Spatial Accessibility to Healthcare Service and Health Outcome for People with Disability

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Introduction

- People whose mobility is limited by low incomes or poor access to transportation are more sensitive to distance.
- People with disabilities tend to face considerable socioeconomic disadvantage and fewer opportunities to access transportation.
- It is more difficult for people with disability to access health care services by traveling long distance.

Introduction

- Gelberg, Andersen and Leake (2000) provided the Behavioral Model for Vulnerable Population to insight into the issue of access to healthcare.

- The objective of this analysis is to determine the importance of spatial accessibility to health care service in health outcome of people with disability in Ohio by adapting the behavioral model for vulnerable populations.

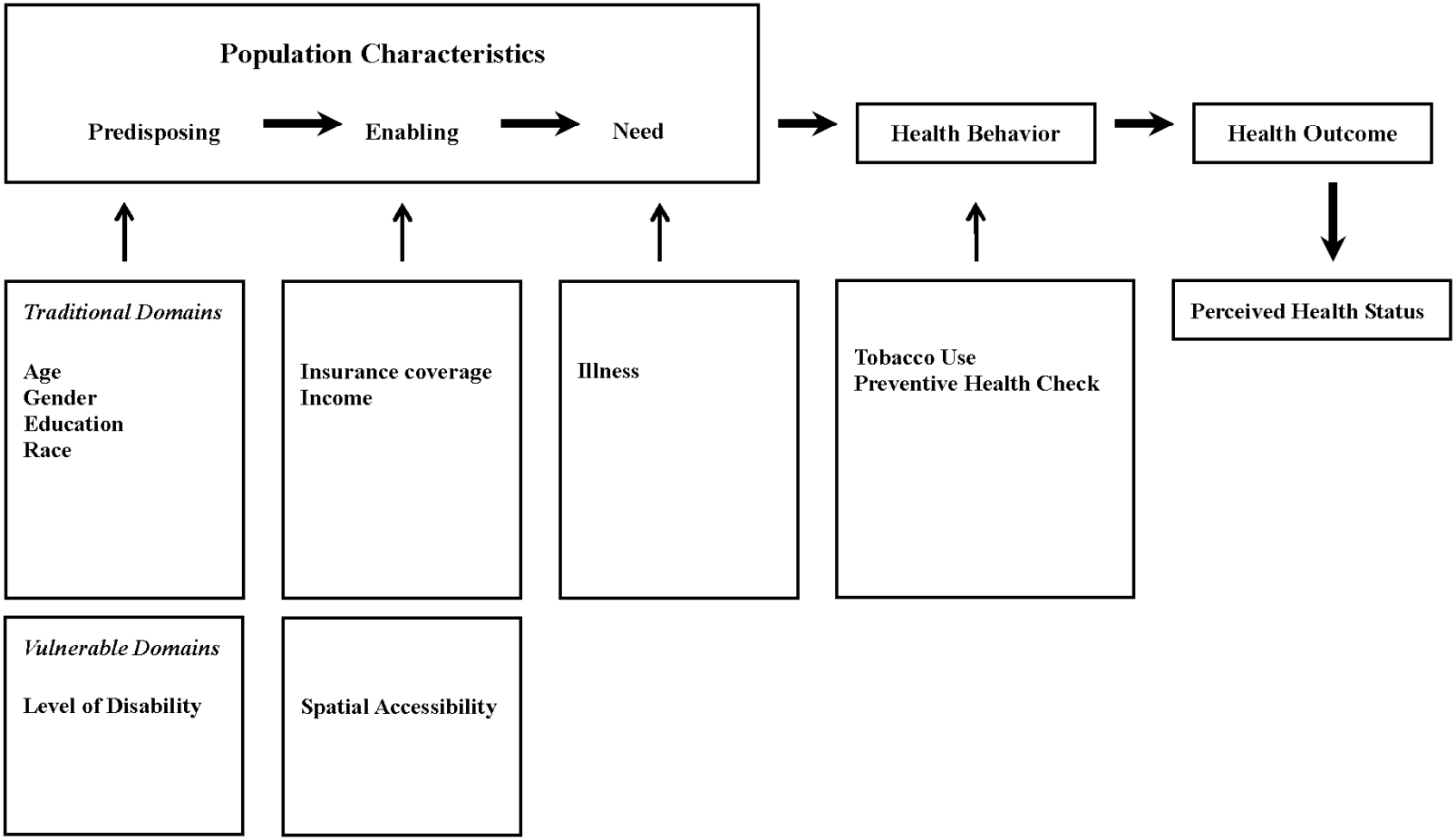


Figure 2. 3 ◆ Model of Spatial Accessibility and Health Outcome for People with Disability

Variables

- Predisposing factors include level of disability, demographic characteristics, education, and aspect of culture (level of disability, age, gender, and race).
- Enabling factors included annual household income and health insurance.
- Health Behavior factors included cigarette use and regular check-up.
- Health status is self-rated general health.

