Operational maps for dialysis centers access time in France

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The REIN registry

The French Renal Epidemiology and Information Network (REIN) registry started in 2002:

- to provide a tool for public health decision support
- For evaluation and research related to renal replacement therapies for end-stage renal disease (ESRD).

Main objectives:

- To describe the incidence and prevalence of dialysis treatments
- To characterize the treated population
- To describe mortality
- To describe treatment modality

Institutional Support: Agence de la biomédecine (health public body)

→ 22 local organizations corresponding to the 22 French regions
1 - Context

Base figures

In 2008 in France:

- ESRD prevalence: 68,000 patients (12/31/2008): 37,000 in dialysis, 31,000 transplants.
- ESRD incidence: 9,300 new cases by year (146 pmp, 361 for US)

The transport time between home and dialysis center is a medical indicator and an economic indicator:

- Dialysis budget: 4 billions € in 2007 (national health insurance)
- The travel cost represents 13% of dialysis budget

It’s also an indicator for public health decision:

- In 2003, 7.5% of patients were over 45 minutes to get to their dialysis center (Source: CNAM)

Quality of life (Health public law)
1 - Context

REIN’s need

- To find a simple, reliable and generally applicable indicator of health care offer adequacy

Objective

- Offer operational documents for public health planification

Public

- Nephrologists and decision makers
Method

- Pilot study in Bourgogne (Burgundy), because journey time is manually informed in the registry for this region, with internet trip planner for each patient

1/ Area description

- Population
- Prevalent localization in 2007

2/ Dialysis centers access

- « real » access time (registry report)
- theoretical access time calculation to the nearest dialysis center (model)
A- Study area description

1/ Territory and population
A-1 Situation
1 Situation
A-1 Situation
A-1 Land occupation

Source: Union européenne – SOéS, CORINE Land Cover, 2006
In 2006 (source INSEE):

- 1,628,000 inhabitants
- 52% women, 48% men
- 25% of inhabitants are older than 60 years old
- 10% of inhabitants are older than 75 years old

Main cities (inhabitants):

- Dijon (150,000)
- Chalon-sur-Saône (50,000)
- Nevers (40,000)
- Auxerre (38,000)
- Mâcon (35,000)
- Sens (27,000)
- Population organized in 3 areas:
  - North west: IDF, Troyes
  - East: Vallée de la Saône
  - South west: Nevers, Decize, Moulins

- "Empty" areas:
  - Morvan
  - Auxois
  - Vallée du Châtillonnais
A-1 Population (relative)

Relative trend:
- North and east Nièvre.
- Rural area

Bourgogne: settlement of retired people from Paris area
A- Study area description

2/ Cohort
A-2 Cohort

825 ESRD patients (12/31/07)

- 800 from all regions and treated in Bourgogne.
- 24 living in Bourgogne but treated in another region
- 1 missing data

A cohort study of 824 patients all treatment modalities combined
A-2 Cohort

507 pmp in dialysis (national: 577)
- Nièvre center
- Sens
- Autun
- Gueugnon
A- Study area description

3/ Dialysis in Bourgogne
A-3 Situation

- 2007: 20 dialysis centers in Bourgogne
- Nearby the main urban areas

Distribution of the dialysis centers in 2007

City with at least one dialysis center
A-3 Centers activity

- Logical and reassuring
- The main activities are in the main cities
There are several types of dialysis: Hemodialysis and peritoneal dialysis.

**Hemodialysis**: purification of the blood through an artificial membrane.

Three structures in France:

- Hemodialysis in specialized centers (permanent presence of a nephrologist): located in an hospital
- Medical dialysis unit (permanent presence of a nurse): located theoretically at a medium distance from an hospital
- Autodialysis unit (the patient is autonomous): located everywhere

*Source image: www.renaloo.com*
A -3 dialysis

Peritoneal dialysis, blood purification through the peritoneal membrane

Source image: www.renaloo.com
B- acces to dialysis centers

1/ The « real » access time
B-1 access to dialysis centers

Patients treated at home are not analyzed.

824 incident cases to 664 (12/31/2007)

Answer the question: where are my patients?
Home dialysis in Bourgogne is not enough developed: a lot of travel can be expected.

560 patients in specialized centers or medical dialysis unit

- mean 30 minutes
- median 25 minutes

Cartography can be used as a quality control tool.
-1 access to dialysis centers

104 patients in autodialysis

- Mean 26 minutes
- Median 20 minutes

An area appears to be in difficulty: Morvan
B- acces to dialysis centers

2/ Theoretical access time calculation to the nearest dialysis center
Is it possible to calculate the access time to a dialysis center for each patient?

Study cohort: 664 patients in 2007 (12/31/07)

- Patients treated at home excluded
- Calculations are made with Network Analyst, without taking into account the toll highways (no health care reimbursement)
- Limit: our network database is old (1999) and without minor roads (poor estimation for urban areas)
Two-third of the calculated times are matching the declared times in the registry for this region.

