

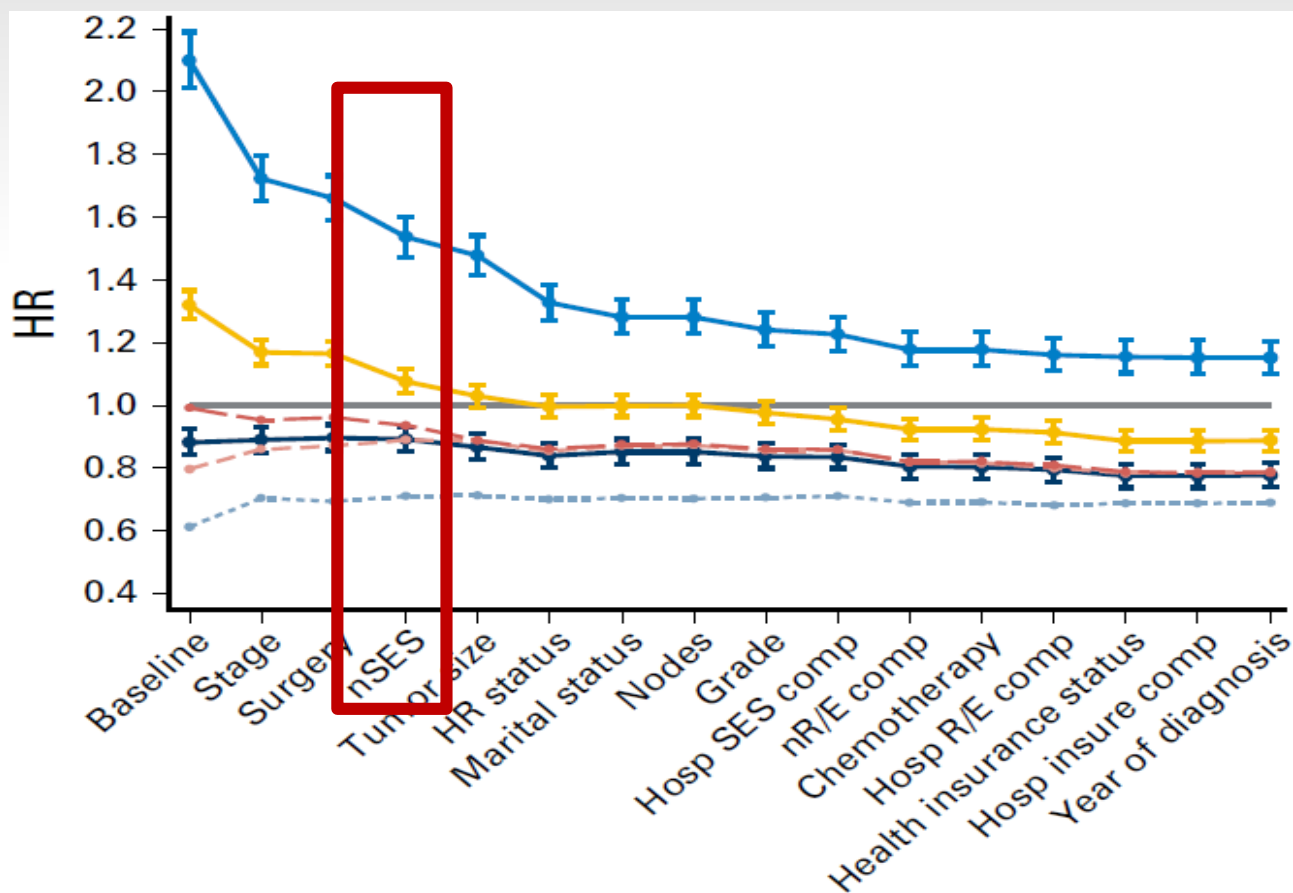
Visually Assessed Environmental Factors Linked to a Cancer Registry: Application to Breast Cancer Survival Disparities

NAACCR 2020 Annual Meeting
Plenary Session 3: *Social Determinates of Cancer*
Jesse J. Plascak, Ph.D.
June 24, 2020



