A New Approach to Cancer Health Disparities: Applications of Geospatial Methods

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Disclaimer

- GIS expertise is lacking!

Development of the Literature

- GIS and health outcomes began as "silo-ed" disciplines
- Developed to tagging on "aggregate" measures on individual data
  - Census data
  - County-level measures
- Associations with aggregate measures were expanded to cancer health outcomes
- Further expanded into cancer disparities

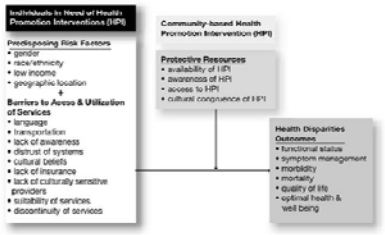
Different Perspectives in the "GIS World"

- Individual
  - Exposure assessment of the individual within the geographic setting
    - A lot of terminology used here is the 'built environment"
      - "human-constructed parts of the landscape"

vs.

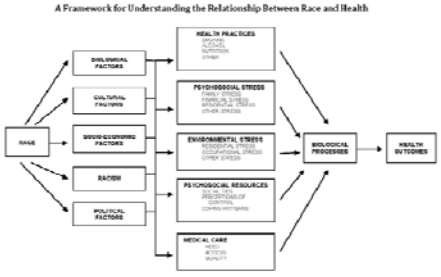
- Aggregate
  - Exposure and Outcome assessment at a level greater than the individual (e.g. ZCTA, census block, census track, county)

Oh no- a conceptual model!!!



Rew L, Hoke M, Horner S, Walker L. Development of a dynamic model to guide health disparities research. Nurs Outlook 2009;57(3):132-42.

…and another one!



King G, Williams D. Race and Health: A Multidimensional Approach to African-American Health. Society and Health.New York: Oxford University Press; 1995. p. 93-130.

3 GIS-Related Projects

Geospatial Methods in Examining Cervical Cancer Screening Behaviors at Three Health Centers in South Carolina

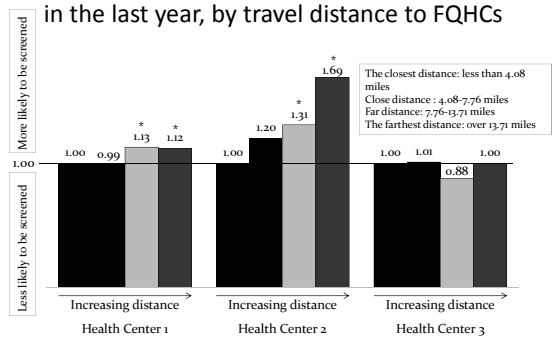
Study overview

- To investigate the relationship between travel distance to Federally Qualified Health Centers (FQHCs) and cervical cancer screening behaviors among FQHCs patients.
- Medical claims data from 3 FQHCs in South Carolina, with 22 delivery sites used.
- Patients' residence and FQHCs facilities were geocoded to the exact street address using ArcGIS.
  - Travel distance from the patients' residence to the delivery site was calculated.

Methods

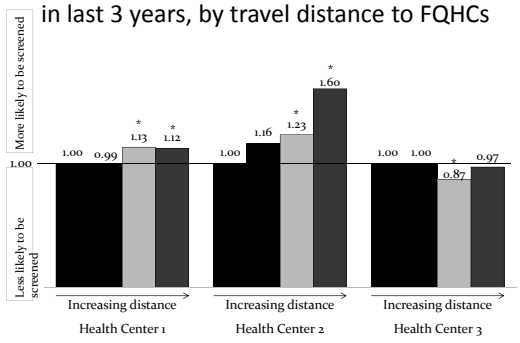
- Due to policy-level changes in cervical cancer screening recommendations, only data from overlapping time periods was utilized
- Several different designations of cervical cancer screening were utilized
  - Pap smear within the last year
  - Pap smear within the last 3 years
- The relationship between distance traveled and cervical cancer screening was assess using unconditional logistical regression

Adjusted odds ratio for cervical cancer screened in the last year, by travel distance to FQHCs



Adjusted for age, race (for all health centers), and marital status (for health center 1 and 2)
* Statistically significant different

Adjusted odds ratio for cervical cancer screened in last 3 years, by travel distance to FQHCs



Adjusted for age, race (for all health centers), and marital status (for health center 1 and 2)
* Statistically significant different

Cervical Cancer Screening in the Last 3 years Stratified by Urban/Rural Residence

