Center effect on early peritoneal dialysis failure
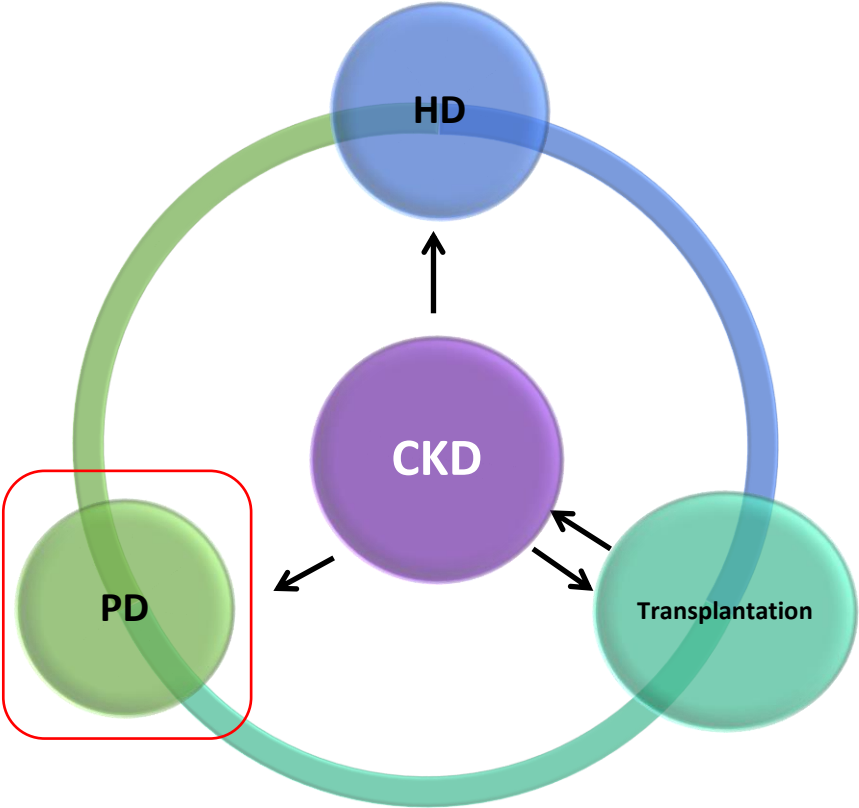
Sonia GUILLOUËT, Thierry LOBBEDEZ
Self-Care Dialysis Symposium
Bruxelles 2016
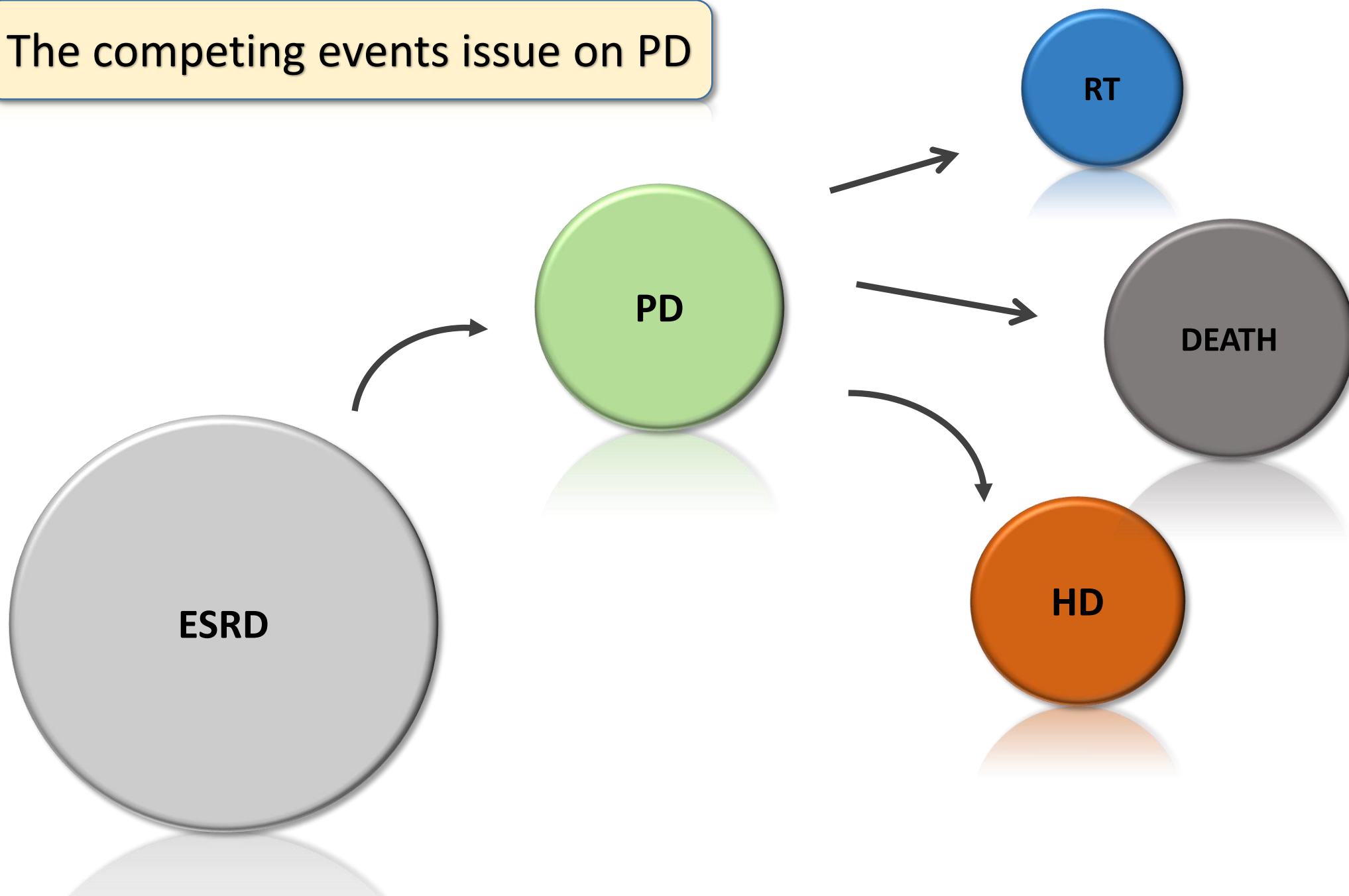
CHU Caen