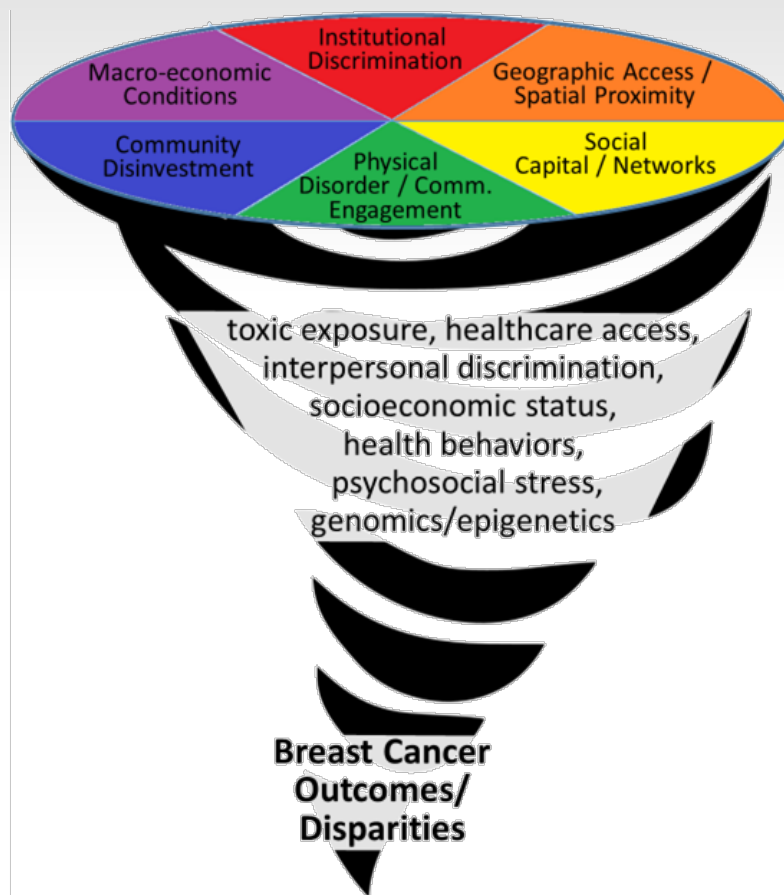
Why Environmental Factors → Breast Cancer?

Black vs White mortality disparity persists after risk factor adjustment



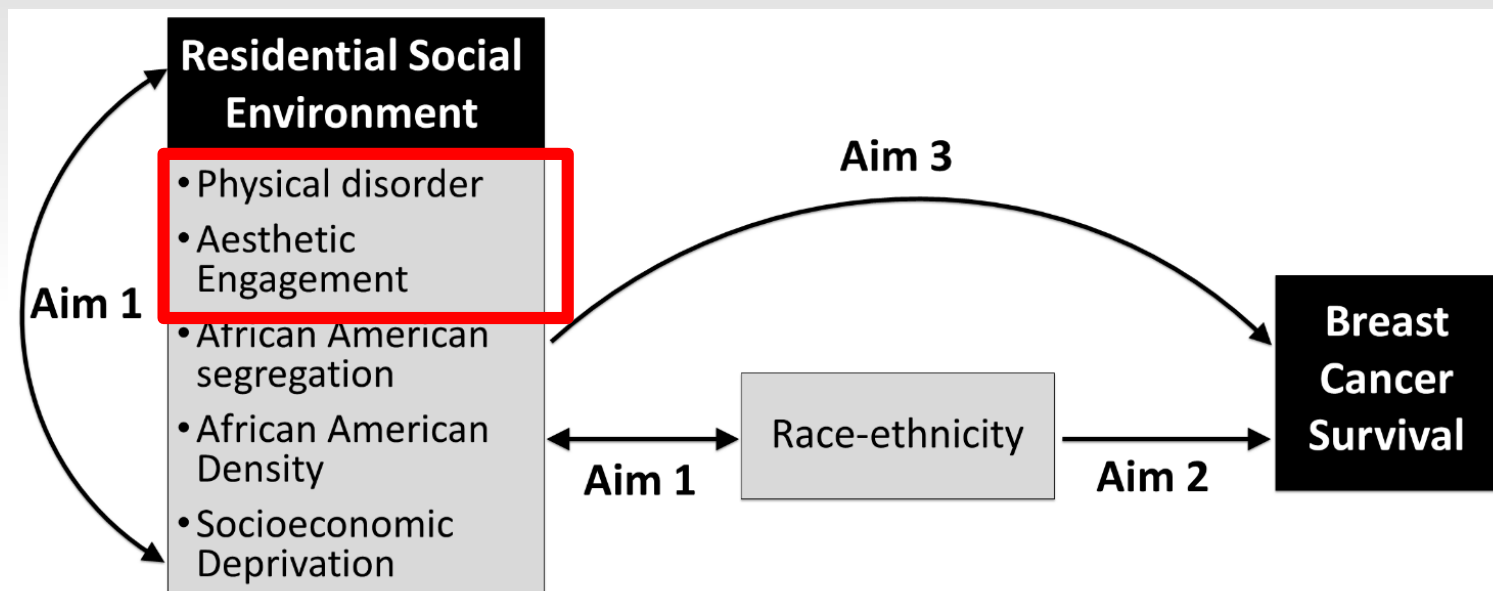
Current Literature: Breast Cancer Survival Disparities by Race

