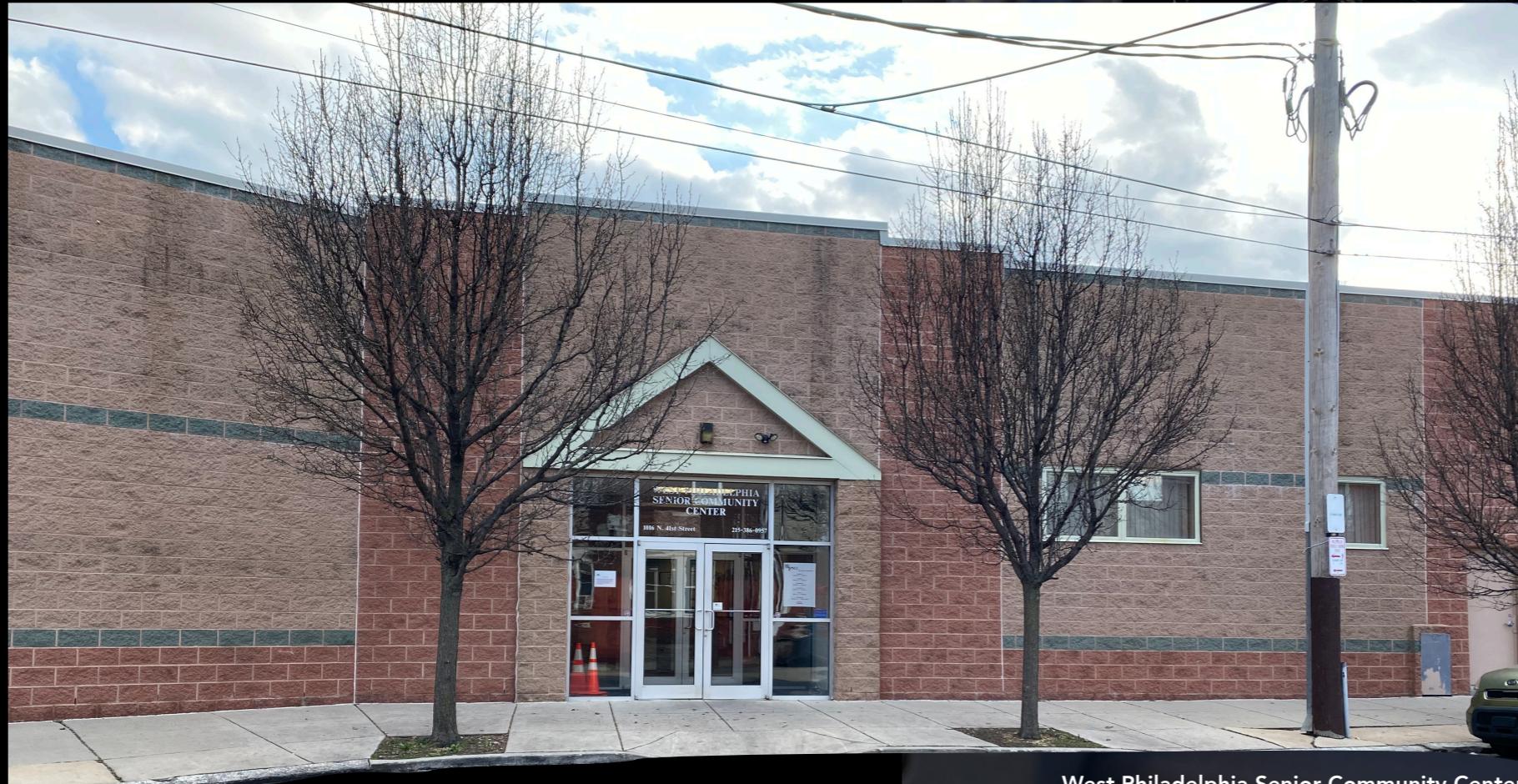


# ACCESSIBILITY OF PHILADELPHIA SENIOR CENTERS VIA PUBLIC TRANSIT: PROGRESS, METHODOLOGY, AND CHALLENGES



West Philadelphia Senior Community Center



GRADUATE MENTOR: ALEX LI  
UNDERGRADUATE RESEARCHER: ANNA DUAN

# LITERATURE REVIEW KEY TAKEAWAYS

## Older adults' accessibility challenges:

- Reduced mobility due to residential location, physical and cognitive impairments (Carr, 2000)
- Minorities, low-income individuals, women, disabled face further barriers (e.g. affordability, safety, discrimination, and time) (Lubitow, Rainer, and Bassett, 2017)
- Low mobility correlated with poor mental and physical health and **social isolation** (Dobbs, Hussey, and Pidborochynksi, 2018)

