Cognability: An ecological theory of neighborhoods and cognitive aging

Dr. Jessica Finlay

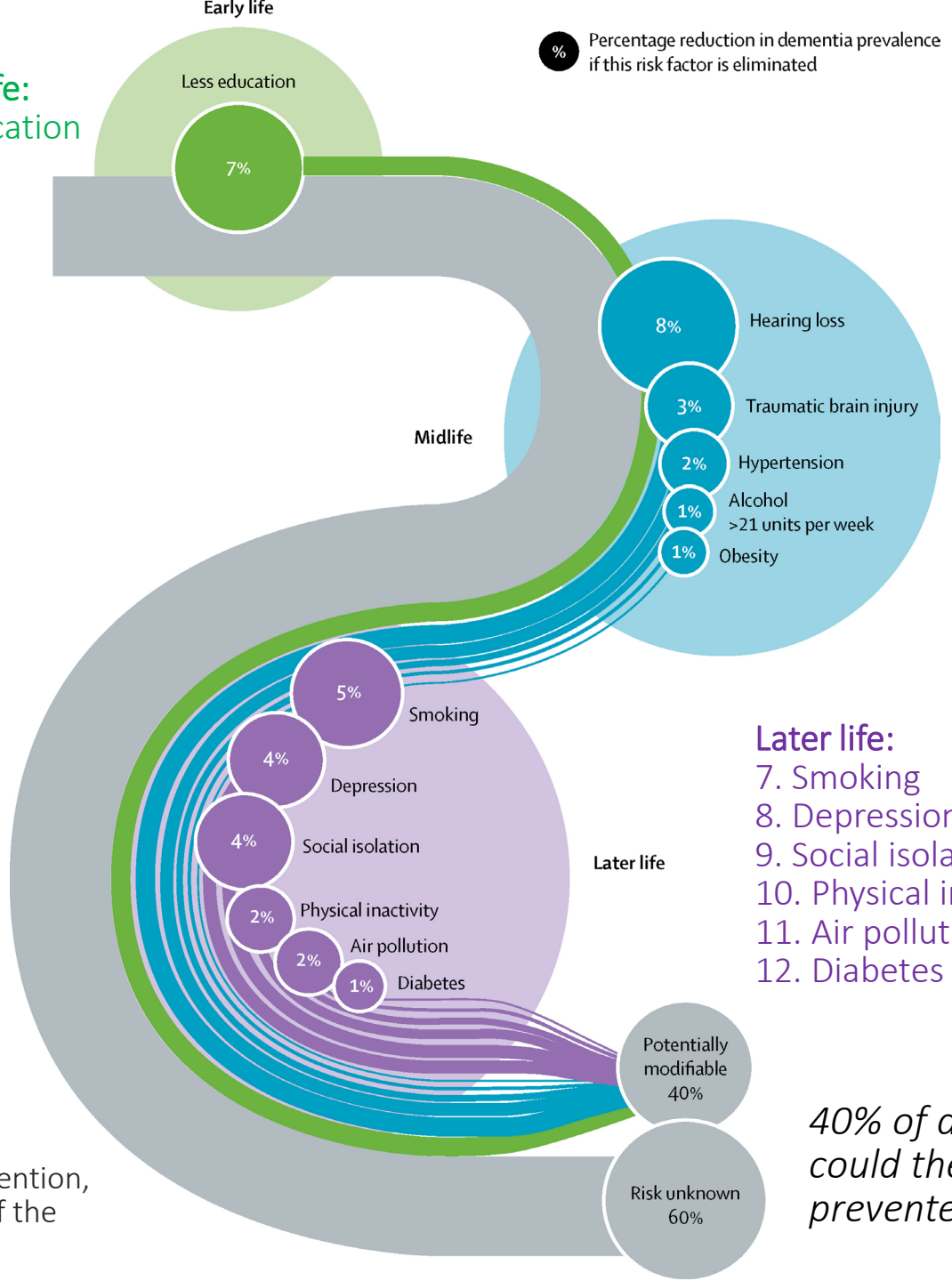
Assistant Professor
Department of Geography and Institute of Behavioral Science
jessica.finlay@colorado.edu • @jessica_finlay • www.jessicafinlay.com








Aging in the *Right* Place Study (Finlay fieldwork photos, 2015-2016)



Early life:
1. Education

Midlife:
2. Hearing loss
3. Head injury
4. Hypertension
5. Excessive alcohol
6. Obesity

Later life:
7. Smoking
8. Depression
9. Social isolation
10. Physical inactivity
11. Air pollution
12. Diabetes

How might environments structure these risk factors?

40% of dementia cases could theoretically be prevented or delayed

Livingston et al. 2020. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *The Lancet.*

SOCIAL ENVIRONMENT AND HEALTH
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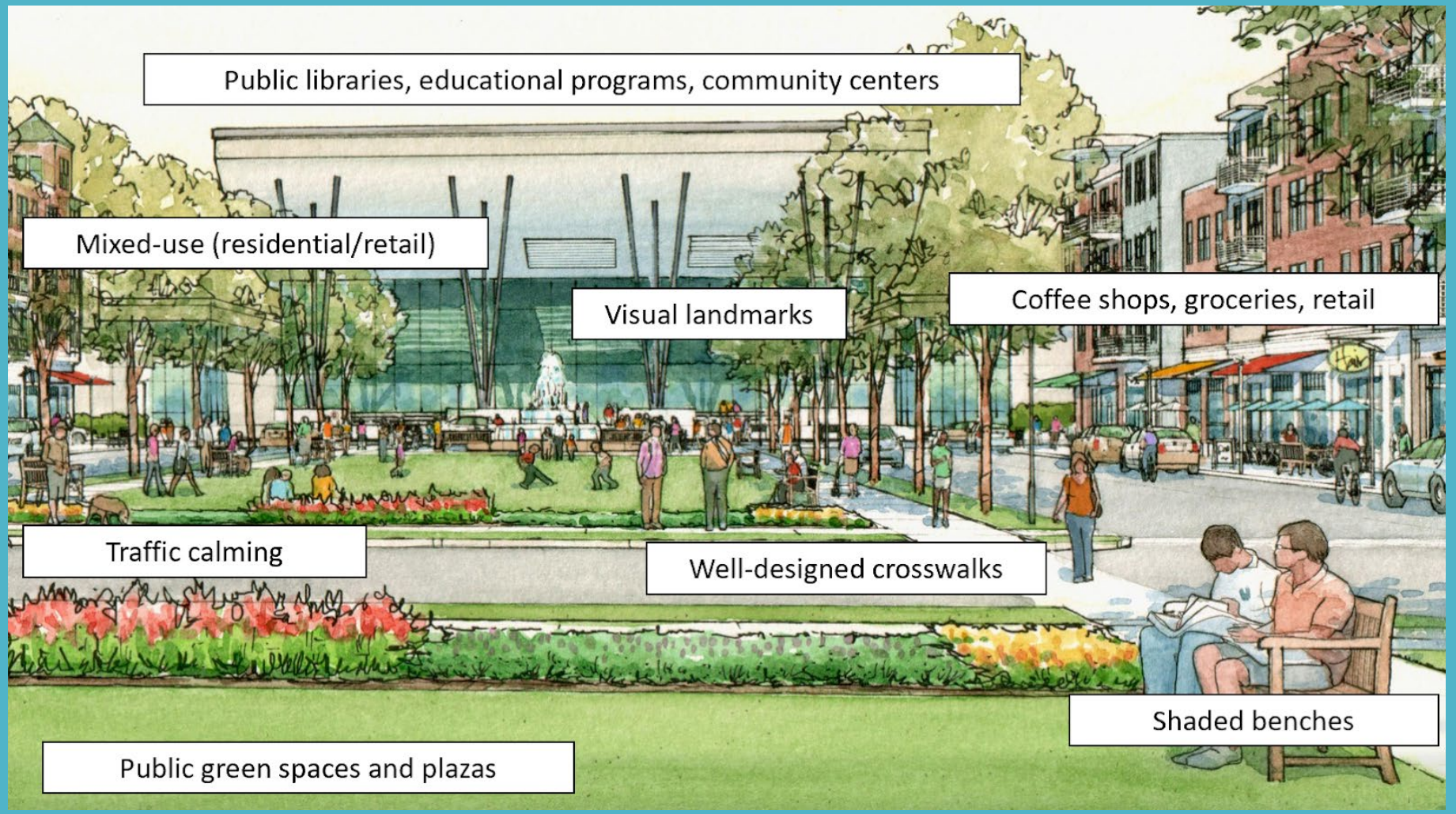
Cognability project