UNICAEN
UNIVERSITÉ CAEN NORMANDIE

Integrated care approach of chronic kidney disease

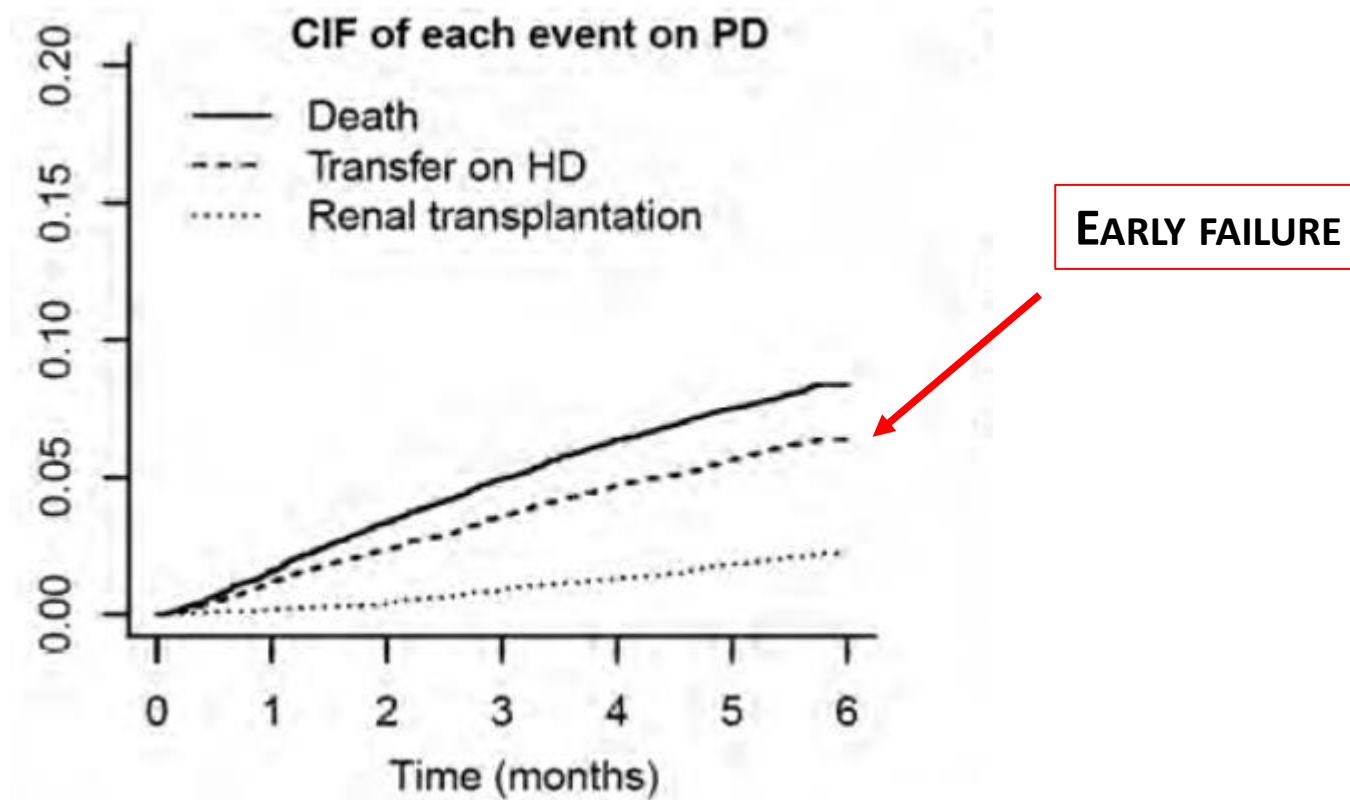The competing events issue on PD

Cumulative incidence of events on peritoneal dialysis

CIF of each event on PD

- —— Death
- ‐ ‐ ‐ Transfer on HD
- ······ Renal transplantation

EARLY FAILURE

[C Béchade, Nephrol Dial Transplant 2014]
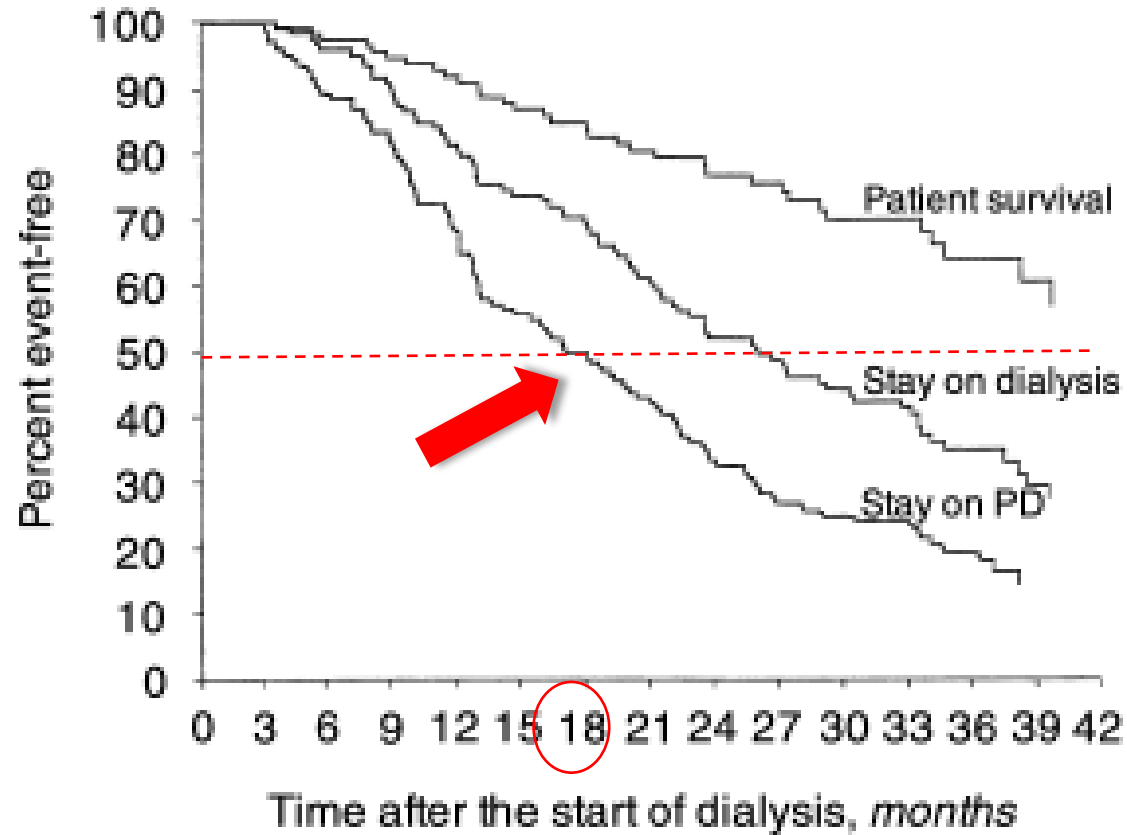
Technique survival in Canada

