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Annual peritoneal dialysis report 2014, the peritoneal dialysis registry

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Abstract

Background: Since 2009, the peritoneal dialysis (PD) registry has been carried out as part of Japanese Society for Dialysis Therapy (JSDT) Renal Data Registry with the cooperation of Japanese Society for Peritoneal Dialysis. In this study, the current status of PD patients is reported on the basis of the results of the survey conducted at the end of 2014.

Methods: The subjects were PD patients who lived in Japan and participated in the 2014 survey. Descriptive analysis was performed for various items including the current status of the combined use of PD and another dialysis modalities such as hemodialysis or hemodiafiltration, the method of exchanging PD fluid, the use of an automated peritoneal dialysis machine, and the incidences of peritonitis and catheter exit-site infection.

Results: From the results of the facility survey in 2014, the number of PD patients was 9255, a decrease of 137 from that in 2013. Among the entire dialysis patient population, 2.9% were PD patients, a decrease of 0.1%. One thousand thirteen (21%) among them were on the combination therapy of PD and hemodialysis or hemodiafiltration. The mean incidence of peritonitis was 0.21 per patient per year in another expression as once per 57.1 patients per month. The mean incidence of catheter exit-site infection was 0.40 per patient per year in the other expression as once per 30.0 patients per month.

Conclusions: The number of PD patients has been stable around 9000~10,000 in these 10 years. High percentage of the combination therapy of PD and other dialysis modality and the lower PD dialysis dose was a unique point of the current PD in Japan. The patient's and center's peritonitis rates were very low as around 0.2 per patient-year. PD registry clearly showed the current trends in PD in Japan which were a little different from those in other many countries.

Trial registration: JSDT renal data registry was approved by the ethical committee of JSDT and registered in "University hospital Medical Information Network (UMIN) Clinical Trials Registry" as an approved number of UMIN000018641 in 2015.

Keywords: PD registry, Dialysis fluid exchange maneuver, Peritonitis, Catheter exit-site infection

Introduction

Japanese Society for Dialysis Therapy (JSDT) has been conducting an annual survey on the current status of regular dialysis treatment in Japan (JSDT Renal Data Registry (JRDR)) at the end of each year since 1968. Since 1983, survey items relating to all dialysis patients

treated in dialysis facilities that participated in the surveys have been included and the obtained data have been registered in an electronic database [1]. In the 2009 survey, JSDT started the peritoneal dialysis (PD) registry survey of patients who underwent PD, in cooperation with Japanese Society for Peritoneal Dialysis (JSPD) [2]. The targets of the PD registry survey include facilities that offer PD alone, which were not targeted in the conventional surveys conducted at the end of each year. The results of the PD registry survey have been reported annually in the sections "Current status of PD treatment" and "Items associated with PD" of the "An

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Overview of Regular Dialysis Treatment in Japan” compiled by Committee of Renal Data Registry (CRDR) in JSDT. In 2012, the results of the PD registry survey were separated from the above overview and independently summarized in the PD registry survey report as an academic paper. The current manuscript is the second publication of “Peritoneal dialysis (PD) registry with 2014 survey report. *J Jpn Soc Dial Ther* 49(1):35–40, 2016,” written in Japanese.

Here, the data obtained from the 2014 PD registry survey are summarized in the following six topics:

- I. Current status of PD patients
- II. Urine output and volume of water removed by PD
- III. Dialysate/plasma creatinine (D/P Cr) ratio in a peritoneal equilibration test (PET)
- IV. Kt/V for residual renal function (residual renal Kt/V) and Kt/V for PD (PD Kt/V)
- V. Peritonitis and catheter exit-site infections
- VI. Encapsulating peritoneal sclerosis (EPS)

Outline of the PD registry in 2014

Survey methods

This survey was conducted by sending questionnaires to individual dialysis facilities. A total of 4367 facilities participating in this survey were either member facilities of JSDT, nonmember facilities offering regular hemodialysis (HD), or nonmember facilities offering PD but not HD, as of December 31, 2014. The number of participating facilities increased by 42 (1.0%) from the previous year (4325 facilities) [3]. Among the 4367 facilities, 986 treated PD patients.

Universal serial bus (USB) memory devices that stored electronic spreadsheets in Microsoft Excel® or paper questionnaires were sent to and collected from the individual dialysis facilities, mainly by postal mail; for some facilities, the questionnaires were sent and collected by fax. In the 2014 survey, two sets of questionnaires were used. One was for the facility survey, which included items on individual dialysis facilities, such as the numbers of patients and staff members. The other was for the patient survey, which included items on individual dialysis patients, such as their demographical background, treatment conditions, and outcomes of treatment. The deadline for acceptance of responses was the end of January 2015. The acceptance of responses submitted after this deadline, including those of the additional surveys, ended on August 7, 2015.

Before 2014, the results from JRDR had been reported in the following three types of report. First, quick analyses of the data obtained by April in the following year were reported at the annual meeting of the JSDT held in June and compiled in “The Atlas, Overview of Regular Dialysis Treatment in Japan,” Second, the responses to

the survey had been continuously collected until September, and the obtained data were screened to determine the definite survey results, which were published in the “An Overview of Regular Dialysis Treatment in Japan, the CD-ROM Report.” Third, the tabulated results based on the definite values in the CD-ROM Report were published as an annual dialysis data report in the *Journal of Japanese Society for Dialysis Therapy*. Therefore, the values in the atlas were different from the definite values in the CD-ROM. The quick estimations were prepared only for the atlas in the annual meeting of JSDT. However, the values in the atlas had been occasionally cited as if they were officially approved values because they were expressed by attractive graphs. To avoid these mal-citations, we decided to publish all the official reports from the 2014 survey based on the definite database.

For the CD-ROM Report, the number of facilities that responded to the facility survey was 4330 (99.2%) and the number of those that responded to both the facility and patient surveys was 4191 (96.0%) [4]. Moreover, the number of facilities that completed the questionnaires using the electronic medium was 3764 (86.9%), which was higher than that in the 2013 survey (3698 facilities, 86.6%). This increase contributed to the accurate and simplified analysis of survey data.

Survey items

The 2014 survey included the following survey items. For the items included in the previous surveys, refer to the members-only pages of the JSDT website (http://member.jsdt.or.jp/member/contents/data/research_list_2000-2015.pdf).

