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Annual dialysis data report of the 2018 JSDT Renal Data Registry: dementia, performance status, and exercise habits

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Abstract

According to the annual survey of the Japanese Society for Dialysis Therapy Renal Data Registry (JRDR) conducted at the end of 2018, there were a total of 339,841 patients receiving dialysis (hereinafter, dialysis patients) in Japan. The survey included questions regarding the presence/absence of dementia, the performance status (PS), and the exercise habits of individual patients. The survey revealed that 10.8% of all dialysis patients had dementia (1.8% in the age group of less than 65 years, 6.8% in the age group of 65–74 years, and 22.7% in the age group of 75 years or older). These prevalences of dementia were approximately equal to those estimated from the survey conducted in 2010. Regarding PS, the percentage of patients with lower activity levels tended to be relatively high among patients who were less than 15 years old and those who were 60 years old or older. Concerning the exercise habits of dialysis patients, the percentage of patients who were classified as "not at all or hardly" in response to the question about exercise habit was the highest (60–80%) of all the exercise habit classifications in each of the age groups analyzed.

Keywords: Dialysis, Registry, Dementia, Performance status, Exercise habits

Introduction

Since 1968, the Japanese Society for Dialysis Therapy (JSDT) has conducted a survey examining the status of chronic dialysis treatment in Japan at the end of every year. This survey, known as the JSDT Renal Data Registry (JRDR), covers nearly all dialysis facilities in Japan [1, 2]. Although these facilities participate voluntarily, the response rate is nearly 100%, suggesting that this survey represents the real-world status of regular dialysis in

Japan. The 2018 JRDR survey contains many topics such as the kinetics of chronic dialysis patients and dialysis facilities at the end of 2018, water treatment and hemodiafiltration, peritoneal dialysis, treatments for diabetes and mental and physical conditions, and the present status of viral hepatitis.

This basic research report was prepared to clarify the actual conditions of the prevalence of dementia, PS, and exercise habits among Japanese dialysis patients as of the end of 2018. The report also serves as an English translation of information regarding the presence/absence of dementia, performance status (PS), and exercise habits of dialysis patients in Japan obtained from the JRDR survey conducted at the end of 2018 and published, in

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Japanese, in the *Journal of the Japanese Society for Dialysis Therapy* [3, 4].

Materials and methods

Details of the survey conducted in 2018 are given in the report on the basic data from the survey [5]. In this survey, the presence/absence of dementia, PS, and exercise habits of dialysis patients were investigated. The patient survey included questions designed to investigate each survey item. Responses to the basic survey items included in the patient survey were collected from 327,336 patients.

Presence/absence of dementia

The survey of dialysis patients conducted in 2018 included questions to determine the presence/absence of dementia. The presence/absence of dementia at the time of the initiation of maintenance dialysis was first included as a question in the 2006 and 2007 surveys [6, 7]. In 2009 and 2010, the presence/absence of dementia was investigated for the entire survey population of dialysis patients [8, 9].

Dementia is defined as follows in the 10th version of the International Classification of Diseases, Injuries, and Causes of Death (ICD10): "dementia is a syndrome due to disease of the brain, usually of chronic or progressive nature, in which there is impairment of multiple higher cortical functions, including memory, thinking, orientation, calculation, learning capacity, language and judgement" [10]. For the diagnosis of dementia, it is necessary to evaluate the cognitive functions of the patient through interviews of the patient and his/her family members; scales such as the Mini Mental State Examination (MMSE) and Hasegawa dementia rating scale-revised (HDS-R) are usually used [11]. During the current survey, a questionnaire was mailed to each participating facility, requesting the facility to answer the questionnaire about the patients and to return the completed questionnaire to our society. Using this survey design, it was impossible to have experts confirm the dementia

Table 1 Performance status [4]

A	(Score 0) Fully active, able to carry on all pre-disease performance without restriction.
B	(Score 1) Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light housework, office work.
C	(Score 2) Ambulatory and capable of all self-care but unable to carry out any work activities. Up and about more than 50% of waking hours.
D	(Score 3) Capable of only limited self-care, confined to bed or chair more than 50% of waking hours.
E	(Score 4) Completely disabled. Cannot carry on any self-care. Totally confined to bed or chair.
Z	Unknown

diagnoses of all the patients being managed at the participating facilities. Thus, the determination of the presence/absence of dementia in this survey was based solely on the inquiry described below and the answer choices contained in the questionnaire.

Please indicate the presence or absence of dementia in the patient at the end of December 2018. *If the patient has not been diagnosed as having dementia by a dementia specialist, the diagnosis made by the patient's main physician based on the patient's status during dialysis treatments or consultations is acceptable.
• Answer choices
A. Without dementia
B. With dementia
Z. Unspecified

In response to the question regarding the presence/absence of dementia during this survey, 250,042 patients (76.4%) were classified as "Without dementia" or "With dementia."

The proportion of patients who were classified as "With dementia" among all the patients who responded to the question about the presence/absence of dementia

Table 2 Age and dementia prevalence (all dialysis patients)

	Without dementia	With dementia	Total	Dementia unknown	No information available	Grand total	Dementia prevalence (%)
Age <65 years	79,339	1452	80,791	5858	18,578	105,227	1.8
Age 65–74 years	75,884	5503	81,387	6133	18,862	106,382	6.8
Age 75 years or older	67,932	19,932	87,864	7287	20,576	115,727	22.7
Total	223,155	26,887	250,042	19,278	58,016	327,336	10.8
Unspecified/no information available	0	0	0	0	0	0	
Grand total	223,155	26,887	250,042	19,278	58,016	327,336	10.8

The data were obtained from the patient survey
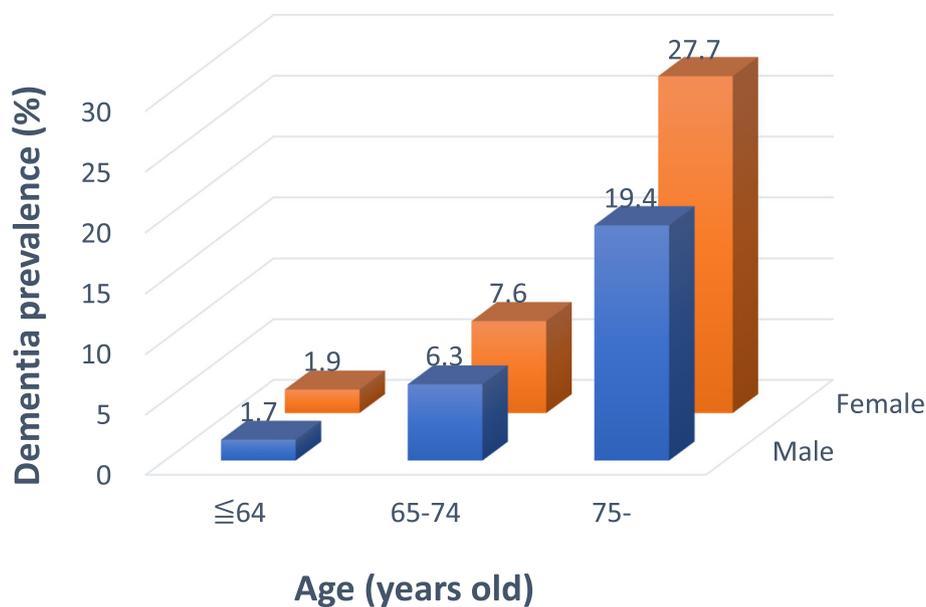
Fig. 1 Dementia prevalence sorted according to age and sex. Data were obtained from the patient survey

was adopted as the "dementia prevalence." The dementia prevalence was calculated using the equation shown below.

$$\text{Dementia prevalence (\%)} = [\text{number of patients who were classified as "With dementia"}]$$

$$\div [\text{"number of patients who were classified as "With dementia"}$$

$$+ \text{number of patients who were classified as "Without dementia"}] \times 100$$

Performance status (PS)

The 2018 survey questionnaire contained questions designed to determine the Eastern Cooperative Oncology Group (ECOG) PS of the patients [4] (Table 1).

According to this PS scale, a higher score means a lower physical activity level of the patient. Under this survey program, PS was first investigated in 1998 and was subsequently examined in 2002 and 2009 [8, 12, 13]. In the current survey, valid responses to the questions about PS were collected from 251,609 patients (76.9%).

