

Determining Healthcare Shortages Using Spatial and Network Analysis

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Healthcare disparity is defined as a particular type of health difference that is closely linked with geographical, social, economic, and/or environmental disadvantage

(CDC, 2012)



In 2014, there are approximately 46 million people underserved by primary care and who experience limited access to services due to physical distance, or other non-physical barriers related to finance, culture, or language

(DHHS, 2014)

A need for a reliable measures of accessibility to healthcare

Shortage Areas

✓ Department of Health and Human Services (DHHS) identified:

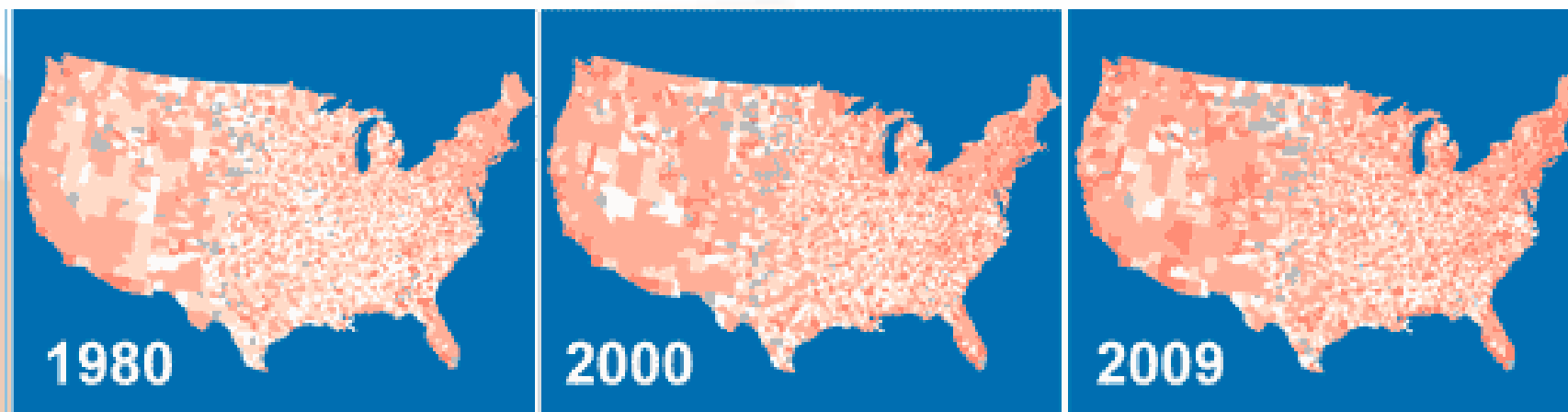
HPSAs

- § Health Professional Shortage Areas
- § 3500:1 of population and full-time-equivalent healthcare provider (primary care, dental, and mental)
- § Based solely on population-to-provider ratios

MUA/P

- § Medically Underserved Area or Population
- § 1000:1 of population and full-time-equivalent primary care physicians
- § Includes non-spatial health determinants

✓ Because DHHS shortage area designations primarily quantify the ratio of population to practitioners, there is some limitation in terms to convey truly underserved areas



No data
 >0.0 per thousand
 >0.5 per thousand
 >1.0 per thousand
 >3.0 per thousand
 >10.0 per thousand

Physicians per 1000 population

Primary Care: fundamental role in US medical system

Acceptability
Extent that users feel comfortable with the more immutable characteristics of the provider

Availability
Total number of facilities in certain boundary

Affordability
Relationships between cost of services and the ability for people to pay

Accessibility
Travel impedance between origin-destination

Accommodation
Extent that clients meets his/her preference for provider's service

