Background:
• Obesity prevalence is on the rise in the US. Obesity is defined as Body Mass Index (BMI) ≥ 30 kg/m².
• Obesity is a risk factor in heat-related illnesses.
• Global mean temperatures are rising.
• There is an established positive association between temperatures and heat-related illnesses.

Objectives:
1. To quantify the number of heat-related illnesses due to increases in adult obesity and increases in temperature.
2. To provide an example of how to evaluate climate change effects on human health by combining climate models and health models.

COMPONENTS OF THE MODEL

Component 1: the relationship between temperature and heat-related illnesses.
The incidence rate of heat-related illnesses is exponentially dependent on temperature for temperatures above 15.6°C (Lippmann, 2013). Incidence rate increase rapidly at temperatures beginning at 30°C.

Component 2: the risk factor of obesity in heat-related illnesses. Donaghue and Bates (2000) analyzed miners working in deep underground mines to find the relationship between heat exhaustion cases and miners’ BMI. They found the obese are 3.63 more likely to get heat exhaustion than those not obese, defined as an odds ratio.

PDF of Projected Daily Temperature in North Carolina:
Densely mean temperature probability density function is generated from observations of daily mean temperature for North Carolina from 1989-2008 (Livneh et al., 2013). We will assume for a first approximation that a future increase of temperature will have the same probability density profile as from 1989-2008 but shifted ΔT (°C).

2. Obesity Projections: Obesity projections are constructed using linear and logit regression from observed data: US National Health and Nutrition Examination Study (NHANES) and US Behavioral Risk Factor Surveillance System (BRFSS).

RESULTS
1. Dependence of Heat-Related Illnesses on temperature and obesity: Incidence rates are more sensitive to temperature than obesity. By 2050 the temperatures are high enough to amplify incidence rate regardless of obesity level.

DISCUSSION
• Both obesity and temperature have an effect the incidence of heat-related illnesses. Temperature has an exponential effect on incidence of heat-related illnesses, obesity has a linear effect. This incidence rate is especially significant at temperatures over 30°C when the rate increases rapidly for increasing temperatures.
• Our model applied to North Carolina at 2050 shows that the projected temperature changes produce much greater incidence rate increases than projected increases in obesity rate.
• Vulnerable areas to heat-related illnesses are dependent on spatial variation in temperature and population.
• Vulnerable areas to heat-related illnesses are primarily regions with high temperatures.

This study is an example of how we can use models from multiple disciplines to quantify effects of climate change on human health. Similar approaches can be used for other studies on climate impacts on public health.

FURTHER WORK
• Spatial variation of obesity is important. This model slightly overestimates the number of observed heat-related illnesses in North Carolina. This is likely due to a uniform obesity rate over North Carolina, whereas the observed obesity rate is 6% lower in populated urban areas than rural areas (Befort et al., 2012). Consistent with this explanation, Lippmann et al. found incidence of heat-related illnesses to be greater in rural than urban counties. Future studies for using better spatial resolution of obesity data along with population data, will be needed to determine areas most vulnerable to heat-related illnesses.
• Include a more comprehensive heat index that takes into account of humidity and temperature, i.e. wet-bulb temperature, to calculate dependence of incidence rate of heat-related illnesses. Obesity projections are slightly overestimates the number of observed heat-related illnesses. Spatial variation of obesity is important. This model slightly overestimates the number of observed heat-related illnesses in North Carolina. This is likely due to a uniform obesity rate over North Carolina, whereas the observed obesity rate is 6% lower in populated urban areas than rural areas (Befort et al., 2012). Consistent with this explanation, Lippmann et al. found incidence of heat-related illnesses to be greater in rural than urban counties. Future studies for using better spatial resolution of obesity data along with population data, will be needed to determine areas most vulnerable to heat-related illnesses. Based on the observed data, the obesity prevalence for observed data: US National Health and Nutrition Examination Study (NHANES) and US Behavioral Risk Factor Surveillance System (BRFSS). Based on the observed data, the obesity prevalence for observed data: US National Health and Nutrition Examination Study (NHANES) and US Behavioral Risk Factor Surveillance System (BRFSS).