Ohio Family Health Survey 2008

- Statewide telephone survey
- Three questions on the limitations of activities (personal care = 5, domestic activities = 3, household maintenance = 1)
- 8262 subjects (408 are excluded)

Spatial Accessibility

- Spatial accessibility to hospitals is represented by the number of hospital within 30 minutes travel time area for each zip code area in Ohio.
- Two-step floating catchment area is used to measure spatial accessibility to primary care physicians from residents in Ohio.

Predisposing and Socioeconomic Variables		
Variables	**Characteristics**	**Recoding**
Age	Ordinal	years old (over 18 years)
Education	Categorical	0= less than HS 1= HS 2= Some college or higher
Gender	Categorical	0= male 1= female
Level of disability	Ordinal	the score is summed up from three movement limitation questions (higher score means more severe)
Race	Categorical	0= Non White 1= White
Enabling Variables		
Health insurance	Categorical	0= non insured 1= insured
Total income	Categorical	0= above poverty level 1= below poverty level
Health Behavioral Variables		
Smoke	Categorical	0= yes 1= no
Regular examine (last 12 months)	Categorical	0= yes 1= no
Health Outcome Variables		
Health outcome	Categorical	0= good health status 1= poor health status

Analysis Methods

- ArcGIS 9.2 is used to calculate spatial accessibility.
- Logistic regression is used to measure the association between spatial accessibility to health care and health outcome for people with disability, statistically controlling for all the other independent variables.

Limitations

- **Individual results could not be compared over time.**
- **It is not possible to know if some respondent has visual, speech, and hearing impairments or mental retardation.**
- **There is no information about transportation in this survey data.**
- **Self-reported measure, like health status, may produce bias.**
- **Survey may not include some of the most vulnerable population, in low income homes with no or intermittent telephone service, those who are homeless, or institutionalized.**

Two-step floating catchment area

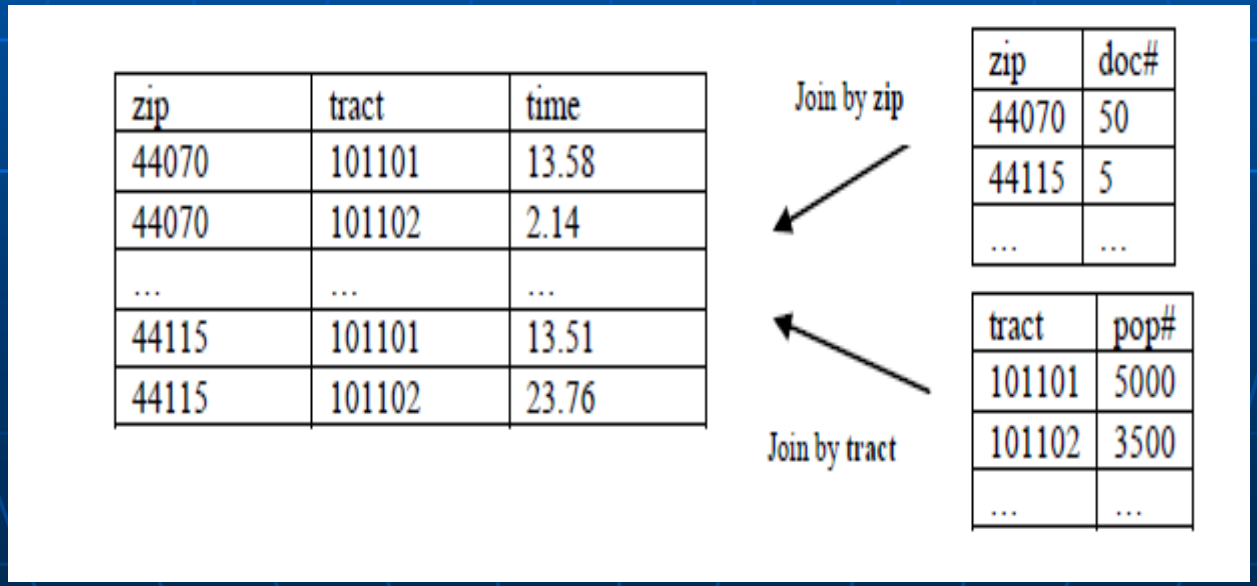
1. **The population-weighted centroids of Zip Code areas and tracts are generated by Mean Center function using block population point.**

