Tsutsui et al. Renal Replacement Therapy (2017) 3:23
DOI 10.1186/s41100-017-0105-z

Renal Replacement Therapy

RESEARCH Open Access

Factors associated with employment in patients undergoing hemodialysis: a mixed methods study

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Abstract

Background: For patients undergoing hemodialysis, continuing in labor is very challenging and many patients have difficulty in current and/or previous workplaces. The objective of the present study is to clarify the determinants of being employed in hemodialysis patients by use of the mixed methods approach.

Methods: One hundred and forty-nine patients undergoing hemodialysis were interviewed between 2010 and 2011 using the "100-category checklists" based on the International Classification of Functioning, Disability and Health developed for hemodialysis patients. The categories with which the participants experienced difficulty at workplace were analyzed using the mixed methods approach. In quantitative data, the patients undergoing hemodialysis were divided into two groups if they experienced any difficulty in current and/or previous workplaces (i.e., "experienced" group vs. "not experienced" group). In qualitative data, responses to the open-ended questions were analyzed using a grounded theory approach.

Results: In total of 149 patients (male, 66%; mean age 62 years; mean hemodialysis vintage, 8.6 years), 62% had diabetes and 86% were in labor at the time of investigation. In a quantitative analysis, compared to the unexperienced group, the experienced group was more likely to show the physical problems such as fatigability and decline of physical strength and declined energy level. In a qualitative analysis, three determinants of being unemployed were emerged including hospital visits (i.e., three times a week), vascular access, and physical symptoms. In contrast, a favorable determinant for the work continuation and job opportunities was found to be a flexible dialysis shift.

Conclusions: Our mixed methods study suggests that patients undergoing hemodialysis frequently suffer from physical problems such as frequent hospital visits for hemodialysis, vascular access troubles, and physical distress, resulting in frequent unemployment. One solution for unemployment of the patients undergoing hemodialysis is a dialysis shift flexible for individual lifestyles.

Keywords: Dialysis shift, Employment, Hospital visits, Patients undergoing hemodialysis, Physical symptoms, Vascular access

Background

Changes in socioeconomic status related to work including position, income, contract, and employment status frequently occur in patients undergoing hemodialysis [1–3]. A prospective study investigating 659 patients undergoing dialysis in The Netherlands reported that at the start of hemodialysis treatment, 31% of the patients were employed, but that the proportion decreased to 25% within 1 year after dialysis initiation [1]. Another study of 4026 patients undergoing dialysis in the US Renal Data System reported that 41.9% of the patients were employed before starting hemodialysis treatment, but the proportion decreased to 21.1% after hemodialysis treatment and decreased even further to 6.6% a year later [2].

In Japan, among very few studies conducted on this issue, Nakayama et al. [3] reported that 63% of their study patients were employed prior to dialysis, 22% of

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which became unemployed after the start of hemodialysis treatment. According to the nationwide report of 10,522 dialysis patients conducted by the National Kidney Disease Council in Japan in 2011 [4], 41% of the men and 43% of the women undergoing hemodialysis became unemployed in the last 5 years. These values show an increasing trend compared with the former report published in 2006 [5]. Although receiving hemodialysis treatment at night, patients on hemodialysis must leave the workplace earlier than the regular office hours thrice a week. This disruption of the work shift sometimes makes it difficult to stay in full-time labor; however, the time constraint, though obvious, may not be the only reason.

Therefore, the purpose of this study was to investigate how patients undergoing hemodialysis experience difficulties in the workplace and to clarify the determinants associated with employment in patients undergoing hemodialysis in Japan. The mixed methods approach was employed to incorporate the quantitative and qualitative analyses of our invented questionnaire system, increasing the validity of the results.

Methods

Patients

A total of 149 outpatients undergoing maintenance hemodialysis consisted of 49 patients at Masuko Memorial Hospital in Nagoya and 100 patients at the Meiyo Clinic in Toyohashi, Japan. Exclusion criteria were (i) hemodialysis duration shorter than 5 years, (ii) dementia, and (iii) hearing difficulty. We confirmed these exclusion criteria by medical record review. Interviews were conducted from December 2009 to January 2011 by a single investigator (HT).

Of the 149 patients, 84 were employed and 65 were unemployed (including retirees) at the time of the investigation.

Written informed consents were obtained from all participants. The study protocol was approved by the Internal Review Board of the Research Center of Health, Physical Fitness, and Sports, Nagoya University (approval number #22-9, #23-09).

Procedure

Study design

We used the mixed methods approach to clarify key factors of the difficulties in patients undergoing hemodialysis maintaining employment [6] and collected both quantitative and qualitative data through interviews. We interviewed all 149 patients. One interviewer (HT) conducted a semi-structured interview with each patient for 40 to 60 min.

100-category checklist

The "100-category checklist" included the following categories from the International Classification of Functioning, Disability and Health (ICF): 40 categories from the "Body functions" component; 14 categories from the "Body structures" component; 25 categories from the "Activities and participation" component; and 21 categories from the "Environmental factors" component [7]. The Cronbach's alpha of this checklist was 0.86 [8]. Of the 100-category checklist, three categories regarding employment were as follows:

1. *d845 Acquiring, keeping and terminating a job*: Have you ever been dismissed, demoted, or changed your employment status from full-time to part-time after starting hemodialysis treatment? For example, in a job interview, have you ever been rejected because of undergoing hemodialysis treatment?
2. *d850 Remunerative employment*: Have you often been absent from the workplace since you began hemodialysis treatment? Because of this, have you ever found any difficulty in working itself?
3. *e590 Labour and employment services, systems and policies*: Have you ever felt that you were not supported in finding a job or in being trained for a job due to hemodialysis treatment?

