GIS and Health Geography
Perspectives on health geography
Why Geography and Health?

As Dr. Trevor Dummer (2008) stated: Geography and health are intrinsically linked. Where we are born, live, study and work directly influences our health experiences: the air we breathe, the food we eat, the viruses we are exposed to and the health services we can access. The social, built and natural environments affect our health and well-being in ways that are directly relevant to health policy.

Spatial location (the geographic context of places and the connectedness between places) plays a major role in shaping environmental risks as well as many other health effects. (CMAJ April 22, 2008 vol. 178 no. 9)

Why is the geography of health important?

- Ageing national and global populations more at risk of disease
- Diseases can have important social, economic and environmental affects
- Correlation between income and welfare
- Link between climate change and emergence of new infectious diseases
- Studying the geographical patterns and spread of diseases is important in controlling them
- Physical and human factors can greatly influence health
- Health is an important factor in development
Geography and health

Early studies identified the differences in diseases experienced by people living at high versus low elevation. It was easily recognized that those at living low elevations near waterways were more prone to malaria than those at higher elevations or in drier, less humid areas. Though the reasons for these variations were not fully understood at the time, the study of this spatial distribution of disease is the beginnings of medical geography. (From About.com’s description of Medical Geography)

Also—flouride in Colorado.
Social and Behavioral Factors Contribute More to Outcomes than Clinical Factors

- Studies demonstrate that social and economic factors may contribute most to health outcomes (40%)
- Health behaviors, including substance abuse, diet and exercise contribute 30% to these outcomes
- Key Finding: Changing health outcomes requires a focus beyond just “clinical care and coordination”

Diagram:
- Health Outcomes
  - Length of Life (50%)
  - Quality of Life (50%)
- Health Factors
  - Tobacco Use
  - Diet & Exercise
  - Alcohol & Drug Use
  - Sexual Activity
  - Access to Care
  - Quality of Care
  - Education
  - Employment
  - Income
  - Family & Social Support
  - Community Safety
  - Air & Water Quality
  - Housing & Transit
- Policies & Programs
  - Social & Economic Factors (40%)
  - Clinical Care (20%)
  - Health Behaviors (30%)
  - Physical Environment (10%)
Geography and health

Exploratory spatial analysis of children's eating habits in Liverpool, United Kingdom. The use of a geographic approach for analyzing, mapping and integrating different data sets allows data to be explored in a novel way (i.e., GIS has changed the way we can look at data).
Geography and health

Obesity Trends* Among US Adults
CDC’s Behavioral Risk Factor Surveillance System
1991-2003
(*BMI≥30, or ~ 30 lbs overweight for 5’4” women)

1991

1996

2003

No Data  <10%  10%-14%  15%-19%  20%-24%  ≥25%

[Map showing obesity trends over time with different color codes for percentage of overweight adults]
Geography matters a lot!

"The only thing more astonishing than this 19-year gap in life expectancy is the short distance you have to travel in Baltimore to get from one extreme to another." - Washington Post

Life expectancy at birth is the average number of years a newborn baby can be expected to live based on current mortality trends.


Life Expectancy (number of years, 2013)

Number of years

- > 76 to 85
- > 73.6 to 76
- > 72.2 to 73.6
- > 69.5 to 72.2
- 66 to 69.5
Medical Geography

In order to understand health geography as it is practiced / conceived of today, we should first consider the past, when medical geography was the norm.

Some definitions of medical geography:

Medical geography is the application of geographical perspectives and methods to the study of health, disease and health care.

Medical Geography

- Medical geography uses the concepts and techniques of the discipline of geography to investigate health-related topics.

- Subjects are viewed in holistic terms within a variety of cultural systems and a diverse biosphere. Drawing freely from the facts, concepts and techniques of other social, physical, and biological sciences, medical geography is an integrative, multi-stranded sub-discipline that has room within its broad scope for a wide range of specialist contributions.

