Equity of Accessibility to Dialysis Facilities

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Abstract. Patients' end-stage renal disease (ESRD) characteristics are changing. Improving the quality of care requires a steady adaptation of treatment modalities together with equity of access to dialysis facilities. We explored the ability of the health system to cope with the demand of ESRD care. An analysis of a 5-year follow-up cohort of ESRD patients in the Limousin region, France, was performed. Data were entered in the Multi-Source Information System of the Renal Epidemiology and Information Network (REIN). The participation rate of centres was complete. We analysed patient characteristics, therapeutic options and driving time to reach dialysis facilities. We investigated geographic accessibility by defining areas within 45 minutes from dialysis units. We constructed scenarios to assess the impact of health care reorganization. In-centre haemodialysis units represented 73% of treatment modalities. One quarter of patients lived at more than 45 minutes of their dialysis unit. Based on a scenario of creating an additional In-centre unit, the number of patients living far from their centre would decrease by 31%. This study emphasizes important issues related to ESRD epidemiology, comorbidity and health care planning. It stimulates the development of new scenarios allowing the assessment of equity in accessing health care facilities.

Keywords. end-stage renal disease, spatial accessibility, dialysis, web interface, decisional support, public health

1. Introduction

During the last decades, the national and international registries allowed a better evaluation of the demand of care for End-Stage Renal Disease (ESRD). Longitudinal analysis of these registries emphasizes changes in patient's characteristics at national and international levels, with country to country variations [1–7]. As of January 2002, we created, the French "Renal Epidemiology and Information Network" (REIN). This registry aimed at providing a tool for public health decision support, evaluation and research, related to renal replacement therapy (RRT) for ESRD. According to the report of the registry, the prevalence rate of ESRD in 2006 was 536 per million population (pmp) [8]. The incidence rate remained rather stable, except among patients older than 75 years, in whom incidence continued to rise.

Improving the quality of care leads to modify the health care organization, to adapt the offer of care according to the demand and also to ensure the equity of accessibility

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to health care facilities. We focused our analysis on the French Limousin region, based on a 5 year follow-up of incident and prevalent cases. The specific aim was to assess the spatial accessibility to care units, given the current distribution of dialysis modalities, and to build scenarios for optimizing travel times.

2. Material and Methods

Multi Source Information System: The information system of the REIN programme [9] was initiated with the Multi-Source Information System (MSIS). The organizational support of the MSIS network has been described elsewhere [10–12]. The data collection began as of January 1st 2002. The detail of the data collected is available on the web [13].

Spatial accessibility and travel (drivetime) data: Both patients and dialysis units are spatially referenced according to their municipality. We used the Google map application programming interface to assess the travel times to join each dialysis unit [14]. However, the analysis of the spatial distribution of both patients and health care units conducted us to privilege an equity indicator. This indicator supposes that each patient is treated in the nearest dialysis unit offering the adapted treatment modality, and excluding dialysis capacity constraints. We investigated spatial accessibility of health facilities units by defining areas within 45 minutes road travel time from dialysis units. We constructed a scenario in order to assess the impact of health care reorganization on dialysis units' accessibility, supposing that patients are treated with the suitable treatment modality.

3. Results

Dialysis units: Until 2005, there were 5 self-dialysis units, 2 MHD units, and 2 in-center units in the Limousin region. In 2006, a self-dialysis unit was transformed into a "medicalized" HD (MHD) unit. The dialysis units located in the neighbouring departments were also included.

ESRD data sets: The population of the Limousin region was 725,000 in 2006. During the 2002–2006 period, 475 patients started dialysis, corresponding to a mean incidence rate of 133 patients per million population (pmp); 150 patients were transplanted (mean rate 41.3 pmp). During the 5 year follow-up period, mean age of new dialysed patients rose gradually from 65 to 69 years. The proportion of patients ≥ 80 year of age increased from 14% in 2002 to 26% in 2006.

As of 31 December 2006, 343 patients were receiving RRT. The adjusted prevalence rate was 377 pmp (national adjusted prevalence rate 536 pmp). Mean age was 67.6 years and median age 71 years. In-centre haemodialysis patients represented 49% of the total number of treated patients and 63% of patients older than 80 years. Compared to MHD units and self-dialysis, for In-centre modality patients were older, (mean age 71 years) and presented with more handicaps (15% had at least one handicap). In-centre units included the majority of elderly patients. The prevalence of patients who received a renal graft was 423 pmp, and median age was 56 years.

During the follow-up period, In-centre treatments increased from 42% to 49%. In-centre and MHD unit treatments rose from 58% to 73% of the dialyzed population.

Conversely, self-dialysis decreased from 26% in 2002 to 13% in 2006; home dialysis (haemodialysis and peritoneal dialysis) remained stable, nearly 14%.

Health care accessibility, analysis and scenario: Mean driving time to join a dialysis unit was 18 minutes to join a self-dialysis unit against 27 minutes for an MHD unit, and 31 minutes for In-centre units. Proportion of patients located at more than 45 minutes from their dialysis unit was 25% for In-centre and MHD units, and 10% for self-dialysis units. We mapped an area at more than 45 minutes of In-centre and MHD units, before and after the opening in 2006 of a MHD unit in the town of Guéret. According to their place of residence (red dots) patients were linked to the location of their dialysis unit. Only patients having a ≥ 45 minutes driving time were represented. As of 31 December 2005, 69 patients lived at ≥ 45 minutes driving time from their dialysis unit, and 68 of them lived in the green areas, meaning that they did not have the possibility to be treated in a nearest unit (Figure 1a, left pannel).

