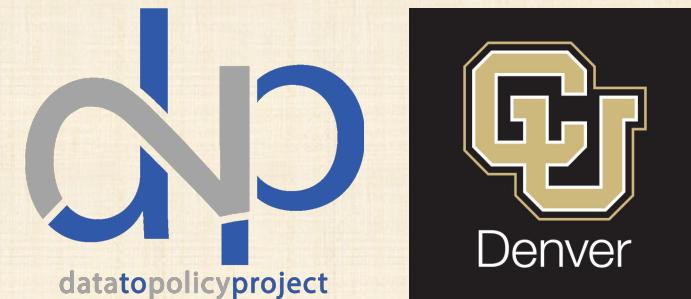


RESIDENTIAL ETHNIC CLUSTERS IN DENVER

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University of Colorado Denver
Math 6384 Spatial Data Analysis
Instructor: Dr. Joshua French



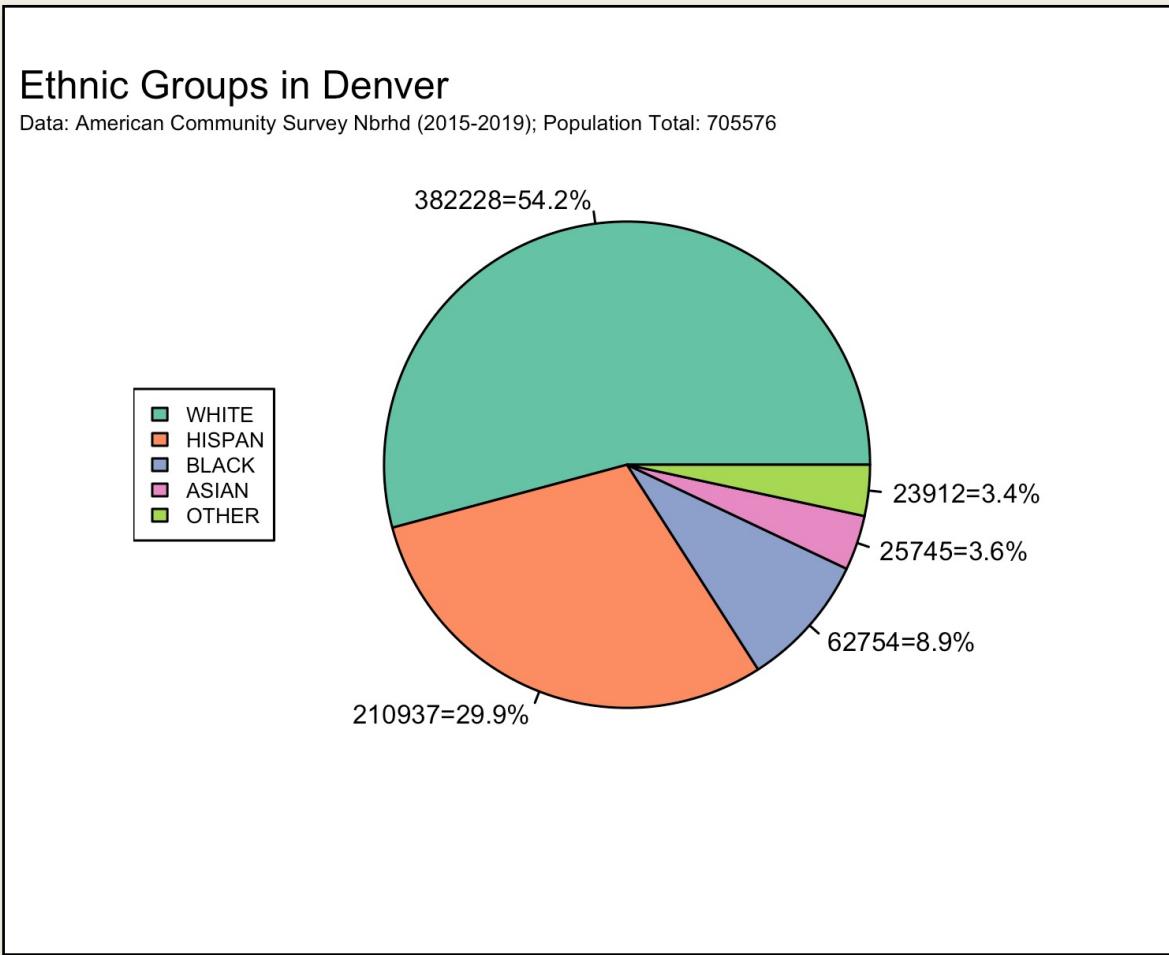
Background

- “An ethnic cluster/enclave is a geographical area where a particular ethnic group is spatially clustered and socially and economically distinct from the majority group.” (Lim, Yi, De La Cruz, & Chau, 2019)
- **The “goods” of ethnic clusters:** cultural connections, job opportunities in intra-ethnic businesses and protection from hostile social atmosphere
- **The “bads” of ethnic clusters:** involuntary formation - marginalized geographically due to financial, social and political reasons.
- Governments who recognize the importance of cultural diversity and racial harmony should be aware of ethnic clusters. Through identifying ethnic clusters, they can provide specific resources to assist various ethnic residents and to prevent ethnic segregation. Eg: Singapore has implemented Ethnic Integration Policy since 1989 to ensure a balanced mix of ethnic communities.
- According to the Census in 2020, Denver scored a Diversity Index (DI) of 61.7%, which is higher than Colorado (52.3%) and the US (61.1%).
- **While the Diversity Index suggests that Denver is a diverse city, how are the ethnic groups geospatially distributed? Do they live in clusters? If so, what are those clusters' characteristics?**