Socio-physical environmental factors are understudied





Socio-Physical Environment ↔ State Cancer Registry



Visual Socio-Physical Environmental Factors

NJ virtual neighborhood audits

- Google Street View virtual audits of 360° view around ~29k locales in NJ
- Via CANVAS
 - Combines Google Street View images with neighborhood audit questionnaire
 - 32 separate items to rate at each location
 - 18 raters trained via standardized protocol



Visual Socio-Physical Environmental Factors

12 Items

- Garbage
- Yard conditions
- Building conditions
- Abandoned/boarded bldg.
- Team sports
- Yard decor.
- Outdoor seat

Physical Disorder / Community Engagement





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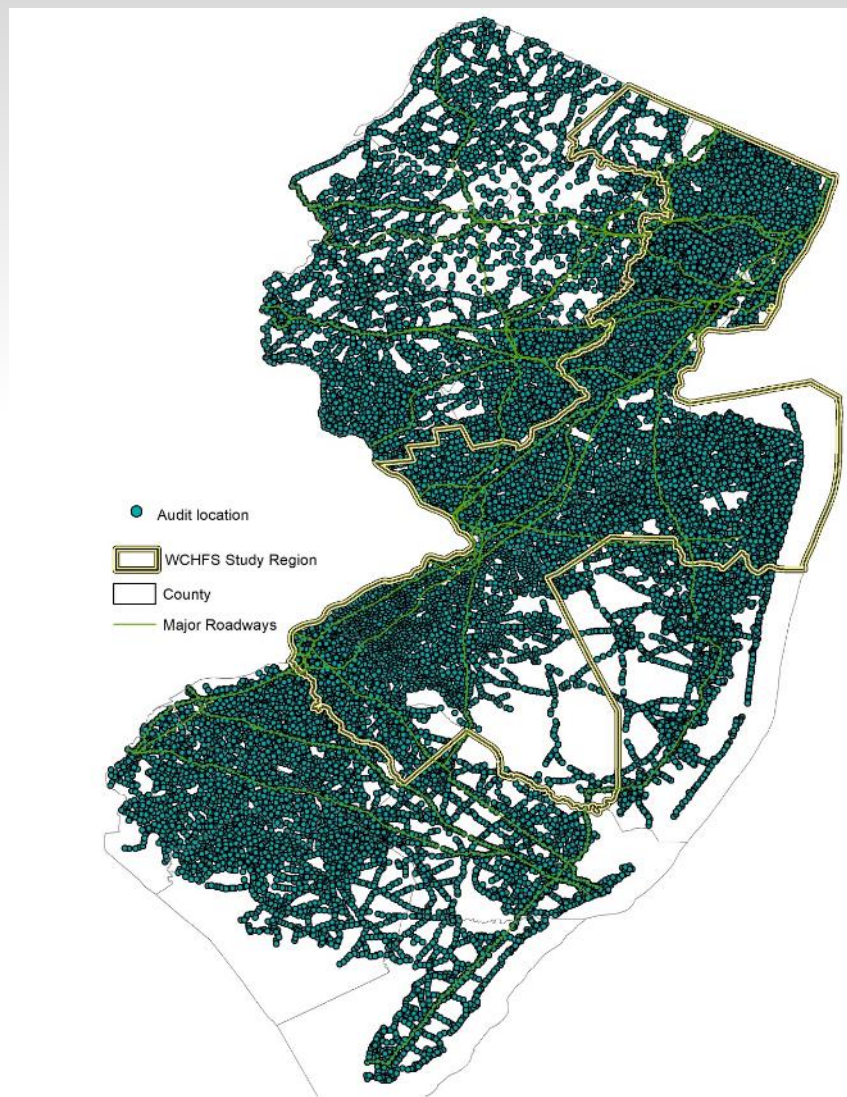
Physical Disorder / Community Engagement