Exercise habits

The 2018 survey questionnaire included, for the first time, questions designed to investigate the exercise habits of dialysis patients. Exercise habits had not been covered by any survey conducted previously within the framework of this survey program. Exercise habits were investigated using the
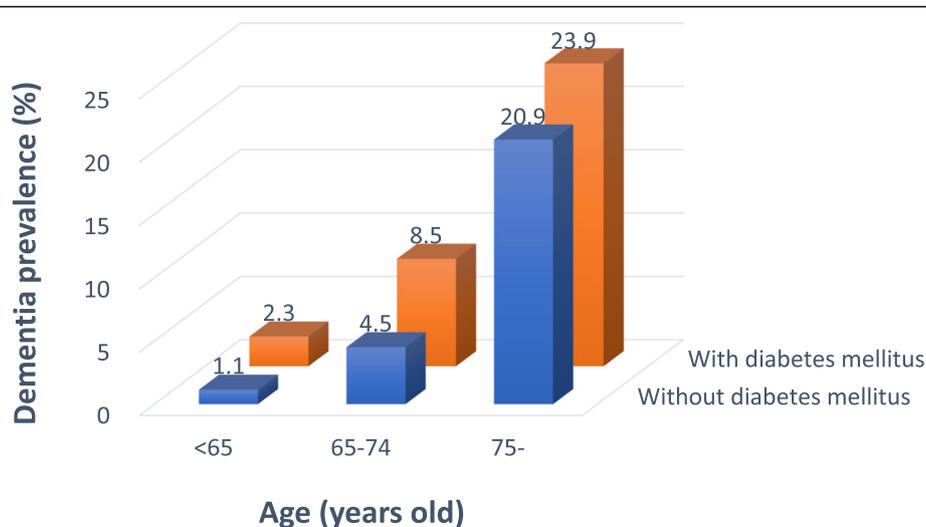
Fig. 2 Dementia prevalence sorted according to age and diabetic status. Data were obtained from the patient survey

Table 3 The prevalence of dementia sorted by age and main three kinds of treatment methods

Age (years old)	Facility hemodialysis							Hemodiafiltration							Peritoneal dialysis						
	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)
<65	41,590	905	42,495	3043	9630	55,168	2.13	34,291	519	34,810	2635	7420	44,865	1.49	2723	22	2745	155	1370	4270	0.80
65≤, <75	44,895	3752	48,647	3448	10,769	62,864	7.71	28,587	1670	30,257	2544	7151	39,952	5.52	1732	66	1798	105	797	2700	3.67
75≤	44,341	14,338	58,679	4723	13,045	76,447	24.43	22,215	5328	27,543	2453	6821	36,817	19.34	1121	244	1365	90	644	2099	17.88
Subtotal	130,826	18,995	149,821	11,214	33,444	194,479	12.68	85,093	7517	92,610	7632	21,392	121,634	8.12	5576	332	5908	350	2811	9069	5.62
Unspecified	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0	
No data available	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0	
Total	130,826	18,995	149,821	11,214	33,444	194,479	12.68	85,093	7517	92,610	7632	21,392	121,634	8.12	5576	332	5908	350	2811	9069	5.62
Mean	68.63	79.37	69.99	70.42	69.86	70.00		66.04	78.11	67.02	67.95	67.78	67.21		63.09	78.56	63.96	62.64	63.74	63.84	
S.D.*	12.10	8.37	12.23	12.45	12.36	12.26		12.26	9.18	12.48	12.18	12.38	12.45		14.07	8.96	14.29	17.66	14.67	14.55	

S.D. standard deviation
Data were obtained from the patient survey
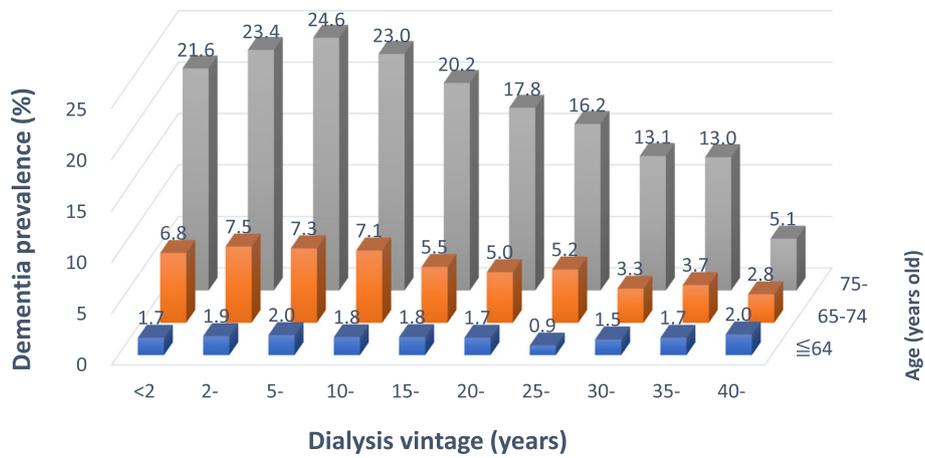
Fig. 3 Dementia prevalence sorted age and dialysis vintage. Data were obtained from the patient survey
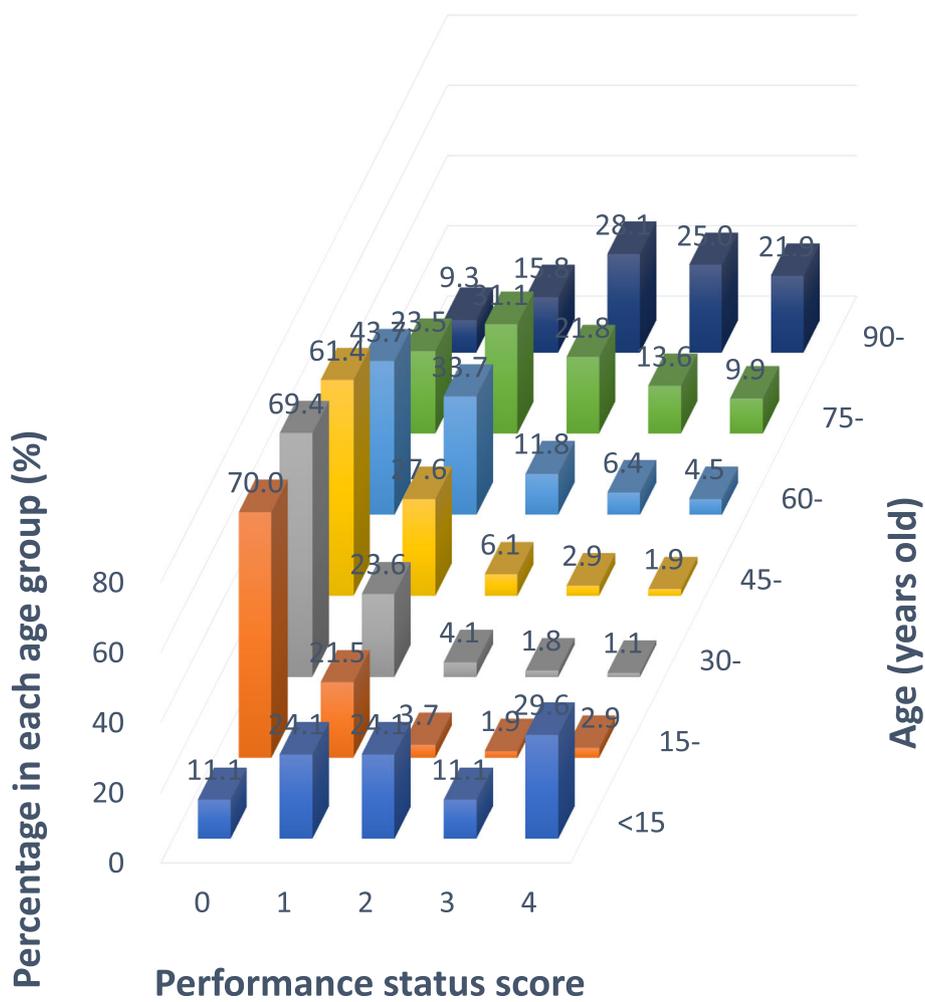
Fig. 4 Performance status and age. The numbers in the figure indicate the percentages for each age group. Data were obtained from the patient survey.

Table 4 Performance status of patients treated by main three kinds of treatment, sorted by different age

Dialysis method	Performance status score					Subtotal	Unspecified	No data available	Total
	Score 0	Score 1	Score 2	Score 3	Score 4				
a. Age <20 years old									
Facility hemodialysis	12	2	3	0	2	19	2	5	26
%	(63.2)	(10.5)	(15.8)	(0.0)	(10.5)	(100.0)			
Hemodiafiltration	7	2	0	1	0	10	0	2	12
%	(70.0)	(20.0)	(0.0)	(10.0)	(0.0)	(100.0)			
Peritoneal dialysis	11	24	12	7	18	72	10	35	117
%	(15.3)	(33.3)	(16.7)	(9.7)	(25.0)	(100.0)			
Total	30	28	15	8	20	101	12	42	155
%	(29.7)	(27.7)	(14.9)	(7.9)	(19.8)	(100.0)			
b. Age 20≤,<45 years old									
Facility hemodialysis	3314	1197	224	106	87	4928	242	1304	6474
%	(67.2)	(24.3)	(4.5)	(2.2)	(1.8)	(100.0)			
Hemodiafiltration	3214	1017	172	63	26	4492	102	1099	5693
%	(71.5)	(22.6)	(3.8)	(1.4)	(0.6)	(100.0)			
Peritoneal dialysis	274	89	7	6	6	382	34	238	654
%	(71.7)	(23.3)	(1.8)	(1.6)	(1.6)	(100.0)			
Total	6802	2303	403	175	119	9802	378	2641	12,821
%	(69.4)	(23.5)	(4.1)	(1.8)	(1.2)	(100.0)			
c. Age 45≤,<60 years old									
Facility hemodialysis	13,855	6543	1590	842	612	23,442	969	6010	30,421
%	(59.1)	(27.9)	(6.8)	(3.6)	(2.6)	(100.0)			
Hemodiafiltration	12,594	5504	1113	455	239	19,905	500	5014	25,419
%	(63.3)	(27.7)	(5.6)	(2.3)	(1.2)	(100.0)			
Peritoneal dialysis	1018	358	48	11	13	1448	79	821	2348
%	(70.3)	(24.7)	(3.3)	(0.8)	(0.9)	(100.0)			
Total	27,467	12,405	2751	1308	864	44,795	1548	11,845	58,188
%	(61.3)	(27.7)	(6.1)	(2.9)	(1.9)	(100.0)			
d. Age 60≤,<75 years old									
Facility hemodialysis	26,500	20,676	7809	4425	3566	62,976	2234	15,901	81,111
%	(42.1)	(32.8)	(12.4)	(7.0)	(5.7)	(100.0)			
Hemodiafiltration	18,841	14,599	4557	2305	1232	41,534	1023	11,136	53,693
%	(45.4)	(35.1)	(11.0)	(5.5)	(3.0)	(100.0)			
Peritoneal dialysis	1396	680	171	55	48	2350	210	1291	3851
%	(59.4)	(28.9)	(7.3)	(2.3)	(2.0)	(100.0)			
Total	46,737	35,955	12,537	6785	4846	106,860	3467	28,328	138,655
%	(43.7)	(33.6)	(11.7)	(6.3)	(4.5)	(100.0)			
e. Age 75≤ years old									
Facility hemodialysis	12,862	16,935	13,098	8973	7275	59,143	2183	15,121	76,447
%	(21.7)	(28.6)	(22.1)	(15.2)	(12.3)	(100.0)			
Hemodiafiltration	6692	9310	6252	3558	2123	27,935	730	8152	36,817
%	(24.0)	(33.3)	(22.4)	(12.7)	(7.6)	(100.0)			
Peritoneal dialysis	426	381	229	132	89	1257	145	697	2099
%	(33.9)	(30.3)	(18.2)	(10.5)	(7.1)	(100.0)			