	Health Center 1		Health Center 2		Health Center 3	
	Rural	Urban	Rural	Urban	Rural	Urban
Q1	1.0	1.0	1.0	1.0	1.0	1.0
Q2	1.43 (0.88-2.32)	0.96 (0.86-1.08)	1.05 (0.82-1.33)	0.93 (0.65-1.33)	**5.10 (1.53-16.95)**	0.99 (0.82-1.20)
Q3	0.90 (0.60-1.33)	1.12 (0.99-1.26)	**1.33 (1.07-1.64)**	1.03 (0.67-1.58)	**4.89 (1.48-16.11)**	0.87 (0.68-1.12)
Q4	0.86 (0.59-1.26)	**1.16 (1.00-1.35)**	**2.10 (1.69-2.61)**	0.72 (0.48-1.08)	**5.68 (1.73-18.68)**	0.91 (0.69-1.20)

Conclusions

- We were expecting that women living further from FQHCs are less likely to have screened for cervical cancer.
- Results indicate that women living further from the health center 1 and 2 are more likely to be screened within the last year and within the last 3 years.
- Cervical cancer screening rates within the last year and within the last 3 years are lower than the rate that BRFSS reported.
- Rural residents of health centers are more likely to be screened with increasing travel distance

The Impact of Federally Qualified Health Centers on Cancer Mortality-to-Incidence Ratios: An Ecological Analysis

Methods

- FQHCs Data - US Department of Health and Human Services Health Resources and Services Administration (HRSA)
  - FQHCs were obtained for each county
  - FQHCs concentration were broken into quartiles
- Cancer Incidence and Mortality Data - Surveillance, Epidemiology, and End Results (SEER) Program
  - Cancer Incidence rates – Age-adjusted incidence from 2004-2008
  - Cancer mortality rates – Age-adjusted mortality from 2003-2007
- Mortality-to-Incidence ratio (MIRs) = the age-adjusted mortality rate divided by the age-adjusted cancer incidence rate
  - MIR has a range between 0-1, with 0 having no deaths and 1 having high deaths in the county

Breast cancer at the county level, by County-Level "Quartile" of FQHCs Concentration

FQHCs	# of counties	Mean±SE	p-value
Q1: 0 FQHC	1,056	0.221±0.002	**0.021**
Q2: 1 FQHC	318	0.217±0.003	
Q3: 2 FQHCs	117	0.222±0.006	
Q4: 3 FQHCs +	181	0.207±0.003	

Cervical cancer at the county level, by County-Level "Quartile" of FQHCs Concentration

FQHCs	# of counties	Mean ± SE	p-value
Q1: 0 FQHC	64	0.385±0.043	0.552
Q2: 1 FQHC	44	0.341±0.017	
Q3: 2-4 FQHCs	65	0.427±0.068	
Q4: 5 FQHCs +	63	0.467±0.079	

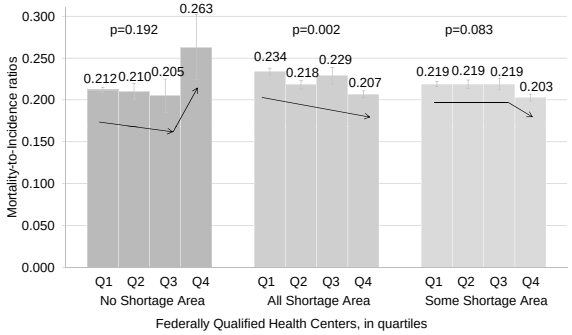
Colon cancer at the county level, by County-Level Quartile of FQHCs Concentration

FQHCs	# of counties	Mean±SE	p-value
Q1: 0 FQHC	1,370	0.391±0.002	0.121
Q2: 1 FQHC	398	0.392±0.004	
Q3: 2 FQHCs	140	0.392±0.006	
Q4: 3 FQHCs +	194	0.377±0.005	

Prostate cancer at the county level, by County-Level Quartile of FQHCs Concentration

FQHCs	# of counties	Mean±SE	p-value
Q1: 0 FQHC	918	0.193±0.002	**<0.001**
Q2: 1 FQHC	293	0.198±0.004	
Q3: 2 FQHCs	109	0.181±0.005	
Q4: 3 FQHCs +	181	0.174±0.003	

