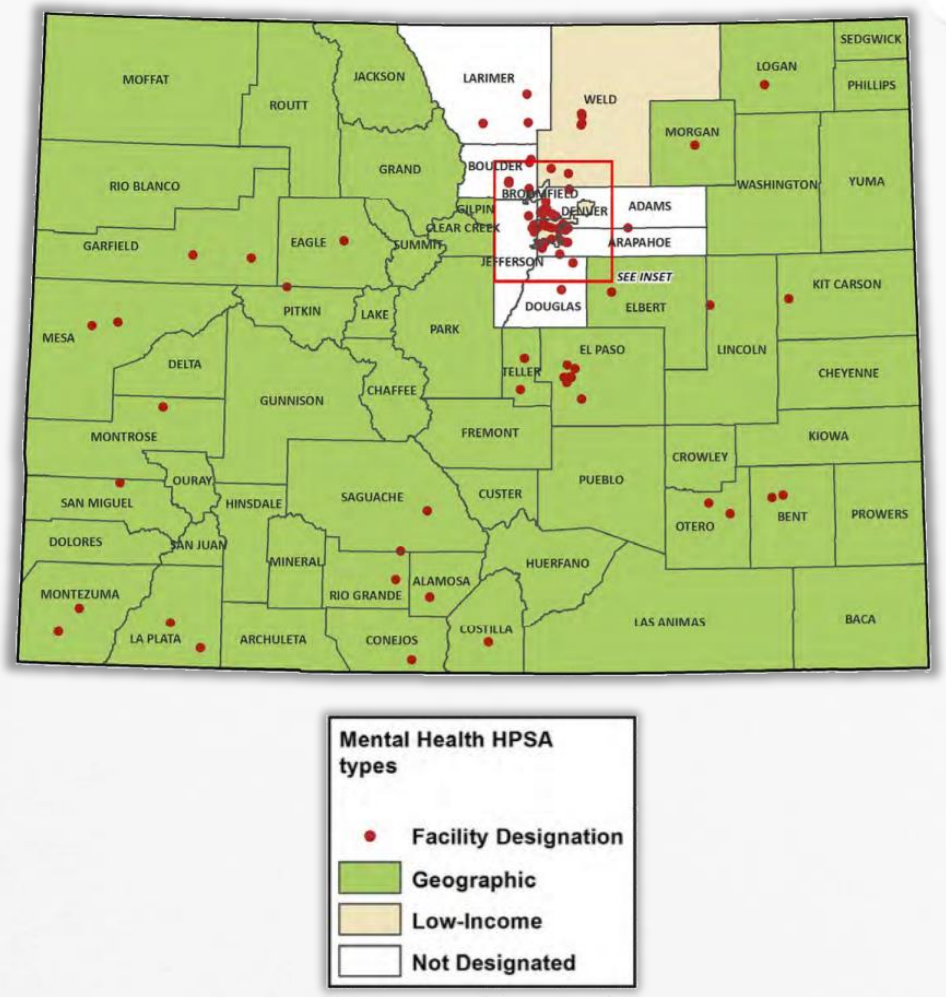
State-Designated Health Professional Shortage Areas (HPSAs) for Substance Use Disorders (SUDs)

Ben White, MPH

The Need for a More Refined HPSA Designation



The burden of Substance Use Disorders (SUD) in Colorado has increased since 2000 by **170 percent** and **300 percent** for adults 25 to 34 and 55 to 64, respectively

Access to treatment for SUDs depends on the capacity of community level behavioral health clinicians

Federal HPSAs are insufficient; They don't account for full workforce capacity & assume a uniform rate of care need

The CO legislature directed the expansion of the Colorado Health Service Corps (CHSC) to include clinician practice incentives for SUD professionals to work in state designated HPSAs.

Source: Colorado State Board of Health August 2018 Meetings, Document 1

New CDPHE HPSAs will…

1. Estimate demand for SUD services for a population within a specific geographic area;
2. Estimate supply of SUD services for the population within a specific geographic area
3. Determine whether supply meets demand within a service area.
4. Determine areas where the supply falls short of minimally adequate SUDs treatment

Lit Review of Defining Access: Two-Step Floating Catchment

- Pioneered by Luo and Wang (2003)
- Builds on Provider-to-Patient Ratios (PPRs)
- Utilizes overlapping catchment areas that are determined by a maximum travel (time or distance)
- All services within that catchment are considered accessible and equally proximate to that population
- All service locations outside of the catchment deemed not accessible

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Measures of spatial accessibility to health care in a GIS environment: synthesis and a case study in the Chicago region

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Abstract. This article synthesizes two GIS-based accessibility measures into one framework, and applies the methods to examining spatial accessibility to primary health care in the Chicago ten-county region. The floating catchment area (FCA) method defines the service area of physicians by a threshold travel time while accounting for the availability of physicians by their surrounded demands. The gravity-based method considers a nearby physician more accessible than a remote one and discounts a physician's availability by a gravity-based potential. The former is a special case of the latter. Based on the 2000 Census and primary care physician data, this research assesses the variation of spatial accessibility to primary care in the Chicago region, and analyzes the sensitivity of results by experimenting with ranges of threshold travel times in the FCA method and travel friction coefficients in the gravity model. The methods may be used to help the US Department of Health and Human Services and state health departments improve designation of Health Professional Shortage Areas.

Introduction

Accessibility refers to the relative ease by which the locations of activities, such as work, shopping, and health care, can be reached from a given location (BTS, 1997, page 173). Access to health care varies across space because access to health care is affected by where health professionals locate (supply) and where people reside (demand) and neither health professionals nor population is uniformly distributed. Physician shortage has been especially pronounced in rural areas and impoverished urban communities (COGME, 2000; Rosenblatt and Lishner, 1991). The US federal government spends about $1 billion a year on programs designed to alleviate access problems, including awarding financial assistance to providers and assigning National Health Service Corps personnel to serve designated shortage areas (GAO, 1995). Any effective remedies begin with reliable measures

Access to health care may be classified acc
(potential versus revealed, and spatial versus
potential spatial access, potential aspatial acce
aspatial access (Khan, 1992). *Revealed accessib*
services, whereas *potential accessibility* signif
care system, but does not ensure the autom
(Joseph and Phillips, 1984; Khan, 1992; Phill
access emphasizes the importance of the spat
facilitator), whereas the *aspatial access* stresses
such as social class, income, ethnicity, age, sex
1992; Meade and Earickson, 2000, page 383 –
measuring *potential spatial accessibility*. The m
include regional availability and regional acces
regional availability approach is simpler and
demand within a region, often expressed as a
variation) within that region. The *regional*

Two-Step Floating Catchment Area (2SFCA)

"The 2SFCA is one of the most popular methods to measure healthcare accessibility.