Proportion of technique failure over time
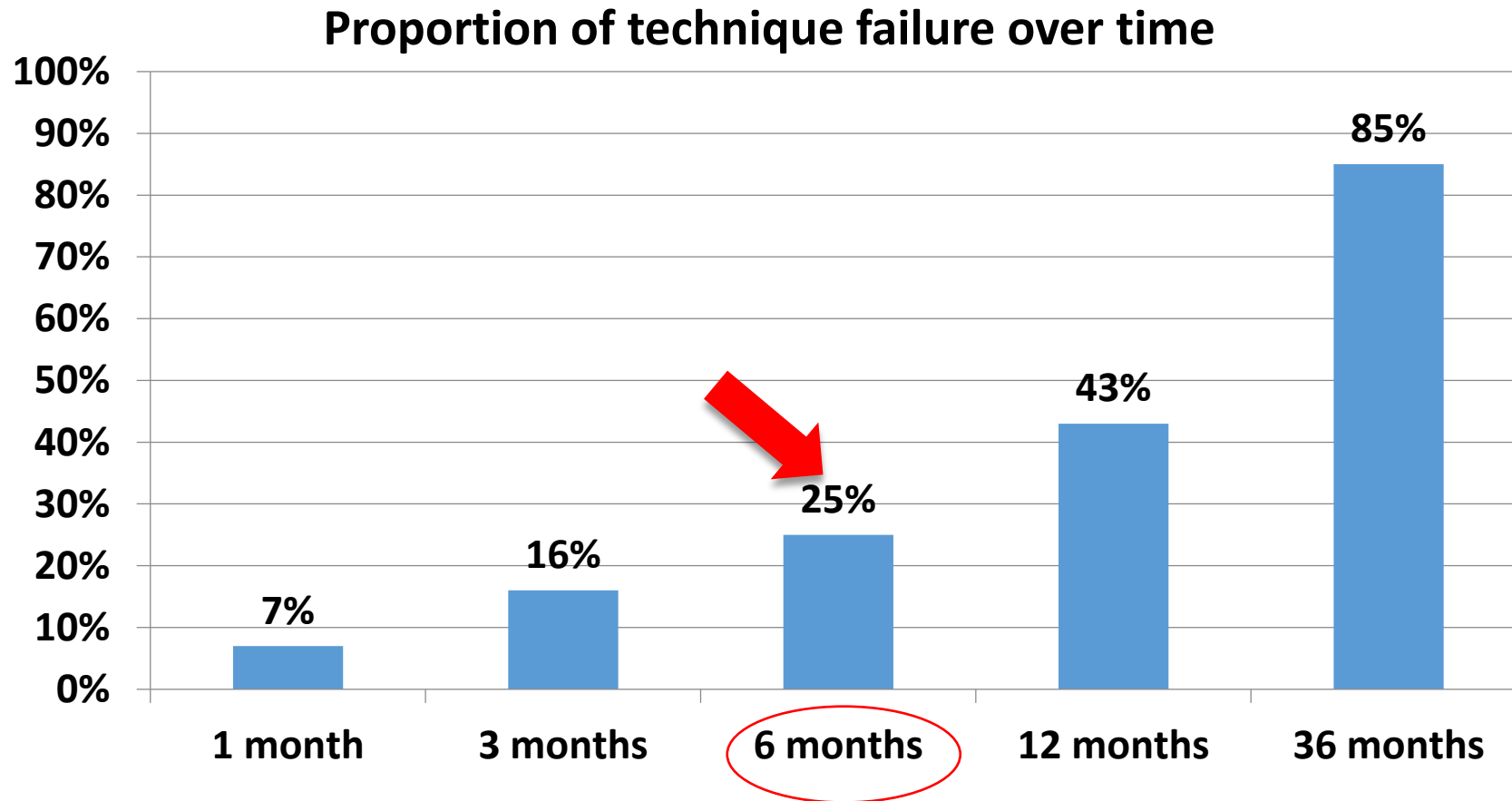
[Mala Chidambaram, Perit Dial Int 2011; 1-9]

PD failure in the Netherlands [NECOSAD]

