

# Bulletin de la Dialyse à Domicile

## Peritoneal dialysis and center effect. Summary of a PHD thesis with data from the RDPLF

(Etude de l'effet centre en dialyse péritonéale. Synthèse d'une thèse de science à partir du RDPLF)

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Note : ce texte est disponible en Français à la même adresse url : <https://doi.org/10.25796/bdd.v3i4.57763>

### Résumé

Le devenir sous traitement des patients en dialyse péritonéale dépend de leurs caractéristiques qui généralement ne sont pas modifiables. A l'inverse, les caractéristiques ou les pratiques des centres ayant un effet sur le devenir des patients peuvent faire l'objet de changement. L'étude de l'effet centre et l'identification de variables « centre » associées au devenir du patient est donc nécessaire. Cet article présente la synthèse d'études réalisées dans le cadre d'une thèse de science, qui montrent l'importance de l'effet centre et le rôle et l'importance des visites infirmières à domicile dans la prévention des infections du liquide de dialyse péritonéale. Nous avons aussi pu observer qu'il existait une disparité entre les centres dans l'utilisation et l'attribution de l'assistance à domicile par un(e) infirmier(e) pour la réalisation de la dialyse. Dans un contexte où les organisations privilégient la polyvalence des professionnels de santé, nos travaux soulignent l'importance de l'expérience et l'expertise des infirmier(e)s de dialyse péritonéale dans le succès de la méthode.

Augmenter la taille des centres et optimiser les ressources pourrait avoir un effet bénéfique sur la survie de la méthode en améliorant l'expérience des centres.

Mots clés : effet centre, dialyse péritonéale, dialyse péritonéale assistée, infirmier, infirmière, péritonite, visite à domicile, organisation

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### Summary

Outcomes of patients treated by peritoneal dialysis depends on their characteristics, which generally cannot be modified. Conversely, center characteristics or practices having an effect on the outcomes of patients and may be subject to change. Study the center effect and identify «center» variables associated with the patient's future is therefore necessary. Taken as part of a science thesis, the importance of the center effect and the role and importance of nursing home visits in preventing peritoneal infections. We also observed that there was a disparity between centers in the use and allocation of home assistance by a nurse for carrying out dialysis. In a context where organizations favor the versatility of health professionals, our work underlines the importance of the experience and expertise of peritoneal dialysis nurses in the success of the method.

Increasing the size of the centers and optimizing resources could have a beneficial effect on the survival of the method by improving the experience of the centers.

Key words : center effect, peritoneal dialysis, assisted peritoneal dialysis, nurse, peritonitis, home visits, organization

## INTRODUCTION

Peritoneal dialysis (PD) is offered to independent patients for whom training is provided by an expert team [1]. Bernardini has shown that there is heterogeneity in the amount of time spent on patient education around the world [2]. Lack of autonomy, functional incapacity such as lack of strength, vision or hearing impairment, as well as cognitive dysfunctions can be compensated for by the implementation of assistance by a private nurse, spouse or family member, domestic worker, or health technician [3]. Assistance increases eligibility for PD [4-5]. Here again, there is heterogeneity in the use of assisted PD in the world, conditioned by the functioning of health systems [6-7]. In France, it is fortunate that all of the expenses linked to the intervention of a private nurse are covered by health insurance [8].

A patient treated with peritoneal dialysis will face two types of events: transplantation and treatment failure. The latter is defined by death or transfer to hemodialysis (HD). The transfer from one method to another (PD to HD) is too often done in an emergency context, in an unplanned way and during hospitalization, not allowing home maintenance [9]. This transition very often occurs too abruptly, including for the patient. It is therefore important to identify the ways in which we can act to prevent this transfer to hemodialysis.

Patient characteristics are useful in identifying subjects at risk of peritoneal dialysis failure, but they are not modifiable factors. On the other hand, the characteristics of the centers in which the patients are treated can be modifiable. One of these characteristics is the type of center: public establishment, association, or private clinic. Another point to consider is the center's level of experience. Some teams see the size of the center as the number of new patients starting PD per year, and others as the proportion of PD patients among the dialysis population. We can consider that the size of the center is also an indicator of its experience, since the number of patients treated by the center reflects its activity and not only its means. In our studies, experience was defined as the number of new patients treated per year. And finally, another characteristic to take into account is the organization of nursing teams. Indeed, some teams work with dedicated nurses (all of their working time is dedicated to PD), referral nurses (have expertise in DP but their working time is shared with other tasks in nephrology), or even a mixture of both. On the other hand, some centers organize home visits (VAD), and among these, there is heterogeneity in frequency. This also concerns medical teams in which there is or not a referent nephrologist in PD. We speak of a center effect when the characteristics of the center have an influence on the occurrence of an event. The latter can be studied using a relevant statistical model, the hierarchical model. It is this methodology that we used in our studies.

