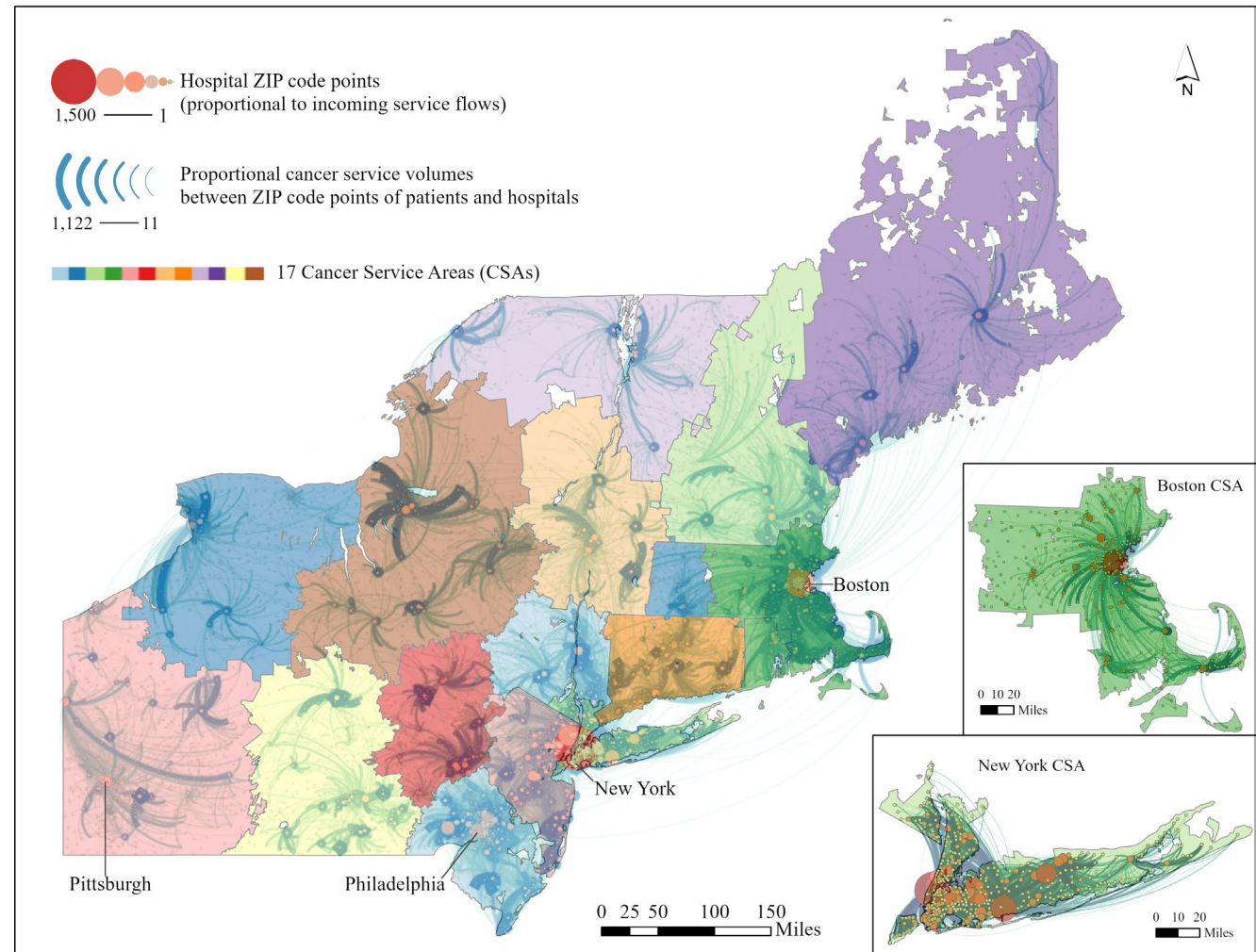


GIS Automated Delineation of **Cancer Service Areas**: From Discrete to Overlapping

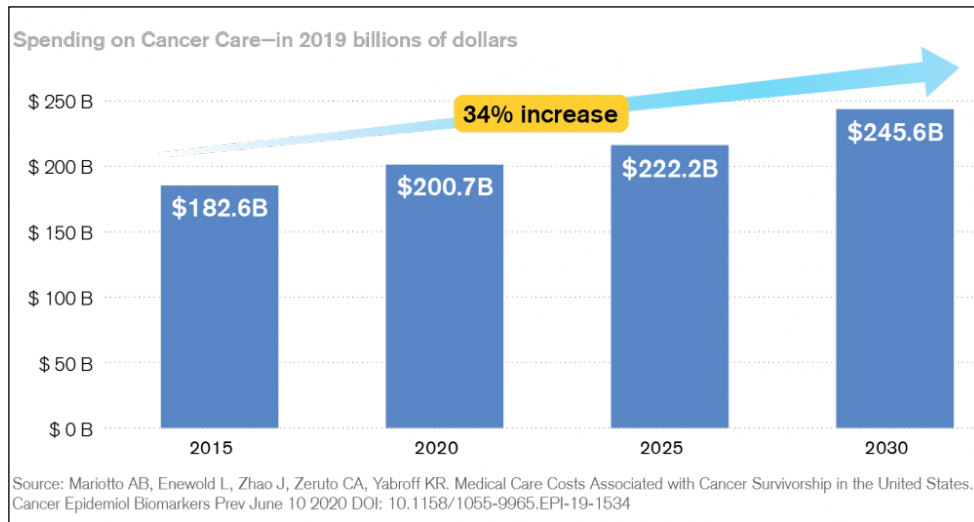
Changzhen Wang, PhD

Assistant Professor
Department of Geography
The University of Alabama



Discrete CSAs

Challenges in Cancer Care



High Mortality & Cost

Which U.S. Population Groups Experience Cancer Health Disparities?

According to the National Cancer Institute cancer health disparities in the United States are adverse differences in cancer measures such as number of new cases, number of deaths, cancer-related health complications, survivorship and quality of life after cancer treatment, screening rates, and stage at diagnosis that exist among certain population groups including:

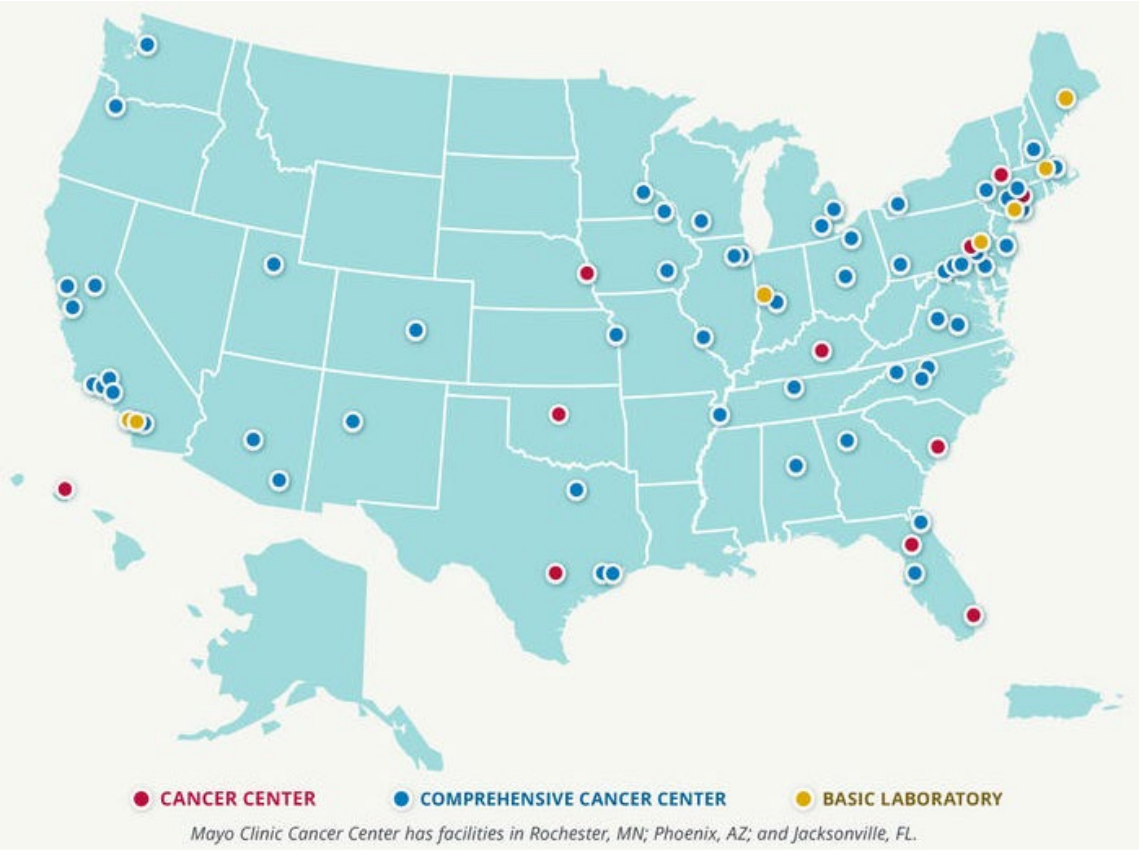
racial and ethnic minority groups; 	individuals of different ancestry; 	individuals of low socioeconomic status; 	individuals with disabilities;
individuals who lack or have limited health insurance coverage; 	residents in certain geographic locations, including rural areas; 	members of the lesbian, gay, bisexual, and transgender community; 	immigrants;
refugees or asylum seekers; 	adolescents and young adults; and 	the elderly. 	

