

Instituto Nacional
de Salud Pública

Geographic Information Systems in Public Health: Mapping Maternal Mortality

Generating evidence for better
decision making

Geographic Information Systems in Public Health

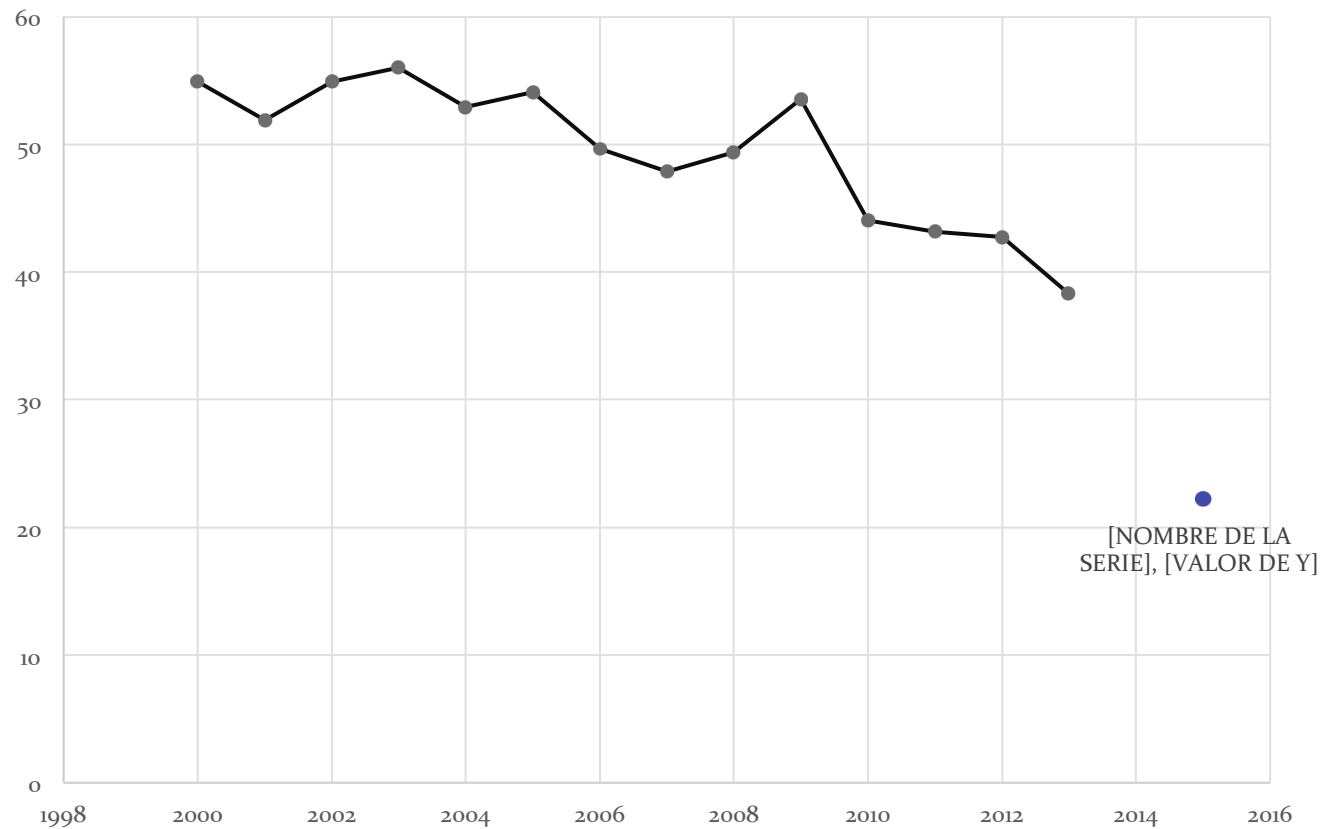
- Geographic Information Systems (GIS) have been used in public health since the nineteenth century
 - John Snow used a rudimentary system to investigate the source of cholera in England during an epidemic outbreak in 1854
- Modern informatics technology and satellite data facilitate the use of GIS in public health
 - Federal, state and local government health agencies in many countries use GIS in the planning, operation and evaluation of public health programs and policies

Information needed to Improve Population's health

- Data generation and integration
 - Accurate, timely, complete and consistent
 - Relevant / useful / accessible
 - Inter-departmental / Inter-institutional / Inter-sector
- Use of information
 - Better decision making
 - Monitoring & Impact evaluation
 - Accountability

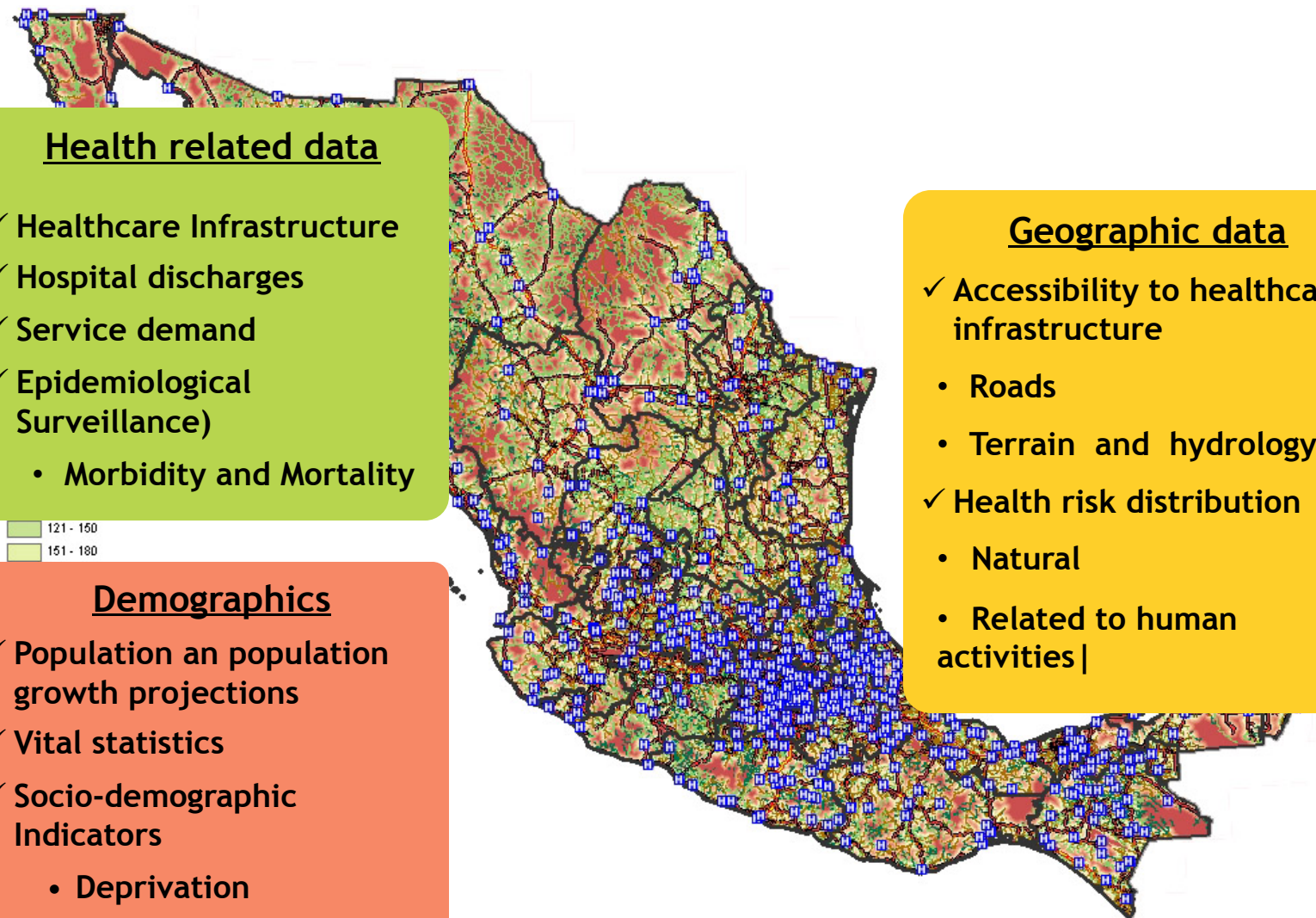
Maternal mortality in Mexico has not declined enough to meet MDG-5.1

