

# Climate Drivers of Morbidity Seasonality in Mexico

Brooke Ury<sup>1</sup>, Rachel E. Baker<sup>1</sup>  
<sup>1</sup>Brown University, RI

## Overview

Analysis of hospitalization data from Mexico indicated that climate factors, such as temperature and precipitation, were important predictors of seasonality for some diseases, while others were driven by non-climate factors

## Background

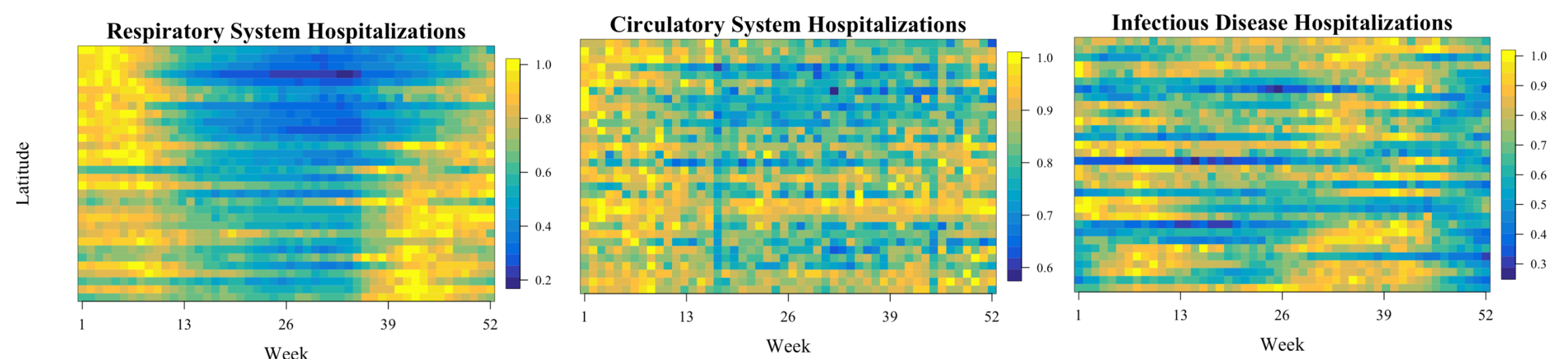
- Disease patterns, including seasonal variations, differ across geographic regions (Hotez et al., 2008; Mitra and Mawson, 2017.; Shetty and Shetty, 2009)
- Climate factors such as rainfall, temperature, and resource availability can greatly affect disease dynamics, influencing these disease seasonality patterns (Altizer et al., 2006; Parks et al., 2018; Koelle et al., 2005)
- Most seasonality research has examined disease distribution in temperate climates and has focused on mortality, overlooking many disease cases (Burkart et al., 2014; Yuan et al., 2021)
- In this quantitative analysis, I analyzed climate drivers of hospitalization seasonality in Mexico, a country with diverse geography and climate conditions

## Methods

- Morbidity was assessed using state-level Mexico hospitalization data from 2000-2013, sourced from the Subsistema Automatizado de Egresos Hospitalarios reported by the Department of Health
- Daily precipitation and temperature data were obtained from the North American Regional Reanalysis
- The analysis focused on six hospitalization categories, identified using ICD codes: respiratory system, circulatory system, digestive system, infectious disease, pregnancy and childbirth, and injury
- Binned fixed effect regression models and natural spline models were used to predict hospitalizations for each disease area based on climate conditions, adjusting for non-climate drivers of seasonality
- A sensitivity analysis was conducted using temperature and precipitation lags
- Linear fixed effects regressions were used to explore the relationship between climate drivers and ICD code groups. P-values were adjusted using the false adjustment rate method