Table 4 Performance status of patients treated by main three kinds of treatment, sorted by different age *(Continued)*

Dialysis method	Performance status score					Subtotal	Unspecified	No data available	Total
	Score 0	Score 1	Score 2	Score 3	Score 4				
Total	19,980	26,626	19,579	12,663	9487	88,335	3058	23,970	115,363
%	(22.6)	(30.1)	(22.2)	(14.3)	(10.7)	(100.0)			

The data were obtained from the patient survey

following 7 answer choices in response to a question regarding exercise habits.

  A. Not at all or hardly
  B. Less than once a week
  C. Almost once a week
  D. Two or three times a week
  E. Four or five times a week
  F. Every day or nearly every day
  Z. Unknown

In the current survey, an answer to the question regarding exercise habits was collected from 213,930 patients (65.4%).

Results
Presence/absence of dementia
Age and dementia prevalence
The prevalence of dementia was calculated among all the dialysis patients and in each of the major age groups. The

Table 5 The prevalence of dementia sorted by age and performance status

Presence/absence of dementia	Performance status score					Subtotal	Unspecified	No data available	Total
	Score 0	Score 1	Score 2	Score 3	Score 4				
a. Age <65 years old									
Without dementia	46,015	21,848	4885	2292	1283	76,323	1233	1783	79,339
With dementia	289	278	226	235	348	1376	37	39	1452
Subtotal	46,304	22,126	5111	2527	1631	77,699	1270	1,822	80,791
Unspecified	592	481	161	94	175	1503	1462	2893	5858
No data available	1008	517	127	80	38	1,770	54	16,754	18,578
Total	47,904	23,124	5399	2701	1844	80,972	2786	21,469	105,227
Dementia prevalence (%)	0.6	1.3	4.4	9.3	21.3	1.8	2.9	2.1	1.8
b. Age 65≤,<75 years old									
Without dementia	32,132	25,876	8703	4218	2211	73,140	1120	1624	75,884
With dementia	519	953	1158	1100	1472	5202	116	185	5503
Subtotal	32,651	26,829	9861	5318	3683	78,342	1236	1809	81,387
Unspecified	460	530	336	196	262	1784	1351	2998	6133
No data available	767	648	260	130	86	1891	57	16,914	18,862
Total	33,878	28,007	10,457	5644	4031	82,017	2644	21,721	106,382
Dementia prevalence (%)	1.6	3.6	11.7	20.7	40.0	6.6	9.4	10.2	6.8
c. Age 75≤ years old									
Without dementia	18,242	22,867	13,660	7186	3305	65,260	1101	1571	67,932
With dementia	1030	2613	4918	4814	5551	18,926	371	635	19,932
Subtotal	19,272	25,480	18,578	12,000	8856	84,186	1472	2206	87,864
Unspecified	339	635	603	449	475	2501	1544	3242	7287
No data available	429	611	480	244	169	1933	50	18,593	20,576
Total	20,040	26,726	19,661	12,693	9,500	88,620	3,066	24,041	115,727
Dementia prevalence (%)	5.3	10.3	26.5	40.1	62.7	22.5	25.2	28.8	22.7

The data were obtained from the patient survey

results are shown in Table 2. The overall dementia prevalence among dialysis patients in the 2018 survey was 10.8% (1.8% in the age group of less than 65 years, 6.8% in the age group of 65–74 years, and 22.7% in the age group of 75 years or older). Thus, the dementia prevalence was markedly higher among subjects older than 65 years.

Sex and dementia prevalence
Figure 1 shows the dementia prevalence in each of the major age groups calculated according to sex. In each age group, the dementia prevalence was higher among females than among males (Supplementary Table 1).

Presence/absence of diabetes mellitus and dementia prevalence
Figure 2 shows the relationship between the presence/absence of diabetes mellitus and the dementia prevalence (Supplementary Table 2). In each age group, the dementia prevalence was higher among diabetic patients than among non-diabetic patients.

Treatment method and dementia prevalence
Table 3 shows the relationship between the three main treatment methods (facility hemodialysis, hemodiafiltration, and peritoneal dialysis) and the dementia prevalence. Hemodialysis patients had the highest prevalence of dementia, followed by hemodiafiltration patients and peritoneal dialysis patients.

Dialysis vintage and dementia prevalence
Figure 3 shows the relationship between the dialysis vintage and the dementia prevalence. During the first 10 years of dialysis, the dementia prevalence increased as the dialysis vintage increased (Supplementary Table 3). After 10 years, however, the dementia prevalence decreased as the dialysis vintage increased.

Performance status (PS)
Age and PS
Figure 4 graphically represents the distribution of age and PS (Supplementary Table 4). The percentages of patients with lower activity levels (higher PS scores) were relatively high among patients who were less than 15 years old or 60 years or older. Among patients who were 90 years or
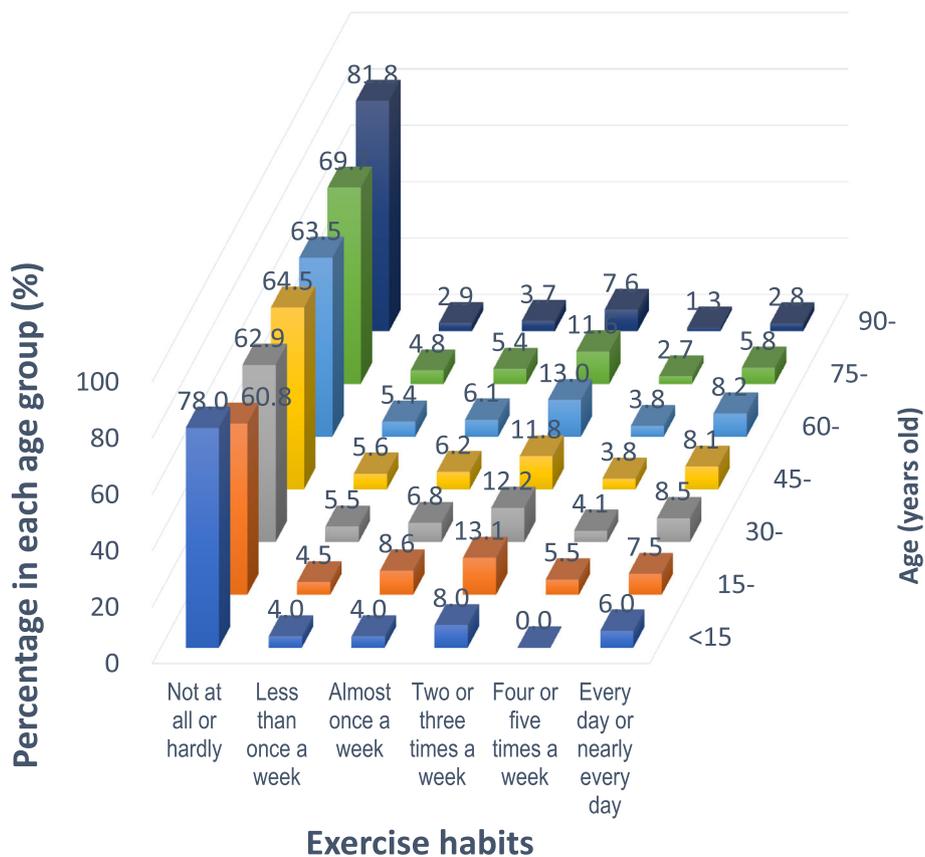
Fig. 5 Exercise habits and age. The numbers in the figure indicate the percentages for each age group. Data were obtained from the patient survey

older, the overwhelming majority of patients had low activity levels (high PS scores), and the percentage of patients with high activity levels (low PS scores) was small.

Treatment method and PS
Table 4 shows the relationship between the main three treatment methods (facility hemodialysis, hemodiafiltration, and peritoneal dialysis) and PS. The number of patients tabulated in some cells was too small, so this tabulation was performed as "under 20 years old" instead of "under 15 years old." Among patients aged 20 years or older, patients treated by peritoneal dialysis were the most active, followed by those treated with hemodiafiltration and facility hemodialysis. Among patients under the age of 20 years, patients treated by hemodiafiltration were the most active, followed by those treated with facility hemodialysis and peritoneal dialysis.