Data

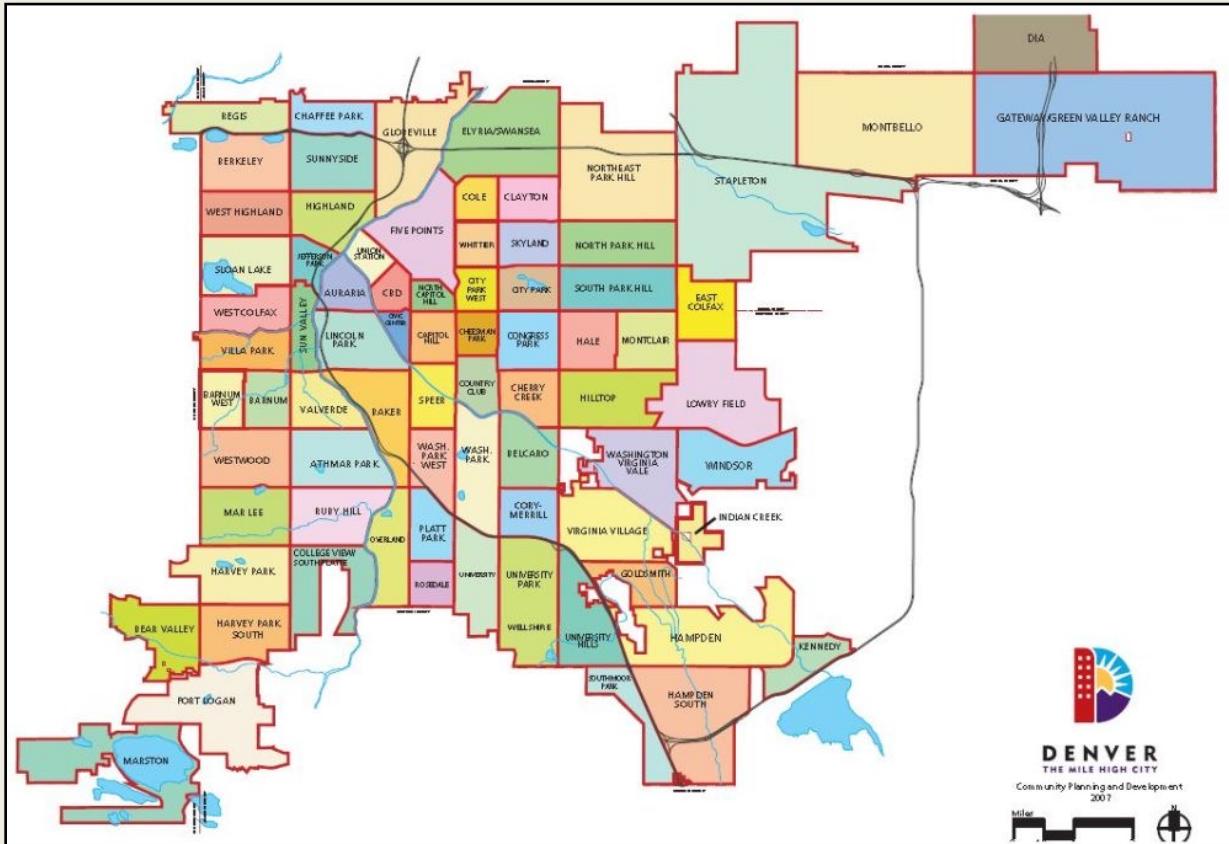
- Neighborhood level derived from the American Community Survey
- Data was aggregated at the census tract level, and the summarized into neighborhoods by the City of County of Denver
- Years 2015 – 2019
- Last updated: Jan 25, 2021
- Source page: <https://www.denvergov.org/opendata/dataset/american-community-survey-nbrhd-2015-2019>
- Ethnic groups analyzed:
 - *White*
 - *Hispanic*
 - *Black*
 - *Asian*
 - *Other (aggregating Native Americans, Hawaiian and Pacific Islanders, Other race and multiple races due to smaller population size)*

Ethnic Groups Overview



	2010-2014	2015-2019	Change
Population	633777	705576	+ 71799
White	52.9 %	54.2 %	+ 1.3 %
Hispanic	31.2 %	29.9 %	- 1.3 %
Black	9.5 %	8.9 %	- 0.6 %
Asian	3.4 %	3.6 %	+ 0.2 %
Other	3.1 %	3.4 %	+ 0.3 %

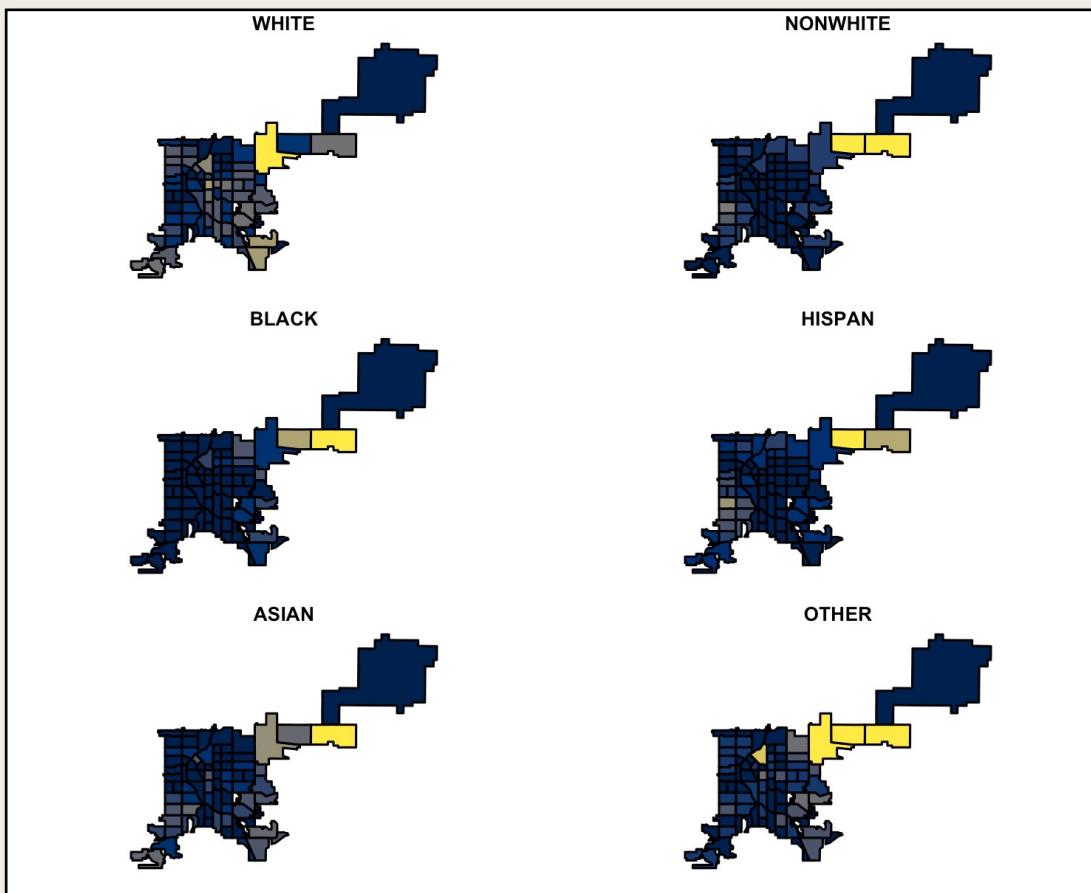
Denver Neighborhoods (78 Total)



