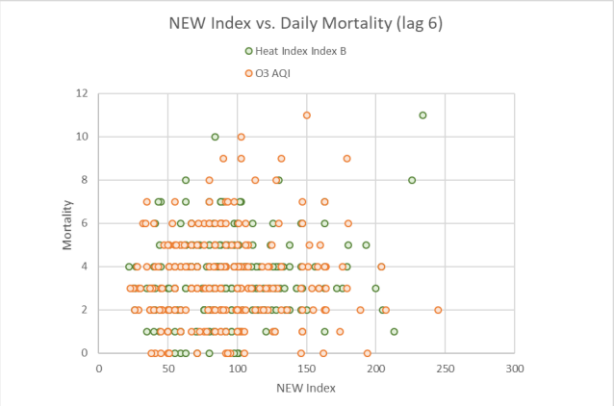

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

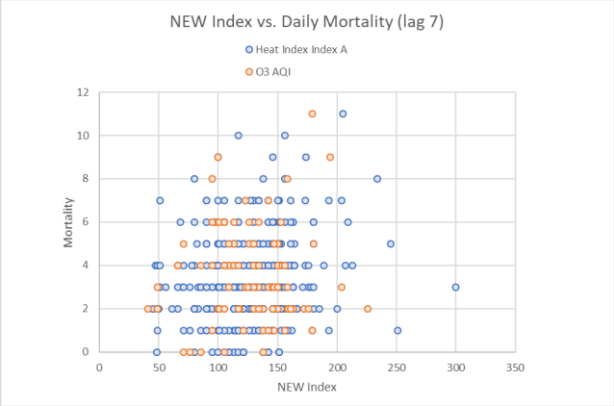

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

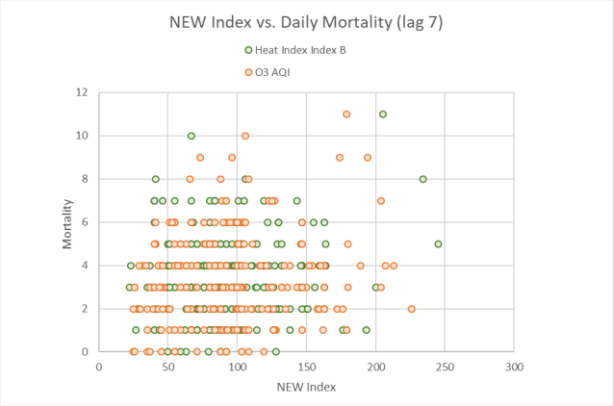

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
2
4
6
8
10
12
0
50
100
150
200
250
300

Production Run:

F, 60-74, resp, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

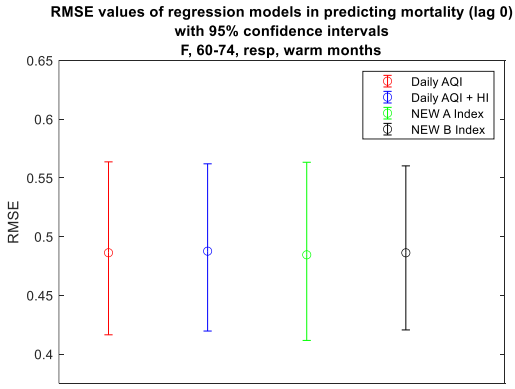
(how I originally defined the transformed HI in our NEW index)

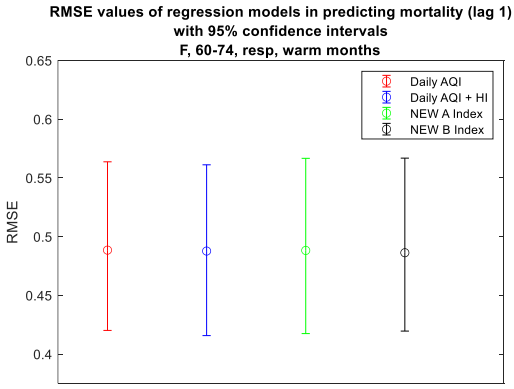
B

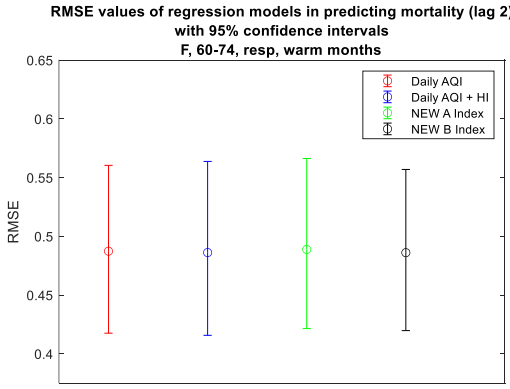
(transformed HI shifted down one category)

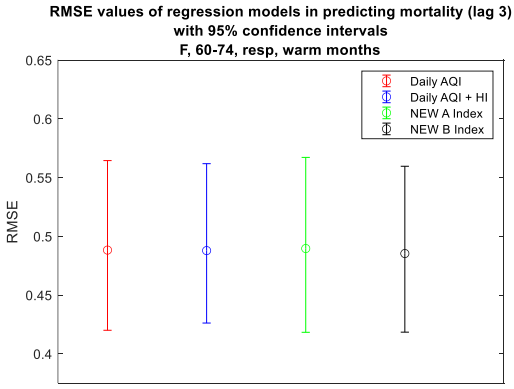
HI_Index Breakpoints

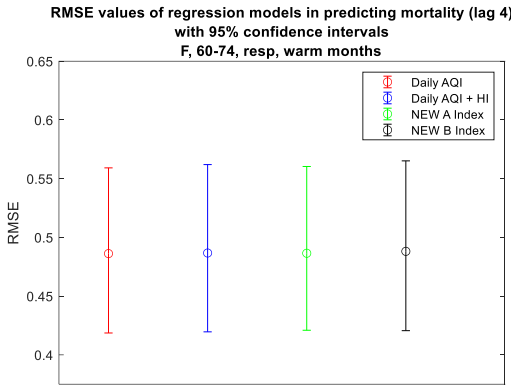
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

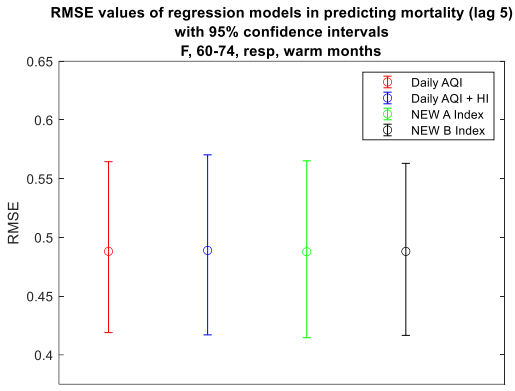









RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 60-74, resp, warm months
RMSE
0.65
0.6
0.55
0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 60-74, resp, warm months
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0.6
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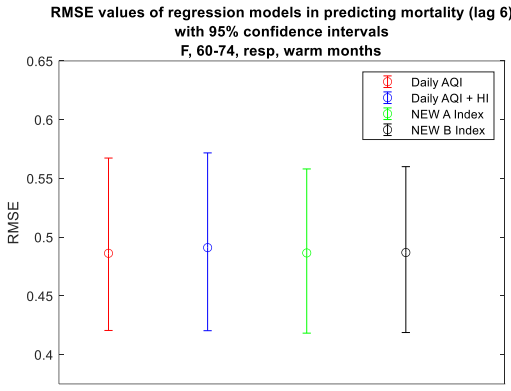
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
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F, 60-74, resp, warm months
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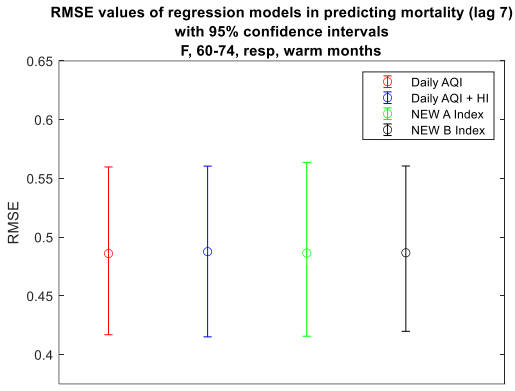
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0.5
0.45
0.4
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.48625 +/-0.073622	0.48758 +/-0.071186	0.48447 +/-0.075841	0.48619 +/-0.069837
1	0.48845 +/-0.071777	0.48768 +/-0.072705	0.4882 +/-0.074606	0.48625 +/-0.073626
2	0.48731 +/-0.071448	0.48617 +/-0.07404	0.48878 +/-0.072419	0.48607 +/-0.068604
3	0.48826 +/-0.072236	0.48784 +/-0.067847	0.48959 +/-0.074461	0.48533 +/-0.070623
4	0.4862 +/-0.070285	0.4867 +/-0.071202	0.4865 +/-0.06972	0.48812 +/-0.072288
5	0.48812 +/-0.072755	0.48888 +/-0.076643	0.48783 +/-0.075306	0.48805 +/-0.073237
6	0.48623 +/-0.073398	0.49106 +/-0.075692	0.48654 +/-0.069897	0.48689 +/-0.070621
7	0.48605 +/-0.071423	0.48764 +/-0.072682	0.48648 +/-0.074003	0.48667 +/-0.070375

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	0.92765 +/-0.32229	0.86571 +/-0.33743	0.88808 +/-0.30357	0.90001 +/-0.24426	0.79833 +/-0.85106
1	1.0642 +/-0.37877	1.0141 +/-0.44802	0.97907 +/-0.33429	1.0291 +/-0.29355	1.4355 +/-1.6289
2	0.9785 +/-0.35458	1.0428 +/-0.45111	1.0245 +/-0.36535	0.99771 +/-0.27669	1.3426 +/-1.6776
3	1.0883 +/-0.36765	1.1773 +/-0.50041	1.1236 +/-0.36609	1.0853 +/-0.2931	1.1685 +/-1.346
4	0.89894 +/-0.32146	1.0017 +/-0.4204	1.0458 +/-0.33431	0.97425 +/-0.26837	1.3245 +/-1.3548
5	0.93332 +/-0.30505	0.9656 +/-0.42681	0.96585 +/-0.36488	0.95558 +/-0.27514	0.58733 +/-0.76787
6	0.96446 +/-0.28635	0.9995 +/-0.4035	0.96274 +/-0.30306	0.92494 +/-0.25128	2.037 +/-2.37
7	1.1697 +/-0.3576	1.1501 +/-0.45135	1.0421 +/-0.32996	1.117 +/-0.29169	2.1631 +/-3.6618

AQI Regression: No statistically significant predictors.

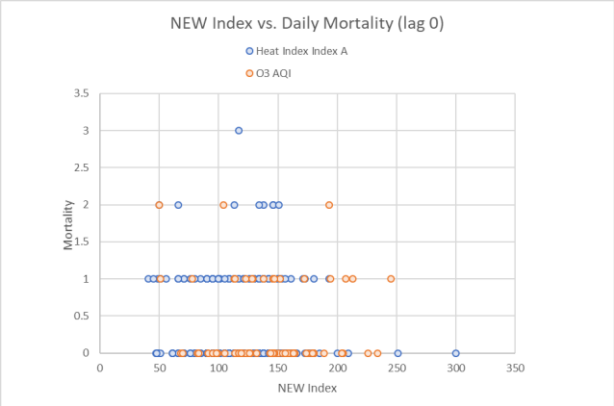
AQI+HI Regression: No statistically significant predictors.