   ArcToolbox > Spatial Statistics Tool > Measuring Geographic Distribution > Mean Center (population as weighted field)

2. **Use GIS street network analysis to compute the travel time between any pair of physician location (taken as the Zip Code area centroid) and population location (taken as the census tract centroid).**

   Network Analysis > OD Cost Matrix

3. For each physician location, select population locations that are within a reasonable travel time (30 minutes) of that physician location.



4. Compute the physician-to-population ratio for catchment by dividing the number of physician (s) by the sum of population within catchment.

zip	tract	time	doc#	pop#
44070	101101	13.58	50	5000
44070	101102	2.14	50	3500
…	…	…	…	
44115	101101	13.51	5	5000
44115	101102	23.76	5	3500

sum pop# by zip
calc. r = doc#/sum-pop#

zip	sum-pop#	doc#	R
44070	22500	50	0.002311
44115	10650	5	0.000935
…	…	…	

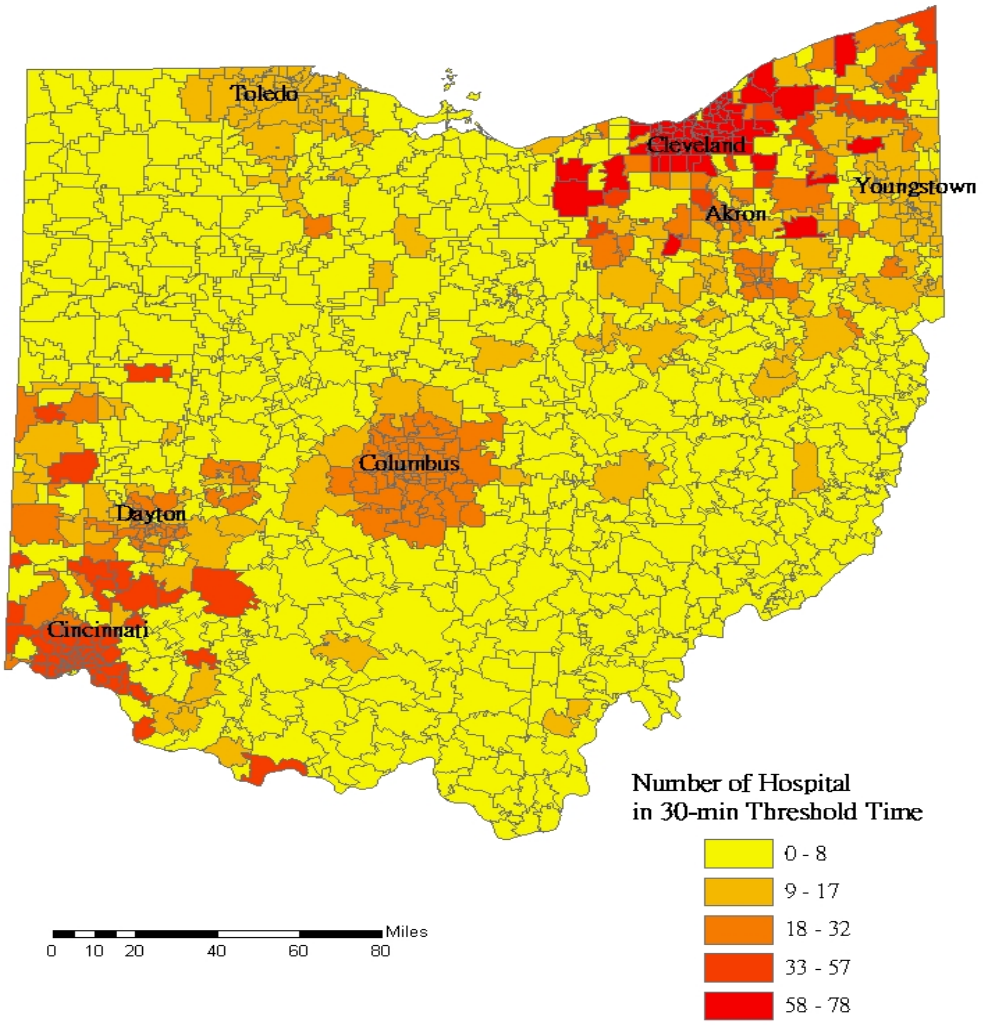
5. For each population location, search all physical locations that are within the reasonable travel time (e.g., 30 minutes), and sum up the physician-to-population ratios at these locations.