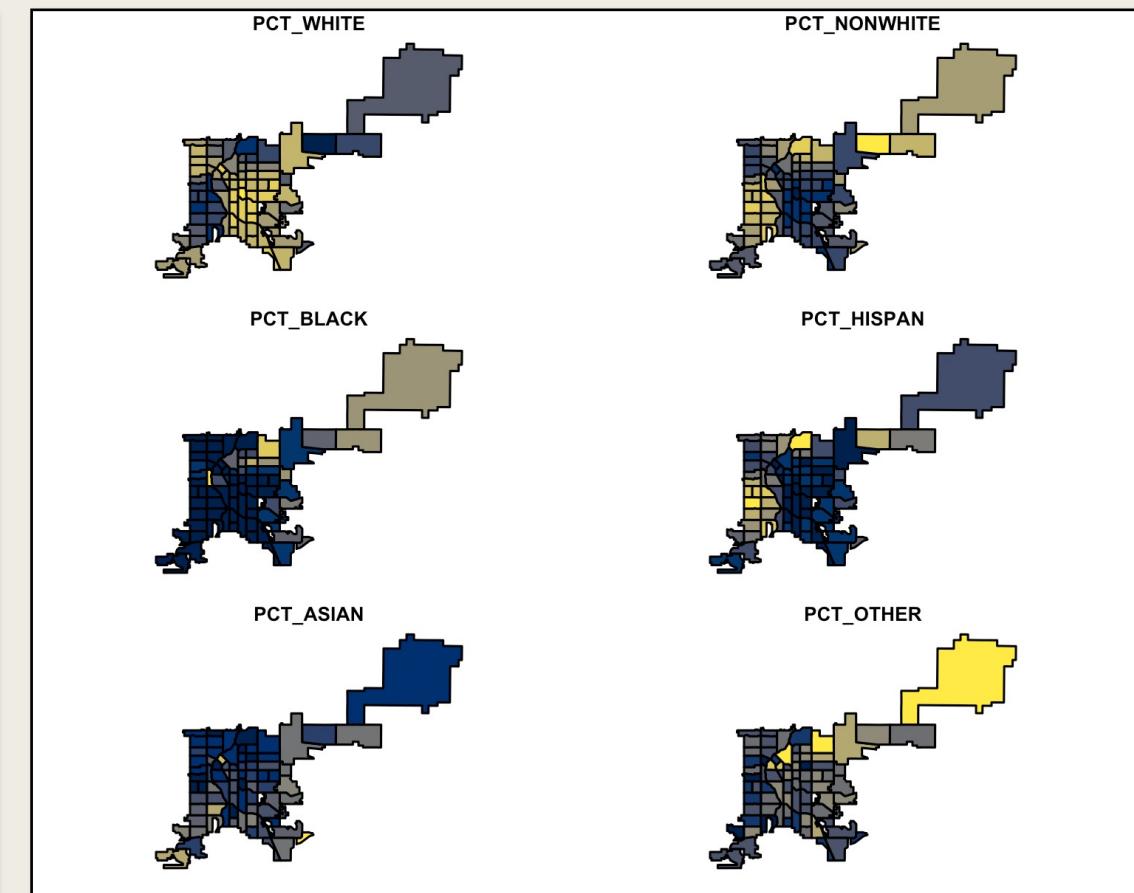
	78 NBHD Min	78 NBHD Max	78 NBHD Median
MED_HH Income	\$ 13,125	\$ 197,813	\$ 70,936
MED_HOME Value	\$ 203.5k	1.1 million	\$ 430.3k
White	9.5 %	92.3 %	67 %
Hispanic	3.2 %	82.1 %	19 %
Black	0%	43.6 %	4.1 %
Asian	0%	11.8%	2.5%
Other	0.4%	7.7%	3 %

Quick Glance at Ethnicity Distribution in Denver NBHD

Choropleth Map –
Population **Count** by Ethnicity



Choropleth Map –
Population **Percentage** by Ethnicity



Statistical Methods for Spatial Correlation

Goal:

Examine if there is evidence of ethnic group clustering in Denver

The following methods were employed to detect Ethnic group clustering in Denver:

1. Moran's I
 - *Test statistics used: Walter(1992). This version accounts for heterogeneity in population and variance*
 2. Tango's Index
 - *Various kappa (different weights on the spatial correlation component) tested*
-
- For all the above methods, testing was conducted under the Constant Risk Hypothesis using 9999 Monte Carlos simulations. Alpha level was set at 0.05
 - Binary Spatial Proximity Matrix was used: NBHD which share region boundary are considered as 'neighbors'

Statistical Testing for Spatial Correlation

RESULTS

Conclusion:

There is strong evidence of clustering for all ethnic groups in Denver

- For Moran's I:
 - *P-values for all the ethnic groups are 0.0001. Under the CRH assumption, there is strong evidence of spatial correlation for all the ethnic groups' cases for the neighborhoods in Denver.*
- For Tango's Index:
 - *P-values for all the ethnic groups are all nearly 0 for the kappa ranges tested. There is strong evidence that the observed proportion of ethnic groups in the neighborhoods in Denver are inconsistent with the CRH.*

So now, where are the clusters?

Statistical Methods for Scanning Local Rates:

Goal:

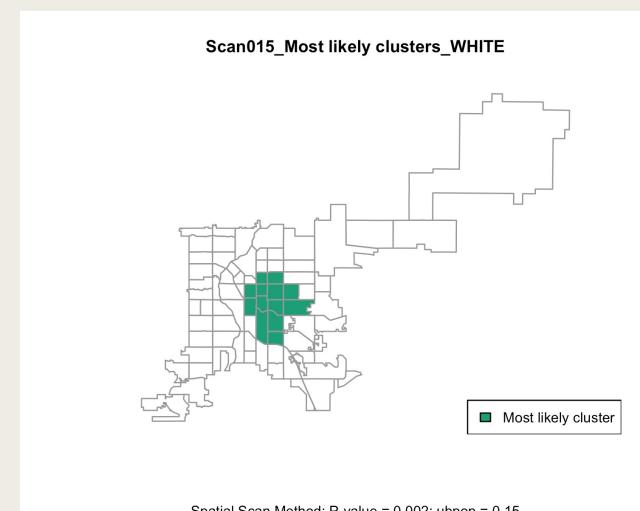
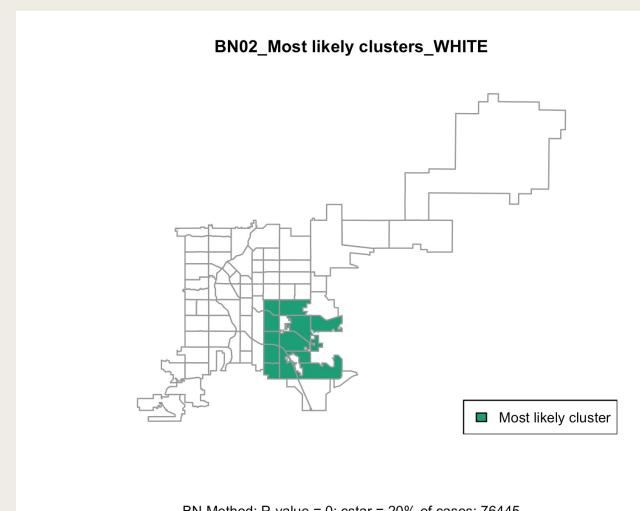
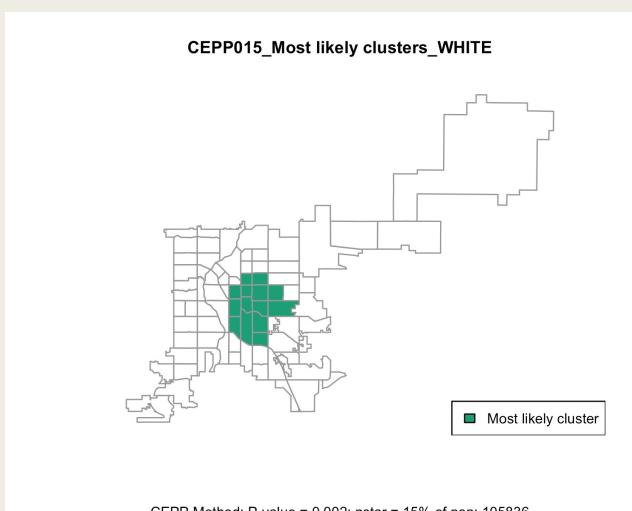
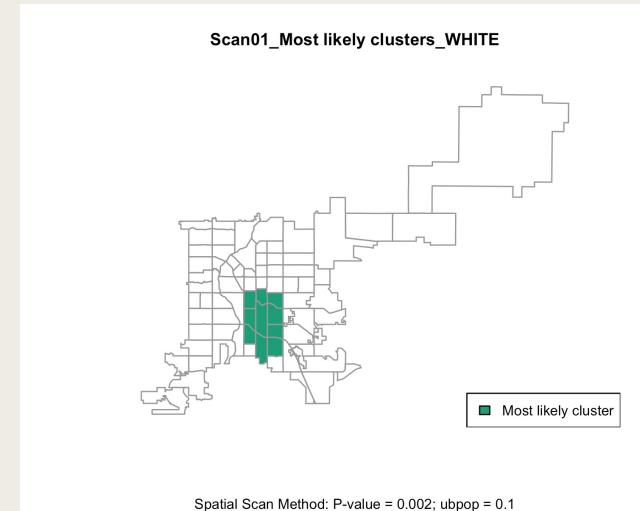
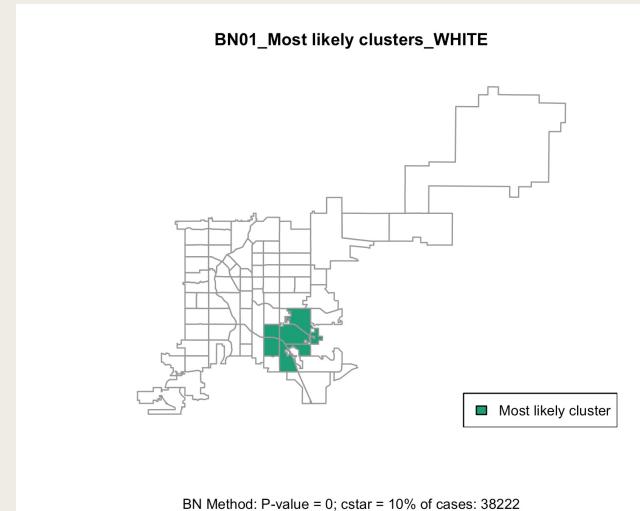
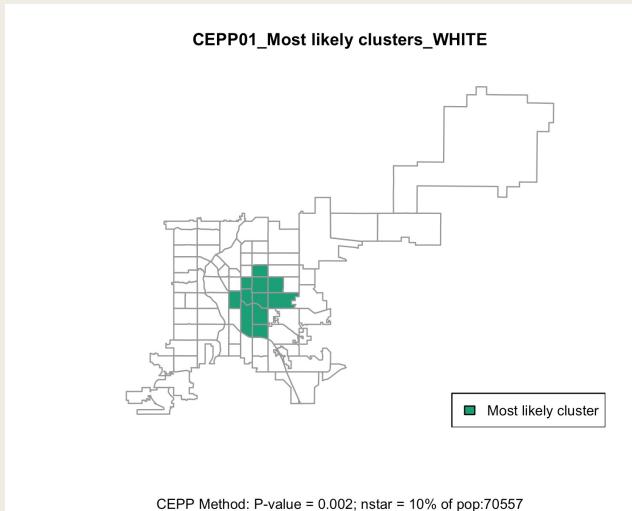
Locate the specific ethnic group clusters

The following methods were employed to identify Ethnic group clusters in Denver:

1. CEPP (Cluster Evaluation Permutation Procedure)
 2. B&N (Besag and Newell) Approach
 3. Spatial Scan Statistics
-
- For all the above methods, testing was conducted under the Constant Risk Hypothesis. Alpha level was set at 0.05. Various window sizes were tested by using different N*(CEPP), C*(B&N) and ubpop (Spatial Scan).