American Association for Cancer Research (AACR) Cancer Disparities Progress Report 2020

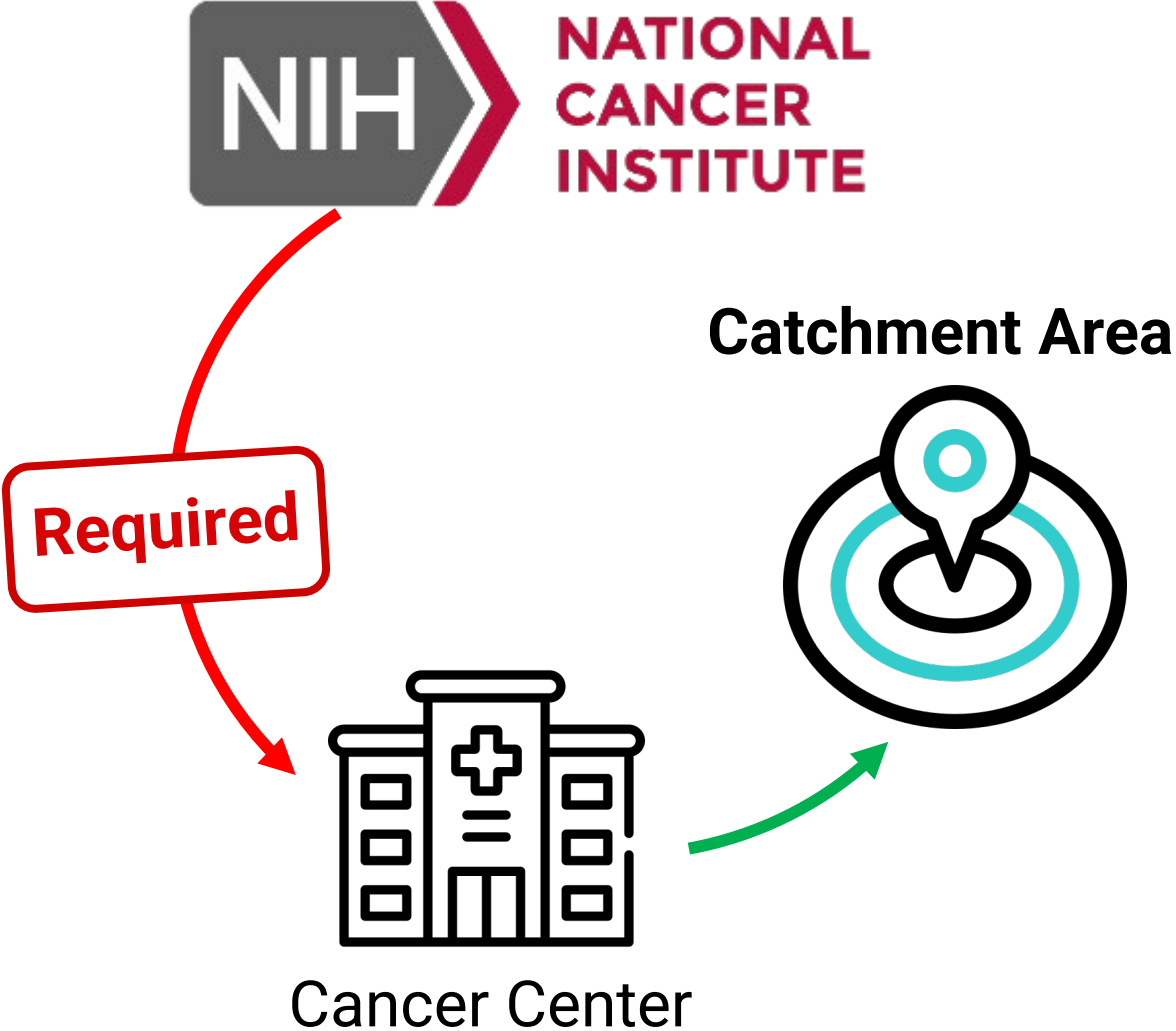
Persistent Cancer Disparities

National Cancer Institute (NCI)'s Mandate

NCI-Designated Cancer Centers

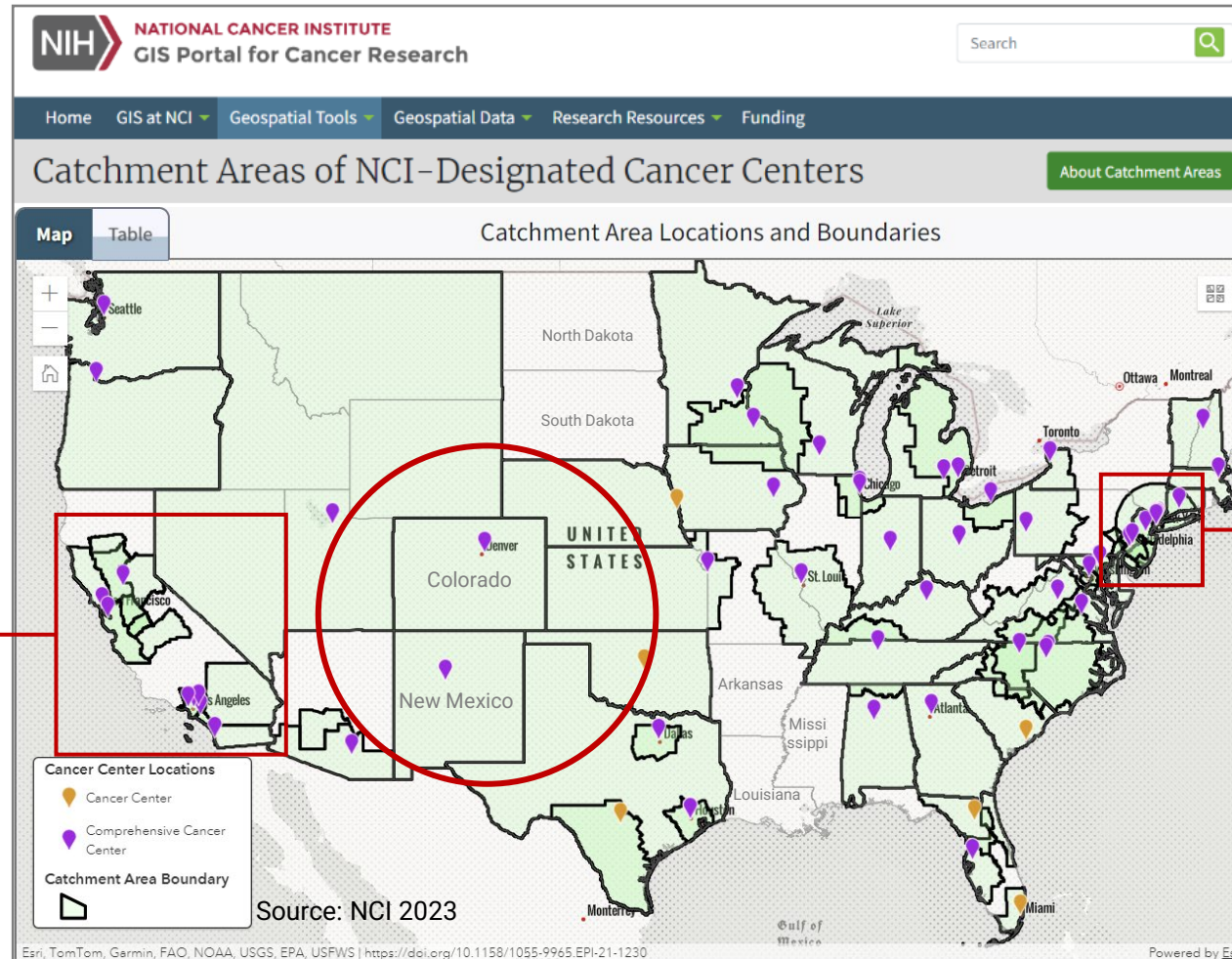
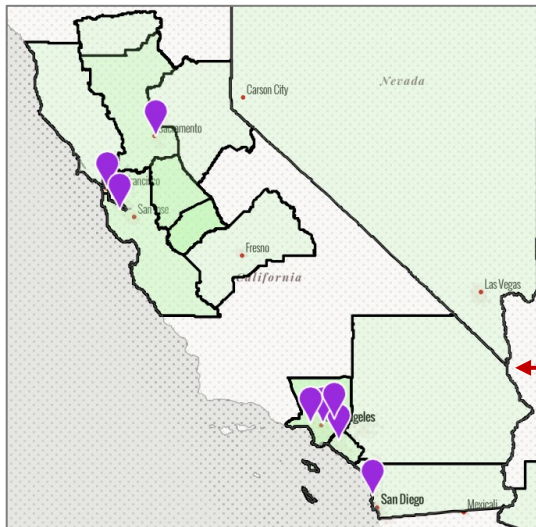