Kaplan Meier curves for peritoneal dialysis failure [NECOSAD]

[KJ Jager Kidney Int 1999; 55: 1476-1485]

A priori causal diagram
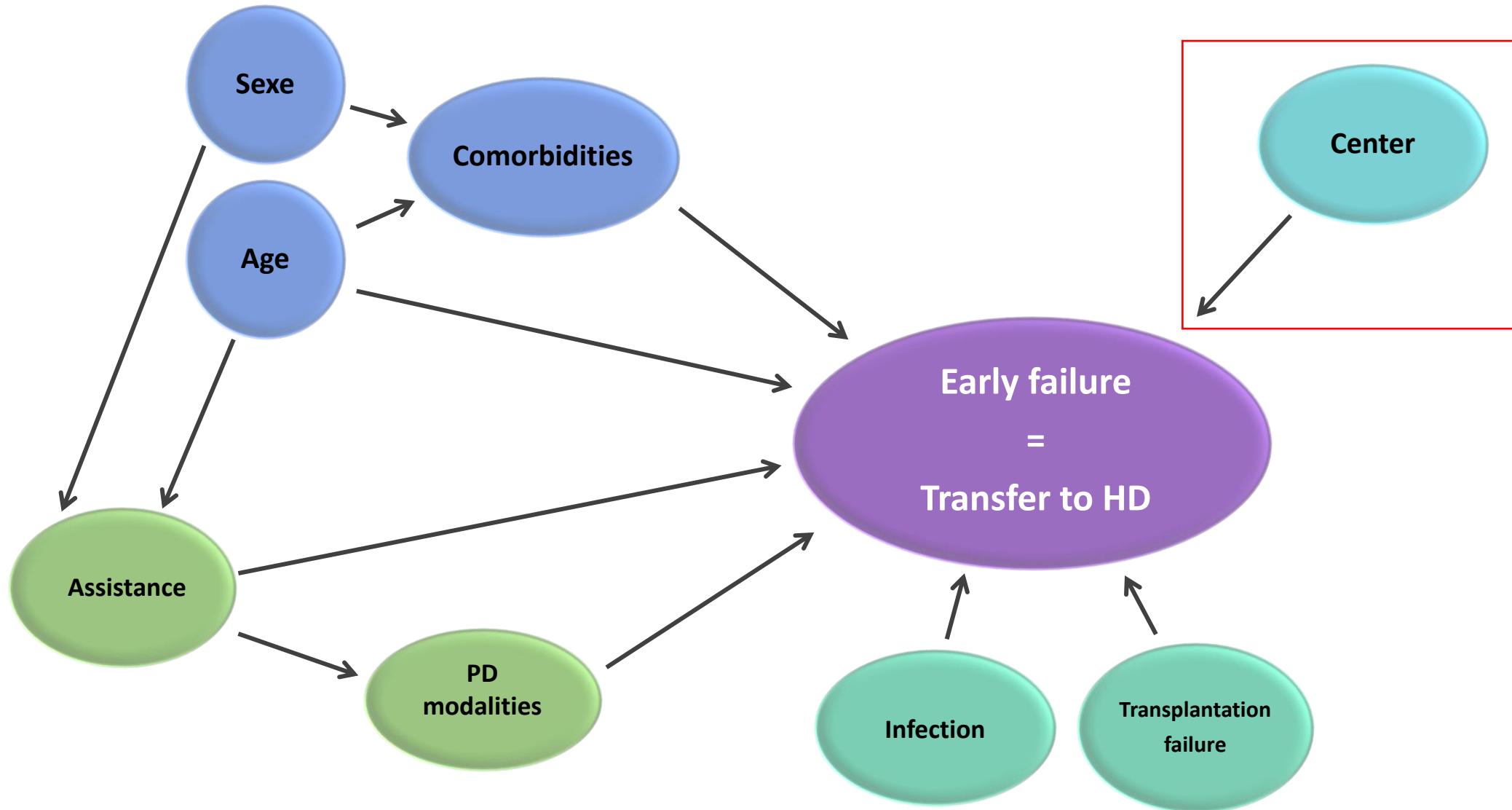
The issue of peritoneal dialysis failure