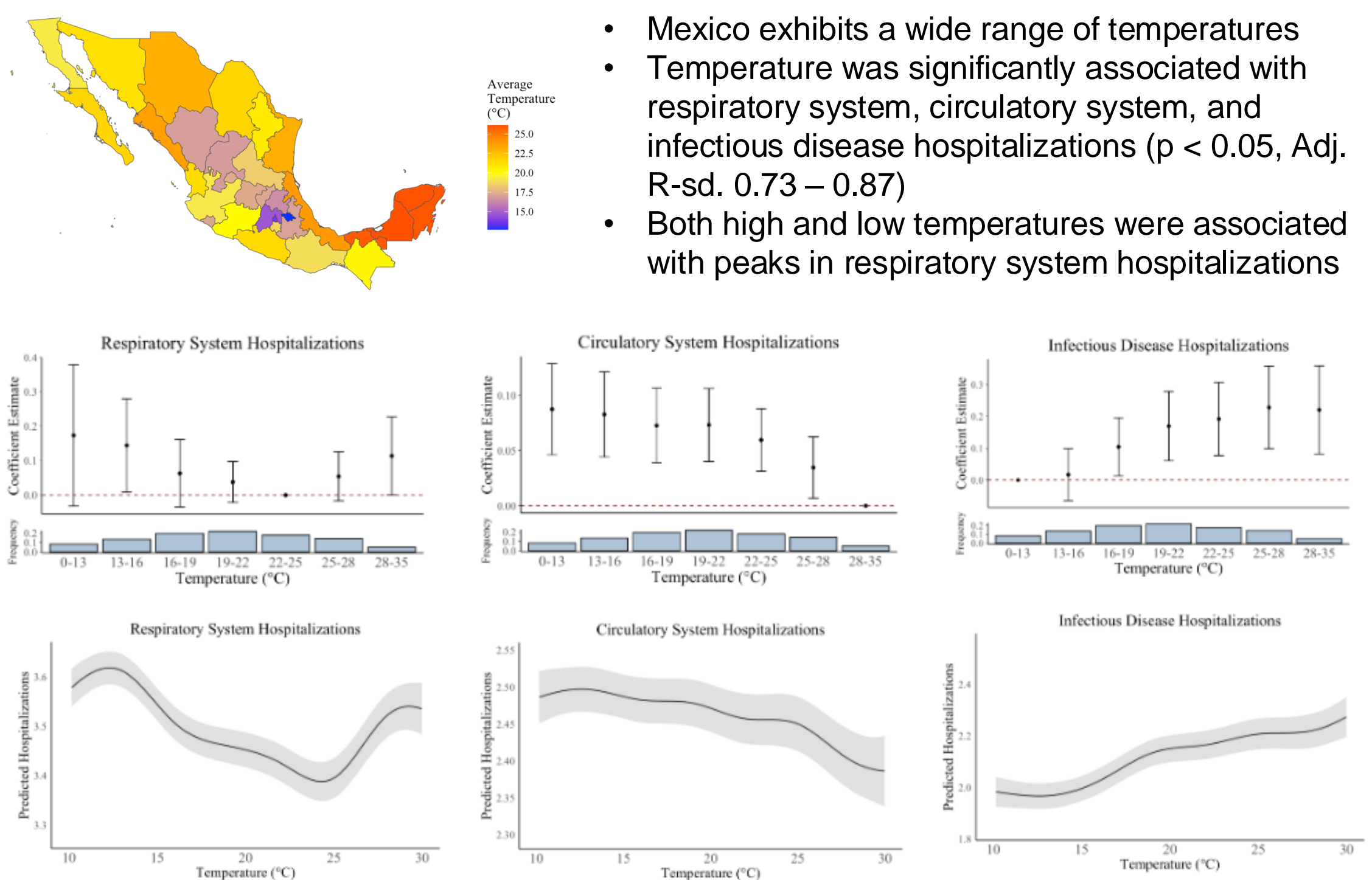
## Results

Figure 1: Seasonality of Hospitalizations in Mexico



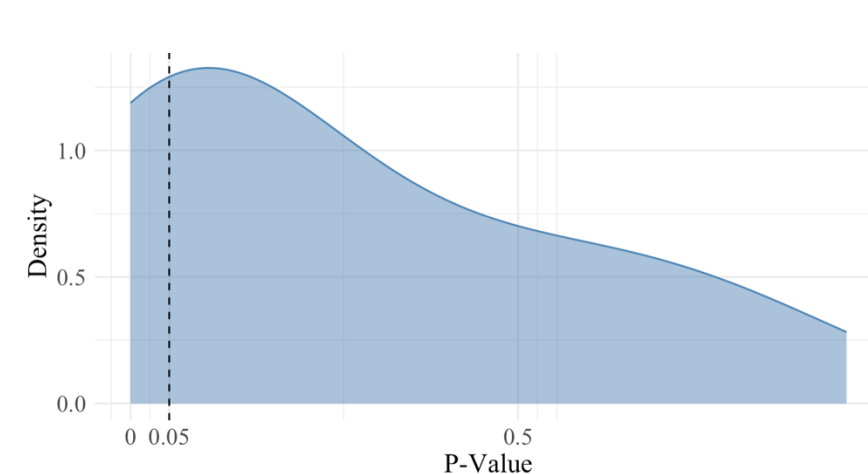
- Respiratory system and circulatory systems showed a seasonal increase in cases in the winter months, particularly in northern, more temperate regions
- Infectious diseases followed a pattern of two seasonal peaks in the spring and fall

Figure 2: Impact of Temperature on Hospitalization



- Mexico exhibits a wide range of temperatures
- Temperature was significantly associated with respiratory system, circulatory system, and infectious disease hospitalizations ( $p < 0.05$ , Adj. R-sd. 0.73 – 0.87)
- Both high and low temperatures were associated with peaks in respiratory system hospitalizations

Figure 3: Temperature as a Driver of Hospitalization Across Disease Areas



- Most disease areas showed no significant linear relationship with temperature, indicating a lack of seasonality or a seasonal pattern driven by non-climate factors
- The areas most influenced by climate were infectious diseases, injuries, maternal conditions, heart conditions, and respiratory conditions

## Discussion

- These findings highlight how precipitation and temperature drive seasonal hospitalization patterns for both communicable and non-communicable diseases in tropical and semi-tropical climates
- This research suggests that for some disease areas, seasonal patterns are influenced more by non-climate factors, such as social, economic, or population dynamics
- Changes in the seasonality of climate factors are among the most significant ways climate change will affect disease patterns; models like these can help us anticipate and prepare for emerging disease trends
- Future research should aim to increase the specificity of these models beyond broad categories to further inform public health action