Maternal Mortality Ratio, Mexico 2000 - 2014



- Mapping maternal mortality in Mexico
 - Use of health administrative records
 - Hospital discharge data
 - Civil registry data
 - Mortality data
 - Infrastructure and resources geographic distribution
 - Census data
 - Topographic maps
 - Hydrology maps
 - Roads

Data Integration in GIS



Health related data

- ✓ Healthcare Infrastructure
- ✓ Hospital discharges
- ✓ Service demand
- ✓ Epidemiological Surveillance)
 - Morbidity and Mortality

Geographic data

- ✓ Accessibility to healthcare infrastructure
 - Roads
 - Terrain and hydrology
- ✓ Health risk distribution
 - Natural
 - Related to human activities |

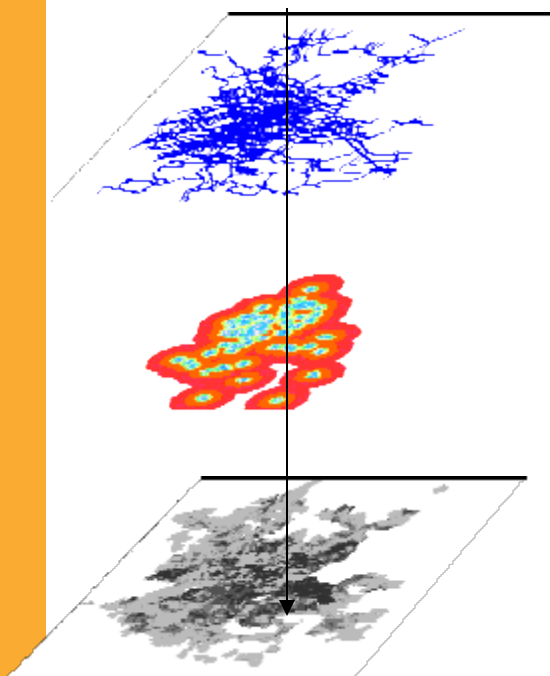
Demographics

- ✓ Population an population growth projections
- ✓ Vital statistics
- ✓ Socio-demographic Indicators
 - Deprivation
 - Human development



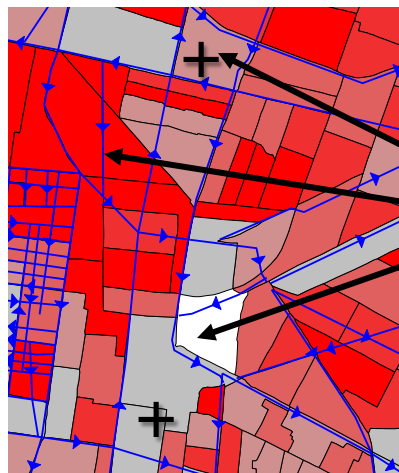
Geographic Information Systems

**Geo-referenced data
organized in map layers**



Spatial queries and analyses of
data

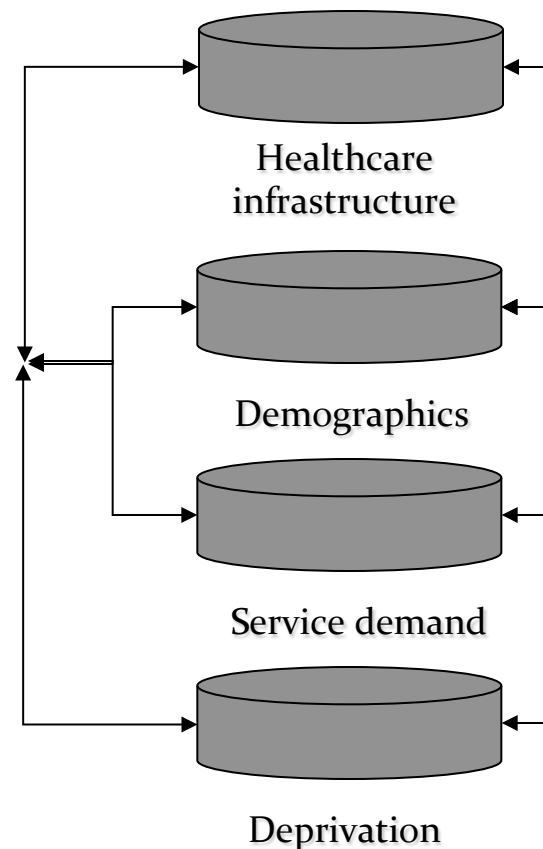
Visualization



- Points
- Lines
- Areas

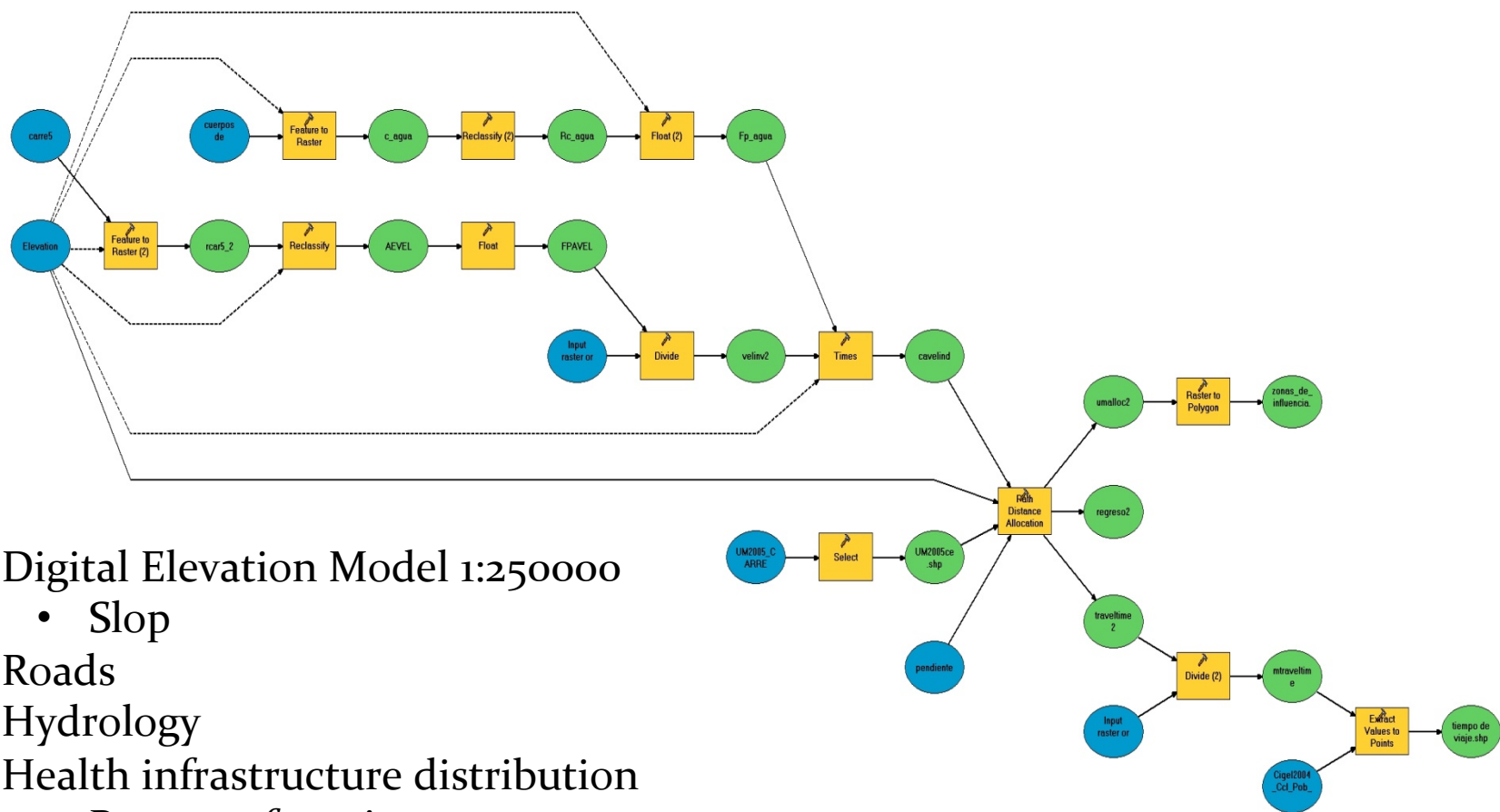
Spatial visualization of database
queries