zip	tract	time	doc#	pop#	sum-pop#	r
44070	101101	13.58	50	5000	225000	0.002311
44070	101102	2.14	50	3500	225000	0.002311
…	…	…	…		…	…
44115	101101	13.51	5	5000	10650	0.000935
44115	101102	23.76	5	3500	10650	0.000935

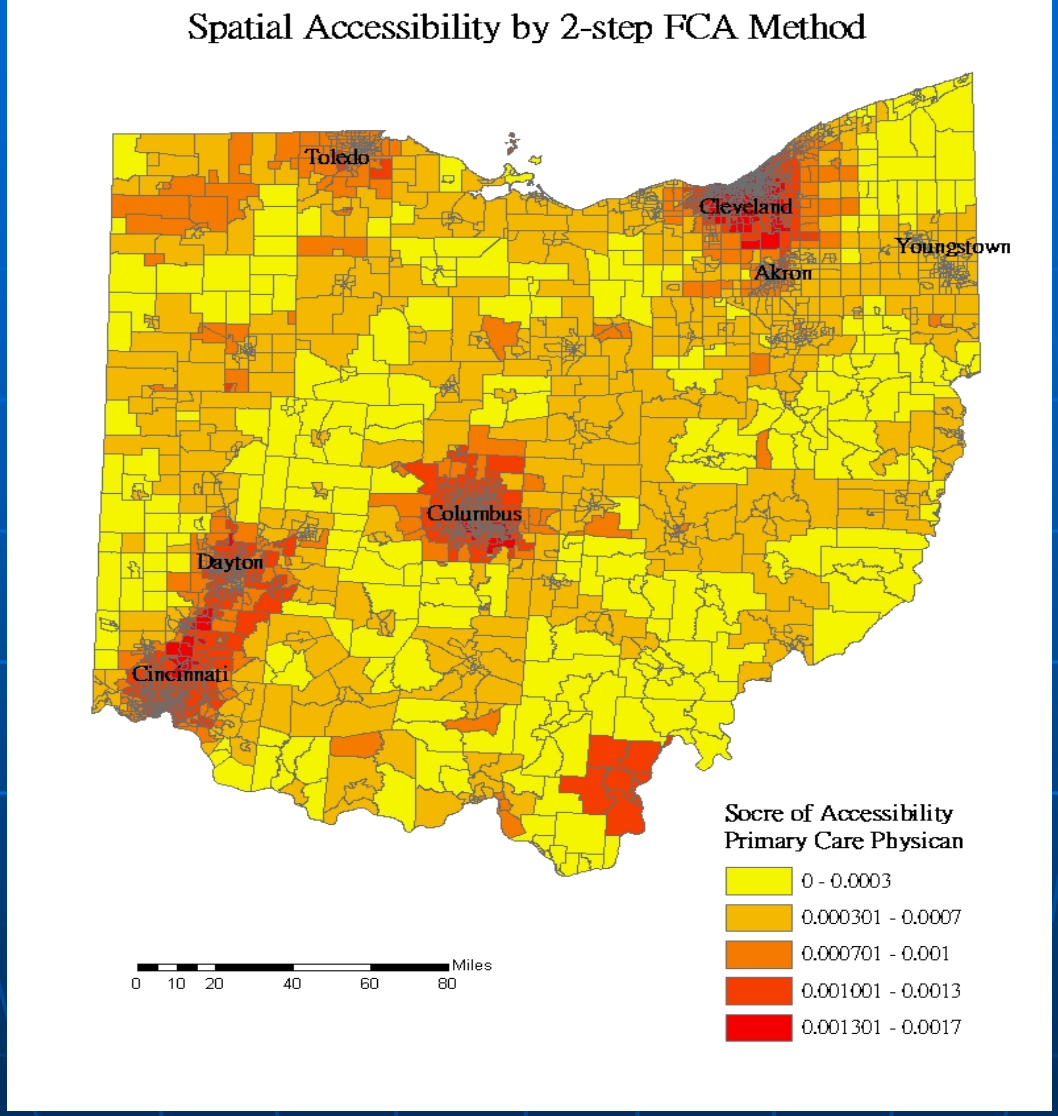
sum r by tarct

tract	r
101101	0.003246
101102	0.005678
…	

Spatial Accessibility to Hospital



Data Source: U.S. Census, Ohio Department of Health and ESRI
Unit: Zip Code Area



Data Source: U.S. Census, Ohio Department of Health and ESRI
Unit: Census Tract

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-.001	.000	5.977	1	.014	.999
Check-up (1 = less than 1 year, 0 = more than 1 year)	.081	.058	1.924	1	.165	1.084
Disability	.180	.011	291.212	1	.000	1.197
Education			10.957	2	.004	
Less than HS	.012	.067	.031	1	.860	1.012
HS	.160	.051	9.802	1	.002	1.173
Gender (1= male, 0 = female)	.296	.054	30.456	1	.000	1.345
Insurance (1= insured, 0 = uninsured)	-.468	.094	24.658	1	.000	.626
Poverty (1= above, 0 = below)	-.697	.055	159.268	1	.000	.498
Race (1= Non White, 0 = White)	.239	.068	12.460	1	.000	1.270
Spatial accessibility to Primary Care Physician	-.374	.061	37.139	1	.000	.688
Smoke (1 = smoke, 0 = no smoke)	-.035	.053	.439	1	.508	.966
Constant	.770	.120	41.550	1	.000	2.161

Logistic Regression I

- Outcome Variables is Health Status (1= poor, 0 = good)
- -2 Log likelihood = 10508.194. Cox & Snell R Square = .087. Nagelkerke R Square = .117.
- The log of the odds of a person in poor health is negatively related to the spatial accessibility to primary care physician (B = -.384, p = .000).
- The level of disability is positively related to the odds of a person in poor health.
- Men are more likely to perceive themselves to be in poor health than women, after controlling for other factors.
- Having insurance (B = -.468, p = .000) and being above federal poverty level (B = -.694, p = .000) are found to be negatively related to poor health status.
- Non-Whites are also significantly more likely to perceive to be in poor health than Whites (odds ratio = 1.27).