## Existing studies:

- Healthcare, employment, food destinations (Syed, Gerber, and Sharp, 2013; Farber, Morang, and Widener, 2014; Owen and Levinson, 2015)
- **Open-sourced data** lets scholars model accessibility of specific destinations via public transit, accounting for factors including trip time and consistency, transfer and wait times (Wessel, Allen, and Farber, 2017; Farber and Fu, 2017; Karner, 2018)
- Very few studies on **older adults** (Ozel, Ozguven, Kocatepe, and Horner, 2016)

# OUR RESEARCH PROBLEM AND QUESTIONS



## 1. ACCESSIBILITY

- 1. Spatial
- 2. Temporal

## 2. DEMOGRAPHIC

- 1. Older adults
  - 1. Race
  - 2. Poverty status
  - 3. Gender

## 3. DESTINATIONS

- 1. Senior centers

**Q1:** How does the accessibility of senior centers via public transit vary across different census tracts in Philadelphia?

**Q2:** How do factors including gender, poverty status, and race correlate with older adults' access to senior centers?

# TRANSPORTATION ACCESSIBILITY

## Definitions of transportation accessibility:

- 'the ease with which any land-use activity can be reached from a location using a particular transport system' (Dalvi and Martin, 1976)
- 'the potential of opportunities for interaction' (Hansen, 1959)
- 'the freedom of individuals to decide whether or not to participate in different activities' (Burns, 1979)

Physical, **temporal, spatial**, economic, social

We are interested in Farber and Fu's approach: "schedule-based origin-to-destination(OD) travel times and their fluctuations over the course of the day."  
(Farber and Fu, 2017)

# FIELD: PHILADELPHIA

- 1. Minority-majority
- 2. Poorest big city in the United States
- 3. Aging city