Dementia prevalence and PS
Table 5 shows the results summarizing the relationship between the prevalence of dementia and PS according to

different age groups. Regardless of age, patients with a lower activity have a higher prevalence of dementia.

Exercise habits
Age and exercise habits
Figure 5 shows the results of the analysis of age versus exercise habits among the dialysis patients (Supplementary Table 5). In each age group, patients who were classified as "Not at all or hardly" in response to the question on exercise habits were predominant, accounting for 60–80% of all the patients.

Dialysis vintage and exercise habits
Next, the patients were divided into four age groups (0–44, 45–64, 65–74, and 75 years or older), and the relationship between the dialysis vintage and exercise habits was analyzed in each age group (Figs. 6, 7, 8 and 9; Supplementary Table 6). In the 45 years and older age groups, the percentages of patients who were classified as "Not at all or hardly" tended to be higher when the dialysis vintage was 35 years or longer. In the 0–44 age groups, the percentage of patients who were classified as "Not at all or
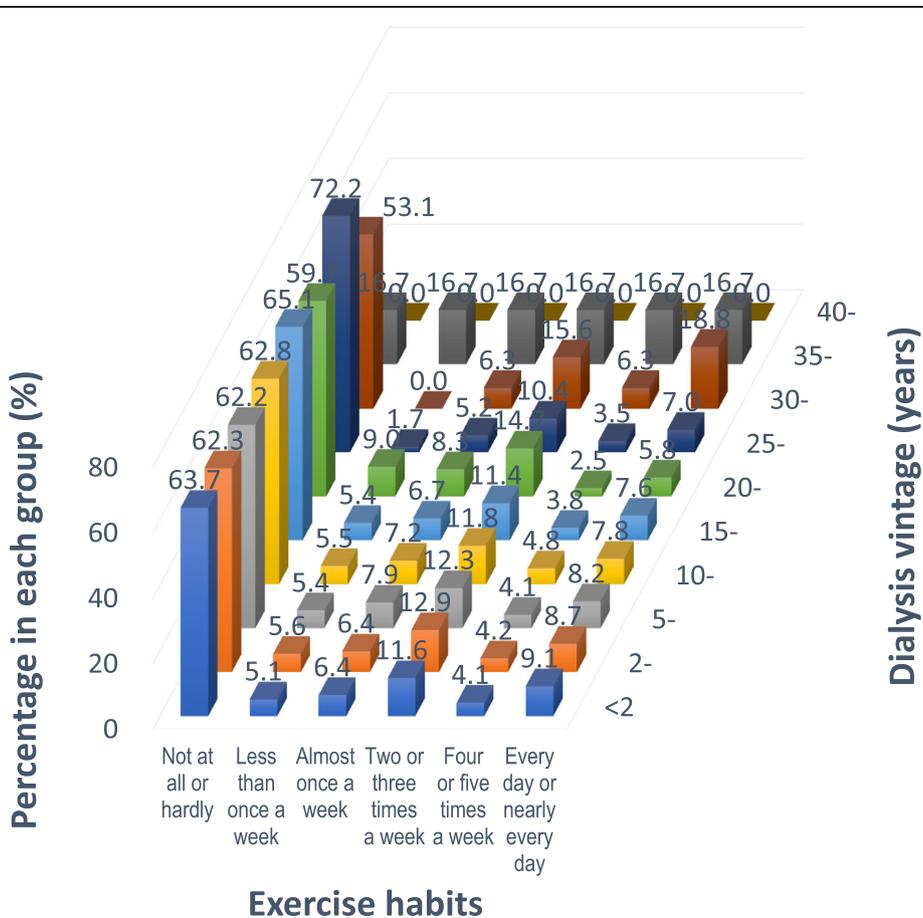
Fig. 6 Exercise habits and dialysis vintage: under 45 years old. The numbers in the figure indicate the percentages for each dialysis vintage group. Data were obtained from the patient survey

hardly" tended to increase in the group with a dialysis vintage of 25–29 years. However, the age 0–44 age groups included almost no patients with a dialysis vintage of 35 years or longer. No other evident relationship between the duration vintage and exercise habits was seen.

PS and exercise habits

Table 6 shows the results summarizing the relationship between exercise habits and PS for all the patients. Patients who exercised more often had a higher physical activity.

Dementia prevalence and exercise habits

Table 7 shows the results of tabulating the relationship between exercise habits and the prevalence of dementia according to major age group. Patients who exercised more frequently had a lower prevalence of dementia across all age groups.

Discussion

Presence/absence of dementia

Age and dementia prevalence

When the prevalence of dementia was analyzed in each of the major age groups, the dementia prevalence was found to be markedly increased in the 65 years or older age group (Table 2). As reference data, Fig. 10 shows the changes in dementia prevalence over time for each of the major age groups in the 2009, 2010, and 2018 surveys (Supplementary Table 7). The analyses in the 2009 and 2010 surveys were confined to "patients receiving hemodialysis at a facility 3 times/week" [8, 9]. For this reason, the analysis in 2018 included only "patients receiving hemodialysis at facilities 3 times/week." The dementia prevalence in 2018 in each age group was approximately equal to the corresponding prevalence recorded in 2009 and 2010. This indicates that the status of dementia prevalence among dialysis patients in Japan has not changed markedly over the past decade.
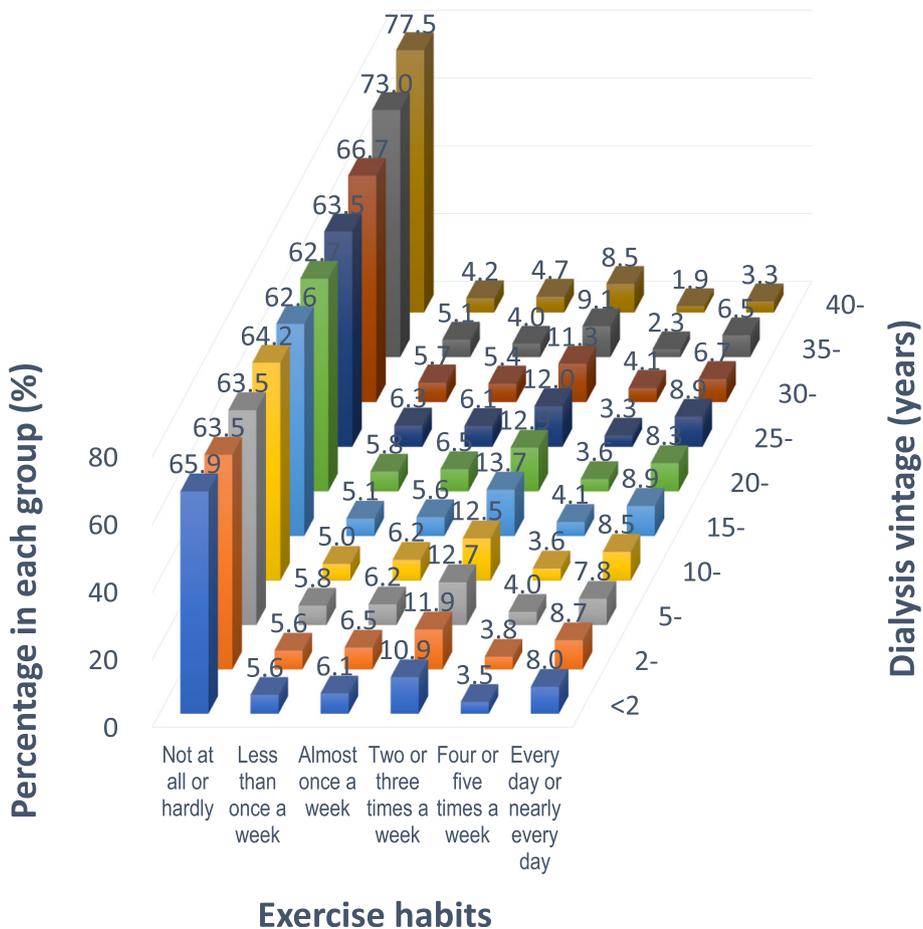
Fig. 7 Exercise habits and dialysis vintage: 45–64 years old. The numbers in the figure indicate the percentages for each dialysis vintage group. Data were obtained from the patient survey
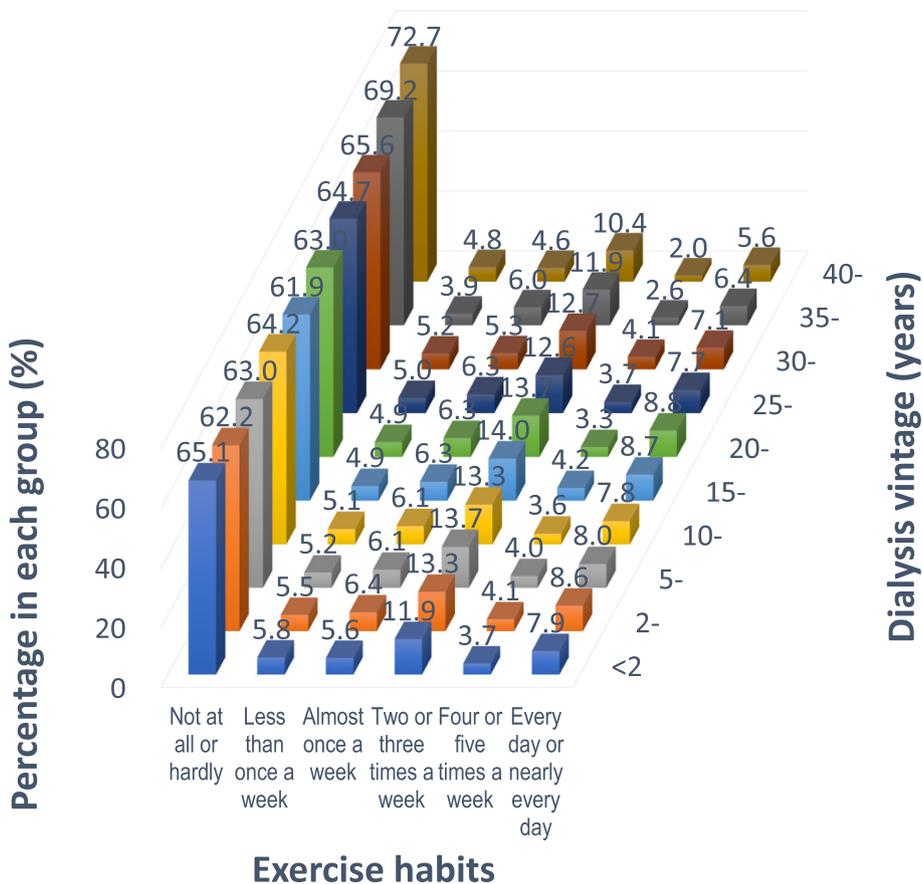
Fig. 8 Exercise habits and dialysis vintage: 65–74 years old. The numbers in the figure indicate the percentages for each dialysis vintage group. Data were obtained from the patient survey