We sought to determine if there was a center effect on the probability of occurrence of an event of interest in peritoneal dialysis (PD) and then to identify modifiable center variables associated with and reducing the center effect. This approach should allow nephrologists and nurses to make changes at the center to improve the care and outcomes of the patients treated by peritoneal dialysis. Our work was carried out using data from the French Language Peritoneal Dialysis Register (RDPLF) [<https://www.rdplf.org>] and by collecting additional data from the PD dialysis centers by telephone.

We present in the following sections a summary of our works based on our PhD thesis [<https://tel.archives-ouvertes.fr/tel-02419285v1>].

### EARLY FAILURE AND CENTER EFFECT [10]

There is no consensus on the definition of early failure of peritoneal dialysis. But in France, 6.3% of subjects starting peritoneal dialysis are transferred to HD within the first 6 months of treatment [11]. The objective of our study was to assess the importance of the center effect on early failure, defined by a transfer to hemodialysis in the first 6 months of peritoneal dialysis, and to identify the center-specific organizations that are associated with the risk of early transfer to hemodialysis.

The characteristics of the patients and of the centers are detailed respectively in Table I and II.

There was significant heterogeneity between centers. At the individual level, the modality of supplemental renal replacement therapy before PD (hemodialysis and kidney transplantation) and nephropathy were associated with early PD failure. At the center level, only the center's experience was associated with the risk of PD failure (Table III). The center effect was not fully explained by the center's experience or the patients' characteristics. Increasing the size of the centers could have a beneficial effect on the survival of the treatment method [12].

### PERITONITIS AND CENTER EFFECT [13]

The objective of our work was to determine, using a multi-level survival model, if there was a center effect on the occurrence of a first episode of peritoneal infection, and if modifiable center variables were associated with the risk of peritonitis and they reduced the center effect.

There was significant heterogeneity between centers in the risk of developing a first peritoneal infection. Patients who were treated in centers with a dedicated nurse (Figure 1) or in centers performing home visits before the initiation of dialysis (Figure 2) had a lower risk of peritonitis. Neither the type of center nor its experience level influenced the risk of peritonitis. In the competitive risk analysis, patients treated in a center with nurses dedicated to peritoneal dialysis, or in centers performing home visits, had a lower risk of peritonitis compared to other subjects. Patients treated in a center with a PD referent nephrologist had a similar risk of peritoneal infection compared to other patients.

In this study, the nursing characteristics were associated with the occurrence of the first episode of peritonitis and had a protective effect, whereas the medical team characteristics did not show any effect on or association with peritonitis. Differences in training practices between centers could influence the risk of peritonitis [14]. In addition, the nurses' experience is associated with the likelihood of peritonitis [15]. It is possible that nurses dedicated to peritoneal dialysis have greater competence in the training of dialysis patients than nurses part of whose working time is devoted to other activities. The study by Figueiredo et al. [14] reported that training time was associated with the risk of peritonitis. One might think that nurses whose time is not entirely dedicated to PD could devote less time to patient education and/or that they were more exposed to task interruption during patient education. We can also hypothesize that the nurses dedicated to PD, taking into account a greater involvement in the activity, update their knowledge better and make better use of the recommendations concerning education in peritoneal dialysis [16].

The protective effect of home visits on the risk of peritonitis was previously reported by Verger et al. [17]. Home visits could help patients start treatment in their usual environment after the

↓ Table I. Patient characteristics (From Guillouët S, Veniez G, Verger C, Béchade C, Ficheux M, Uteza J, Lobbedez T. Estimation of the Center Effect on Early Peritoneal Dialysis Failure: A Multilevel Modelling Approach. *Perit Dial Int.* 2016;36(5):519-525)

Covariate	N=5406			
	No early failure N = 4687		Early failure N= 343	
	Median (IQR)		Median (IQR)	
<b>Age at PD initiation</b>	70 (55-80)		70 (51-80)	
<b>CCI</b>	6 (4-8)		6 (4-8)	
<b>Modified CCI</b>	3 (2-5)		3 (2-5)	
	N	%	N	%
<b>Age by tertiles</b>				
18-61 years	1631	35%	120	35%
62-77 years	1454	31%	103	30%
>77 years	1602	34%	120	35%
<b>Modified CCI by categories</b>				
2	1555	33%	127	37%
3	845	18%	60	17%
4	774	17%	65	19%
5	651	14%	37	11%
6	401	9%	30	9%
7	461	10%	24	7%
<b>Gender (Male)</b>	2775	59%	214	62%
<b>Diabetes</b>	1619	32%	109	32%
<b>Underlying nephropathy</b>				
Unknown	494	11%	19	6%
Interstitial nephritis	245	5%	28	8%
Glomerulonephritis	696	15%	20	6%
Diabetic	865	18%	75	22%
Polycystic kidney disease	328	7%	67	20%
Miscellaneous	190	4%	12	3%
Uropathy	164	3%	13	4%
Vascular	1592	34%	97	28%
Systemic disease	113	2%	12	3%
<b>First PD modality (CAPD)</b>	3570	76%	250	73%
<b>Modality of assistance</b>				
Self-care PD	2284	49%	173	50%
Family assisted PD	411	9%	32	9%
Nurse-assisted PD	1992	42%	138	41%
<b>Treatment before PD</b>				
Hemodialysis	520	11%	62	18%
Not on dialysis	4007	85%	255	74%
Renal transplantation	160	3%	26	8%
<b>Suboptimal starter</b>	185	4%	17	5%