**Relational database
system**



Database management and
analyses through common index
key variables

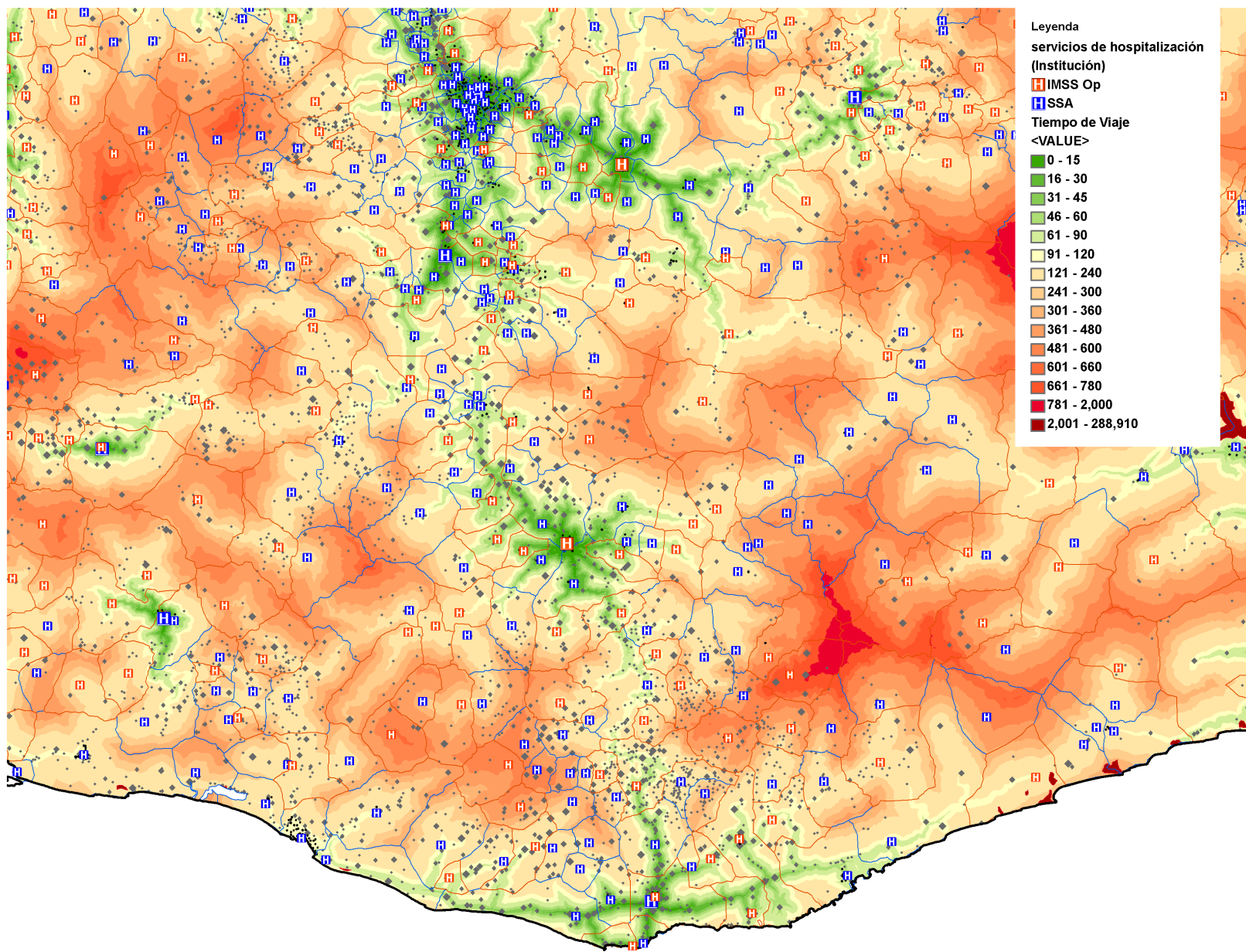
Spatial Model for travel time estimation



- Digital Elevation Model 1:250000
 - Slope
- Roads
- Hydrology
- Health infrastructure distribution
 - By type of service
 - By Institution
- Population distribution
- Cost surface based on the difficulty to transit through each 90m x 90m cell

