Modeling treatment trajectories to optimize the organization of renal replacement therapy and public health decision making.

Cecile Couchoud[1], Emmanuelle Dantony[2,3], Mad-Helenie Elsensohn[2,3], Emmanuel Villar[2,4] and Rene Ecochard[2,3].
[1]**REIN registry**, Agence de la biomédecine, [2]Service biostatistique, Hospices civils de Lyon, [3]CNRS, UMR 5558, Université Lyon 1, [4]Centre hospitalier Saint-Joseph Saint-Luc, France.

INTRODUCTION

Nephrologists need to better understand the impact of their decisions about long-term treatment strategies.
Health-care planning requires anticipation of demand.
Indicators from ESRD registries, like prevalent rates, are especially difficult to interpret when the underlying dynamic process is not well understood.
Therefore, we have developed a statistical tool to study the course of incident ESRD patient cohorts over time and to quantify, by simulations, the impact of various expected changes or new strategies.

METHODS

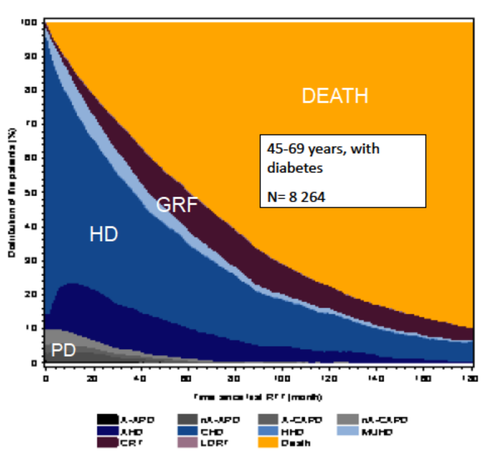
Based on the data from 67 258 ESRD adult patients, we first estimated transition rates between 10 different modalities of treatment ("compartments") with a multistate model.

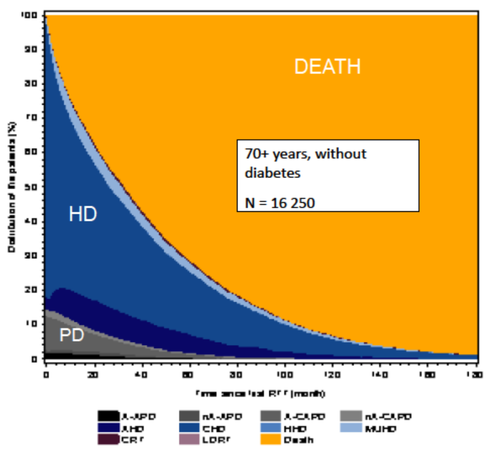
In a second step we predicted the number of patients in each compartment at each time point for a cohort of 1 000 patients for 180 months after the onset of renal replacement therapy (RRT). We tested 2 scenarios to illustrate the possibility of simulating policy changes.

RESULTS

Outcomes of 67 258 adult patients, registered in the French REIN registry, were used for this study.

The following figures show two examples of observed distribution of the patients in the various treatment modalities according to time since first RRT (in months), considering age at RRT initiation or diabetes status.



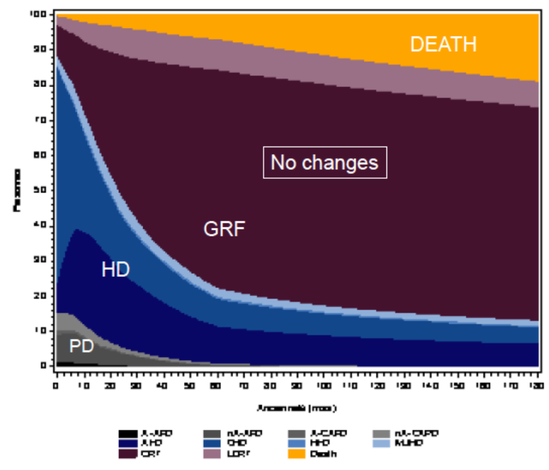


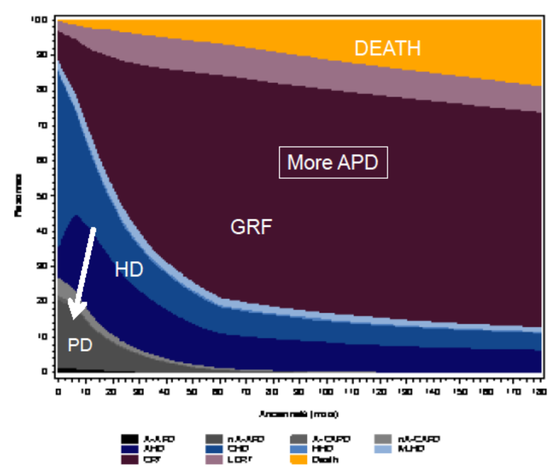
Of those aged 45-69 years with diabetes, 9.9% started with PD and 1.5% with a preemptive graft. Fifteen years after RRT onset, 87% were dead. The 15-year restricted mean lifetime was 75.2 months, less than half the potential 180 months. Over the 15-year period, PD accounted for only 4.5% of the RRT time, and transplantation for 23.6%.