Facility survey items

- Name of facility, contact numbers (telephone and fax), name of representative (doctor), and name of respondent
- Year and month when the facility started offering dialysis treatment

Table 1 Number of prevalent PD patients

	Number of patients
Prevalent PD patients	9255
Patients with a catheter for PD such as those who underwent only peritoneal lavage	278
New patients who started on PD in 2014 but switched to other methods in the same year	193
Patients who underwent PD + HD(F)	1913

These data were obtained by the facility survey

Table 2 Distribution of prevalent PD patients, by PD vintage and combination frequency

PD vintage	<1 year	1-<2 years	2-<4 years	4-<6 years	6-<8 years	8-<10 years	≥10 years	Subtotal	No information available	Total	Mean	SD
PD only (%)	1252 (96.7)	948 (89.9)	1269 (83.7)	640 (73.1)	269 (59.1)	101 (46.5)	109 (41.3)	4588 (80.8)	2600 (77.8)	7188 (79.7)	2.80	2.72
PD + HD(F) once a week (%)	35 (2.7)	93 (8.8)	219 (14.4)	205 (23.4)	151 (33.2)	86 (39.6)	113 (42.8)	902 (15.9)	642 (19.2)	1544 (17.1)	5.69	3.92
PD + HD(F) twice a week (%)	4 (0.3)	7 (0.7)	12 (0.8)	20 (2.3)	27 (5.9)	26 (12.0)	26 (9.8)	122 (2.1)	55 (1.6)	177 (2.0)	7.53	4.15
PD + HD(F) three times a week (%)	-	3 (0.3)	3 (0.2)	2 (0.2)	2 (0.4)	-	5 (1.9)	15 (0.3)	25 (0.7)	40 (0.4)	6.58	5.05
PD + HD(F) at other frequencies (%)	4 (0.3)	4 (0.4)	14 (0.9)	8 (0.9)	6 (1.3)	4 (1.8)	11 (4.2)	51 (0.9)	22 (0.7)	73 (0.8)	6.47	4.99
Total (%)	1295 (100.0)	1055 (100.0)	1517 (100.0)	875 (100.0)	455 (100.0)	217 (100.0)	264 (100.0)	5678 (100.0)	3344 (100.0)	9022 (100.0)	3.40	3.27

These data were obtained by the patient survey

Table 3 Changing maneuver of PD fluids

Method of PD solution exchange	Completely manual exchange	Double-bag system with ultraviolet light irradiation	Double-bag system with sterile connecting device	Double-bag system (methods other than those on the left columns, including semimanual methods)	Subtotal	Unspecified	No information available	Total
Number of patients (%)	1422 (32.2)	2322 (52.6)	607 (13.7)	66 (1.5)	4417 (100.0)	76	2695	7188

These data were obtained from the PD-only patients in the patient survey

- Number of bedside consoles, total number of patients who can simultaneously receive dialysis, and maximum number of admissible patients
- Number of full-time and part-time workers engaged in dialysis treatment (e.g., doctors, nurses, clinical engineers, nutritionists, case workers)
- Number of dialysis doctors
- Number of outpatients and inpatients who underwent dialysis (daytime dialysis, nighttime dialysis, home HD, and PD)
- Number of prevalent dialysis patients at the end of 2014
- Number of new patients who were started incident dialysis patients in 2014
- Number of dialysis patients who died during 2014
- Number of patients who underwent HD or hemodiafiltration (HDF) and did not undergo PD despite having a catheter for PD (underwent only peritoneal lavage), number of patients who underwent both PD and HD or HDF, and number of new patients who were started on PD in 2014 but introduced to another blood purification method in the same year
- Current status of dialysate quality control (details not shown)

Patient survey items

The following are the basic survey items that have been annually surveyed since 1983.

- Anonymized name
- Gender and date of birth
- Year and month of start of dialysis and year and month of transfer from another hospital
- Primary disease
- Prefecture where the patient lives
- Dialysis method
- Outcome, year, and month (transfer, death, change in dialysis method, or transplantation) (code of facility to which the patient is transferred)
- Cause of death

The following were added to the basic survey items and were surveyed using both paper and electronic media.

- Dialysis modality, current status of combined use of PD, and HD or HDF
- History of PD
- Number of renal transplantations

Table 4 Use or nonuse of APD machine, by PD vintage

PD vintage	Use	Nonuse	Subtotal	Unspecified	No information available	Total
<1 year (%)	627 (52.8)	561 (47.2)	1188 (100.0)	3	61	1252
1–<2 years (%)	451 (50.0)	451 (50.0)	902 (100.0)	2	44	948
2–<4 years (%)	672 (55.8)	532 (44.2)	1204 (100.0)	16	49	1269
4–<6 years (%)	340 (55.6)	272 (44.4)	612 (100.0)	7	21	640
6–<8 years (%)	163 (63.7)	93 (36.3)	256 (100.0)	–	13	269
8–<10 years (%)	66 (70.2)	28 (29.8)	94 (100.0)	2	5	101
≥10 years (%)	71 (68.3)	33 (31.7)	104 (100.0)	–	5	109
Subtotal (%)	2390 (54.8)	1970 (45.2)	4360 (100.0)	30	198	4588
No information available (%)	48 (55.8)	38 (44.2)	86 (100.0)	–	2514	2600
Total (%)	2438 (54.8)	2008 (45.2)	4446 (100.0)	30	2712	7188
Mean	2.99	2.56	2.80	3.41	2.67	2.80
SD	2.91	2.42	2.71	2.02	3.02	2.72

These data were obtained from the PD-only patients in the patient survey

Values in parentheses under each figure represent the percentage relative to the total in each row
APD automated peritoneal dialysis