- Mead and Earickson (2000) Medical Geography, p.1
Health Geography

The new generation of health geographers, in reaction to the previous medical geographer's view of the discipline, state:

Our reply is that this dominant ‘biomedical’ viewpoint is both flawed and limited.

There is an urgent need to ‘go outside the body,’ to develop an alternative social and environmental perspective on health in which geography can play an important part, along with other social sciences.

Local variations in health status and health care provision are certainly important, but the principal concerns of medical geography as currently practised--access to, and the location and utilisation of health facilities, the use of quantitative techniques for spatial analysis in health care planning, or the socio-political determinants of health and access to health care--are limiting. Medical geography requires radical surgery if it is truly to come to grips with such issues.

Health Geography

In the marriage of humanistic geography and contemporary models of health suggested by these writers, we have an incipient “post-medical” geography of health.

Perspectives

In so far as it is possible to distinguish clearly between the areas of work labeled ‘traditional’ and ‘contemporary’, we suggest that the ‘traditional’ strands accept disease as a naturally occurring, culture-free, and ‘real’ entity, where the problems posed by questions of accurate measurement and distribution are assumed to be technical and solvable.

In contrast, the ‘contemporary’ strands adopt a stance which argues, in various ways, that notions of health, disease, and illness are problematic, and intimately linked to power relations in society. Thus, the assumption of health professionals as invariably caring, neutral scientists is questioned, and the different roles they fulfill in maintaining the current social order become subjects for scrutiny.

Robin Kearns (1993) suggested: ‘Rather than advocating a renaming of medical geography, I suggest that two interrelated streams be identified within the medicine/health/geography nexus: medical geography and the geography of health.

The concerns of the former are well known and involve spatial and ecological perspectives on disease and health care delivery.

The concerns of the latter would consider the dynamic relationship between health and place and the impacts of both health services and the health of population groups on the vitality of places'.

(Kearns (1993) Professional Geographer 45(2), 144-5)
Perspectives

Five Strands of Health Geography

Spatial patterning of disease and health

Spatial patterning of service provision

Humanistic approaches to ‘medical geography’

Structuralist / materialist / critical approaches to ‘medical geography’

Cultural approaches to ‘medical geography’
Spatial patterning of disease and health

Approaches

*Patterns of disease + patterns of topography, meteorology*

*Medical cartography (e.g. mortality atlases)*

*Early work actually conducted by physicians (Snow, 1855)*

**Diffusion**

**Quantitative**

**Assumptions**

*Diseases = ‘facts’*

*Role = understand ecology of diseases (Jacques May, 1958—‘father’ of medical geography)*

**Examples:** cholera in Soho London - 1854 (Snow); malaria

**Limitations:** Ecological fallacy = main analytical enemy
Medical cartography:
US Cancer Atlas

http://www3.cancer.gov/atlasplus/
Epidemiology

Host

Environment
- Temperature, humidity, altitude
- Crowding, housing, neighborhood
- Water, milk, food
- Radiation, pollution, noise

Agent
- Biologic (bacteria, viruses)
- Chemical (poison, alcohol, smoke)
- Physical (trauma, radiation, fire)
- Nutritional (lack, excess)

GIS

GeoSpatial/Statistical Analysis
- Spatial concepts, functions, relationships, clustering, aggregation, statistics and detection

Data Administration
- Relational geodatabase design & maintenance, data generation & editing, spatial-enabling

Application Development
- Programming & application development, web apps, desktop tools, web services, system integration, support

Cartography
- Geovisualization, insights, geospatial techniques, reporting, map use and comprehension

ANALYZE
CREATE
BUILD
VISUALIZE

8th Annual GIS and Public Health Day

The number of public alerts per day resulting in 2000

93

Epidemiology
Perspectives

Spatial patterning of service provision

Approaches

Spatial patterns of health service facilities (mainly hospitals)
Patterns of utilization
Patterns of inequity in supply and use (demand) of services
Quantitative

Assumptions

Disease = ‘fact’
People are ‘optimizers’ - re: rationality
Health care = major determinant of ‘health’
Distance decay
‘Build it, and they will come.’