Sex and dementia prevalence

When the dementia prevalence in each of the major age groups was analyzed according to sex, the prevalence in each age group was higher in the females than in the males (Fig. 1). A similar trend to that noted in the current survey was also observed in the surveys conducted in 2009 and 2010 within the framework of this survey program [8, 9]. Among elderly patients, the prevalence of dementia is generally higher in females than in males [14]. On the other hand, in Japan, the prevalence of dementia among young people under the age of 65 years has been reported to be lower in females than in males [15]. However, in this report, the prevalence of dementia in dialysis patients under the age of 65 years was higher in females than in males. To explore this matter, the prevalence of dementia according to the presence or absence of diabetes and the dialysis vintage was calculated for each sex (Tables 8 and 9). As shown here, the prevalence of dementia calculated for each age group was higher in females than in males, regardless of the presence of diabetes or the dialysis vintage. These

results indicate that among Japanese dialysis patients, females are more susceptible to dementia than males. We could not clarify the reason for this difference in the present analysis.

Presence/absence of diabetes mellitus and dementia prevalence

An analysis of the relationship between the presence/absence of diabetes mellitus and the dementia prevalence revealed that the dementia prevalence was higher among diabetic patients than among non-diabetic patients in each age group (Fig. 2). This result was consistent with the previously reported finding that diabetes mellitus is a risk factor for dementia [16]. A trend similar to that observed in the current survey was also noted in the surveys conducted in 2009 and 2010 within the framework of this survey program [8, 9].

Treatment method and dementia prevalence

As shown in Table 3, facility hemodialysis patients had the highest prevalence of dementia, followed by
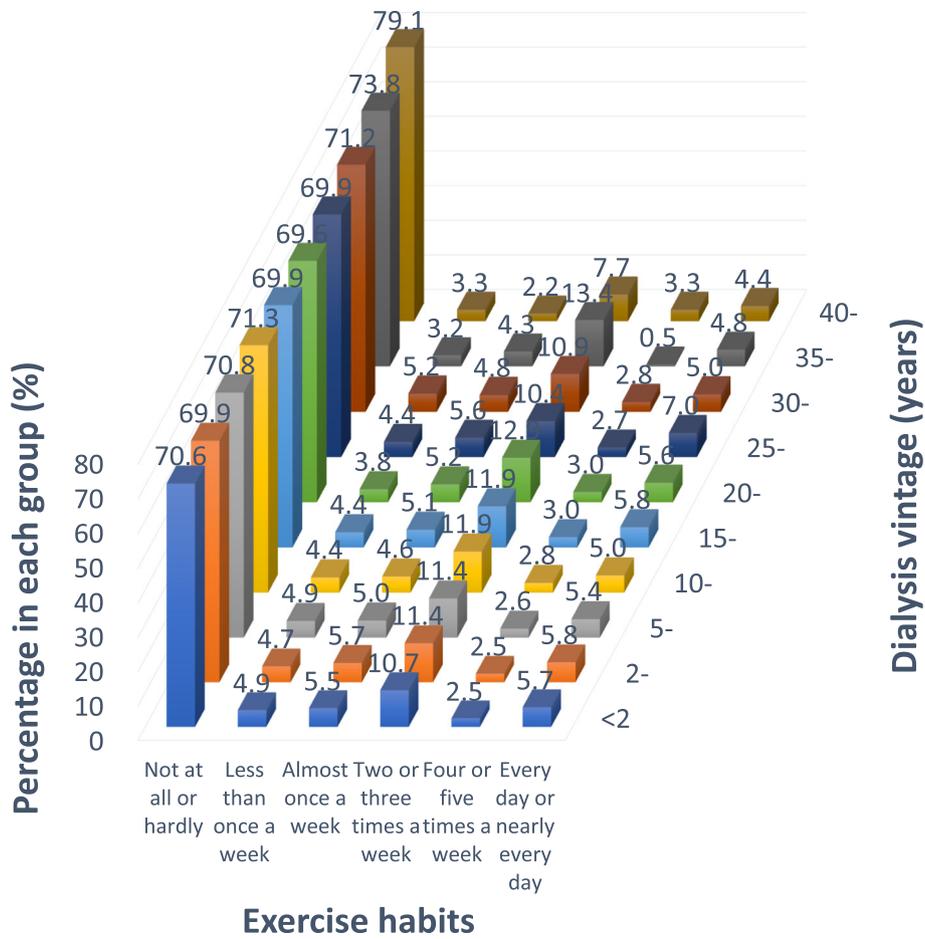
Fig. 9 Exercise habits and dialysis vintage: 75 years or older. The numbers in the figure indicate the percentages for each dialysis vintage group. Data were obtained from the patient survey

hemodiafiltration patients and peritoneal dialysis patients, regardless of age. Table 10 shows the basic background factors of the patients who were treated with each of the three main treatment methods. The mean age of the facility hemodialysis patients was the highest, followed by the mean ages of the hemodiafiltration and peritoneal dialysis patients. However, the prevalence of dementia, shown in Table 3, had already been stratified according to the different age groups. Therefore, it is difficult to attribute the high prevalence of dementia in facility hemodialysis patients to their advanced age. The mean dialysis vintage was the longest for hemodiafiltration, followed by those for facility hemodialysis and peritoneal dialysis. There was no significant difference in the percentage of male patients receiving each treatment. Thus, it seems unlikely that these findings could have affected the high prevalence of dementia among facility hemodialysis patients. The prevalence of diabetes was highest among facility hemodialysis patients, followed by patients receiving hemodiafiltration and peritoneal dialysis. This report shows that patients with diabetes have a

high prevalence of dementia. This may have affected the high prevalence of dementia among facility hemodialysis patients and the low prevalence of dementia among peritoneal dialysis patients.

Dialysis vintage and dementia prevalence
In an analysis of the relationship between the duration of dialysis and the dementia prevalence, the dementia prevalence increased as the dialysis vintage increased in patients whose dialysis vintage was less than 10 years. Among patients whose dialysis vintage was more than 10 years, however, the dementia prevalence decreased as the dialysis vintage increased (Fig. 3). A trend similar to the one observed in the current survey was also noted in the surveys conducted in 2009 and 2010 within the framework of this survey program [8, 9]. To clarify this background, the relationships between dialysis vintage and basic background factors are summarized in Table 11. No significant difference in the mean age of patients belonging to each dialysis vintage was seen for patients with a dialysis vintage of less than 10 years, but the mean age tended to be lower in patients with a long dialysis vintage among

Table 6 Exercise habits and performance status (all dialysis patients)

Exercise habits	Performance status score					Subtotal	Unspecified	No data available	Total
	Score 0	Score 1	Score 2	Score 3	Score 4				
Not at all or hardly	48,347	40,194	22,863	15,643	13,161	140,208	781	576	141,565
%	(34.5)	(28.7)	(16.3)	(11.2)	(9.4)	(100.0)			
Less than once a week	4522	4282	1596	479	139	11,018	13	10	11,041
%	(41.0)	(38.9)	(14.5)	(4.3)	(1.3)	(100.0)			
Almost once a week	5315	4541	1769	648	172	12,445	35	20	12,500
%	(42.7)	(36.5)	(14.2)	(5.2)	(1.4)	(100.0)			
Two or three times a week	11,325	9262	3256	1457	497	25,797	43	197	26,037
%	(43.9)	(35.9)	(12.6)	(5.6)	(1.9)	(100.0)			
Four or five times a week	3975	2472	483	167	98	7195	7	33	7235
%	(55.2)	(34.4)	(6.7)	(2.3)	(1.4)	(100.0)			
Every day or nearly every day	9398	4699	969	275	86	15,427	21	104	15,552
%	(60.9)	(30.5)	(6.3)	(1.8)	(0.6)	(100.0)			
Subtotal	82,882	65,450	30,936	18,669	14,153	212,090	900	940	213,930
%	(39.1)	(30.9)	(14.6)	(8.8)	(6.7)	(100.0)			
Unspecified	16,455	10,356	3730	2012	1010	33,563	7507	718	41,788
No data available	2485	2051	851	357	212	5956	89	65,573	71,618
Total	101,822	77,857	35,517	21,038	15,375	251,609	8496	67,231	327,336
%	(40.5)	(30.9)	(14.1)	(8.4)	(6.1)	(100.0)			

The data were obtained from the patient survey

patients with a dialysis vintage of 10 years or more. In addition, a small proportion of patients with a dialysis vintage of 10 years or more had diabetes. This tendency was remarkable among patients with a dialysis vintage of 20 years or more. Thus, patients with diabetes had a relatively high prevalence of dementia in this tabulation. This may have been associated with the low prevalence of dementia among patients with a long dialysis vintage. It was previously reported that in non-diabetic patients with no history of cerebrovascular disease undergoing maintenance hemodialysis, the risk of the onset of dementia decreased as the dialysis vintage increased [17]. The results of the current survey may be consistent with this previous report.