NIH/NIA grant 1RF1AG057540-01 (Clarke)
NIH/NIA Ruth L. Kirschstein National Research Service Award Individual Postdoctoral Fellowship F32 AG064815-01 (Finlay)
Michigan Institute for Clinical & Health Research (MICHR) Postdoctoral Translational Scholar Program (Finlay)
Michigan Alzheimer's Disease Research Center Early Career Investigator Mentorship Program (2021—2023)(Finlay)
NIH/NIA Pathway to Independence K00/R00 Award (1K99AG075152-01, 2022—2027)(Finlay)

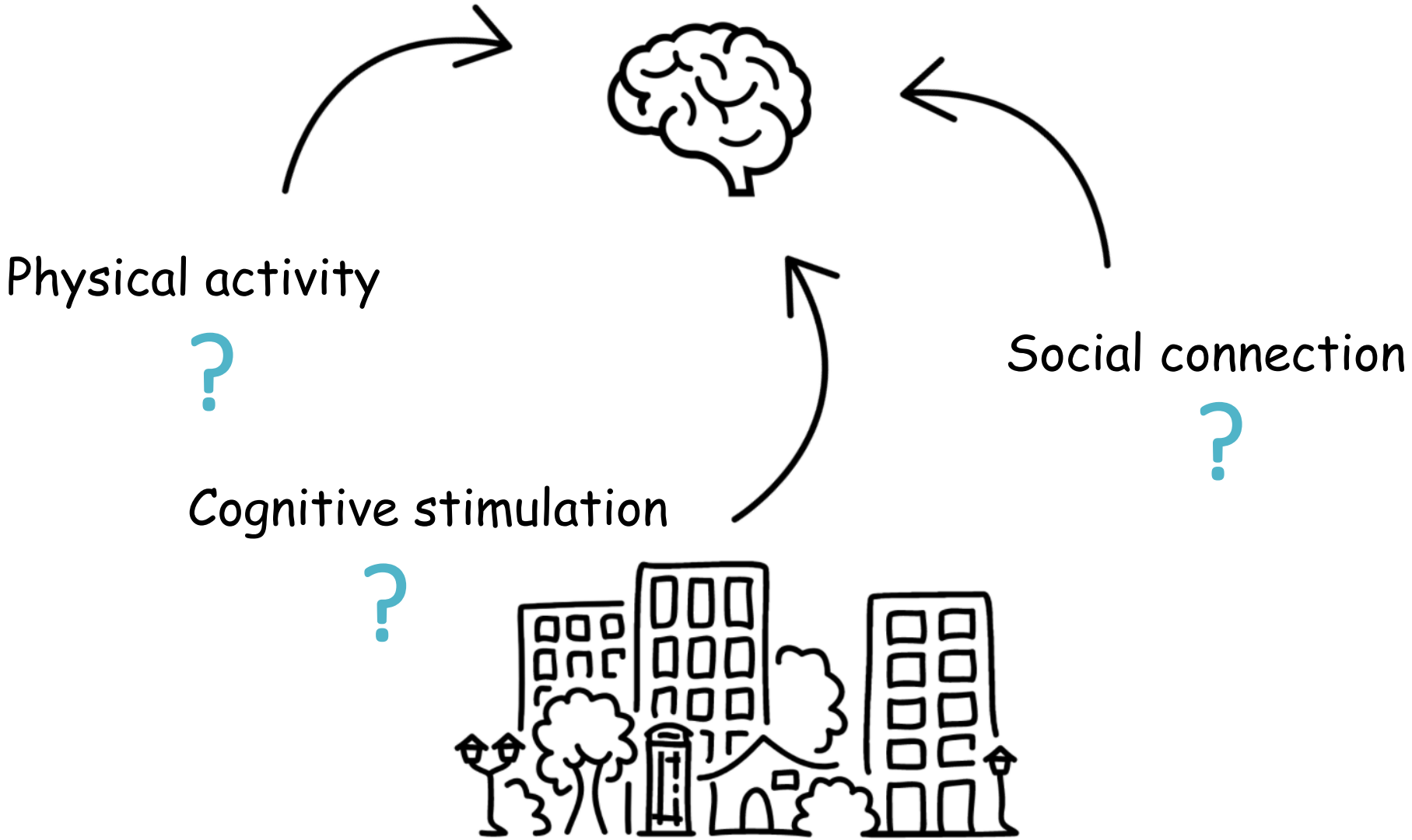


Early vision of Cognability, 2018

Cognability

A new theory of how supportive an area is to cognitive health through built and social environmental features that encourage physical activity, social connection, and cognitive stimulation in later life

Identify *specific* neighborhood features that may support healthy cognitive aging