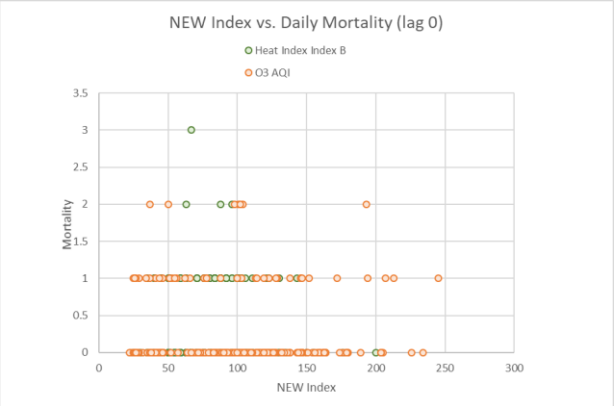
NEW A Regression: No statistically significant predictors.

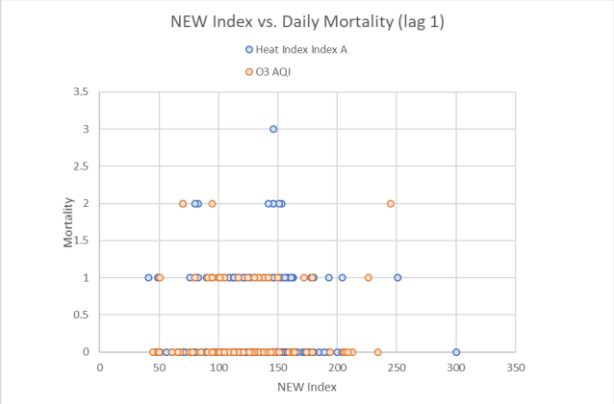
NEW B Regression: No statistically significant predictors.

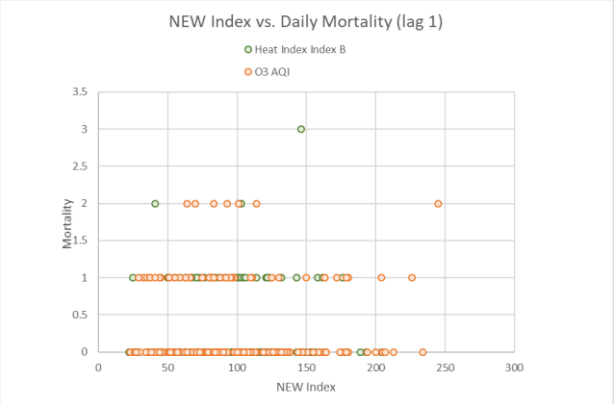
RAW Regression: Relative humidity predictor statistically significant on lag day 6 with 90% confidence.

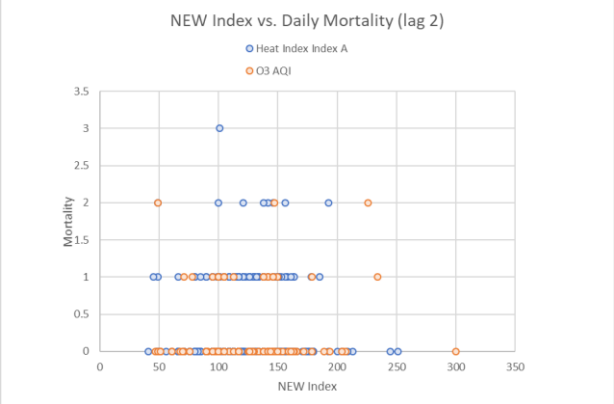
NEW Index vs. Daily Mortality Plots (for F, 60-74, resp, warm months)

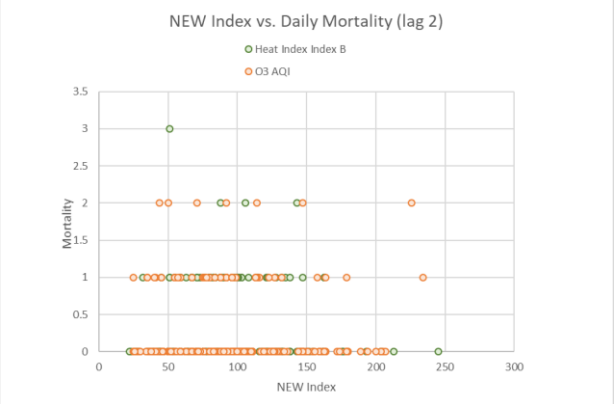


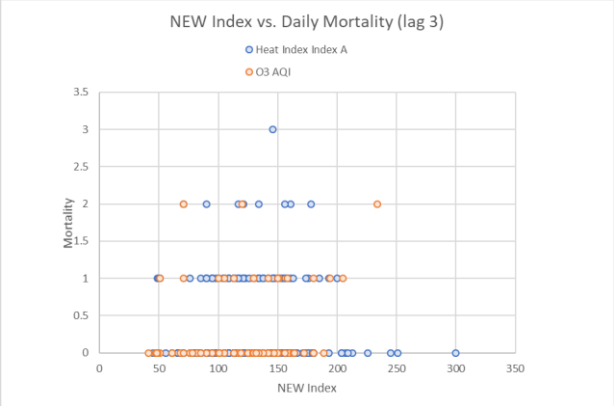


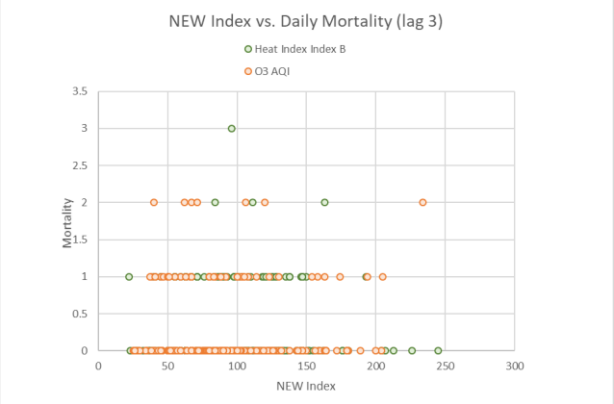


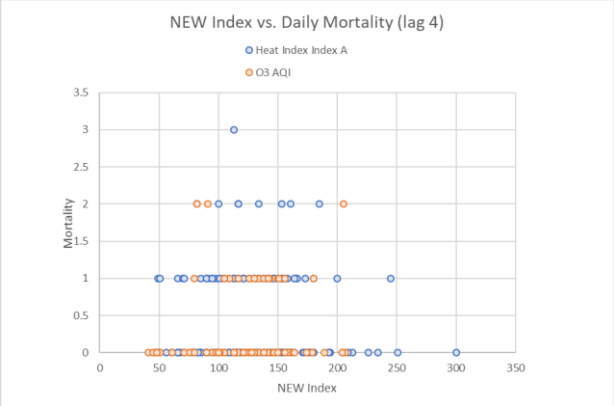


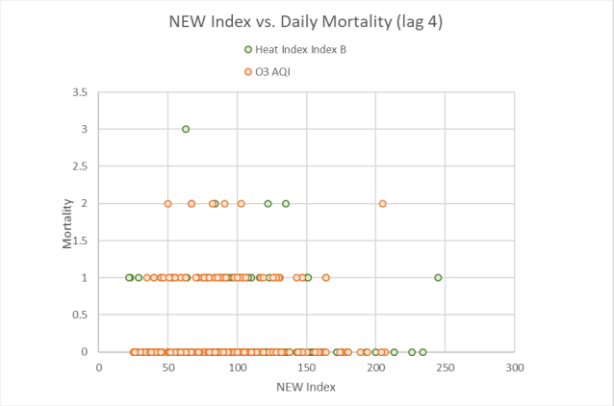


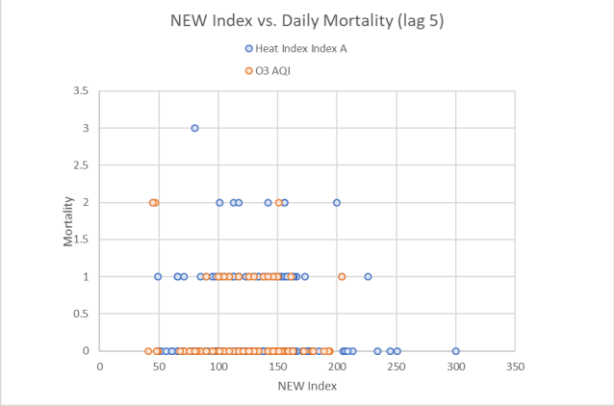


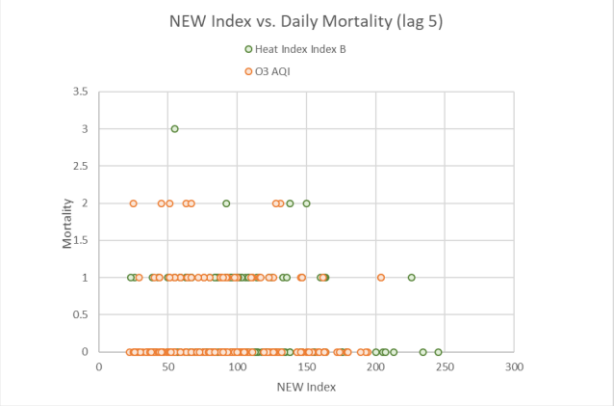

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

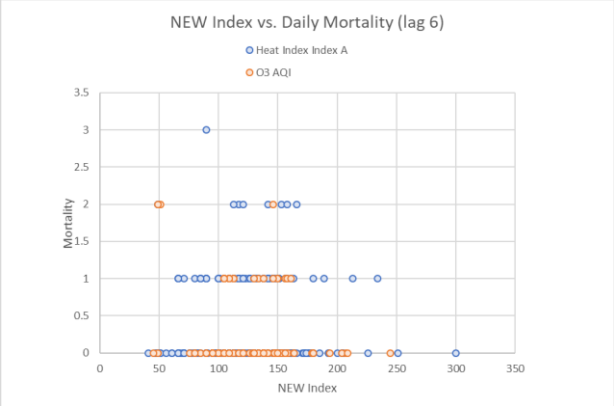

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

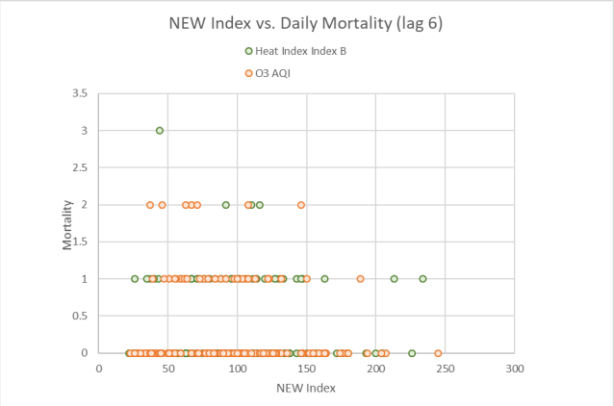

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

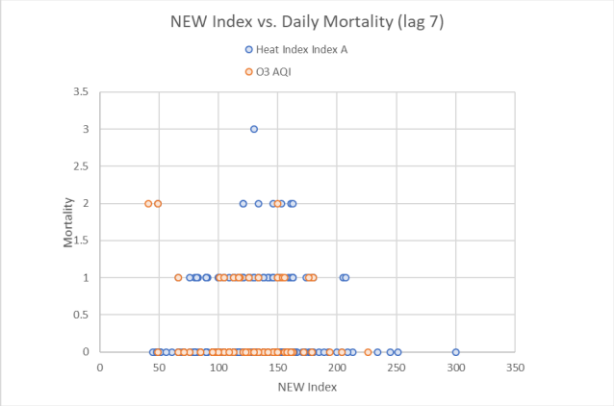

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

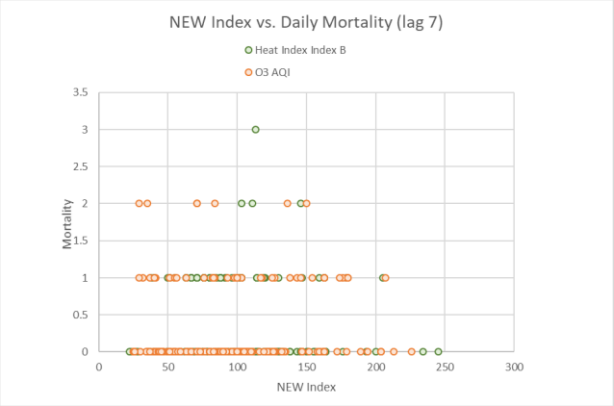

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150
200
250
300

Production Run:

F, 75+, resp, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

A

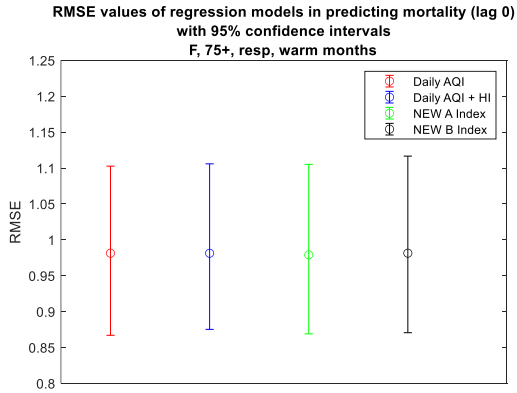
(how I originally defined the transformed HI in our NEW index)

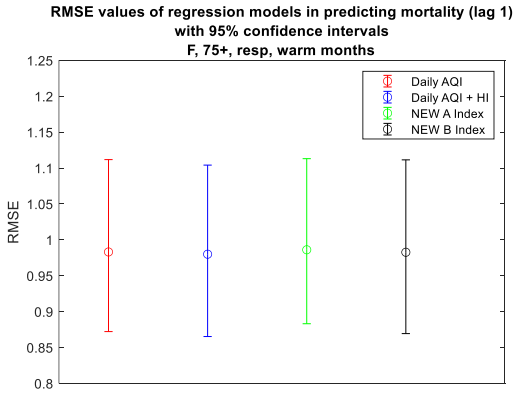
B

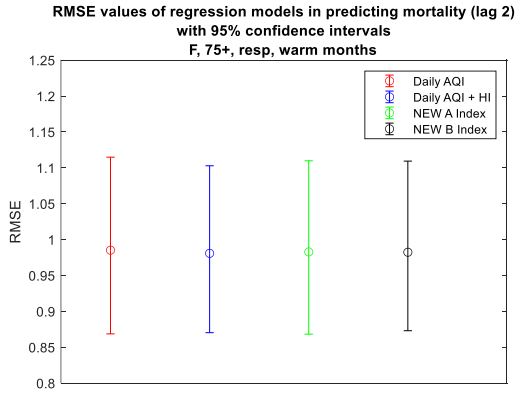
(transformed HI shifted down one category)

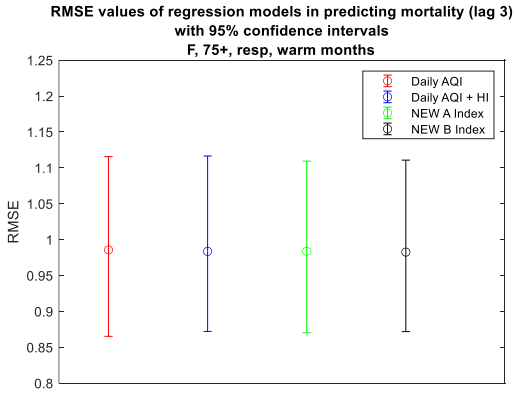
HI_Index Breakpoints

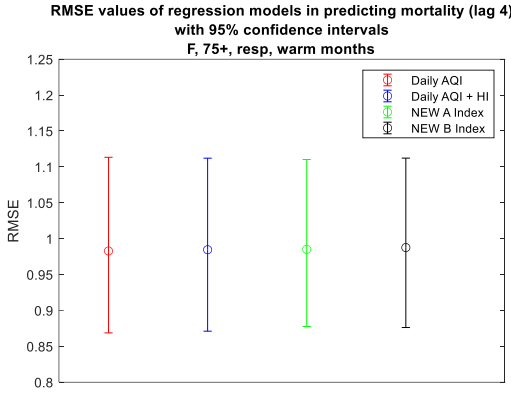
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

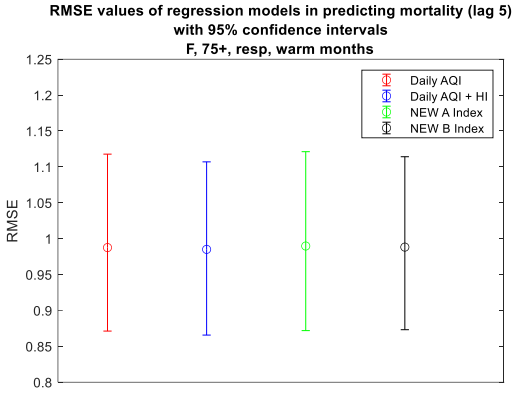


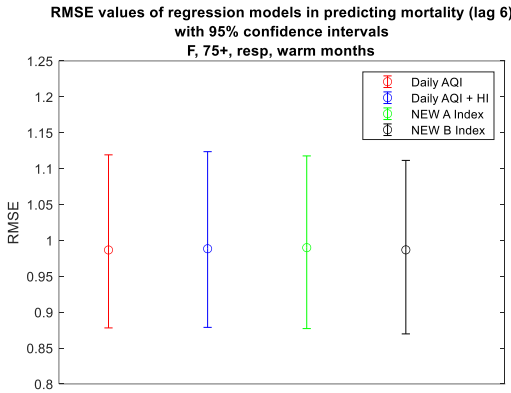


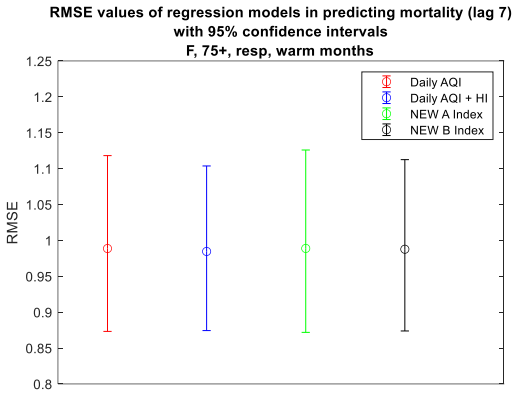





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
F, 75+, resp, warm months
RMSE
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
0.85
0.8
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	0.9814 +/-0.11782	0.98134 +/-0.11531	0.97906 +/-0.11809	0.9814 +/-0.12302
1	0.98311 +/-0.1198	0.97998 +/-0.11942	0.98615 +/-0.11498	0.98269 +/-0.12103
2	0.9852 +/-0.1231	0.98084 +/-0.11628	0.98279 +/-0.12078	0.98236 +/-0.11814
3	0.98553 +/-0.12522	0.98351 +/-0.12217	0.98365 +/-0.11953	0.98251 +/-0.11945
4	0.98283 +/-0.12232	0.9846 +/-0.12051	0.98518 +/-0.1163	0.98757 +/-0.118
5	0.98756 +/-0.12326	0.98506 +/-0.12067	0.98973 +/-0.12464	0.98823 +/-0.12049
6	0.98666 +/-0.12056	0.98836 +/-0.12241	0.98986 +/-0.12028	0.9868 +/-0.12086
7	0.98867 +/-0.12245	0.98459 +/-0.11467	0.9888 +/-0.12703	0.98768 +/-0.11935

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0389 +/-0.16979	1.1396 +/-0.24321	1.1029 +/-0.18932	1.0522 +/-0.14013	1.0559 +/-0.63593
1	1.0918 +/-0.15966	1.1594 +/-0.22128	1.0721 +/-0.16099	1.065 +/-0.13224	0.86463 +/-0.52345
2	1.1367 +/-0.17734	1.1319 +/-0.22084	1.0402 +/-0.16252	1.0563 +/-0.13266	1.0651 +/-0.61406
3	0.99616 +/-0.17673	1.0595 +/-0.22565	1.0305 +/-0.16415	0.99215 +/-0.1332	1.3505 +/-0.78869
4	1.0611 +/-0.17367	1.0846 +/-0.21898	1.0012 +/-0.15995	1.019 +/-0.13601	0.99469 +/-0.58275
5	0.95521 +/-0.1506	0.98051 +/-0.19727	0.98591 +/-0.1671	0.97907 +/-0.1214	0.82232 +/-0.36563
6	1.0554 +/-0.16726	1.0873 +/-0.20828	1.0627 +/-0.17152	1.0375 +/-0.12768	0.84297 +/-0.48223
7	0.992 +/-0.16385	1.0414 +/-0.20402	1.0416 +/-0.16438	1.0013 +/-0.12104	1.174 +/-0.70056

AQI Regression: No statistically significant predictors.

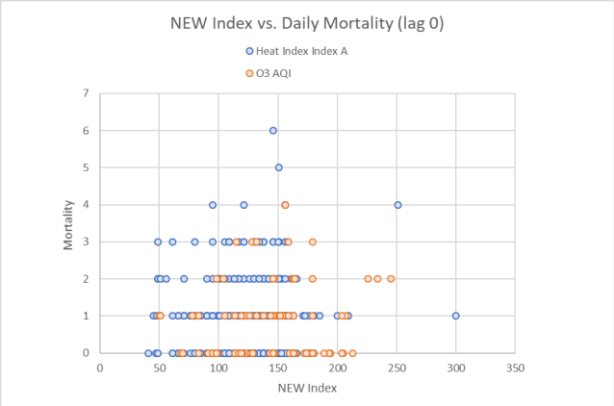
AQI+HI Regression: O3 AQI predictor statistically significant on lag day 2 with 90% confidence.

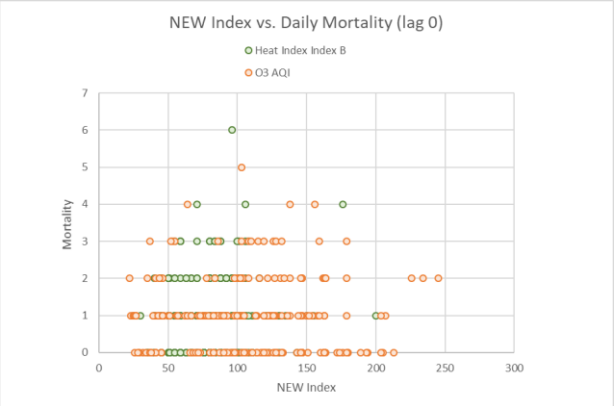
NEW A Regression: No statistically significant predictors.