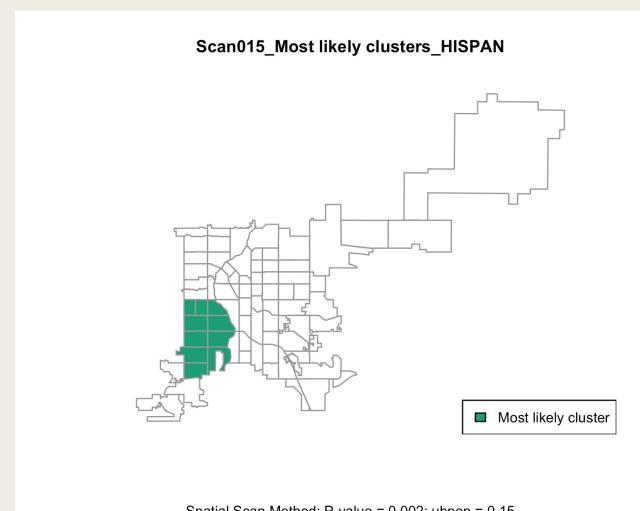
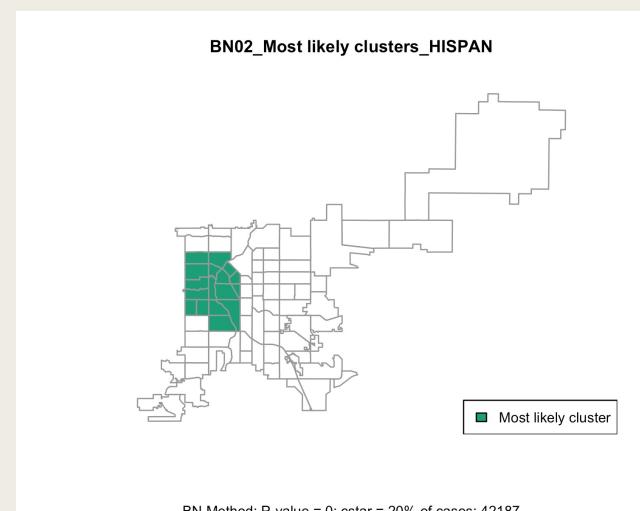
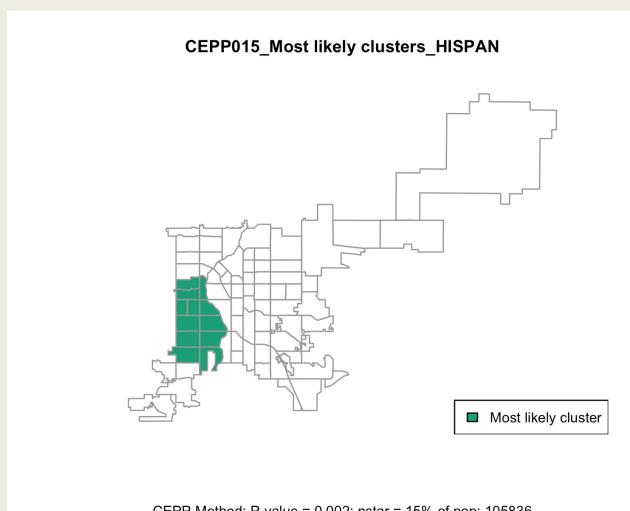
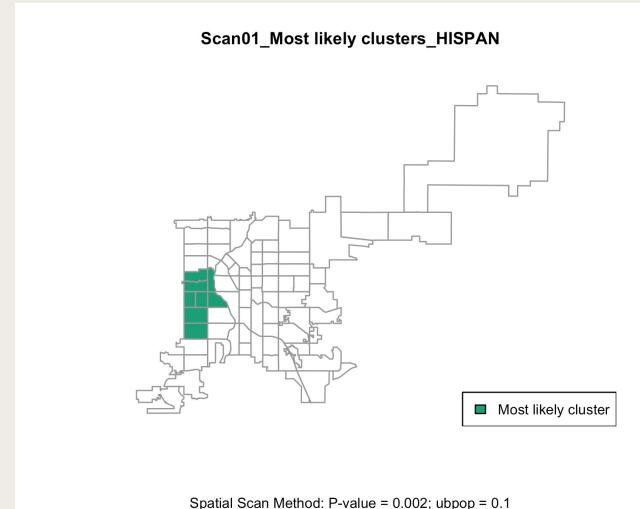
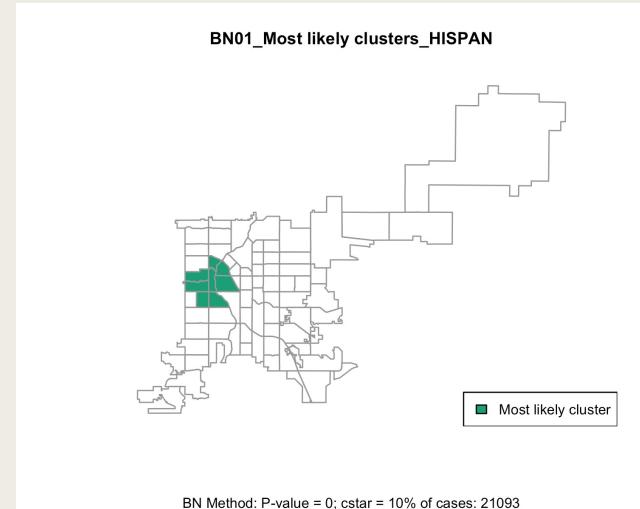
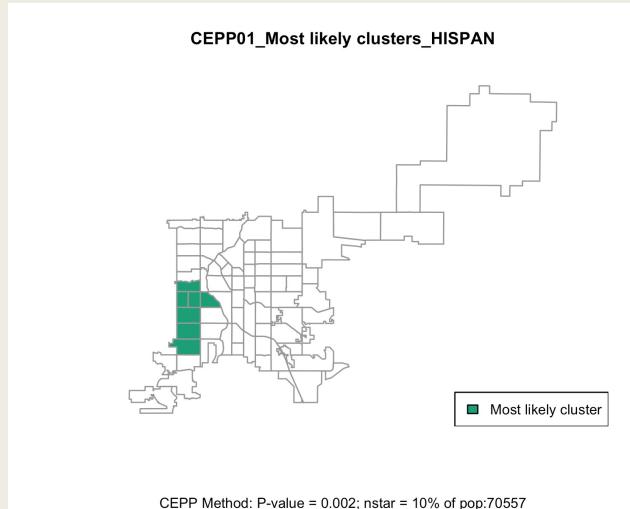
Ethnic Clusters – White: Central Area