In the first step, the supply to demand ratio (R_j) is calculated at each location of a healthcare facility (j) within the critical travel time (t_0) boundary. It is calculated by dividing the number of supply (S_j) by the total population located at k within the critical travel time (t_0). S_j depends on the number of healthcare employees or the number of beds."

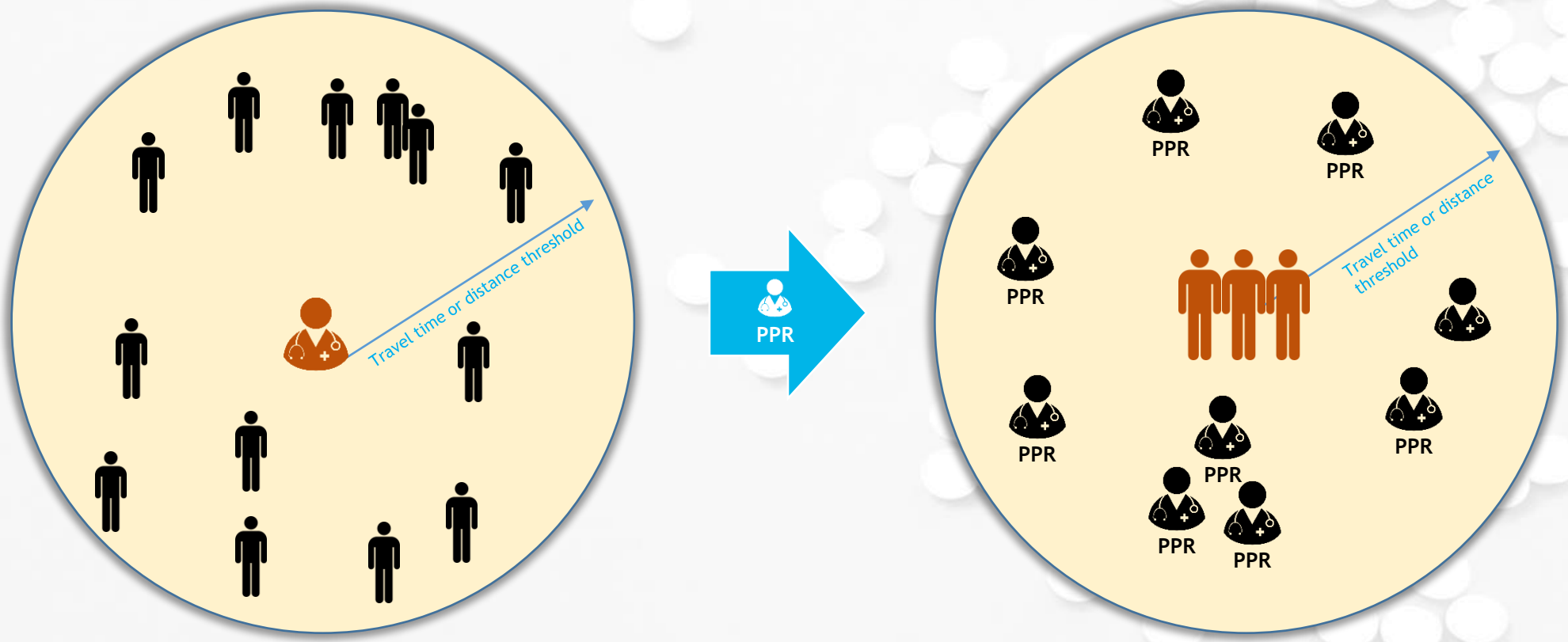
$$R_j = \frac{S_j}{\sum_{t_{kj} \in t_0} P_k}$$

"In the second step, the accessibility to healthcare (A_i) and opportunities for healthcare per person are calculated as a sum of the supply to demand ratio R_j for all facilities falling within the critical travel time from each population (i)."

$$A_i = \sum_{j \in (t_{ij} \leq t_0)} R_j = \sum_{j \in (t_{ij} \leq t_0)} \frac{S_j}{\sum_{k \in (t_{kj} \leq t_0)} P_k}$$

Source: Kim, Byon & Yeo (2018)

What is Two-Step Floating Catchment?



- Determine total population within each provider location's catchment

- Calculate a Provider-to-Population Ratio **(PPR)** for each provider location

- Determine the number of provider locations (and their PPR's) within a population center's catchment

-Find the Cumulative Provider-to-Population Ratio **(CPPR)** for each population center location within its catchment (travel time/distance)

2SFCA Requirements

1. **Service providers are represented by their geocoded organizational address (latitude, longitude)** Aggregating reduces 2SFCA sensitivity to small-area discrimination.

2. **Population (aggregated) groups are represented through a single location** (centroid, usually geometric or population-weighted). Smaller areal units = more accurate small-area measurement of 'local' access, but greatly increases computation.

3. **Population-provider proximity is measured as time or distance** separation (point-to-point) through some transport network (roads, public transport). Euclidean distance less accurate.