CORRELATED WITH LOWER  
ACCESSIBILITY AND ACCESS TO  
TRANSPORT

## PHILADELPHIA

## UNITED STATES

1. Non-White Population

1. 65.4%

1. 39.6%

2. Poverty Rate

2. 24.3%

2. 11.8%

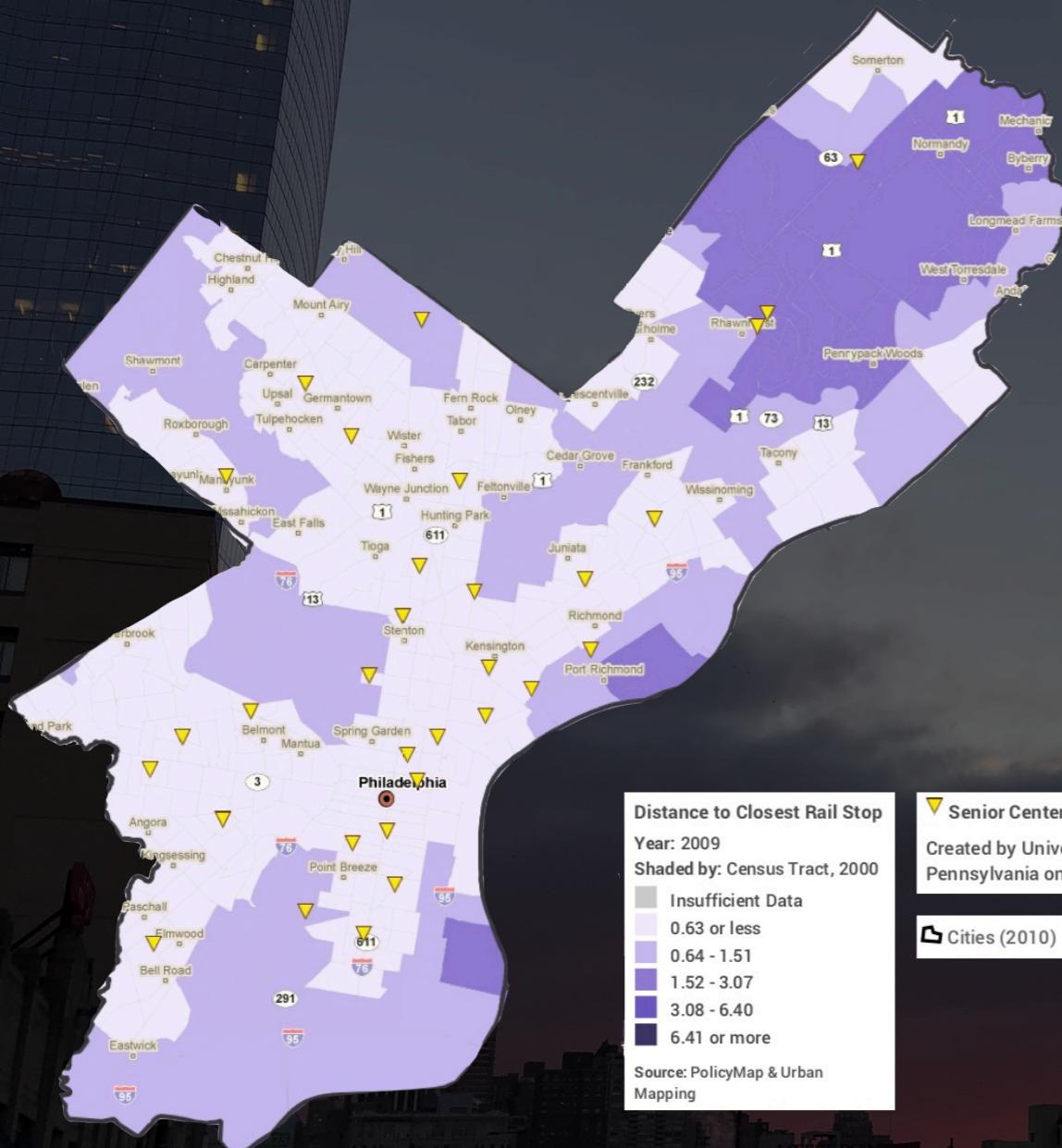
3. Share of Older Adults (65+)