[PD: peritoneal dialysis, IQR: Interquartile range, CCI: Charlson Comorbidities Index, CAPD: Continuous Ambulatory Peritoneal Dialysis]

↓ **Table II. Centers characteristics** (From Guillouët S, Veniez G, Verger C, Béchade C, Ficheux M, Uteza J, Lobbedez T. Estimation of the Center Effect on Early Peritoneal Dialysis Failure: A Multilevel Modelling Approach. *Perit Dial Int.* 2016;36(5):519-525.)

Covariate	N = 127	
	N	%
<b>Center experience (new patients per year)</b>		
≤ 10	96	76%
<b>Type of center</b>		
Non profit	20	16%
Community hospital	72	56%
Academic hospital	15	12%
Private hospital	20	16%
<b>Home visits</b>		
Home visit	112	88%
Before starting PD	86	68%
At PD initiation	106	83%
Three months after PD initiation	14	11%
Six months after PD initiation	21	16%
Annually	29	23%
<b>Center organization</b>		
Full time nurses	31	24%
Part time nurses	86	68%
Other	8	6%
Nephrologists specialized on PD	81	64%
<b>Median (IQR)</b>		
<b>Number of caregivers</b>		
Numbers of nurses by center	3 (3-5)	
Numbers of nephrologists by center	5 (3.5-7)	

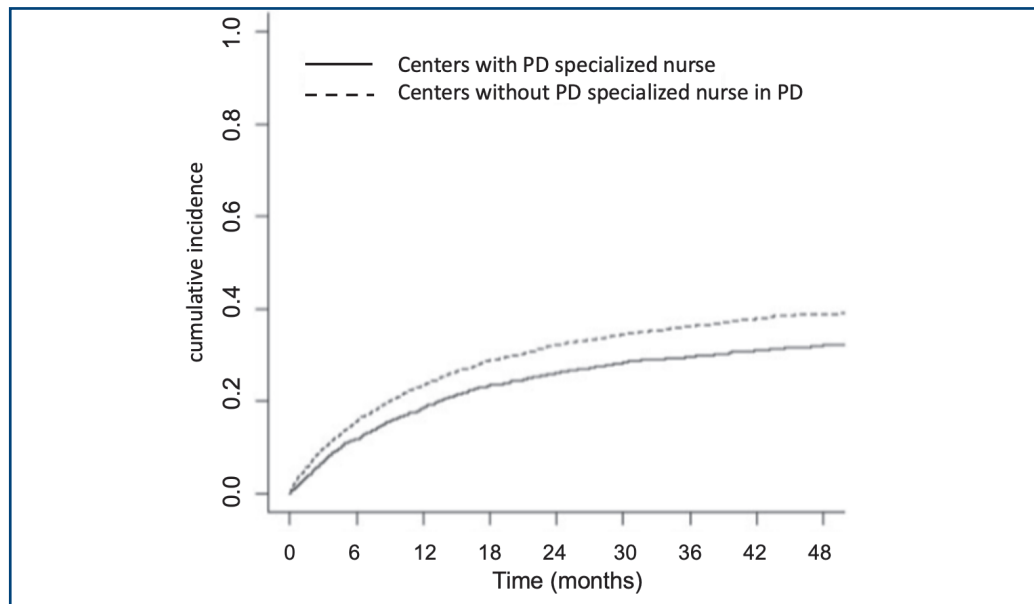
[PD: peritoneal dialysis, IQR: Interquartile range]

↓ Table III. Multivariate logistic regression of factors associated with early PD failure (From Guillouët S, Veniez G, Verger C, Béchade C, Ficheux M, Uteza J, Lobbedez T. Estimation of the Center Effect on Early Peritoneal Dialysis Failure: A Multilevel Modelling Approach. *Perit Dial Int.* 2016;36(5):519-525)