- Link between center experience and risk of early failure
- Link between center size and risk of transfer to hemodialysis
- No study available about the center effect *per se*

COVARIATES THAT ARE ASSOCIATED WITH THE RISK OF EARLY FAILURE

- Patient characteristics: non-modifiable factors
- Center characteristics: modifiable factors

Background: PD failure and center effect

- **Center size : 20 cumulative patients**

- Huisman RM *et al*. Patient-related and centre-related factors influencing technique survival of peritoneal dialysis in The Netherlands. Nephrol Dial Transplant 2002; 17: 1655-1660

- **Center size: 25 cumulative patients**

- Afolalu B *et al.* Technique failure and center size in a large cohort of peritoneal dialysis patients in a defined geographic area. Perit Dial Int 2009; 29: 292-296

- **Center experience : proportion of patients on peritoneal dialysis**

- Schaubel DE *et al*. Effect of renal center characteristics on mortality and technique failure on peritoneal dialysis. Kidney Int 2001; 60: 1517-1724

- **Center experience : 10 new patients per year**

- Bechade C *et al*. Early failure in patients starting peritoneal dialysis: a competing risks approach. Nephrol Dial Transplant 2014; 29: 2127-2135

How could we explain the center effect?
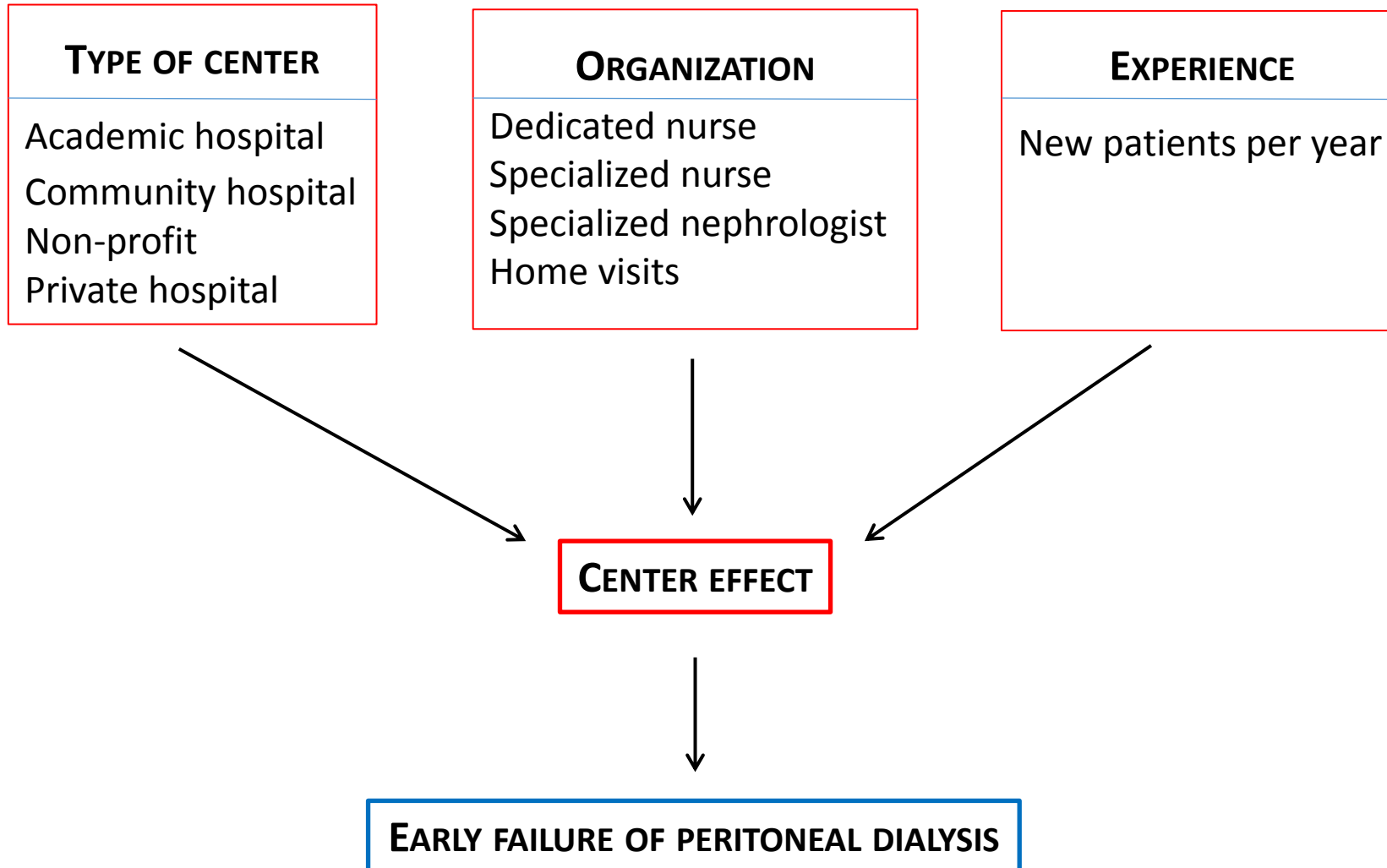
Aims of the study