Visual Socio-Physical Environmental Factors

Audit location sampling

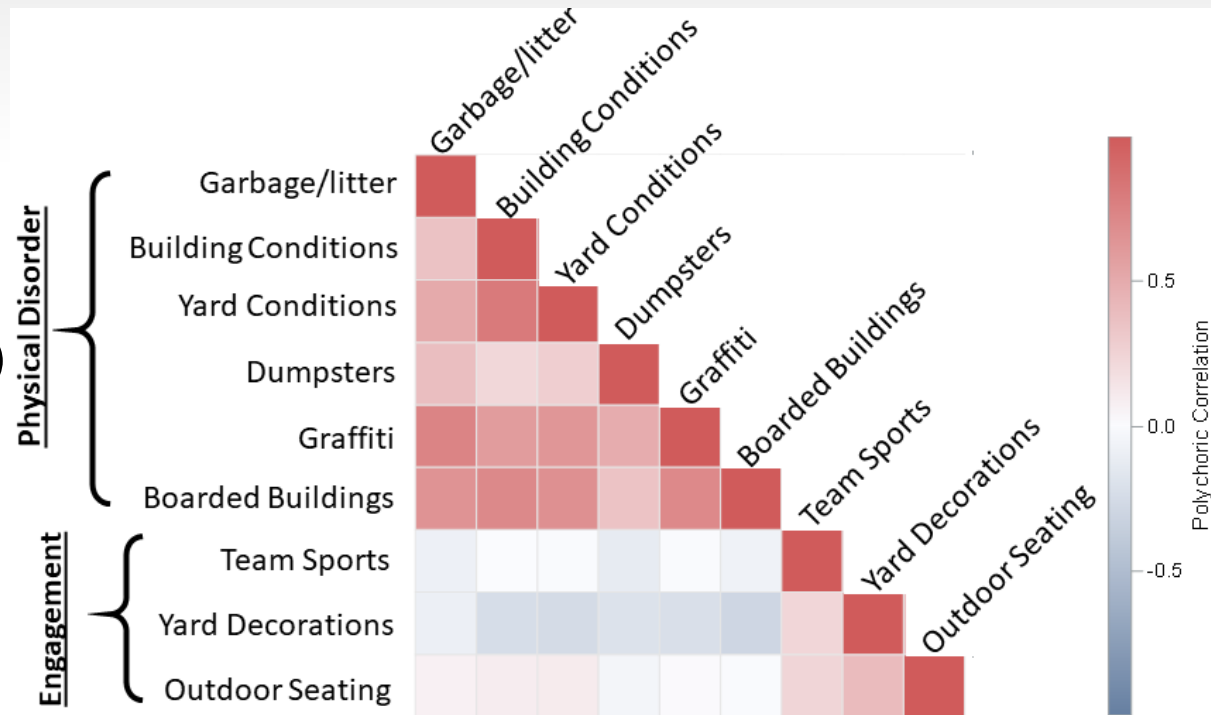
- Every ~600 m along non-Highway roads
- Uniform spatial sample (w.r.t. roads)