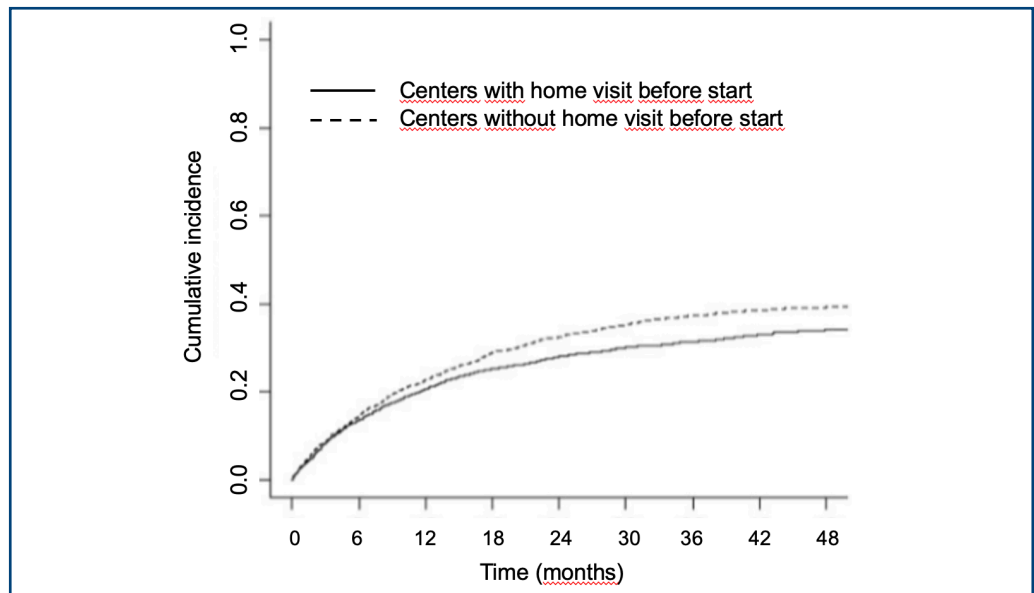
	Empty model	Model 1		Model 2	
		OR (95%CI)	p-value*	OR (95%CI)	p-value*
<b>FIXED EFFECTS</b>					
<b>Level 1 : patients</b>					
<b>Age by decade</b>	-	1.03 (0.96-1.09)	0.41	1.02 (0.95-1.09)	0.57
<b>Modified CCI (per unit)</b>	-	0.95 (0.88-1.01)	0.12	0.95 (0.89-1.02)	0.16
<b>Underlying nephropathy</b>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

[SD: Standard Deviation, LRT: Likelihood Ratio Test, ICC: Intraclass Coefficient Correlation, PCV: Proportional Change in Variance]

\*p-heterogeneity, probability for heterogeneity for non-categorical variables; p-trend: probability for linear tendency for categorical variables



↑ Figure 1. Cumulative incidence of peritonitis by organization of the center (specialized nurse) (From Béchade C, Guillouët S, Verger C, Ficheux M, Lanot A, Lobbedez T. Centre characteristics associated with the risk of peritonitis in peritoneal dialysis: a hierarchical modelling approach based on the data of the French Language Peritoneal Dialysis Registry. *Nephrol Dial Transplant.* 2017;32(6):1018-1023)



↑ Figure 2. Cumulative incidence of peritonitis by center organization (home visits) (From Béchade C, Guillouët S, Verger C, Ficheux M, Lanot A, Lobbedez T. Center characteristics associated with the risk of peritonitis in peritoneal dialysis: a hierarchical modeling approach based on the data of the French Language Peritoneal Dialysis Registry. *Nephrol Dial Transplant.* 2017; 32 (6): 1018-1023)

inpatient training phase. Home visits, when performed before initiating dialysis, may be one way to select patients at higher risk of infection. We believe that centers should have a dedicated nurse and offer home visits by members of the treating center.

### **ATTRIBUTION OF ASSISTANCE [18]**

Most assisted PD programs are for elderly patients. However, there are also younger patients who are unable to be independent on peritoneal dialysis. The objective of this study was to estimate the prevalence of assisted peritoneal dialysis in the population aged fewer than 65 years and to determine the individual and center variables that were associated with the attribution of assisted peritoneal dialysis in subjects entering peritoneal dialysis in France. The other objective was to estimate the importance of the center effect on the prescription of nurse-assisted peritoneal dialysis.

Our work shows that non-elderly patients are frequently unable to be independent at the start of dialysis. There was heterogeneity between centers in the use of nurse-assisted PD. At the individual level, age, sex (female as a reference class), nephropathy, and HD treatment prior to onset of PD were associated with the use of nurse-assisted PD. The variance of the random effect increased by 19% after adjusting for individual characteristics, showing that the center effect was not due to differences in patient characteristics between centers. However, no center variable was significantly associated with the use of nurse-assisted PD (Table IV).