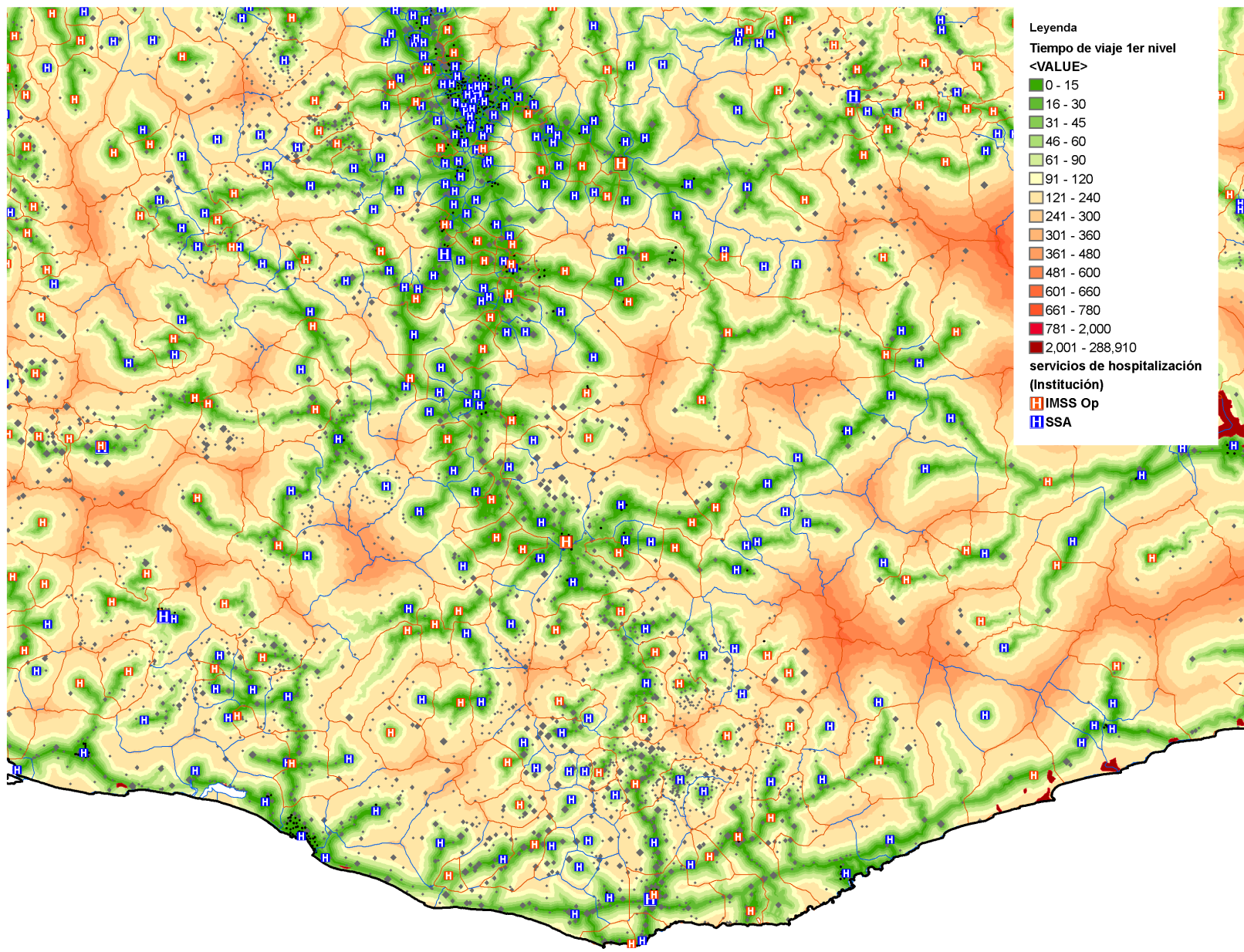


Spatial Model Results

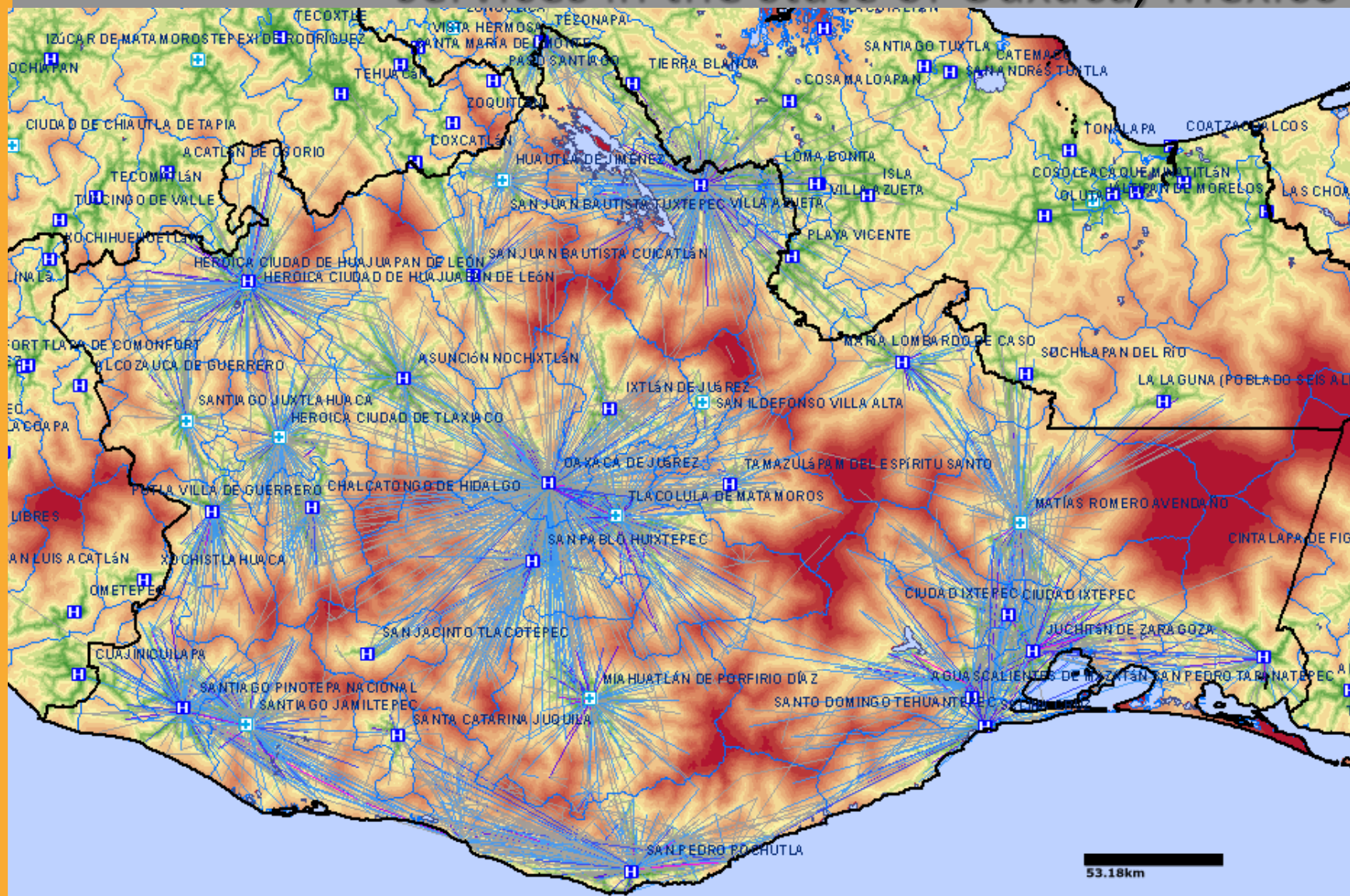




Spatial Model Results



ent patterns in seek of birth care health services in the state of Oaxaca, Mexico





SHARING RESULTS THROUGH WEB MAPPING APPLICATIONS

- Web Based GIS applications allow data integration and use of information in all governmental levels (local, state, national)
 - They provide a common frame to gather and share information
 - Data input can be done over the Internet to a common database or use distributed databases
 - Data is accessible to all who need it as soon as it is entered
 - Training curve is less steep

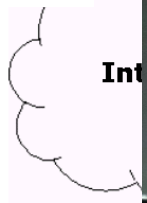


Web Based GIS Schematic Architecture

Users:
Public health workers
Scientific Community
General population



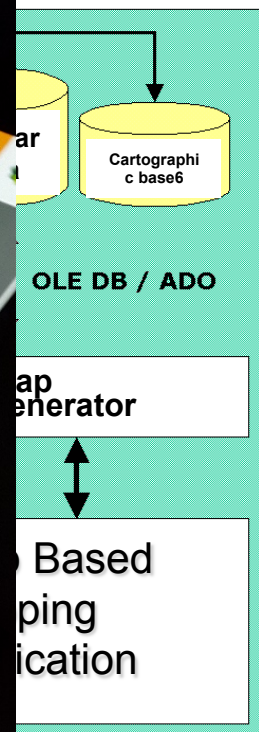
Data input
Statistical
or
geographic
queries