Table 5 PD treatment time, by PD vintage

PD vintage	1-<5 h	5-<9 h	9-<13 h	13-<18 h	18-<24 h	24 h	Subtotal	No information available	Total	Mean	SD
<1 year (%)	21 (1.8)	294 (25.5)	221 (19.2)	91 (7.9)	33 (2.9)	493 (42.8)	1153 (100.0)	99	1252	15.97	7.46
1-<2 years (%)	13 (1.5)	181 (20.5)	135 (15.3)	73 (8.3)	32 (3.6)	450 (50.9)	884 (100.0)	64	948	17.38	7.27
2-<4 years (%)	23 (2.0)	157 (13.4)	159 (13.6)	108 (9.2)	48 (4.1)	678 (57.8)	1173 (100.0)	96	1269	18.54	6.98
4-<6 years (%)	5 (0.8)	67 (11.2)	62 (10.3)	43 (7.2)	20 (3.3)	403 (67.2)	600 (100.0)	40	640	19.81	6.46
6-<8 years (%)	6 (2.4)	19 (7.8)	16 (6.5)	14 (5.7)	7 (2.9)	183 (74.7)	245 (100.0)	24	269	20.65	6.20
8-<10 years (%)	2 (2.2)	5 (5.4)	4 (4.3)	5 (5.4)	3 (3.2)	74 (79.6)	93 (100.0)	8	101	21.42	5.55
≥10 years (%)	1 (1.0)	5 (5.2)	10 (10.4)	3 (3.1)	4 (4.2)	73 (76.0)	96 (100.0)	13	109	20.97	5.89
Subtotal (%)	71 (1.7)	728 (17.2)	607 (14.3)	337 (7.9)	147 (3.5)	2354 (55.5)	4244 (100.0)	344	4588	18.02	7.19
No information available (%)	8 (20.5)	5 (12.8)	6 (15.4)	3 (7.7)	1 (2.6)	16 (41.0)	39 (100.0)	2561	2600	14.67	8.62
Total (%)	79 (1.8)	733 (17.1)	613 (14.3)	340 (7.9)	148 (3.5)	2370 (55.3)	4283 (100.0)	2905	7188	17.99	7.21
Mean	2.61	1.88	2.13	2.51	2.86	3.27	2.78	2.95	2.80	-	-
SD	2.37	1.92	2.18	2.16	2.76	2.92	2.67	3.28	2.72	-	-

These data were obtained from the PD-only patients in the patient survey

Table 6 Urine output, by PD vintage

PD vintage	<100 mL/day	100-<400 mL/day	400-<800 mL/day	800-1200 mL/day	1200-<1600 mL/day	≥1600 mL/d	Subtotal	No information available	Total	Mean	SD
<1 year (%)	36 (3.6)	99 (10.0)	231 (23.3)	284 (28.6)	227 (22.9)	116 (11.7)	993 (100.0)	259	1252	970.04	552.21
1-<2 years (%)	51 (6.7)	112 (14.8)	215 (28.3)	193 (25.4)	108 (14.2)	80 (10.5)	759 (100.0)	189	948	826.58	554.06
2-<4 years (%)	102 (9.7)	211 (20.1)	304 (28.9)	241 (22.9)	127 (12.1)	66 (6.3)	1051 (100.0)	218	1269	711.19	539.97
4-<6 years (%)	107 (20.5)	124 (23.8)	133 (25.5)	86 (16.5)	47 (9.0)	25 (4.8)	522 (100.0)	118	640	564.16	528.89
6-<8 years (%)	83 (40.1)	44 (21.3)	40 (19.3)	24 (11.6)	10 (4.8)	6 (2.9)	207 (100.0)	62	269	385.73	480.29
8-<10 years (%)	37 (45.1)	11 (13.4)	13 (15.9)	9 (11.0)	7 (8.5)	5 (6.1)	82 (100.0)	19	101	473.66	659.63
≥10 years (%)	54 (61.4)	15 (17.0)	6 (6.8)	10 (11.4)	1 (1.1)	2 (2.3)	88 (100.0)	21	109	239.49	403.43
Subtotal (%)	470 (12.7)	616 (16.6)	942 (25.4)	847 (22.9)	527 (14.2)	300 (8.1)	3702 (100.0)	886	4588	748.87	572.45
No information available (%)	15 (40.5)	4 (10.8)	6 (16.2)	8 (21.6)	3 (8.1)	1 (2.7)	37 (100.0)	2563	2600	472.97	529.49
Total (%)	485 (13.0)	620 (16.6)	948 (25.4)	855 (22.9)	530 (14.2)	301 (8.1)	3739 (100.0)	3449	7188	746.14	572.62
Mean	5.48	3.25	2.51	2.19	1.85	1.96	2.80	2.77	2.80	-	-
SD	4.05	2.55	2.01	2.24	1.82	1.92	2.71	2.76	2.72	-	-

These data were obtained from the PD-only patients in the patient survey

Table 7 Ultrafiltration volume by PD, by PD vintage

PD vintage	<-1000 mL/day	-1000-<0 mL/day	0-<1000 mL/day	1000-<2000 mL/day	2000-<3000 mL/day	3000-<4000 mL/day	≥4000 mL/day	Subtotal (1000)	No information available	Total	Mean	SD
<1 year (%)	1 (0.1)	78 (7.5)	836 (79.9)	123 (11.8)	8 (0.8)	-	-	1046 (100.0)	206	1252	450.31	453.10
1-<2 years (%)	-	54 (6.5)	618 (74.9)	146 (17.7)	6 (0.7)	1 (0.1)	-	825 (100.0)	123	948	554.78	478.10
2-<4 years (%)	1 (0.1)	46 (4.2)	755 (69.3)	274 (25.1)	11 (1.0)	2 (0.2)	1 (0.1)	1090 (100.0)	179	1269	676.10	502.64
4-<6 years (%)	-	15 (2.7)	358 (64.0)	179 (32.0)	6 (1.1)	-	1 (0.2)	559 (100.0)	81	640	753.31	494.71
6-<8 years (%)	-	4 (1.8)	138 (60.8)	81 (35.7)	3 (1.3)	1 (0.4)	-	227 (100.0)	42	269	806.98	507.14
8-<10 years (%)	-	-	47 (56.6)	35 (42.2)	1 (1.2)	-	-	83 (100.0)	18	101	843.47	458.93
≥10 years (%)	-	1 (1.2)	51 (60.7)	31 (36.9)	1 (1.2)	-	-	84 (100.0)	25	109	838.49	474.98
Subtotal (%)	2 (0.1)	198 (5.1)	2803 (71.6)	869 (22.2)	36 (0.9)	4 (0.1)	2 (0.1)	3914 (100.0)	674	4588	615.84	498.33
No information available (%)	-	-	27 (77.1)	7 (20.0)	1 (2.9)	-	-	35 (100.0)	2565	2600	727.29	515.26
Total (%)	2 (0.1)	198 (5.0)	2830 (71.7)	876 (22.2)	37 (0.9)	4 (0.1)	2 (0.1)	3949 (100.0)	3239	7188	616.83	498.52
Mean	1.50	1.80	2.56	3.70	3.22	3.15	3.71	2.78	2.89	2.80	-	-
SD	1.89	1.67	2.56	2.88	3.21	2.40	0.41	2.65	3.06	2.72	-	-