Breast cancer MIR stratified by HPSA designation



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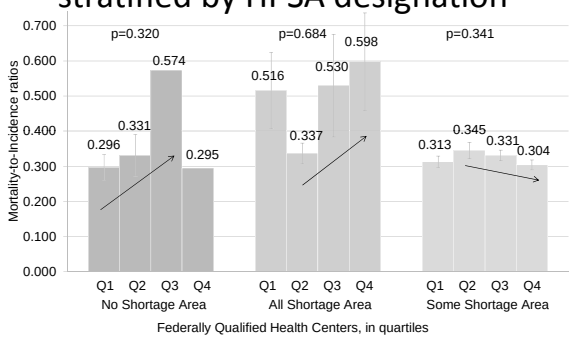

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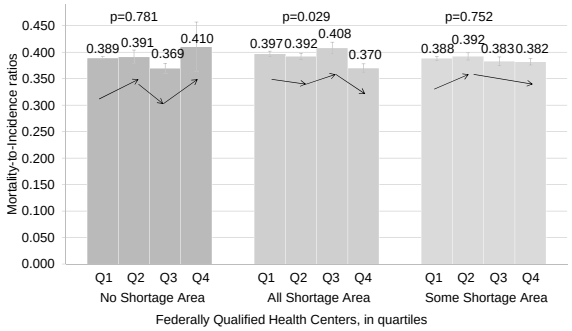

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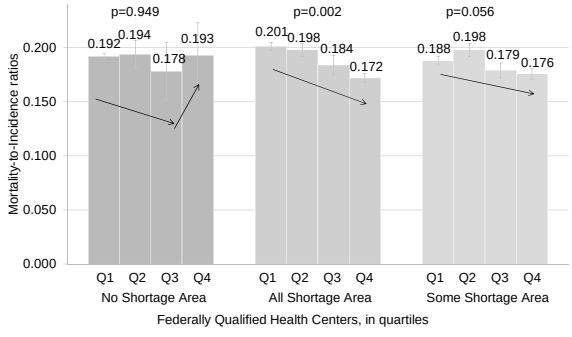
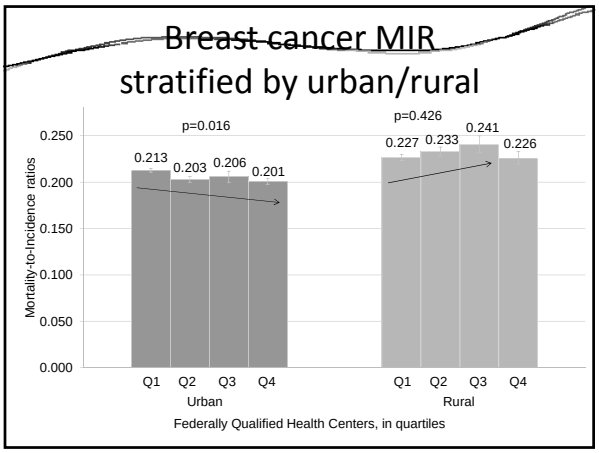


Breast cancer MIR stratified by urban/rural



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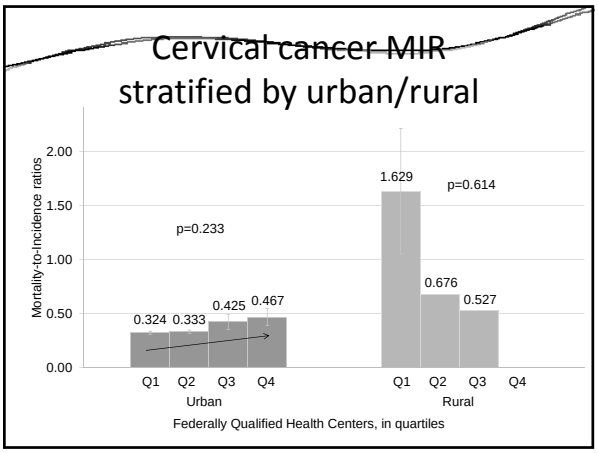

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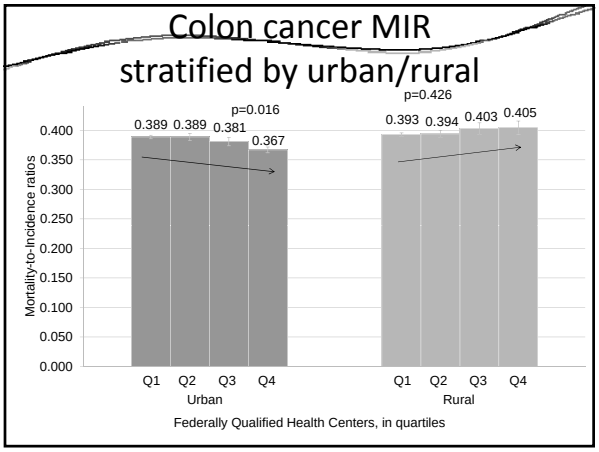