Using the 100-category checklist for hemodialysis patients based on the ICF [7, 8], participants were interviewed and asked whether they had experienced any difficulties in each category of the checklist since the initiation of hemodialysis treatment. Participants answered each question with either "yes" or "no". If a participant answered "yes", the person concerned was further asked to report how and why the patient perceived difficulties; this portion of the study was used for qualitative analysis.

We set up a research question, "What are the factors impeding the work of patients undergoing hemodialysis?" Among the 149 study patients, we conducted qualitative analysis of 87 patients who experienced any difficulty in current or previous workplaces. As the interview progressed, the concept of "existence of vascular access trouble" was generated and the hypothesis that vascular access trouble affects work was formulated, so a question asking about the influence on work during the time of vascular access trouble was added.

Analyses

In quantitative data, the patients undergoing hemodialysis were divided into two groups according to whether they experienced any difficulty in current or previous workplaces (i.e., experienced group vs. not experienced group). The chi-square test or Fisher's exact test was used for categorical variables, and the t test was used for continuous variables showing normal distribution. The baseline clinical characteristics included age and hemodialysis vintage; these are continuous variables that are expressed as mean

± standard deviation. In addition, sex, underlying diseases, complications, hemodialysis shift, and employed status are categorical variables and are expressed as numbers and percentages.

Crude and adjusted odds ratios were computed along with the 95% confidence interval for each 100-category checklist category. Multivariate logistic regression analysis for the effect of each category on experiencing work-related difficulty as outcome was performed by adjusting for age, hemodialysis vintage, presence of diabetic nephropathy, retinopathy or neuropathy, cerebral vascular disorder, anemia, and employment status. All statistical analyses were carried out using SPSS, version 19.0 (IBM Corp, Armonk, NY, USA). Statistical significance was set at $p < 0.05$.

In qualitative data, responses to the open-ended questions were analyzed using the grounded theory approach [9]. Transcript analyses were conducted to interpret data and saturate findings according to the grounded theory. The data were scrutinized line by line with open coding to reach a consensus on a core category that accounted for the data. During analysis, emerging themes and theories were discussed with our research team. Emerging categories were explored and identified by comparing and contrasting the data. The first author (HT) developed the initial codes, and the third author (AI) reviewed the coding scheme. All codes were reviewed to discover codes that had similarities between them or shared similar properties in order to form categories. These operations were repeated, and categories that best represented the data were created. A diagram was developed with feedback from nephrologists and internists on the properties of emerging categories. Interviews were conducted in the Japanese language, and Japanese words were used to analyze the data. The final diagram was developed with which all collaborators in our research team agreed.

Results

Quantitative results

The characteristics of the study patients undergoing hemodialysis are shown in Table 1. The patients in the

Table 1 Clinical characteristic in patients undergoing hemodialysis

Characteristics	Total ($n = 149$)	Difficulty in current and/or previous workplaces		P
		Experienced ($n = 87$)	Not experienced ($n = 62$)	
Sex (men/women) [n]	98/51	57/30	41/21	0.938
Age (years)	62 ± 11	59 ± 10	66 ± 10	<0.001
Hemodialysis vintage (years)	8.6 ± 5.6	10.7 ± 5.7	5.5 ± 3.7	<0.001
Underlying diseases				
Chronic glomerulonephritis [n (%)]	26 (17.4)	26 (100.0)	0	–
Diabetic nephropathy [n (%)]	93 (62.4)	31 (33.3)	62 (66.7)	0.001
Nephrosclerosis [n (%)]	14 (9.4)	14 (100.0)	0	–
IgA nephropathy [n (%)]	4 (2.7)	4 (100.0)	0	–
Polycystic kidney [n (%)]	3 (2.0)	2 (100.0)	0	–
Others [n (%)]	5 (3.4)	5 (100.0)	0	–
Unidentified [n (%)]	4 (2.7)	4 (100.0)	0	–
Complications				
Diabetic retinopathy [n (%)]	78 (52.3)	26 (29.9)	52 (83.9)	<0.001
Diabetic neuropathy [n (%)]	25 (16.8)	10 (11.5)	15 (24.2)	0.041
Cerebral vascular disorder [n (%)]	50 (33.6)	20 (23.0)	30 (48.4)	0.001
Cardiovascular disorder [n (%)]	78 (52.3)	47 (54.0)	31 (50.0)	0.628
Anemia [n (%)]	43 (28.9)	33 (37.9)	10 (16.1)	0.004
Secondary hyperparathyroidism [n (%)]	29 (19.5)	21 (24.1)	8 (12.9)	0.088
Reshape of vascular access [n (%)]	77 (51.7)	44 (56.6)	33 (53.2)	0.750
Hemodialysis shift				
Daytime [n (%)]	112 (75.2)	70 (80.5)	42 (67.7)	0.011
Night [n (%)]	37 (24.8)	17 (19.5)	20 (32.3)	0.742
Employed at the time of investigation [n (%)]	84 (56.4)	71 (81.6)	13 (21.0)	<0.001