Results: All methods identified statistically significant clusters



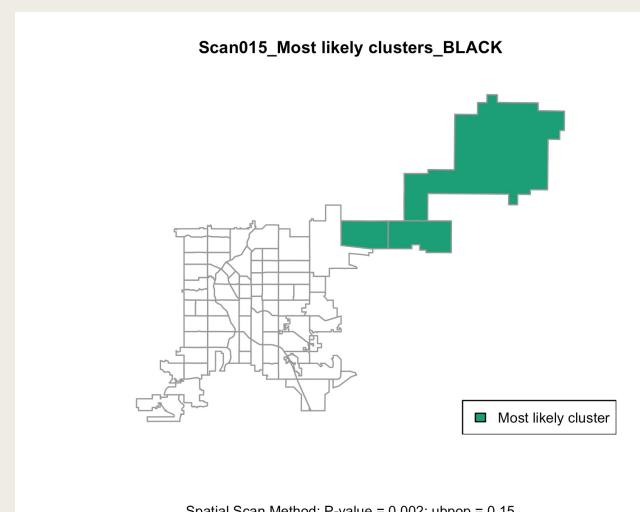
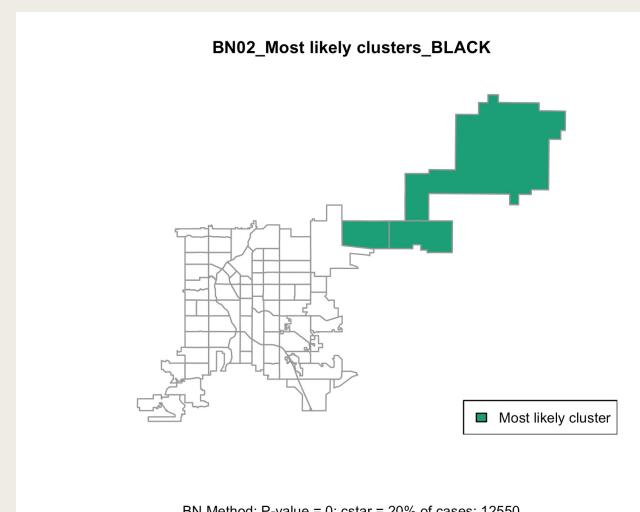
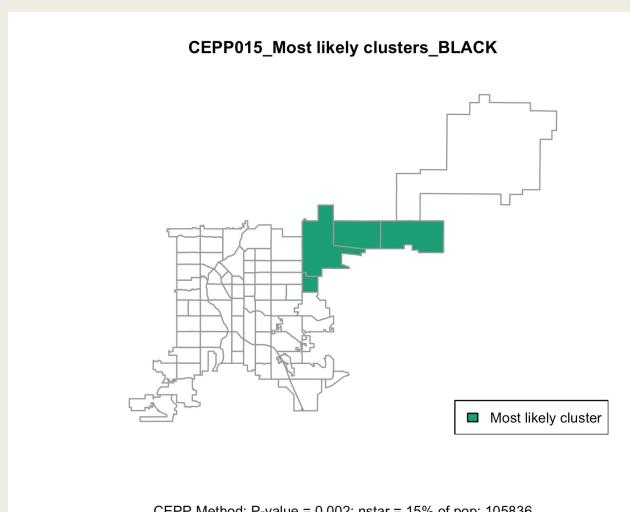
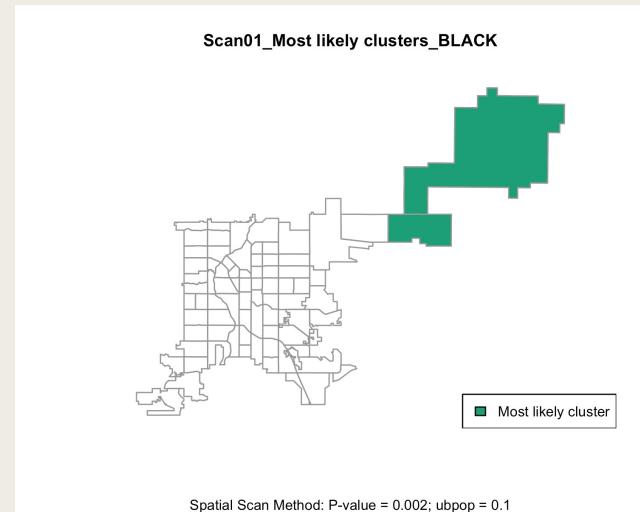
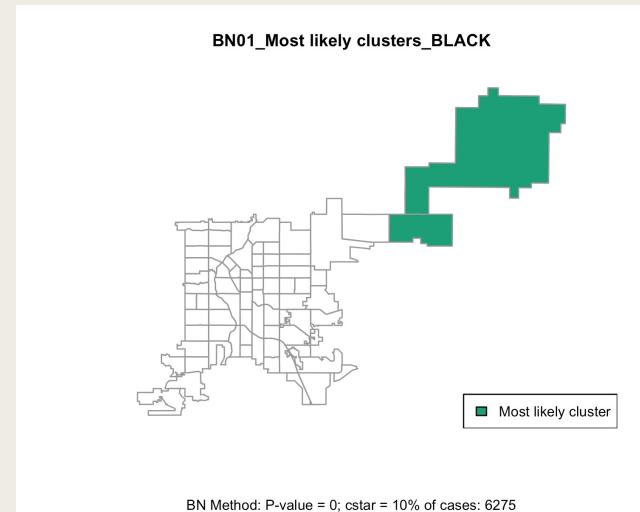
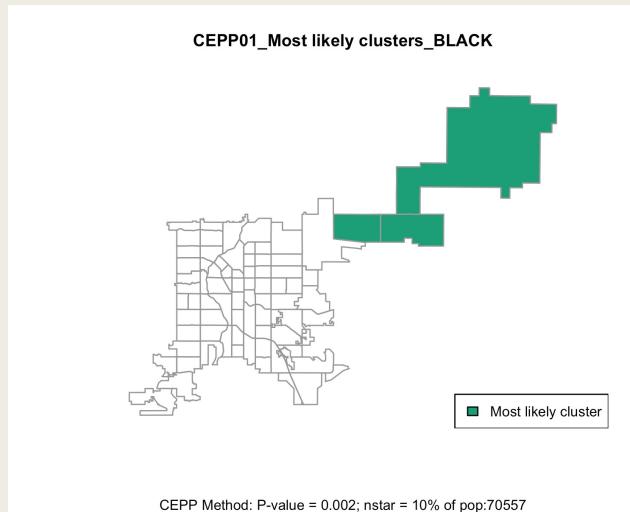
Ethnic Clusters – Hispanic: Middle West

