

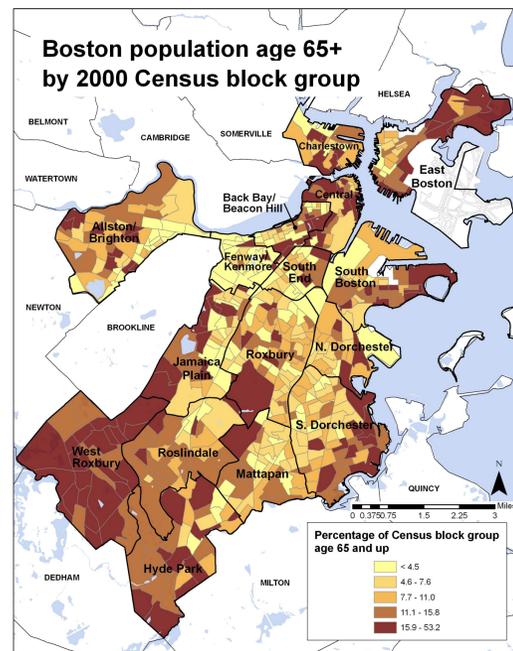
Assessing Vulnerability to Heat Stress Among Boston Seniors

Project Goals

This project uses GIS to create a composite index of heat stress vulnerability among the elderly in Boston. The project goal is to spatially identify those Boston census block groups in which seniors are at highest risk of heat-stress-related morbidity and mortality.

Background

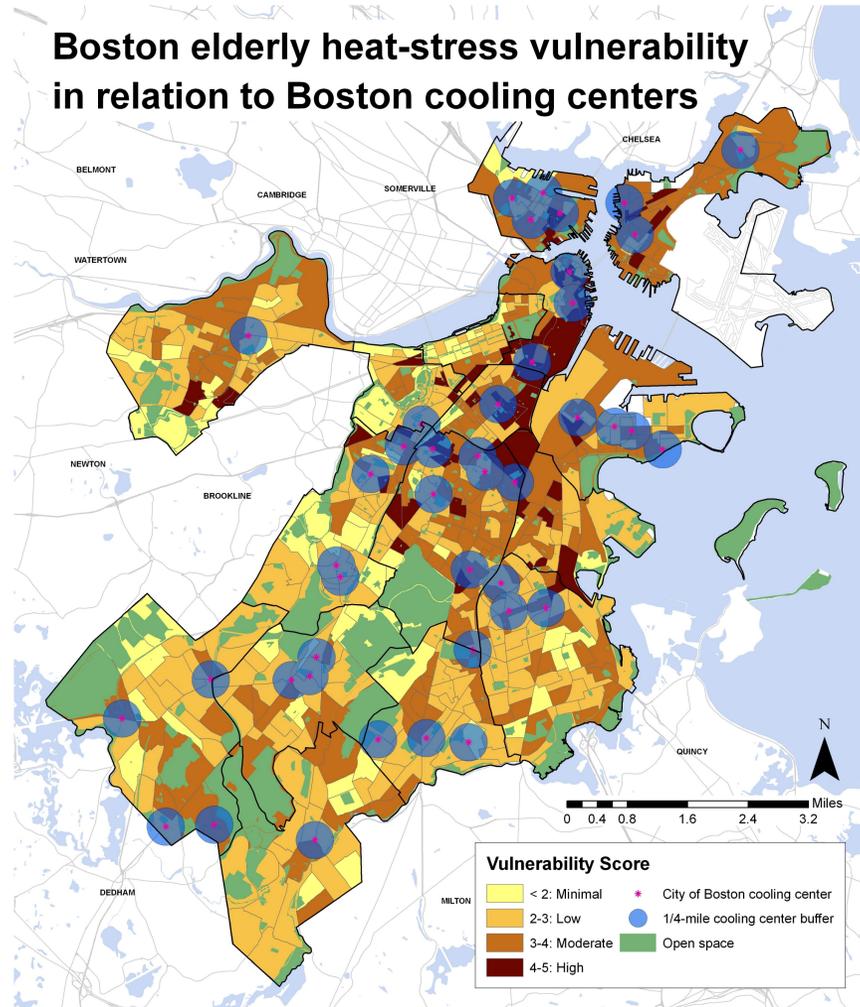
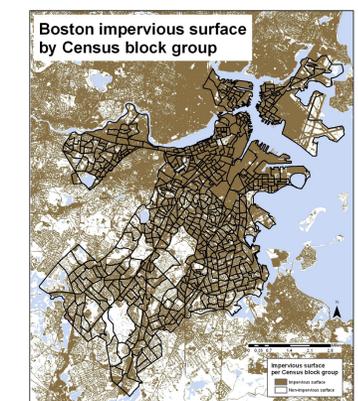
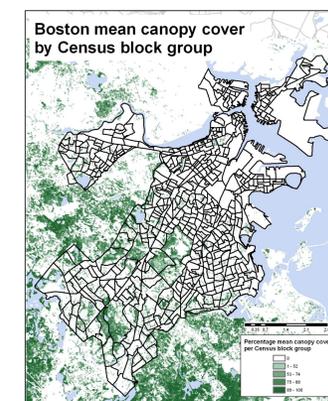
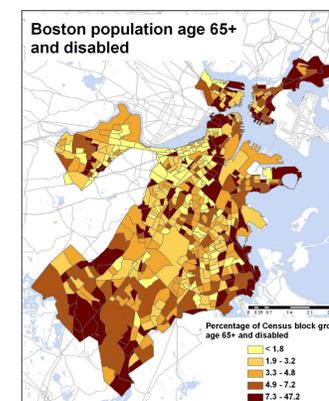
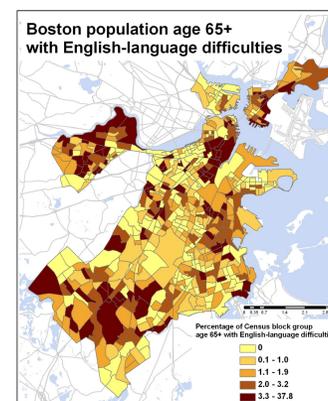
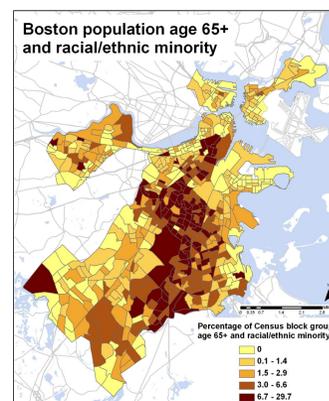
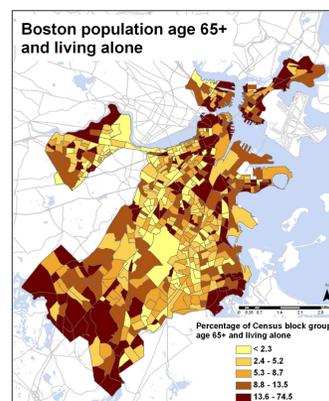
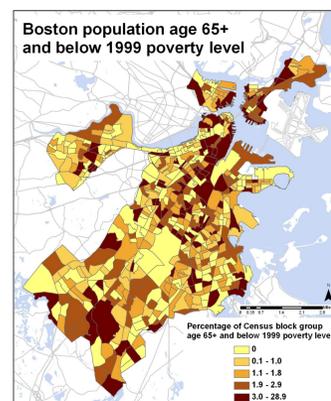
Extreme weather events, including heat waves, are predicted to increase in frequency and severity due to climate change. Prolonged exposure to extreme heat increases the risk of heat stress, which can result in a variety of heat-related illnesses and death. The epidemiology literature identifies several socio-economic, demographic, and environmental factors associated with increased sensitivity to heat (age over 65, racial/ethnic minority, poverty, disability, social and linguistic isolation) and increased exposure to heat (prevalence of heat island contributors such as impervious surfaces and lack of tree canopy).