Data on age and hemodialysis vintage are shown as mean ± standard deviation. The chi-square tests were used for comparisons of sex, underlying diseases, complications, and employed at the time of investigation. The t test was used for comparisons of age and hemodialysis vintage

group who experienced employment difficulty (experienced group) were significantly younger, had shorter hemodialysis vintage, were less likely to have diabetic nephropathy, were more likely to have anemia, and were more likely to be employed compared with the patients in the group who had not experienced in an employment difficulty (not experienced group). Because the patients in the experienced group seemed to be in better physical condition than the patients in the not experienced group, the experienced group seemed to more easily remain employed than the not experienced group. However, although the experienced group looked healthy in appearance, they were not able to carry out such activities as going on business trips, working overtime, or carrying heavy baggage, like healthy people. For that reason, they experienced involuntary changes in their work assignments and decreases in salaries because they talked about the fact that they could not accomplish these activities due to hemodialysis therapy. Although they experienced these difficulties, they were not quitting their jobs, thinking that "it is better than unemployment".

The response patterns of the experienced group and not experienced group and the results of the logistic regression models for the 100-category checklist are shown in Tables 2, 3, 4, and 5.

Compared to patients in the not experienced group, participants in the experienced group reported difficulties in the following categories: *attention functions* (*b140*); *sensory functions related to temperature and other stimuli* (*b270*); *hematological system functions* (*b430*); *general physical endurance* (*b4550*); *aerobic capacity* (*b4551*); *fatigability* (*b4552*); *weight maintenance functions* (*b530*); *urinary excretory functions* (*b610*); *sexual functions* (*b640*); *functions of hair* (*b850*); *heart (s4100)*; *structure of urinary system (b610)*; *looking after one's health (d570)*; *sports (d9201)*; *socializing (d9205)*; *products or substances for personal consumption (e110)*; *individual attitudes of health professionals (e450)*; *media services, systems and policies (e560)* and *health services, systems and policies (e580)*.

After adjusting for age, hemodialysis vintage, presence of diabetic nephropathy, retinopathy and neuropathy, cerebral vascular disorder, anemia, and employment status, participants in the experienced group were found to report difficulties in the following categories compared with participants in the not experienced group: *energy level* (*b1300*); *attention functions* (*b140*); and *sensory functions related to temperature and other stimuli* (*b270*). They were also more likely to have difficulty in the categories of *fine hand use* (*d440*); *looking after one's health* (*d570*); *socializing* (*d9205*); and *individual attitudes of health professions* (*e450*).

Qualitative results

Ten categories were generated including *hospital visit*; *vascular access*; *physical symptoms*; *difficulty in commuting*; *restriction of work* including workload, job contents, and working hours; *attitude of coworkers in the workplace*; *changes of work conditions* including position, salary, and status; *acceptance of reality by patients*; *balance between work and treatment*; and *decrease in time to spend with family*. These categories were further grouped into two themes including (i) *factors associated with being employed* and (ii) *adjusted hemodialysis shift* (Fig. 1).

Factors associated with being employed

The three properties of hospital visit, vascular access, and physical symptoms emerged as factors associated with being employed in patients undergoing hemodialysis. For example,

> "(For hemodialysis) I was recommended to quit working (because I was not able to contribute to the workplace) due to the 3-times-a-week hospital visits." (Age 59, female)

> "I experienced vascular access occlusions twice and I feel finger-tip numbness and drop things frequently… Under such a physical condition, I had experienced difficulty at work." (Age 62, male)
> "I quit working because I had to leave the workplace early 3 times a week because of hemodialysis. In addition, I had to be absent from the workplace due to unexpected events like a hypoglycemic attack during duty hours and hospitalization to treat vascular access problems." (Age 63, female)

Difficulty in commuting Participants perceived difficulty in commuting due to physical symptoms. For example,

> "If a commuter bus is full, I have to take care that my vascular access is not compressed." (Age 48, male)
> "I feel numbness of my feet frequently; especially in the right toes (as though they were pressed) and…so it is hard to go up and down the stairs of the subway, I am always worn out when I arrive at the company every morning…Thus, I was not able to work very much after I initiated hemodialysis." (Age 60, male)

Restriction of work The three properties of hospital visit, vascular access, and physical symptoms formed restriction of work such as *limitation of workload and job contents* and *reduction of working hours*. For example,

> "It greatly impacted my work because I was not able to go on a business trip on a day of hemodialysis treatment. In addition, I was not able to carry heavy baggage because of my vascular access; this prevents me from going on a business trip." (Age 55, male)
> "I am an interior decorator mechanic. My working hours are shortened because of visiting the hospital

Table 2 Comparison of the categories which reported difficulty in the components of "Body functions" according to employment status ($n = 149$)