These data were obtained from the PD-only patients in the patient survey

Table 8 History of PET

Performance or nonperformance of PET	Not performed	PET performed	Fast PET only	Subtotal	Unspecified	No information available	Total
Number of patients (%)	1513 (34.5)	1885 (42.9)	992 (22.6)	4390 (100.0)	90	2708	7188

These data were obtained from the PD-only patients in the patient survey

- Frequency of dialysis per week, duration of one session of dialysis (min/session), and blood flow rate (mL/min) (for patients who underwent blood purification by extracorporeal circulation)
- Method of diluting HDF solution and volume of substitution fluid per HDF session (L) (for patients who underwent HDF)
- Height and predialysis and postdialysis body weights
- Predialysis and postdialysis serum blood urea nitrogen (BUN) (mg/dL) and creatinine (mg/dL) levels
- Predialysis albumin (g/dL), C-reactive protein (CRP) (mg/dL), calcium (mg/dL), phosphorus (mg/dL), and blood hemoglobin (g/dL) levels and parathyroid hormone (PTH) (pg/mL) levels and the measurement method of PTH
- Use or nonuse of antihypertensive drugs and smoking habit
- History of comorbidity (diabetes, myocardial infarction, cerebral hemorrhage, cerebral infarction, quadruple amputation, femoral neck fracture, and EPS)

USB-only survey items

Details of PD were surveyed as USB-only survey items separately from the abovementioned questionnaires for the facility and patient surveys. The following are the USB-only survey items associated with PD.

- PD vintage (months)
- Number of months when PD was performed in 2014
- Performance or nonperformance of PET

Table 9 Type of PD fluid, by PET D/P Cr ratio

Type of PD fluid	<0.5	0.5–<0.65	0.65–<0.81	≥0.81	Subtotal	No information available	Total	Mean	SD
1.5% dextrose only (%)	143 (61.9)	485 (55.6)	402 (39.7)	103 (31.2)	1133 (46.3)	958 (46.5)	2091 (46.4)	0.63	0.13
1.5 and 2.5% dextrose (%)	26 (11.3)	110 (12.6)	128 (12.6)	29 (8.8)	293 (12.0)	272 (13.2)	565 (12.5)	0.65	0.14
2.5% dextrose only (%)	1 (0.4)	11 (1.3)	22 (2.2)	11 (3.3)	45 (1.8)	81 (3.9)	126 (2.8)	0.71	0.12
4.25% dextrose only (without icodextrin) (%)	1 (0.4)	1 (0.1)	–	–	2 (0.1)	5 (0.2)	7 (0.2)	0.44	0.21
Icodextrin only (without dextrose) (%)	2 (0.9)	7 (0.8)	7 (0.7)	4 (1.2)	20 (0.8)	31 (1.5)	51 (1.1)	0.70	0.16
1.5% dextrose + icodextrin (%)	37 (16.0)	146 (16.7)	275 (27.1)	108 (32.7)	566 (23.1)	439 (21.3)	1005 (22.3)	0.69	0.13
1.5 and 2.5% dextrose + icodextrin (%)	10 (4.3)	68 (7.8)	111 (11.0)	42 (12.7)	231 (9.4)	135 (6.6)	366 (8.1)	0.69	0.13
2.5% dextrose + icodextrin (%)	11 (4.8)	44 (5.0)	66 (6.5)	33 (10.0)	154 (6.3)	140 (6.8)	294 (6.5)	0.68	0.16
4.25% dextrose + icodextrin (%)	–	1 (0.1)	2 (0.2)	–	3 (0.1)	–	3 (0.1)	0.67	0.12
Subtotal (%)	231 (100.0)	873 (100.0)	1013 (100.0)	330 (100.0)	2447 (100.0)	2061 (100.0)	4508 (100.0)	0.66	0.14
Unspecified	5	19	9	2	35	13	48	0.59	0.15
No information available	3	8	17	3	31	2601	2632	0.67	0.11
Total	239	900	1039	335	2513	4675	7188	0.66	0.14

These data were obtained from the PD-only patients in the patient survey
 PET peritoneal equilibration test, D/P Cr dialysate/plasma creatinine

Table 10 Residual renal KtV, by PD vintage

PD vintage	<0.1	0.1–<0.4	0.4–<0.8	0.8–<1.2	1.2–<1.7	1.7–<2.0	2.0–<2.4	≥2.4	Subtotal	Unspecified	Total	Mean	SD
<1 year (%)	16 (4.0)	49 (12.2)	126 (31.3)	121 (30.0)	56 (13.9)	18 (4.5)	14 (3.5)	3 (0.7)	403 (100.0)	849	1252	0.84	0.54
1–<2 years (%)	22 (5.7)	64 (16.7)	116 (30.3)	94 (24.5)	62 (16.2)	11 (2.9)	9 (2.3)	5 (1.3)	383 (100.0)	565	948	0.79	0.56
2–<4 years (%)	58 (10.9)	162 (30.4)	158 (29.6)	76 (14.3)	41 (7.7)	18 (3.4)	8 (1.5)	12 (2.3)	533 (100.0)	736	1269	0.65	0.81
4–<6 years (%)	74 (27.3)	79 (29.2)	64 (23.6)	29 (10.7)	14 (5.2)	2 (0.7)	6 (2.2)	3 (1.1)	271 (100.0)	369	640	0.45	0.57
6–<8 years (%)	49 (45.0)	30 (27.5)	15 (13.8)	9 (8.3)	5 (4.6)	–	–	1 (0.9)	109 (100.0)	160	269	0.29	0.46
8–<10 years (%)	16 (48.5)	6 (18.2)	4 (12.1)	3 (9.1)	1 (3.0)	1 (3.0)	–	2 (6.1)	33 (100.0)	68	101	0.5	0.94
≥10 years (%)	22 (68.8)	4 (12.5)	3 (9.4)	2 (6.3)	1 (3.1)	–	–	–	32 (100.0)	77	109	0.19	0.39
Subtotal (%)	257 (14.6)	394 (22.3)	486 (27.6)	334 (18.9)	180 (10.2)	50 (2.8)	37 (2.1)	26 (1.5)	1764 (100.0)	2824	4588	0.66	0.67
No information available (%)	2 (50.0)	1 (25.0)	–	–	1 (25.0)	–	(0.0)	–	4 (100.0)	2596	2600	0.38	0.57
Total (%)	259 (14.6)	395 (22.3)	486 (27.5)	334 (18.9)	181 (10.2)	50 (2.8)	37 (2.1)	26 (1.5)	1768 (100.0)	5420	7188	0.66	0.67
Mean	5.29	3.22	2.42	1.94	1.94	1.88	1.94	3.09	2.86	2.75	2.80	–	–
SD	3.51	2.09	1.98	1.88	1.73	1.67	1.55	2.48	2.50	2.85	2.72	–	–