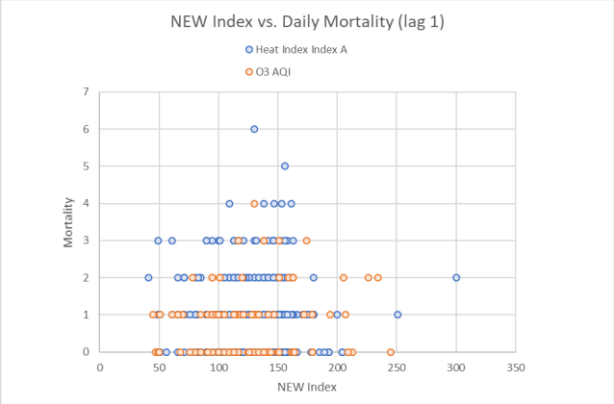
NEW B Regression: No statistically significant predictors.

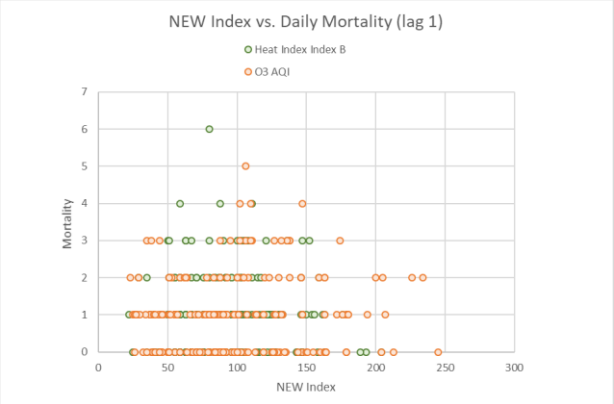
RAW Regression: No statistically significant predictors.

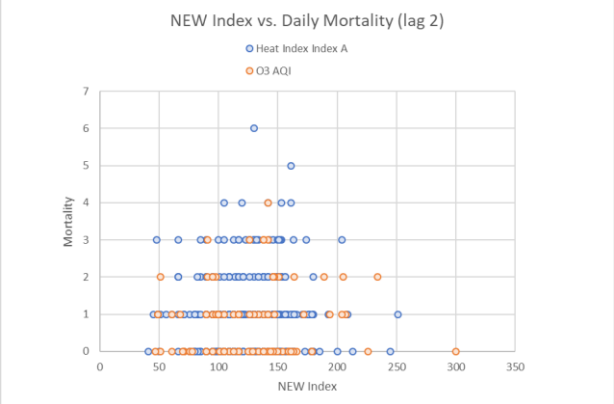
NEW Index vs. Daily Mortality Plots (for F, 75+, resp, warm months)

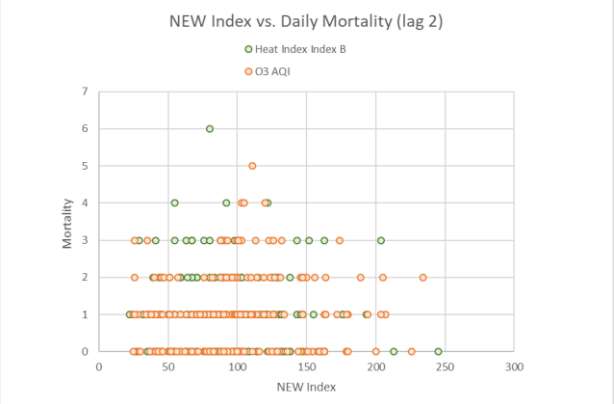


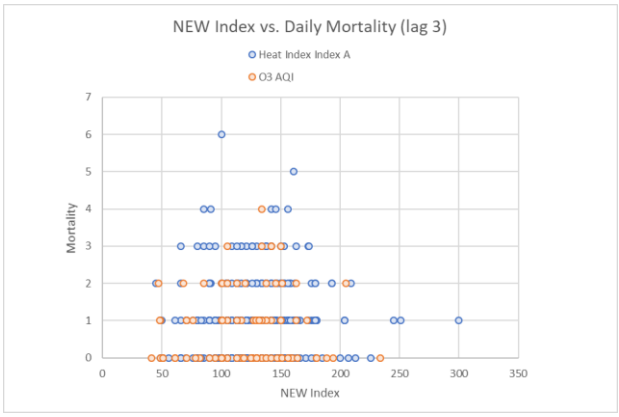


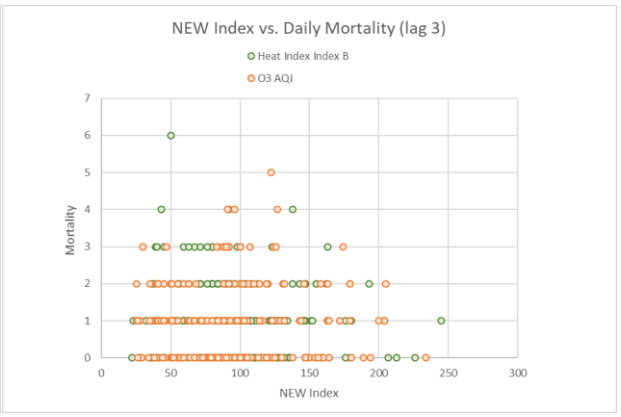


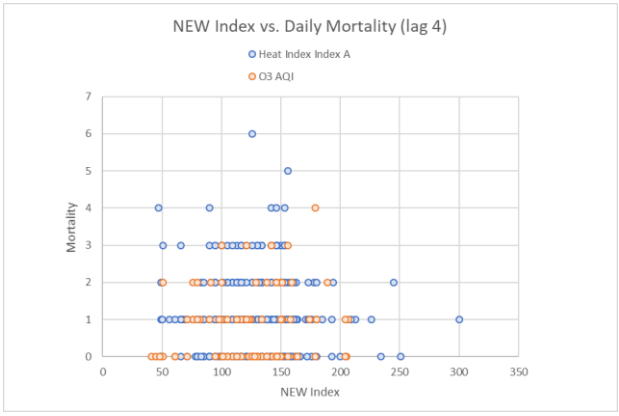


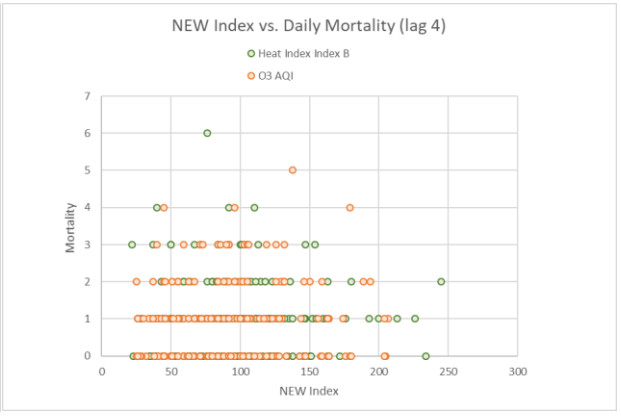


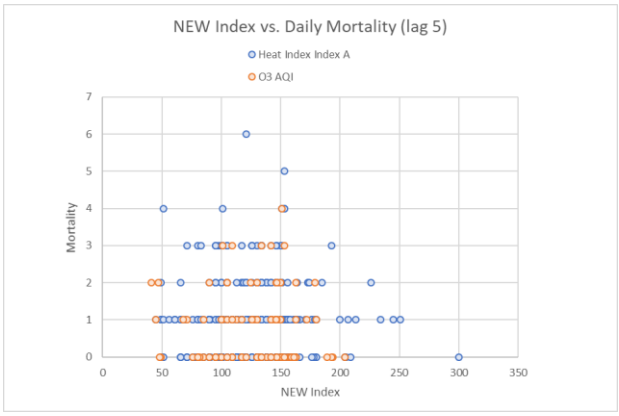


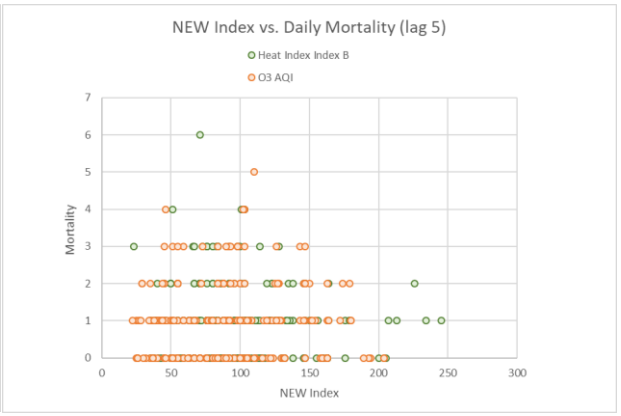

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

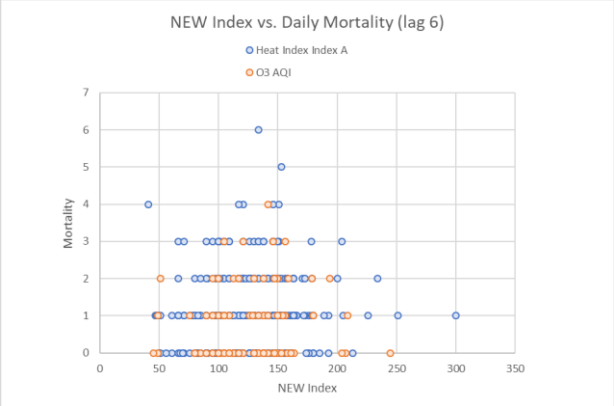

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

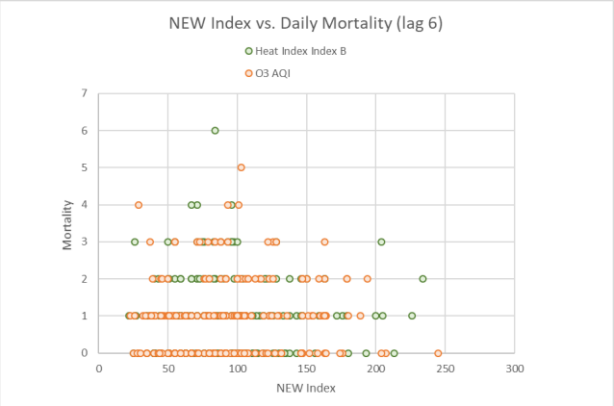

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

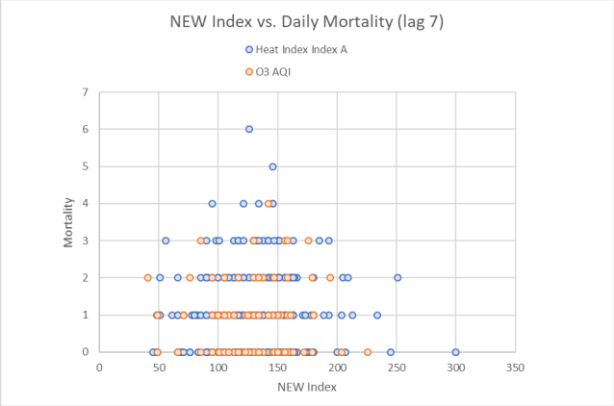

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

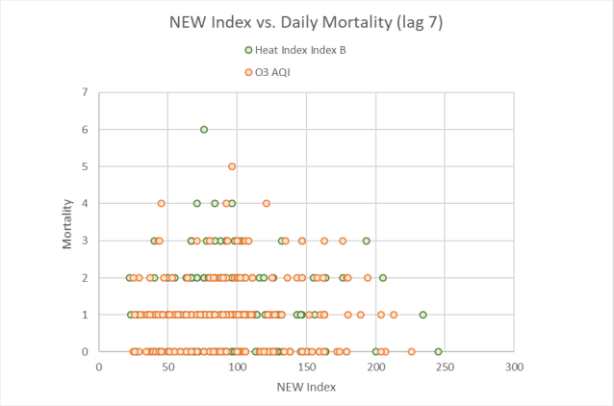

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index

Production Run:

M & F, 60+, cardio & resp, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

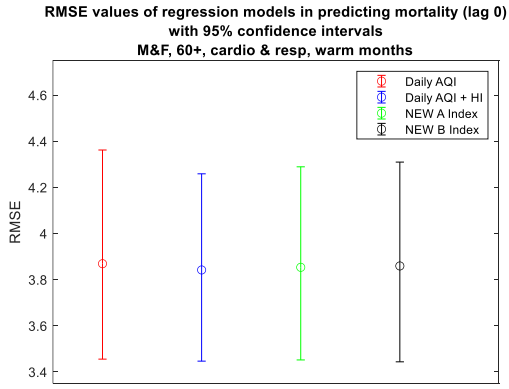
Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3 AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

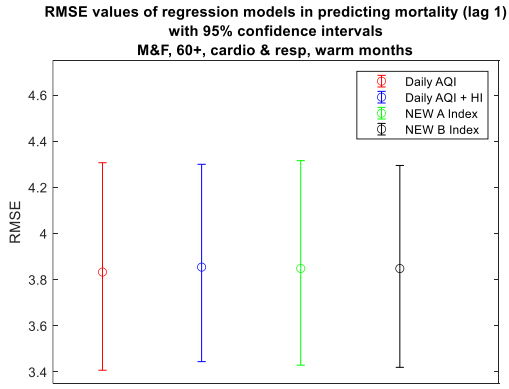
A (how I originally defined the transformed HI in our NEW index)

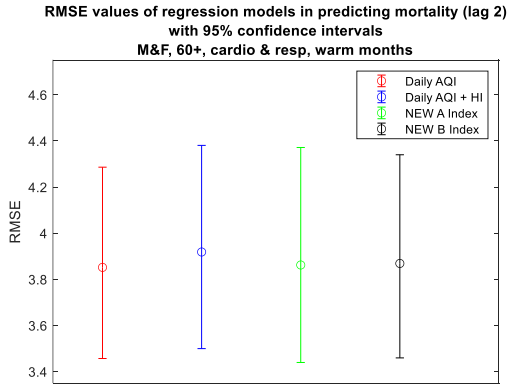
B (transformed HI shifted down one category)

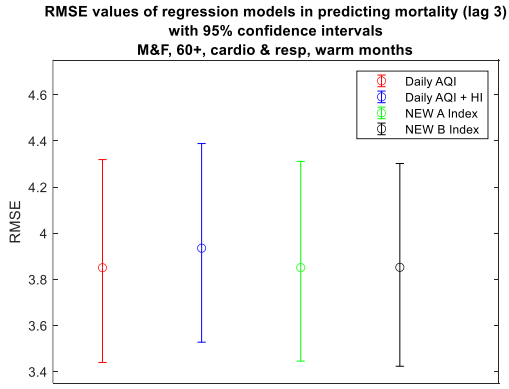
HI_Index Breakpoints

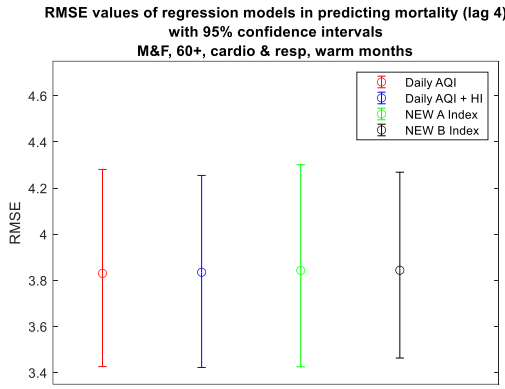
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

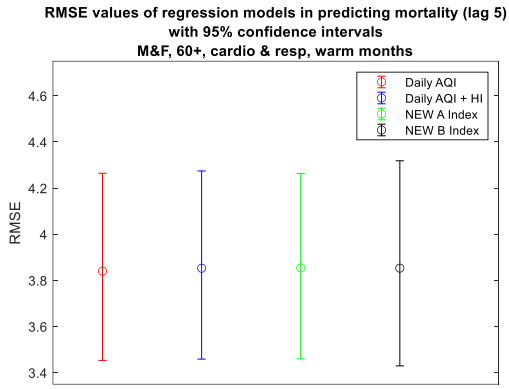


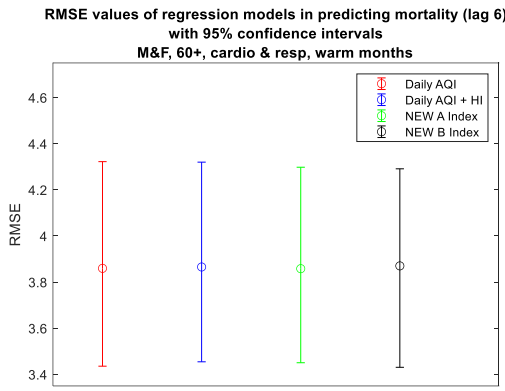


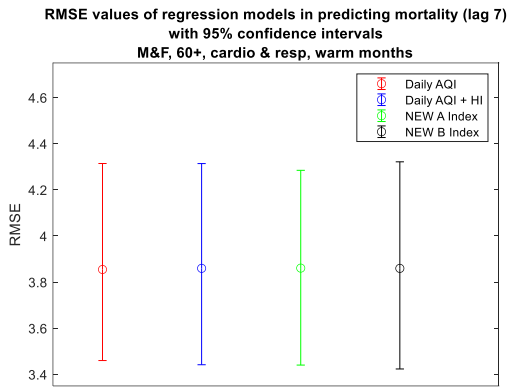





RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M&F, 60+, cardio & resp, warm months
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
RMSE
4.6
4.4
4.2
4
3.8
3.6
3.4

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	3.8688 +/-0.45321	3.8417 +/-0.40598	3.8531 +/-0.41855	3.859 +/-0.43284
1	3.8326 +/-0.44972	3.854 +/-0.42768	3.8482 +/-0.44331	3.8479 +/-0.43751
2	3.8517 +/-0.41463	3.9183 +/-0.44041	3.862 +/-0.46594	3.8687 +/-0.44023
3	3.8503 +/-0.43972	3.9348 +/-0.43047	3.8508 +/-0.43294	3.852 +/-0.43939
4	3.8303 +/-0.42733	3.8352 +/-0.4162	3.843 +/-0.43802	3.844 +/-0.40276
5	3.8398 +/-0.40556	3.8526 +/-0.40778	3.8542 +/-0.40185	3.8531 +/-0.44444
6	3.8597 +/-0.44328	3.8656 +/-0.43268	3.8583 +/-0.42371	3.8703 +/-0.43019
7	3.8548 +/-0.42703	3.8597 +/-0.43595	3.8607 +/-0.42205	3.8595 +/-0.44894

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0276 +/-0.051619	1.0598 +/-0.061084	1.0502 +/-0.050323	1.0295 +/-0.037781	1.1043 +/-0.17189
1	1.0618 +/-0.048124	1.0816 +/-0.066786	1.0418 +/-0.048341	1.0429 +/-0.037513	1.0597 +/-0.16788
2	1.0416 +/-0.048242	1.0716 +/-0.065475	1.0356 +/-0.047605	1.0307 +/-0.040343	1.0539 +/-0.18387
3	1.0557 +/-0.054357	1.097 +/-0.0738	1.0517 +/-0.050753	1.041 +/-0.040228	1.1203 +/-0.19316
4	1.0636 +/-0.054628	1.0899 +/-0.068487	1.0483 +/-0.052986	1.0478 +/-0.046671	1.1229 +/-0.19355
5	1.0587 +/-0.058159	1.0668 +/-0.064092	1.0433 +/-0.053665	1.0456 +/-0.043683	1.0518 +/-0.18036
6	1.037 +/-0.049585	1.0529 +/-0.062693	1.038 +/-0.054968	1.03 +/-0.040993	0.99262 +/-0.16695
7	1.0487 +/-0.052683	1.0678 +/-0.067411	1.046 +/-0.053231	1.0359 +/-0.043303	1.132 +/-0.18228

AQI Regression: O3 AQI predictor statistically significant on lag days 2 and 7 with 90% confidence and on lag days 1, 3, 4, and 5 with 95% confidence.

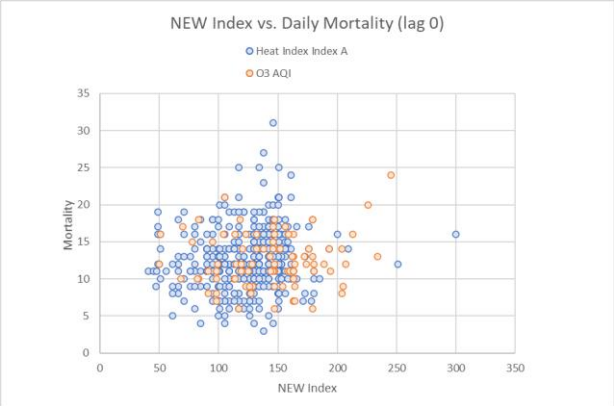
AQI+HI Regression: O3 AQI predictor statistically significant on lag days 2, 4, 5, and 7 with 90% confidence and on lag day 1 with 95% confidence. HI predictor statistically significant on lag day 0 with 90% confidence and on lag day 3 with 95% confidence.

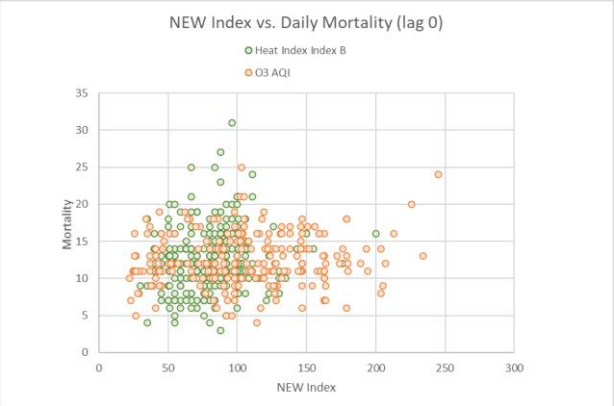
NEW A Regression: NEW A index predictor statistically significant on lag days 0, 1, 4, 5, and 7 with 90% confidence and on lag day 3 with 95% confidence.

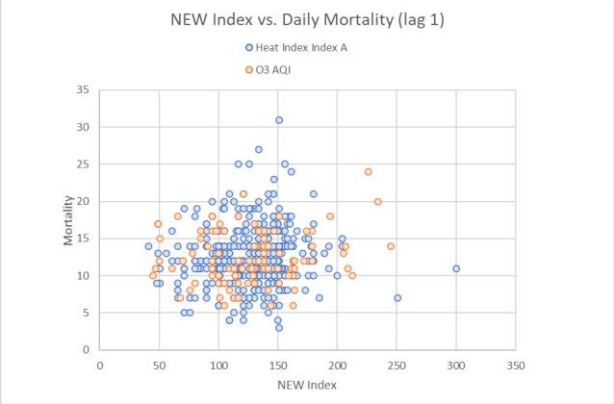
NEW B Regression: NEW B index predictor statistically significant on lag days 3 and 7 with 90% confidence and on lag days 1, 4, and 5 with 95% confidence.