Performance status (PS)
Age and PS
When the PS was analyzed according to age, the percentage of patients with lower activity levels (larger PS scores) increased in the 75 years or older age group. In the 65–74 years age group, on the other hand, the distribution of the PS scores was close to that in the 45–59 years age group. This result may indicate that the physical activity level in dialysis patients is relatively well preserved until the age of 75 years but begins to decrease rapidly after the age of 75 years. On the other hand, there were many patients with low activity scores in the under 15-year-old age group. This finding may indicate

that renal failure impedes the development of the patients' physical functions.

Figures 11, 12, and 13 show the distribution of the PS scores in each of the major age groups evaluated at 3 points of time (1998, 2009, and 2018) [8, 12]. The data for 1998 and 2018 cover all the dialysis patients, while the data for 2009 covers only those patients who were receiving hemodialysis at a facility 3 times/week. During the period from 1998 to 2009, the percentage of patients with high activity levels increased slightly and that of patients with low activity levels decreased slightly in each age group (note that a small PS score means a high activity level). However, during the period from 2009 to 2018, the percentage of patients with high activity levels decreased and that of patients with low activity levels increased slightly in the 75 years or older age group. This may indicate that the physical activity level in the dialysis patients tended to improve from 1998 to 2009, but has improved minimally thereafter.

Treatment method and PS
As shown in Table 4, among patients aged 20 years and older, the PS of peritoneal dialysis patients was better than those of hemodiafiltration and facility hemodialysis patients. The number of patients tabulated in some cells was too small, so this tabulation

Table 7 Exercise habits and the prevalence of dementia, sorted by different age

Exercise habits	Presence/absence of dementia		Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)
	Without dementia	With dementia					
a. Age <65 years old							
Not at all or hardly	40,525	933	41,458	754	939	43,151	2.3
Less than once a week	3571	51	3622	81	37	3740	1.4
Almost once a week	4007	92	4099	57	54	4210	2.2
Two or three times a week	7686	123	7809	137	233	8179	1.6
Four or five times a week	2450	22	2472	31	46	2549	0.9
Every day or nearly every day	5342	42	5384	84	107	5575	0.8
Subtotal	63,581	1263	64,844	1144	1416	67,404	1.9
Unspecified	12,753	139	12,892	1827	349	15,068	1.1
No data available	3005	50	3055	2887	16,813	22,755	1.6
Total	79,339	1452	80,791	5858	18,578	105,227	1.8
b. Age 65≤,<75 years old							
Not at all or hardly	38,775	3786	42,561	890	900	44,351	8.9
Less than once a week	3404	157	3561	102	37	3700	4.4
Almost once a week	3907	220	4127	63	52	4242	5.3
Two or three times a week	8348	408	8756	177	249	9182	4.7
Four or five times a week	2520	57	2577	45	60	2682	2.2
Every day or nearly every day	5326	133	5459	103	119	5681	2.4
Subtotal	62,280	4761	67,041	1380	1417	69,838	7.1
Unspecified	10,796	467	11,263	1765	351	13,379	4.1
No data available	2808	275	3083	2988	17,094	23,165	8.9
Total	75,884	5503	81,387	6133	18,862	106,382	6.8
c. Age 75≤ years old							
Not at all or hardly	37,285	14,275	51,560	1480	1023	54,063	27.7
Less than once a week	2952	518	3470	93	38	3601	14.9
Almost once a week	3330	590	3920	80	48	4048	15.1
Two or three times a week	6992	1257	8249	208	219	8676	15.2
Four or five times a week	1740	183	1923	41	40	2004	9.5
Every day or nearly every day	3703	401	4104	111	81	4296	9.8
Subtotal	56,002	17,224	73,226	2013	1449	76,688	23.5
Unspecified	9273	1762	11,035	2038	268	13,341	16.0
No data available	2657	946	3603	3236	18,859	25,698	26.3
Total	67,932	19,932	87,864	7287	20,576	115,727	22.7

The data were obtained from the patient survey

was performed as "under 20 years old" instead of "under 15 years old." This table may indicate that highly active patients are more likely to choose peritoneal dialysis. On the other hand, among patients under the age of 20 years, most of the patients chose peritoneal dialysis, and several peritoneal dialysis patients had low activity levels. These results suggest that pediatric renal failure patients tend to choose peritoneal dialysis and that their physical activity level is relatively low.

Dementia prevalence and PS
As shown in Table 5, regardless of age, patients with lower activity levels had a higher prevalence of dementia. Previous studies have shown that physical activity prevents the onset of dementia [18, 19]. The result of this
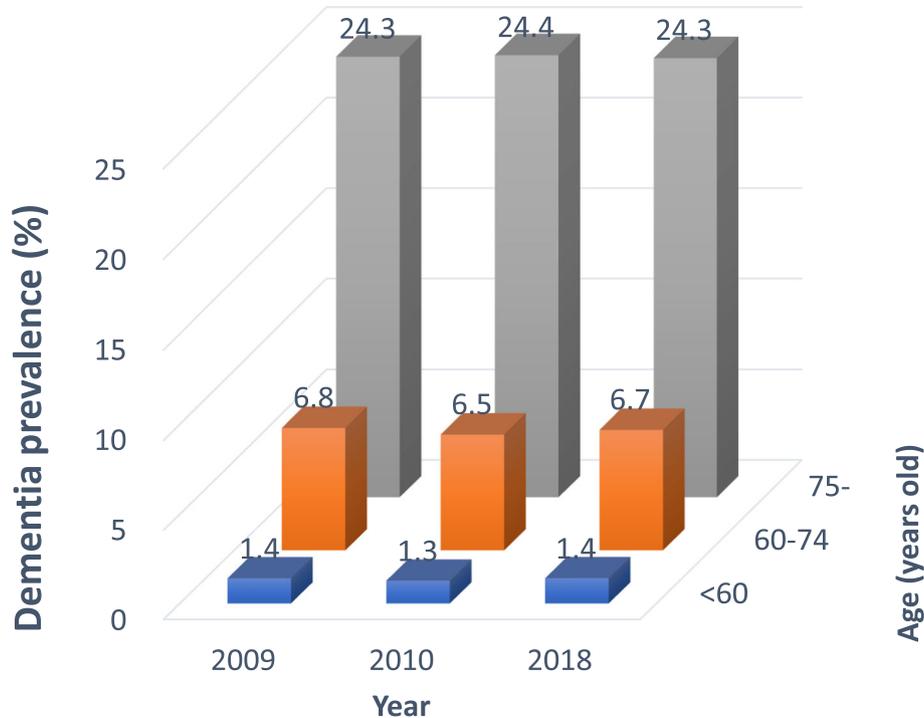
Fig. 10 Trend in dementia prevalence in hemodialysis patients who were treated three times a week. Data were obtained from the patient survey

report is consistent with the results of these previous studies.

Exercise habits

Age and exercise habits

When exercise habits were analyzed according to age, the answer "Not at all or hardly" was predominantly selected in each age group (Fig. 9). The next most frequently selected choice was "Two or three times a week" (8–13%) in each age group. This may indicate that the patients exercised at a pace consistent with a schedule in which hemodialysis was performed three times weekly. The percentages of patients who were classified as "Almost once a week" and "Every day or nearly every day" were each 4–8% in each age group.

Dialysis vintage and exercise habits

When the exercise habits were analyzed according to dialysis vintage (Figs. 7, 8, and 9), the percentage of patients who were classified as "Not at all or hardly" tended to be relatively high in the patients with a long dialysis vintage in each age group. This finding suggests that some patients receiving prolonged hemodialysis might have developed a motor disorder.

PS and exercise habits

As shown in Table 6, patients who exercised more often had higher physical activities. However, these results represent single observations made at one time point. Therefore, the causal relationship between exercise habits and physical activity cannot be discussed based on these results. However, this result indicates that exercise habits and physical activity are closely related even in dialysis patients.

Dementia prevalence and exercise habits

As shown in Table 7, patients who exercised more frequently had a lower prevalence of dementia across all age groups. Previous studies have shown that physical exercise prevents the onset of dementia [18, 19]. This result is consistent with the results of these previous studies. However, the present results represent observations made at a single point in time. Therefore, the causal relationship between exercise habits and dementia prevalence cannot be discussed based on these results.