After the opening of a MHD unit in Guéret in 2006, 71 patients remained at more than 45 minutes of a dialysis unit, 16 of them were still treated in Limoges, despite the presence of a nearest unit. Among these patients, 15 were treated in an In-centre unit, and 12 presented handicaps or several heavy comorbidities. To ameliorate their health care accessibility, we made a scenario of opening an In-centre unit in Guéret (Figure 1b). As expected, the percentage of patients living at more than 45 minutes of an In-centre unit decreased by 31%. However, 49 patients still remained at more than 45 minutes of their dialysis unit.

4. Discussion

The analysis of health care accessibility has been approached recently [15–17]. Since 2002 in the Limousin region, the total number of dialysed patients remained relatively stable, as well as in metropolitan France. The characteristics of new treated patients remained also rather stable during this period, ¼ of patients presenting with diabetes or vascular disease [8]. Noticeably, the proportion of elderly patients (≥ 80 years of age) increased, representing more than ¼ of patients. Concomitantly, the patients' distribution among the categories of dialysis unit changed, with a decrease of self-dialysis and an increase of In-centre and MHD units. As of 31 December 2006, In-centre and MHD units represented 73% of the regional treatments.

In mean, patients are 13 years younger in self-dialysis units than in In-centre units. The use of driving time rather than distance to measure the spatial accessibility was privileged since in France, 93 % of treated patients (home dialysis excluded) used taxi or ambulance to reach their dialysis unit three times a week.

About 1 out of 4 patients was located at more than 45 minutes of his/her dialysis unit. Despite the opening of an MHD unit in Guéret in 2006, this proportion remained unchanged because almost all patients living in the neighbourhood were still treated in an In-centre unit. To assess dialysis accessibility, we tested several indicators, using for instance the average travel time to the nearest dialysis unit, or using more recent methods such as the two-step floating catchment areas method (2SFCA) [18]. To ensure equity of accessibility to In-centre units, we assessed the impact of creating an In-centre unit in Guéret. Based on the hypothesis that each patient is treated in the nearest appropriated dialysis unit, this reorganization involved a 31% decrease of patients located at more than 45 minutes of a dialysis unit. However, 33% of the general population remained at ≥ 45 minutes from an In-centre unit.
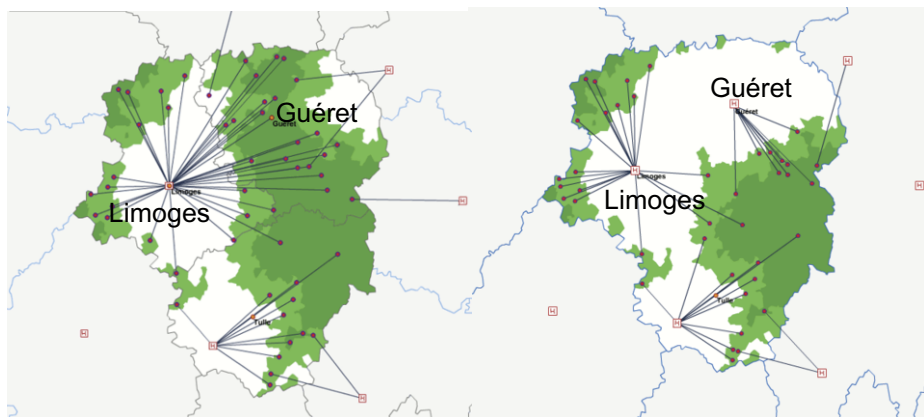
Figure 1. Health care accessibility and patients living at more than 45 minutes of an In-centre or a MHD unit Figure 1a (left panel): Status, as of 12/31/2005. Figure 1b (right panel): Status, as of 12/31/2006 after creation of an In-centre unit in Guéret. Driving-time (min) to the nearest dialysis unit in center or MHD unit: white <45min; light green 45-60 min; dark green > 60 min. H: Dialysis unit (In-centre & MHD). Red dots: patients with a driving time ≥ 45min.

Focusing on the French Limousin region presented several advantages. The Limousin inhabitants are in mean the oldest of France; analysing the needs for health care planning in this region represents an interesting outline of the future requirements at a national level [19]. In 2030, the French age structure will reach the current one in Limousin. In a relatively sparsely populated area such as Limousin, appropriate planning of the location of dialysis units is crucial. Adapting treatment modalities to facilitate access to treatment is an important issue to ameliorate the quality of life of dialysed patient as well as optimizing the costs. In effect, transport costs represent 13% of total dialysis costs [20]; they are linked to the type of vehicle (taxi, ambulance, ...) used, and the covered distance [21].

Our study has several limitations, especially concerning the practicability of the scenario. In effect, the feasibility of creating In-centre units in such a region is bound by economical constraints and by the difficulty to recruit physicians in rural areas. Moreover, the hypothesis that each patient is treated in the nearest centre can be discussed. If 90% of patients are currently treated in the nearest unit, it does not mean that they will opt for changing of dialysis unit in case of creation of a new one. Moreover, the scenario integrates an adaptation of the capacity of the dialysis facility to the demand. We considered no limitation in adapting the recruitment capacity, but a work is in progress to assess the importance of this parameter. Finally, the scenario supposes that ESRD patients are always treated according to the more appropriate modality, a status which has not been clearly established yet. Future scenarios could analyse the impact of modifying the distribution of treatment modalities, evaluating for instance the ability to develop peritoneal dialysis treatment for the elderly [21].

The remoteness from a dialysis unit has important implications for patients considering the impact on their quality of life since they need accessing their dialysis centre three times a week. It also impacts the economic costs of reimbursements for the national Medical insurance since for example transports to dialysis units represent a significant component of dialysis costs. It is critically important to articulate the supply and demand of health services and to understand how they might better match in the

future [22]. This work highlights organizational issues that will be encountered in the near future according to ageing [23].

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