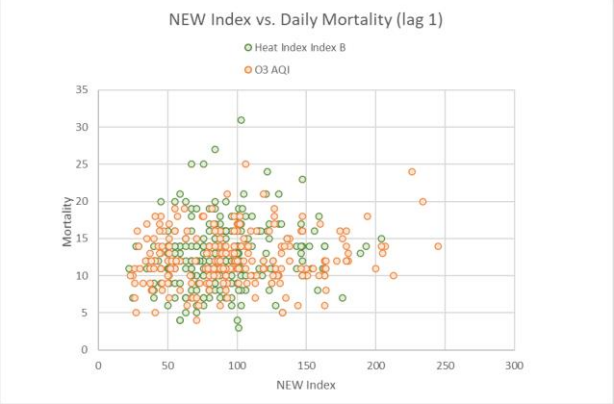
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence. PM2.5 predictor statistically significant on lag day 0 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence.

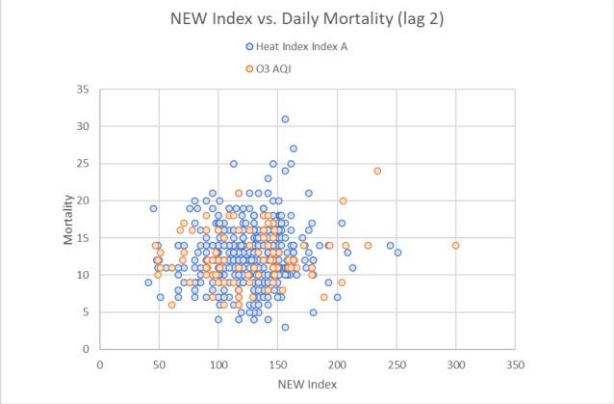
NEW Index vs. Daily Mortality Plots (for M & F, 60+, cardio & resp, warm months)

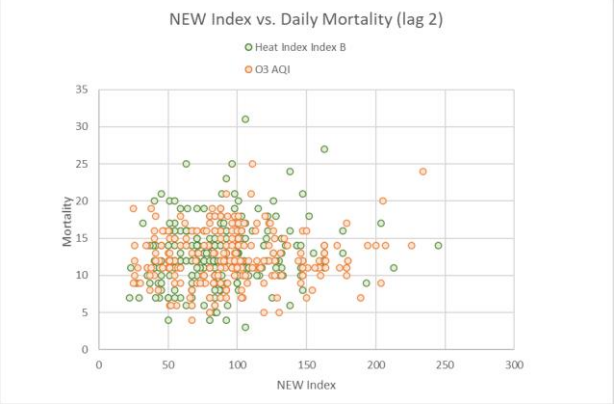


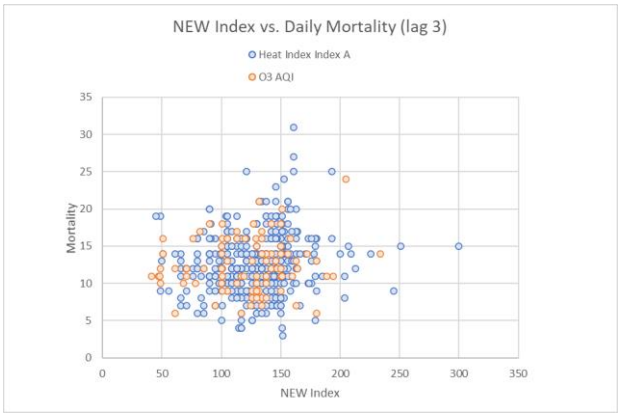


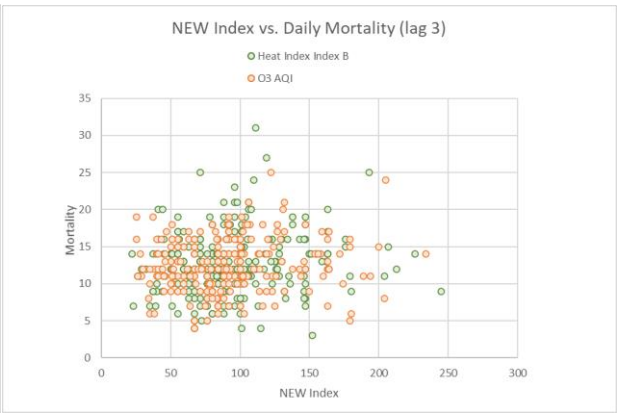


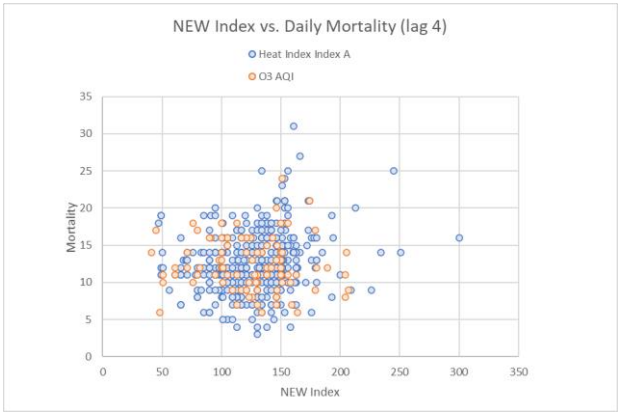


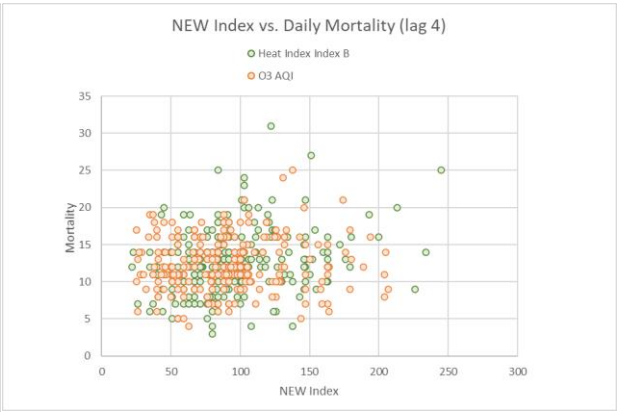


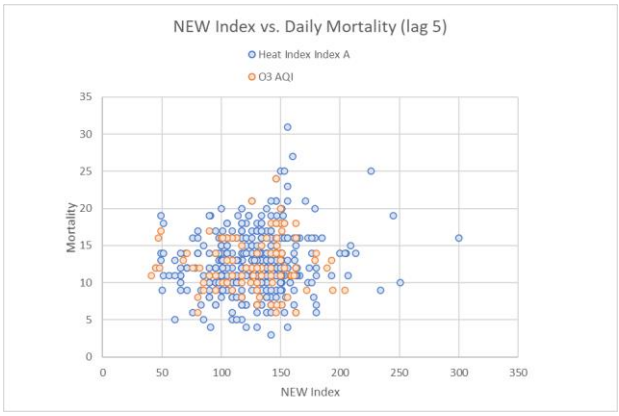


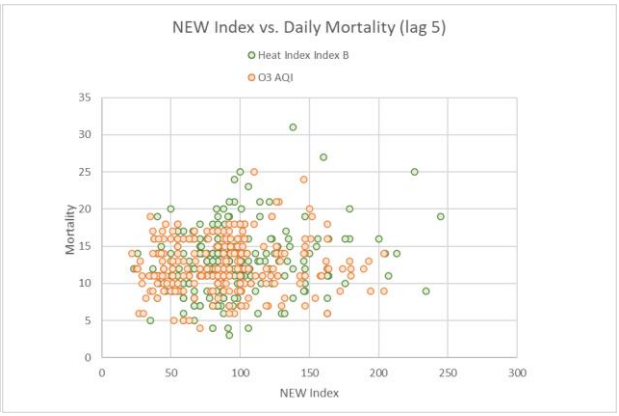

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

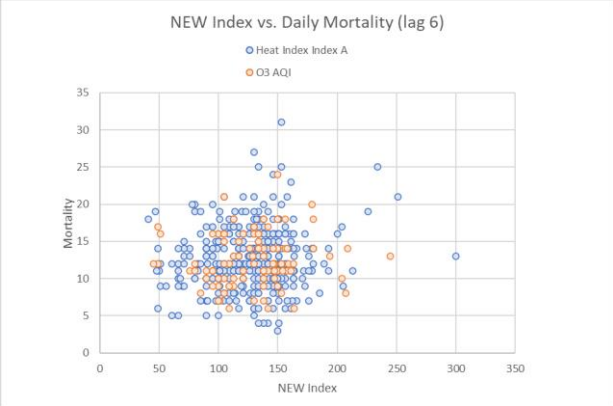

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

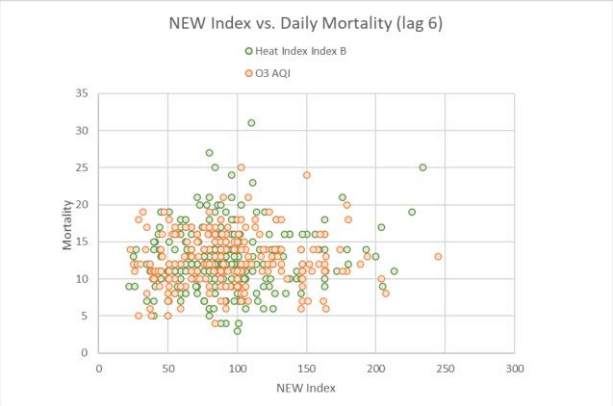

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
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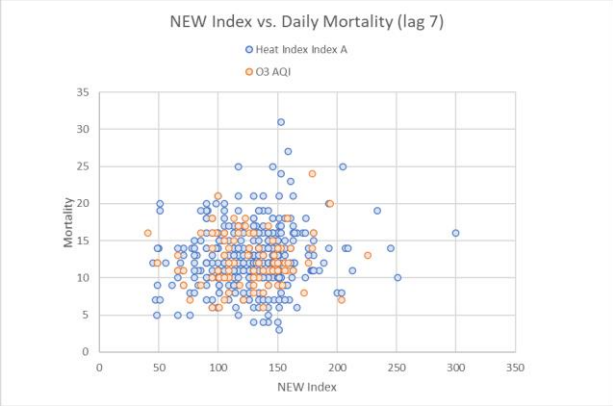
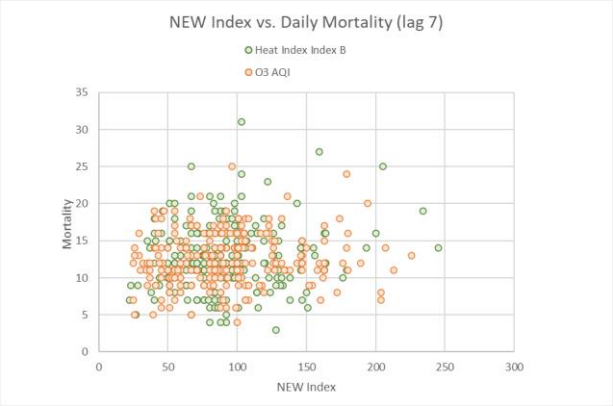

NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300

Production Run:

M & F, all ages, cardio & resp, warm months (O3 AQI)

RMSE values and 95% confidence intervals of the regression models

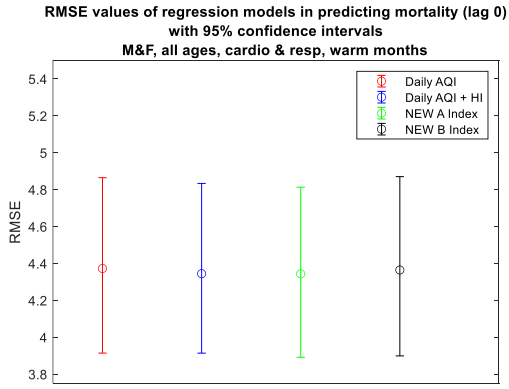
Red = Daily O3 AQI as the only predictor,
Blue = Daily O3 AQI and HI as the predictors,
Green = NEW A index (highest of daily O3l AQI and HI-A) as the predictor,
Black = NEW B index (highest of daily O3 AQI and HI-B) as the predictor:

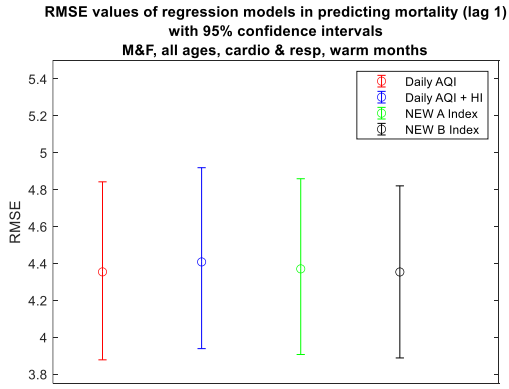
A (how I originally defined the transformed HI in our NEW index)

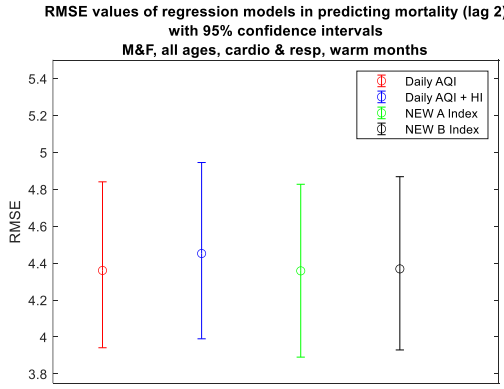
B (transformed HI shifted down one category)

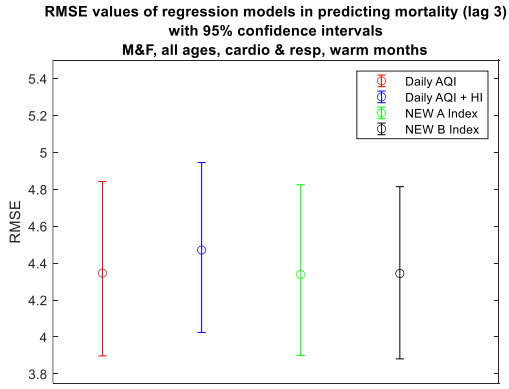
HI_Index Breakpoints

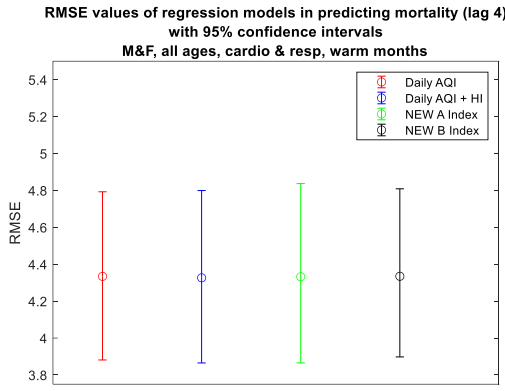
0-80°F	0-50	80-90°F
80-90°F	51-100	91-103°F
91-103°F	101-150	104-124°F
104-124°F	151-200	125-137°F
125-137°F	201-300	
	301-500	

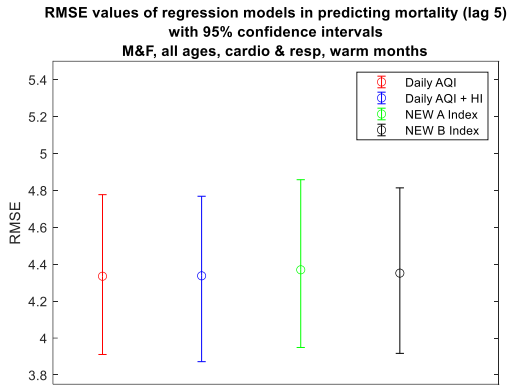


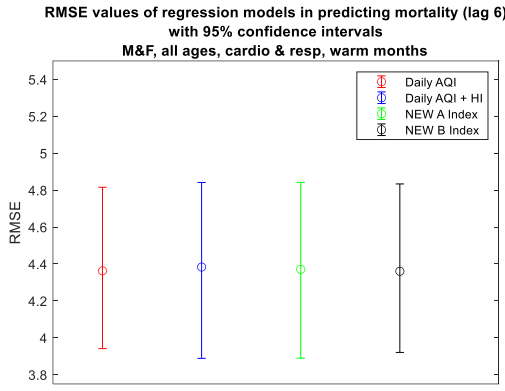







RMSE values of regression models in predicting mortality (lag 4)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8


RMSE values of regression models in predicting mortality (lag 5)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8


RMSE values of regression models in predicting mortality (lag 6)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
Daily AQI
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NEW A Index
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5.4
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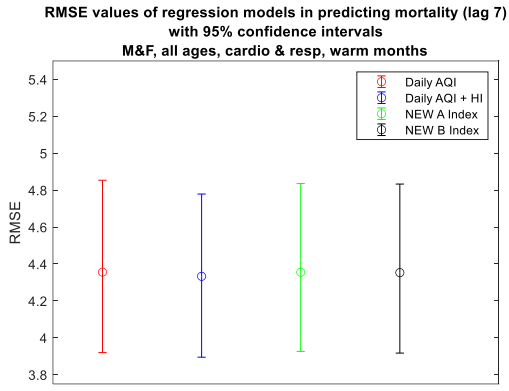
4.2
4
3.8


RMSE values of regression models in predicting mortality (lag 7)
with 95% confidence intervals
M&F, all ages, cardio & resp, warm months
RMSE
Daily AQI
Daily AQI + HI
NEW A Index
NEW B Index
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8

RMSE values and 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B
0	4.3725 +/-0.47522	4.3444 +/-0.45981	4.3435 +/-0.46085	4.3644 +/-0.4856
1	4.3542 +/-0.4822	4.4081 +/-0.49014	4.3705 +/-0.47615	4.3537 +/-0.46616
2	4.3605 +/-0.44949	4.4523 +/-0.47756	4.3583 +/-0.46826	4.3689 +/-0.46934
3	4.3459 +/-0.47251	4.4711 +/-0.46044	4.3382 +/-0.46216	4.3438 +/-0.46649
4	4.3341 +/-0.45564	4.3265 +/-0.4671	4.3321 +/-0.48565	4.3349 +/-0.45546
5	4.335 +/-0.43299	4.3373 +/-0.44809	4.37 +/-0.4545	4.3519 +/-0.44836
6	4.3627 +/-0.43707	4.3834 +/-0.47643	4.3709 +/-0.47627	4.3603 +/-0.45645
7	4.356 +/-0.46692	4.3331 +/-0.44197	4.355 +/-0.4546	4.3531 +/-0.45791

Relative Risk (RR) values with 95% confidence intervals:

Lag	AQI	AQI+HI	NEW-A	NEW-B	RAW
0	1.0274 +/-0.047381	1.0517 +/-0.055501	1.0426 +/-0.043965	1.0258 +/-0.03678	1.0945 +/-0.15676
1	1.0512 +/-0.042643	1.0682 +/-0.057747	1.0371 +/-0.045462	1.0359 +/-0.036159	1.0149 +/-0.15958
2	1.0305 +/-0.047495	1.0633 +/-0.065998	1.0322 +/-0.045502	1.023 +/-0.039233	1.0515 +/-0.14952
3	1.0428 +/-0.048873	1.0882 +/-0.062663	1.0465 +/-0.047604	1.032 +/-0.038938	1.0996 +/-0.16078
4	1.0533 +/-0.048179	1.0807 +/-0.066458	1.0489 +/-0.046793	1.0407 +/-0.038259	1.1229 +/-0.17821
5	1.0484 +/-0.047083	1.0616 +/-0.056553	1.038 +/-0.045078	1.0366 +/-0.035913	1.0267 +/-0.14797
6	1.032 +/-0.048	1.046 +/-0.058649	1.0325 +/-0.047379	1.0261 +/-0.038108	0.98563 +/-0.1406
7	1.0425 +/-0.049159	1.0629 +/-0.058755	1.0383 +/-0.044995	1.0307 +/-0.038797	1.1105 +/-0.156

AQI Regression: O3 AQI predictor statistically significant on lag days 3 and 7 with 90% confidence and on lag days 1, 4, and 5 with 95% confidence.

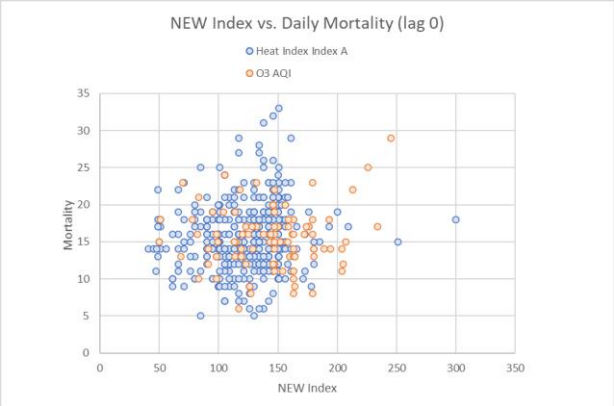
AQI+HI Regression: O3 AQI predictor statistically significant on lag days 4 and 5 with 90% confidence and on lag day 1 with 95% confidence. HI predictor statistically significant on lag day 0 with 90% confidence and on lag day 3 with 95% confidence.

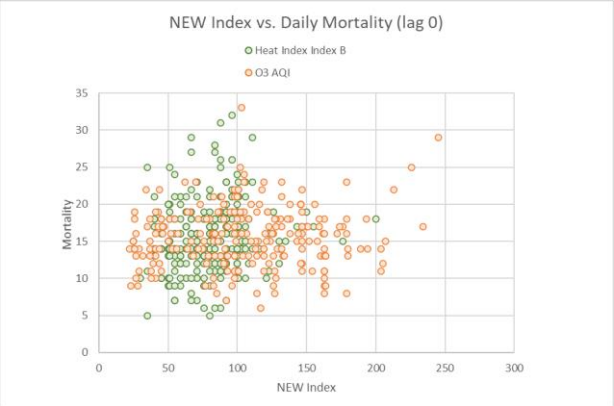
NEW A Regression: NEW A index predictor statistically significant on lag days 0, 3, and 5 with 90% confidence and on lag day 4 with 95% confidence.

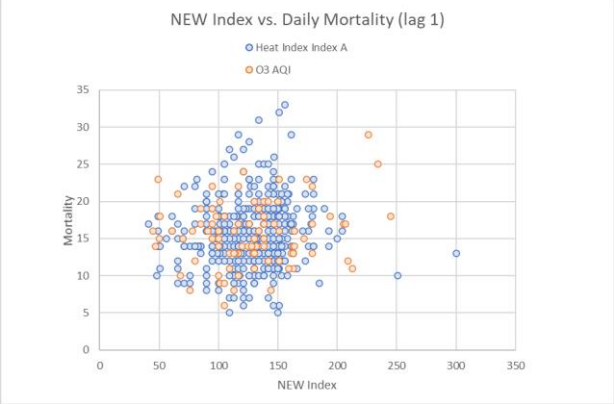
NEW B Regression: NEW B index predictor statistically significant on lag days 1 and 5 with 90% confidence and on lag day 4 with 95% confidence.