Source: Kim, Byon & Yeo (2018)

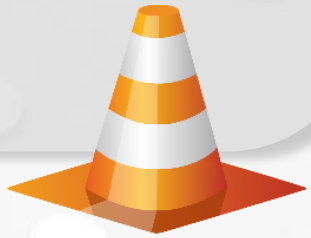
2SFCA Caveats

Traditional 2SFCA has three (3) important limitations:

1) It is dichotomous in describing access/no access based on a threshold

2) It does not consider distance decay within functions (i.e. a location closest to the center of the catchment is considered to have the same equal access as a location 40 miles away at the edge of the catchment)

3) By using a fixed catchment distance, it does not correctly reflect the reality that people in rural areas are willing to/must drive farther distances to access the same services as their urban counterparts



The solution? …

Source: Kim, Byon & Yeo (2018)

Variable 2SFCA

…Introduce **varying catchment sizes** in both steps of the 2SFCA process. Set thresholds of both base population (BP) to sustain a provider (Step 1) and a base Physician/Population Ratio (PPR) for a population center (Step 2). If this threshold is not met for a catchment of a certain time/distance, incrementally expand that catchment until the threshold is met. Use the new catchment size for that location.

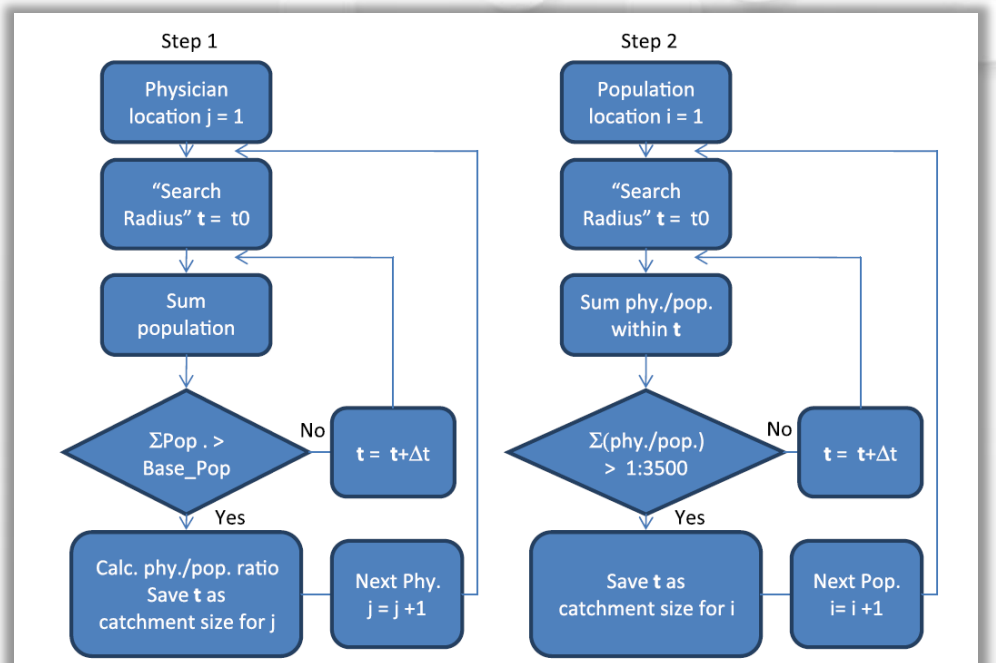
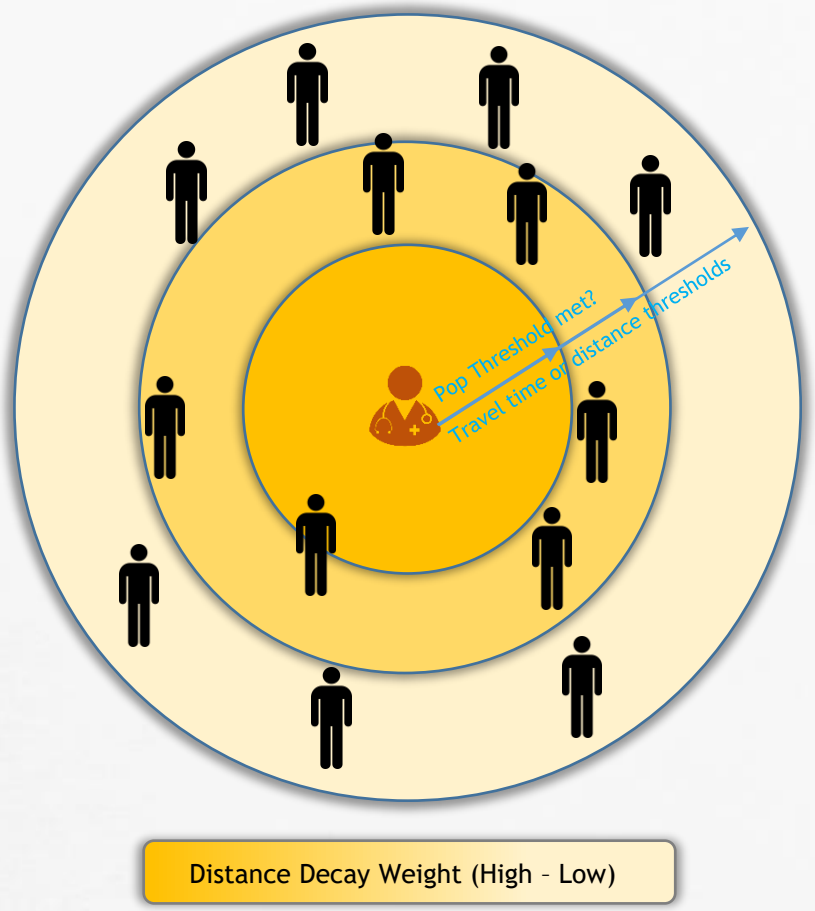


Fig. 1. Flow diagram of steps in determining variable catchment sizes for the 2SFCA method.