Examples: optimal ambulance shed locations - location/allocation models; spatial patterns of childhood immunization, HMO
Patterns of utilization

Medicare spending per beneficiary in regional health care markets

VARIATIONS IN HEART SURGERIES
City: # Rate of open-heart surgeries per 1,000 Medicare enrollees in selected cities. Numbers are rounded.
One surgery per 1,000 enrollees

All figures are for 2001, the most recent year available.
Health care service provision

Perspectives

Humanistic approaches to ‘medical geography’

Approaches

Understand lay rationality
Qualitative - e.g., grounded theory, phenomenology

Assumptions

Illness = socially constructed
People are ‘satisficers’ - re: rationality
Perception of health = major determinant of ‘health’
Social context influences perception
Meaning can be understood from stories

Examples: lay perceptions of health (Eyles and Donovan 1986 (e.g.)); impact of environmental policy on the health of communities

Limitations: what about social constraints on human action?
Environmental justice

http://msucares.com/health/health/appa1.htm

http://leftinsf.com/blog/index.php/archives/1672
Environmental justice
Perspectives

Structuralist / materialist / critical approaches to ‘medical geography’

Approaches

- Inequalities in health
- Marxist critiques of capitalism

Assumptions

- Structure of social/political/economic system is the key determinant of health and variation in health
- Macro-scale analysis is important
- Understand links between h/c professionals and reproduction of unequal power relations

Examples: community-based childcare; health inequalities in Canada

Limitations: what about human agency/creativity to overcome social constraints?
Socio-economic factors
Social and Behavioral Factors Contribute More to Outcomes than Clinical Factors

- Studies demonstrate that social and economic factors may contribute most to health outcomes (40%)

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- Key Finding: Changing health outcomes requires a focus beyond just “clinical care and coordination”
Perspectives

Cultural approaches to ‘medical geography’

Approaches
- Therapeutic landscapes (e.g., e.g.)
- Health promotion

Assumptions
- Reframe health in positive terms
- ‘Place’ important determinant of health

Examples: Hokianga district New Zealand - rural health centres (Kearns, 1993); culturally sensitive health promotion (Manson-Singer et al., 1996)

Limitations: what about social constraints on human action?

http://www.ingentaconnect.com/content/els/13538292/1998/00000004/00000004/art00033
The differences

The discipline has traditionally been divided into two fairly distinct fields: one examines the geographical factors which contribute to ill-health and disease (geographical epidemiology); whereas the other deals with geographical factors influencing the provision of and access to health services (geography of health care).
The differences

Place versus space: Health geographers put the emphasis on place as opposed to space – that is, the unique characteristics of particular places as opposed to spatial variations and relationships.

Geographical scale: There is a tendency for health geographers to focus on the relationship between people and their local contexts, or on societal factors, as opposed to variations between places at a regional, national, or even international level.
The differences

Qualitative versus quantitative research methodologies: ‘Pure’ health geographers tend to favour qualitative methodologies (e.g. in-depth interviews) as opposed to quantitative methodologies (e.g. statistical analysis of mortality or morbidity data).

The centrality of social theory: Health geographers tend to be firmly rooted within social theory, whereas more traditional medical geographers tend to be more eclectic.
The similarities

Geographic research in health is often dichotomized between quantitative and qualitative methodologies, with quantitative studies closely aligned with epidemiology and qualitative studies aligned with medical sociology and social sciences (Dummer, 2008).

Although differences in approach are important for the assessment of complex problems, these methodologies share a common theme: the role of place and space in health.
The similarities

For example, a quantitative study of an outbreak of an infectious disease such as mumps might focus on spatial modelling of disease diffusion, whereas a qualitative investigation might focus on socio-cultural influences on vaccination uptake within communities, the characteristics of which have been defined within an epidemiology–health geography framework.
The similarities

Often, health geographers will combine quantitative and qualitative methods in complimentary mixed-methods approaches. Geographers contribute to methodological developments that are useful in health research, including multi-level statistical models, cluster analysis and geographically weighted regression analysis.