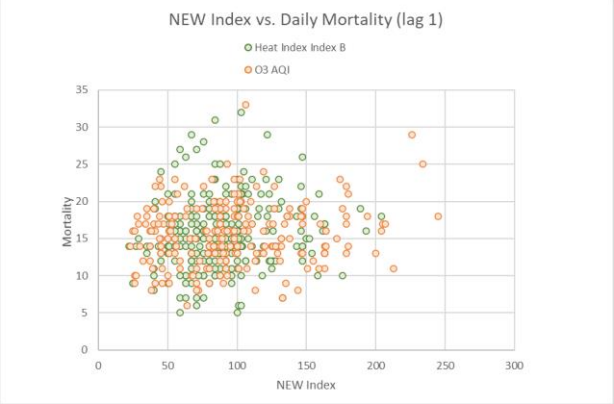
RAW Regression: O3 predictor statistically significant on lag day 1 with 90% confidence. PM2.5 predictor statistically significant on lag days 0 and 2 with 90% confidence and on lag days 1, 3, 4, 5, 6, and 7 with 95% confidence.

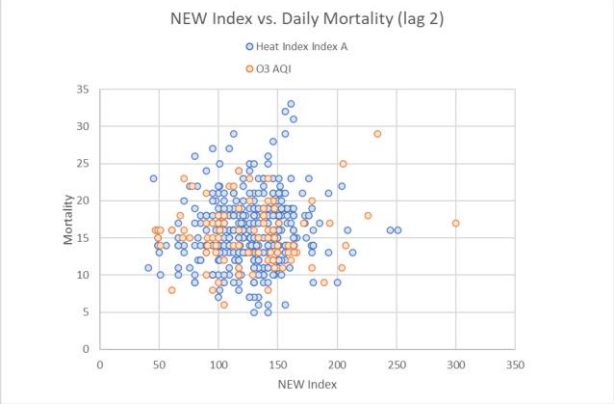
NEW Index vs. Daily Mortality Plots (for M & F, all ages, cardio & resp, warm months)

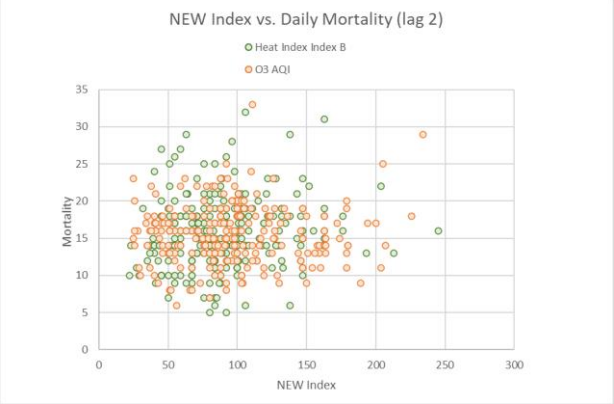


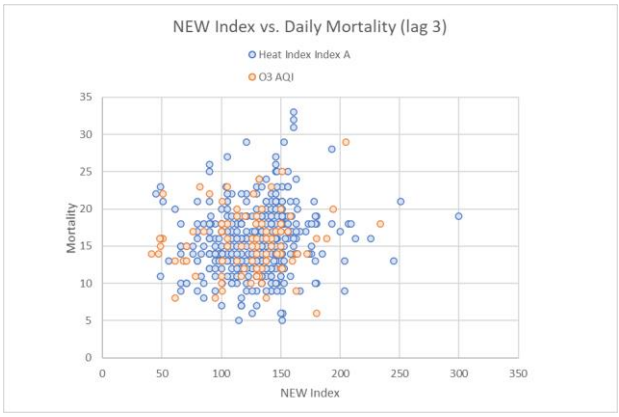


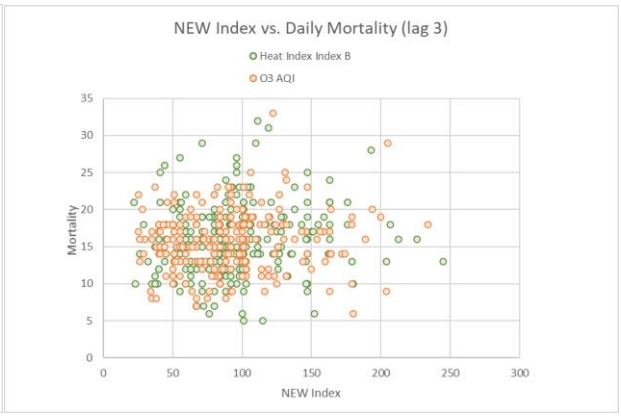


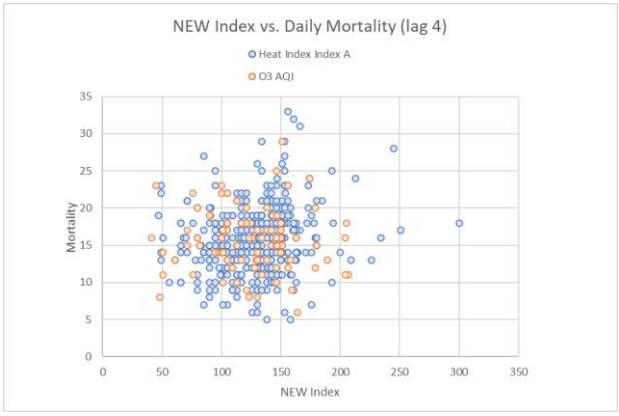


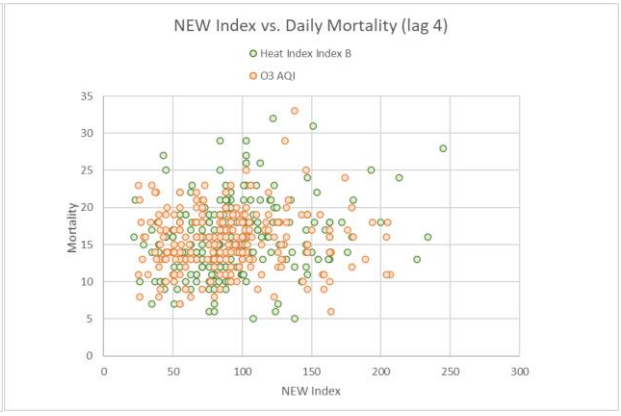


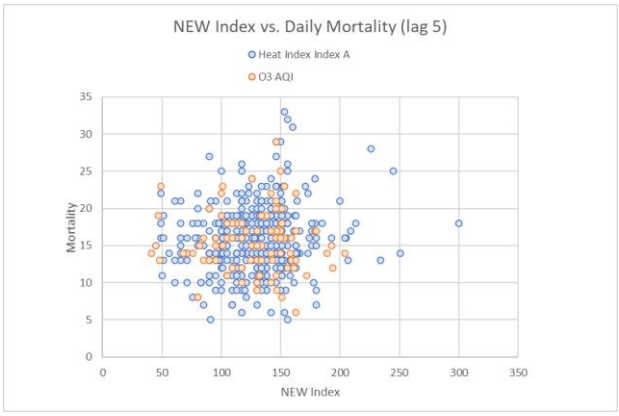


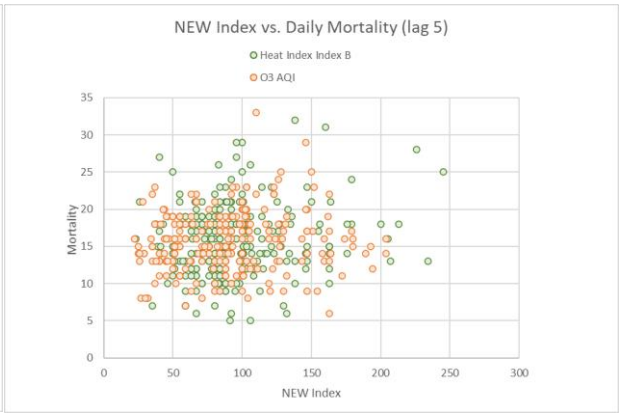

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index A
O3 AQI
Mortality
NEW Index

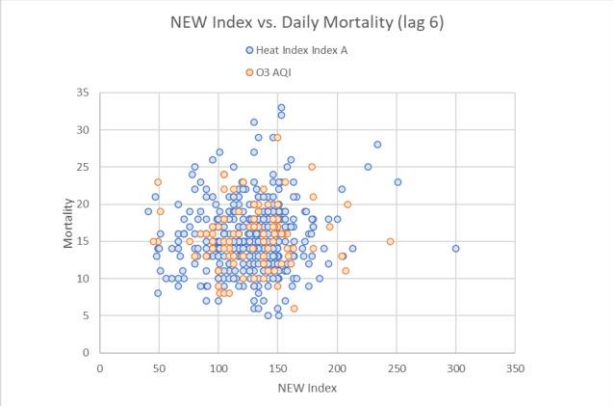

NEW Index vs. Daily Mortality (lag 3)
Heat Index Index B
O3 AQI
Mortality
NEW Index

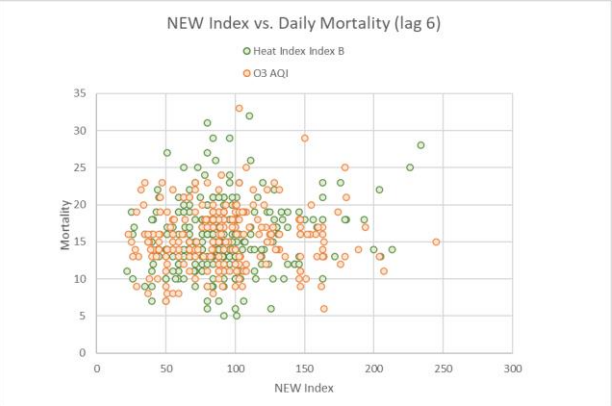

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index A
O3 AQI
Mortality
NEW Index

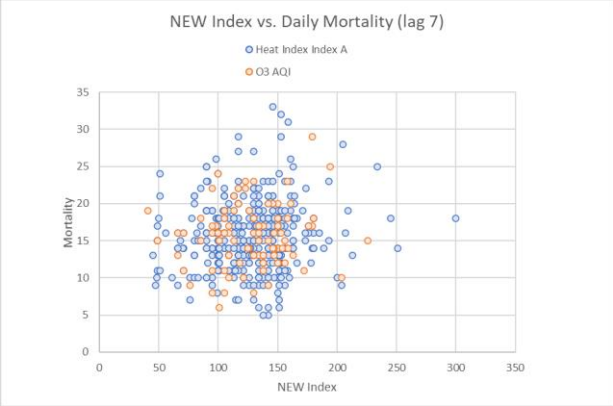

NEW Index vs. Daily Mortality (lag 4)
Heat Index Index B
O3 AQI
Mortality
NEW Index

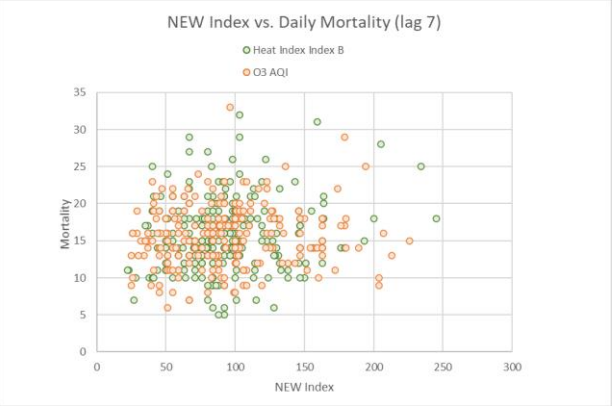

NEW Index vs. Daily Mortality (lag 5)
Heat Index Index A
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 5)
Heat Index Index B
O3 AQI
Mortality
NEW Index


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 6)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index A
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
350


NEW Index vs. Daily Mortality (lag 7)
Heat Index Index B
O3 AQI
Mortality
NEW Index
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300