Source: NCI 2024

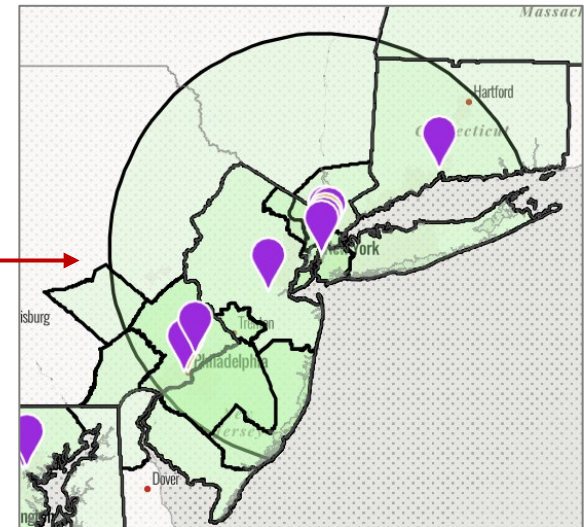


NCI Catchment Area (CA)

Overlapping CA

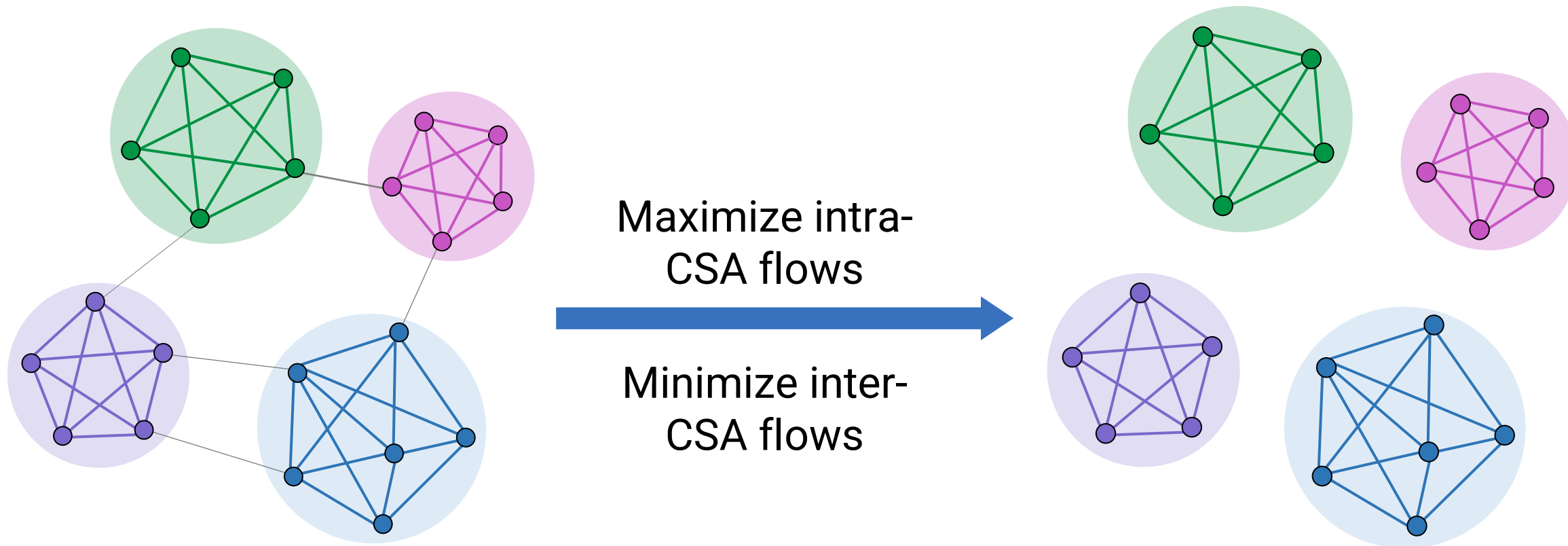


Overlapping CA



Source: DelNero et al. (2022)

ScLeiden Method to Delineate Discrete CSAs



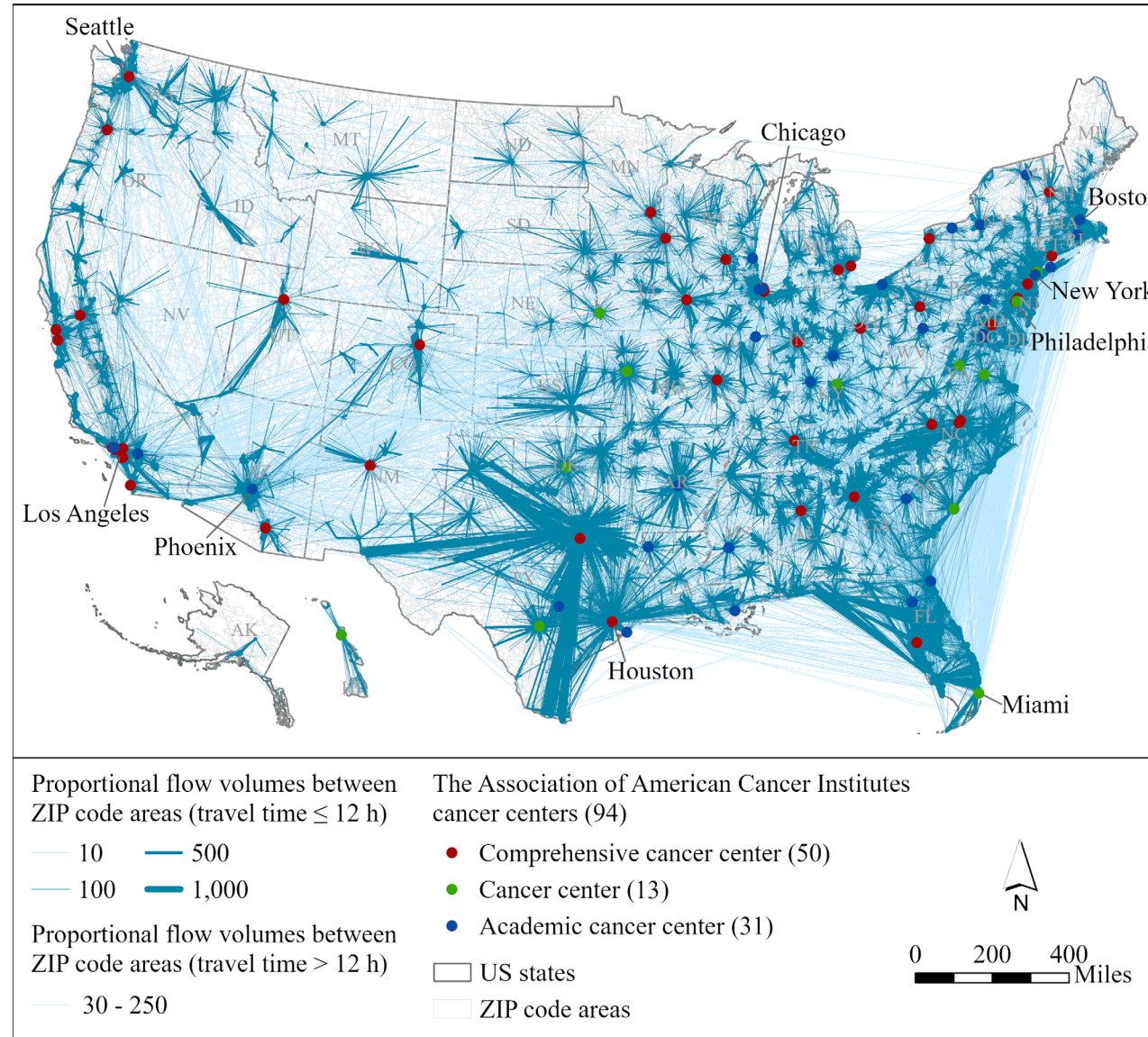
  CSA (e.g., densely connected subnetwork)