These data were obtained from the PD-only patients in the patient survey
KtV index for standardized dialysis dose defined as; K: urea clearance, t dialysis time, V: body fluid volume

Table 11 PD Kt/V, by PD vintage

PD vintage	<0.1	0.1–<0.4	0.4–<0.8	0.8–<1.2	1.2–<1.7	1.7–<2.0	2.0–<2.4	≥2.4	Subtotal	Unspecified	Total	Mean	SD
<1 year (%)	5 (1.1)	30 (6.8)	82 (18.7)	144 (32.8)	118 (26.9)	31 (7.1)	15 (3.4)	14 (3.2)	439 (100.0)	813	1252	1.10	0.62
1–<2 years (%)	1 (0.2)	21 (5.0)	58 (13.8)	104 (24.7)	153 (36.3)	40 (9.5)	28 (6.7)	16 (3.8)	421 (100.0)	527	948	1.25	0.56
2–<4 years (%)	3 (0.5)	33 (5.8)	43 (7.5)	120 (21.1)	232 (40.7)	76 (13.3)	37 (6.5)	26 (4.6)	570 (100.0)	699	1269	1.38	0.89
4–<6 years (%)	–	15 (4.9)	28 (9.2)	46 (15.0)	118 (38.6)	53 (17.3)	29 (9.5)	17 (5.6)	306 (100.0)	334	640	1.47	0.94
6–<8 years (%)	–	11 (8.6)	7 (5.5)	8 (6.3)	48 (37.5)	34 (26.6)	17 (13.3)	3 (2.3)	128 (100.0)	141	269	1.47	0.56
8–<10 years (%)	–	2 (5.3)	5 (13.2)	5 (13.2)	11 (28.9)	8 (21.1)	4 (10.5)	3 (7.9)	38 (100.0)	63	101	1.54	1.03
≥10 years (%)	1 (2.9)	2 (5.7)	3 (8.6)	–	12 (34.3)	7 (20.0)	9 (25.7)	1 (2.9)	35 (100.0)	74	109	1.51	0.64
Subtotal (%)	10 (0.5)	114 (5.9)	226 (11.7)	427 (22.0)	692 (35.7)	249 (12.9)	139 (7.2)	80 (4.1)	1937 (100.0)	2651	4588	1.31	0.77
No information available (%)	–	2 (33.3)	–	2 (33.3)	1 (16.7)	–	1 (16.7)	–	6 (100.0)	2594	2600	0.95	0.69
Total (%)	10 (0.5)	116 (6.0)	226 (11.6)	429 (22.1)	693 (35.7)	249 (12.8)	140 (7.2)	80 (4.1)	1943 (100.0)	5245	7188	1.31	0.77
Mean	2.39	2.89	2.25	2.04	3.02	3.99	3.90	3.11	2.89	2.72	2.80	–	–
SD	2.10	2.45	2.24	1.71	2.37	3.24	2.92	2.55	2.51	2.86	2.72	–	–

These data were obtained from the PD-only patients in the patient survey

Table 12 Patient's peritonitis rate

Peritonitis episodes per patient-year	0	1.0–<2.0	2.0–<3.0	3.0–<4.0	4.0–<5.0	≥5.0	Subtotal	Unspecified/no information available	Total	Mean
Number of patients (%)	3758 (86.7)	400 (9.5)	82 (2.3)	25 (0.8)	13 (0.3)	23 (0.4)	4301 (100.0)	2887	7188	0.21

These data were obtained from the PD-only patients in the patient survey

Patient's peritonitis rate per patient-year = (Peritonitis episodes in 2014 in all subjects ÷ Total months on PD in 2014 in all subjects) × 12

- PET-derived 4-h dialysate/plasma creatinine ratio (PET D/P Cr ratio)
- Type of PD fluid
- Volume of PD fluid per day
- Remaining renal function (daily urine output)
- Mean ultrafiltration (UF) volume per day (UF volume)
- Residual renal Kt/V and PD Kt/V
- Changing maneuver of PD fluids
- Use or nonuse of automated peritoneal dialysis (APD) machine
- PD treatment time per day
- Past history of peritonitis during 2014
- At history of catheter exit-site infections (ESI) in 2014

PD vintage (<1 year, 3.3%; 1–<2 years, 10.1%; 2–<4 years, 16.3%; 4–<6 years, 26.9%; 6–<8 years, 40.9%; 8–<10 years, 53.5%; and ≥10 years, 58.7%). Regarding the frequency of HD(F), the majority of the PD patients underwent HD(F) once a week (nearly 82.8%) (Table 2).

Changing maneuver of PD fluids

To the questions regarding the method of PD solution exchange, 4417 of the PD-only patients responded. The number of PD patients who performed completely manual PD fluid exchanges was 1422 (32.2%). The number of PD patients who used a double-bag system with ultraviolet light irradiation was 2322 (52.6%), and the number of those who used the same system but with a sterile connecting device was 607 (13.7%) (Table 3).

Results and discussion

Current status of PD patients

Number of patients

According to the facility survey, the number of PD patients was 9255 at the end of 2014, a decrease of 137 from the previous year. The percentage of PD patients among the entire dialysis patient population was 2.9%, a decrease of 0.1% from the previous year. The number of patients who underwent a nonPD modality but despite having a PD catheter, most of whom are considered to have undergone only peritoneal lavage, was 278 and it was a decrease of 14 from the previous year. The number of new patients who were started PD in 2014 but switched to another method in the same year was 193, an increase of 19 from the previous year. The number of patients on the combination therapy of PD and HD or HDF was 1913, a decrease of 7 from the previous year (Table 1).