Visual Neighborhood Physical Disorder-related Factors

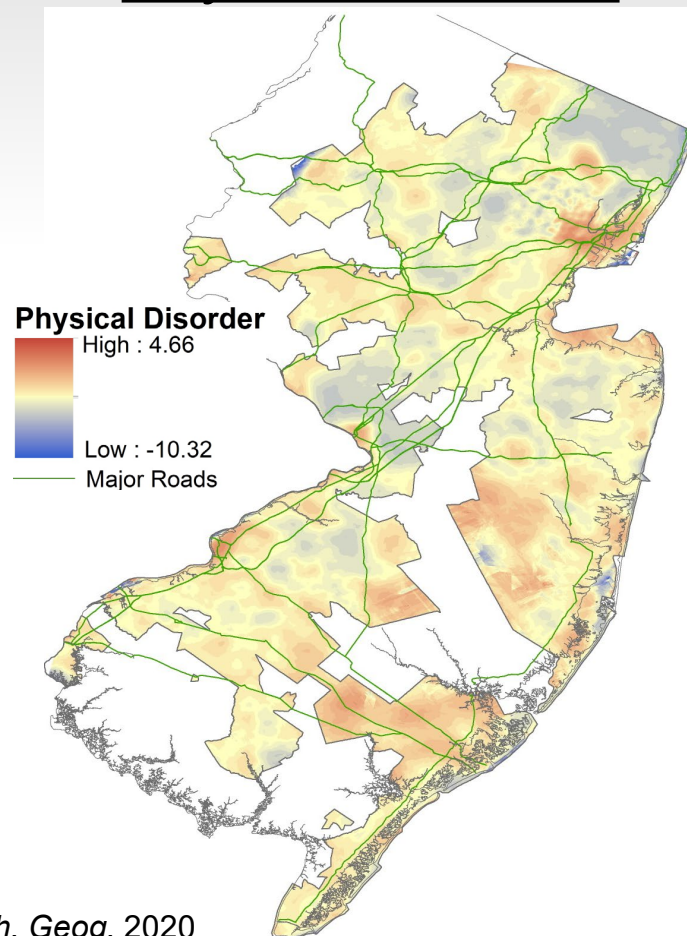
‘Physical disorder’ is internally consistent and not the same construct as ‘Engagement’ (not internally consistent)

- Limited to RUCA=1
 - 93% of NJ pop
- Physical disorder
 - 43.3% variation
 - $\alpha=0.70$ (acceptable)
- Engagement
 - 17.3% variation
 - $\alpha = 0.31$
(unacceptable)

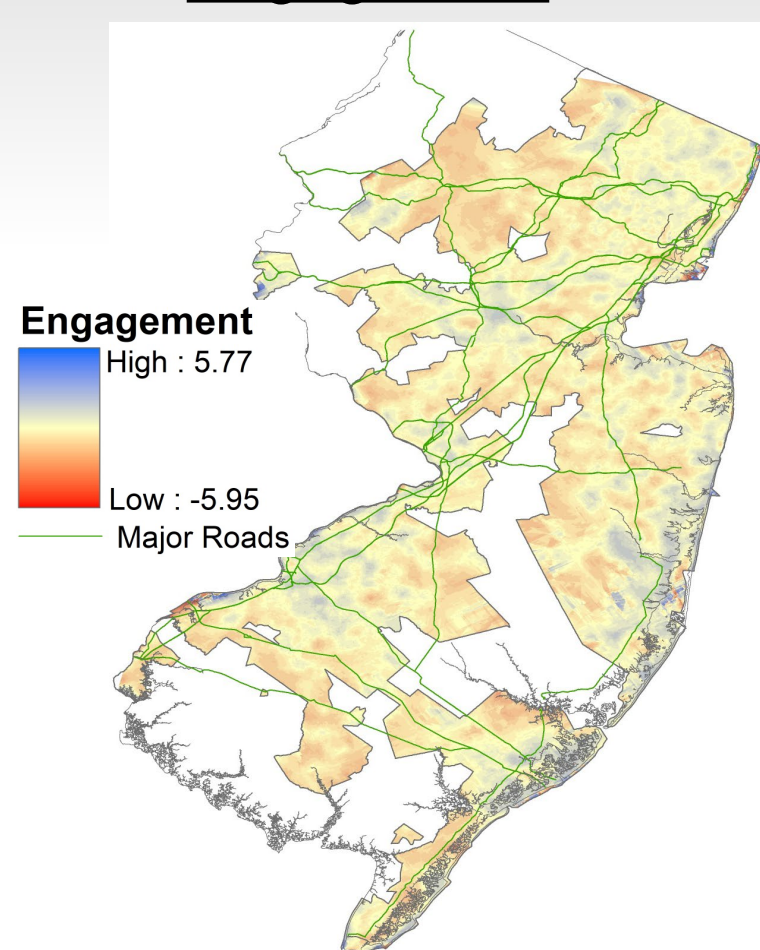


Visual Neighborhood Physical Disorder-related Factors

Physical Disorder



Engagement



Continuous
surfaces via
spatial
interpolation
(Kriging) of
item
response
theory factor
scores