Legend     Node (e.g., ZIP code of cancer patients, ZIP code of cancer centers)

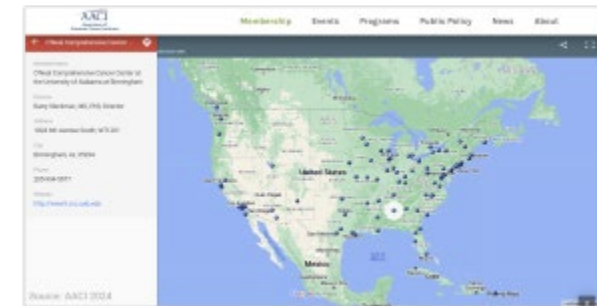
 Edge (e.g., number of services)

Cancer Care Utilization Data

Medicare enrollment and claims for **Cancer** from **CMS** (*Centers for Medicare and Medicaid Services*) (2014–2015)

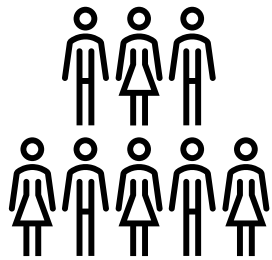


AACI Cancer Centers



Source: Wang et al. (2022)

110 Discrete CSAs



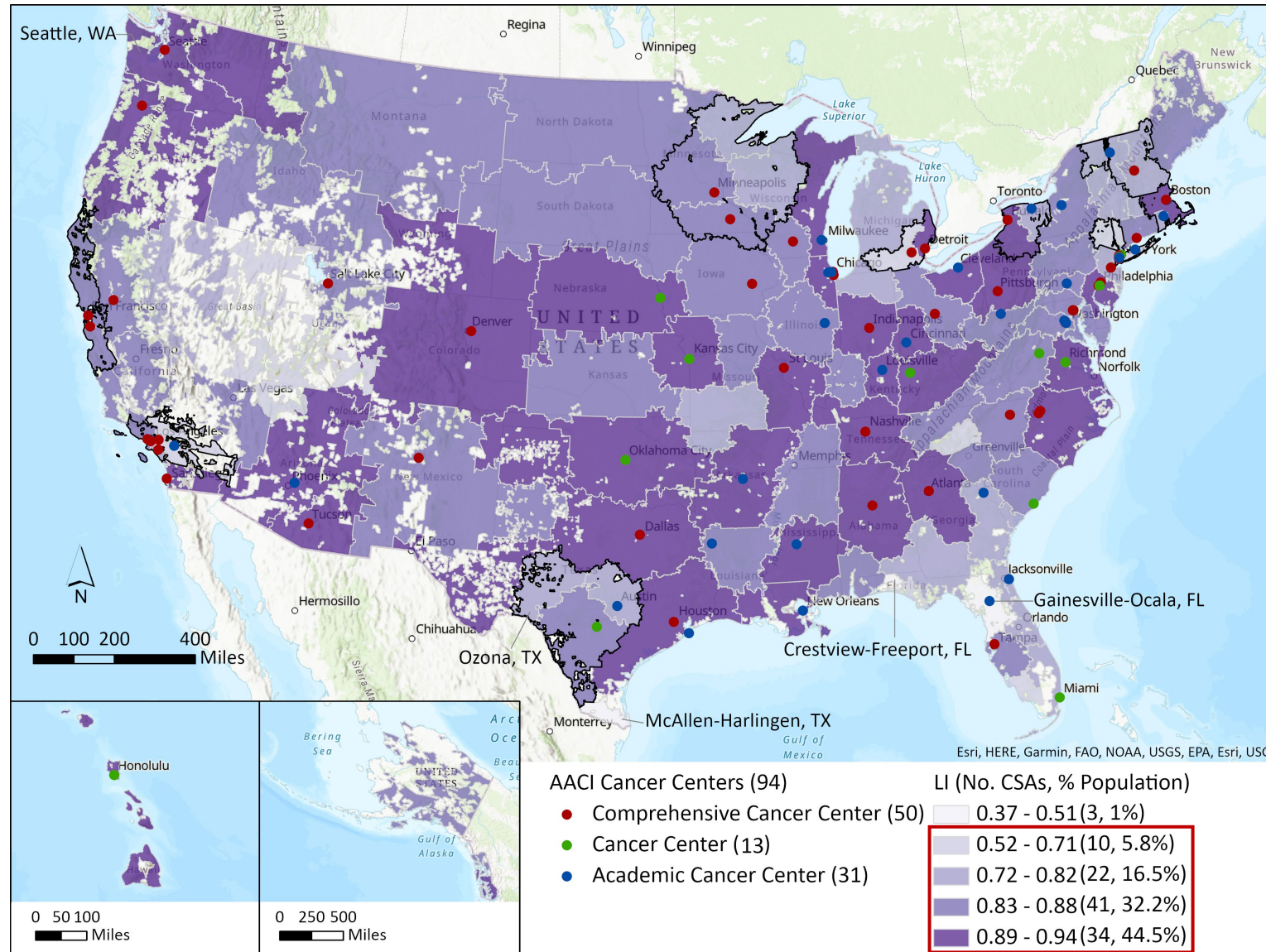
Population

$$\bar{P} = 2,807,040$$



Travel time