Populations at increased risk of heat stress include the elderly, young children, and persons with chronic disease. Because heat stress prevention strategies can differ for vulnerable sub-populations, it is important for urban planners and public health professionals to identify those most at risk and tailor planning responses to the unique needs of those communities.

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HEAT STRESS SENSITIVITY FACTORS



Limitations

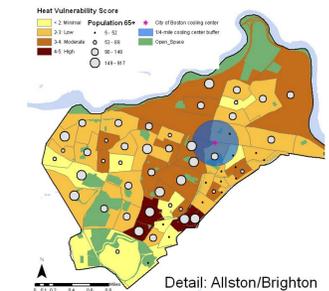
The main limitations of this analysis stem from the age of the census data and the lack of available data that would yield more insight into differential heat exposure on the block-group level. Future analyses would benefit from neighborhood-scale climate data as well as accurate data on air conditioner ownership on the block-group level.

Methods

The theoretical framework for this project is a conceptual model proposed by Rinner et al. (2010) which views heat stress vulnerability as a function of population sensitivity, exposure, and adaptive capacity. Using the census block group as the unit of analysis, I mapped socio-economic and demographic data from US Census 2000 cross-tabulated with age to create a series of maps that show the spatial distribution of heat sensitivity vulnerability factors among Boston adults age 65+. Using raster data from MassGIS and the National Land Cover Dataset, I also mapped Boston tree canopy and impervious surface coverage – both associated with exposure to heat in the urban environment – then aggregated that raster data up to the census block level. For each map, I classified the results into quintiles and assigned each quintile a score of one to five for increasing heat stress vulnerability. I added up all the heat sensitivity/exposure scores for each block group to create a cumulative vulnerability score, then mapped the results to spatially identify the block groups according to cumulative heat stress vulnerability. Finally, I geocoded the addresses of official Boston cooling centers for 2009 and mapped them with a 1/4-mile buffer to visually highlight the most heat-vulnerable census block groups that are beyond walking distance to a cooling center.

Results

The mapped composite heat stress index revealed several high-and moderate-vulnerability block groups located beyond a walkable distance to a cooling center. Further analysis that accounted for the absolute size as well as the percentage of the elderly population in each block group revealed a notable mismatch between the location of cooling centers and high-vulnerability/large-elderly population block groups in the following neighborhoods: Allston/Brighton, North Dorchester, East Boston, north Jamaica Plain, southwest Roxbury, and parts of the Fenway/Back Bay area.



HEAT STRESS EXPOSURE FACTORS