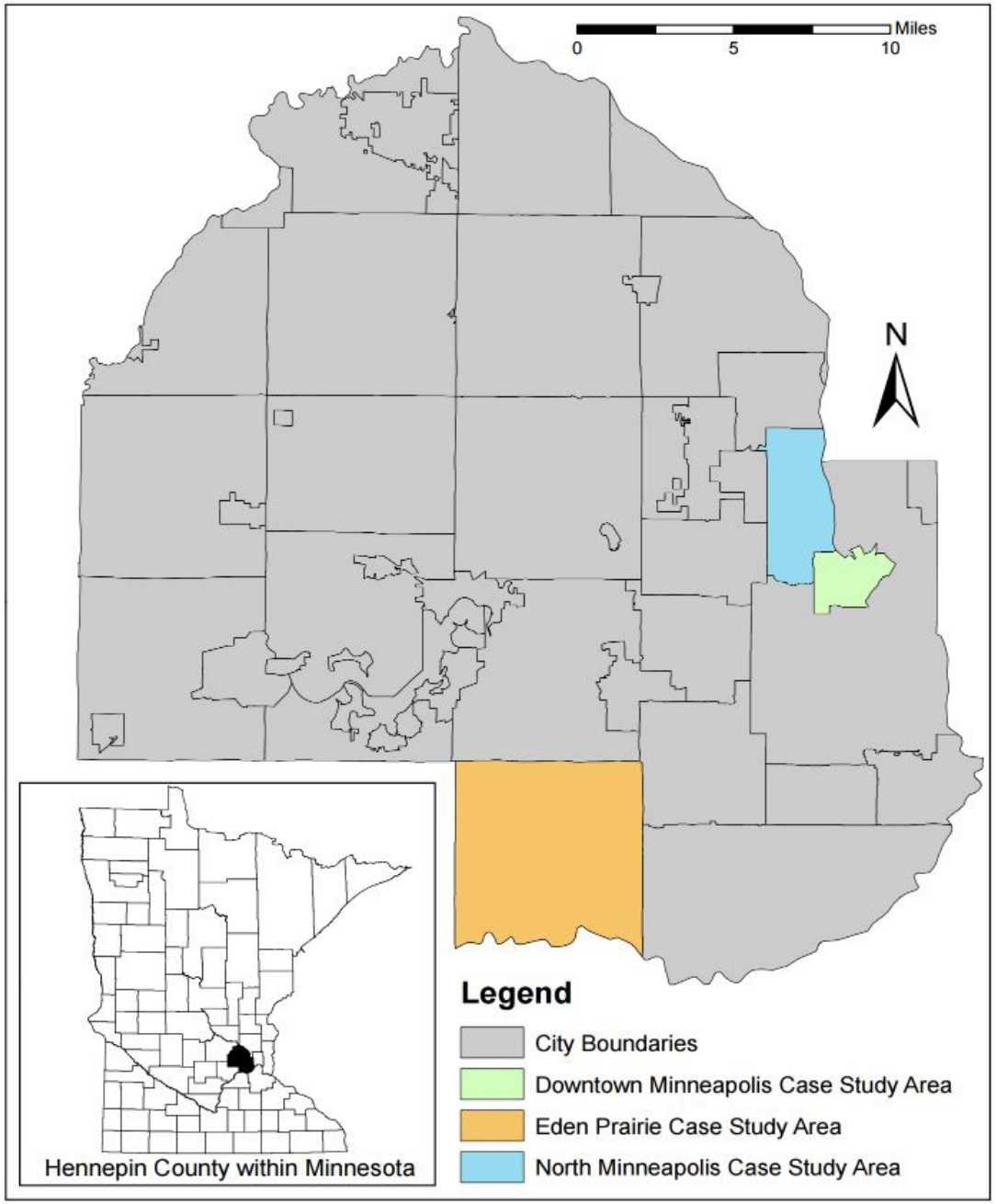
Mixed-methods approach

1) Qualitative: Where and how do older adults socialize, exercise, and engage in cognitively stimulating activities outside of their homes?

Aging in the Right Place (AIRP) Study

2) Quantitative: Is availability of and access to these neighborhood sites associated with cognitive function?

REasons for Geographic And Racial Differences in Stroke (REGARDS) Study



Finlay fieldwork photos (2015—2016)

AIRP Study

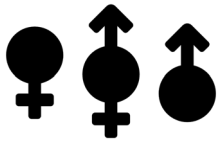
Qualitative Data Collection (2015—2016)

- 125 in-home seated interviews
  - *Subset:* 96 mobile interviews (a 'tour' of the home and neighborhood)
- Ethnography with a subset of 6 participants over 12 months

Finlay & Bowman. 2017. Geographies on the Move: A Practical and Theoretical Approach to the Mobile Interview. *The Professional Geographer.*

AIRP Qualitative sample (n=125)

Age:
71.3 years
± 7.8



Gender:
67% Female
33% Male

Race:
57% White
25% Black
18% Other*

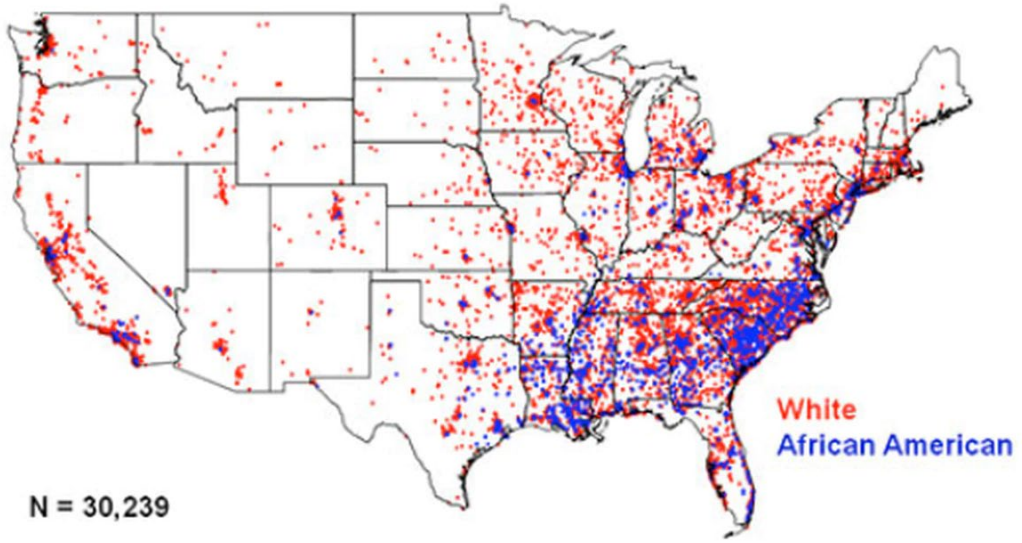
Marital:
34% Married
66% Not married

Education:
57% HS max
43% Some college +

* Other self-identified races and ethnicities include (in alphabetical order): African, American Indian, Arabic, Asian, Bohemian, French, German, Hispanic and Latinx, Irish, Jewish, Norwegian, Polish, Swedish

Quantitative REGARDS Study

- Over 30,000 non-Hispanic Black and white adults
- Ongoing since 2003
- Average age at baseline: 64 years
- Annual follow-up
  - Physical and mental health
  - Cognitive testing
  - Residential address tracking



Composite score

Language and Executive Function:

Animal Fluency

Letter Fluency

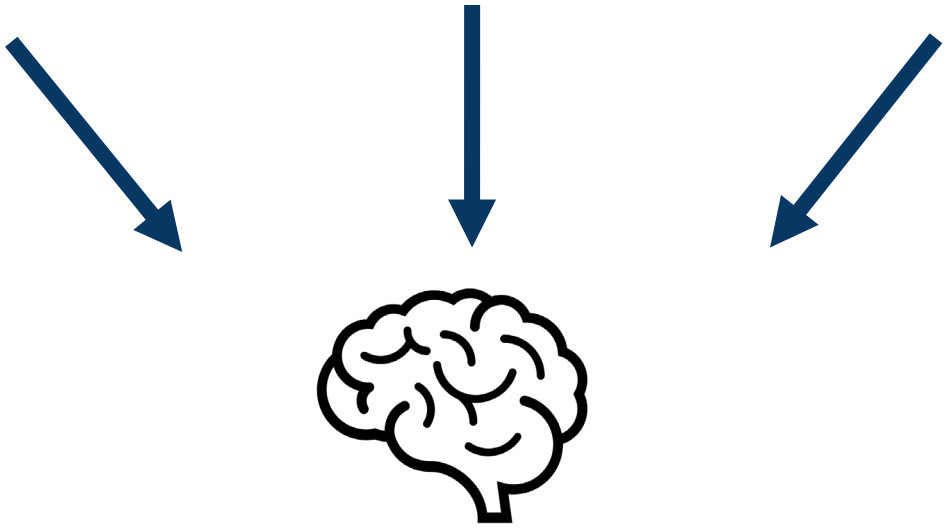
Learning and Memory:

World List Learning

Word List Delayed

Recall and Orientation:

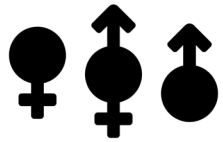
Montreal Cognitive Assessment (MoCA)



Global cognitive function

REGARDS Quantitative Sample (n=21,151*)

Age:
67 years
± 8.8



Gender:
56% Female
44% Male

Race:
60% White
40% Black

Education:
60% HS max
40% Some college +

Cognitive Function:
0.02
± 2.36

* Restricted quantitative sample to REGARDS participants living in metro areas to match the urban- and suburban-dwelling AIRP qualitative sample

Analysis

Dr. Michael Esposito

Qualitative (AIRP Study): thematic analysis

How and why did participants perceive and use their local environments?