3. 13.7%

3. 16%

# PHILADELPHIA TRANSIT LANDSCAPE

Distance to nearest transit rail stop in miles, 2009



SEPTA Service Map

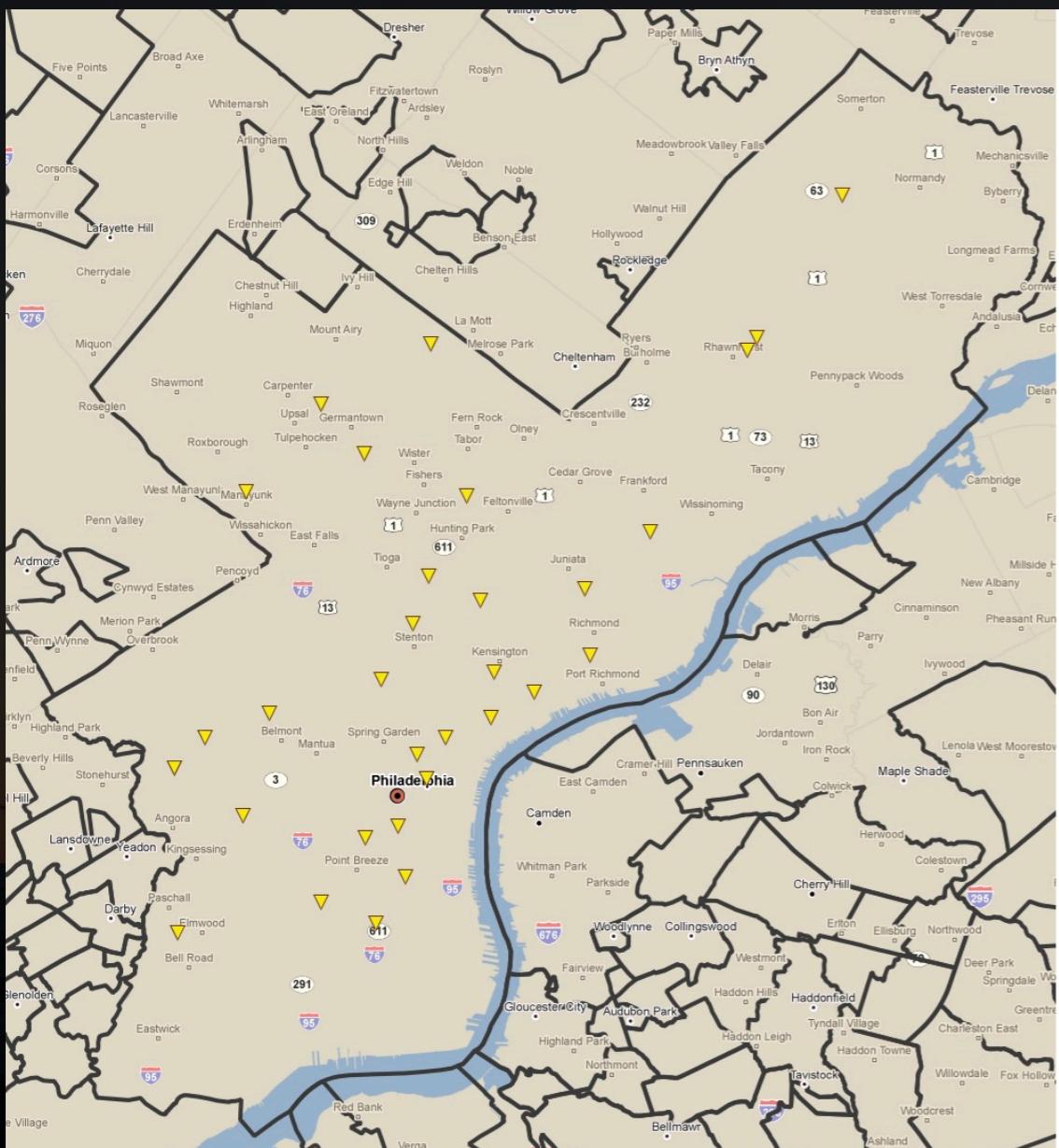


SOURCE: [HTTP://SEPTA.ORG/](http://HTTP://SEPTA.ORG/)

SOURCE: [HTTPS://WWW.POLICYMAPPING.COM/](https://WWW.POLICYMAPPING.COM/)