Source: Luo & Whippo (2012)

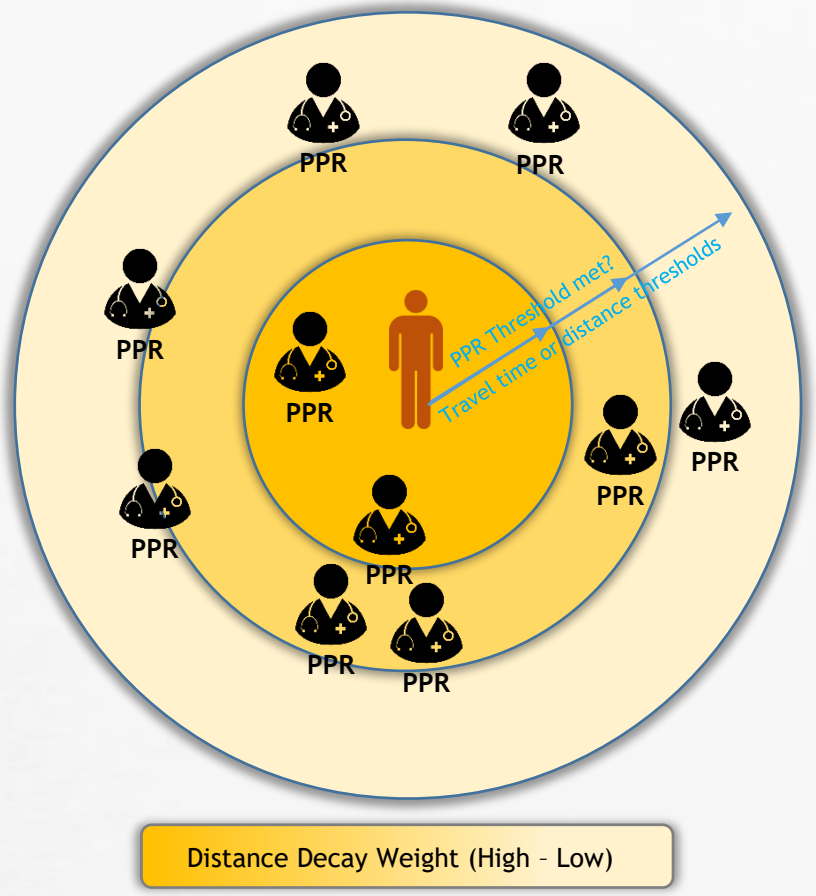
Variable Two Step Floating Catchment Area



- Determine the total population within each provider location's catchment (travel time/distance threshold)
- If the base population threshold **(BP)** is not met, expand the catchment size to the next increment
- Continue the previous step until the **BP** is met. Assign this catchment level to the provider
- Calculate a Provider-to-Population Ratio **(PPR)** for each provider location with the following formula:
  *(Providers/Population) * Distance Decay Function Weight*

Source: Luo & Whippo (2012)

Variable Two Step Floating Catchment Area



- Determine the total **PPRs** within each population center location's catchment (travel time/distance threshold)
- If the base **PPR** threshold is not met, expand the catchment size to the next increment
- Continue the previous step until the **PPR** is met. Assign this catchment level to the provider
- Sum the total Provider to Population Ratios **(PPR)** for each population center location with the following formula:
  (Summed PPR) * Distance Decay Function Weight

Source: Luo & Whippo (2012)

Modeling Distance Decay

Discount both the populations and PPR by weights which are obtained from the distance decay function being used to model the interaction and movement. There are many decay functions, and the best way to determine which fits your V2SFCA process is by modeling actual OD data.

$$R_j = \frac{S_j}{\sum_{k \in \{d_{kj} \leq C_j\}} P_k W_{kj}}$$

$$A_i^F = \sum_{j \in \{d_{ij} \leq C_i\}} R_j W_{ij}$$

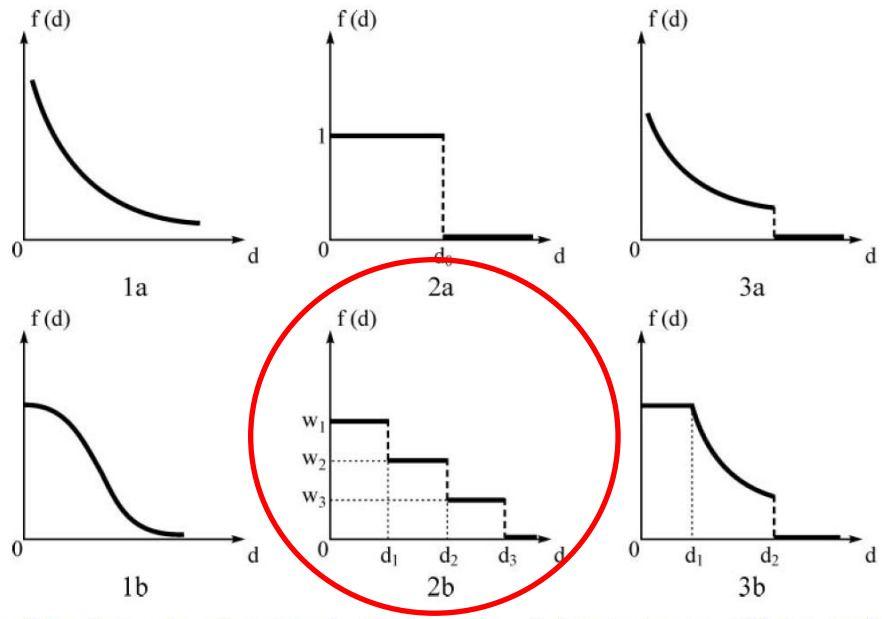


Figure 1. Conceptualizing distance decay in patient–physician interactions: (1a) gravity function, (1b) Gaussian function, (2a) binary discrete, (2b) multiple discrete, (3a) kernel density, and (3b) three-zone hybrid.

Source: Luo & Whippo (2012)

Available Data

Colorado Roads

OpenStreetMap

Colorado Census Block Groups, 2012-2016 ACS 5yr Estimates (excludes group qtrs.)

