Public Health and Territory

What do we need?

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When space is essential in Public Health

- To understand how context affects people health: ecological studies
- Environmental factors (weather, pollution, insects)
- Health services access and definition of functional regions
Spatial Analysis for Public Health

GIS

Layers
Routes
Search
Spatial Analysis for Public Health

- Cluster
- Statistics
- Intelligent Systems
- Aggregation
- Fuzzy
- Space-time Modeling
- Geostatistics
- Urban Facilities
- Cartographic data
- Health Services
- GIS

- Layers
- Routes
- Search
- Lines
- Polygons
- Satellite Image
Applications
Context: Leprosy and poverty
Small area analysis and detection of risk to leprosy

The problem:
- Very high rates of leprosy detection in Pernambuco
- Leprpsy control is based on cases treatment
- Under-registration and poverty

Objective:
- Identify high-priority areas
- Evaluate the control program

Method: to model the cases distribution based on the spatial structure and a deprivation indicator.
Deprivation map of Olinda

Deprivation Index
1991-1995

- 0.60 to 0.75 (11)
- 0.45 to 0.60 (43)
- 0.30 to 0.45 (66)
- 0.15 to 0.30 (80)
- 0.00 to 0.15 (53)

Deprivation Index
1996-2000

- 0.60 to 0.75 (1)
- 0.45 to 0.60 (11)
- 0.30 to 0.45 (98)
- 0.15 to 0.30 (94)
- 0.00 to 0.15 (95)

1.5 kilometres
30
N
E
S

1991
2000
Leprosy X Poverty

a) 1991-1995

b) 1996-2000

Detection Rates vs Deprivation Index
Sources of error:
- Geocoding – addresses!
- Health Services access under registration
- Small areas
**Number of cases**

Just smoothing

Modeling

**Smoothed Detection Rates 1991-1995**
- 30 to 40 (1)
- 20 to 30 (8)
- 10 to 20 (38)
- 0 to 10 (196)

**Censored Model 1991-1995**
- 70 to 80 (1)
- 60 to 70 (1)
- 50 to 60 (1)
- 40 to 50 (1)
- 30 to 40 (16)
- 20 to 30 (15)
- 10 to 20 (43)
- 0 to 10 (166)
Predicted number of cases: modeling the under registration

Targets

1996-2000

Smoothed Detection Rates 1995-2000

- 90 to 167 (2)
- 80 to 90 (1)
- 70 to 80 (3)
- 50 to 60 (5)
- 40 to 50 (9)
- 30 to 40 (17)
- 20 to 30 (35)
- 10 to 20 (97)
- 0 to 10 (130)

Nº de Casos
- <5 (206)
- 5 to 10 (13)
- >10 (24)
The PSF
Family Health Program
Functional regions

- Cases localized at census tract level
- Coordinates of Health Services
- GIS with statistical capabilities (kernel)

Functional regions based on use

Olinda: 1991 - 1995

Olinda: 1996 - 2000

Áreas Programáticas
Áreas de Domínios das Unidades

Barros Barreto
São Benedito

Distritos Sanitários

Peixinhos
Mirueira

CISAM
Sem Domínio
Health Services Access
Maternity wards – Public System

TabWin (Datasus) and Inpe
Maternity wards – Private System
Satellite image: the environment
Satellite in urban areas and vector borne disease

Low resolution for urban areas
Data on weather, humidity
Terribly difficult

Bhattacharya
Correia, 2005
Isoseg
The Google revolution
The Google revolution

Beautiful, but...

• Population: Where is it?
• Health determinants: Which?
• Spatial unities: Exist?
• Health events: Invisible?
We need

- Dataware
- Software
- Specific technological and methodological development
- Peopleware
Data and Information

- Health events – our responsibility
- Health facilities localization
- Population and Socioeconomic indicators – IBGE (Brasilian Census Bureau)
- Routes – inter and intra-urban
- Environment – satellite (high resolution?)
- Climate – temperature, rainfall, humidity

ALL FREE
Free Software

- Terra
- Spring
- R (aRT)
- TabWin
Development of Technology

- Addressing system
- Adequate models
- Capacitation
We have been working... (for about 15 years)

- RIPSA – Health Information Network (joining all potential sources of health related information)
  - Geo working group:
    - A book – “Introdução à análise de dados espaciais em saúde”
    - Leaflets to Municipal Health Authorities;
    - Guidelines for address registration;
    - All Health Information Systems (SUS) can be analysed at municipal scale (maps available);
    - Software;
    - Courses
Peopleware: partnership

➢ Instituto Nacional de Pesquisas Espaciais:
  ➢ Gilberto Câmara, Miguel Monteiro, Virginia Ragoni e ....

➢ IBGE
  ➢ DGEO/CESTE: Daniel Skaba, Sonia Sterron e Paulo Cezar Martins
  ➢ Dept Geografia: Evangelina Gouveia

➢ DATASUS
  ➢ Ernani Bandarra e Claudia Risso
Universities...

- Estadual do Rio de Janeiro/IMS:
  - Guilherme Werneck

- Federal da Bahia/ISC:
  - Florisneide Barreto,
    Maria da Glória Teixeira

- Federal de Minas Gerais/LESTE:
  - Renato Assunção e equipe

- University of Exeter:
  - Trevor Bailey

- Universidade do Rio de Janeiro - UNIRIO
  - Tereza Serrano Barbosa, Enirtes Melo

- Federal de Pernambuco/D.CAR:
  - José Luiz Portugal

- Universidade do Porto (PT)
  - Fátima Pina

- Federal do Paraná/D.EST:
  - Silvia Shimakura, Paulo Justiniano Ribeiro
And more....

- Students-partners (not referred elsewhere)
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  - Eliana Bender (UFPel)
  - Francisco Santana
  - Franz Muñoz
  - Tatiana Campos (SMS-RJ)
  - Wagner Tassinari
  - Cláudio Bustamante Sá (in memorian)
  - Simone Santos
  - And more....
At home...

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  - Salvador: Albert Ko e equipe
  - PROCC: Oswaldo G. Cruz, Claudia Codeço
  - CICT: Christovam Barcellos, Mônica Magalhães, Renata Gracie
  - ENSP: Reinaldo Souza-Santos, Carlos Osanai, Paulo Sabroza
  - Recife: Wayner Souza, Tiago Lapa, Fátima Militão, André Furtado, Leda Régis, Alice Varjal, Cynthia Braga, Constantino Silveira Jr e todos mais!
On development

- Large capacitation program, financed by the Health Ministry
  - Objective: training people at State and Municipal level in geo-related techniques
  - Includes:
    - Texts based on real life problems;
    - Practical exercises;
    - Based on TerraView & TabWin
This is the result of a collaborative work.