

Assessing Time Spent in Various Microenvironments in Two Urban Environmental Justice Communities

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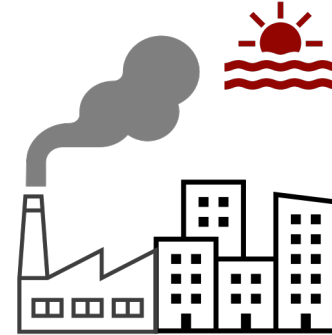


Background

Real-time data on where people spend their time informs understanding of environmental exposures



Limited use of time- activity global positioning systems (GPS) data with self-report data to estimate time spent in microenvironments



Questionnaires and self-reported data used to characterize time spent in microenvironments
Recall bias, exposure misclassification occur



Lack of data for environmental justice (EJ) study populations

Objective: Utilize GPS and self-reported data to assess time-location patterns during the summer of 2020 for 18 adult residents of Chelsea and East Boston, two EJ communities (defined as low income, communities of color) in Massachusetts (MA)

Results

- Approximately **80%** of participants' time spent in Chelsea and East Boston (Fig. 2)
- Participants within 40m of their home location for average of **75%** (range: 35-99%) of time, 16 of 18 spending >70% of time at home
- GPS results consistent with self-reported data: participants reported spending most of time indoors in their homes
- Less than **3%** of time spent at either retail establishments or outdoors in green spaces
- Potentially more time spent at home on high temperature days (Fig. 1)

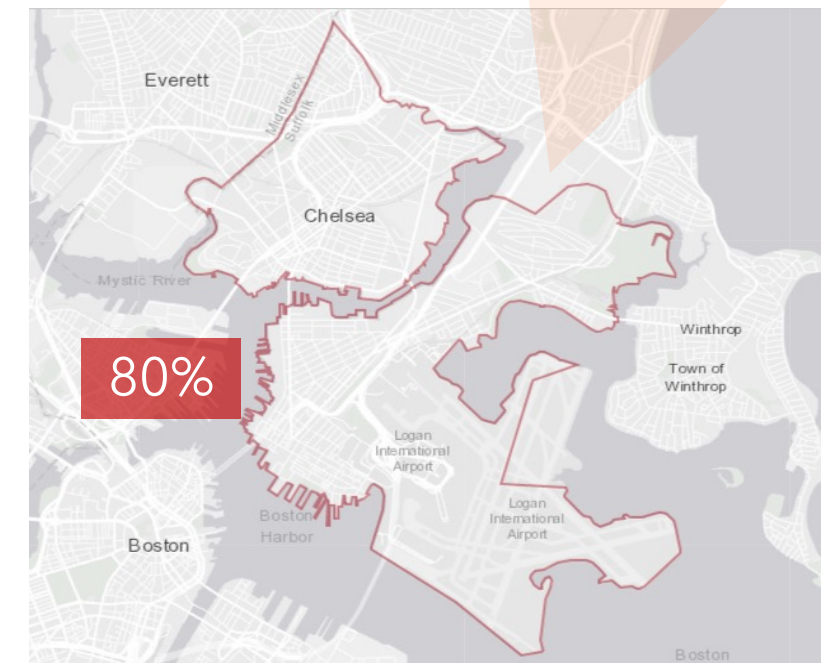
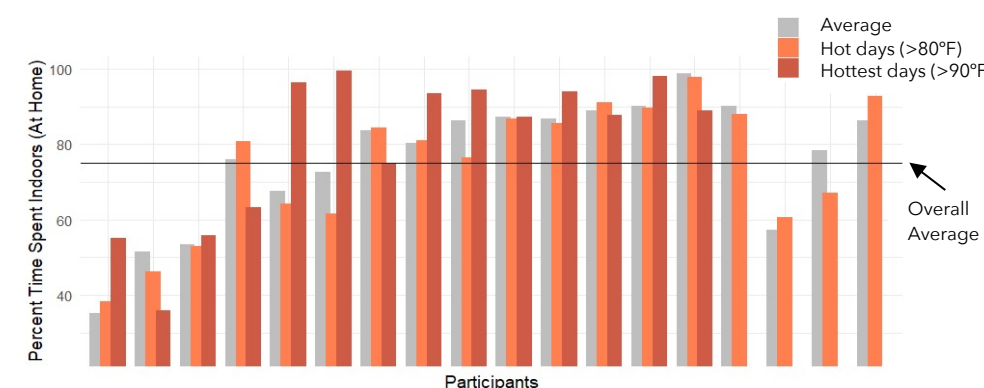
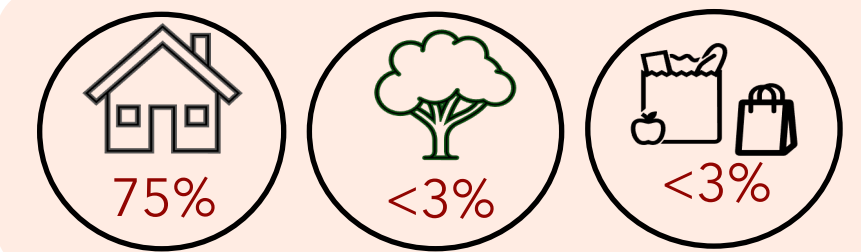


Figure 2: Chelsea & East Boston, MA outlined in red. Map created using MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS | Esri, HERE, NPS

Methods

Data Collection



Data utilized from Chelsea and East Boston Heat Study Summer 2020 field study participants

- 112,241 GPS points collected from 18 Tile Mates /Tile smartphone application with 97,447 points meeting data quality checks
- Sampling protocol of 1 point per 10 minutes
- Secure database created with Tile application programming interface (API), Microsoft Graph API and Microsoft Azure FunctionApp



Self-reported questionnaire data collected from study participants on how their time was spent



Geospatial data secured from MassGIS Protected and Open Space shapefile, ESRI ArcGIS Business Analyst Database

Geospatial Analysis



- Geocoded resident addresses, digitized household footprints
- Created greenspace and retail store layers



- Built 25- and 40-meter buffers around households (potential GPS signal error)
- Buffer sensitivity checks



- Spatially joined GPS and microenvironment data layers for overall, weekday vs. weekend, and high temperature days
- Generated summary statistics for location trends

Discussion & Conclusion

Explored strengths and limitations using mixed-methods and multiple data streams:

| | Tile Application Data | Questionnaire Data | Geospatial Data |
|---|---|---|---|
| + | Continuous recording, more precise real-time location | Community engagement, participant perspectives | Powerful and understandable visualizations, data integration |
| - | Unique privacy considerations, technical expertise needed, signal/use error | Recall bias, data show broader trends, lack of in-depth responses | Underlying data limitations, spatial scale, processing power required |

Successfully developed methods to capture time spent in microenvironments during hot summer months of 2020

- COVID 19 may have impacted mobility
- Observed need for at-home interventions to reduce heat exposure
- Future research needed to explore GPS-based exposure assessment, with inclusion of sociodemographic and EJ data

Acknowledgements

The C-HEAT Team: GreenRoots, Inc., Boston University School of Public Health, the City of Chelsea, C-HEAT Advisory Team, Chelsea and East Boston Study participants. Work supported by the Barr Foundation, National Science Foundation Research Traineeship (NRT grant to Boston University (DGE 1735087))

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