Spatial Accessibility

1. What is the spatial extent of primary healthcare disparities in Florida?

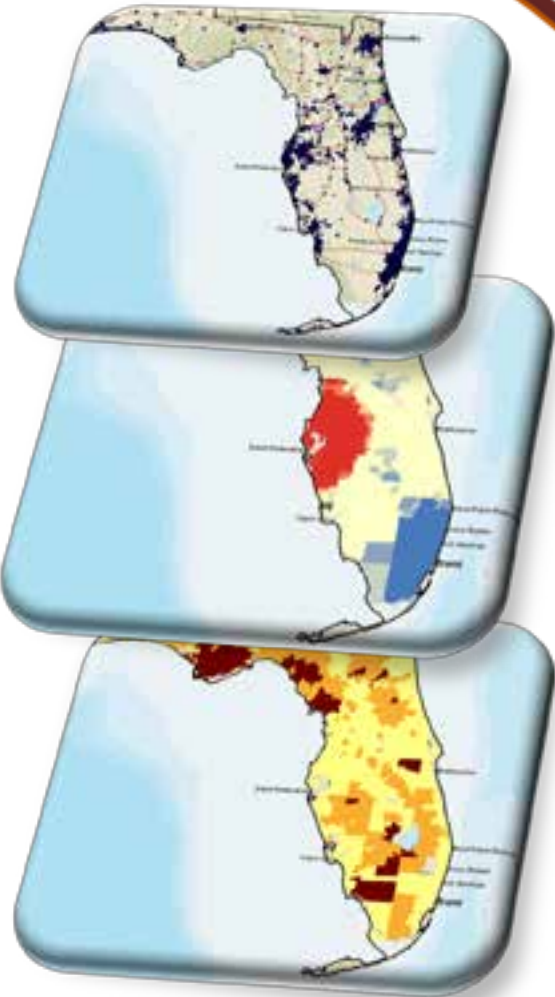
- Develop measures of spatial access (availability & accessibility) using GIS

2. Where are the areas of primary healthcare disparities in Florida?

- Identify the areas in finer geographic scope that provide better accuracy

Indicator	Measurement	Data Description	Feature Type	Data Type	Data Source
Spatial pattern of healthcare provider	Population	Population attribute in Census block group	Polygon	Attribute	US Census 2010
	# of PCP	Aggregated total # of PCPs in each individual census block group	Point aggregated in polygon		2012 American Medical Association
	Urban/rural definition	Rural-Urban Commuting Areas (RUCA) code to define urban or rural areas	Polygon		USDA Economic Research Service 2010
Travel time to the nearest PCP	Census block group Centroid	Census block group	Point	Spatial	US Census 2010
	PCP practice location	Mailing address of PCPs	Point		2012 American Medical Association
	Street network	Street Map USA	Line		ESRI

Using Spatial Analyst and Network Analyst Tools:



Geocode locations of Primary Care Physicians (PCPs) in Florida

§ 13,432 PCPs

Availability: Calculate **Getis-Ord Gi*** statistics of healthcare providers

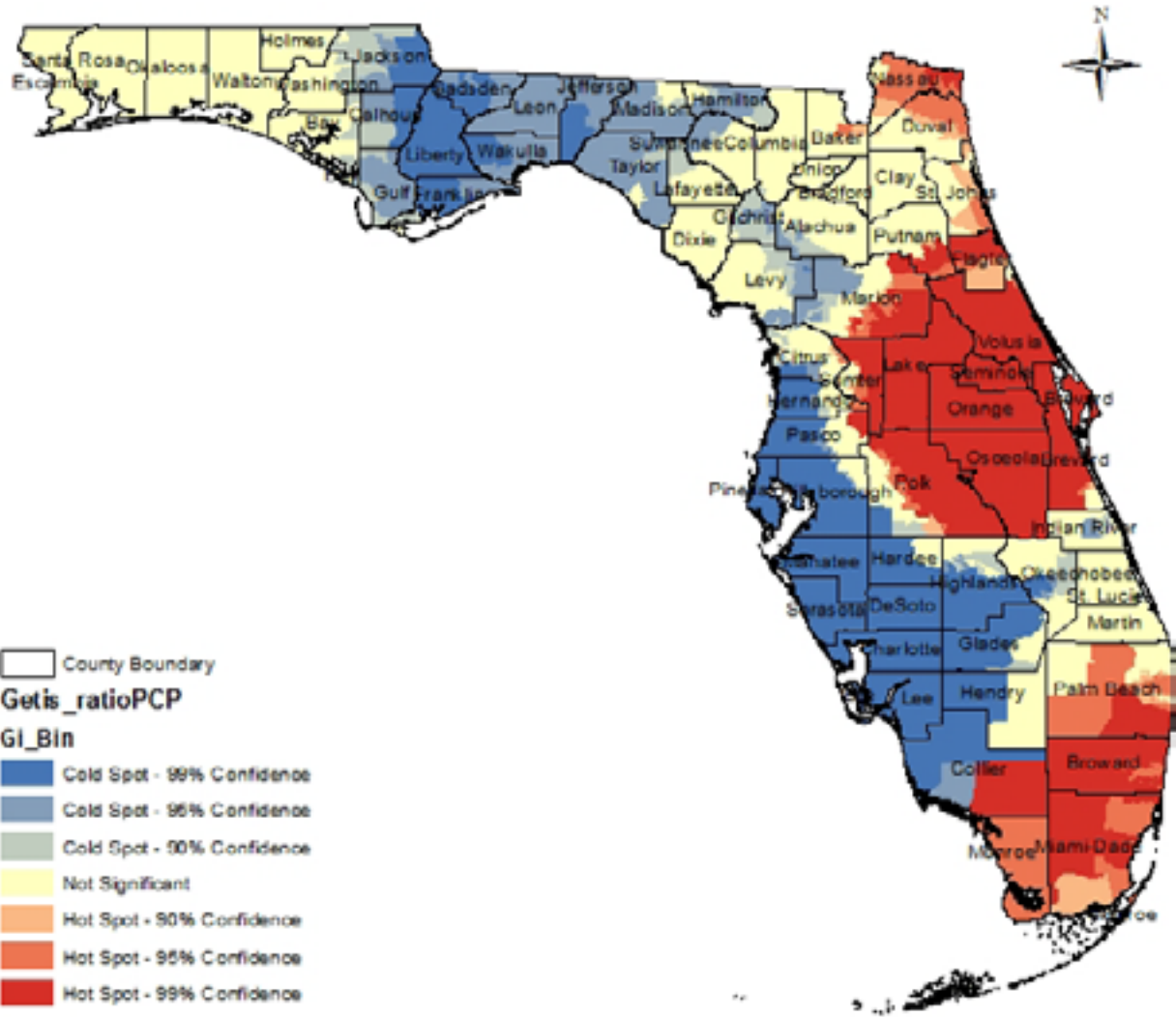
Accessibility: Calculate **driving time** to the nearest healthcare providers

§ To identify travel time to the nearest PCPs by census block group

Overlay: 1) spatial clusters of low availability index for population, and 2) travel time of population that counts low or high accessibility

