Investigating the impact of neighborhood and environmental exposures in breast cancer survivorship cohort: the Pathways Study

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Pathways Forum, 9/21/2023
Place matters: opportunities for improving health
“When we think about health, we usually think about health care and access to health care and the quality of care. But what research clearly shows is that health is embedded in the larger conditions in which we live and work. Sometimes, we naively think of improving health by simply changing behaviors. But the choices of individuals are often limited by the environments in which they live.”

Professor David Williams (Harvard)
“Unnatural Causes. Place Matters.” (PBS documentary, 2008)
Why is your street address...such a good predictor of your health?

Example 1: Exercise

Example 2: Diet
Contributions of neighborhood environments to health inequalities

Cells-to-Society Model for Health Disparities Research

A framework for multilevel research

Centers for Population Health and Health Disparities, NIH

Adapted from Warnecke et al. AJPH 2008
Pathways Participants’ Neighborhoods
Pathways: A study of breast cancer survivorship

MPIs: Larry Kushi, Christine Ambrosone (U01CA195565, R01CA105274)

- 4,504 breast cancer survivors
  - Kaiser Permanente Northern California, 2005-2013
  - Data: surveys, electronic health records, biospecimens, genetic data
  - 97% (n=4,354) geocoded address at or near time of diagnosis

- Neighborhood
  - Block group (~1800 residents)
  - Census tract (~4000 residents)
  - 1600 meter buffers/street network distances
Pathways: Neighborhood Data Resource

- Existing geospatial data

Table 1. Description of neighborhood social and built environment measures

<table>
<thead>
<tr>
<th>Contextual data</th>
<th>Data source</th>
<th>Description of measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socioeconomic status</td>
<td>2007–2011 ACS (29)</td>
<td>Block group-level composite measure for income, education, poverty, employment, occupation, housing, and rent values (53)</td>
</tr>
<tr>
<td>Racial/ethnic composition</td>
<td>U.S. Census 2010 short-form data (54)</td>
<td>Block group-level measures of % of each racial/ethnic group</td>
</tr>
<tr>
<td>Immigration/acculturation</td>
<td>2007–2011 ACS</td>
<td>Block group-level measures of residential composition on % foreign-born; tract-level measure of ethnic enclave (Hispanic, Asian)</td>
</tr>
<tr>
<td>characteristics</td>
<td>U.S. Census 2010 short-form data</td>
<td>Block group-level measures of population size per square mile</td>
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<tr>
<td>Population density</td>
<td>U.S. Census 2010 short-form data</td>
<td>Block group-level composite measure based on census defined urbanized area, population size, and population density</td>
</tr>
<tr>
<td>Urbanization (rural/urban)</td>
<td>U.S. Census 2010 short-form data</td>
<td>Residential buffer (1,600 m) measures of total businesses, total number of recreational facilities, retail food environment index (38), and restaurant environment index</td>
</tr>
<tr>
<td>Businesses</td>
<td>Dunn &amp; Bradstreet annual business listings (1990–2008), via Walls &amp; Associates (35)</td>
<td>Tract-level measures of proportion of population who drive to work (car, motorcycle, taxi cab, and other)</td>
</tr>
<tr>
<td>Commuting by car</td>
<td>2007–2011 ACS</td>
<td>Block group-level measure of walkability, using the gamma index (31)</td>
</tr>
<tr>
<td>Street connectivity</td>
<td>NAVTEQ (32)</td>
<td>Residential buffer (1,600 m) measure of total number of parks</td>
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<td>Parks</td>
<td>NAVTEQ (32)</td>
<td>Tract-level counts of farmers’ markets</td>
</tr>
<tr>
<td>Farmer’s markets</td>
<td>California Department of Food and Agriculture (36)</td>
<td>Residential buffer (500 m) measure of volume of traffic (34)</td>
</tr>
<tr>
<td>Traffic density</td>
<td>California Department of Transportation (33)</td>
<td></td>
</tr>
</tbody>
</table>
Pathways: Neighborhood Data Resource

- Existing geospatial data
- Remote sensing/machine learning methods
Green space, blue space, and light at night
Pathways: Neighborhood Data Resource

- Existing geospatial data
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- Virtual street audits
Pathways: Neighborhood Data Resource

- Existing geospatial data
- Remote sensing/machine learning methods
- Virtual street audits
- Self-report data on neighborhood attributes
  - 72-month follow-up survey

Access to Resources by Race/Ethnicity/Nativity

- Can do most shopping at local stores
- Stores within easy walking distance
- Many places to go within easy walking distance of home
- Easy to walk to a transit stop