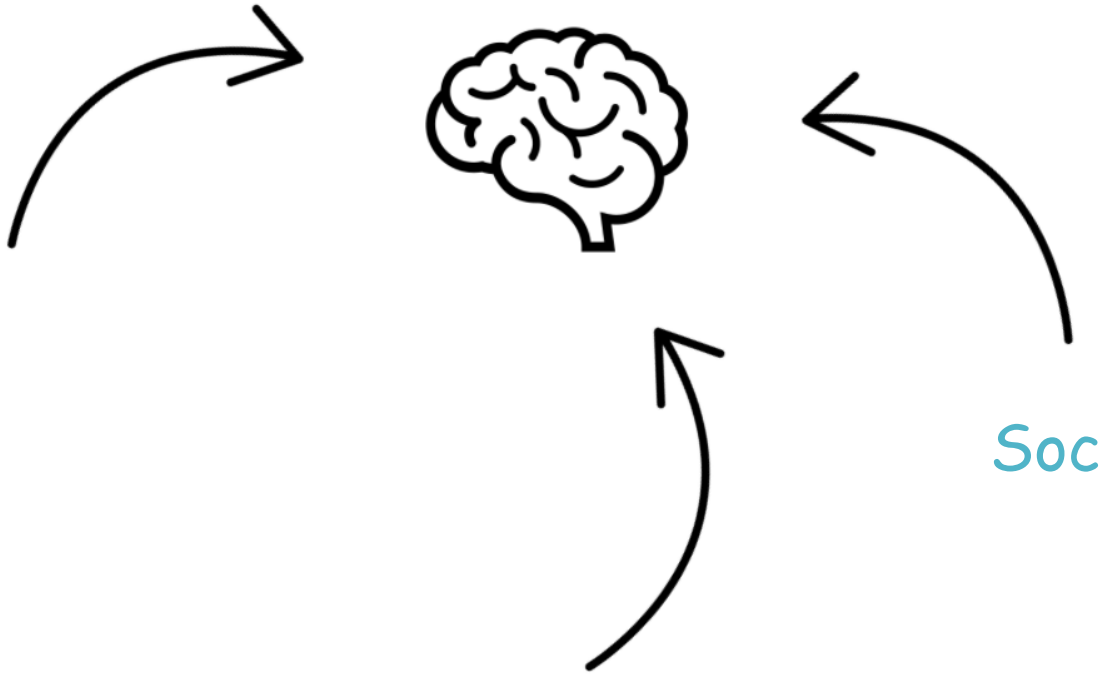
Quantitative (REGARDS Study): multilevel linear regression and generalized additive models

- Global cognitive function: composite score of 5 cognitive tests assessing language, executive function, learning, memory, orientation
- Neighborhood features: kernel density; individual buffers; census tracts
- REGARDS participants active 2006—2017
- Adjusted for individual- and area-level covariates

  Individual traits: Age, gender, race, education

  Census tract traits: population density, proportion living below the poverty line, proportion non-Hispanic Black residents

Cognability

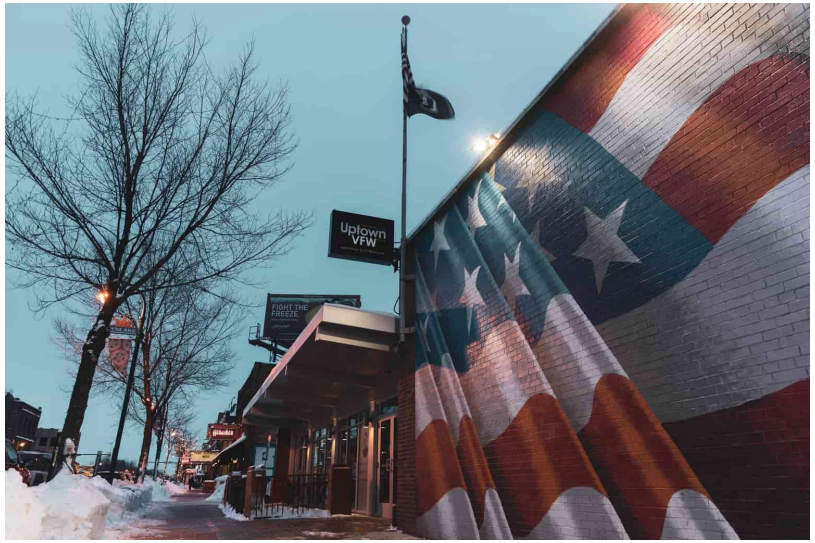


Social connection

?

Places for social connection and support

Senior centers



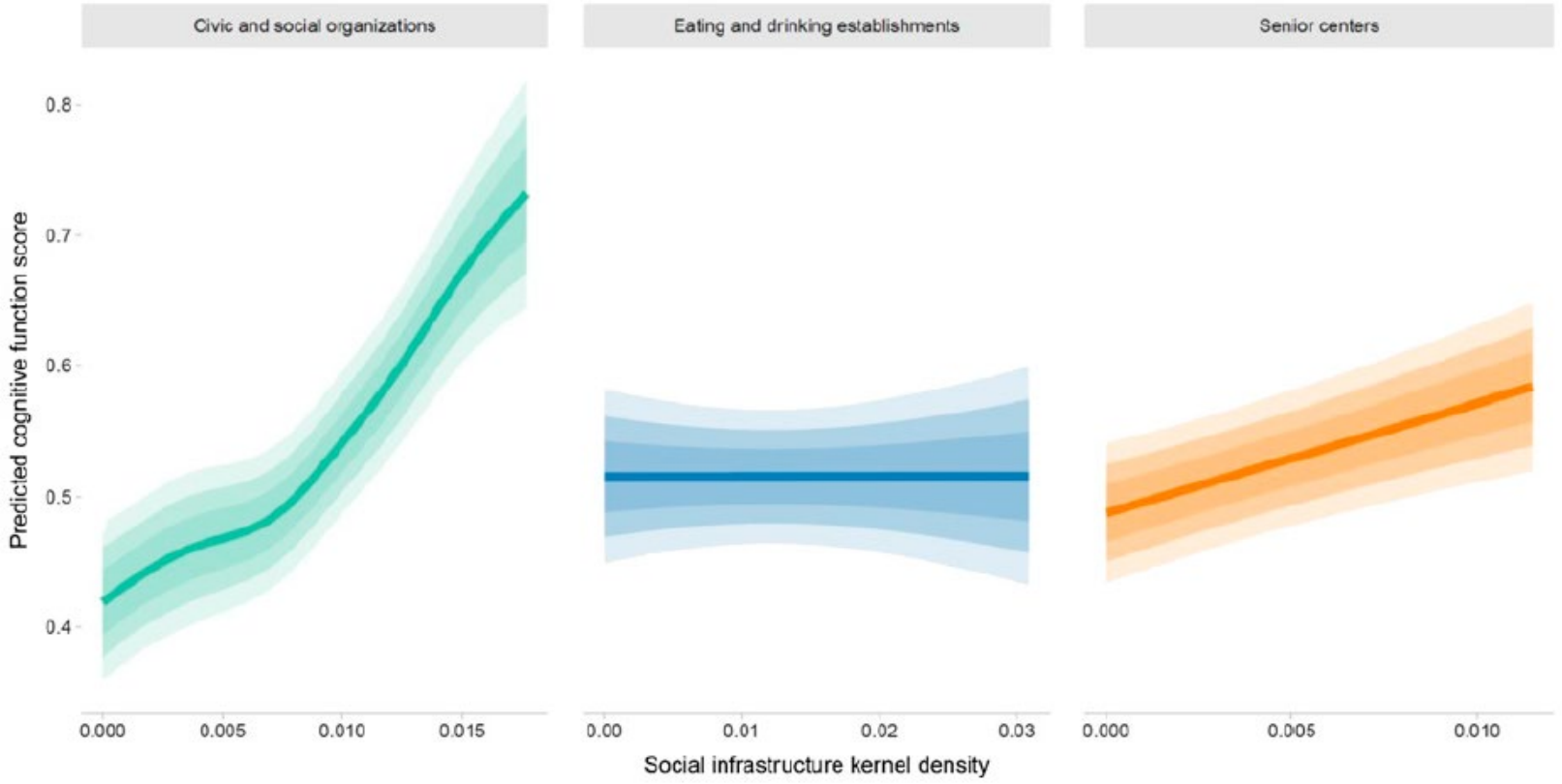
Civic/social organizations

Food & drinking places

Part I: Qualitative thematic analysis (AIRP Study)

Finlay et al. 2021. Can Neighborhood Social Infrastructure Modify Cognitive Function? A Mixed-Methods Study of Urban-Dwelling Aging Americans. *Journal of Aging and Health.*

Civic/social organizations and senior centers positively associated with cognitive function