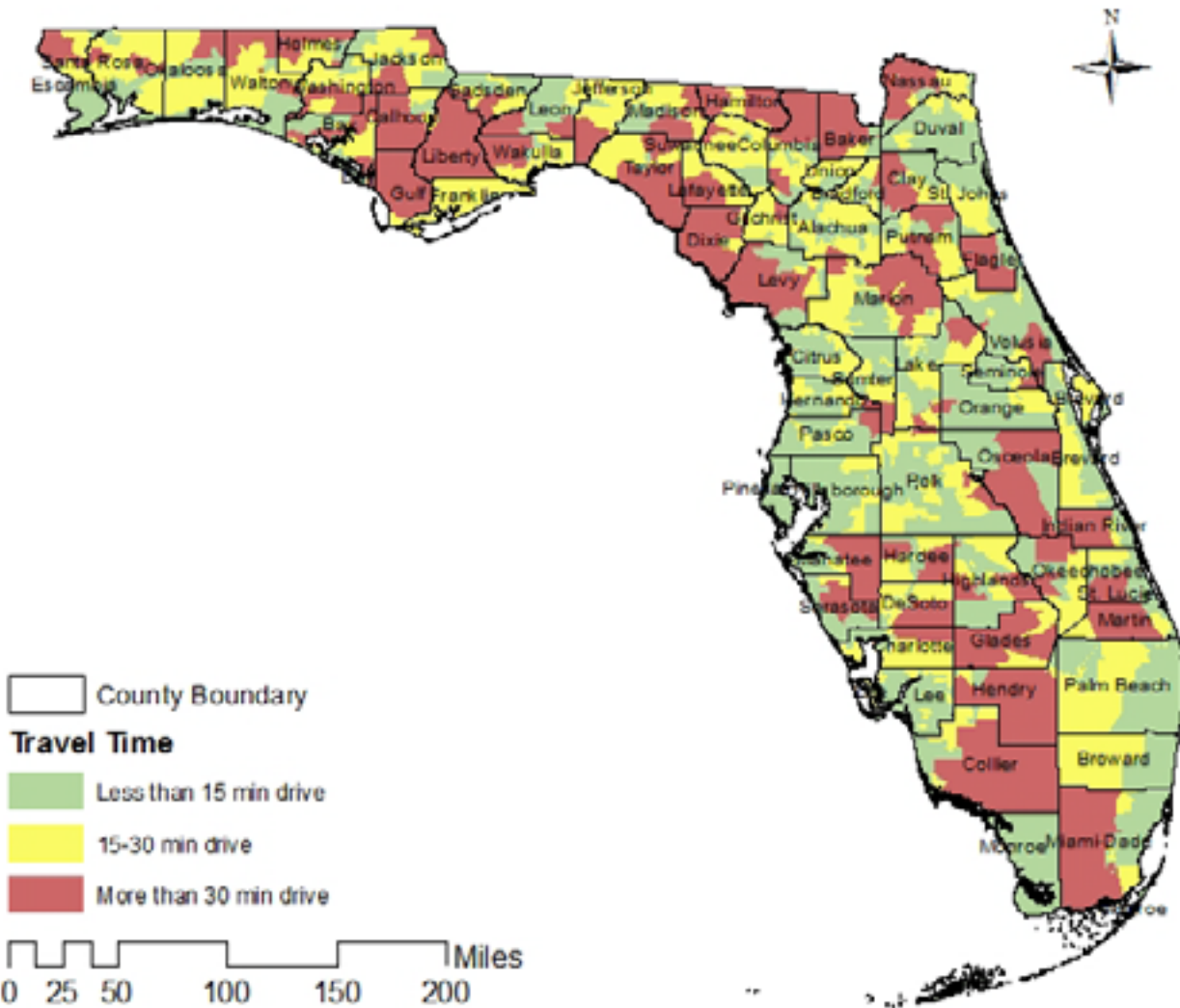
Results	Hot	Cold	No Clustering
Less than 15 minutes	15min-Hot	15min-Cold	15min-NoCluster
15 to 30 minutes	15-30min-Hot	15-30min-Cold	15-30min-NoCluster
More than 30 minutes	30min-Hot	30min-Cold	30min-NoCluster