But 21% of the residuals are between +/- 5 to 10 minutes

- Network database is not enough detailed
- Acceptable for a study at this scale

<table>
<thead>
<tr>
<th>Résidus déclarés-calculés en 2007 (Obs_Theo5_2007)</th>
<th>Quantile</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>664</td>
<td>664</td>
</tr>
<tr>
<td>Mean</td>
<td>0.05572289</td>
<td>37</td>
</tr>
<tr>
<td>Std Deviation</td>
<td>10.3050705</td>
<td>106.194477</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.7832124</td>
<td>5.83553294</td>
</tr>
<tr>
<td>Coeff Variation</td>
<td>18493.4237</td>
<td>0.39991429</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>99%</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>95%</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>25%</td>
<td>-5</td>
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<tr>
<td></td>
<td>10%</td>
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<tr>
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<td>-20</td>
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<td></td>
<td>1%</td>
<td>-35</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>-70</td>
</tr>
</tbody>
</table>
C- Centers’ access

Indicator of health care offer adequacy
C- Indicator of health care offer adequacy

Objective : Offer operational documents for public health planification

Postulate :

1- The previous model is acceptable for a regional study (scale).

2- Depending on the treatment modalities, patients are going to the nearest dialysis center.

Methods :

- Calculating the theoretical journey time to the nearest dialysis center, by treatment modality.

- Cross with demographic data (INSEE 2006) → theoretical influence of each dialysis center.

- Cross with REIN registry data → What would be the theoretical impact for the patients in case of an opening/closing of a center.

- Only for the patients living in the region (626 without home dialysis)
Theoritical approach

<table>
<thead>
<tr>
<th>Total centers 2007</th>
<th>&gt; 40 minutes</th>
<th>% &gt; 40 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global population</td>
<td>132 568</td>
<td>8.1</td>
</tr>
<tr>
<td>75 years old and more</td>
<td>17 839</td>
<td>10.6</td>
</tr>
<tr>
<td>All residents patients*</td>
<td>73</td>
<td>11.6</td>
</tr>
</tbody>
</table>

*except home dialysis

8.1 % of the global population have an access time to the nearest dialysis center greater than 40 minutes
C-Theoretical approach

Why taking into account centers with only one patient?

- Limit: at least 4 patients
- Saulieu et Chatillon sur Seine
### Theoritical approach

17.8% of the global population have an access time to the nearest autodialysis center greater than 40 minutes.
### Theoretical Approach

<table>
<thead>
<tr>
<th>Specialized centers and MDU 2007</th>
<th>&gt; 40 minutes</th>
<th>% &gt; 40 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global population</td>
<td>298,850</td>
<td>18.3</td>
</tr>
<tr>
<td>75 years old and more</td>
<td>39,224</td>
<td>23.3</td>
</tr>
<tr>
<td>All residents patients*</td>
<td>121</td>
<td>19.3</td>
</tr>
<tr>
<td>Resident patients in specialized centers / MDU</td>
<td>102</td>
<td>19.2</td>
</tr>
</tbody>
</table>

*except home dialysis
### Theoretical access

<table>
<thead>
<tr>
<th></th>
<th>&gt; 40 minutes</th>
<th>% &gt; 40 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autodialysis (&gt;3) 2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global population</td>
<td>290,976</td>
<td>17.8</td>
</tr>
<tr>
<td>75 years old and more</td>
<td>376,080</td>
<td>22.4</td>
</tr>
<tr>
<td>All residents patients*</td>
<td>114</td>
<td>18.2</td>
</tr>
<tr>
<td>Resident patients in autodialysis</td>
<td>15</td>
<td>15.6</td>
</tr>
</tbody>
</table>

### Example: 2 closing, 1 opening

<table>
<thead>
<tr>
<th></th>
<th>&gt; 40 minutes</th>
<th>% &gt; 40 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autodialysis (&gt;3) 2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global population</td>
<td>264,880</td>
<td>16.2</td>
</tr>
<tr>
<td>75 years old and more</td>
<td>33,734</td>
<td>20.1</td>
</tr>
<tr>
<td>All residents patients</td>
<td>96</td>
<td>15.3</td>
</tr>
<tr>
<td>Resident patients in autodialysis</td>
<td>12</td>
<td>12.5</td>
</tr>
</tbody>
</table>
Conclusion
- Conclusion

1. The results calculated by the model are similar to the actual data in the registry. But the results in urban area have to be improved ➔ a new network database in November 2010

2. Access to dialysis centers in Bourgogne is pretty good
   - Only 11.6% of the patients (8% of the region population) have an access time to the nearest dialysis center greater than 40 minutes
   - This is a major information for nephrologists and decision makers

3. This study highlights some hot-spots in Morvan
   - Small number of patients but several statistical methods show this area as significant
Assesment

The REIN registry will be able to provide an indicator of health care offer adequacy for access time:

- The number of patients located at x minutes of the nearest dialysis center

With hindsight: classical study in health geography, but:

- In France they are scarce but the needs from the professionals are real
- Stakes for the patients quality of life and for economical reasons
Thank you for your attention

Many thanks to Dr. Cécile Couchoud, Dr Jean-François Cabanne, Dr. Christian Jacquelinnet, ESRI Health and ESRI France
A-3 Centers activities

Dialysis centers activities by modalities (12/31/07)

*Location of the monitoring establishment
A-2 Cohort: 60 years old and more

- Nièvre center
- Sens
- Dijon
- Chalon-sur-Saône
- Gueugnon
- West of Dijon

Complex interpretation

- Rurality and age
- Urbanity and health care access