Visual Physical Disorder-related Factors → BrCa Survival

Sample: NJ State Cancer Registry

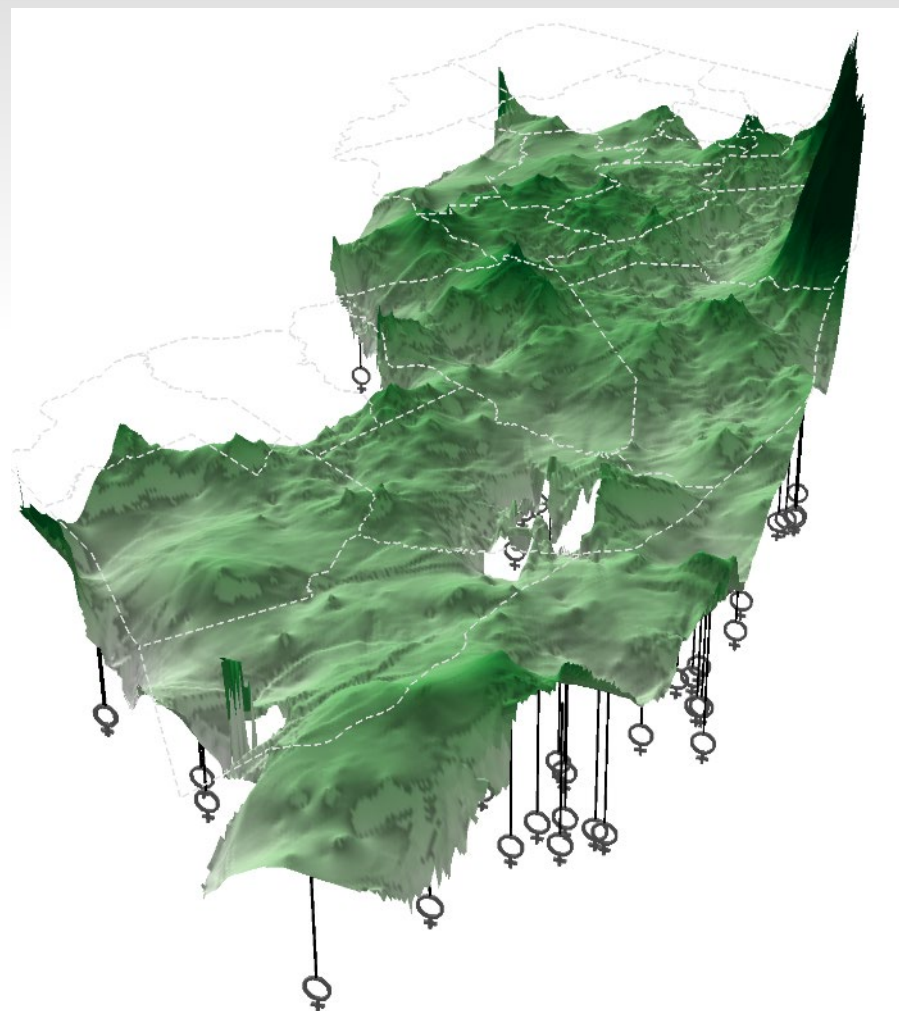
- Primary, incident, histologically confirmed, invasive BrCa dx 2008-2013
- Female, 20-74 yrs old
- Resident of urban area (RUCA='Metropolitan area core', 93% sample)
- Covariates: age, geocoded address at diagnosis, race-ethnicity, primary payer, tumor stage, tumor grade, tumor subtype, census tract-level socioeconomic status (Yost index, Black residential segregation (Gini and Isolation Indices), % Black

