Space and Time in the Current Landscape of Geography and Health Research

Sound bites …

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“On Airs, Waters and Places …”

Hippocrates c. 400 B.C.
Place and health

- Places – environments infused with meaning
- Spatial characteristics of places are important
- People experience places differently
- Complex pathways link place characteristics and health
- “People create places and places create people” (MacIntyre and Ellaway 2003)
- Dynamism of places and people
- “time and space are born together” (Massey 1999, p. 274)

**Topics:**
- How are time and space incorporated in contemporary research in geography and health?
- What are the implications for health research?
Spatial diffusion

Map sequences of measles in Iceland

Space-time dynamics


Transmission via Social and Spatial Networks

- Geographic proximity
- Social/kin interactions

Root ED et. al. (2011) The role of vaccine coverage within social networks in cholera vaccine efficacy. *PLOS One*, 6(7), e22971
Agent-based modeling of disease diffusion

Spatial Diffusion and Genetic Evolution

Context and Health

- Health affected by diverse factors and exposures in place contexts
- At varying geographic and temporal scales
- Multilevel analysis

Contexts should reflect everyday activity spaces and exposures

- Reliance on geopolitical units -- County, ZIP code, census tract
- “Areal units are particularly sacred once they have become established, even though they later may become serious obstacles to solution of contemporary problems.” (Abler, Adams and Gould 1971).

Activity spaces do not correspond to geopolitical units

Concept mapping (O’Campo et al. 2005)
Activity spaces are often larger than residential neighborhoods.

Zenk S. et. al. (2011) Activity space environment and dietary and physical activity behaviors: A pilot study. *Health & Place*, 17(5), 1150-1161
Advanced methods and perspectives from time geography can be used to model and understand activity spaces

People experience places differently

Activity spaces vary by age, gender, SES, nativity

Women whose daily activities were concentrated in the local neighborhood were less likely to have undergone cervical cancer screening than were women with more expansive activity spaces.

Using real-time GPS-enabled devices to track activity patterns and monitor environmental exposures

Contexts are dynamic

- Unfold over time
  - At varying time scales
    - Rhythms of everyday life
    - Work week
  - Spatially and temporally fuzzy

- Place contexts are actively created
Contexts change during illness

Shifting to longer time scales

- Migration is important
- Life course, period, cohort effects
Figure 5.17. A topology of residential histories for three people in time and space. Person #1 resided in Place A his entire life. Person #1 was Person #2’s neighbor except when Person #2 attended college in Place C about the same time as Person #3 who grew up in Place B. After college, Person #3 moved to Place D and then to Place E. A brief contamination event in Place A from t1 to t2 exposed both Person #1 and Person #2. A later contamination event in Place A which was of greater duration from t3 to t4 exposed only Person #1 because Person #2 was away at college. The contamination event at Place E from time t5 to t6 affected only Person #3.

For diseases with long latency periods, we can trace back shared environmental exposures and assess spatiotemporal clustering.

Methods for space-time cluster detection: Local spatial clustering of exposure traces for bladder cancer, 1979 and 1982

Significant values of Janus statistic (# k nearest neighbors with overlapping induction periods)

Analyzing spatiotemporal changes in health inequalities

- Components of change
  - Compositional – change in population age, gender, race/ethnicity
  - Contextual – social, environmental, policy changes
- Migration, immigration are important
New methods for exploring spatiotemporal trends: space-time Bayesian approaches, etc

Decline in late-stage diagnosis of prostate cancer after introduction of PSA testing varies geographically among Florida counties

Identifying geographically uneven components of change

Change in low birthweight %, Brooklyn NY, 1990 - 2000
Selective migration impacts health inequalities

Figure 2. Flowchart depicting the methods used to calculate the smoking migration balance in the Auckland district health board (1981).

Migration experience may be linked to health outcomes.

Rural in- and out-migrants less likely to die prematurely than long-term urban residents.

Changes in population settlement affect social interactions and resources, with implications for health outcomes.


Impacts of health policy changes on health-related behaviors and outcomes

Conclusions

- Increasing attention to the spatial and temporal dynamics of people’s lives and activities
- Real-time activity and environmental measures
- Scales, both temporal and geographic, are important
- From space and time to spacetime
Gaps in understanding

- How does diversity among people map onto diversity in places?
  - Especially important for the most vulnerable populations

- Dynamism of people and places
  - Spatial arrangement of opportunities affects people’s spatial behaviors and decision-making

- Incorporating and understanding change in place environments
  - How do public health policy changes affect people’s health risks and behaviors?