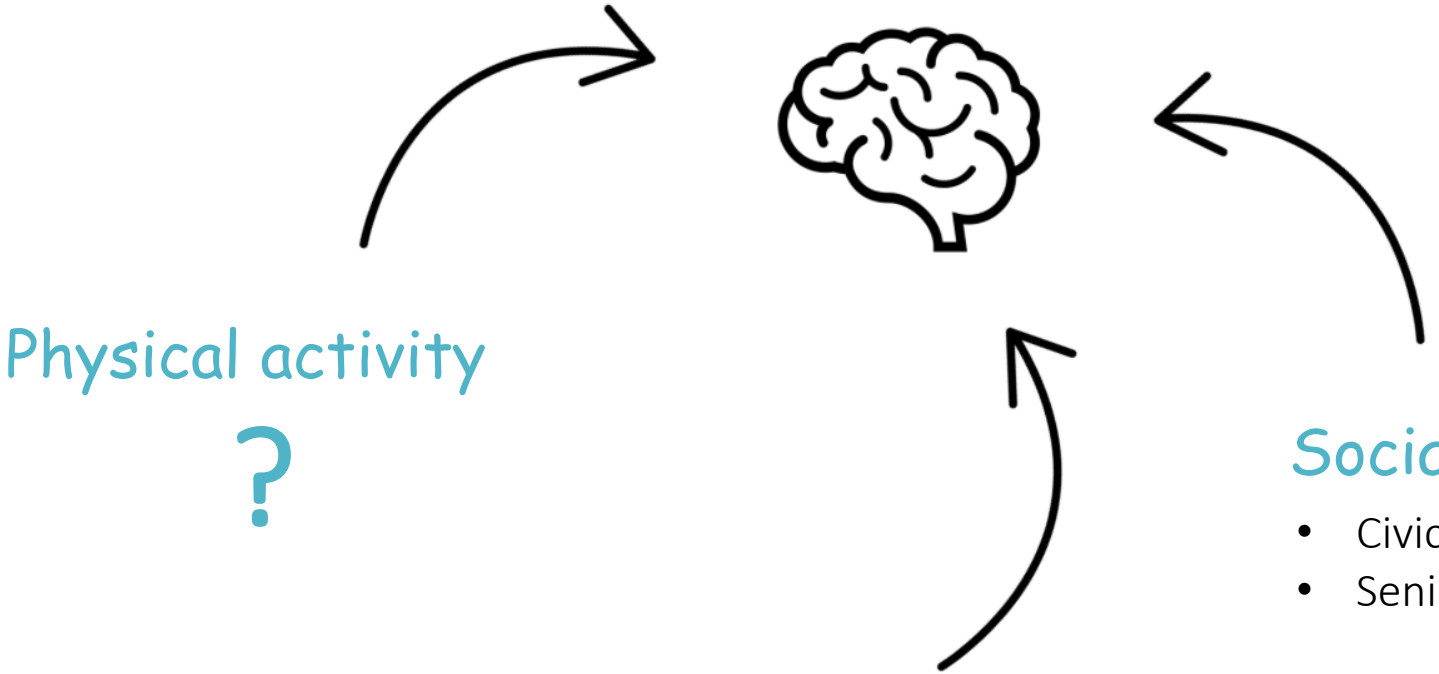


Part II: Gaussian generalized additive multilevel model (REGARDS Study)

Covariates: Individual-level (age, gender, race, education, marital status, years of follow-up since baseline) and area-level (census tract population density, proportion living below the poverty line, proportion non-Hispanic Black residents, proportion owner-occupied housing units)

Shading: 50%, 75%, and 90% uncertainty intervals

Cognability



Physical activity

?

Social connection

- Civic/social organizations
- Senior centers

Places for active aging

Walkable destinations

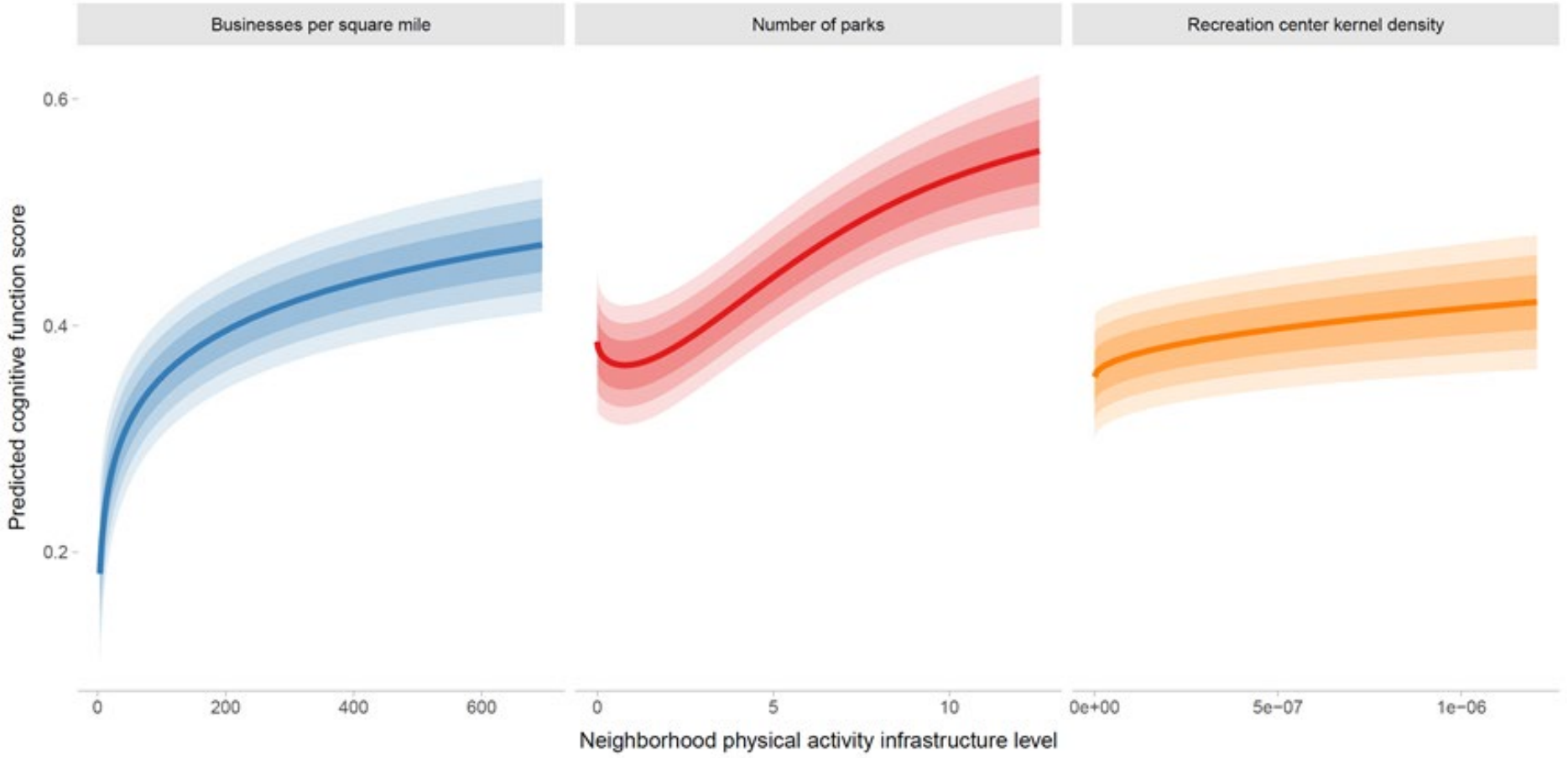
Parks

Recreation centers

Part I: Qualitative thematic analysis (AIRP Study)

Finlay et al. 2021. Neighborhood Active Aging Infrastructure and Cognitive Health: A Mixed-Methods Study of Aging Americans. *Preventive Medicine.*

Walkable destinations, parks, and recreation centers positively associated with cognitive function