Our results show that patients treated with hemodialysis before peritoneal dialysis were more likely to be treated with nurse-assisted PD. Some of the patients treated by hemodialysis are treated in an emergency context and/or without prior nephrological follow-up. Nursing assistance may have served as a gateway to autonomous peritoneal dialysis for patients entering dialysis on hemodialysis and then transferred to peritoneal dialysis. A Danish study pointed out that the combined use of an unplanned and assisted PD program allowed late-onset dialysis patients to have a choice between dialysis modalities [19].

In our study, there was significant inter-center variability in the use of nurse-assisted peritoneal dialysis. However, the center's experience and organization did not influence the rate of use of assisted peritoneal dialysis or the modalities of assistance. Given the heterogeneity between the centers, it cannot be ruled out that in some cases the decision regarding help from private nurses was inappropriate. Even if peritoneal dialysis assisted by a nurse is less expensive than hemodialysis in a center, the assistance of a patient entails additional costs, in a situation where the use of resources allocated to health should be prioritized [20]. On the other hand, the availability of private nurses is not evenly distributed over the territory, and their training in PD is not homogeneous.

### **PATIENT ASSESSMENT FOR THE ATTRIBUTION OF ASSISTANCE [21]**

The main objective of our study was to explore, at the national level, the link between the peritoneal dialysis nurse's subjective evaluation of the patient's inability to be independent and the use, for dialysis treatment, of assistance by a private nurse or by the family. The other objective was to determine whether cognitive dysfunction, functional impairment, or hearing and/or visual impairment estimated by the nurse were associated with the use of assisted PD, regardless of



↓ Table IV. Multivariate logistic regression of factors associated with nurse-assisted vs autonomous PD (From Guillouët S, Lobbedez T, Lanot A, Verger C, Ficheux M, Béchade C. Factors associated with nurse assistance among peritoneal dialysis patients: a cohort study from the French Language Peritoneal Dialysis Registry. *Nephrol Dial Transplant.* 2018;33(8):1446-1452)

	Empty model	Model 1 OR (95%CI)	Model 2 OR (95%CI)
<b>FIXED EFFECTS</b>			
<b>Level 1: patients</b>			
<b>Age by decade</b>	-	1.79 (1.50-2.12)**	1.79 (1.51-2.13)**
<b>Modified CCI (by categories)</b>		**	**
<b>2</b>		Ref	Ref
<b>3</b>		1.22 (0.75-1.99)	1.21 (0.74-1.98)
<b>4</b>	-	2.71 (1.65-4.44)	2.70 (1.65-4.44)
<b>5</b>		5.04 (3.00-8.48)	5.04 (2.99-8.49)
<b>6</b>		4.90 (2.53-9.49)	4.76 (2.45-9.24)
<b>≥7</b>		6.52 (3.56-11.95)	6.34 (3.45-11.63)
<b>Diabetes</b>	-	1.32 (0.79-2.22)	1.28 (0.76-2.15)
<b>Gender (male)</b>	-	0.47 (0.35-0.64)**	0.47 (0.35-0.64)**
<b>Underlying nephropathy</b>		**	
Polycystic kidney disease		Ref	**Ref
Unknown		6.54 (2.49-17.20)	6.51 (2.47-17.14)
Interstitial nephritis		10.22 (3.89-26.85)	9.95 (3.79-26.14)
Glomerulonephritis		2.39 (0.94-6.09)	2.31 (0.90-5.89)
Diabetes	-	4.50 (1.67-12.10)	4.72 (1.75-12.71)
Miscellaneous		4.20 (1.45-12.13)	4.14 (1.43-12.00)
Urologic		7.47 (2.46-22.68)	7.22 (2.38-21.91)
Vascular		9.26 (3.80-22.59)	9.22 (3.77-22.55)
Systemic disease		5.48 (1.87-16.09)	5.60 (1.90-16.47)
<b>Treatment before PD</b>			
Not on dialysis		Ref	Ref
Hemodialysis		1.49 (1.03-2.15)	1.48 (1.02-2.15)
Transplantation		0.75 (0.36-1.53)	0.75 (0.37-1.55)
<b>Level 2: centers</b>			
<b>Center experience (new patients per year)</b>			
≤10	-	-	Ref
>10			0.97 (0.61-1.55)
<b>Type of center</b>			
Non profit			Ref
Community hospital	-	-	0.91 (0.49-1.69)
Academic hospital			0.77 (0.40-1.49)
Private hospital			0.51 (0.20-1.26)
<b>Center organization</b>			
Other			Ref
Full time nurses	-	-	0.52 (0.25-1.09)
Part time nurses			0.70 (0.35-1.40)
<b>Inability to walk (% of ESRD patients within the district)</b>	-	-	1.00 (0.94-1.07)
<b>Family caregiver (% of ESRD patients within the district)</b>			1.01 (0.98-1.05)
<b>Private nurse density (per 1000 habitants)</b>			
≤ 150	-	-	Ref
> 150			0.89 (0.58-1.39)
<b>RANDOM EFFECTS</b>			
Level 2 Variance (SD)	0.451 (0.672)	0.449 (0.670)	0.373 (0.611)
LRT p	<0.001	-	-
Anova p	-	<0.001	<0.001
ICC	0.12	0.12	0.10
PCV	-	-0.19	0.17