ICF category		Difficulty in current and/or previous workplaces			Logistic regression analysis					
		Experienced (%)	Not experienced (%)		Univariate			Multivariate[a]		
		$n = 87$	$n = 62$	P*	OR	95% CI	P	OR	95% CI	P
b110	Consciousness functions	31.0	29.0	0.793	0.74	0.35–1.55	0.416	1.13	0.38–3.39	0.824
b1300	Energy level	50.6	45.2	0.515	1.71	0.85–3.48	0.135	3.78	1.30–11.04	0.015
b1302	Appetite	31.0	27.4	0.633	0.81	0.38–1.72	0.582	0.59	0.18–1.93	0.382
b134	Sleep functions	59.8	56.5	0.685	0.86	0.42–1.75	0.682	1.27	0.45–3.62	0.652
b140	Attention functions	37.9	25.8	0.120	2.61	1.14–5.98	0.023	5.35	1.61–17.73	0.006
b152	Emotional functions	32.2	16.1	0.027	1.95	0.82–4.67	0.133	0.51	0.12–2.14	0.353
b210	Seeing functions	63.2	83.9	0.006	0.35	0.14–0.86	0.022	–	–	–
b240	Sensations associated with hearing and vestibular function	46.0	40.3	0.493	0.89	0.44–1.79	0.739	1.04	0.36–3.00	0.937
b250	Taste function	26.4	22.6	0.591	1.28	0.56–2.92	0.560	0.83	0.26–2.66	0.750
b260	Proprioceptive function	23.0	66.1	<0.001	0.30	0.15–0.62	0.001	0.70	0.25–1.99	0.507
b265	Touch function	13.8	24.2	0.104	0.48	0.21–1.14	0.096	–	–	–
b270	Sensory functions related to temperature and other stimuli	19.5	4.8	0.013	10.18	1.32–78.53	0.026	38.62	2.30–648.65	0.011
b280	Sensory of pain	51.7	38.7	0.116	1.34	0.66–2.71	0.414	0.75	0.26–2.14	0.584
b410	Heart functions	54.0	50.0	0.629	1.48	0.73–2.97	0.275	2.56	0.87–7.52	0.087
b415	Blood vessel functions	23.0	48.4	0.001	0.36	0.17–0.73	0.005	–	–	–
b420	Blood pressure functions	82.8	87.1	0.470	1.24	0.48–3.16	0659	3.00	0.48–18.67	0.238
b430	Hematological system functions	37.9	16.1	0.004	2.45	1.03–5.80	0.043	–	–	–
b440	Respiration functions	34.5	29.0	0.483	0.97	0.46–2.05	0.945	1.35	0.45–4.05	0.597
b4550	General physical endurance	69.0	22.6	<0.001	5.01	2.29–10.99	<0.001	1.97	0.62–6.25	0.251
b4551	Aerobic capacity	62.1	22.6	<0.001	3.94	1.81–8.61	0.001	2.26	0.68–7.10	0.188
b4552	Fatigability	74.7	43.5	<0.001	3.46	1.68–7.14	0.001	2.75	0.95–7.93	0.062
b515	Digestive functions	14.9	21.0	0.399	0.81	0.33–1.99	0.650	0.83	0.22–3.16	0.786
b525	Defecation functions	66.9	72.6	0.139	0.42	0.19–0.94	0.034	0.77	0.25–2.40	0.656
b530	Weight maintenance functions	25.3	14.5	0.110	3.73	1.22–11.38	0.021	1.33	0.30–5.92	0.712
b535	Sensations associated with the digestive system	37.9	35.5	0.760	0.87	0.43–1.78	0.708	0.82	0.29–2.30	0.701
b545	Water, mineral and electrolyte balance functions	17.2	17.7	0.937	2.85	0.92–8.82	0.069	1.13	0.25–5.08	0.869
b555	Endocrine gland functions	32.2	0	<0.001	–	–	–	–	–	–
b610	Urinary excretory functions	86.2	38.7	<0.001	4.94	4.34–10.44	<0.001	1.06	0.34–3.34	0.922
b620	Urination functions	60.9	38.7	0.007	1.83	0.91–3.70	0.092	1.12	0.39–3.25	0.832
b640	Sexual functions	31.0	6.5	<0.001	18.49	2.44–140.34	0.005	0.16	0.02–1.49	0.107
b670	Sensations associated with genital and reproductive functions	0	0	NA	–	–	–	–	–	–
b710	Mobility of joint functions	55.2	61.3	0.456	0.83	0.41–1.68	0.603	1.06	0.37–3.03	0.908
b730	Muscle power functions	8.0	0	0.042	–	–	–	–	–	–
b735	Muscle tone functions	0	0	NA	–	–	–	–	–	–
b780	Sensations related to muscles and movement functions	75.9	69.4	0.377	1.76	0.82–3.75	0.146	1.82	0.57–5.82	0.316
b810	Protective functions of the skin	72.4	54.8	0.027	1.49	0.73–3.06	0.274	1.11	0.40–3.09	0.839

Table 2 Comparison of the categories which reported difficulty in the components of "Body functions" according to employment status ($n = 149$) *(Continued)*

b820	Repair functions of the skin	43.7	43.5	0997	1.31	0.64–2.65	0.460	1.24	0.44–3.50	0.685
b840	Sensation related to the skin	70.1	77.4	0.321	0.57	0.24–1.31	0.183	0.81	0.26–2.53	0.711
b850	Functions of hair	46.0	19.4	0.001	2.95	1.29–6.74	0.010	1.76	0.58–5.37	0.319

OR odds ratio, *ICF* International Classification of Functioning, Disability and Health, *CI* confidence interval
*Chi-square test
[a]Adjusting for age, hemodialysis vintage, presence of diabetic nephropathy, retinopathy and neuropathy, cerebral vascular disorder, anemia, and employment status

for hemodialysis treatment. Therefore, my salary went down." (Age 51, male)

Attitude of coworkers in the workplace The restriction of work such as the limitation of workload and job contents and reduction of working hours further affects Attitude of coworkers in the workplace such as *reaction of colleagues and superior* and *the response of the employer and coworkers in management positions*. For example,

"I felt guilty that I had to leave my workplace early three times a week due to hemodialysis treatment, especially at the end of a one-year term work schedule (when the workload is maximized). I left work under their cold stares." (Age 60, female)

"It was very difficult to have my employer understand that my working hours were shortened because of hospital visits for hemodialysis." (Age 58, male)

Moreover, Attitude of coworkers in the workplace was affected by *misunderstanding* of coworkers in the workplace and *prejudice* against hospital visits, vascular access, and physical symptoms.