AMERICAN COMMUNITY SURVEY
U.S. CENSUS BUREAU

Estimates on age/race behavioral health SUDs prevalence

Age	Male	Female
18-25	25.7%	12.9%
26-34	17.6%	8.8%
35-49	10.4%	5.2%
50-64	6.1%	3.1%
65 or older	2.5%	1.3%

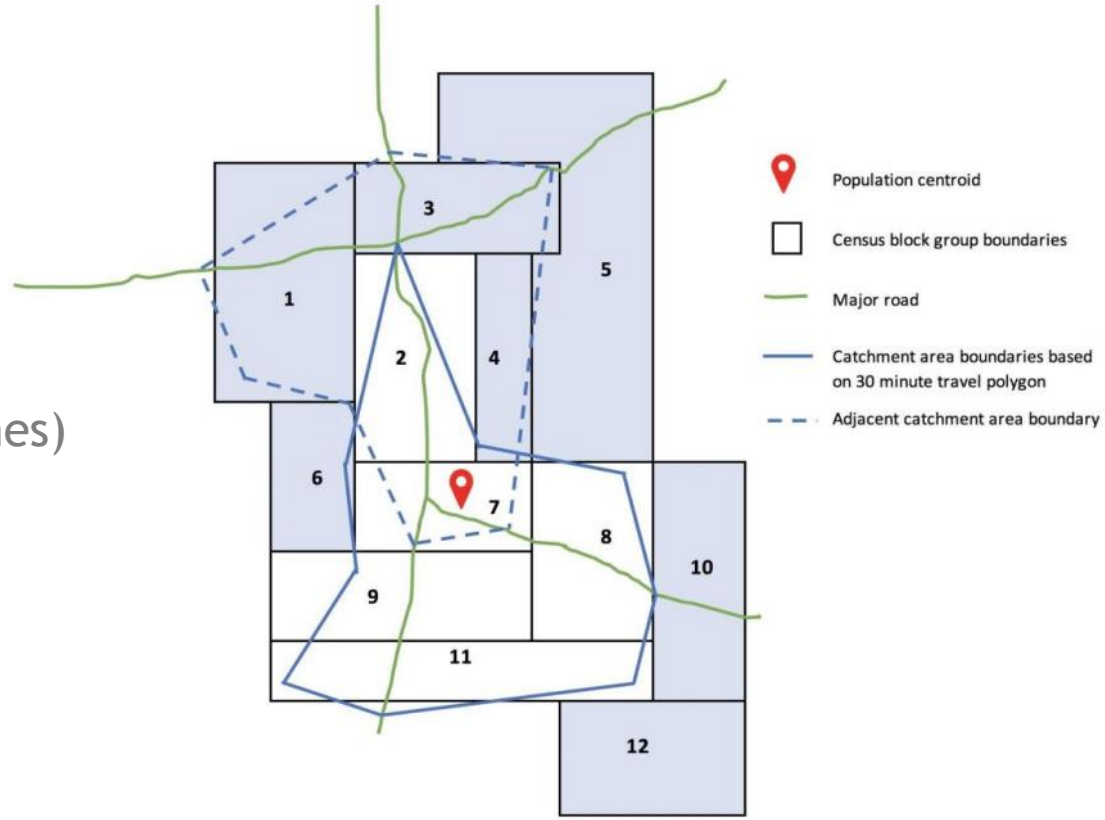
Colorado Health Systems – Registered Providers & yearly encounters

Behavioral Health Discipline	Panel Size	Encounters/Year
Psychiatrist (MD, DO)	513	1827
Psychologist (Ph.D., Psy.D.)	266	1549
Social Worker (LCSW)	207	1575
Individual Therapist (LPC, LAC, LMFT, NP, PA)	275	1740
Group Therapist (CAC)	967	7736

The SUD multiplier by age and sex was derived from national data from the report "Behavioral Health, United States, 2012" page 36 "Table 2. Past year mental illness and substance use disorders among adults, by selected characteristics: percentage, United States, 2010-2011 combined" and, page 44 "Table 5. Past year substance use disorders among adults, by sex: percentage, United States, 2010-2011 combined" (Substance Abuse Mental Health Services Administration, 2012).

Geospatial Tools/Steps Used

- Geocoding (QA/QC of provider data)
- Geodatabase vector editing(OSM road attribute editing, spatial cleaning)
- Network Analyst (creation of road network)
- Drive-time analysis (20min/40min/60min isochrones)
- OD-Matrix (90min max cut-off)
- Huff Model (Business Analyst) for beta comparison
- Spatial Joins
- Summary statistics



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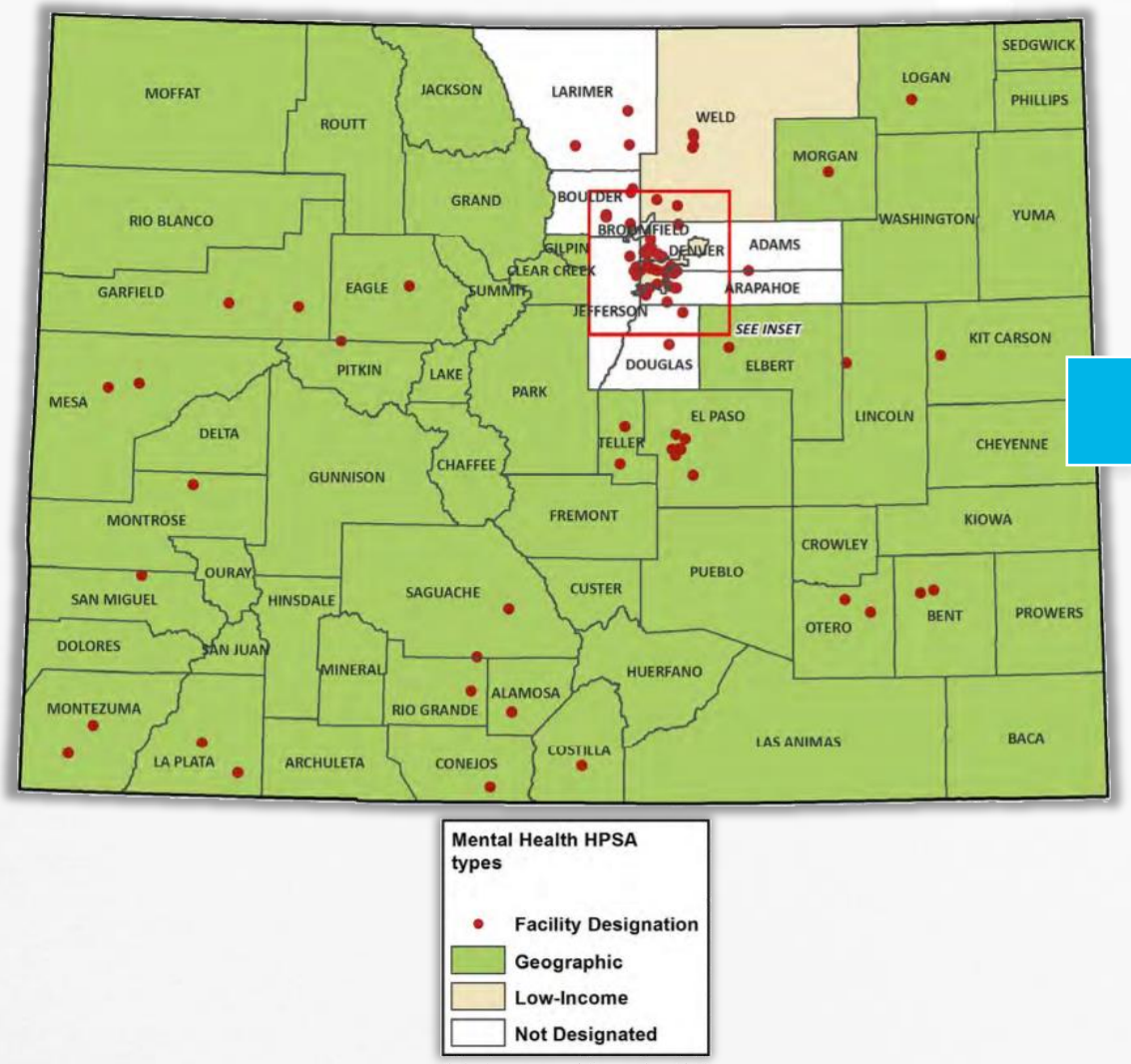
Behavioral HPSAs: Federal Designation vs. CO-V2SFCA