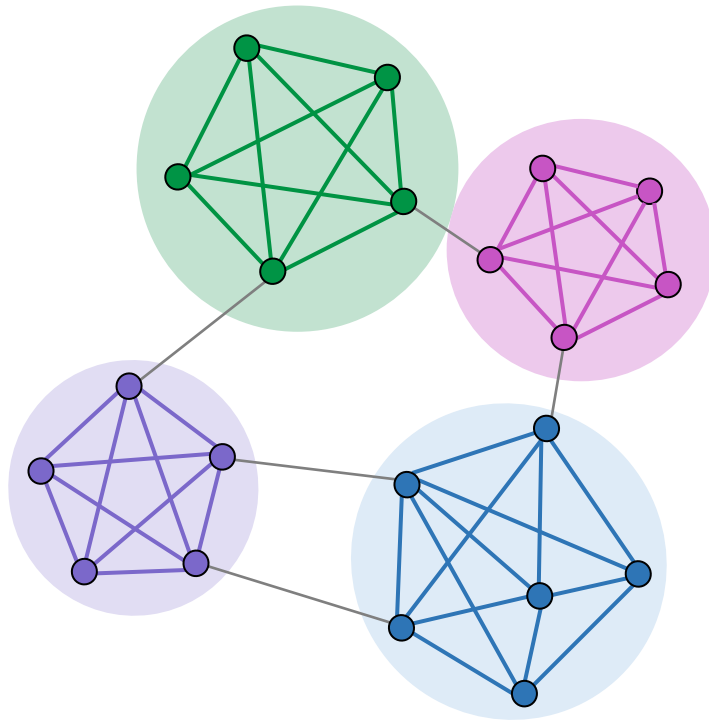
$$\bar{T} = 112 \text{ minutes}$$



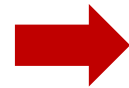
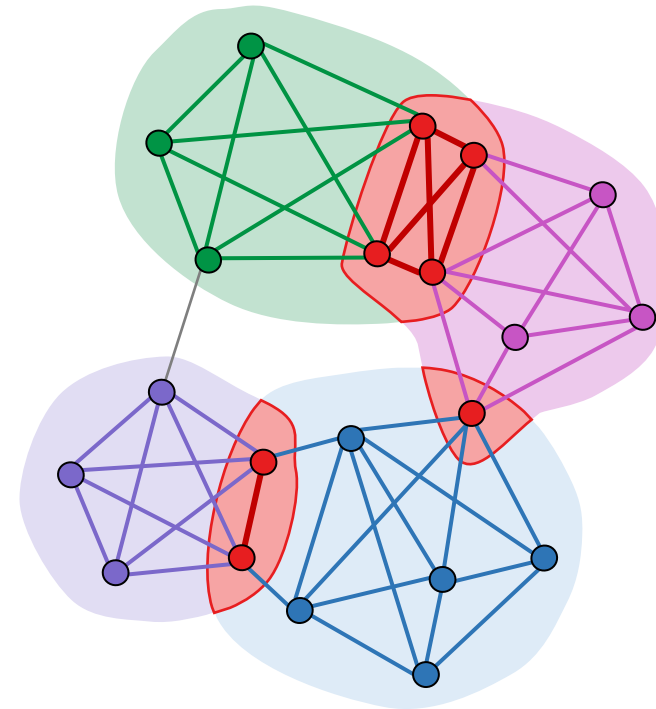
Source: Wang et al. (2022)

From Discrete to Overlapping CSAs

ScLeiden method to delineate **discrete CSAs**



ScSLPA method to delineate **overlapping CSAs**

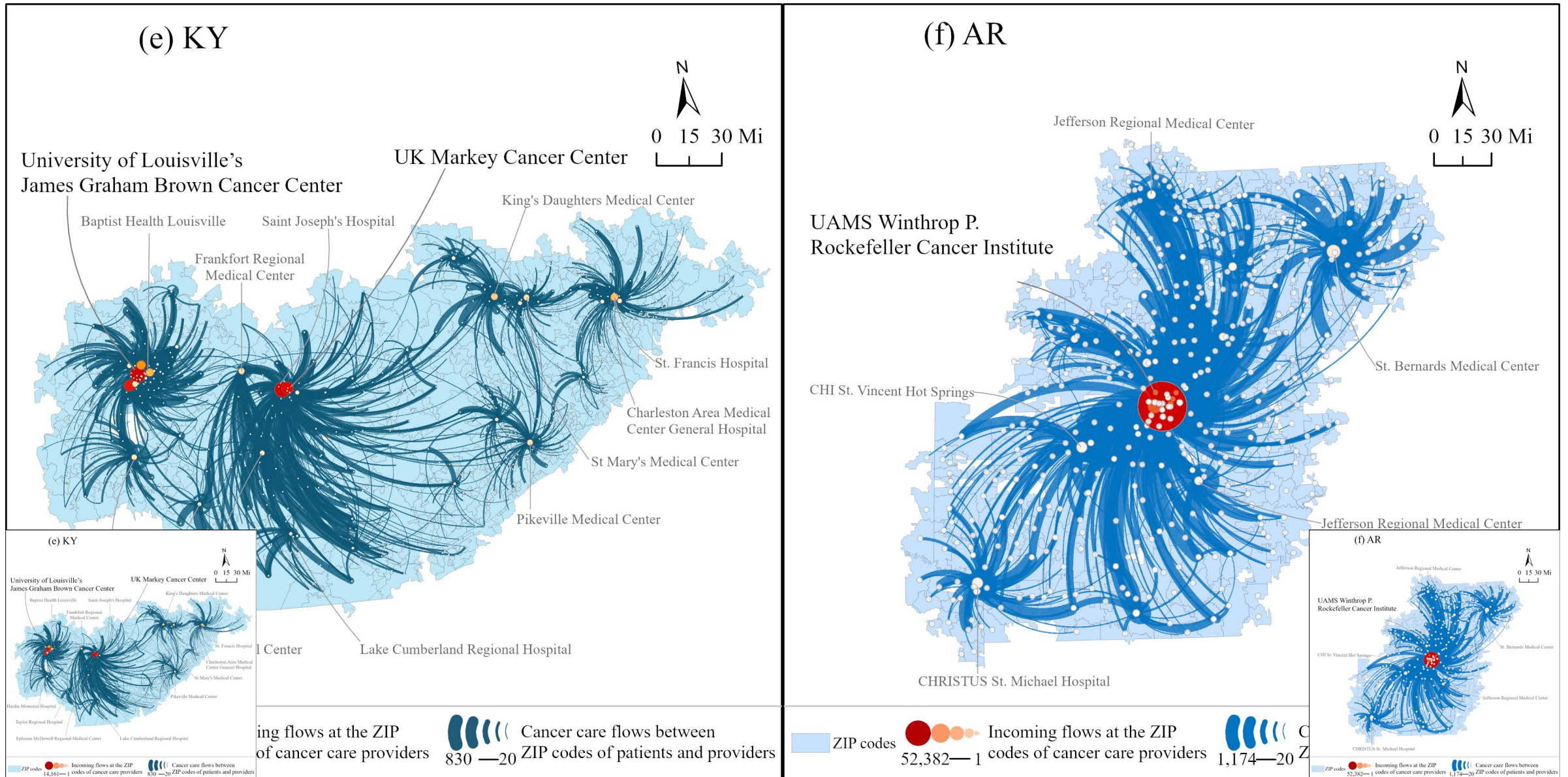


  CSA (e.g., densely connected subnetwork)

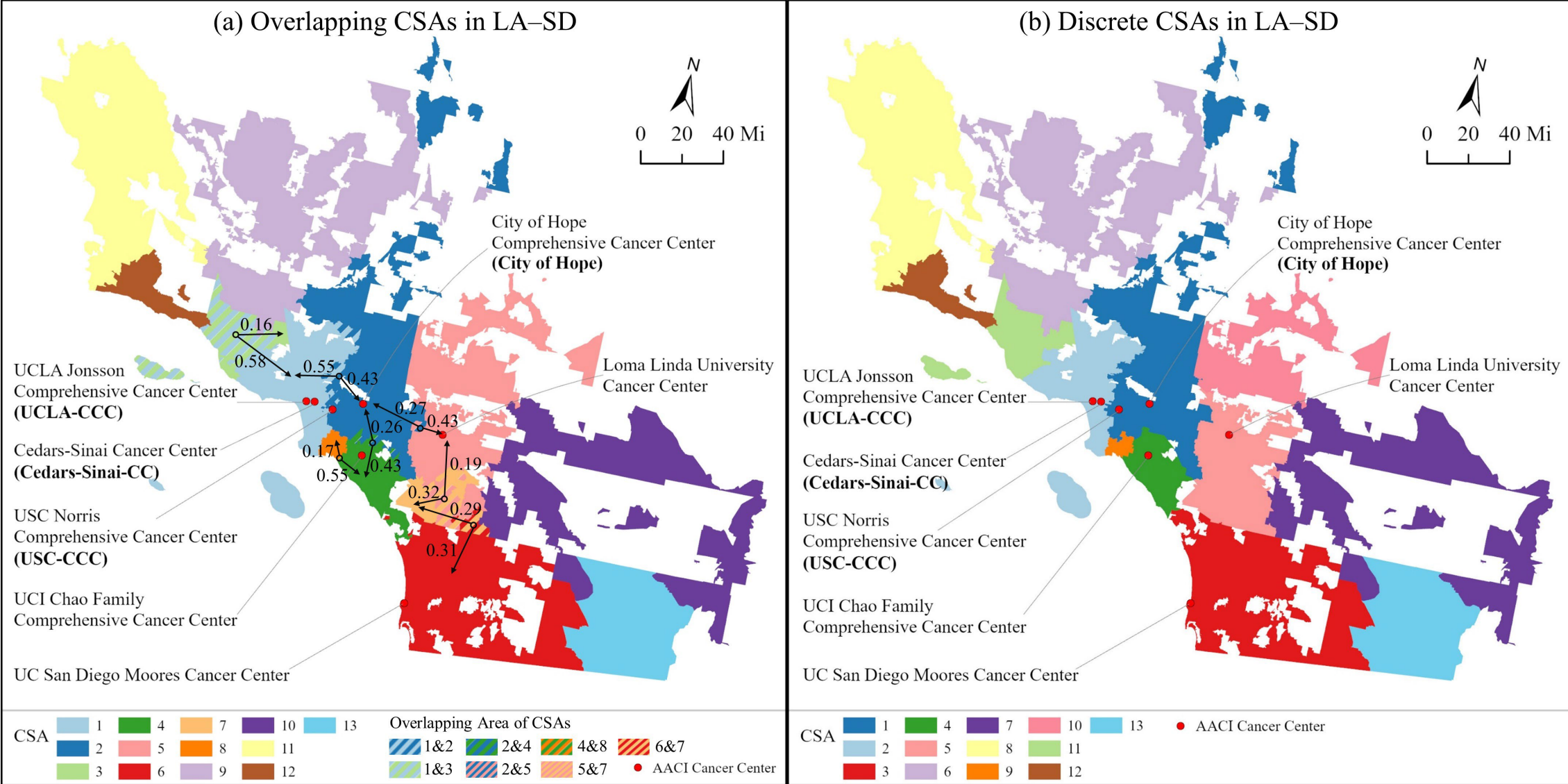
Legend    Node (e.g., ZIP code of cancer patients, ZIP code of cancer centers)