Analyses

- Random intercept (census tract), Cox proportional hazard regression of BrCa-specific death by physical disorder & engagement
- Time-dependent stage

Methods - Linking Interpolated Surface to Non-sampled, NJSCR Locations

- Extract Kriged values based on NJSCR spatial coordinates (geocoded residential address at dx)





Results – NJSCR Characteristics

- Median BrCa dx date = 01/24/2011 among 22,390 BrCa cases
- 2,040 BrCa-specific deaths and median follow-up time of 2.7 years (Follow-up through 12/31/2014)
- Median Google Street View scene date = September 2013



Results – NJSCR Characteristics by Socio-Physical Enviro Factors

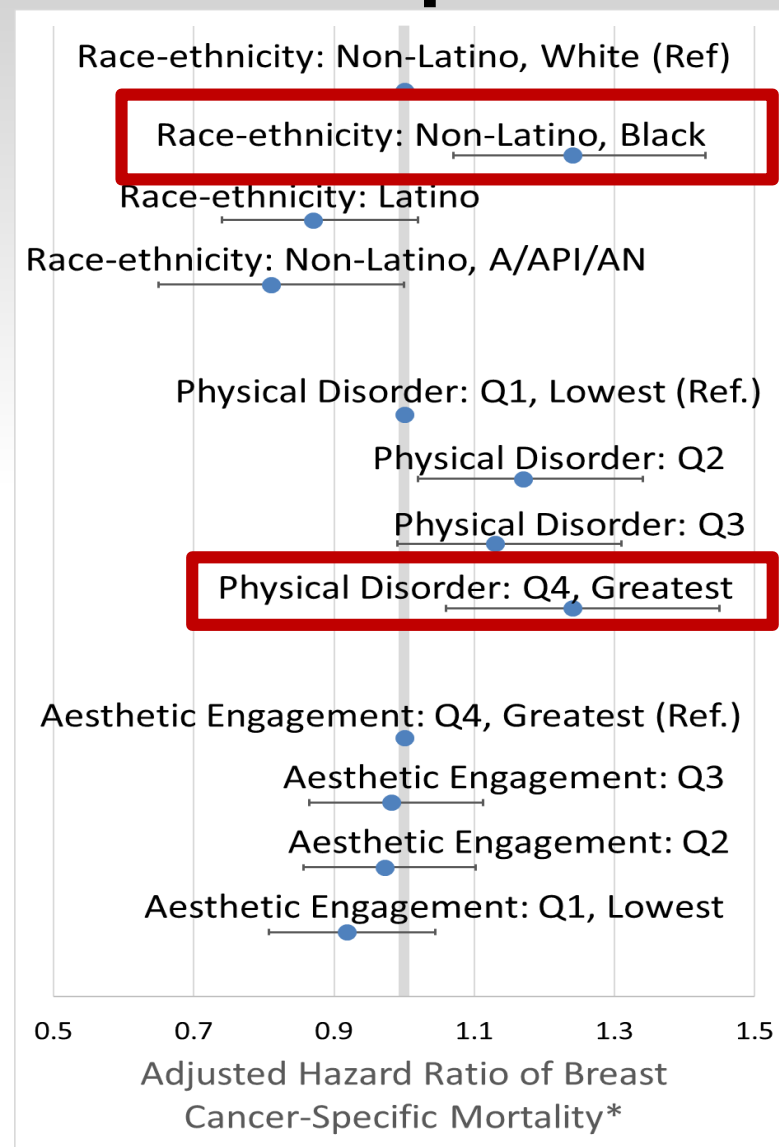
	Physical Disorder Mean/N (SD/%)		Aesthetic Engagement Mean/N (SD/%)	
	<u>Low</u>	<u>High</u>	<u>High</u>	<u>Low</u>
Age, y	55.7 (10.4)	55.7 (10.8)	55.9 (10.6)	55.5 (10.6)
Race-ethnicity				
Non-Latina, White	9174 (56.7)	7000 (43.3)	8379 (51.8)	7795 (48.2)
Non-Latina, Black	697 (23.8)	2236 (76.2)	1260 (43.0)	1673 (57.0)
Latina	723 (30.0)	1685 (70.0)	1204 (50.0)	1204 (50.0)
Non-Latina, Asian/API/AN*	936 (59.4)	639 (40.6)	628 (39.9)	947 (60.1)
Neighborhood factors				
Socioeconomic Status Q1 (Low)	544 (11.7)	4105 (88.3)	2339 (50.3)	2310 (49.7)
Socioeconomic Status Q2	1641 (36.9)	2812 (63.1)	2643 (59.4)	1810 (40.6)
Socioeconomic Status Q3	2719 (52.3)	2479 (47.7)	2721 (52.3)	2477 (47.7)
Socioeconomic Status Q4	4066 (76.4)	1255 (23.6)	2332 (43.8)	2989 (56.2)
Socioeconomic Status Q5 (High)	2350 (86.2)	376 (13.8)	1063 (39.0)	1663 (61.0)
Gini Segregation (0-100)	69.6 (15.1)	63.7 (15.7)	68.4 (15.9)	64.9 (15.2)
Isolation Segregation (0-100)	12.9 (11.2)	25.1 (23.2)	17.7 (16.8)	20.2 (21.2)
AA residential density, %	5.6 (8.6)	17.3 (23.3)	9.9 (15.5)	13.0 (20.9)