[SD: Standard Deviation, LRT: Likelihood Ratio Test, ICC: Intraclass Coefficient Correlation, PCV: Proportional change in variance]

\* p-value < 0.01

its modality. For this work, we have moved away from the center effect criteria to focus on the caregivers.

In this study, we used data from the RDPLF nursing module [22]. Among the 154 participating centers, 125 centers collect data for this module. It contains information on patients' ability to be independent and on the reasons for their disabilities.

The results are presented in Tables V and VI. The nurse's subjective assessment of the patient's inability to be independent was associated with the use of family- or nurse-assisted PD. The likelihood of being treated with family- or nurse-assisted PD was higher in patients with functional impairment. The likelihood of being on family- or nurse-assisted PD was higher when the patient presented with cognitive dysfunction. Deafness and/or visual impairment were associated with assisted PD regardless of its modality. There was no interaction between cognitive dysfunction, functional impairment, and deafness and/or visual impairment. It is possible that the nurse's subjective assessment of self-reliance was influenced by the burden of illness on family caregivers [23-24].

The International Society of Peritoneal Dialysis (ISPD) has issued recommendations for training patients in PD. The ISPD Nursing Liaison Committee suggests using several education tools depending on the patient's preferred learning style [16]. In an Australian study, there were large differences between centers in educational practices [25]. Appropriate tools could be used to train PD patients with deafness and/or visual impairment. Thus, the association between deafness and/or visual impairment and assistance could reflect the difficulty for the nurse of educating the patient on autonomous dialysis.

In our study, the functional disability estimated by the nurse was associated with the use of assistance by the family or a nurse. However, in the RDPLF, no information is collected on the tools nurses use to assess the patient's functional capacity, so the assessment may vary from center to center. Standardized tools to better assess patients are therefore necessary.

Our studies have limitations regarding nursing teams. Indeed, we did not take into account the skills and seniority of these professionals. These data were impossible to collect from teams without time specifically dedicated to PD activity.

## CONCLUSION

Several recent publications show that the role of centers' organization in the patient's future is a concern of nephrologists and healthcare teams [26]. Our work falls within this theme; we have shown that there is heterogeneity between peritoneal dialysis centers in the occurrence of peritoneal infections and the early failure of the method. Some organizations could be modified to improve the patient's future by optimizing resources. Our work confirms the role of nursing teams and the importance of home visits in reducing the risk of peritonitis. The provision of minimal human resources could constitute one of the criteria for granting authorizations for dialysis treatment to health establishments.

Increasing the size of the centers could have a beneficial effect on the survival of the method

by improving the centers' experience levels. In this context, the regrouping of activity between

↓ Table V. Bivariate analysis: association between the characteristics of the population studied and the assistance modalities [Relative Risk (RR) and risk difference (RD)] (From Guillouët S, Boyer A, Lanot A, Ficheux M, Lobbedez T, Béchade C. Assessment for Assisted Peritoneal Dialysis by Peritoneal Dialysis Nurses: Results of a Cohort Study. *Am J Nephrol.* 2019;50(6):489-498)