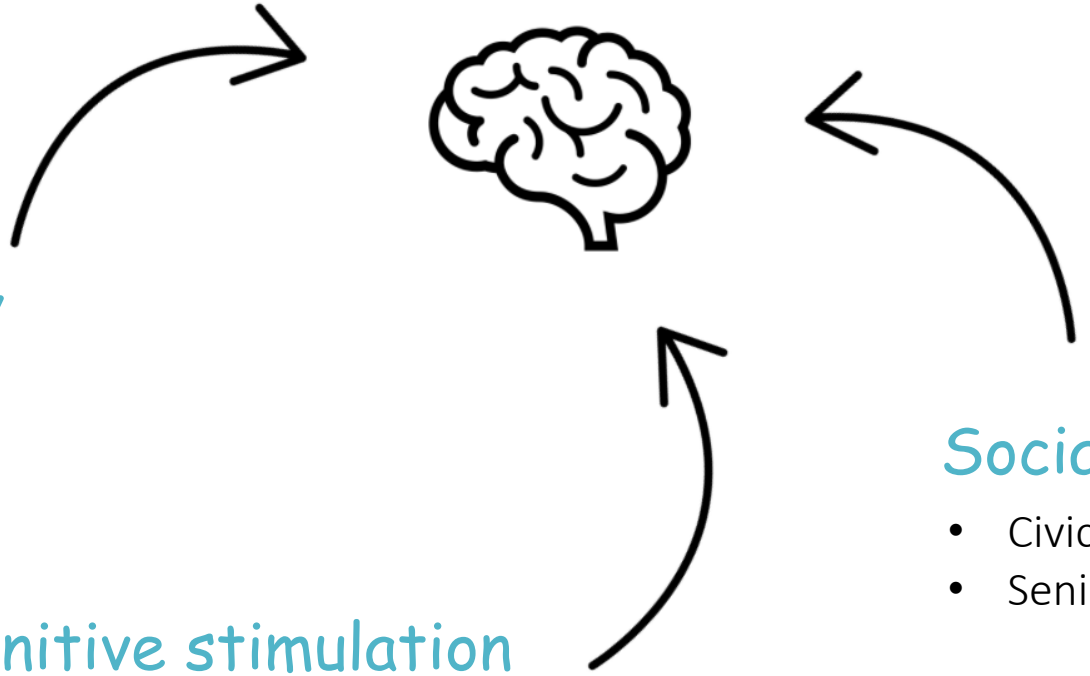


Part II: Generalized additive multilevel model (REGARDS Study)

Covariates: Individual-level (age, gender, race, education, years of follow-up since baseline) and area level (census tract population density, proportion living below the poverty line, proportion non-Hispanic Black residents, proportion owner-occupied housing units)

Shading: 50%, 75%, and 90% uncertainty intervals

Cognability



Physical activity

- Walkable destinations
- Parks
- Recreation centers

Social connection

- Civic/social organizations
- Senior centers

Cognitive stimulation

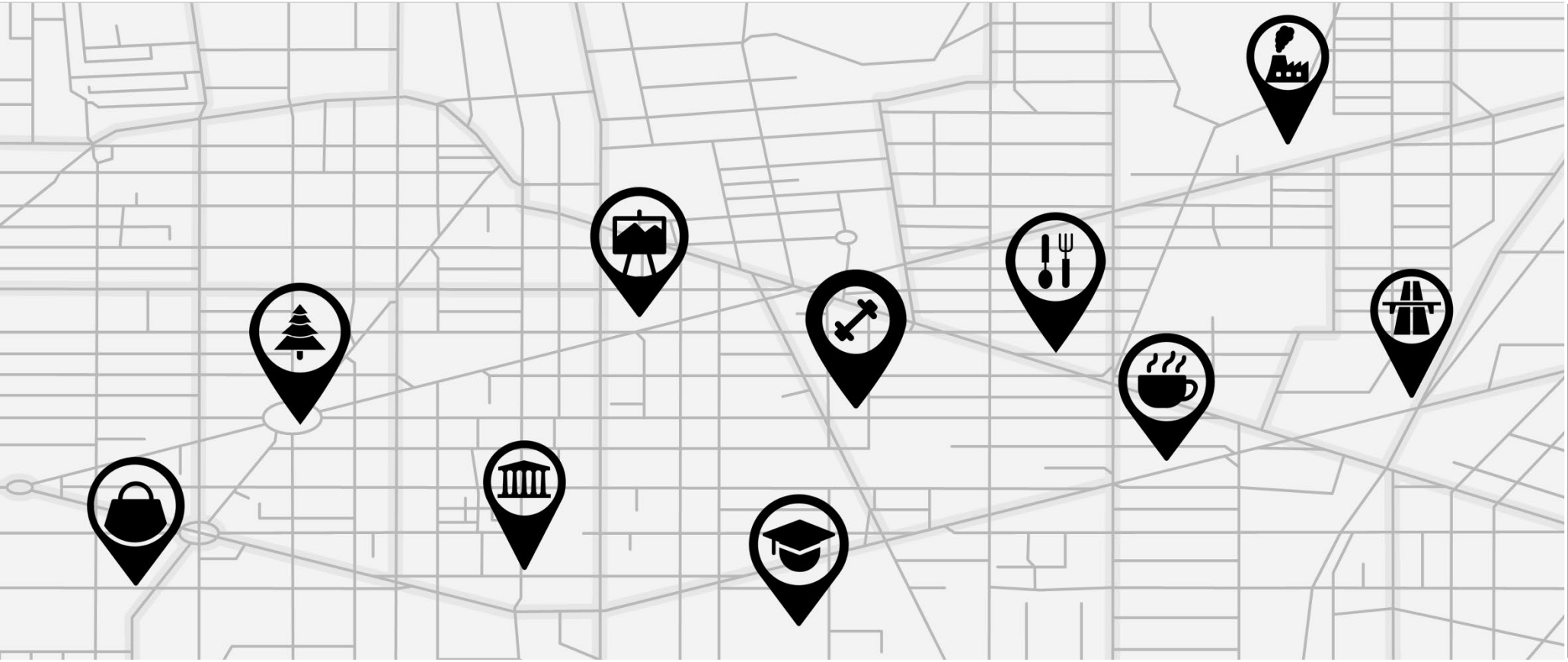
- Arts and cultural sites

Hazards

- Polluting sites
- Highways

Finlay et al. 2021. Neighborhood cognitive amenities? A mixed-methods study of intellectually-stimulating infrastructure and cognitive function among older Americans. *Wellbeing, Space & Society.* // Wu et al. 2023. Neighborhood 'disamenities'. *BMC Public Health.*