# PHILADELPHIA SENIOR CENTER LANDSCAPE

## **PCA-Partnered Senior Centers in Philadelphia, 2020**



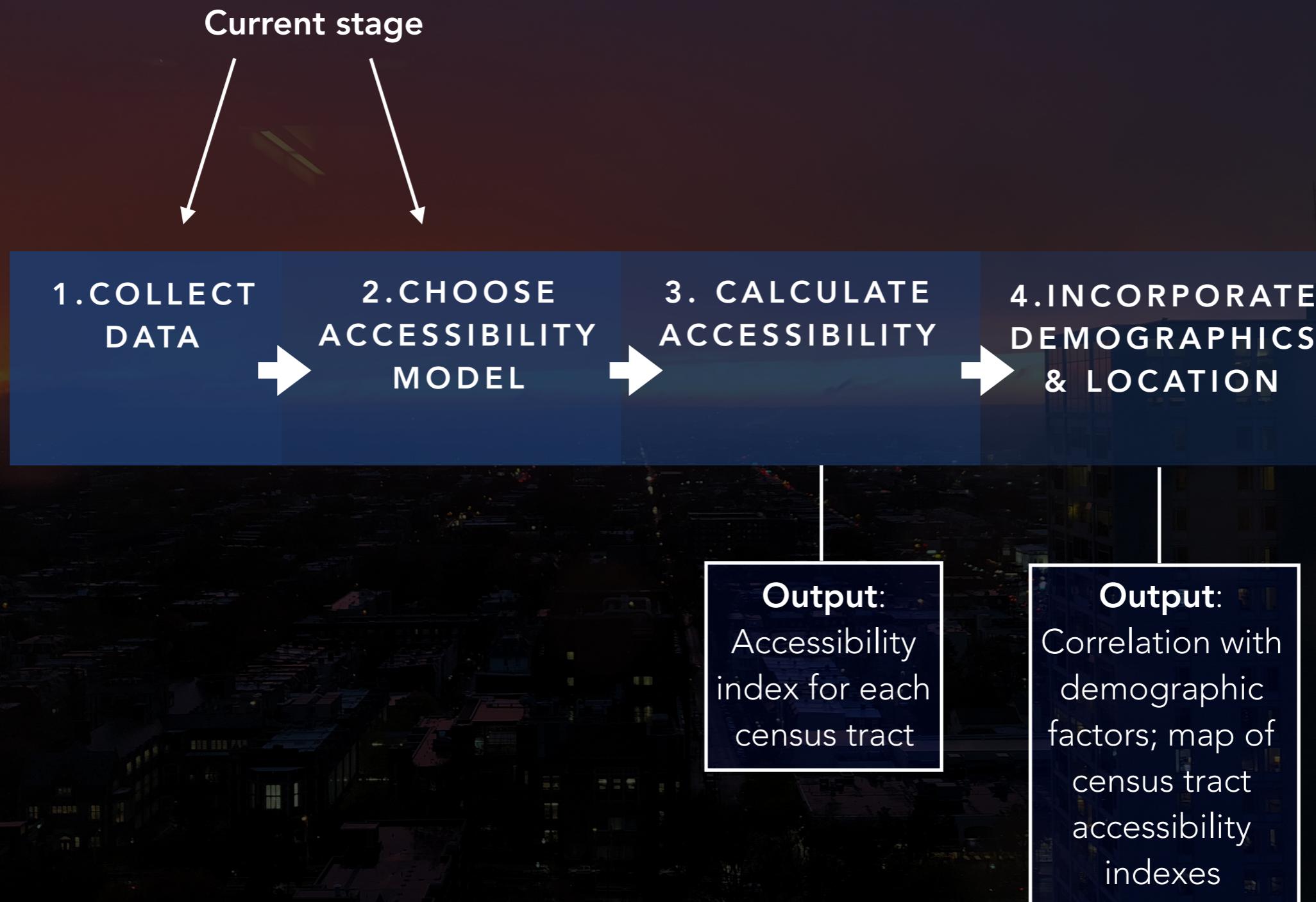
- Partners with 35 senior community centers to plan events and services that are free for individuals 65+



- Funds 27 senior community centers to provide activities, food, and service to individuals 65+ for free

SOURCE: [HTTPS://WWW.POLICYPMAP.COM/](https://www.policymap.com/)

# METHODOLOGY



# METHODOLOGY P1: DATA COLLECTION

Q1: How does the accessibility of senior centers via public transit vary across different census tracts in Philadelphia?

SENIOR  
CENTER  
ADDRESSES

OPEN  
STREET  
MAPS

GENERAL  
TRANSIT FEED  
SPECIFICATION

Q2: How do factors including gender, poverty status, and race correlate with older adults' accessibility to senior centers?