NH White
African American
Asian, US-born
Hispanic, foreign-born
Hispanic, US-born
Other
Total
Pathways: Neighborhood Data Resource

- Existing geospatial data
- Remote sensing/machine learning methods
- Virtual street audits
- Perceived neighborhood attributes (72-month)
- Residential histories

- Physical environment
  - Air pollutants: ozone, PM$_{2.5}$, diesel,
  - Ground pollutants: agricultural pesticides, toxic releases from facilities, toxic clean-ups, solid waste sites
  - Water pollutants: groundwater, hazardous waste facilities, impaired water bodies
  - Source: Cal EnviroScreen 3.0, California Communities Environmental Health Screening Tool
Findings from the Pathways Study
Neighborhood attributes associated with overweight/obesity:
- Lower socioeconomic status
- High minority composition
- High traffic density
- High prevalence of commuting by car/motorcycle
- Higher number of fast-food restaurants
Neighborhood attributes and risk of cardiovascular disease

- Highest crime score: 50% increased risk
- Lowest % of Asian American residents: 85% increased risk
Varied by attributes of place:
- Segregation
- Ethnic enclave

Residing in neighborhoods with more residents from shared racial or ethnic group may buffer impact

- Discrimination was associated with worse quality of life
Social stressors and embodiment of stress

- Neighborhood stressors
  - Low SES
  - Nighttime light
  - Crime
  - Traffic density
  - Household crowding
  - Unhealthy food environment (convenient stores, liquor stores, fast food restaurants)

- Potential buffers
  - Green space
  - Blue space
How do these stressors get under your skin?

▪ Allostatic load: a biological measure of the wear and tear of chronic and cumulative stress on the body
  - Intermediary survivorship outcome \(\rightarrow\) morbidity and mortality

▪ Biological pathways
  - Cardiovascular
  - Metabolic
  - Immune/inflammatory
  - Neuroendocrine
Neighborhood factors associated with allostatic load

- Increased odds of high allostatic load was associated with
  - **Neighborhood socioeconomic status**
  - Household crowding
  - Unhealthy Food Environment
  - Crime
  - Traffic density
  - Light at night

- Decreased odds of high AL was associated with
  - Green space
## Neighborhood SES – allostatic load associations

<table>
<thead>
<tr>
<th>Neighborhood Socioeconomic Status (quintiles) d</th>
<th>Model 1 (age, stage)</th>
<th>Model 2 (+ neighborhood)</th>
<th>Model 3 (+ stress, physical activity, smoking, alcohol)</th>
<th>Model 4 (+ race/ethnicity, education, income, marital status, parity, comorbidity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: &lt;-0.76 (low)</td>
<td>OR (95% CI)</td>
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</tr>
<tr>
<td>Q2: -0.76- -0.13</td>
<td>2.07 (1.48-2.89)</td>
<td>1.73 (1.19-2.50)</td>
<td>1.59 (1.07-2.35)</td>
<td>1.25 (0.81-1.93)</td>
</tr>
<tr>
<td>Q3: -0.14-0.43</td>
<td>2.01 (1.55-2.62)</td>
<td>1.80 (1.36-2.39)</td>
<td>1.58 (1.19-2.11)</td>
<td>1.21 (0.87-1.67)</td>
</tr>
<tr>
<td>Q4: 0.44-1.08</td>
<td>1.68 (1.33-2.11)</td>
<td>1.58 (1.25-2.00)</td>
<td>1.58 (1.23-2.04)</td>
<td>1.45 (1.09-1.92)</td>
</tr>
<tr>
<td>Q5: &gt;1.08 (high; reference)</td>
<td>1.51 (1.22-1.87)</td>
<td>1.47 (1.18-1.82)</td>
<td>1.41 (1.11-1.78)</td>
<td>1.29 (1.00-1.67)</td>
</tr>
<tr>
<td>p-trend</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Summary across neighborhood studies

- Neighborhood factors: not as highly correlated
- Results varied by racial, ethnic and nativity groups
- Multilevel interventions: consider neighborhood attributes that can promote health
Discussion

- Pathways Study: a unique resource
- Neighborhood studies: multilevel factors influence survivorship outcomes
- Data dissemination: communities
Acknowledgements

- Kaiser Permanente Northern California
- Roswell Comprehensive Cancer Center
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- University of California San Francisco
- Zero Breast Cancer

- Study participants and CAB
Thank you!
Questions?

https://dreamlab.ucsf.edu/

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