Current status of the combination therapy of PD + HD(F) with respect to PD vintage

To the questions regarding PD vintage and current status of PD + HD(F), 5678 patients responded. The percentage of patients who underwent PD + HD(F) increased with

Use or nonuse of APD machine with respect to PD vintage

Among the PD-only patients, 4446 responded to the questions regarding their PD vintage and use or nonuse of an APD machine. The percentage of PD-only patients who used an APD machine was 45.2%. The percentages of PD-only patients who used an APD machine were ≥40% for PD vintages of <6 years (<1 year, 47.2%; 1–<2 years, 50.0%; 2–<4 years, 44.2%; and 4–<6 years, 44.4%). However, the percentage of PD-only patients who used an APD machine decreased to around 30% for PD vintages of ≥6 years (≥10 years, 31.7%) (Table 4).

Number of hours of PD session per day with respect to PD vintage

Among the PD-only patients, 4244 responded to the questions regarding their PD vintage and PD treatment time per day. The percentage of patients who underwent PD for the whole day (24 h) was 55.5%. The percentages of patients who underwent PD for the whole day tended to increase with PD vintage (<1 year, 42.8%; 8–<10 years, 79.6%; and ≥10 years, 76.0%) (Table 5).

Table 13 Center's peritonitis rate

Peritonitis rate (episodes per year per facility)	0~	1.0~	2.0~	3.0~	4.0~	5.0~	Subtotal	No information available	Total	Mean
Number of facilities (%)	195 (85.9)	25 (11.0)	5 (2.2)	1 (0.4)	0 (0.0)	1 (0.4)	227 (100.0)	263	490	0.21

These data were obtained from the PD-only patients in the patient survey

Center's peritonitis rate per patient-year = (Peritonitis episodes in 2014 in all patients in the facility ÷ Total months on PD in 2014 in all patients in the facility) × 12

Table 14 Patient's ESI rate

ESI episodes per patient-year	0	1.0–<2.0	2.0–<3.0	3.0–<4.0	4.0–<5.0	≥5.0	Subtotal	Unspecified/no information available	Total	Mean
Number of patients (%)	3465 (80.8)	495 (11.5)	159 (3.7)	58 (1.4)	40 (0.9)	72 (1.7)	4289 (100.0)	2899	7188	0.40

These data were obtained from the PD-only patients in the patient survey

The patient's ESI rate per patient-year = (ESI episodes in 2014 in all subjects ÷ Total months on PD in 2014 in all subjects) × 12

Urine output and ultrafiltration volume by PD

Urine output by PD vintage

To the questions regarding urine output and PD vintage, 3702 of the PD-only patients responded. The mean urine output of the PD patients was 748.9 mL/day. The urine output tended to decrease with increasing PD vintage (<1 year, 970.0 mL/day and ≥10 years, 239.5 mL/day) (Table 6).

Ultrafiltration volume by PD by PD vintage

To the questions regarding the ultrafiltration volume by PD and PD vintage, 3914 of the PD-only patients responded. The mean ultrafiltration volume by PD was 615.8 mL/day. The mean ultrafiltration volume by PD tended to increase with PD vintage (<1 year, 450.3 mL/day and ≥10 years, 838.5 mL/day) (Table 7).

Peritoneal equilibration test (PET)

History of PET

To the questions regarding the history of PET, 4390 of the PD-only patients responded. Among these patients, 1885 (42.9%) underwent a standard PET and 992 (22.6%) underwent a fast PET; that is, a total of 2877 (65.5%) underwent PET (Table 8).

PET D/P Cr ratio and type of PD fluid

To the questions regarding the type of PD fluid, 4508 of the PD-only patients responded. Among these patients, 2782 (61.7%) used 1.5 or 2.5% dextrose and only 10 (0.2%) used 4.25% dextrose. The number of patients who used icodextrin was 1719 (38.1%). The percentage of patients who used icodextrin increased with PET D/P Cr ratio (<0.5, 26.0%; 0.5–<0.65, 30.5%; 0.65–<0.81, 45.5%; and ≥0.81, 56.7%) (Table 9).

Residual renal Kt/V and PD Kt/V

Residual renal Kt/V by PD vintage

To the questions regarding the residual renal Kt/V and PD vintage, 1764 of the PD-only patients responded. The mean residual renal Kt/V was 0.66. The mean

residual renal Kt/V decreased with increasing PD vintage of <8. For patients with PD vintage of ≥8, the residual renal Kt/V was considered to be varied significantly among patients (Table 10).

PD Kt/V by PD vintage

To the questions regarding PD Kt/V and PD vintage, 1937 of the PD-only patients responded. The mean PD Kt/V was 1.31. The mean PD Kt/V tended to increase with increasing PD vintage (<1 year, 1.10 and ≥10 years, 1.51) (Table 11).

Peritonitis and catheter exit-site infections

Peritonitis is defined as a white blood cell count of ≥100/μL (neutrophil, ≥50%) in waste PD fluid. A catheter exit-site infection is defined by the presence of purulent drainage from the exit site. The rates of peritonitis and catheter exit-site infections were calculated in the PD-only patients using the following formulae.

Patient's peritonitis rate

The patient's peritonitis rate per patient-year was calculated as follows,

$$\begin{aligned} & \text{The patient's peritonitis rate per patient-year} \\ & = (\text{Peritonitis episodes in 2014 in all subjects} \\ & \div \text{Total months on PD in 2014 in all subjects}) \times 12 \end{aligned}$$

According to the International Society for Peritoneal Dialysis (ISPD) guidelines (Peritoneal Dialysis-Related Infection Recommendations: 2010 Update) [5], "the center's peritonitis rate should be no more than 1 episode every 18 months (0.67 per patient-year)."