Covariate	Family-assisted vs self-care PD [ref]		Nurse-assisted vs self-care PD [ref]	
	RR [95% CI]	RD [95% CI]	RR [95% CI]	RD [95% CI]
<b>Age at PD initiation</b>	1.08 [1.07;1.10]	1% [1%;1%]	1.12 [1.11;1.13]	2 [2%;2%]
<b>Modified CCI [by categories]</b>	Ref	Ref	Ref	Ref
2	1.88 [1.52;2.33]	9% [5%;12%]	1.55 [1.45;1.65]	3% [-2%;9%]
3	2.49 [2.05;3.01]	16% [11%;20%]	1.74 [1.64;1.85]	2% [-4%;7%]
4	3.03 [2.54;3.64]	22% [16%;28%]	1.92 [1.81;2.03]	2% [-3%; 8%]
5	3.37 [2.78;4.08]	28% [20%;36%]	1.94 [1.83;2.06]	1% [-5%;8%]
6	3.41 [2.86;4.06]	27% [20%;34%]	1.94 [1.83;2.05]	0% [-5%;7%]
≥7				
<b>Diabetes</b>	2.55 [2.14;3.03]	19% [15%;23%]	1.69 [1.58;1.81]	26% [23%;30%]
<b>Sex (male)</b>	0.97 [0.81;1.16]	-1% [-4%;2%]	0.82 [0.76;0.88]	-9% [-12%; -6%]
<b>Underlying nephropathy</b>				
Polycystic kidney disease	Ref	Ref	Ref	Ref
Unknown	0.14 [0.07;0.25]	-25% [-30%;-19%]	0.18 [0.13;.25]	-51% [-57%;-46%]
Interstitial nephritis	0.63 [0.46;0.87]	-10% [-17%;-3%]	0.72 [0.63;0.81]	-16% [-22%;-10%]
Glomerulonephritis	0.51 [0.33;0.77]	-13% [-21%;6%]	0.59 [0.49;0.71]	-24% [-31%;-17%]
Diabetes	0.22 [0.15;0.33]	-22% [-27%;-17%]	0.23 [0.18;2.28]	-48% [-53%;-44%]
Urologic	0.23 [0.12;0.43]	-22% [-28%;-15%]	0.29 [0.21;0.40]	-43% [-52%;36%]
Vascular	0.90 [0.71;1.13]	-3% [-9%;3%]	1.00 [0.91;1.09]	0% [-5%;5%]
Miscellaneous	0.48 [0.29;0.81]	-14% [-2%;-6%]	0.53 [0.41;0.68]	-27% [-36%;-19%]
<b>PD modality (CAPD)</b>	2.14 [1.77;2.59]	12% [9%;15%]	2.99 [2.68;3.34]	41% [38%;44%]
<b>Treatment before PD</b>				
Not on dialysis	Ref	Ref	Ref	Ref
Hemodialysis	0.93 [0.74;1.19]	-1% [-5%;3%]	0.85 [0.78;0.94]	-7% [-11%;-3%]
Transplantation	0.31 [0.09;1.04]	-11% [-16%;7%]	0.23 [0.14;0.37]	-37% [-42%;-31%]
<b>Suboptimal starter</b>	0.95 [0.71;1.28]	0%[-5%;4%]	1.17 [1.06;1.29]	8% [3%;13%]
<b>Center experience</b>				
≤10	Ref	Ref	Ref	Ref
11-20	1.12 [0.92;1.36]	2% [-1%;5%]	1.21 [1.13;1.31]	9% [5%;12%]
>20	0.83 [0.62;1.10]	-3% [-7%;1%]	1.04 [0.94;1.15]	19% [-27%;7%]
<b>Type of center</b>				
Nonprofit	Ref	Ref	Ref	Ref
Community hospital	1.42 [1.12;1.81]	6% [2%;9%]	1.26 [1.16;1.38]	10% [6%;15%]
Academic hospital	0.98 [0.71;1.35]	0% [-4%;4%]	0.99 [0.88;1.11]	-1% [-6%;5%]
Private hospital	1.48 [1.07;2.04]	7% [-12%;13%]	1.11 [0.98;1.26]	5% [-1%;11%]
<b>Nurse's evaluation</b>				
Functional impairment	3.70 [3.09;4.42]	37% [30%;45%]	1.68 [1.55;1.81]	29% [24%;34%]
Cognitive dysfunction	1.88 [1.49;2.39]	14% [7%;20%]	1.56 [1.44;1.68]	24% [19%;29%]
Deafness and/or visual impairment	2.47 [2.06;2.96]	19% [15%;24%]	1.67 [1.57;1.78]	26% [23%;30%]
Inability to be treated by self-care PD	15.92 [12.85;19.71]	66% [62%;71%]	9.17 [8.05;10.45]	82% [80%;84%]

[PD: peritoneal dialysis, CCI: Charlson comorbidities index, CAPD: continuous ambulatory peritoneal dialysis, RR: relative risk, CI: confidence interval]

↓ Table VI. Multivariate analysis, association between the subjective assessment of the nurse and the assistance modality [Relative Risk (RR) and risk difference (RD)] (From Guillouët S, Boyer A, Lanot A, Ficheux M, Lobbedez T, Béchade C. Assessment for Assisted Peritoneal Dialysis by Peritoneal Dialysis Nurses: Results of a Cohort Study. *Am J Nephrol.* 2019;50(6):489-498)