Conclusion

In the 2018 survey, the presence/absence of dementia, PS, and exercise habits was investigated in individual

Table 8 The prevalence of dementia sorted by age and presence or absence of diabetes

Age (years old)	Males							Females						
	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)
a) The patients without diabetes mellitus														
<65	23,937	256	24,193	701	1406	26,300	1.06	13,697	176	13,873	363	839	15,075	1.27
65≤,<75	20,194	892	21,086	681	1316	23,083	4.23	13,568	697	14,265	397	893	15,555	4.89
75≤	19,931	4181	24,112	992	1575	26,679	17.34	13,536	4653	18,189	715	1110	20,014	25.58
Subtotal	64,062	5,329	69,391	2,374	4297	76,062	7.68	40,801	5526	46,327	1475	2842	50,644	11.93
Unspecified	0	0	0	0	0	0		0	0	0	0	0	0	
No data available	0	0	0	0	0	0		0	0	0	0	0	0	
Total	64,062	5329	69,391	2374	4297	76,062	7.68	40,801	5526	46,327	1475	2842	50,644	11.93
Mean	66.85	79.99	67.86	69.50	68.41	67.94		68.19	81.53	69.78	71.83	69.88	69.85	
S.D.*	13.30	8.54	13.46	13.63	13.41	13.46		12.71	7.95	12.98	13.51	13.25	13.02	
b) The patients with diabetes mellitus														
<65	29,767	667	30,434	2216	6423	39,073	2.19	9123	267	9390	669	2005	12,064	2.84
65≤,<75	28,507	2376	30,883	2340	6608	39,831	7.69	10,947	1283	12,230	916	2500	15,646	10.49
75≤	21,222	5611	26,833	2125	5556	34,514	20.91	10,362	4316	14,678	1190	3025	18,893	29.40
Subtotal	79,496	8654	88,150	6681	18,587	113,418	9.82	30,432	5866	36,298	2775	7,530	46,603	16.16
Unspecified	0	0	0	0	0	0		0	0	0	0	0	0	
No data available	0	0	0	0	0	0		0	0	0	0	0	0	
Total	79,496	8654	88,150	6681	18,587	113,418	9.82	30,432	5866	36,298	2775	7,530	46,603	16.16
Mean	66.89	76.62	67.85	68.21	67.82	67.87		69.14	78.97	70.73	71.19	70.43	70.71	
S.D.*	11.32	8.62	11.45	11.54	11.41	11.45		11.56	8.30	11.68	11.35	11.80	11.68	

The data were obtained from the patient survey

Table 9 The prevalence of dementia sorted by different age and dialysis vintage

a) Dialysis vintage <5 years

Age (years old)	Males							Females						
	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)
<65	25,681	454	26,135	1956	6240	34,331	1.74	9280	183	9463	711	2304	12,478	1.93
65≤,<75	22,929	1634	24,563	1951	5926	32,440	6.65	9381	859	10,240	788	2388	13,416	8.39
75≤	24,125	5764	29,889	2524	7120	39,533	19.28	12,615	4929	17,544	1479	4146	23,169	28.10
Subtotal	72,735	7852	80,587	6431	19,286	106,304	9.74	31,276	5971	37,247	2978	8838	49,063	16.03
Unspecified	0	0	0	0	0	0		0	0	0	0	0	0	
No data available	0	0	0	0	0	0		0	0	0	0	0	0	
Total	72,735	7852	80,587	6431	19,286	106,304	9.74	31,276	5971	37,247	2978	8838	49,063	16.03
Mean	67.64	78.60	68.71	69.12	68.77	68.75		69.72	81.05	71.53	71.98	71.19	71.50	
S.D.*	12.85	8.69	12.92	13.05	12.98	12.94		13.10	7.86	13.08	13.36	13.43	13.16	

b) Dialysis vintage 5≤,<10 years

Age (years old)	Males							Females						
	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)
<65	21,049	378	21,427	1561	4688	27,676	1.76	9100	203	9303	658	2121	12,082	2.18
65≤,<75	19,582	1402	20,984	1581	4780	27,345	6.68	9573	859	10,432	740	2313	13,485	8.23
75≤	14,938	3856	18,794	1551	4352	24,697	20.52	9006	3746	12,752	1018	2932	16,702	29.38
Subtotal	55,569	5636	61,205	4693	13,820	79,718	9.21	27,679	4808	32,487	2416	7366	42,269	14.80
Unspecified	0	0	0	0	0	0		0	0	0	0	0	0	
No data available	0	0	0	0	0	0		0	0	0	0	0	0	
Total	55,569	5636	61,205	4693	13,820	79,718	9.21	27,679	4808	32,487	2416	7366	42,269	14.80
Mean	66.65	77.75	67.67	68.31	67.95	67.76		68.37	80.26	70.13	70.70	70.07	70.15	
S.D.*	11.94	8.76	12.12	12.10	12.03	12.10		12.25	8.54	12.51	12.19	12.72	12.53	

c) Dialysis vintage 15 years ≤

Table 9 The prevalence of dementia sorted by different age and dialysis vintage (*Continued*)

Age (years old)	Males							Females						
	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)	Without dementia	With dementia	Subtotal	Unspecified	No data available	Total	Dementia prevalence (%)
<65	8754	144	8898	578	1987	11,463	1.62	5448	88	5536	359	1213	7108	1.59
65≤,<75	7779	362	8141	566	1833	10,540	4.45	6621	385	7006	487	1600	9093	5.50
75≤	3792	688	4480	349	1027	5856	15.36	3434	927	4361	318	961	5,640	21.26
Subtotal	20,325	1194	21,519	1493	4847	27,859	5.55	15,503	1400	16,903	1164	3774	21,841	8.28
Unspecified	0	0	0	0	0	0		0	0	0	0	0	0	
No data available	0	0	0	0	0	0		0	0	0	0	0	0	
Total	20,325	1194	21,519	1493	4847	27,859	5.55	15,503	1400	16,903	1164	3774	21,841	8.28
Mean	64.92	74.70	65.47	66.40	65.57	65.53		66.80	76.93	67.64	68.20	67.59	67.66	
S.D.*	10.68	8.98	10.83	10.52	10.90	10.83		10.08	8.11	10.32	10.37	10.43	10.34	

**Table 10** The basic background factors of patients treated by main three kinds of dialysis methods

| Treatment methods	Mean age (years old)	Mean dialysis vintage (years)	Percentage of male patients	Percentage of patients with diabetes
Facility hemodialysis	70.0	6.7	65.2	57.5
Hemodiafiltration	67.2	8.4	65.9	53.9
Peritoneal dialysis	63.8	2.9	65.9	52.2

Table 11 The basic background factors of patients sorted by different dialysis vintage

Background factors		Dialysis vintage (year)				
		<5	5≤,<10	10≤,<20	20≤	Total
Percentage of patients treated by each method	Facility hemodialysis	58.4	52.8	50.1	43.3	54.1
	Hemodiafiltration	36.7	45.1	48.5	51.8	42.3
	Peritoneal dialysis	4.8	1.9	0.6	0.2	2.9
	Others	0.1	0.3	0.8	4.8	0.7
Percentage of male patients		68.8	66.7	62.0	53.8	65.7
Percentage of patients with diabetes		62.9	62.3	47.4	14.5	56.1
Mean age (years old) of each dialysis vintage patients		69.9	69.2	67.9	66.6	69.1