To the questions regarding peritonitis, 4301 of the PD-only patients responded. The mean peritonitis rate was 0.21 per patient-year (1 episode every 57.1 patient-months). This was much lower than the recommendation in the ISPD guidelines. The number of patients who did not develop peritonitis in 2014 was 3758 (87.4%). The number of patients with a peritonitis rate

Table 15 Center's ESI rate

Episodes of ESI per patient-year	0~	1.0~	2.0~	3.0~	4.0~	5.0~	Subtotal	No information available	Total	Mean
Number of facilities (%)	191 (75.9)	51 (15.2)	11 (5.2)	1 (1.1)	3 (0.7)	4 (1.9)	261 (100.0)	229	490	0.40

These data were obtained from the PD-only patients in the patient survey

The center's ESI rate per patient-year = (ESI episodes in 2014 in all patients in the center ÷ Total months on PD in 2014 in all patients in the center) × 12

of 1.0–<2.0 was 400 (9.3%) and that with a peritonitis rate of ≥ 2.0 was 143 (3.3%) (Table 12).

Center's peritonitis rate

The center's peritonitis rate was calculated as follows,

$$\begin{aligned} & \text{The center's peritonitis rate per patient-year} \\ & = (\text{Peritonitis episodes in 2014 in all patients in the center} \\ & \div \text{Total months on PD in 2014 in all patients in the center}) \times 12 \end{aligned}$$

On the basis of the valid responses obtained from 227 centers, the mean center's peritonitis rate was 0.21 per patient-year (1 episode each 57.1 patient-months) (Table 13).

Patient's catheter exit-site infection (ESI) rates

The patient's ESI rate was calculated as follows,

$$\begin{aligned} & \text{The patient's ESI rate per patient-year} \\ & = (\text{ESI episodes in 2014 in all subjects} \\ & \div \text{Total months on PD in 2014 in all subjects}) \times 12 \end{aligned}$$

To the questions regarding ESI, 4289 of the PD-only patients responded. The mean patient's ESI rate in the PD-only dialysis patients was 0.40 per patient-year (1 episode every 30.0 patient-months). The number of patients who did not develop ESI in 2014 was 3465 (80.8%). The number of patients with ESI rate of 1.0–<2.0 was 495 (11.5%) and that with ESI rate of ≥ 2.0 was 329 (7.7%) (Table 14).

Center's ESI rate

The center's ESI rate was calculated as follows.

$$\begin{aligned} & \text{The center's ESI rate per patient-year} \\ & = (\text{ESI episodes in 2014 in all patients in the center} \\ & \div \text{Total months on PD in 2014 in all patients in the center}) \times 12 \end{aligned}$$

On the basis of the valid responses obtained from 261 centers, the mean center's ESI rate was 0.40 per patient-year (1 episode each 30.0 patient-months) (Table 15).

Encapsulating peritoneal sclerosis (EPS)

History of EPS in the patients with PD history

The history of EPS and the treatments for EPS, surgical treatment and/or steroids, were surveyed on the patients on PD and the patients with past PD history currently on another dialysis modality. Among the 12,865 patients who responded to the questions regarding their history of EPS, 676 (5.3%) had a history of EPS. Among these 676 patients, 541 (80.0%) had received surgical treatments (Table 16).

History of EPS by PD vintage

Responses to the questions regarding PD vintage and EPS history were obtained from 4917 patients. The percentages of patients with a history of EPS who had undergone PD for <6 years were low (<1 year, 0.4%; 1–<2 years, 0.7%; 2–<4 years, 0.5%; and 4–<6 years, 0.3%). However, the percentages of such patients who had undergone PD for a longer duration increased to around 1% (6–<8 years, 1.6%; 8–<10 years, 1.1%; and ≥ 10 years, 0.9%) (Table 17).

Table 16 PD patient distribution, by treatment for EPS and dialysis modality

Treatment for EPS	EPS (–)	EPS (+)				Subtotal	Unspecified	No information available	Total
		Surgery (+) steroids (+)	Surgery (+) steroids (–)	Surgery (–) steroids (+)	Surgery (–) steroids (–)				
In-center HD (%)	5051 (91.2)	376 (6.8)	12 (0.2)	56 (1.0)	46 (0.8)	5541 (100.0)	198	730	6469
HDF (%)	1250 (90.5)	104 (7.5)	3 (0.2)	9 (0.7)	15 (1.1)	1381 (100.0)	35	161	1577
Hemofiltration (%)	1 (100.0)	–	–	–	–	1 (100.0)	–	–	1
Hemoadsorption (%)	46 (79.3)	8 (13.8)	1 (1.7)	–	3 (5.2)	58 (100.0)	4	3	65
Home HD (%)	72 (98.6)	1 (1.4)	–	–	–	73 (100.0)	–	4	77
PD (%)	5769 (99.3)	36 (0.6)	–	3 (0.1)	3 (0.1)	5811 (100.0)	67	3063	8941
Subtotal (%)	12,189 (94.7)	525 (4.1)	16 (0.1)	68 (0.5)	67 (0.5)	12,865 (100.0)	304	3961	17,130
No information available (%)	–	–	–	–	–	–	–	–	–
Total (%)	12,189 (94.7)	525 (4.2)	16 (0.2)	68 (0.6)	67 (0.4)	12,865 (100.0)	304	3961	17,130

These data were obtained from the patients on PD and the patients with past PD history currently on another dialysis modality
EPS encapsulating peritoneal sclerosis

Table 17 PD patient distribution, by PD vintage and treatment for EPS

PD vintage	<1 year	1-<2 years	2-<4 years	4-<6 years	6-<8 years	8-<10 years	≥ 10 years	Subtotal	No information available	Total	Mean	SD
EPS (-) (%)	1130 (99.6)	909 (99.3)	1326 (99.5)	764 (99.7)	371 (98.4)	172 (98.9)	215 (99.1)	4887 (99.4)	7302 (91.9)	12,189 (94.7)	3.34	3.19
EPS (+) surgery (+), steroids (+) EPS (+) surgery (+), steroids (+) (%)	4 (0.4)	6 (0.7)	6 (0.5)	1 (0.1)	5 (1.3)	2 (1.1)	1 (0.5)	25 (0.5)	500 (6.3)	525 (4.1)	4.15	3.89
EPS (+) surgery (+), steroids (-) EPS (+) surgery (+), steroids (-) (%)	-	-	-	-	-	-	-	-	16 (0.2)	16 (0.1)	-	-
EPS (+) surgery (-), steroids (+) EPS (+) surgery (-), steroids (+) (%)	1 (0.1)	-	1 (0.1)	-	1 (0.3)	-	-	3 (0.1)	65 (0.8)	68 (0.5)	3.89	3.29
EPS (+) surgery (-), steroids (-) EPS (+) surgery (-), steroids (-) (%)	-	-	-	1 (0.1)	-	-	1 (0.5)	2 (0.0)	65 (0.8)	67 (0.5)	8.38	4.89
Subtotal (%)	1135 (100.0)	915 (100.0)	1333 (100.0)	766 (100.0)	377 (100.0)	174 (100.0)	217 (100.0)	4917 (100.0)	7948 (100.0)	12,865 (100.0)	3.35	3.20
Unspecified	8	1	12	9	6	5	5	46	258	304	5.26	4.37
No information available	152	140	173	100	71	38	42	716	3245	3961	3.65	3.60
Total	1295	1056	1518	875	454	217	264	5679	11,451	17,130	3.40	3.27