 Edge (e.g., number of services)

6 Study Areas

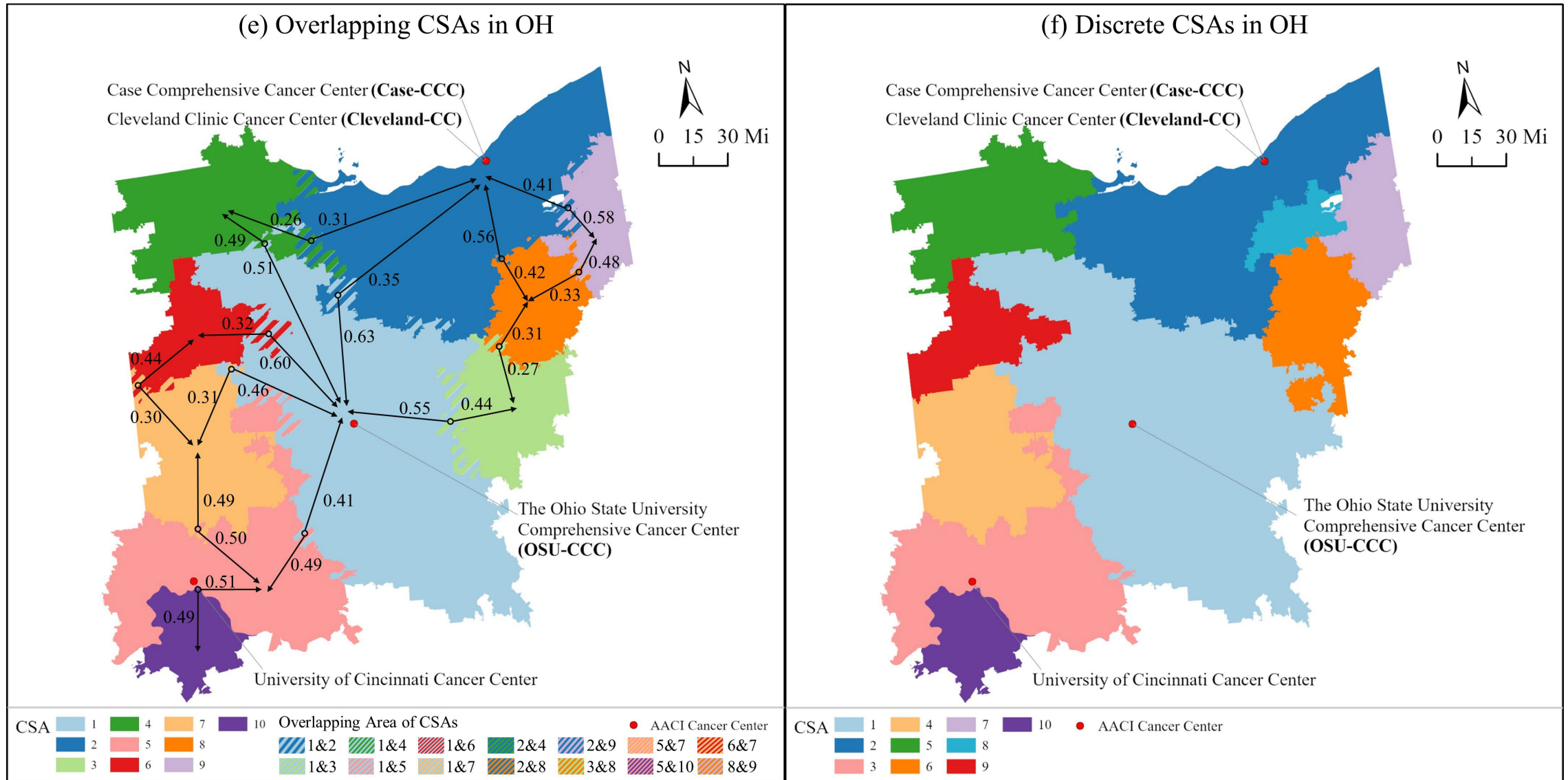


Overlapping vs. Discrete CSAs in LA-SD



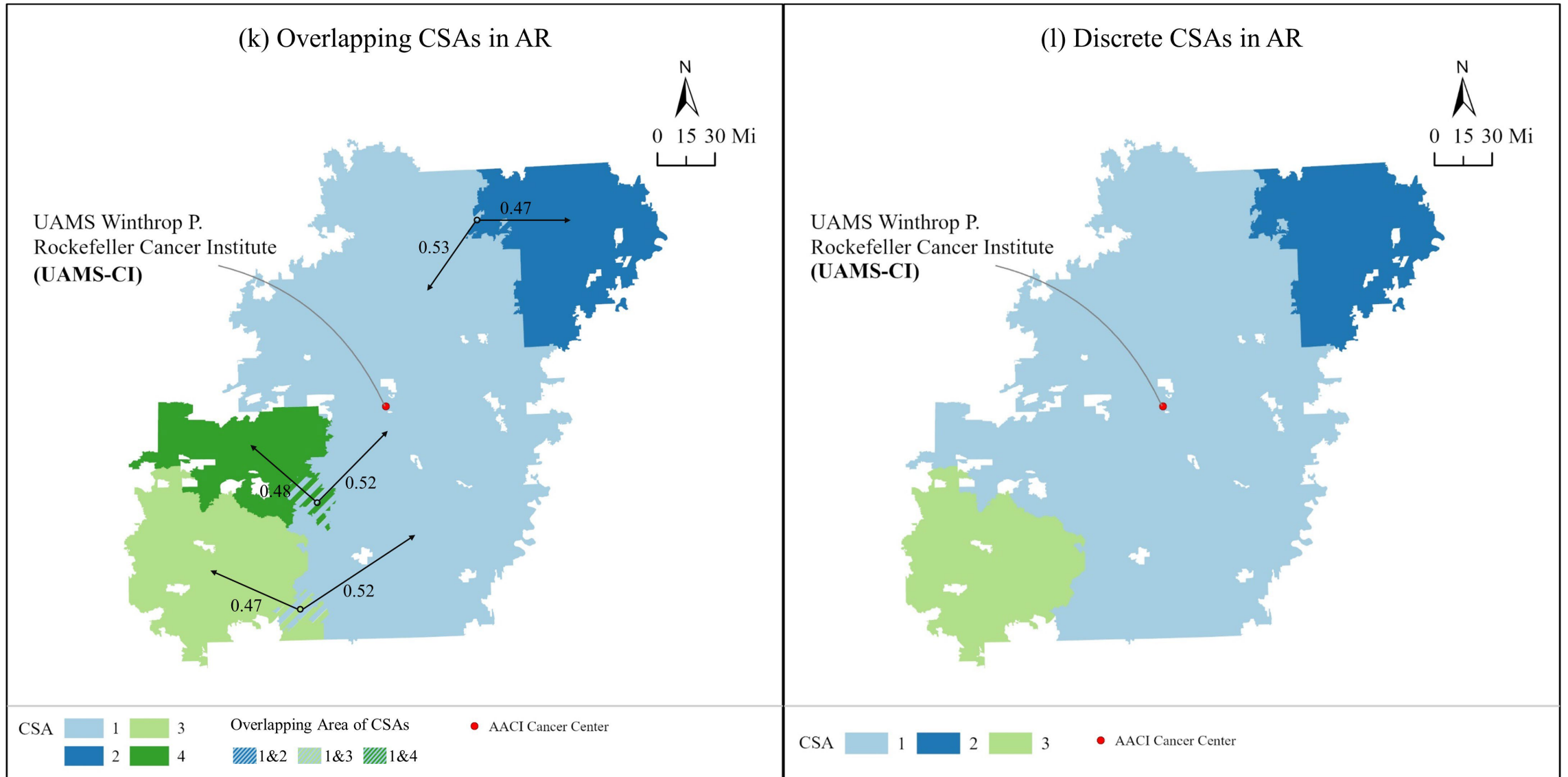
Source: Wang et al. (2024)