SENIOR  
CENTER  
ADDRESSES

OPEN  
STREET  
MAPS

GENERAL  
TRANSIT FEED  
SPECIFICATION

AMERICAN  
COMMUNITY  
SURVEY

# METHODOLOGY P2: ACCESSIBILITY MODELING

## 1. GRAVITY MODEL

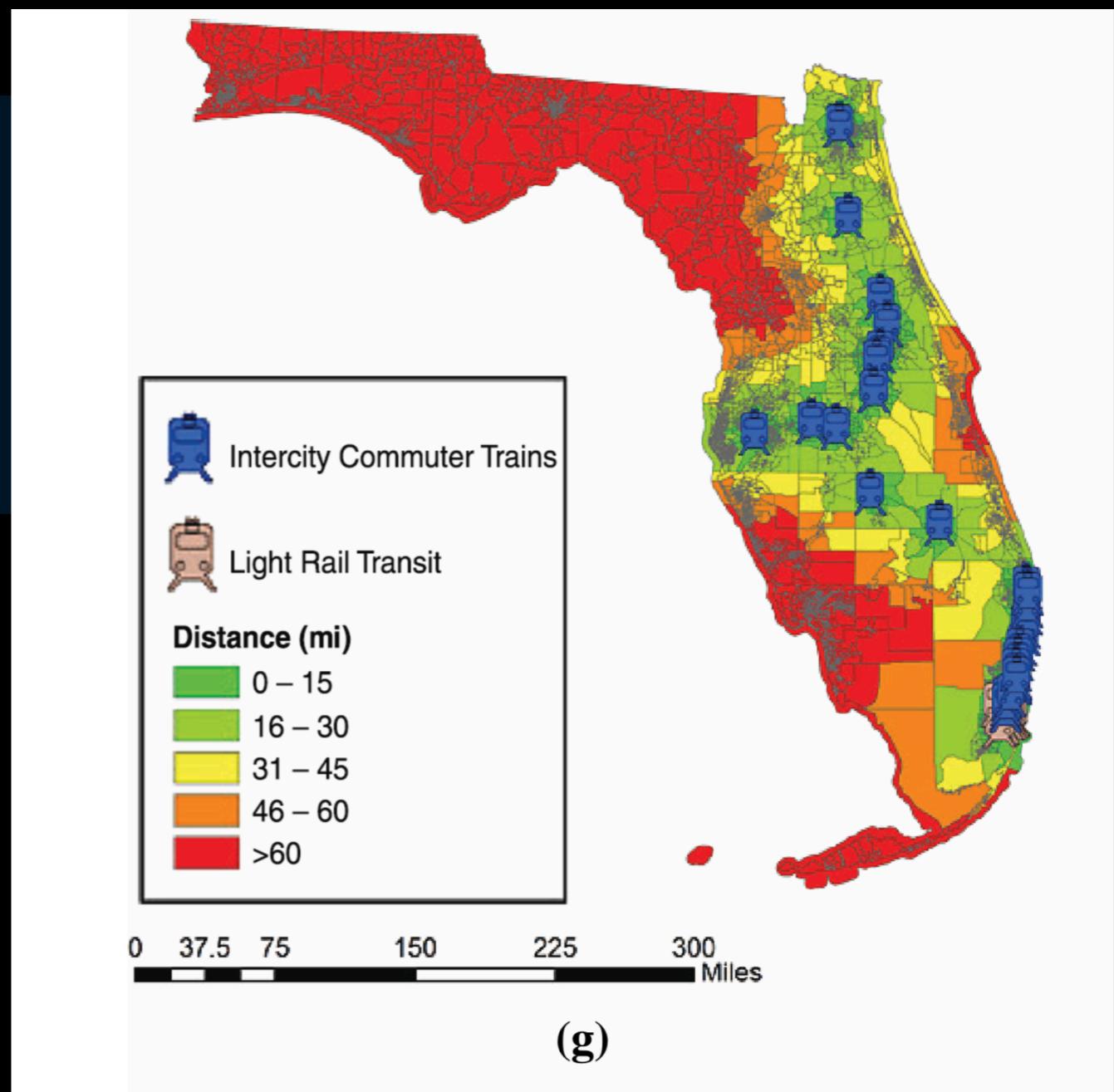
- Each census tract's average access to all Philadelphia senior centers
- Inputs: census tract centroid coordinates, OSM data, GTFS data\*, ACS
- Output: accessibility index for each census tract

### TYPICAL ACCESSIBILITY INDEX CALCULATION:

$$AT_i^w = \sum_j E_j^w e^{-\beta t_{ij}}$$

Accessibility at stop i  
Jobs in zone j with wage w  
 $\beta$ : impedance term  
 $t_{ij}$ : average peak period transit travel time in minutes, from stop i to zone j  
(Karner, 2018)

DISTANCE TO NEAREST RAIL TRANSIT STATION FROM CENSUS BLOCK GROUPS IN FLORIDA



(Ozel, Ozguven, Kocatepe, and Horner, 2016)

# METHODOLOGY P2: ACCESSIBILITY MODELING

ACCESSIBILITY TO EMPLOYMENT BY BUS AFTER TRANSPORTATION PROJECT, FOR 15, 30 AND 45 MINUTE TRIPS DEPARTING BETWEEN 7:15 AND 7:30 AM