Internet



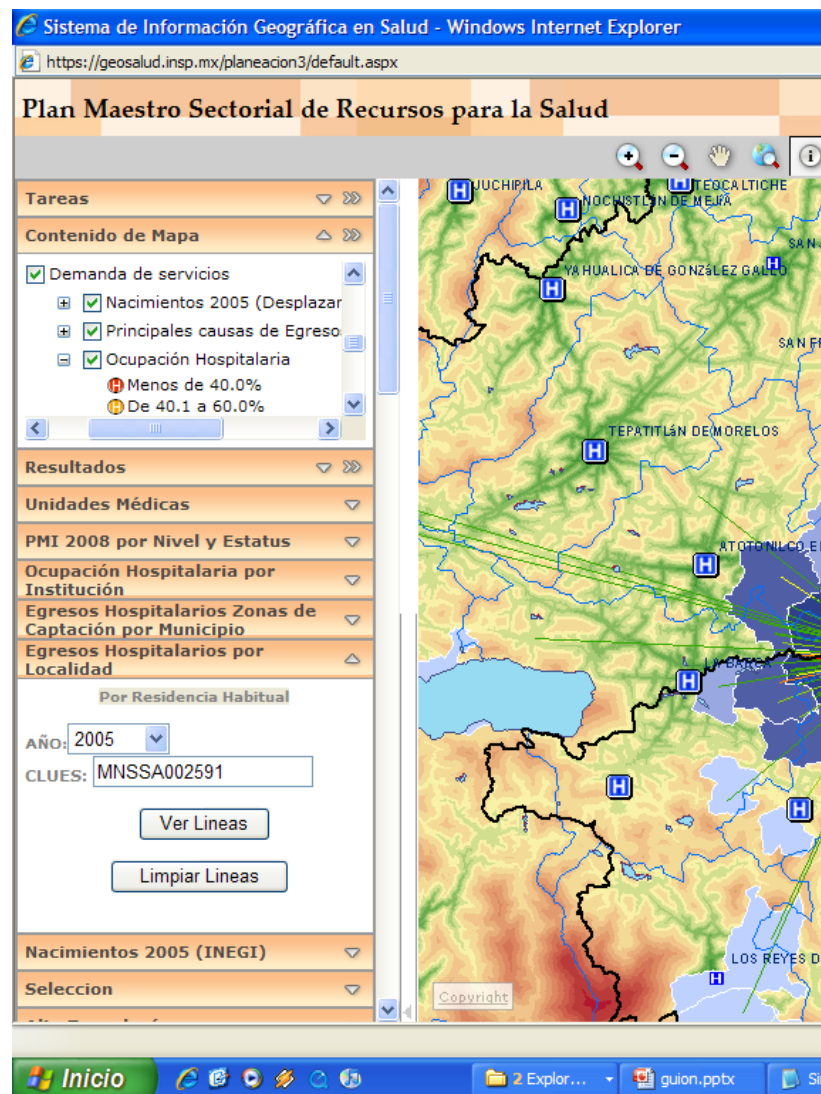
Windows Enterprise
Server



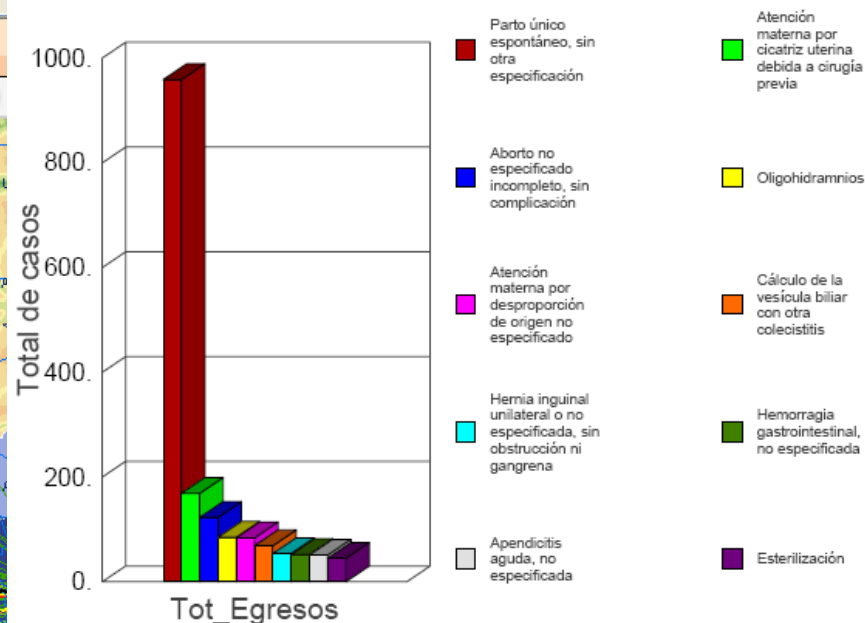
WebServer
IIS



Main causes of hospital discharges



Egresos Hospitalarios



[Ver Principales Causas](#)
[Ver Principales Causas Sin Obstetricas](#)
[Ver por grupo de Edad](#)
[Ver Por tipo de Servicio](#)

Egresos 2006

[Ver Principales Causas](#)
[Ver Principales Causas Sin Obstetricas](#)
[Ver por grupo de Edad](#)
[Ver Por tipo de Servicio](#)

Egresos 2007

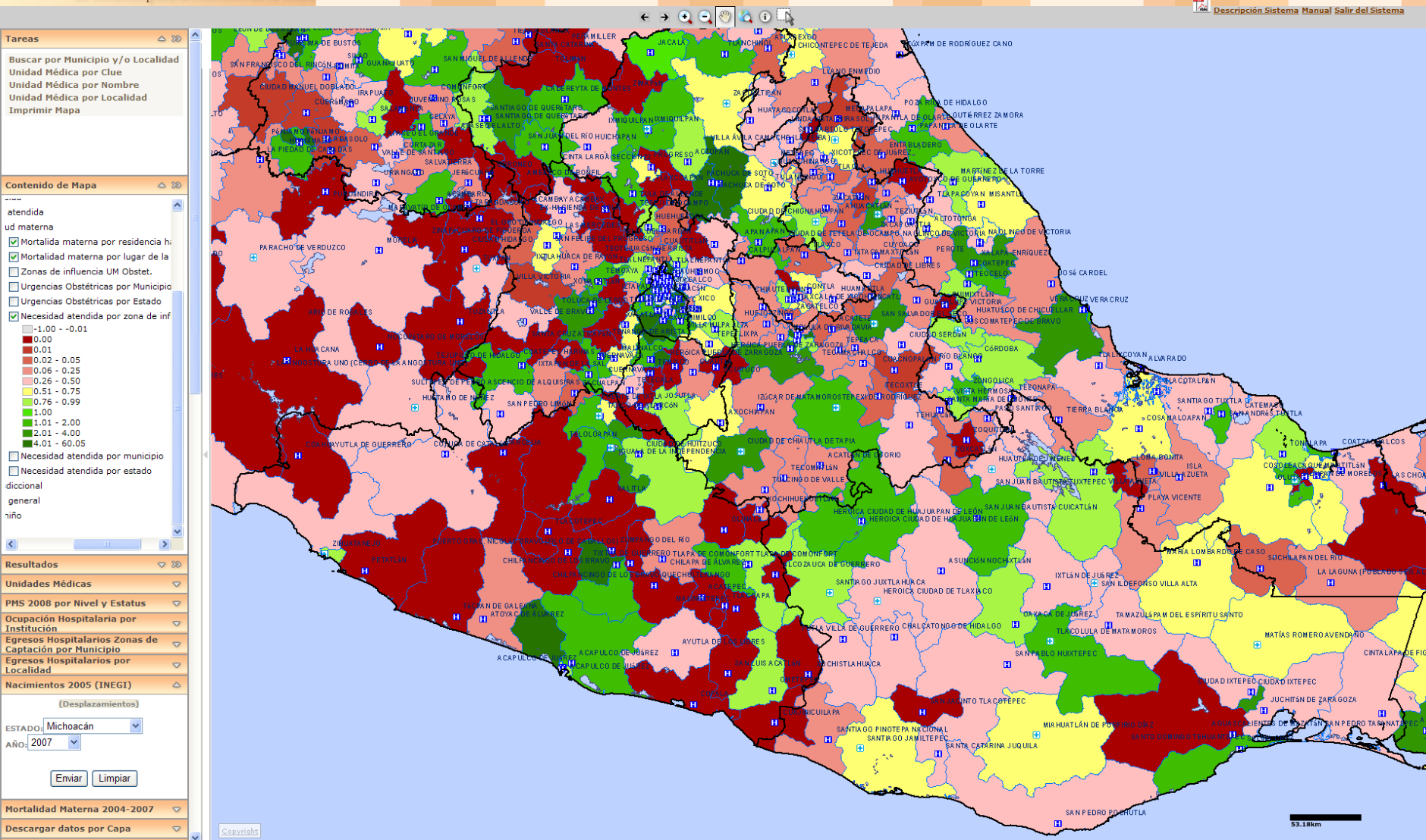
[Ver Grupos de edad](#)
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Met need index for obstetric emergency care