These data were obtained from the patients on PD and the patients with past PD history currently on another dialysis modality

Conclusions

The number of PD patients has been stable around 9000~10,000 in these 10 years, and the penetration rate of PD among all dialysis patients was just 2.9%, which is one of the lowest numbers in the world. There were several unique points in the current status of PD therapy in Japan compared with other many countries. One of them was the combination therapy of PD and other dialysis modality and 21% of the PD patients were on the combination therapy. The second is lower PD dialysis dose as the mean PD Kt/V was 1.31, and it was supposed to be smaller than that from the world reports. The third is the lower risk of PD-related infections as the patient's peritonitis rate was 0.21 per patient-year and it was smaller than that of ISPD guideline. The final is about EPS. The percentage of the patients with the history of EPS among the patients with current and past PD treatment was 5.3%, and 80% of them had received the surgical treatment. The PD registry in Japan has clarified unique points in the current status of PD therapy in Japan and the differences from the trends in the other countries in the world. Based on the further analysis of the PD registry data, we would like to improve the quality of PD therapy in Japan and send messages about the merits of our therapeutic policy to the world.

Abbreviations

APD: Automated peritoneal dialysis; BUN: Blood urea nitrogen; CRDR: The committee of renal data registry; CRP: C-reactive protein; D/P Cr: Dialysate/plasma creatinine; EPS: Encapsulating peritoneal sclerosis; ESI: Exit-site infection; HDF: Hemodiafiltration; ISPD: The International Society for Peritoneal Dialysis; JRDR: JSDT renal data registry; JSDT: Japanese Society for Dialysis Therapy; Kt/V: Index for standardized dialysis dose defined as; K: urea clearance; PD: Peritoneal dialysis; PET: Peritoneal equilibration test; PTH: Parathyroid hormone; t: Dialysis time, V: body fluid volume; USB: Universal serial bus

Acknowledgements

We owe the completion of this survey to the efforts of the members of the subcommittee of local cooperation mentioned as follows and the staff members of dialysis facilities who participated in the survey and responded to the questionnaires. We would like to express our deepest gratitude to all these people.

District Cooperative Committee in JRDR

Noritomo Itami, Tetsuya Kawata, Chikara Oyama, Koji Seino, Toshinobu Sato, Shigeru Sato, Minoru Ito, Masaaki Nakayama, Atsushi Ueda, Takashi Yagisawa, Tetsuo Ando, Tomonari Ogawa, Hiroo Kumagai, Makoto Ogura, Takahiro Mochizuki, Ryoichi Ando, Kazuyoshi Okada, Tetsuya Kashiwagi, Chieko Hamada, Yugo Shibagaki, Nobuhito Hirawa, Junichiro Kazama, Yoichi Ishida, Hitoshi Yokoyama, Ryoichi Miyazaki, Mizuya Fukasawa, Masaki Nagasawa, Teppei Matsuoka, Akihiko Kato, Noriko Mori, Yasuhiko Ito, Hirotake Kasuga, Sukenari Koyabu, Takashi Udu, Tetsuya Hashimoto, Masaaki Inaba, Terumasa Hayashi, Tomoyuki Yamakawa, Shinichi Nishi, Akira Fujimori, Tatsuo Yoneda, Shigeo Negi, Akihisa Nakaoka, Takafumi Ito, Hitoshi Sugiyama, Takao Masaki, Yutaka Nitta, Hirofumi Hashimoto, Masato Yamanaka, Masaharu Kan, Kazumichi Ota, Masahito Tamura, Koji Mitsui, Yuji Ikeda, Masaharu Nishikido, Akira Miyata, Tadashi Tomo, Shoichi Fujimoto, Tsuyoshi Nosaki, Yoshinori Oshiro

Funding

There are no funding for the current study. All efforts and costs for the 2014 JRDR survey and making the report were totally given by JSDT.

Availability of data and materials

When anyone wants to use the data and materials from the current manuscript without modifications, all data and materials are freely available with stating "data from JSDT."

When anyone wants to use the data and materials from the current manuscript with modifications, any re-calculations or something, they have to state the following sentence in their publication. "The data reported here have been provided by Japanese Society for Dialysis Therapy (JSDT). The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as an official policy or interpretation of the JSDT."

Authors' contributions

IM was the director of CRDR in 2014 and directed all of the 2014 JRDR survey. IM and TH finalized the results of the survey and made this manuscript. SO and AW designed the survey sheets and made a special program mounted in MS Excel worksheet for the convenience of self-assessment for the dialysis quality of each dialysis facility. SN, NK, and TH had the responsibilities on the data analysis. KW had the responsibility on the ethical aspect of the JRDR survey. KN was the president of the JSDT in 2014 and checked all the results from the 2014 JRDR survey and approved them to be published. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Follow the "Availability of data and materials."

Ethics approval and consent to participate

The JSDT registry was approved by the ethical committee of JSDT; the approval no. is 1.

The aims of JSDT Renal Data Registry (JRDR) were well explained for the participated dialysis patients through the dialysis facilities.

It does not always need to get the documented approval form from the patients because all collected data were existing one and there were no new interventions.

The original data had been totally anonymized so there are no risks for deteriorating the privacy of the dialysis facilities and the patients.

The data presented in the current manuscript does not contain any images, videos, and voice recording which might have a risk for identifying an individual.

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Received: 25 January 2017 Accepted: 24 February 2017

Published online: 15 May 2017

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