Changes in work conditions Attitudes of coworkers in the workplace driven by misunderstanding and prejudice against patients undergoing hemodialysis determined *changes in work conditions* such as *reshuffling*, *switch from full-time to part-time labor*, *decrease in wages*, and *dropping from promotion ladder*. For example,

"Because of leaving the workplace early due to hospital visits or hemodialysis treatment), I was transferred from sales promotion to an office job." (Age 41, male)

"Though I worked full-time, I was switched to part-time because I was not able to go to a business trip." (Age 65, male)

Table 3 Comparison of the categories which reported difficulty in the components of "Body structures" according to employment status ($n = 149$)

ICF category		Difficulty in current and/or previous workplaces			Logistic regression analysis					
		Experienced (%)	Not experienced (%)		Univariate			Multivariate[a]		
		$n = 87$	$n = 62$	P*	OR	95% CI	P	OR	95% CI	P
s220	Structure of eyeball	54.0	80.6	0.001	0.34	0.15–0.78	0.010	1.28	0.15–11.04	0.820
s410	Structure of cardiovascular system	33.3	56.5	0.005	0.45	0.22–0.91	0.027	2.04	0.54–7.72	0.292
s4100	Heart	25.3	1.6	<0.001	12.22	1.59–93.70	0.016	5.33	0.39–72.44	0.209
s550	Structure of pancreas	3.4	1.6	0.641	1.35	0.14–13.34	0.797	–	–	–
s5801	Thyroid gland	8.0	6.5	0763	0.77	0.21–2.76	0.683	0.23	0.02–2.66	0.241
s5802	Parathyroid gland	8.0	6.5	0.763	1.22	0.49–2.99	0.670	6.45	0.11–1.87	0.273
s610	Structure of urinary system	88.5	35.5	<0.001	4.94	2.34–10.44	<0.001	1.00	0.32–3.16	0.998
s6100	Kidneys	100.0	100.0	NA	–	–	–	–	–	–
s630	Structure of reproductive system	9.2	8.1	0.809	0.69	0.21–2.24	0.537	–	–	–
s730	Structure of upper extremity	50.6	53.2	0.750	0.66	0.33–1.34	0.253	0.55	0.20–1.56	0.261
s750	Structure of lower extremity	24.1	25.8	0.816	1.07	0.48–2.42	0.862	1.43	0.43–4.84	0.562
s770	Additional musculoskeletal structures related to movement	4.6	3.2	1.000	2.30	0.26–20.23	0.454	6.28	0.40–98.48	0.191
s830	Structure of nails	62.1	79.0	0.027	0.72	0.33–1.56	0.399	1.79	0.52–6.20	0.359

OR odds ratio, *ICF* International Classification of Functioning, Disability and Health, *CI* confidence interval
*Chi-square test
[a]Adjusting for age, hemodialysis vintage, presence of diabetic nephropathy, retinopathy and neuropathy, cerebral vascular disorder, anemia, and employment status
NA refers to "not applicable"

Table 4 Comparison of the categories which reported difficulty in the components of "Activities and participation" according to employment status ($n = 149$)

ICF category		Difficulty in current and/or previous workplaces			Logistic regression analysis					
		Experienced (%)	Not experienced (%)		Univariate			Multivariate[a]		
		$n = 87$	$n = 62$	P*	OR	95% CI	P	OR	95% CI	P
d220	Undertaking multiple tasks	26.4	0	<0.001	–	–	–	–	–	–
d240	Handling stress and other psychological demands	10.3	1.6	0.046	–	–	–	–	–	–
d430	Lifting and carrying objects	54.0	33.9	0.015	1.91	0.93–3.93	0.077	2.35	0.82–6.78	0.114
d440	Fine hand use	29.9	33.9	0.606	1.08	0.51–2.09	0.846	5.42	1.61–18.30	0.006
d450	Walking	9.2	27.4	0.003	0.27	0.11–0.66	0.004	0.64	0.18–2.19	0.473
d465	Moving around using equipment	10.3	16.1	0.297	0.57	0.21–1.52	0.261	1.60	0.37–6.87	0.530
d470	Using transportation	20.7	30.6	0.166	0.41	0.19–0.89	0.024	0.74	0.23–2.43	0.619
d475	Driving	31.0	30.6	0.960	0.77	0.37–1.62	0.490	1.21	0.41–3.62	0.728
d510	Washing oneself	10.3	21.0	0.072	0.48	0.19–1.20	0.114	1.06	0.36–3.78	0.931
d520	Caring for body parts	10.3	14.5	0.441	0.67	0.24–1.85	0.435	1.08	0.26–4.42	0.918
d550	Eating	5.7	9.7	0.366	0.77	0.21–2.76	0.683	1.18	0.22–6.53	0.847
d570	Looking after one's health	32.2	24.2	0.289	2.99	1.22–7.37	0.017	4.05	1.24–6.26	0.021
d630	Preparing meals	8.0	14.5	0.209	0.30	0.10–0.86	0.026	1.00	0.18–5.65	0.996
d640	Doing housework	17.2	21.0	0.566	0.43	0.19–1.01	0.052	0.31	0.06–1.50	0.144
d660	Assisting others	4.6	3.2	1.000	0.89	0.16–5/04	0.894	–	–	–
d845	Acquiring, keeping and terminating a job	100.0	0	<0.001	–	–	–	–	–	–
d850	Remunerative employment	89.7	8.1	<0.001	–	–	–	–	–	–
d9201	Sports	33.3	16.1	0.019	5.40	1.79–16.30	0.003	3.71	0.54–14.66	0.062
d9204	Hobbies	43.7	38.7	0.144	1.02	0.50–2.06	0.960	2.53	0.88–7.28	0.085
d9205	Socializing	40.2	19.4	0.007	2.90	1.23–6.84	0.015	5.86	1.63–21.06	0.007

