Using Arcgis for Server for organ allocation optimization an evaluation in France

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Objective of this presentation: how can we use a spatial data infrastructure to:

- Improve the non-systemic organ allocation (outside the main rules)
- Delegate the map production
1 - Context
L’Agence de la biomédecine

■ Created by the bioethics law of 2004.

■ French public body (health ministry).

■ Responsible for:
  ▪ operational coordination and administration of organ transplantation and tissue harvesting.
    ➔ Organ allocation is national and entirely managed by the Agence
  ▪ Coordination and administration of hematopoietic stem cell grafting.
  ▪ Administration of assisted reproductive technology, human embryology and human genetics.

■ Missions in these fields:
  ▪ promote.
  ▪ Regulate.
  ▪ Assess.
  ➔ To improve access to treatment throughout France for everyone who needs it.
L’Agence de la biomédecine

Health geography plays a key role in these missions:

- To communicate about health care organization
- To provide an access to geographic data for healthcare practitioners
- For decision making process
- For allocation rules (gravity model in the Liver and Kidney Score)
1 - Context

Example: the Liver Score

In liver transplant, the compromise between efficacy, equity and feasibility must take into account:

- Specific recipient condition (i.e. emergency life threatening conditions)
- The quality/safety of the transplant and organ
- The distance between donor and transplant centres (cold ischemia time, transplantation team’s security)

- Urgency
- Liver Score
- Exceptional Allocation

The distance between donor and transplant team doesn’t matter
Interaction between patient’s condition and the distance (gravity model)
The distance between donor and transplant team is the most important component
Objectives

Since 2008, health geography is a part of the Agence de la biomédecine expertise.

- Map production, Spatial Analysis, Geographical analysis, Webmapping

Several needs assessment have shown benefits of a webmapping tools for the Agence de la biomédecine and its partners

Information feedback

Our partners are recording patients’ data for allocation or evaluation, and the Agence de la biomédecine provides a feedback.

Evaluation tool

Our partner or internal users want an access to geographical information:
- What is the organ donation rate by year and by region?
- Where are the transplantation teams?
- Where does my patients come from?

Decision support tool

Some more complex operations can be automated:
- How many patients are living from 45 minutes and more from this dialysis center?
- What happen to drive time access if we open a new center?

Operational tool

To offer a geographical decision making tool for some specifics organ allocation:
- Where is the closest patient from this graft?
- Helping the transport organization for an organ retrieval
- Where is the perfusion machine?
- Reducing cold ischemia time
1 - Context

Needs

- spatial-data-infrastructure.
- Integrated inside our information system.
- With a web application.
- Secure access by the Agence security portal.
- Filtering view depending of user’s rights.

Public

Agence de la biomédecine’ users

- Evaluation (distribution of the opposition rate by region)
- Operational (where is the closest patient from this graft? )

Partners (transplantation teams, dialysis centers, medical assisted procreation centers)

- Evaluation (where are living my patients ?)
- Operational (when the perfusion machine will come ? )
2 - Methodology
2 - Methodology

Previous tools

Webmapping : BO-Webigéo-ArcIMS (since 2007)
- Only for geographical data information access.
- Users : Agence de la biomédecine

Maps production : Arcmap
- Geographical database
- Maps production ≈ 250/year

➤ Use of outcomes, functional and data specifications
Project schedule

2 - Methodology

Arcgis for server integration and installation
- A middleware for the security access has been developed by ESRI France
- A web application based on ESRI’s Javascript API has been developed with Memoris
Network architecture

Internet

DMZ

External users
Portal
Tomcat 6
Middleware Orion
Arcgis for Server 10.2
Oracle 11 + SDE
Data warehouse

LAN

Internal users
Arcmap’s users
Admin

External users
-BO -SAS

-BO
-SAS
Objectives: filter the access to mapservices or to the mapservice content (whereclause) depending on the user’s profile. These profiles already exist for our Business Objects application.

A/ Users see everything on the mapservice
- Mapservice: patients & DEM
- Layers: all
- Fields = patients’ name only

B/ Users see one region on the mapservice
- Mapservice: patients & DEM
- Layers: Region = ‘north’
- Fields = all

C/ Users can’t see the patients mapservice
- Mapservice: DEM only
2 - Methodology

Data

■ 40 base maps created by the Agence de la biomedecine.
■ 1 DEM.
■ 1 Network Analyst road network.
■ 15 000 health structures geocoded every night at the address.
■ 12 000 patients of the national waiting list for organ transplantation geocoded every night at the address.
■ Aggregate activity indicators (population, opposition rate, patients’ flow etc.).
■ WMS and WMTS data from the french national geographic institute (IGN)
3 - Results
3 - Results

Demo

https://www.sipg.sante.fr/
4 - Conclusion
Since July 2015, 700 users, 545 unique users (potential: 2200), 330 000 requests

Organ allocation platform uses it every night

Time saving for the organ platform for exceptional allocation (when allocation scores don’t apply) for cold ischemia time reducing.

- Liver’s exceptional allocations,
- some pediatric patients,
- deceased donors after cardiac death,
- HBC and HCV donors,
- finding the closest structure or patient

Time saving for maps production

- Direct and easy access to the maps for healthcare practitioners and Agence de la biomedecine’s users
- More time for spatial analysis

But the challenge of this tool remains the lack of analysis by the geographer. The opening of a push-button application to non-specialists of spatial phenomena is a complex issue for geographers
Future works

New thematics to add:

- Dialysis (2016)
- procreation and genetics
- hematopoietic stem cell

Perfusion machine GPS data

Web application design improvement
Thank you for your attention