Overlapping vs. Discrete CSAs in OH



Source: Wang et al. (2024)

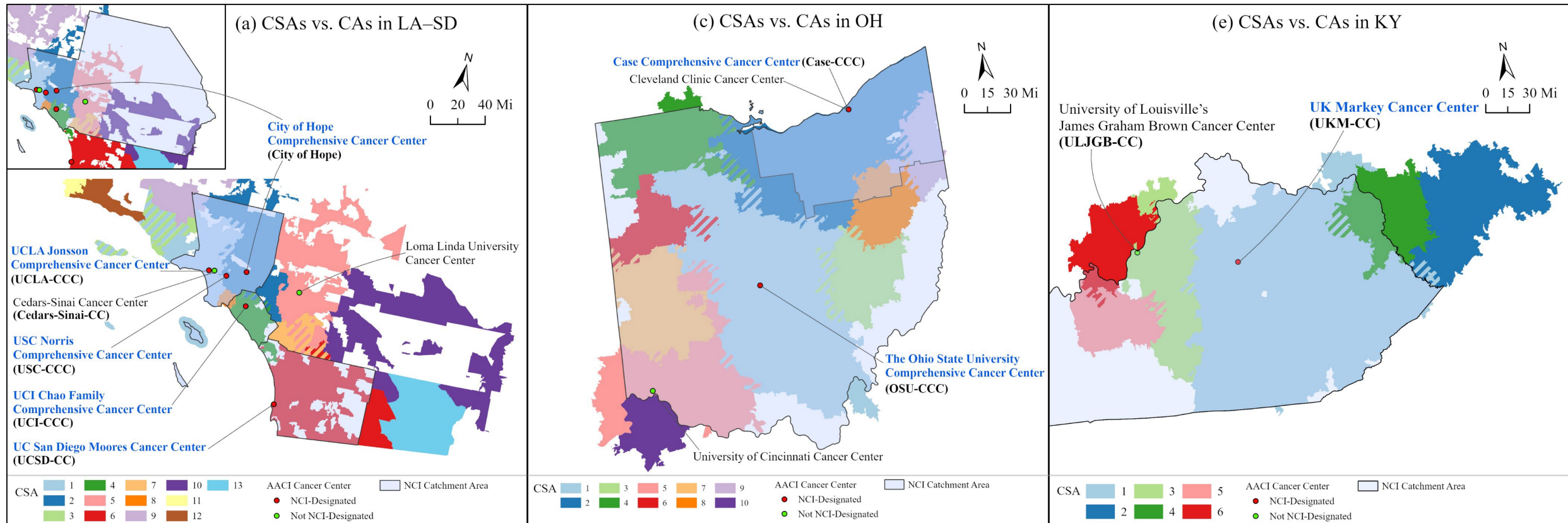
Overlapping vs. Discrete CSAs in AR



Source: Wang et al. (2024)

Overlapping CSAs vs. NCI CAs

- NCI CAs are defined for NCI cancer centers and intended to serve all populations
- CSAs are defined for all cancer care facilities and focus on cancer patients



Highly urbanized area

Moderately urbanized area

Lesser urbanized area

Source: Wang et al. (2024)

Implications for Health Policy

- NCI cancer centers can partner with local cancer hospitals or establish satellite centers to implement missions in cancer control and prevention
 - Conduct more diverse clinical trials
 - Disseminate innovative technologies, research, and education
 - Team up via telehealth
- Local cancer hospitals join the networks or alliance of the NCI cancer centers to provide high-quality care to local communities

Conclusions

- **Discrete CSAs are reliable:**

- **Federal agencies:** conduct comparative analyses of cancer care
- **Health systems and cancer centers:** target specific regions to improve access and outcomes with affordable costs
- **Professionals and researchers:** examine health disparity

- **Overlapping CSAs:**

- Tend to form in higher urbanized areas
- Provide patients with more choices and expand their access
- Inform where cross-center/hospital collaboration, referral, and coordination are needed