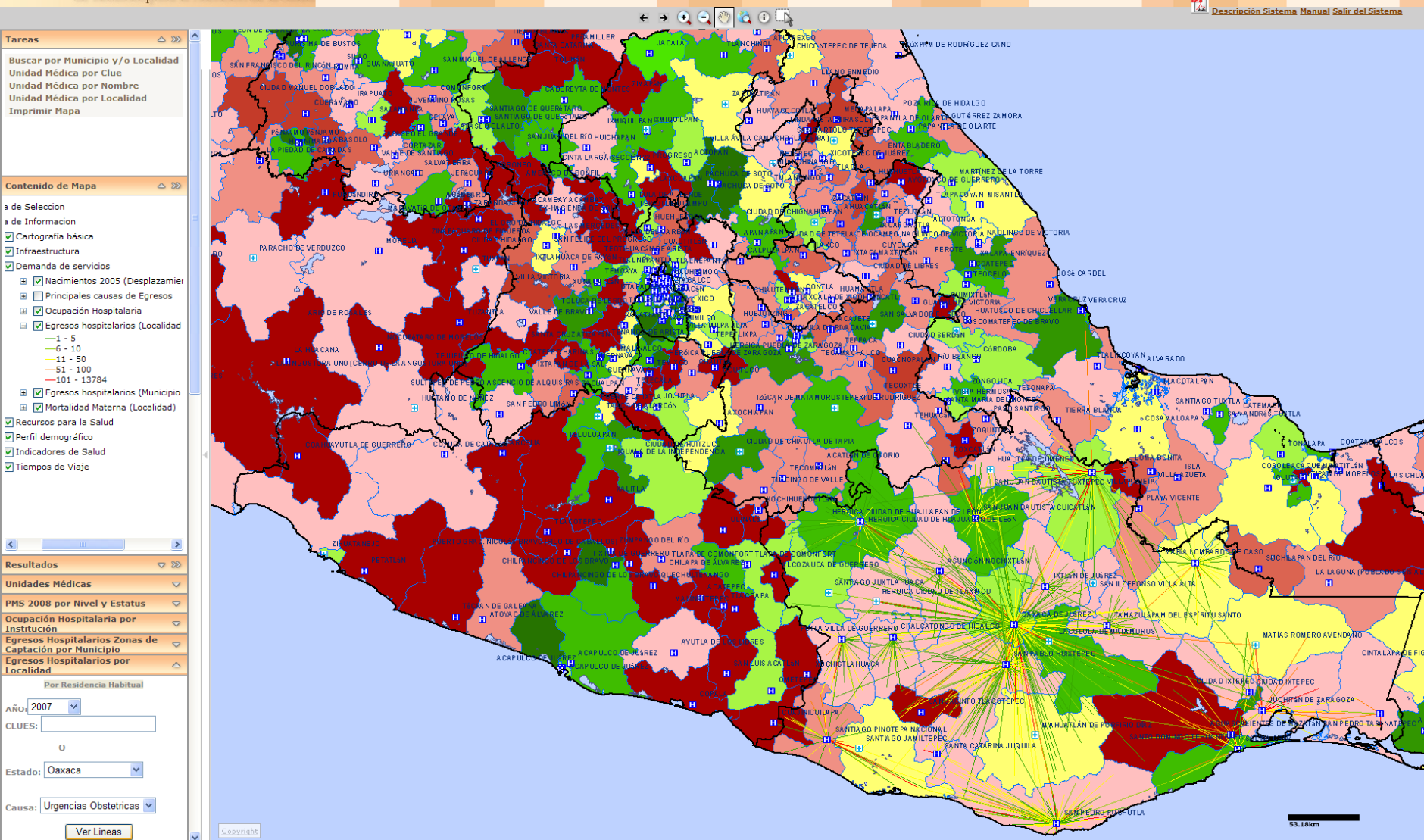
PMS Plan Maestro Sectorial
de Recursos para la Atención de la Salud





Movement patterns in seek of obstetric emergency care in the state of Oaxaca

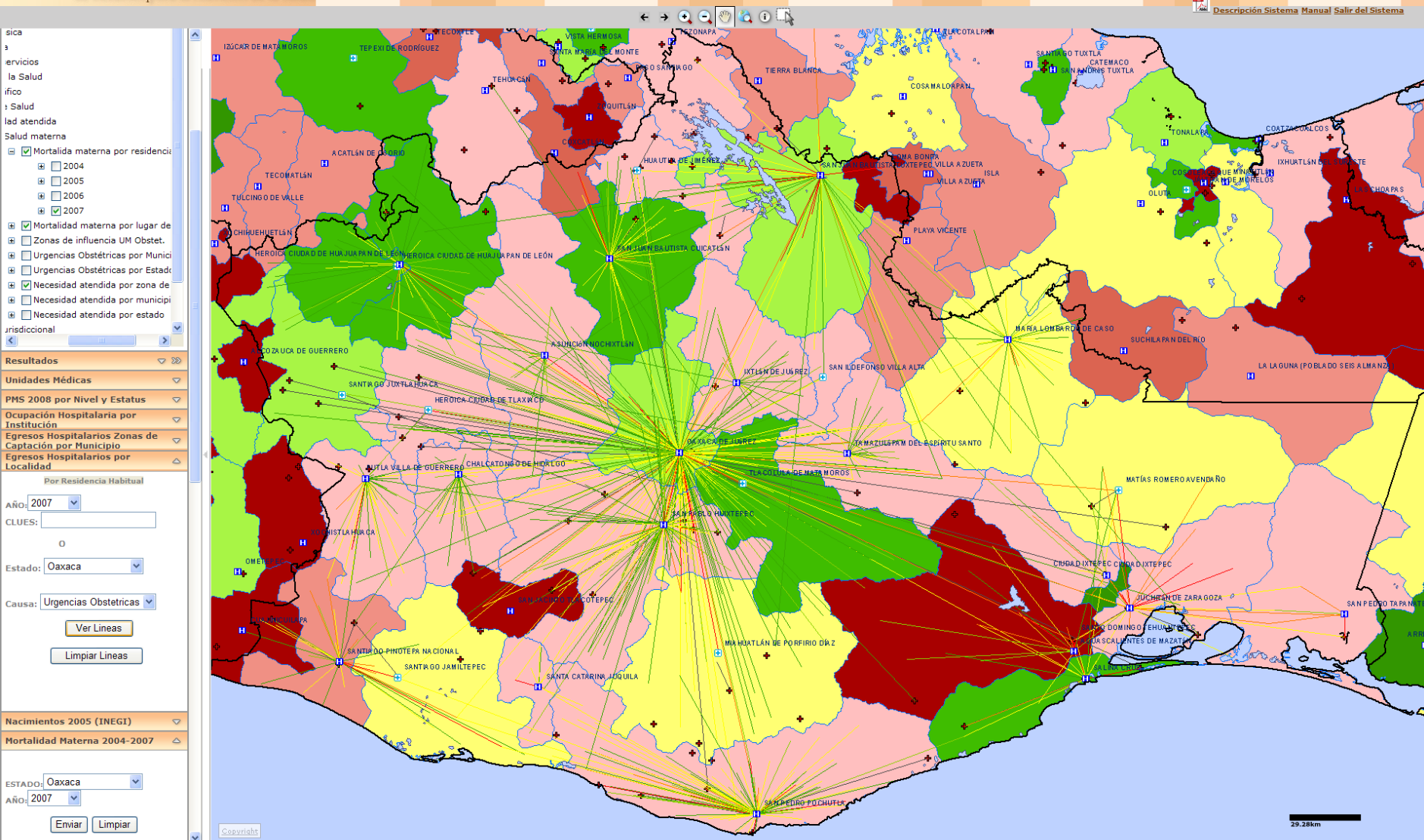
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Movement patterns in seek of obstetric emergency care in the state of Oaxaca