- To assess the center effect on early failure peritoneal dialysis and estimate its magnitude

- To evaluate center size, center organization, center experience were associated with early failure peritoneal dialysis

- **Event of interest** = TRANSFER TO HD within the first 6 months of peritoneal dialysis

Study population

Inclusion criteria

- Patients starting peritoneal dialysis
- Older than 18 years
- Registered in the French Language Peritoneal Dialysis Registry (RDPLF)
- Treated in metropolitan France
- Between 01-01-2008 and 31-12-2012
- End of the observation period : 31-12-2013

Exclusion criteria

- Patients treated in centers that had stopped to collect the data regularly during the study period
- Centers having only 1 patient starting PD during the study period

Additional questionnaire to collect data about center organization and center characteristics

Multilevel modelling approach

- **Traditional model**

$$\text{logit}\ [P(E)] = \propto + \sum \beta i X i$$

Basic probability   Centers and patients characteristics

- **Hierarchical model**

$$\text{logit}\ [P(E)] = \propto + \alpha_{AL} + \sum \beta i X i$$

Basic probability   Centers and patients characteristics

Probability associated with the centers

- Probability significantly different from 0 ?
- That becomes this probability after adjustement on patients and centers characteristics ?

Multilevel modelling approach

[Adapted from Merlo J, J Epidemiol Community Health 2005]

Multilevel modelling approach
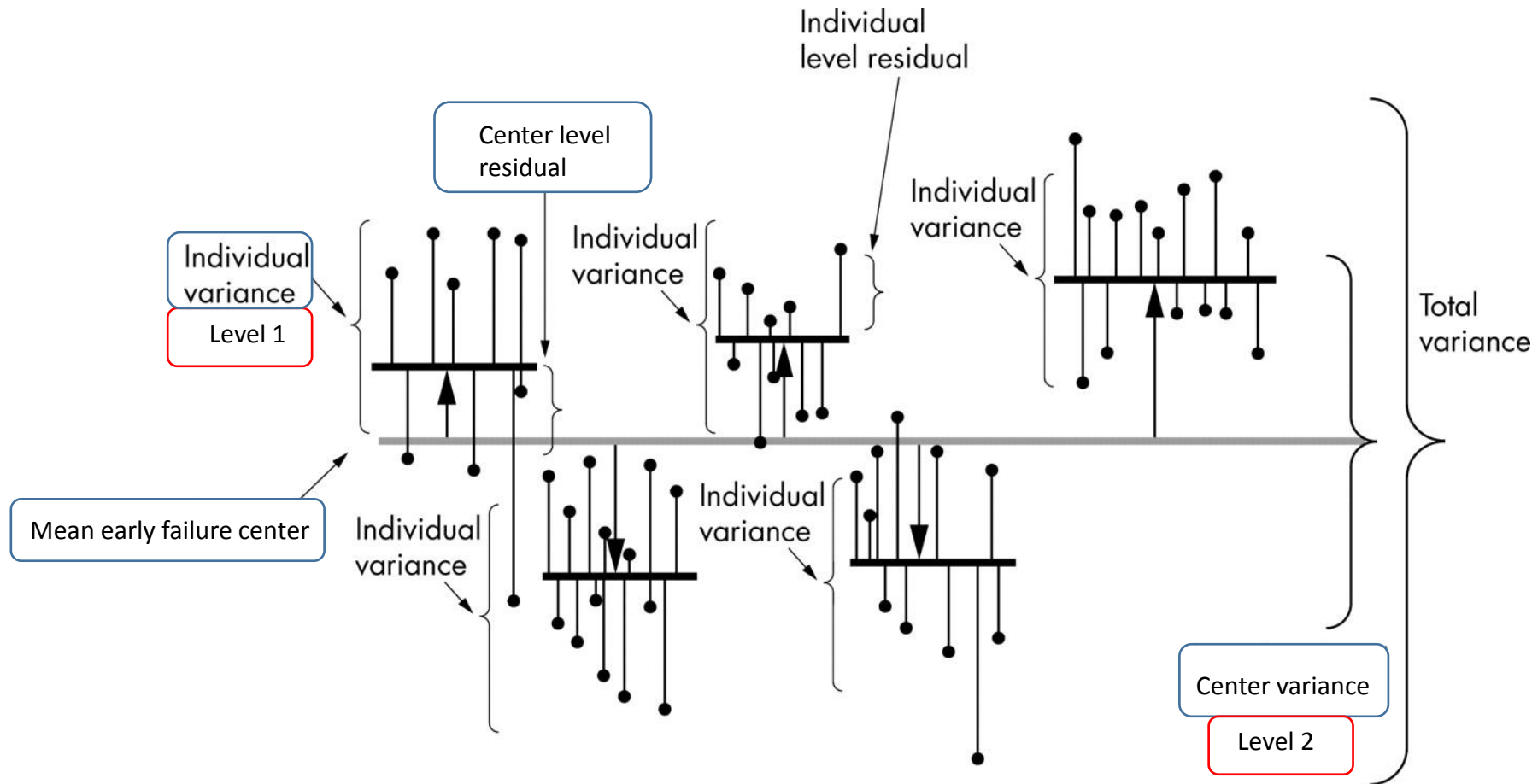
- **ICC = Intraclass Correlation Coefficient**