FINDINGS

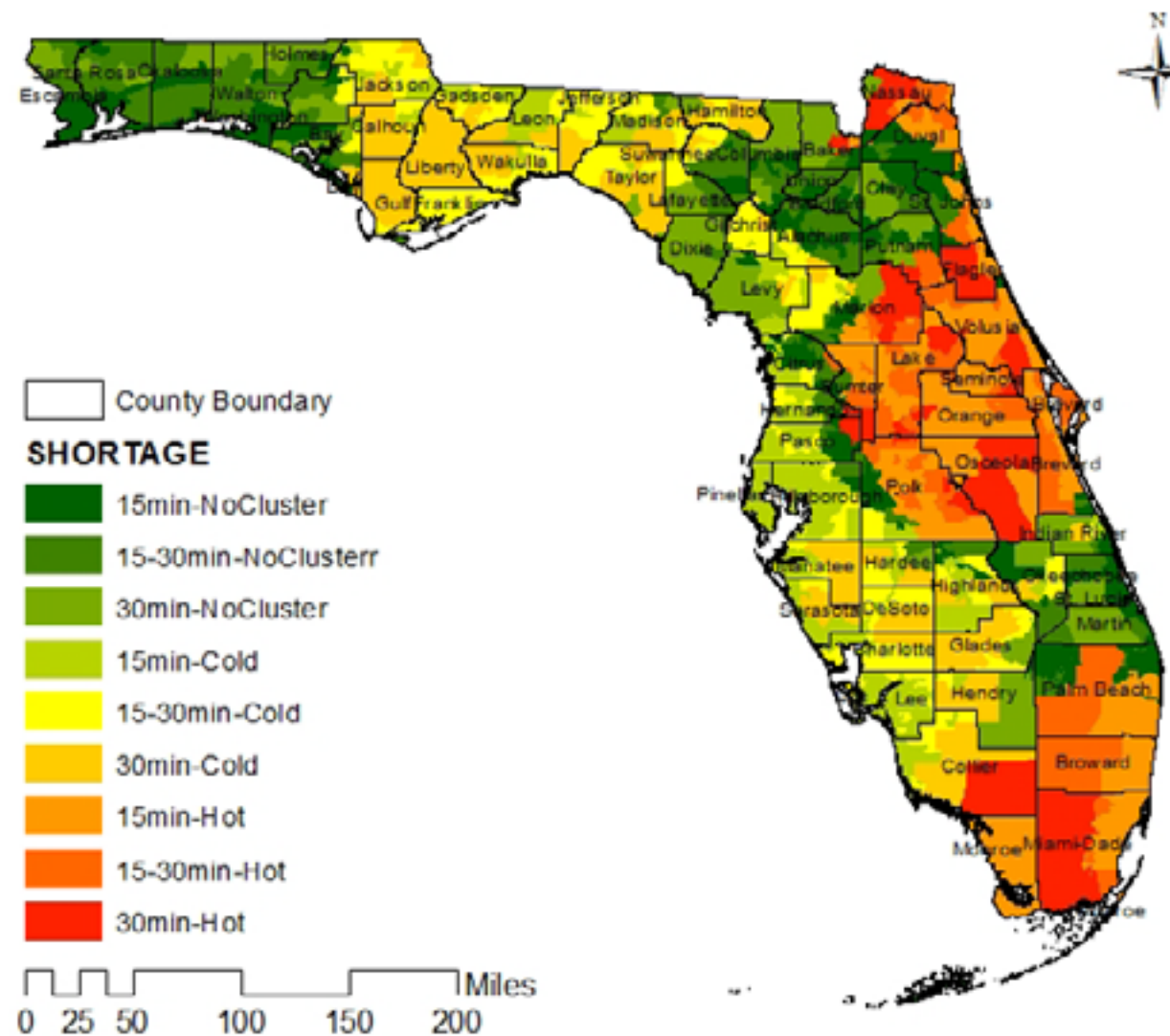
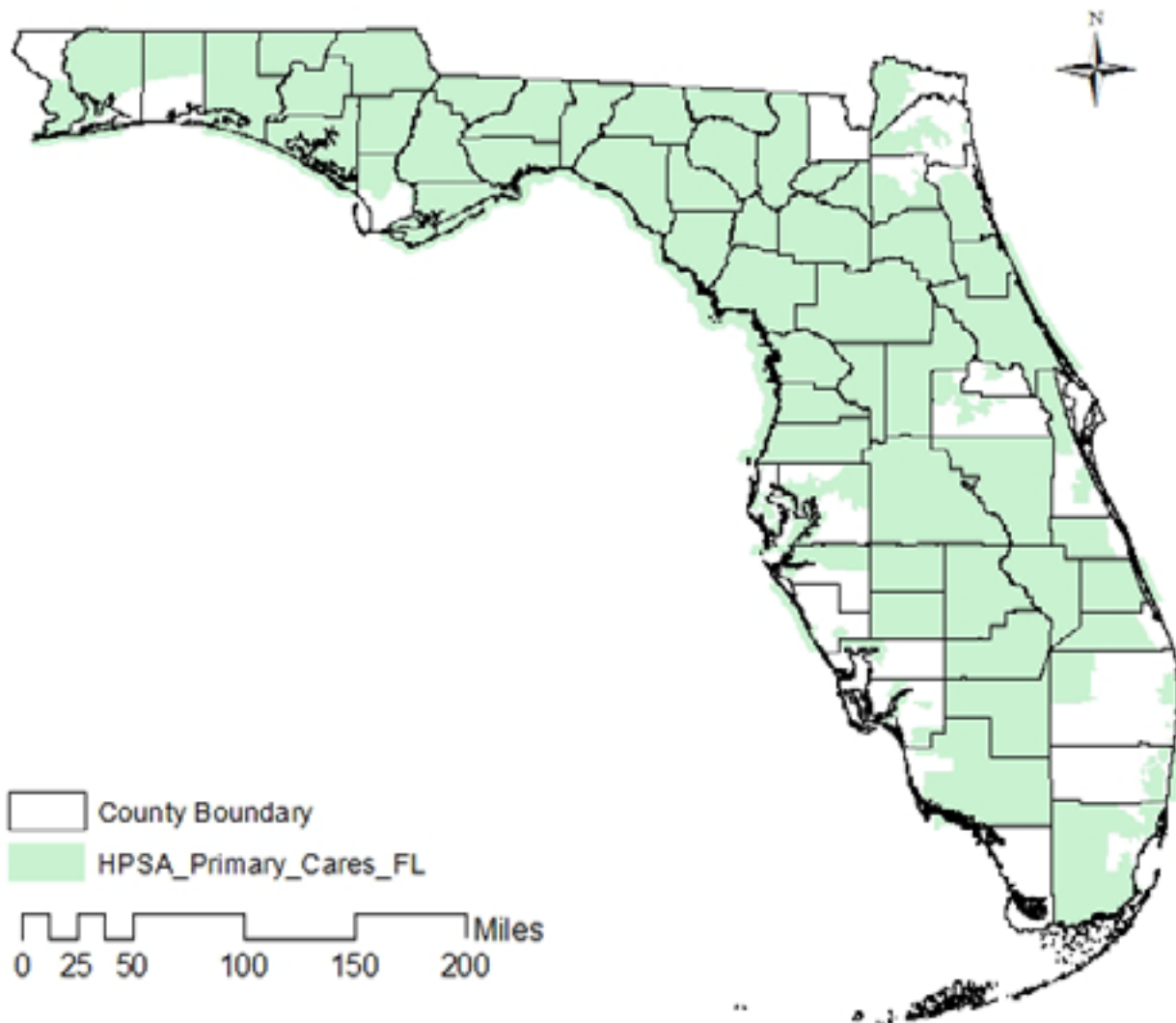