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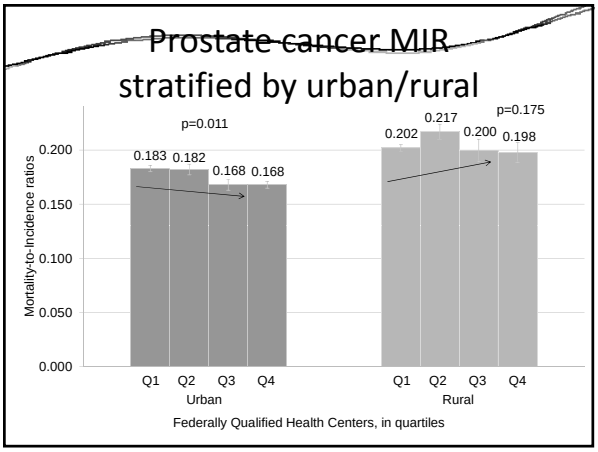
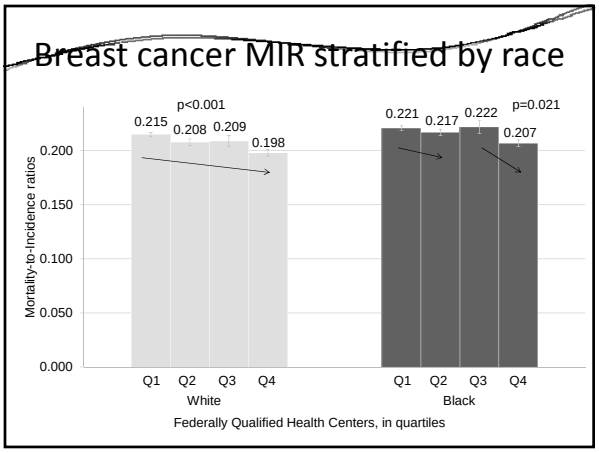
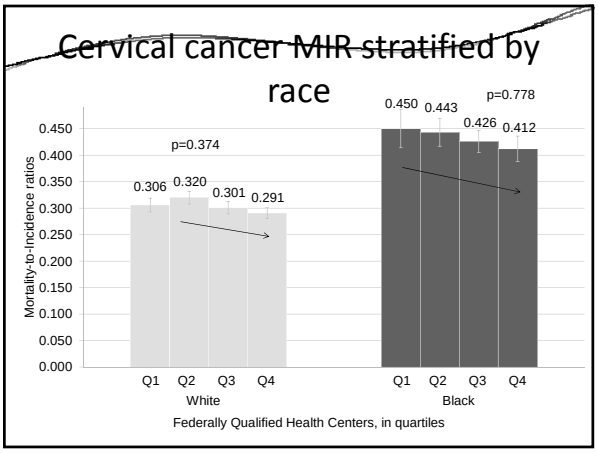


Breast cancer MIR stratified by race



Cervical cancer MIR stratified by race



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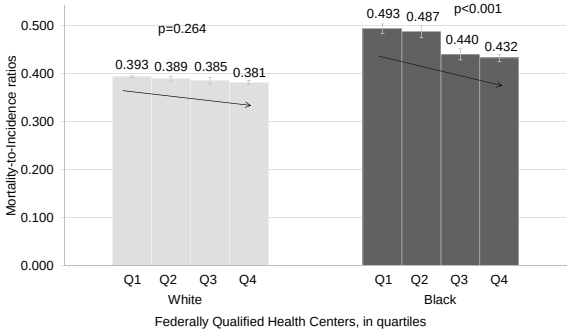
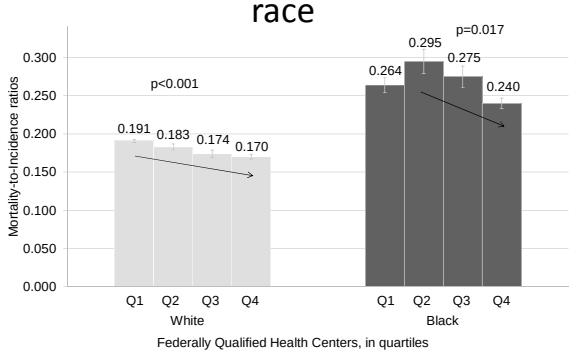