OR odds ratio, *ICF* International Classification of Functioning, Disability, and Health, *CI* confidence interval
*Chi-square test
[a]Adjusting for age, hemodialysis vintage, presence of diabetic nephropathy, retinopathy and neuropathy, cerebral vascular disorder, anemia, and employment status

"My salary stopped increasing because I had to leave the workplace early due to hospital visits for hemodialysis." (Age 47, male)
"Because I do not have time to visit the hospital and undergo hemodialysis during business trips, I cannot go on business trips. I had no choice regarding this, but I was not able to be promoted because of that. As a result, my subordinate has become my boss." (Age 59, male)

With these aforementioned examples, changes of work conditions led to a change of work conditions or to resignation from the job among patients undergoing hemodialysis. Simultaneously, these patients who experienced changes or resignation from a job have also been exposed to continuous anxiety about work continuation or reemployment.

Acceptance of reality by patients Changes in work conditions make some patients accept what they face (i.e., *so what attitude*) including *hard work for job hunting*, *revocation of unofficial decision due to hemodialysis*, and *loss of job*. For example,

"Whenever I confessed, "I am a hemodialysis patient", I was failed in an employment test…I have not obtained a job yet so far." (Age 49, male)
"After I informed my new workplace after my retirement that I have initiated hemodialysis, I was told 'Please abandon the contract'." (Age 60, male)
"When I told my workplace that I was going to start hemodialysis, I was dismissed immediately." (Age 61, female)

Adjusted hemodialysis shift

Balance between work and treatment might go well if hemodialysis shifts were well adjusted for individual needs such as *flexibility of dialysis shift* and *cooperation between dialysis clinics*. Simultaneously, balance between work and treatment may *decrease time to spend with family*. For example,

Table 5 Comparison of the categories which reported difficulty in the components of "Environmental factors" according to employment status ($n = 149$)

ICF category		Difficulty in current and/or previous workplaces			Logistic regression analysis					
		Experienced (%)	Not experienced (%)		Univariate			Multivariate[a]		
		$n = 87$	$n = 62$	P*	OR	95% CI	P	OR	95% CI	P
e110	Products or substances for personal consumption	43.7	30.6	0.107	2.20	1.02–4.72	0.043	2.06	0.73–5.83	0.173
e310	Immediate family	6.9	3.2	0.470	1.36	0.26–7.01	0.713	0.62	0.03–13.20	0.758
e320	Friends	11.5	1.6	0.026	4.84	0.60–38.97	0.139	0.87	0.03–25.77	0.936
e325	Acquaintances, peers, colleagues, neighbors and community members	6.9	1.6	0.240	2.78	0.33–23.81	0.350	0.72	0.02–22.88	0.853
e330	People in positions of authority	2.3	0	0.511	–	–	–	–	–	–
e350	Domesticated animals	0	0	NA	–	–	–	–	–	–
e355	Health professionals	6.9	0	0.041	–	–	–	–	–	–
e410	Individual attitudes of immediate family members	3.4	11.3	0.094	0.27	0.07–1.01	0.051	1.73	0.21–14.39	0.612
e420	Individual attitudes of friends	6.9	1.6	0.240	2.78	0.33–23.81	0.350	5.52	0.34–89.43	0.230
e425	Individual attitudes of acquaintances, peers, colleagues, neighbors and community members	6.9	3.2	0.470	1.36	0.26–7.01	0.713	3.17	0.37–27.51	0.296
e430	Individual attitudes of people in positions of authority	8.0	1.6	0.042	–	–	–	–	–	–
e440	Individual attitudes of personal care providers and personal assistants	1.1	3.2	0.571	0.22	0.02–2.44	0.215	0.46	0.02–13.65	0.655
e450	Individual attitudes of health professionals	23.0	16.1	0.303	3.55	1.16–10.84	0.026	5.77	1.40–23.85	0.015
e465	Social norms, practices, and ideologies	20.7	12.9	0.217	1.61	0.60–4.31	0.347	0.70	0.16–3.13	0.644
e540	Transportation services, systems and policies	10.3	4.8	0.360	5.38	0.67–42.98	0.112	7.35	0.54–100.82	0.136
e555	Associations and organizational services, systems, and policies	12.6	9.7	0.175	1.52	0.47–4.93	0.489	2.36	0.45–12.38	0.309
e560	Media services, systems and policies	18.4	12.9	0.369	3.67	1.04–13.00	0.044	2.59	0.55–12.24	0.230
e570	Social security services, systems and policies	26.4	11.3	0.023	3.55	1.16–10.84	0.026	1.74	0.40–7.55	0.461
e580	Health services, systems and policies	25.3	8.1	0.007	4.35	1.24–0.30	0.022	2.18	0.42–11.34	0.354
e590	Labour and employment services, systems and policies	74.7	25.8	<0.001	–	–	–	–	–	–