Results – Hazard Ratio of BrCa-Specific Mortality

Adjustment for physical disorder and aesthetic engagement alone reduced the non-Latino AA vs non-Latino White HR by 13% ($HR_{Crude} = 2.01$, $HR_{Adj} = 1.75$)

Mutually adjusted and additionally adjusted for age, primary payer, tumor subtype, tumor grade, cancer stage (by time interaction), census tract-level socioeconomic status, AA residential segregation, and AA residential density





Limitations

Visual environment / Google Street View data

- Unknown GSV protocol, conspicuous visual characteristics only, measurement error with subjective characteristics
- Residential address at dx precedes outcomes, but Google images could be dated post-outcome

Registry data

- Limited covariates for adjustment / mechanism investigation
- Data not collected for hypothesis testing (only address at diagnosis, unknown/missing covariates, etc.)



Conclusions / Next Steps

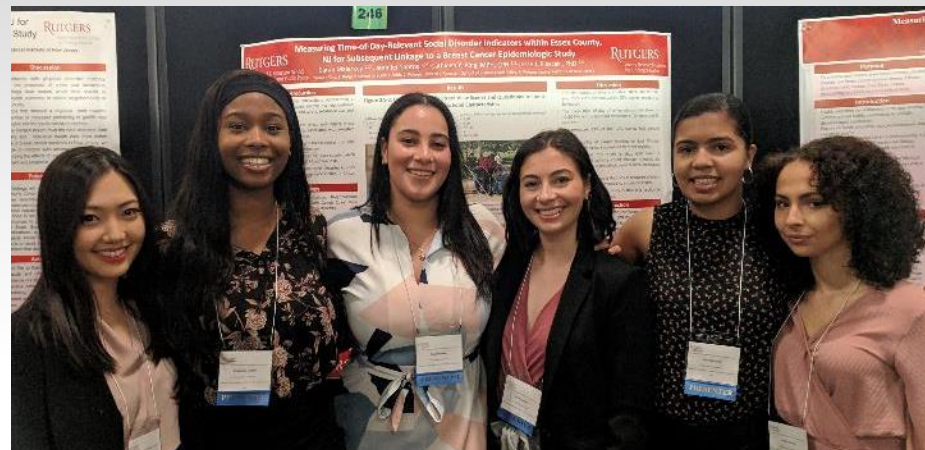
1. Observed visual characteristics of neighborhood physical disorder might be a novel / important factor of BrCa survival
2. Neighborhood physical disorder might account for some of the Black vs White BrCa survival disparity
3. Observed residential environmental factors deserve further epidemiologic investigation as well as variables to consider in central cancer registry surveillance systems

Future work should investigate time-varying covariates via residential environmental factors assessed over space and time



Acknowledgements

Neighborhood Auditors



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Thank you



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Census Tract Level Correlation Matrix of Physical Disorder, Social Aesthetics, AA Segregation, % AA, Neighborhood SES (RUCA=1)