Whole-neighborhood model

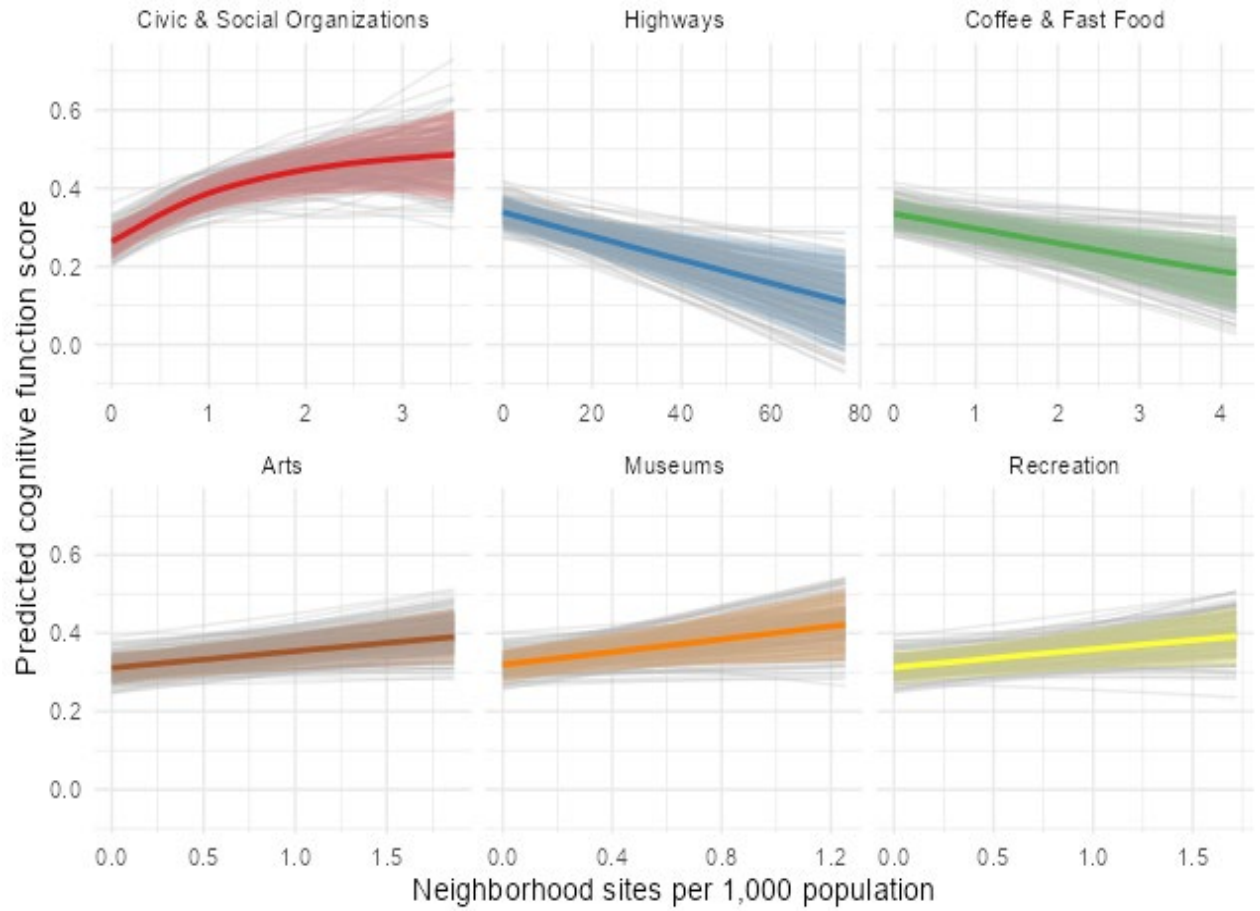


Neighborhood features:

- Civic and social orgs.
- Grocery stores
- Higher ed. campuses
- Highways
- Libraries
- Museums
- Parks
- Performing arts
- Polluters
- Recreation centers
- Religious organizations
- Senior centers

Finlay*, Esposito*, Langa, Judd & Clarke. 2022. 'Cognablity': An Ecological Theory of Neighborhoods and Cognitive Aging. *Social Science & Medicine.* (* co-first authors)

Civic/social organizations and highways most strongly associated with cognitive function



Gaussian generalized additive multilevel model (REGARDS Study)

Covariates: Individual-level (age, gender, race, education, years of follow-up since baseline) and area-level (census tract population density, proportion living below the poverty line, proportion non-Hispanic Black residents, proportion owner-occupied housing units)

Shading: 90% uncertainty intervals; 200 draws from the model plotted to further summarize uncertainty

Interaction models

Are neighborhood features more or less important to different sub-populations?

- Sites may be less accessible through structural racism, sexism, and classism

Model	AIC	$AIC_{Model\ X} - AIC_{Model\ 1}$
Model 1 (uniform)	287161.7	-
Model 2 (race-specific)	287172.7	11.0
Model 3 (gender-specific)	287192.9	31.2
Model 4 (education-specific)	287165.1	3.4

Akaike's Information Criterion (AIC) comparison of multiple candidate models of cognitive function score.
The column titled $AIC_{Model\ X} - AIC_{Model\ 1}$ summarizes the change in AIC between each model and Model 1.

Allowing the *full set* of neighborhood drivers of cognitive function to vary by race, gender, and education did not yield substantial improvements to the full-model

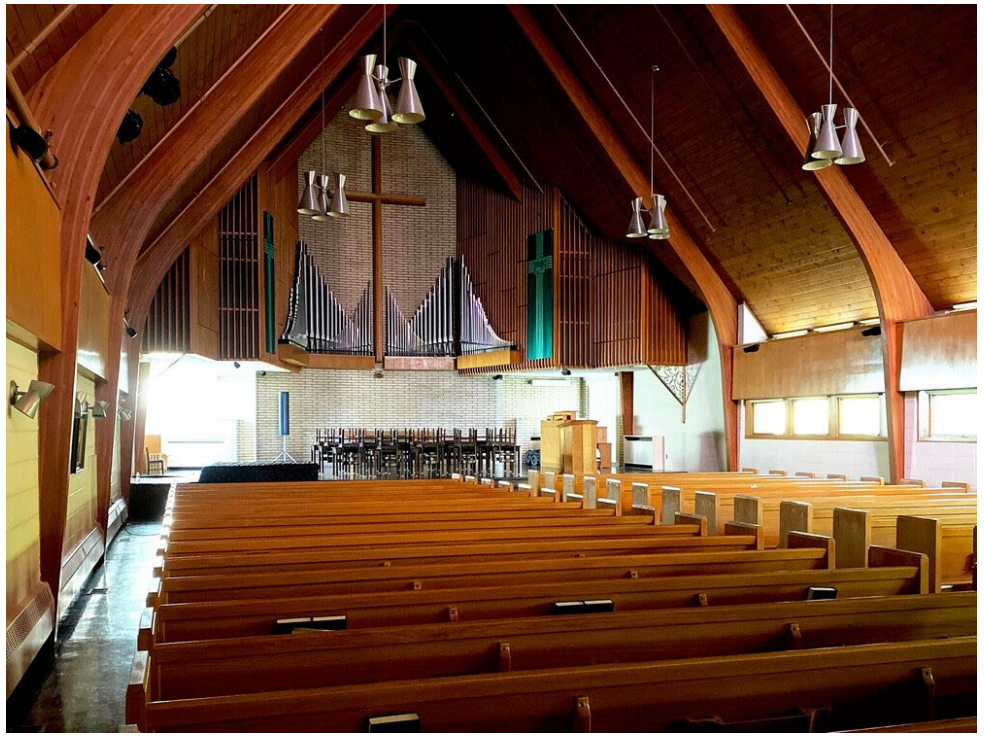
- Exploratory and therefore expensive analytical approach

Opportunity for theoretically motivated investigations

Some individual neighborhood features *did* differ significantly by group

- E.g., religious organization density was significantly and positively associated with cognitive health among Black adults

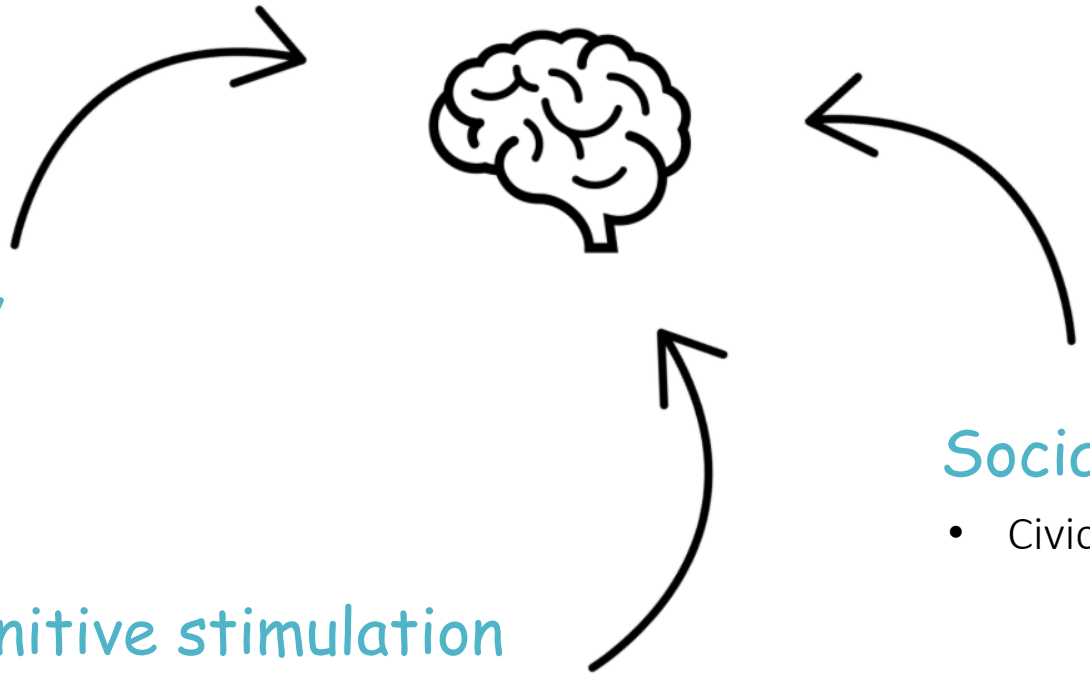
Avoid altering our original tests or "backfitting" hypotheses to match results