Of those older than 70 years without diabetes, 14.6% started with PD. After 2 years, only 6.8% were still on PD. Fifteen years after RRT onset, 97.7% had died. The 15-year restricted mean lifetime was 45.2 months. Over the 15-year period, PD accounted for 9.3% of the RRT time.

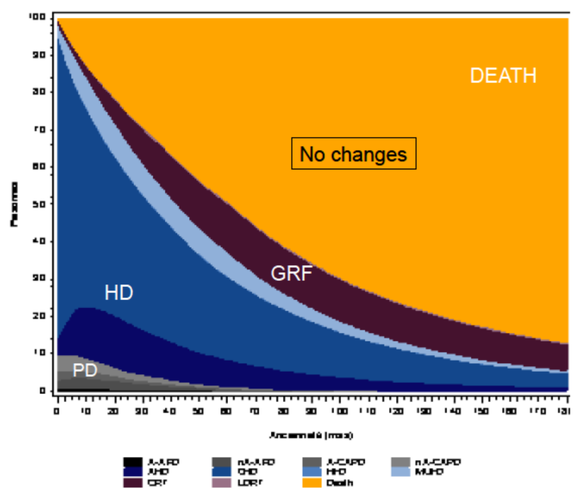
We were able to simulate new strategies by changing some transition rates or the initial distribution of patients in the various treatment modalities. Each scenario was then compared with the unchanged baseline scenario, for a 15-year restricted mean lifetime, the number of transitions between RRT modalities (per 1000 patients), and mean time spent in each modality.

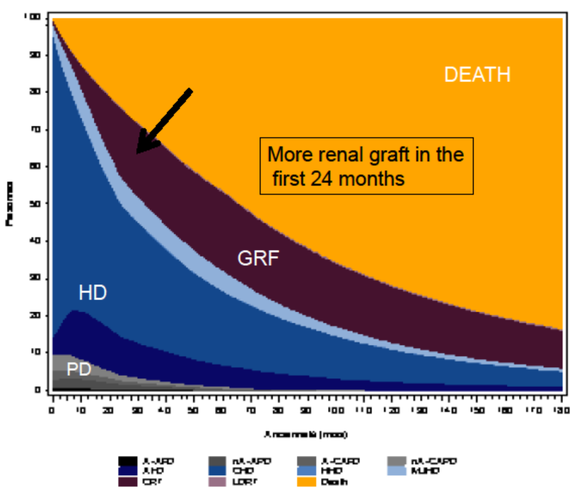
Multiplying the initial percentage of patients starting with non-assisted automated PD by 2.5 (from 7.7% to 19.2% at RRT onset) in patients aged 18-44 years without diabetes will increase the total time spent in this modality by only 1.3%, (i.e., 1.5 to 2.8 months, on average), for an unchanged restricted mean lifetime (162,7 versus 161,9 months).





Improving access to kidney transplants from cadaveric donors for patients 45-69 years with diabetes will increase the 15-year restricted mean lifetime by 5 months (80.7 versus 75.3 months) and the time spent with a functioning graft (34% vs. 23%). This change would imply greater availability of renal grafts (287 transplants versus 186) and a shorter time spent on the waiting list.





Conclusion

In conclusion, a model based on patients' treatment trajectories can usefully improve descriptions and understanding of the dynamic phenomenon of RRT. It should help nephrologists and patients as well as the Ministry of Health and the health insurance funds to optimize the organization of renal care and public health decision-making. It may also be a tool to facilitate evidence-based public health decisions by evaluating the performance of the organization of renal care, before and after modification, under different useful configurations and over long periods of time. Such a tool might also help to evaluate the benefit of various strategies. As many factors are related to treatment choice and in view of the lack of randomized clinical trials, simulations may be a way to promote translational research in public health and clinical medicine.

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Epidemiology - renal outcomes
Cécile Couchoud
Poster presented at: ERA-EDTA 50th Congress Istanbul, Turkey May 15-21, 2013
PosterSessionOnline.com