GIS Tools & Book



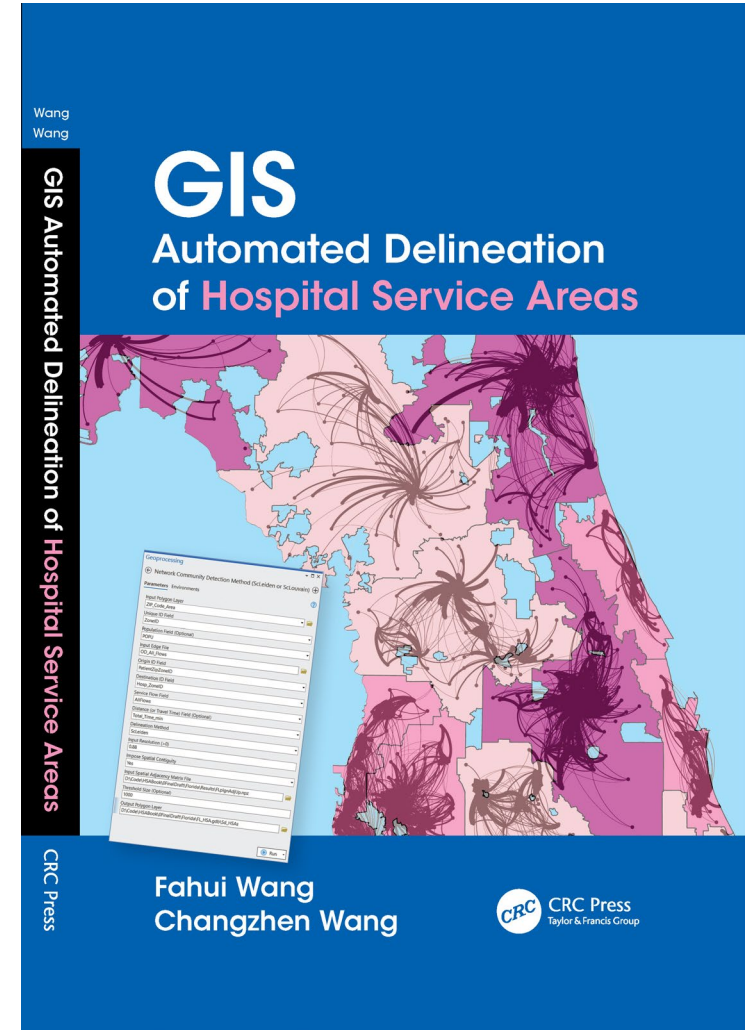
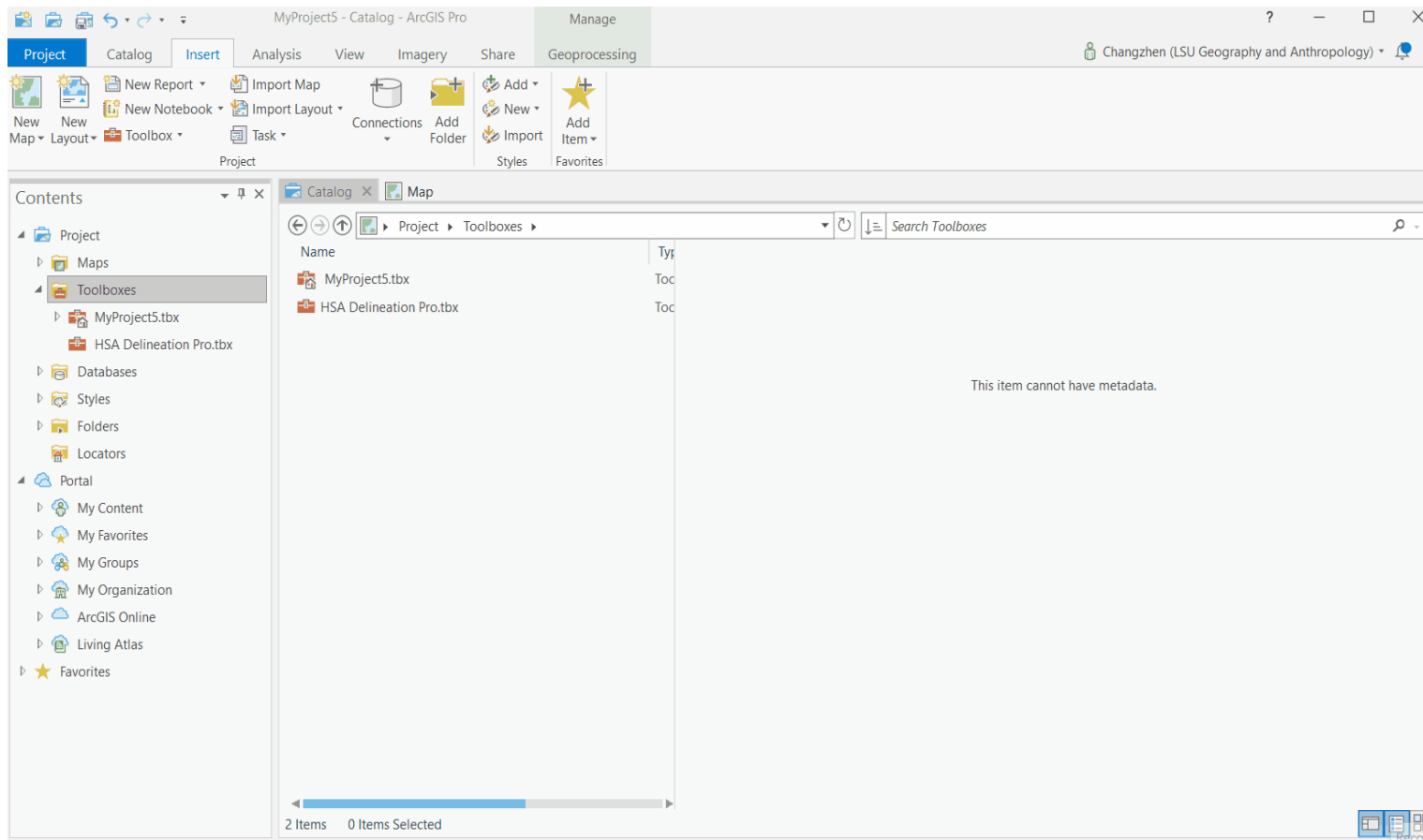
Case Study



ArcGIS Pro

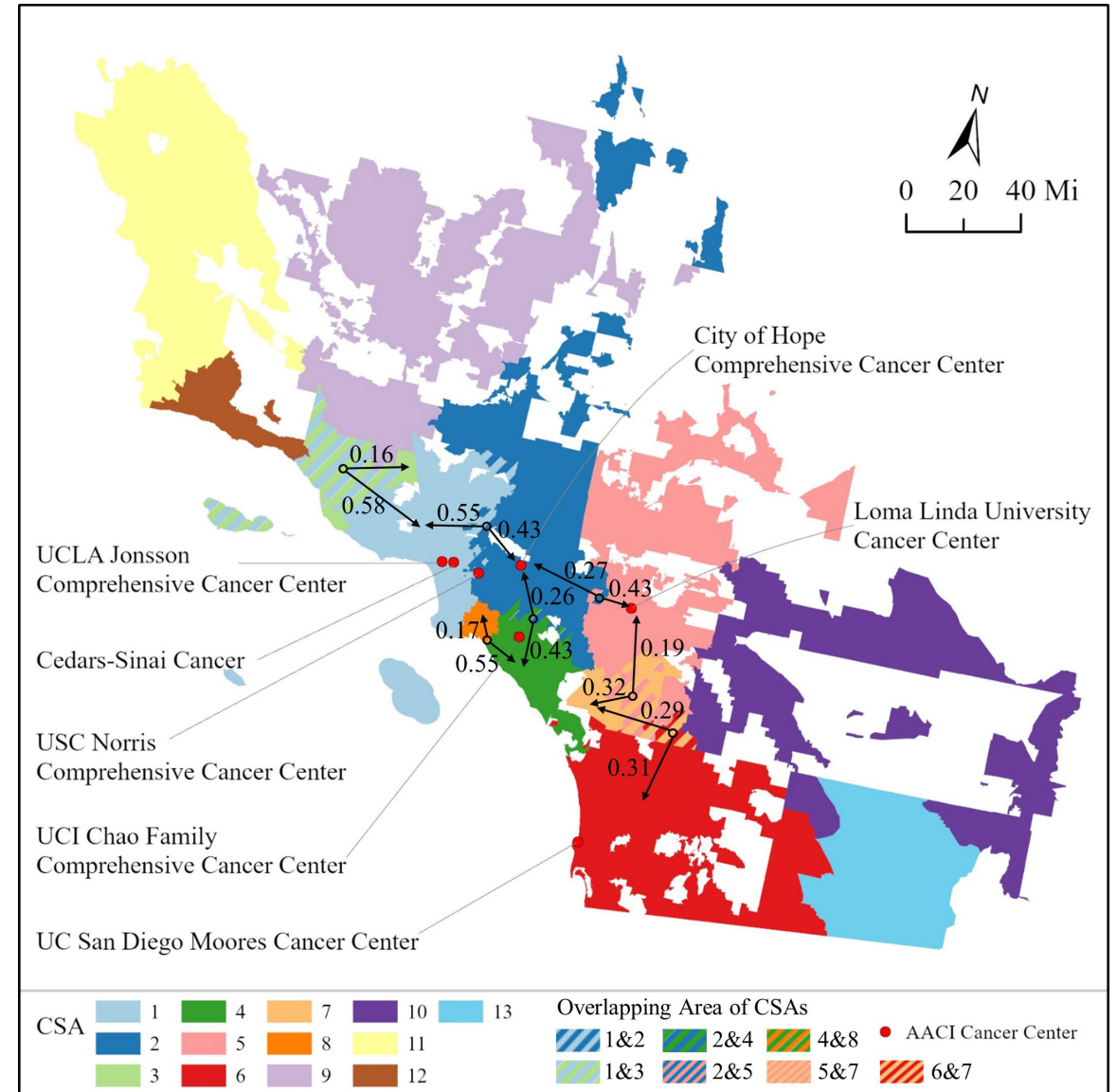
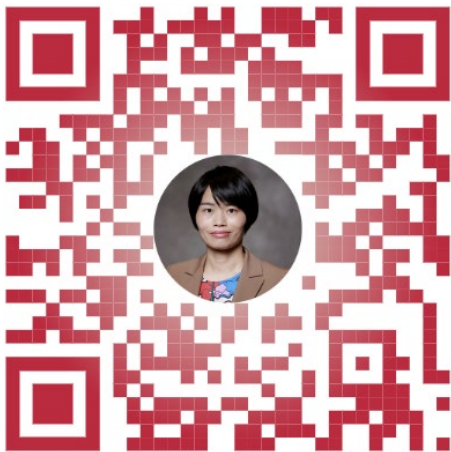


Python



Thank you!

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Overlapping CSAs