**Data collection**

**QUANT (WP A: Healthy Cities Network characteristics)**
- 80 cities
  - Procedures
    - Data extraction of city socio-economic characteristics (INSEE)
    - Coverage of cities' Urban Green Space (IGN) & Open Street Map
    - HIAP maturity questionnaires
    - Green Space Policy questionnaire
  - Products
    - Database
    - City typologies

**QUAL-quant (WP B: Green Space Policies and HIAP)**
- 6 cities
  - Procedures
    - In depth case studies
      - City governance, HIAP & health equity strategies (WP B1)
        - Documents
        - Interviews
      - City Green space policy (WP B2)
        - Documents
        - Interviews
        - Meetings
    - Construction of 6 QUAL-QUANT case studies (WP D2)
  - Products
    - Open ended data
    - Memos
    - Transcripts

**QUAL-QUANT (WP C: Green Urban space characteristics and use)**
- 6 cities
  - Procedures
    - In depth case studies
      - Cities QUANT and QUAL spatial and geographical characteristics of urban green space (WP C1)
        - Documents
        - Databases (IGN, CORINE Land Cover)
        - Field visits
      - Use/non use of cities' green space (WP C2)
        - Interviews
        - Observation
    - Transferability for all French cities (WP D1): contextualisation of the best practice policy approach with data issued from the 6 case studies and from the 80 city profiles
  - Products
    - Topographic analysis
    - 6 case studies of urban green space characteristics and use

**Data analysis**

**QUANT**
- Statistical procedures: descriptive, univariate, multilevel, multivariate for construction of city profiles
- Score construction & Multi criteria analysis

**QUAL**
- Categories, Themes
- 6 policy case studies

**Mixed methods interpretation and transferability**

- INSEE: French National Institute of Statistics and Economic Studies
- IGN: French National Geographic Institute
- HIAP: Health in all policies
- WP: Work Package
### Health Geography Research Areas

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<th>Research area</th>
<th>Examples</th>
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<td>Services, infrastructures and land-use planning</td>
<td>• Geographic accessibility of healthy foods(^7)</td>
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<td>• Land-use planning and influences on socio-demographic variation in physical activity(^8)</td>
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<tr>
<td>Disease surveillance, modelling and mapping</td>
<td>• Infectious disease control, including mapping malaria outbreaks, leprosy elimination and Lyme disease surveillance(^9)</td>
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<td>• Analysis of geographic clusters of deaths due to breast cancer(^10)</td>
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<td>Disease etiology and determinants of health</td>
<td>• Geographic variation in inflammatory bowel disease and the identification of potential environmental risk factors(^11)</td>
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<td>• Local and modifiable influences on diet, physical activity and obesity(^12)</td>
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<td>Environmental health risk factor assessment</td>
<td>• Adverse pregnancy outcomes among women living close to incinerators and sources of environmental pollution(^13)</td>
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<td>• Association between air pollution and mortality(^14)</td>
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<td>Health service use</td>
<td>• Access to hospitals and family physicians, and the use of hospital inpatient services(^15)</td>
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<td>• Regional reorganization of cardiovascular surgery provision(^16)</td>
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<td>Inequalities in health outcomes</td>
<td>• Rural-urban and intrarural variations in health in Quebec(^17)</td>
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<td>• Social and spatial polarization in health outcomes across the life course(^18)</td>
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<td>Therapeutic and healthy landscapes</td>
<td>• Influence of woodland and green space on adolescent mental health(^19)</td>
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<td>• The role of city image, risk perception, environmental stigma and neighbourhood inequality in characterizing healthy and unhealthy places(^20)</td>
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*Dr. Trevor Dummer, CMAJ April 22, 2008 vol. 178 no. 9*
Health Geography

Conclusion

‘medical geography’ = too narrow for some – ‘health geography’ preferred

Now, much more in tune with debates in social theory and policy

Special role for ‘place’ - physical space, place in the world, sense of place, cultural space