https://www.gospellifemn.org/

Taylor et al. 2017. Church-Based Exchanges of Informal Social Support among African Americans. *Race and Social Problems.*

Cognability



Physical activity

- Recreation centers

Social connection

- Civic/social organizations

Cognitive stimulation

- Performing art theaters
- Museums

Hazards

- Fast-food
- Highways

COGNABILITY

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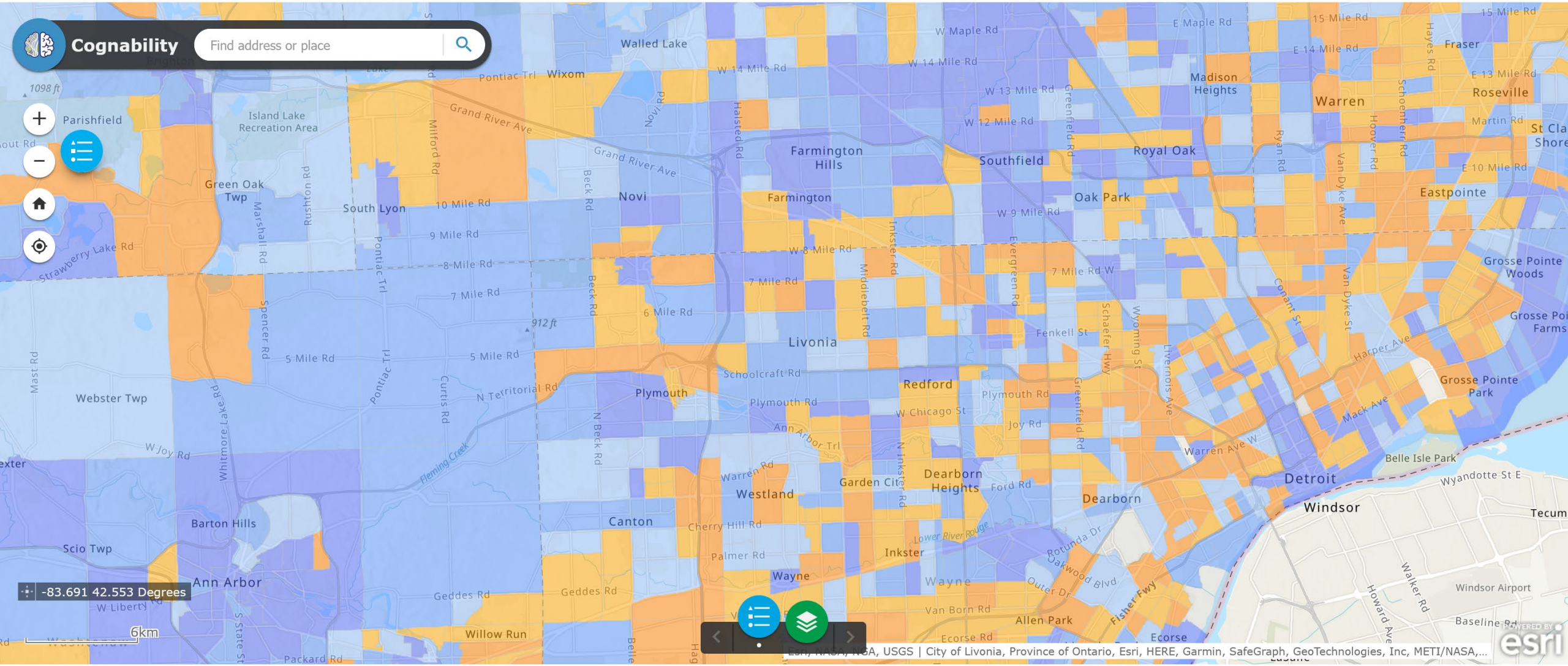


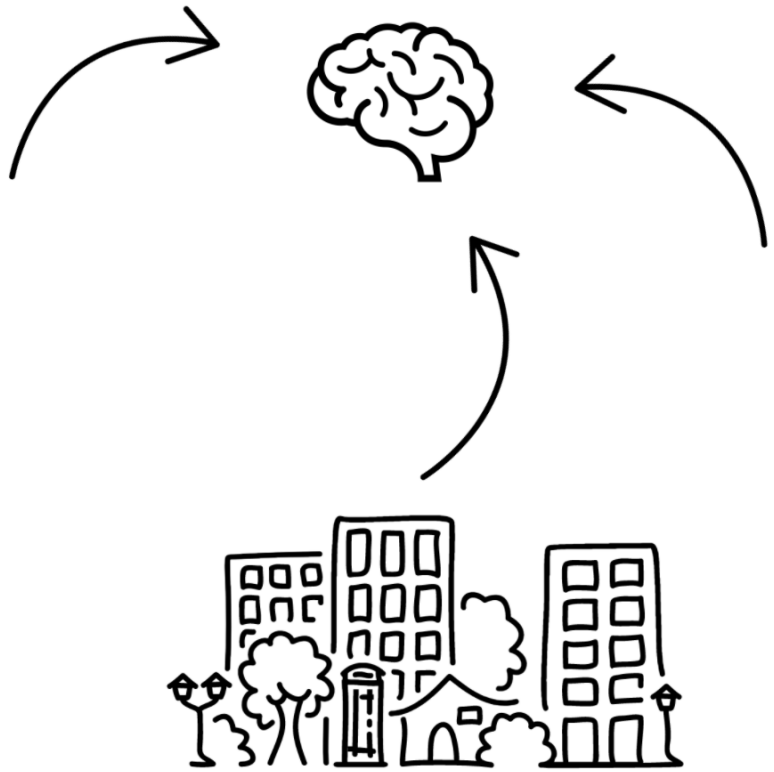
https://cognability.isr.umich.edu/

Next steps: Validate and extend Cognability

Test Cognability in the nationally-representative Health and Retirement Study (HRS)

Advance understanding

- Earlier-life environments and exposures ("life course Cognability")
- Gene—environment interactions
- Rural communities
- International contexts
- Perceived social environments and expectations/norms



NIH/NIA Pathway to Independence K00/R00 Award (1K99AG075152-01, 2022—2027)
Michigan Alzheimer's Disease Research Center Early Career Investigator Mentorship Program (2021—2023)

Cognability 2.0?

Fundamental changes since the COVID-19 pandemic onset

Mixed-methods analyses to understand long-term changes to neighborhood landscapes and ways of aging in place

References:

Finlay & Bowman. 2017. Geographies on the Move: A Practical and Theoretical Approach to the Mobile Interview. *The Professional Geographer.* https://doi.org/10.1080/00330124.2016.1229623

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Taylor et al. 2017. Church-Based Exchanges of Informal Social Support among African Americans. *Race and Social Problems.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5344191/

Wu et al. 2023. Neighborhood 'disamenities'. *BMC Public Health.* https://pubmed.ncbi.nlm.nih.gov/36717795/

Thank you!

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