Prostate cancer MIR stratified by race



Conclusion

- The overall trend of MIRs is same for all cancers (Breast, Cervical, Conlon, and Prostate): with higher FQHCs concentration, the lower the MIR.
- Blacks, rural, and HPSA have higher MIR for all four cancers than Whites, urban, and non-HPSA.
- FQHCs may play a role in reducing cancer MIR.

Travel Distance to Screening Facilities and Completion of Abnormal Mammography Follow-up among Disadvantaged Women

Leepao Khang, Doctoral Candidate
Dissertation

Objective

- To examine the relationship between travel distance to the screening provider, mammography facility, and completion of abnormal mammogram follow-up among economically disadvantaged women

Methods

- Include participants in BCN from 1996-2009 who received mammogram
- Must have BI-RADS rating of 4 or 5
- Computed # days between initial mammogram and completion of follow-up
- Cox Proportional Hazards used to assess relationship between distance to provider and # of days to completion
- 3 assessments of distance: "provider" (referring physician); mammography provider; closest mammography

Median days to Diagnostic Resolution by Distance to Referring Provider

	Black			White			
Distance	n	Days	p-value	n	Days	p-value	p-value
Quartiles 1	116	22 (17-31)	0.98	49	24 (15-28)	0.39	<0.01
Quartiles 2	91	23 (18-29)		64	19.5 (14-21)		
Quartiles 3	81	24 (20-31)		80	22 (18-28)		
Quartiles 4	68	28 (19-37)		95	21 (17-25)		

Median days to Diagnostic Resolution by Distance to Mammography Provider

	Black			White			
Distance	n	Days	p-value	n	Days	p-value	p-value
Quartiles 1	88	22 (19-31)	0.08	30	21.5 (11-29)	0.34	**0.01**
Quartiles 2	58	25 (17-31)		58	21 (18-29)		
Quartiles 3	67	32 (21-41)		51	21 (16-26)		
Quartiles 4	71	30 (25-40)		48	29 (19-35)		

Median days to Diagnostic Resolution by Distance to Closest Mammography Provider

	Black			White			
Distance	n	Days	p-value	n	Days	p-value	p-value
Quartiles 1	166	27 (22-33)	0.20	88	28 (22-35)	**0.02**	**0.01**
Quartiles 2	137	23 (20-28)		118	21 (18-27)		
Quartiles 3	118	31 (23-40)		138	23 (20-28)		
Quartiles 4	147	28 (23-32)		102	18 (14-24)		

Conclusions

- Women who lived the closest to their diagnosing mammography facility were more likely to have a completed abnormal mammogram follow-up compared to those who lived the farthest
- AA women had longer day to completion of abnormal mammogram work-up compared to EA women (although not statistically significant interaction)

Grants

- R01 submitted 10/2010
  - Link Medicaid & SCCCR
  - Geocode Medicaid
  - Calculate distance to mammography provider
  - For BrCA cases, calculate distance to treatment provider
  - Examine association between distance and mammography follow

Outcome: Discussed, Scored: 56; Primary weaknesses: mobile mammography, not account for other variables (conceptual framework); no clear idea of how results will forward science and impact disparities

Next Attempt

- R15 (Academic Research Enhancement Award)
  - Link Medicaid, BCN, and SCCCR
  - Utilize BrCA cases
- Create a cohort of racially, socio-economically, and geographically (urban/rural) diverse women to examine breast cancer treatment and survival outcomes among women in South Carolina;
- To contrast and compare racial, socioeconomic status, and geographical differences in BrCA care including receipt and duration of surgical, chemotherapeutic, radiotherapy, and hormonal therapies and test these factors in relation to BrCA survival and BrCA and all-cause mortality in this racially diverse cohort of women; and
- Apply geospatial methodologies in innovative ways to examine the influence of geographic variables (such as treatment travel distance, neighborhood-level indicators of economic stress, and segregation) on BrCA-related disparities in treatment and mortality.

Next Ideas

- Add in Medicare component
- Expand into other GIS-related measures
- Further develop the linkage between this work and impact

Thank you!

- Questions
- Comments
- Suggestions
- Criticisms