## 2. CUMULATIVE OPPORTUNITIES MODEL

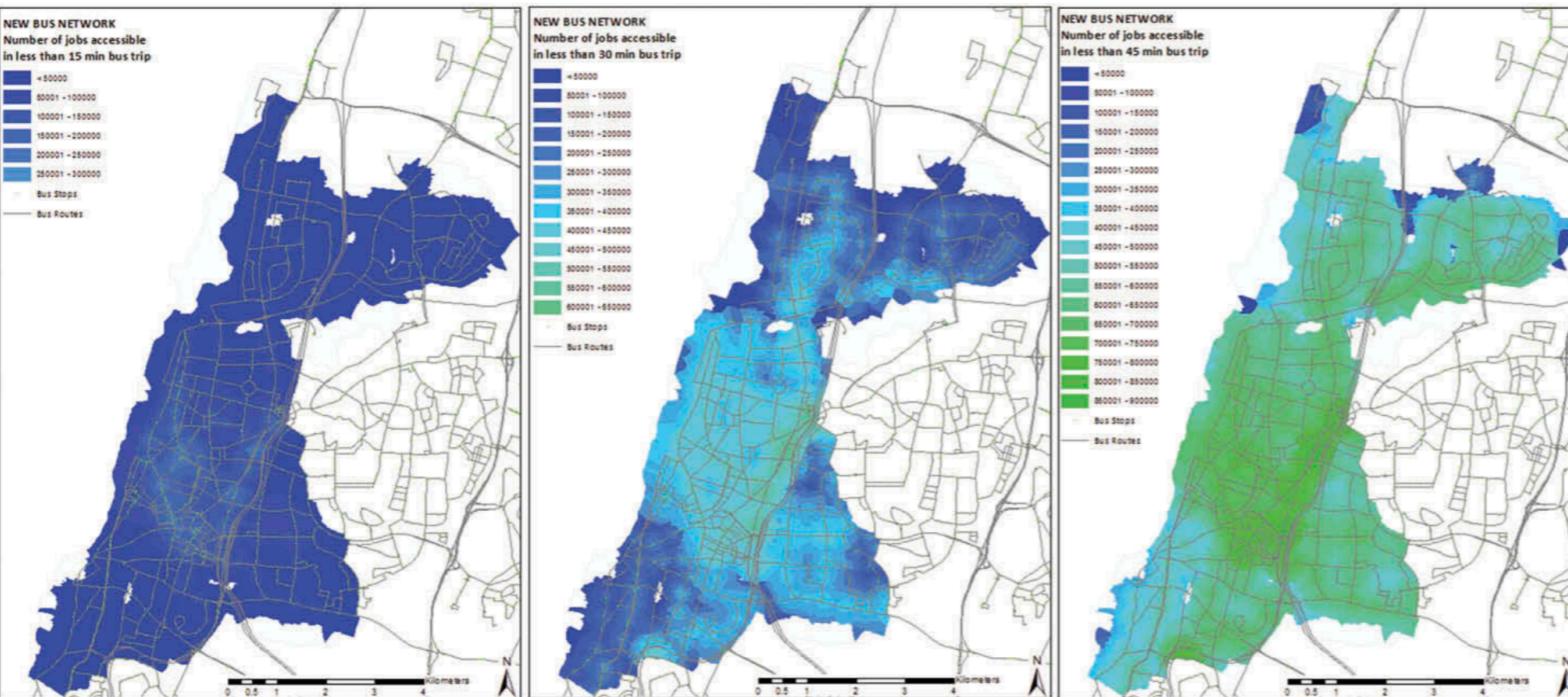


Figure 5. Accessibility to employment by bus, after the reform for 15 (left), 30 (center), and 45 (right) min trips departing between 07:15 and 07:30.

(Benenson, Ben-Elia, Rofé, And Geyzersky, 2016)

- Number of opportunities available within time thresholds
- Inputs: GIS layers (roads, transit modes, origins and destinations) Table: transit departure and arrival times for each stop
- Output: map of time-adjusted accessibility scores based on opportunities' temporal availability

# NEXT STEPS AND CHALLENGES

1. Selecting A Model
2. Incorporate Acs Data
3. Defining "Senior Center?"
4. Categorizing Older Adults By Physical Capability?