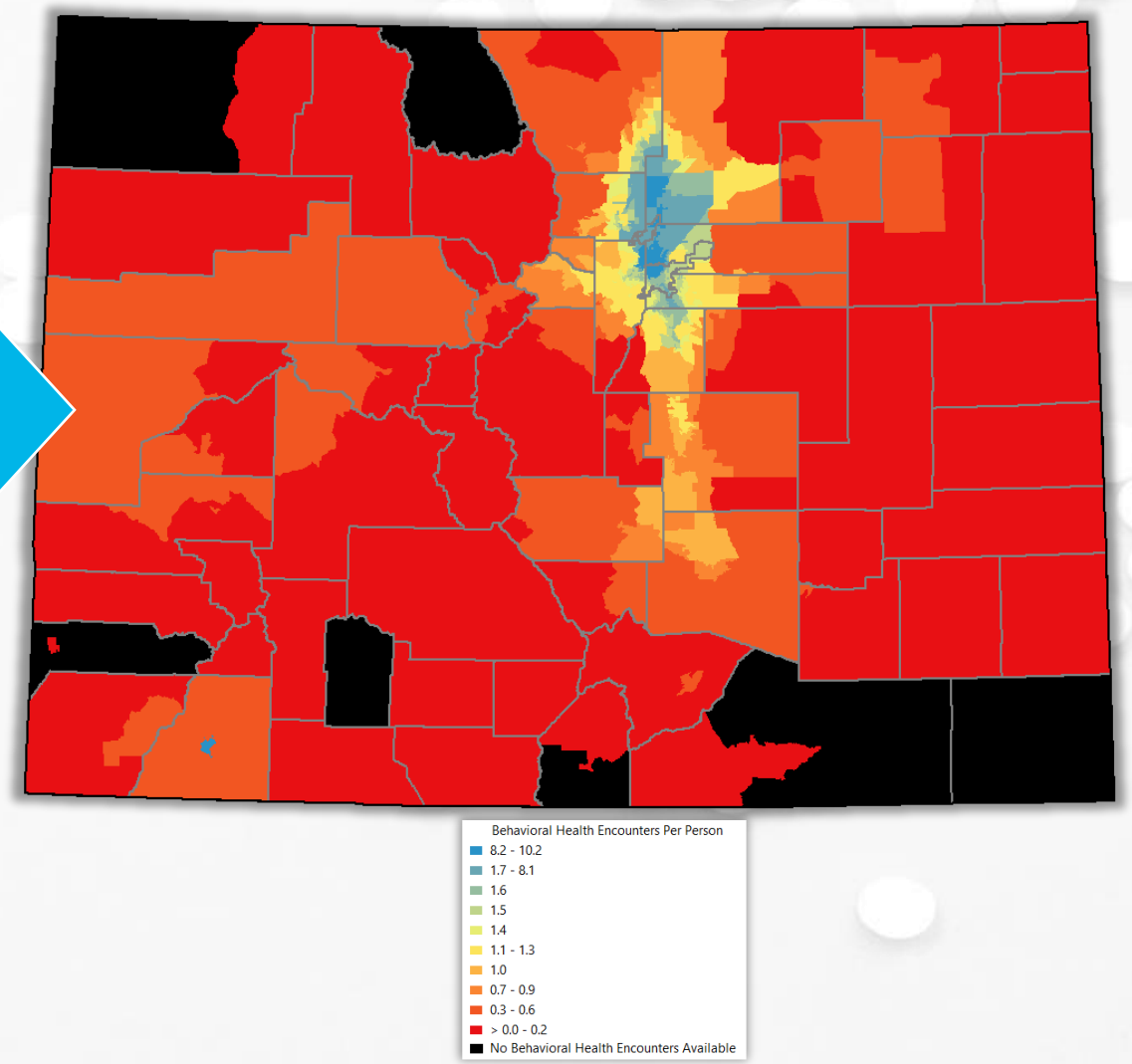
The following map shows the number of behavioral health encounters (1hr sessions) available to the Colorado civilian population age 18+ in each U.S. Census Block Group based on V2SFCA methodology, binned by deciles.

Fewer than eight (8) visits available per person is deemed inadequate by the National Comorbidity Survey and thus designates a census block group a **HPSA** area.