    = Variance due to differences between centers

- **PCV = Percentage Change in Variance**

    = % of variance explained by level-1 covariates and level-2

    covariates introduced in the model

Multilevel modelling approach

1. Center effect ? → **model with covariate center as random effect**

ICC and comparison to empty traditionnal model

Empty model

↓

2. Addition of level 1 covariates (patient) → **Modification of random effect ?**

ICC et PCV

Model 1

↓

3. Addition of level 2 covariates (center) → **Modification of random effect ?**

ICC et PCV

Model 2

Patients characteristics

N=5406

Covariate	No early failure N = 4991		Early failure N= 415	
	Median (IQR)		Median (IQR)	
Age at PD initiation	70 (55-80)		69 (51-80)	
CCI	6 (4-8)		6 (3-8)	
Modified CCI	3 (2-5)		3 (2-5)	
	N	%	N	%
Age by tertiles				
18-60 years	1638	33%	144	35%
61-77 years	1659	33%	125	30%
>77 years	1693	34%	145	35%
Gender (Male)	2935	59%	251	60%
Diabetes	1606	32%	129	31%
Underlying nephropathy				
Unknown	534	11%	33	8%
Interstitial nephritis	258	5%	26	6%
Glomerulonephritis	737	15%	94	23%
Diabetic	924	19%	74	18%
Polycystic kidney disease	345	7%	24	6%
Miscellaneous	212	4%	13	3%
Uropathy	174	3 %	17	4%
Vascular	1678	34%	115	28%
Systemic disease	129	3%	19	5%
First PD modality (CAPD)	3792	76%	301	73%
Assisted PD	2555	51%	203	49%
Modality of assistance				
Self-care PD	2436	49%	212	51%
Family assisted PD	448	9%	34	8%
Nurse-assisted PD	2107	42%	169	41%
Treatment before PD				
Hemodialysis	804	16%	109	26%
Not on dialysis	4027	81%	279	67%
Renal transplantation	160	3%	27	7%
Suboptimal starter	481	10%	44	11%

Centers characteristics

Covariate	N = 128	
	N	%
Center experience (new patients per year)		
≤ 10	97	76%
Type of center		
Non profit	20	16%
Community hospital	72	56%
Academic hospital	15	12%
Private hospital	21	16%
Home visits		
Home visit	113	88%
Before starting PD	87	68%
At PD initiation	107	84%
Three months after PD initiation	14	11%
Six months after PD initiation	22	17%
Annually	29	23%
Center organization		
Full time nurses	31	24%
Part time nurses	87	68%
Full time and part time nurses	8	6%
Other	2	2%
Nephrologists specialized on PD	82	64%
		Median (IQR)
Number of caregivers		
Numbers of nurses by center		3 (3-5)
Numbers of nephrologists by center		5 (3.5-7)

Bivariate analysis with patients characteristics

Covariate	Early failure	p-value *
	OR (95%CI)	
Age at PD initiation	0.99 (0.99-1.00)	<0.05
Age by decade	0.94 (0.89-0.99)	<0.05
Gender (Male)	1.07 (0.87-1.32)	0.5
Diabetes	1.05 (0.85-1.31)	0.87
CCI (per unit)	0.96 (0.92-1.00)	<0.05
Modified CCI (per unit)	0.94 (0.89-0.99)	<0.05
Underlying nephropathy		
Polycystic kidney disease	Ref	
Unknown	0.89 (0.52-1.54)	
Interstitial nephritis	1.45 (0.81-2.59)	
Glomerulonephritis	1.83 (1.17-2.98)	
Diabetes	1.15 (0.73-1.89)	<0.001
Miscellaneous	0.88 (0.43-1.74)	
Urologic	1.40 (0.72-2.67)	
Vascular	0.98 (0.64-1.59)	
Systemic disease	2.12 (1.11-3.99)	
First PD modality (CAPD)	0.83 (0.67-1.05)	0.12
Suboptimal starter	1.11 (0.79-1.52)	0.52
Modality of assistance		
Self-peritoneal dialysis	Ref	
Family assisted	0.87 (059-1.25)	0.64
Nurse assisted	0.92 (0.75-1.14)	
Treatment before PD		
Not on dialysis	Ref	
Hemodialysis	1.96 (1.54-2.47)	<0.001
Renal transplantation	2.43 (1.56-3.66)	