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Age	-.001	.000	6.228	1	.013	.999
Check-up (1 = less than 1 year, 0 = more than 1 year)	.082	.058	1.972	1	.160	1.085
Disability	.180	.011	291.016	1	.000	1.197
Education Less than HS HS	 .007 .159	 .067 .051	11.067 .010 9.739	2 1 1	.004 .921 .002	 1.007 1.172
Gender (1= male, 0 = female)	.300	.054	31.264	1	.000	1.349
Insurance (1= insured, 0 = uninsured)	-.469	.094	24.803	1	.000	.625
Poverty (1= above, 0 = below)	-.702	.055	161.716	1	.000	.496
Race (1 = Non White, 0 = White)	.146	.066	4.849	1	.028	1.157
Spatial accessibility to Hospital	-.004	.001	8.925	1	.003	.996
Smoke (1 = smoke, 0 = no smoke)	-.033	.053	.388	1	.533	.968
Constant	.591	.173	11.663	1	.001	1.805

Logistic Regression II

- Outcome Variables is Health Status (1= poor, 0 = good)
- -2 Log likelihood = 10536.597. Cox & Snell R Square = .084. Nagelkerke R Square = .112.
- The log of the odds of a person in poor health is negatively related to the spatial accessibility to hospital (B = -.004, p = .002).
- The disability score is positively related to the odds of a person in poor health(B = .180, p = .000).
- Men are more likely to perceive themselves to be in poor health than women.
- People with insurance are significantly less likely than people without insurance to perceive themselves to be in poor health status (odds ratio = .625).
- People above federal poverty level are 50% more likely to report to be in poor health (odds ratio = .496).
- Non-Whites are also significantly more likely to perceive to be in poor health than Whites (odds ratio = 1.157).

Conclusion

- This paper found the importance of spatial accessibility in the health status of people with disability in Ohio.
- The variable of region can be added into the model (urban and rural area).
- In the future, autocorrelation can help to identify the Health Professional Shortage Areas. Then government can help those areas to increase more health care providers or to improve more convenient transportation system.