Source: https://www.colorado.gov/pacific/cdphe/shortage-area-maps-and-data

Behavioral HPSAs: Federal Designation vs. CO-V2SFCA





Source: https://www.colorado.gov/pacific/cdphe/shortage-area-maps-and-data
Source: Colorado State Board of Health August 2018 Meetings, Document 1

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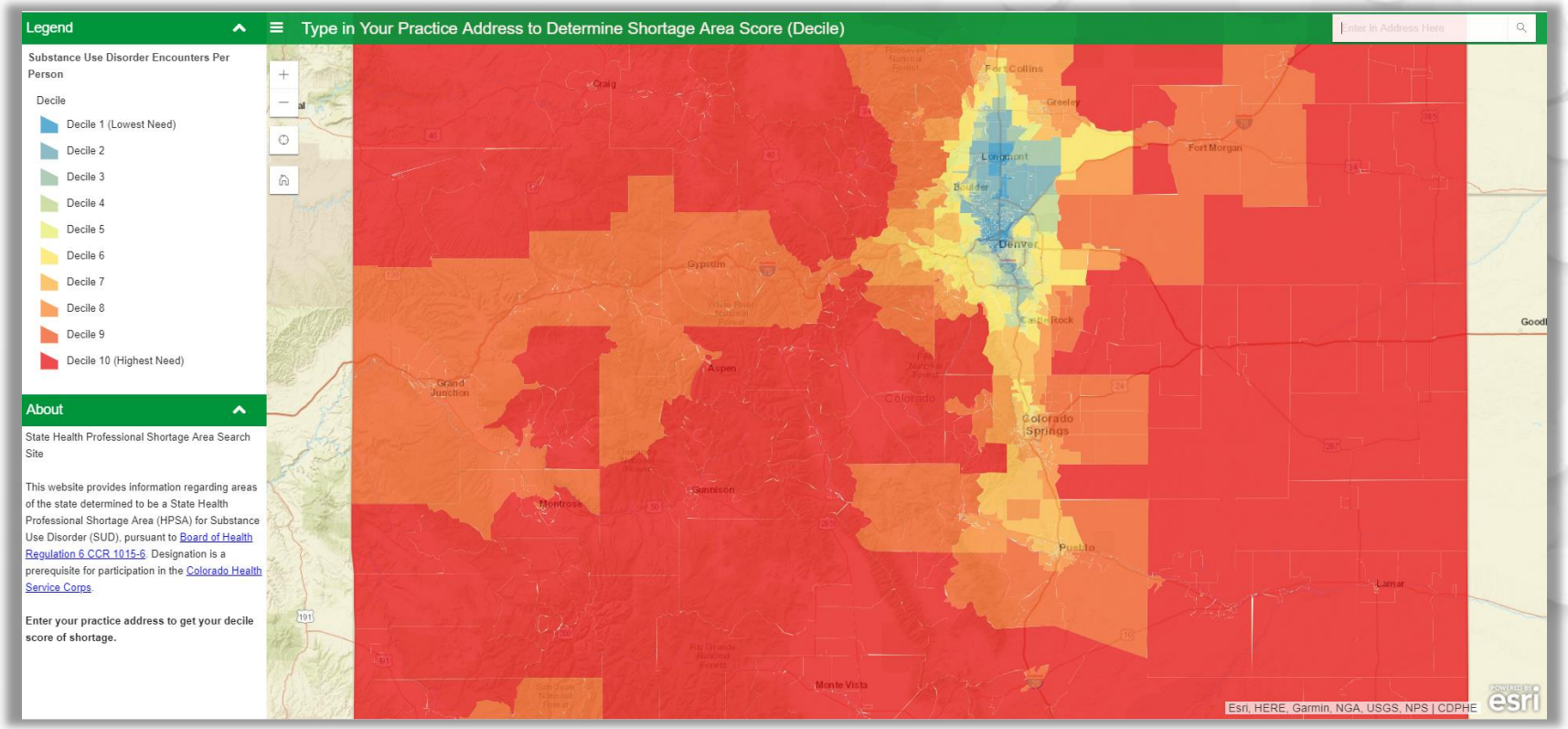
Interactive Web Map for Decision Makers & Colorado Health Services Corp applicants



https://cdphe.maps.arcgis.com/apps/SimpleViewer/index.html?appid=9f17f6155cde42aab58b0ccf65a179d5

Application: Determining Funding for Providers in BHPSAs

in loan assistance/retraining funding

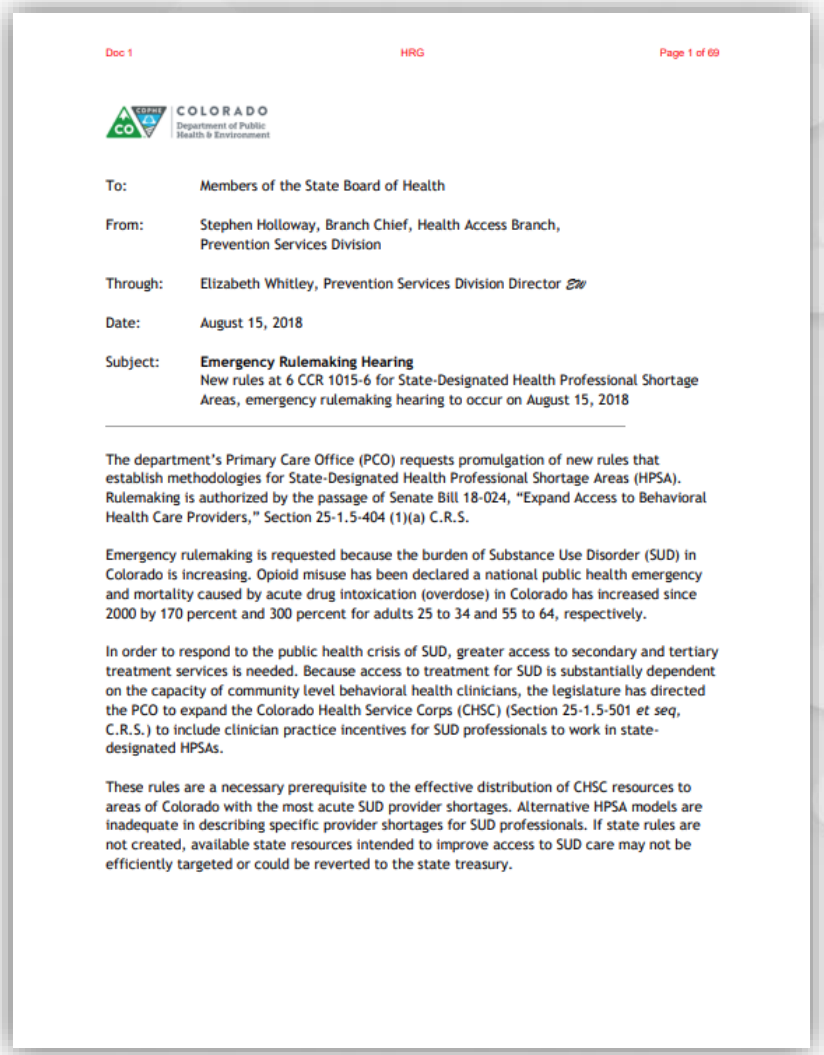
62 Applicants (FY 2018-2019)