OR odds ratio, *ICF* International Classification of Functioning, Disability and Health, *CI* confidence interval
*Chi-square test
[a]Adjusting for age, hemodialysis vintage, presence of diabetic nephropathy, retinopathy and neuropathy, cerebral vascular disorder, anemia, and employment status
NA refers to "not applicable"

> "Because I was not able to find a job if I underwent hemodialysis in a daytime shift, I switched to a night shift and then I got a new job." (Age 34, male)

> "On the day of hemodialysis, I come back home late, and on the day without hemodialysis I come home back late because of compensating for the loss I made for hemodialysis treatment. I do not have enough time to play with my child so I feel pity." (Age 33, male)

The respondents also reported that because adjusted hemodialysis shift is not usually offered at their clinics, the patients always perceived *anxiety about work continuation or reemployment*.

Discussion

Using a mixed methods approach, we demonstrated that the three factors of three times a week hospital visits, vascular access, and physical symptoms rank the main reasons for employment difficulties for patients undergoing hemodialysis. The present results are consistent with the previous study indicated that employment of patients aged 18 to 54 was greater in facilities offering a 5 p.m. or later hemodialysis shift [10]. Muehrer et al. [11] reported that treatment of anemia with erythropoietin before the development of renal insufficiency and education for patients on job friendly home dialysis options may improve work retention. Kutner et al. [10] reported that a facility employment rate was positively associated independently with availability of a 5 p.m. or later dialysis shift,

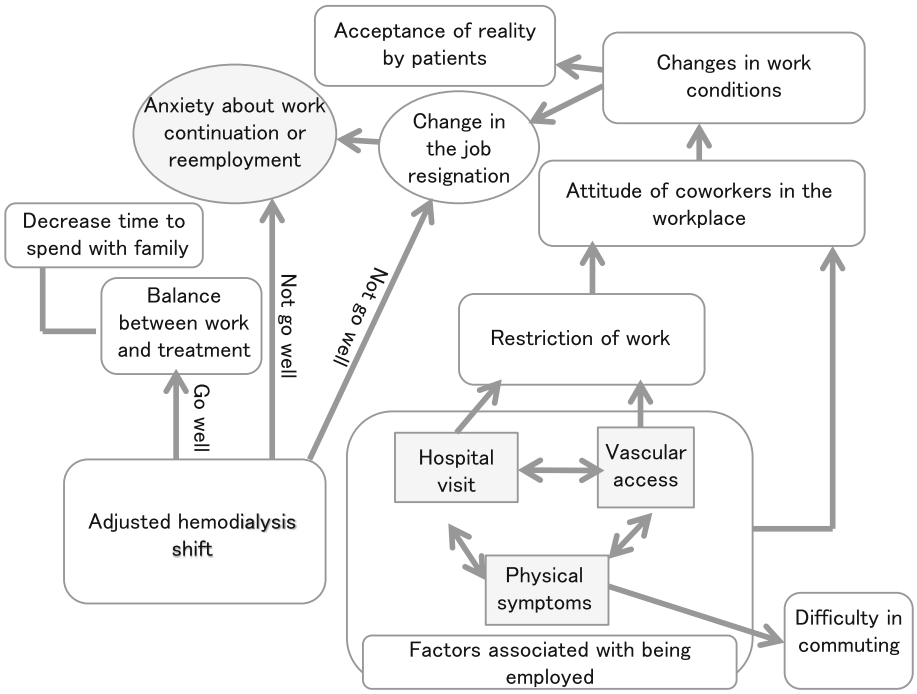

Fig. 1 Factors associated with employment in patients undergoing hemodialysis. The influence diagram involves two variable types for notation: The *rounded rectangles* denote the categories generated from concepts by a grounded theory approach, and the *ovals* designate our interpretations

after adjusting for patient/social-worker ratio, rurality of unit location, and unit size. Although we have not investigated issues regarding anemia treatment or home dialysis, the fact that a 5 p.m. or later dialysis shift improves the working situation has been made clear not only through the results of the quantitative study but also as the actual experience of patients undergoing hemodialysis, as shown by the qualitative study. The strength of our approach was the use of the mixed methods approach.

Although not a mixed methods study, Nakayama et al. reported that working patients who initiated hemodialysis experienced a decline in the average number of working hours and a decrease in their average annual individual income in a Japanese cohort study [3]. Furthermore, depending on the work style (e.g., frequent official trips in trade business), job opportunities were limited in order to protect the vascular access. Indeed, in our quantitative analysis, more than half of the patients in the experienced group agreed on the inconvenience of carrying baggage due to the vascular access.

Moreover, patients who experienced an occlusion of the vascular access had to urgently take days off to be hospitalized for treating the vascular occlusion. For these reasons, patients undergoing hemodialysis are always exposed to such types of discrimination at the workplace as pay cuts, relocation, and so on. These issues frequently occurred in our study sample; approximately 80% of our participants experienced occlusions of the vascular access. Such a high incidence of vascular access occlusions may be explained by vascular atherosclerosis because the majority of the participants suffered diabetic nephropathy as the underlying kidney disease [12].