Cluster Type	Urban/Rural	Census Block Group	% Blkg	Population	% Pop
Hot	Urban	5281	46.30	9741382	51.23
	Rural	42	0.37	38000	0.20
	Total	5323	46.67	9779382	51.43
Cold	Urban	3641	31.92	5253728	27.63
	Rural	139	1.22	156165	0.82
	Total	3780	33.14	5409893	28.45
No Cluster	Urban	2207	19.35	3714299	19.53
	Rural	95	0.83	112495	0.59
	Total	2302	20.18	3826794	20.12
Total		11405	100	19016069	100

- Red (Hotspots): higher than the mean values are tends to be close to one another
- Blue (Coldspots): lower than the mean values are tend to be close together



Travel Time	Urban/ Rural	Census Block Group	% Blockg	Population	% Pop
Less than 15 minutes	Urban	10275	90.09	17044341	89.63
	Rural	105	0.92	104883	0.55
	Total	10380	91.01	17149224	90.18
15 to 30 minutes	Urban	625	5.48	1201925	6.32
	Rural	108	0.95	133471	0.70
	Total	733	6.43	1335396	7.02
More than 30 minutes	Urban	229	2.01	463143	2.44
	Rural	63	0.55	68306	0.36
	Total	292	2.56	531449	2.79
Total		11405	100.00	19016069	100.00



HPSAs in Florida

Overlaid of availability and spatial accessibility for PCPs



Index	Census Block Group	% Blkg	Population	% Pop
15min-NoCluster	1927	16.90	3190577	16.78
15-30min-NoCluster	256	2.24	424604	2.23
30min-NoCluster	119	1.04	211613	1.11
15min-Cold	3381	29.64	4803032	25.26
15-30min-Cold	293	2.57	437995	2.30
30min-Cold	106	0.93	168866	0.89
15min-Hot	5072	44.47	9155615	48.15
15-30min-Hot	184	1.61	472797	2.49
HPSA_Primary_Cares_FL 30min-Hot	67	0.59	150970	0.79
	11405	100.00	19016069	100.00



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Thank You

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