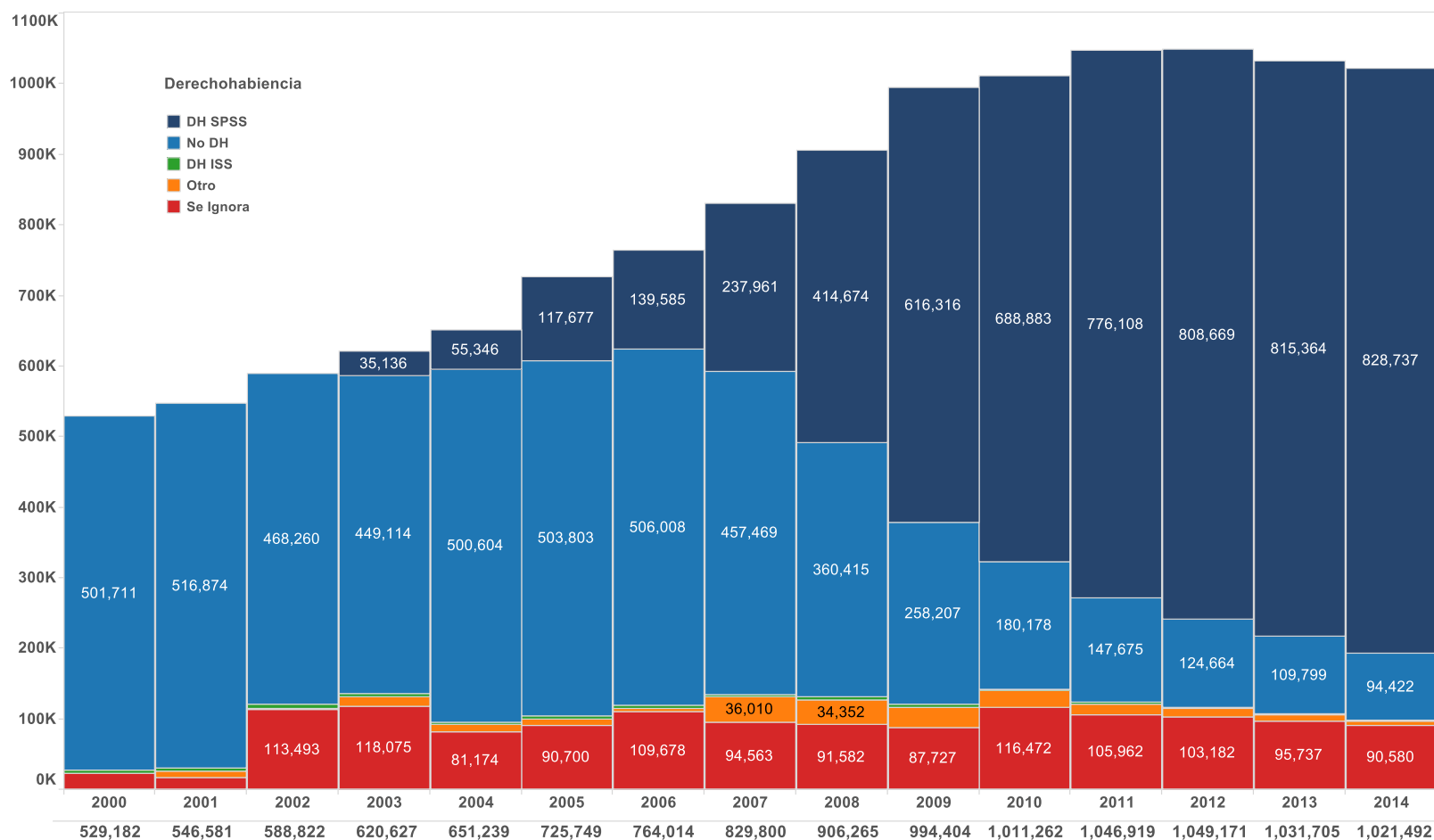
PMS Plan Maestro Sectorial
de Recursos para la Atención de la Salud



- Visualization of geographical and institutional barriers to access EmOC services aided in the development of a new maternal health policy in Mexico: Regardless on health insurance status, any woman should receive free-of-charge EmOC services in any public hospital in Mexico; this was extended later to include also childbearing services.



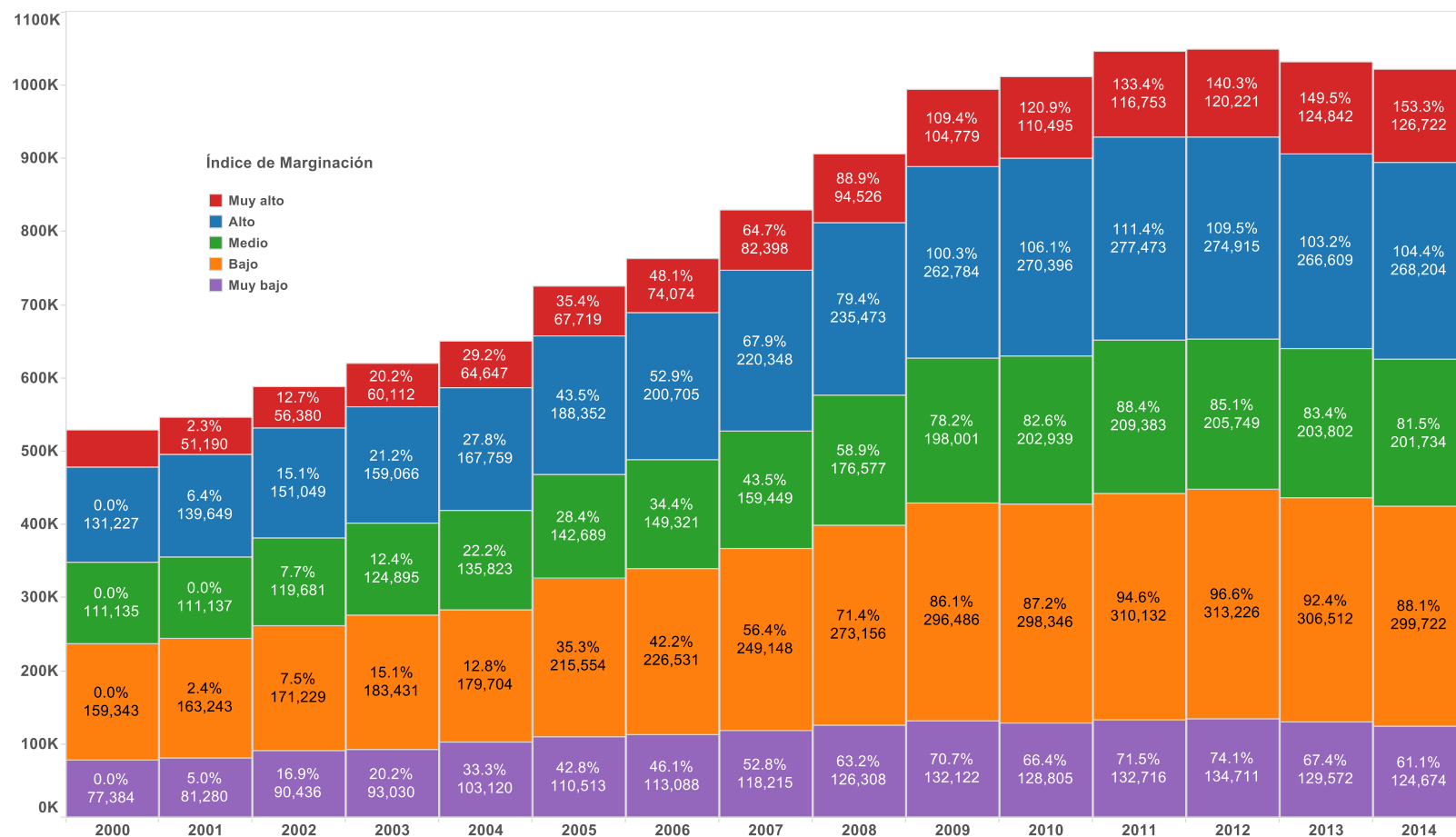
Birth services provided by health insurance of the mother, México 2000 - 2014