Covariate	Family-assisted vs self-care PD [ref]		Nurse-assisted vs self-care PD [ref]	
	RR [95% CI]	RD [95% CI]	RR [95% CI]	RD [95% CI]
<b>Inability to be treated by self-care PD</b>	11.11 [8.49;14.56]	62% [57%;67%]	5.40 [4.58;6.35]	67% [64%;70%]
<b>Age at PD initiation</b>	1.02 [1.01;1.02]	0% [0%;0%]	1.02 [1.01;1.02]	0% [0%;0%]
<b>Modified CCI [by categories]</b>				
2	Ref	Ref	Ref	Ref
3	1.34 [1.02;1.61]	1% [-1%;4%]	1.19 [1.10;1.29]	3% [0%;5%]
4	1.39 [1.01;1.02]	2% [-1%;6%]	1.19 [1.09;1.28]	2% [-1%;5%]
5	1.38 [1.09;1.77]	2% [-2%;7%]	1.29 [1.19;1.41]	7% [3%;10%]
6	1.34 [1.03;1.75]	2% [-4%;8%]	1.22 [1.11;1.33]	4% [0%;8%]
≥7	1.48 [1.14;1.93]	5% [0%;11%]	1.31 [1.20;1.44]	6% [2%;11%]
<b>Diabetes</b>	1.14 [0.96;1.36]	4% [-1%;8%]	1.04 [0.98;1.10]	1% [-2%;4%]
<b>Sex (male)</b>	-	-	0.91 [0.87;0.95]	-4% [-6%;-2]
<b>Underlying nephropathy</b>				
Polycystic kidney disease	Ref	Ref	Ref	Ref
Unknown	0.60 [0.36;1.00]	-1% [-7%;4%]	0.68 [0.54;0.86]	-6% [-11%;-2%
Interstitial nephritis	1.00 [0.79;1.27]	2% [-4%;8%]	1.03 [0.95;1.12]	1% [-3%;5%]
Glomerulonephritis	1.15 [0.83;1.60]	2% [-5%;8%]	1.06 [0.94;1.18]	0% [-6%;4%]
Diabetes	0.91 [0.68;1.22]	1% [-4%;7%]	0.79 [0.69;0.91]	2% [-6%;1%]
Urologic	0.97 [0.63;1.49]	3% [-3%;9%]	0.91 [0.76;1.08]	0% [-5%;5%]
Vascular	0.99 [0.82;1.19]	1% [-4%;7%]	1.03 [0.97;1.10]	2% [-2%;5%]
Miscellaneous	1.02 [0.68;1.52]	0% [-7%;8%]	1.06 [0.92;1.10]	0% [-7%;6%]
<b>PD modality (CAPD)</b>	0.95 [0.82;1.10]	-1% [-3%;1%]	1.13 [1.05;1.22]	3% [1%;6%]
<b>Treatment before PD</b>				
Not on dialysis	Ref	Ref	Ref	Ref
Hemodialysis	1.06 [0.91;1.24]	2% [-1%;4%]	1.05 [0.99;1.11]	2% [0%;4%]
Transplantation	1.11 [0.63;1.95]	1% [-2%;4%]	0.95 [0.67;1.35]	0% [-4%;4%]
<b>Suboptimal starter</b>	-	-	0.98 [0.92;1.04]	0% [-3%;3%]
<b>Center experience</b>				
≤10	Ref	Ref	Ref	Ref
11-20	1.34 [1.16;1.54]	5% [2%;7%]	1.07 [1.02;1.12]	4% [2%;6%]
>20	1.19 [0.89;1.59]	2% [-2%;6%]	1.16 [1.07;1.26]	6% [2%;9%]
<b>Type of center</b>				
Nonprofit	Ref	Ref	Ref	Ref
Community hospital	1.02 [0.78;1.34]	0% [-4%;3%]	1.11 [1.03;1.20]	3% [0%;6%]
Academic hospital	0.88 [0.65;1.19]	-2% [-6%;1%]	1.10 [1.01;1.20]	3% [0%;6%]
Private hospital	0.98 [0.72;1.32]	-1% [-6%;3%]	1.00 [0.91;1.11]	0% [-5%;3%]

[PD: peritoneal dialysis, CCI: Charlson comorbidities index, CAPD: continuous ambulatory peritoneal dialysis, RR: relative risk, CI: confidence interval, RD: risk difference]

several establishments could have a positive effect on the survival of the method. We have also

observed that there was a disparity between the centers in the use of assistance: its allocation is mainly based on the evaluation of the dialysis nurse, which suggests possibilities for rationalization in the use of assistance. In view of the cost of assistance, additional studies are necessary in order to define award criteria. Our work showed that the allocation of assistance is essentially based on the nurses' assessment, so further research should be done on their methods of assessing the patient's inability to be independent, as well as the use and validation of tools to estimate their capacity for patient empowerment.

### ACKNOWLEDGEMENTS

We would like to thank the teams participating in the RDPLF and more particularly the nursing teams, whose expertise is essential in the success of peritoneal dialysis.

### CONFLICT OF INTEREST

*The author declare no conflict of interest for this article.*

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received 2020/07/23 accepted after revision 2020/08/27, published 2020/12/15



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