Results: All methods identified statistically significant clusters



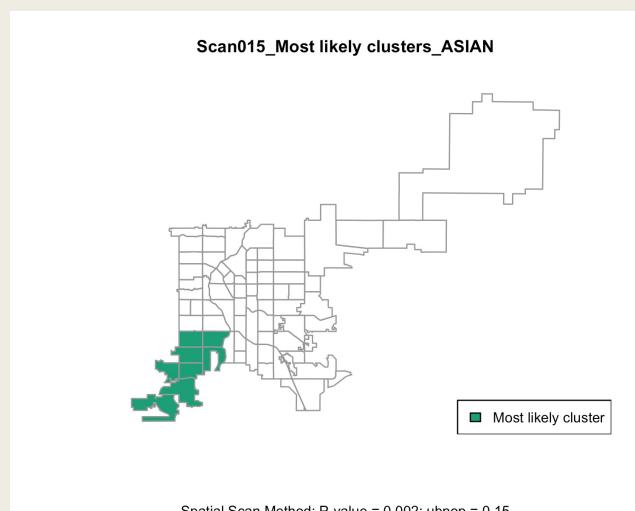
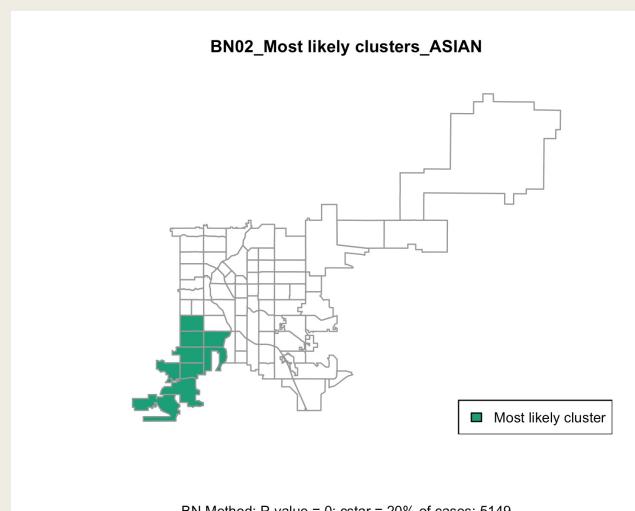
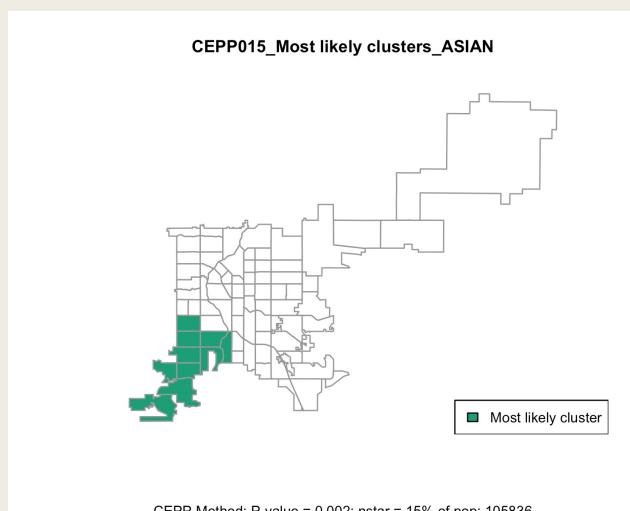
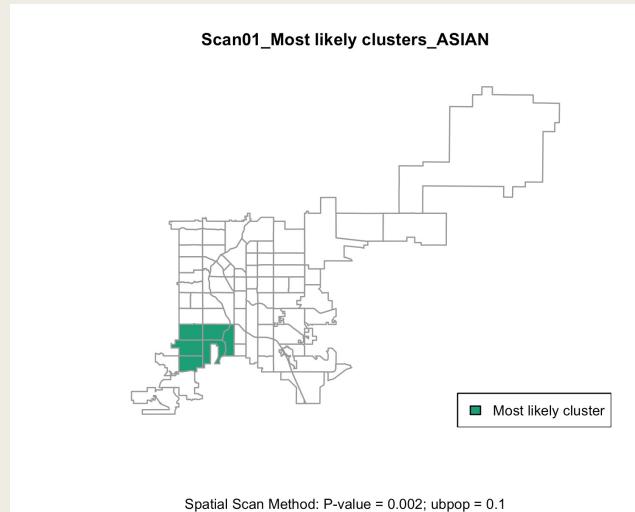
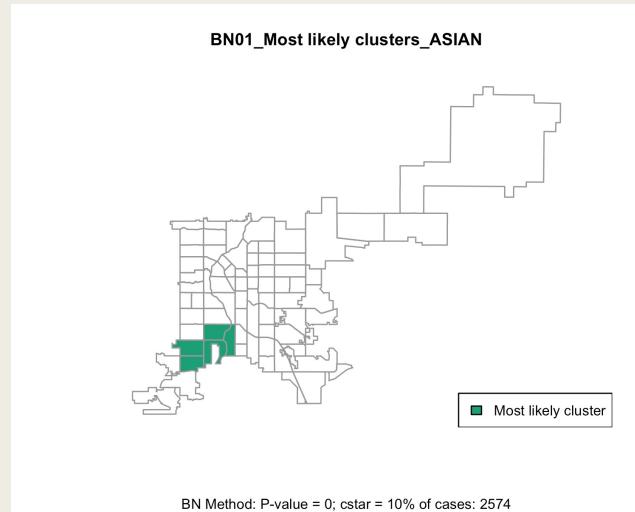
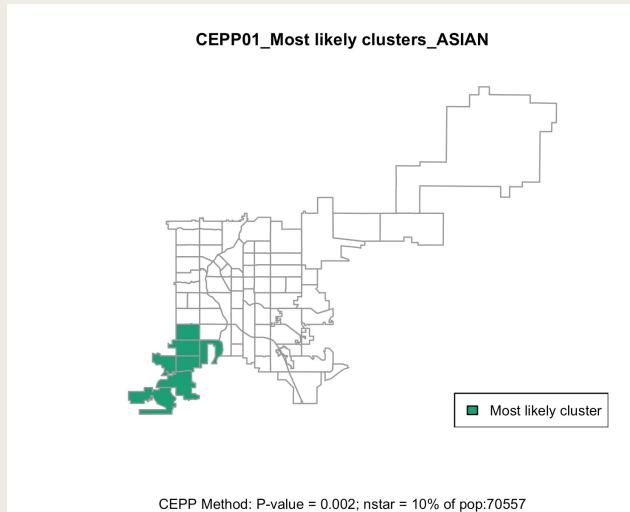
Ethnic Clusters – Black: Northeast