Applicants assigned a decile score based on V2SFCA SUD HPSA results at location of their practice office

This decile ranking helps decide applicant funding priority. However, it is not the only deciding factor.

Source: Colorado State Board of Health August 2018 Meetings, Document 1

August 15th, 2018 BoH Ruling



Doc 1 HRG Page 1 of 69

COLORADO
Department of Public Health & Environment

To: Members of the State Board of Health

From: Stephen Holloway, Branch Chief, Health Access Branch, Prevention Services Division

Through: Elizabeth Whitley, Prevention Services Division Director

Date: August 15, 2018

Subject: **Emergency Rulemaking Hearing**
New rules at 6 CCR 1015-6 for State-Designated Health Professional Shortage Areas, emergency rulemaking hearing to occur on August 15, 2018

The department's Primary Care Office (PCO) requests promulgation of new rules that establish methodologies for State-Designated Health Professional Shortage Areas (HPSA). Rulemaking is authorized by the passage of Senate Bill 18-024, "Expand Access to Behavioral Health Care Providers," Section 25-1.5-404 (1)(a) C.R.S.

Emergency rulemaking is requested because the burden of Substance Use Disorder (SUD) in Colorado is increasing. Opioid misuse has been declared a national public health emergency and mortality caused by acute drug intoxication (overdose) in Colorado has increased since 2000 by 170 percent and 300 percent for adults 25 to 34 and 55 to 64, respectively.

In order to respond to the public health crisis of SUD, greater access to secondary and tertiary treatment services is needed. Because access to treatment for SUD is substantially dependent on the capacity of community level behavioral health clinicians, the legislature has directed the PCO to expand the Colorado Health Service Corps (CHSC) (Section 25-1.5-501 *et seq*, C.R.S.) to include clinician practice incentives for SUD professionals to work in state-designated HPSAs.

These rules are a necessary prerequisite to the effective distribution of CHSC resources to areas of Colorado with the most acute SUD provider shortages. Alternative HPSA models are inadequate in describing specific provider shortages for SUD professionals. If state rules are not created, available state resources intended to improve access to SUD care may not be efficiently targeted or could be reverted to the state treasury.

Source: Colorado State Board of Health August 2018 Meetings, Document 1

Continued Use of Methodology

Methodology used in 2020 to identify primary care HPSAs

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Health professional shortage area maps and data

- Prevention and wellness
  - Health Access
    - Colorado Health Service Corps
    - Colorado School Nurse Grant Program
    - Health workforce planning and assessment
      - Colorado Health Systems Directory
      - **Health Professional Shortage Area maps and Data**
      - Health Professional Shortage designation process

Use the maps and data provided here to determine whether your community is located in a Health Professional Shortage Area (HPSA).

Colorado shortage area maps

- Federal Designations
  - Designated Health Professional Shortage Areas:
    - Primary care.
    - Mental health.
    - Oral health.
  - Medically Underserved Areas and Populations.

Eligibility for HPSA status is based on demonstration of unmet need for provider capacity. The federal scoring method takes into account population to provider ratios for the designation, as well as other indicators of need that are specific to the discipline of the designation. Because of the additional factors, larger HPSA scores are generally indicative of greater need, but are not valid for direct comparison of provider capacity deficiency between designations.

In addition to these federal designations, Colorado has created a HPSA for substance use disorder treatment under a method described in state Board of Health Rules. The methodology for substance use disorder designation is based on:

- State Designations
  - Designated Health Professional Shortage Areas:
    - Substance Use Disorder.
    - Primary care.

https://cdphe.maps.arcgis.com/apps/SimpleViewer/index.html?appid=eaae1ef0530c46bd89394770a8cf9d7c

https://cdphe.colorado.gov/prevention-and-wellness/health-access/health-workforce-planning-and-assessment/health-professional

Source Links

- https://www.sos.state.co.us/CCR/GenerateRulePdf.do?ruleVersionId=7729&fileName=6%20CCR%201015-6
- https://www.amazon.com/Quantitative-Methods-Applications-Fahui-Wang/dp/0849327954
- http://www.ij-healthgeographics.com/content/10/1/2
- http://dx.doi.org/10.1080/00330124.2016.1266950
- http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0193013
- https://ij-healthgeographics.biomedcentral.com/track/pdf/10.1186/1476-072X-11-50
- https://en.wikipedia.org/wiki/Two-step_floating_catchment_area_method
- http://www.unm.edu/~lspear/health_stuff.html
- https://hub.arcgis.com/datasets/eed971483638476a9d669aa7e3a8c1ab_3
- http://agis.maps.arcgis.com/home/item.html?id=4fe25317dd9c45c1ba5100680991f22f
- https://ij-healthgeographics.biomedcentral.com/articles/10.1186/1476-072X-3-3
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- https://www.ncbi.nlm.nih.gov/pubmed/20630792
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC394340/
- https://www.ncbi.nlm.nih.gov/pubmed/19576837
- https://www.tandfonline.com/doi/full/10.1080/00330124.2017.1365308
- Personal email correspondence with Dr. Fahui Wang

Questions?