This tabulation was performed on all dialysis patients
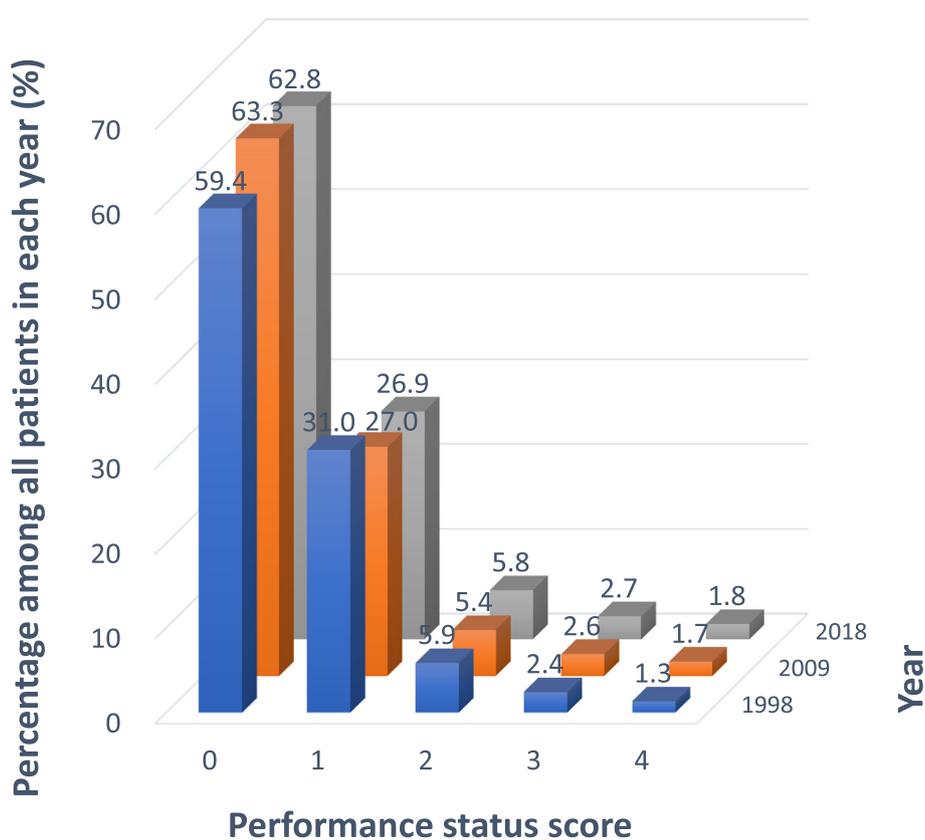
Fig. 11 Trend in performance status: under 60 years old. The numbers in the figure indicate the percentages for each year. Data in 1998 and 2018 are for all dialysis patients, while the data in 2009 is only for patients who were receiving hemodialysis at a facility 3 times/week. Data were obtained from the patient survey
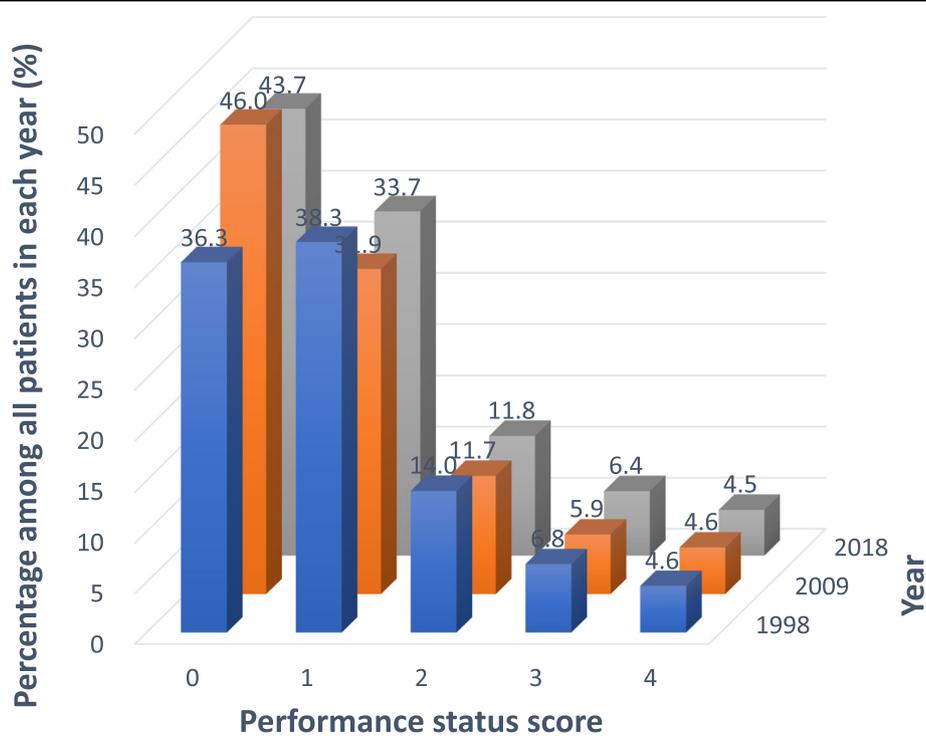
Fig. 12 Trend in performance status: 60–74 years old. The numbers in the figure indicate the percentages for each year. The data in 1998 and 2018 are for all dialysis patients, while the data in 2009 is only for those patients who were receiving hemodialysis at a facility 3 times/week. Data were obtained from the patient survey
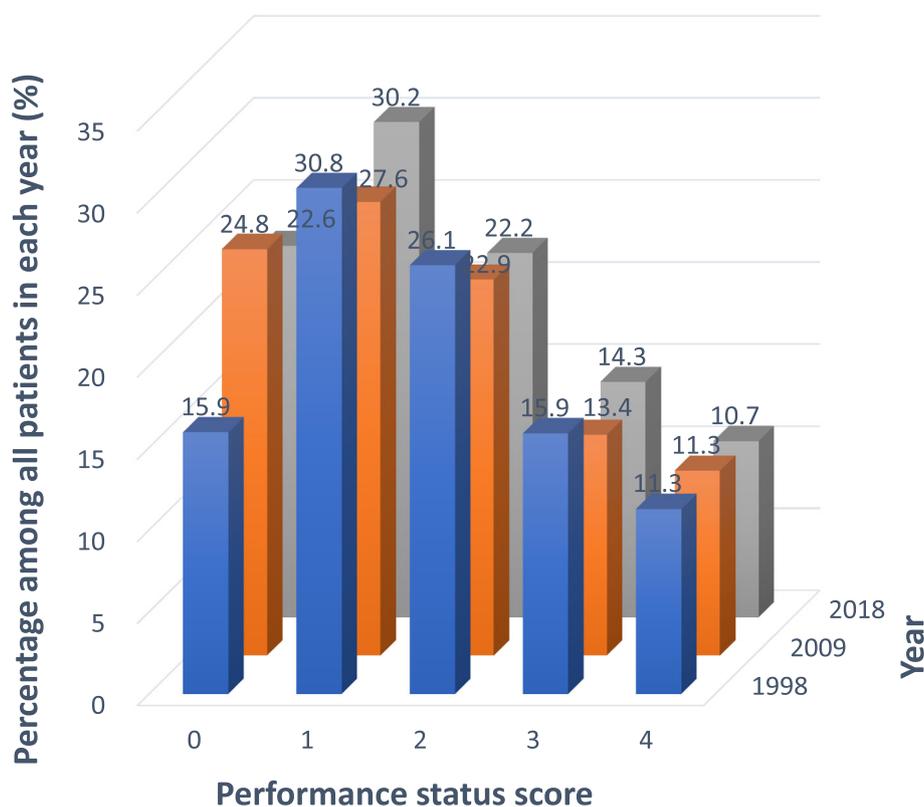
Fig. 13 Trend in performance status: 75 years or older. The numbers in the figure indicate the percentages for each year. The data in 1998 and 2018 are for all dialysis patients, while the data in 2009 is only for those patients who were receiving hemodialysis at a facility 3 times/week. Data were obtained from the patient survey

dialysis patients. The dementia prevalence in the dialysis patients overall was 10.8% (1.8% in the less than 65 years age group, 6.8% in the 65–74 years age group, and 22.7% in the 75 years or older age group). An analysis of the patients' PS revealed that the percentage of patients with low activity levels (high PS scores) tended to be relatively high in the less than 15-year-old and 60 years or older age groups. An analysis of the exercise habits revealed that the percentage of patients selecting the choice of "Not at all or hardly" was the highest (60–80%) in each age group.

Abbreviations
HDS-R: Hasegawa dementia rating scale-revised; ICD10: 10th version of the International Classification of Diseases, Injuries, and Causes of Death; JRDR: JSDT Renal Data Registry; JSDT: Japanese Society for Dialysis Therapy; MMSE: Mini Mental State Examination; PS: Performance status; S.D.: Standard deviation; UMIN: University hospital Medical Information Network

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s41100-021-00357-5.

Additional file 1: Supplementary Table 1. Dementia prevalence sorted according to age and sex.

Additional file 2: Supplementary Table 2. Dementia prevalence sorted according to age and diabetic status.

Additional file 3: Supplementary Table 3. Dementia prevalence sorted according to age and dialysis vintage.

Additional file 4: Supplementary Table 4. Performance status and age.

Additional file 5: Supplementary Table 5. Exercise habits and age.

Additional file 6: Supplementary Table 6. Exercise habits, age and dialysis vintage.

Additional file 7: Supplementary Table 7. Trends in dementia prevalence among hemodialysis patients treated three times a week.

Additional file 8: Supplementary Table 8. Trends in performance status.Additional file 8 of Annual dialysis data report 2018, JSDT Renal Data Registry; dementia, performance status and exercise habits

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Authors' contributions
KN, IM, MT, and SN finalized the results of the survey and prepared this manuscript. SN, NH, and AW designed the survey sheets and made a special program operating within an MS Excel worksheet for the convenience of the self-assessments of dialysis quality made by each dialysis facility. T. Hase, T. Hama, JH, NJ, KM, SG, and MA were responsible for the data analysis. KY and IM were responsible for the ethics of the JRDR survey. HN was the president of JSDT in 2018, checked all the results from the 2018 JRDR survey, and approved their publication. The authors read and approved the final manuscript.

Availability of data and materials
For anyone wanting to use the data and materials from the current manuscript without modifications, all the data and materials will be freely available provided that "data from the JSDT" is stated.
Anyone wanting to use the data and materials from the current manuscript with modifications or re-calculations, etc., must include the following sentence in their publication: "The data reported here have been provided by the Japanese Society for Dialysis Therapy (JSDT). The interpretation and reporting of these data are the responsibility of the authors and should in no way be seen as an official policy or interpretation of the JSDT."

Declarations

Ethics approval and consent to participate
The JRDR was approved by the ethics committee of the JSDT (approval no. 1) and was registered in the "University hospital Medical Information Network (UMIN) Clinical Trials Registry" under the clinical trial ID of UMIN000018641 on August 8, 2015: (Accessed June 2, 2020).
The aims of the JSDT Renal Data Registry (JRDR) were well explained to the participating dialysis patients at the dialysis facilities.
Documented approval forms from the patients were not required because all the data had already been collected, and there were no new interventions.
The original data was totally anonymized to avoid any risk of compromising the privacy of the dialysis facilities and the patients.
The data presented in the current manuscript does not contain any images, videos, or voice recording that could be used to identify an individual.

Consent for publication
Not applicable

Competing interests
The authors declare that they have no competing interests.

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