Results: All methods identified statistically significant clusters



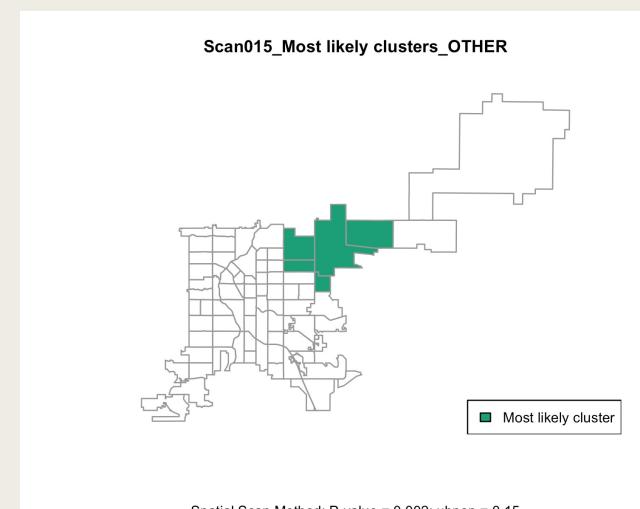
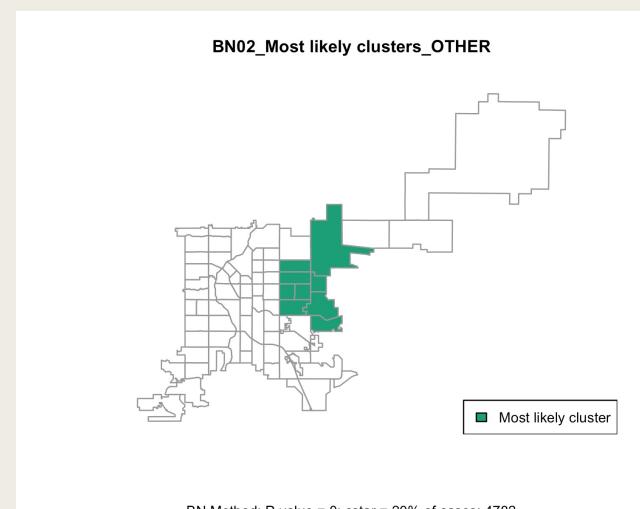
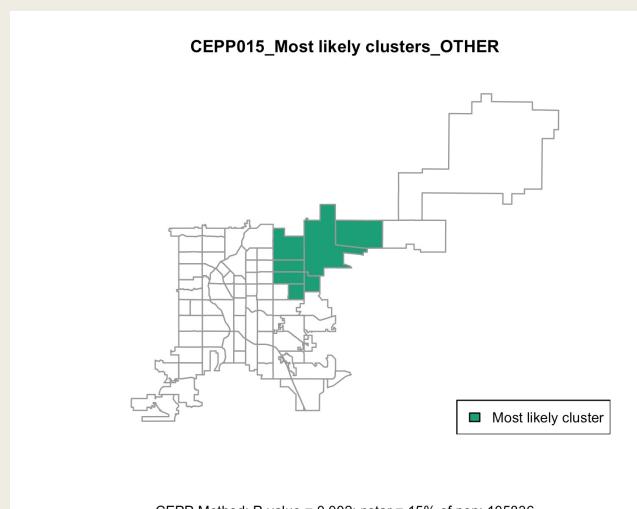
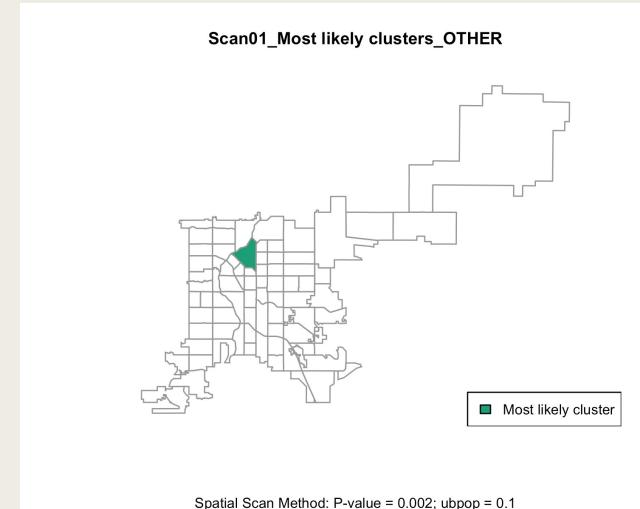
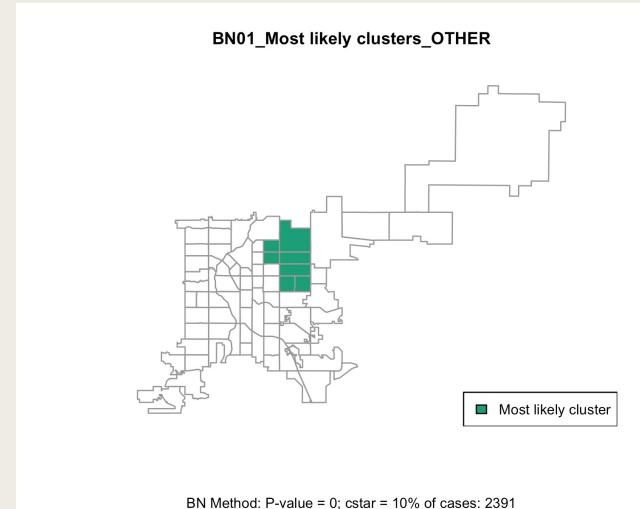
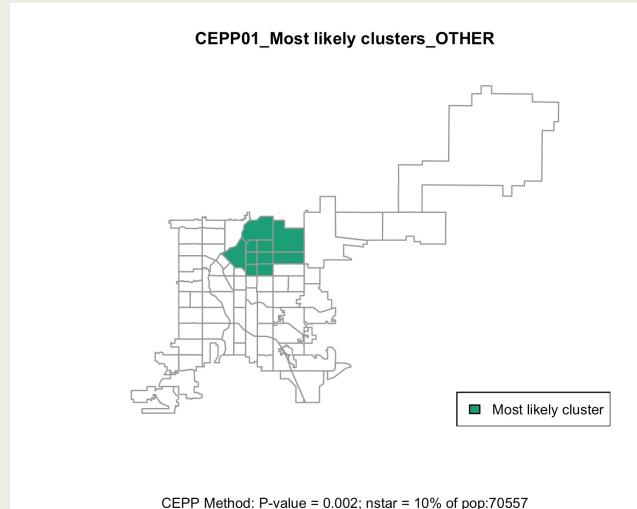
Ethnic Clusters – Asian: Southwest

Results: All methods identified statistically significant clusters



Ethnic Clusters – Other: Middle North

Results: All methods identified statistically significant clusters



Now, let's summarize these ethnic clusters' characteristics

Demographic

Ethnic Clusters	# NBHD in cluster	Foreign Born	Under 18	Above 65
White	11	9%	14%	20%
Hisp	10	23%	26%	12%
Black	3	26%	30%	8%
Asian	8	21%	25%	15%
Other	6	13%	23%	13%

Household

Ethnic Clusters	Male HH No Wife	Fem HH No Hubb	Family HH	Only English
White	3%	5%	39%	84%
Hisp	6%	15%	59%	51%
Black	7%	15%	74%	49%
Asian	7%	14%	62%	57%
Other	5%	12%	56%	71%

Economic

Ethnic Clusters	Commute 30min +	College Grad	Med HH Income	Family Poverty
White	18%	54%	\$103.5k	3.5%
Hisp	22%	17%	\$55.9k	20.3%
Black	23%	15%	\$62k	8.7%
Asian	24%	17%	\$57.6k	10.4%
Other	18%	36%	\$91.3k	9%

Housing

Ethnic Clusters	House Built 2000 +	Med Home Value	Med Rent	Renter Occupied
White	12%	\$633.9k	\$1604	52%
Hisp	11%	\$335.8k	\$1016	53%
Black	52%	\$249.8k	\$1442	32%
Asian	7%	\$279.1k	\$1115	44%
Other	29%	\$479.1k	\$1520	41%

Analysis Conclusion

Overall:

Strong evidence of ethnic clustering was found in Denver.

Each ethnic group clusters in distinct areas of the city.

- Black Cluster NBHD (Northeast) has

the highest % of

- *Foreign Born population*
- *Population below 18*
- *Householders without spouse present*
- *Family households*
- *Other-than-English speakers*
- *Houses built after 2000*

the lowest

- *Median home value*
- *% of population with Bachelor's degree*

- Asian Cluster NBHD (Southwest) has

- *The highest % of 30+ minutes commuters*
- *The lowest % of houses built after 2000.*

- Other-race Cluster NBHD (Middle North)

- *Generally falls in the middle rank among all categories*

- Hispanic Cluster NBHD (Middle West) has

the highest % of

- *Family Poverty*
- *Renter-Occupied residence*

the lowest

- *Median household income*
- *Median rent*

- White Cluster NBHD (Central) has

the highest

- *% of population above 65*
- *English-only speakers*
- *% of population with Bachelor's degree*
- *Median household income*
- *Median home value*
- *Median rent*

the lowest

- *% of Foreign Born population*
- *\$ of population below 18*
- *% of householders without spouse present*
- *% of Family Poverty*

Policy recommendations

- The City of Denver should be aware of the distinct ethnic clusters present and be cautious of the social dynamic among clusters to prevent ethnic clustering growing into negative residential ethnic segregation.
- The ethnic clusters have very distinct ranges of housing and rent prices. Housing programs should be implemented to encourage racial integration.
- Supports for young people, children, single-parents and education should be emphasized in the newly-developed neighborhoods in the Northeast such as Central Park, Montbello, Green Valley Ranch and DIA.
- Government should also consider enhancing translation services in hospitals, courts and voting stations of the above neighborhoods, as well as the middle West part of the city such as West Colfax to Westwood areas.
- Good transportation network should be maintained for the Southwest area of the city such as Harvey Park downwards.
- Employment and career training programs should be increased for the West part of the city to lower family poverty.
- More assistance for elderly should be provided in the central part of Denver.