Fuente: Subsistema Automatizado de Egresos Hospitalarios (SAHE), DGIS/Ssa



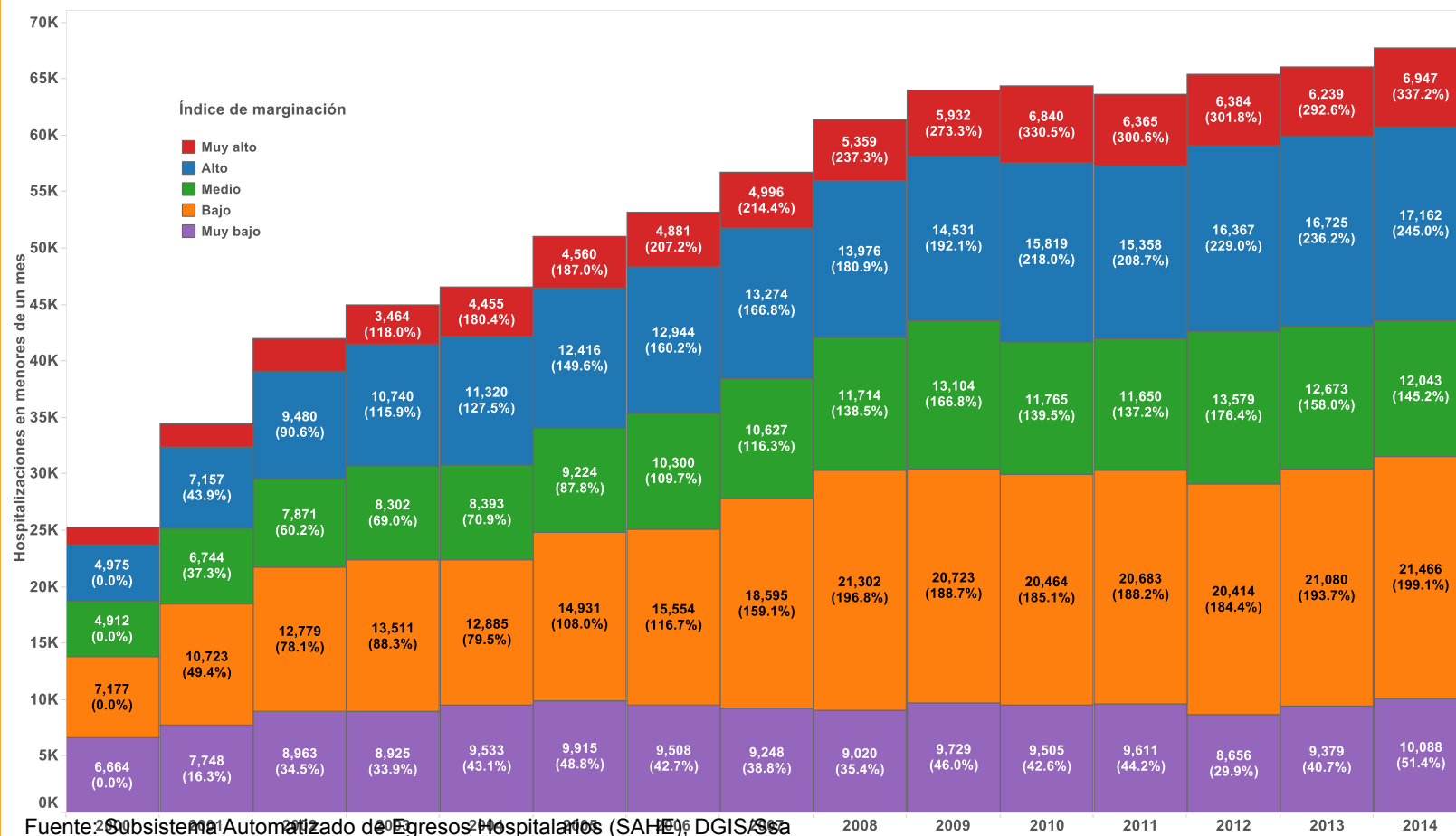
Birth services provided by marginality index of state of residence of the mother, México 2000 - 2014



Fuente: Subsistema Automatizado de Egresos Hospitalarios (SAHE), DGIS/Ssa

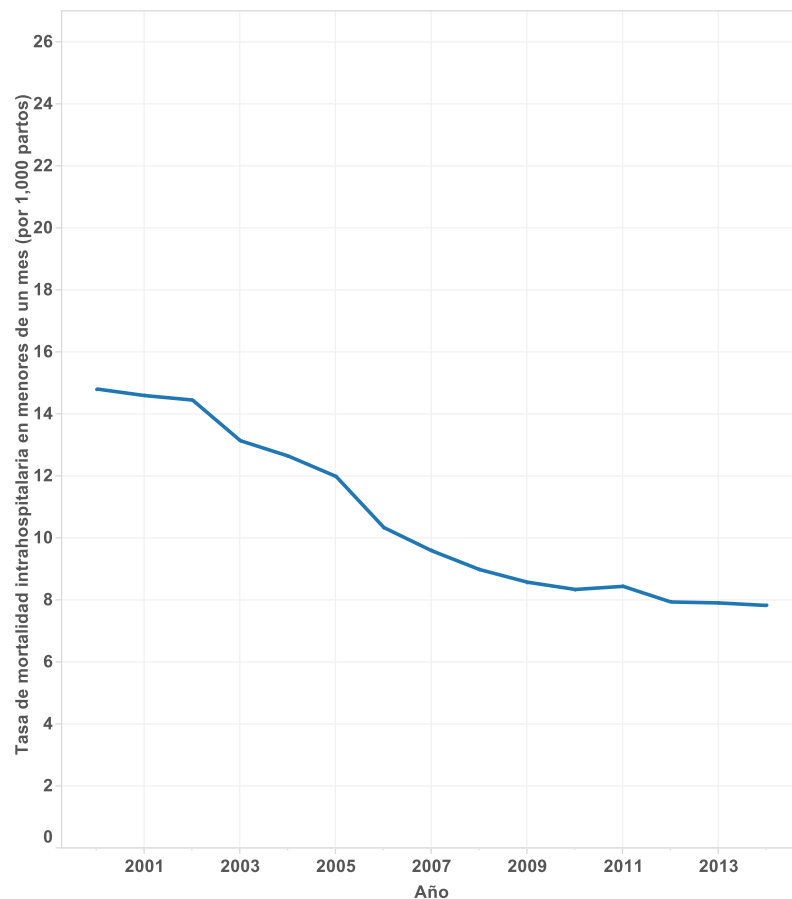


Hospital utilization in new born infants by marginality index of the state of residence of the mother, México 2000 - 2014

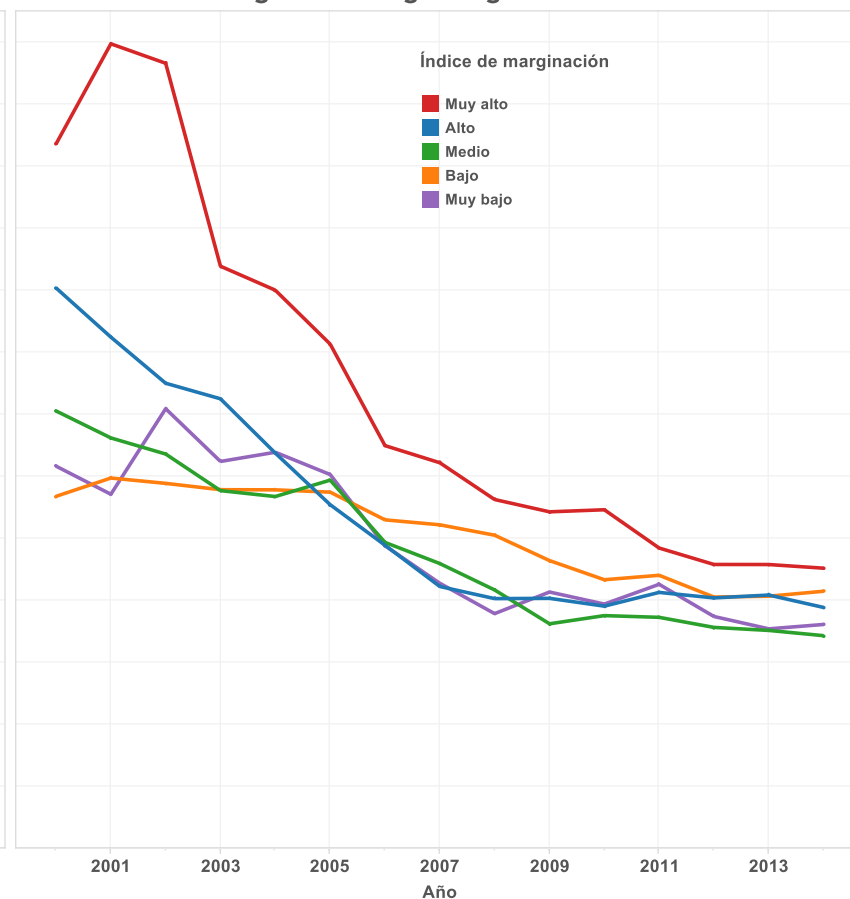


Hospital mortality in infants (27 days or less) México 2000 - 2013

General



Por índice de marginación según lugar de residencia



- We are clearly reducing gaps in maternal and newborn health but we still need to focus our strengths to reach every mother and child
- Mapping geographical and institutional barriers was helpful as one of the pieced of evidence reviewed in the development of better public health policies
- Nationally, the impact of such policies benefited all the population but, mostly those in most need
- Web-based mapping applications to plan health infrastructure and to monitor access, utilization and quality of services may become a cornerstone in the reduction of maternal and newborn deaths
- We want to seek, detect and correct anomalies in the maternal and newborn services before we have to count another death

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- Miriam González Velasco
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- Gabriel Núñez Urquiza
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THANK YOU VERY MUCH!