Patients in our study manifested various physical symptoms. In particular, patients in the experienced group were more likely to report fatigability and decline in physical strength. According to previous studies, these two physical symptoms are known as two major complaints among patients undergoing hemodialysis [13–15]. Jhamb et al. reported that the incidence of fatigue in patients undergoing hemodialysis ranges from 60 to 97% [13]. Many previous studies have shown that physical activity levels are extremely low in patients undergoing hemodialysis probably because of reduced aerobic capacity [14, 15]. Impairments in physical functions increase the likelihood of loss of unemployment in patients undergoing hemodialysis [1, 4]. In addition to the previous findings, we could show that the participants in the experienced group were more likely to report problems with energy level, attention functions, sensory functions related to temperature and other stimuli, and fine hand use according to the result of the multivariate logistic regression model. A relationship between decline of energy level and maintenance of employment after dialysis initiation has been observed [16]. Indeed, Kutner et al. [17] reported that patients who remained employed had a lower score on the Patient Health Questionnaire 2 (PHQ-2) depression measure; on the basis of

the PHQ-2 cutoff score ≥3, 12.1% of the 191 patients who remained employed had possible or probable depression, compared with 32.8% of the 394 patients who were no longer employed.

Misunderstanding and prejudice of superiors and colleagues at the workplace mainly affected employment of the patients undergoing hemodialysis due to the three factors such as frequent hospital visits, vascular access, and physical symptoms. In our quantitative analysis, patients in the experienced group were more likely to report that they had ever been bothered by the attitudes of their superiors and colleagues; some of these patients had actually quit working or changed jobs.

Our study suggested a counteraction to leaving the workplace: if hemodialysis shifts were adapted to the lifestyle of an individual patient, the likelihood of job continuation and job acquisition increased. Indeed, Kutner et al. [10] reported that the strongest predictor of the employment rate among patients on hemodialysis is a night dialysis shift and that the employment rates increased three-fold among facilities which adopted a night shift [10]. According to a Japanese nationwide report [4], 65.4% of patients undergoing hemodialysis in the evening were employed. Among these, 59.6% of civil service workers and 50.4% of general office workers in particular received evening hemodialysis starting after 5:00 p.m. This indicates that patients who use night shift dialysis may not be able to work at night or overtime, but they do not need to leave the workplace early during the day time. To maintain work continuation in patients undergoing hemodialysis, flexible adjustment of dialysis shifts may be a key factor. Mutual use of dialysis shifts among working satellite clinics and flexible shifts to adapt to individual lifestyles may ameliorate the employment rate among patients undergoing hemodialysis.

The present study had several limitations that need to be mentioned. First, our study sample was retrieved from medical charts from two facilities in Aichi prefecture, Japan; thus, the generalizability of our results may be limited to some extent. Second, we only investigated patients who reported difficulties regarding the checklist and who were employed at the time of investigation. We did not evaluate patients who did not report any difficulties even if they were employed. Thus, some information bias might exist. Third, the number of patients does not suffice for a detailed statistical analysis with multiple parameters. Therefore, we performed analysis using the mixed methods approach. Fourth, we did not investigate into the educational status, family income, and marital status which have an impact on the employment. Accordingly, as for our result, influence of these socioeconomic statuses may not be considered. Fifth, laboratory parameters were not evaluated in conjunction with the questionnaire. Despite these limitations, we could clearly show the close relationship between the employment status and the physical status of the patients undergoing hemodialysis by a mixed methods approach.

Conclusions

The present study clearly showed that the negative determinants of employment in patients undergoing hemodialysis were frequent hospital visits, vascular access, and unfavorable physical symptoms. The present result also demonstrated the usefulness of hemodialysis shifts. Specifically, night dialysis starting evening may play a key role in enabling patients to maintain their employment. The mutual use of a night hemodialysis shift among working satellite clinics and flexible shifts to adapt to individual lifestyles may decrease the difficulty in working among patients undergoing hemodialysis.

Abbreviations

ICF: International Classification of Functioning, Disability and Health; PHQ-2: The Patient Health Questionnaire 2

Acknowledgements

This study was supported by a grant from the Kidney Foundation, Aichi. The authors would like to thank M. Ogi, Y. Nagata, K. Kita, M. Natsume, F. Ito, and S. Ozaki—head nurses at Meiyo Clinic; Drs. A. Ito and F. Kato—nephrologists; and H. Sato—director of nursing service department, at Masuko Memorial Hospital, for their support with respect to the interviews.

Funding

This study was in part supported by a grant from the Aichi Kidney Foundation.

Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

HT organized the design of the study, implementation of interview survey, and acquisition of the data; performed the statistical analysis; and wrote a draft of the manuscript. KN and SU edited the draft. AI assisted with data analysis. YT, SK, and YY recruited patients and assisted with the interview survey. YO was the person in charge of this research project and made substantial contributions to the conception and design of the study. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

Consent for publication

When we performed informed consent, we got the agreement of publication as an article from all participants.

Ethics approval and consent to participate
Written informed consents were obtained from all participants. The study protocol was approved by the Internal Review Board of the Research Center of Health, Physical Fitness, and Sports, Nagoya University (approval number #22-9, #23-09).

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Received: 9 October 2016 Accepted: 3 March 2017
Published online: 02 June 2017

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