Bivariate analysis with centers characteristics

Covariate	Early failure	p-value
	OR (95%CI)	
Center experience (new patients per year)		
≤10	Ref	<0.01
>10	0.71 (0.58-0.88)	
Type of center		
Non profit	Ref	0.50
Community hospital	1.18 0.89-1.59)	
Academic hospital	0.98 (0.69-1.40)	
Private hospital	1.00 (0.62-1.59)	
Home visits		
Home visit	1.13 (0.80-1.64)	0.51
Before starting PD	1.09 (0.88-1.36)	0.42
At PD initiation	1.17 (0.87-1.60)	0.31
Three months after PD initiation	0.88 (0.65-1.18)	0.41
Center organization		
Other	Ref	<0.05
Full time nurses	1.16 (0.78-1.80)	
Part time nurses	1.52(1.04-2.30)	
Nephrologists specialized on PD	0.96 (0.78-1.18)	0.68
Number of caregivers		
Number of part time nurses (organization with part time nurses)	1.01 (0.97-1.06)	0.46
Number of full time nurses (organization with full time nurses)	0.94 (0.89-0.98)	<0.05
Numbers of nephrologists by center	1.00 (0.98-1.03)	0.45

Hierarchical model

FIXED EFFECTS	Empty model	Early failure			
		Model 1		Model 2	
		OR (95%CI)	p-value*	OR (95%CI)	p-value*
Level 1 : patients					
Age by decade	-	1.03 (0.96-1.09)	0.41	1.02 (0.95-1.09)	0.57
Modified CCI (per unit)	-	0.95 (0.88-1.01)	0.12	0.95 (0.89-1.02)	0.16
Underlying nephropathy Polycystic kidney disease Unknown Interstitial nephritis Glomerulonephritis Diabetes Miscellaneous Urologic Vascular Systemic disease	-	Ref 1.74 (1.20-2.29) 2.06 (1.64-2.49) 1.55 (1.10-1.99) 1.17 (0.62-1.73) 0.93 (0.26-1.60) 1.56 (0.93-2.19) 1.19 (0.78-1.60) 2.39 (1.77-3.00)	< 0.01	Ref 1.72 (1.18-2.27) 2.04 (1.62-2.47) 1.53 (1.08-1.97) 1.16 (0.61-1.72) 0.92 (0.25-1.60) 1.51 (0.88-2.14) 1.18 (0.78-1.59) 2.39 (1.78-3.00)	<0.01
First modality (CAPD)	-	0.91 (0.66-1.53)	0.44	0.90 (0.66-1.14)	0.41
Treatment before PD Not on dialysis Hemodialysis Renal transplantation	-	Ref 0.51 (0.27-0.75) 1.14 (0.67-1.61)	<0.001	Ref 0.52 (0.28-0.76) 1.19 (0.71-1.66)	<0.001
Level 2 : centers					
Centre experience (new patients per year) ≤10 >10	-	-		Ref 0.78 (0.53-1.00)	<0.05
Center organization Other Full time nurses Part time nurses	-	-		Ref 1.17 (0.71-1.63) 1.44 (1.00-1.88)	0.11
RANDOM EFECTS					
Level 2 Variance (SD) LRT p Anova p ICC PCV	0.102 (0.319) <0.05 - 0.03 Ref	0.103 (0.321) - <0.001 0.037 -0.01%		0.049 (0.223) - <0.01 0.01 52%	

Discussion

- No study of the center effect on transfer to hemodialysis except those carried out with traditional approach

- Identification of a significate heterogeneity between centers not due to patient characteristics

- No association between center organization, type of center and risk of early failure as been observed

Discussion

- Center experience explain only partially early PD failure

- Center practices could explain an other part of heterogeneity between centers

- Early failure was the only event of interest of our study. However in peritoneal dialysis, there are other frequent events
  - Association between peritonitis incidence and training patterns in centers (Figueirido, Nephrol Dial Transplant 2015)
  - Association between risk of peritonitis and nurse's home visits in assisted automated peritoneal dialysis (Verger, Nephrol Dial Transplant 2007)

Limitations

- Residual confounders, such as BMI or detailed PD prescription, were not taken into account because not captured in the registry

- Competing events could lead to biased risk estimation

- Difficulty to estimate adequately the number of caregivers by center

Conclusion and perspectives

- There was a significantly center effect on early failure in our study

- Nevertheless the magnitude of the center effect was not huge

- Further studies are needed to understand the center effect

  - to try to estimate the remaining center effect on the early failure-> other center characteristics must be investigated like training practices...
  - with other peritoneal dialysis events : peritonitis, attribution of assistance...

ESTIMATION OF THE CENTER EFFECT ON EARLY PERITONEAL DIALYSIS FAILURE: A MULTILEVEL MODELLING APPROACH

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• Others studies are on going...