

# Evaluation of psychological distress using the K6 in patients on chronic hemodialysis

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## Abstract

**Objective** The aim of this study was to evaluate psychological distress in patients on chronic hemodialysis.

**Subjects and methods** A total of 72 patients on chronic hemodialysis were enrolled in this study. We evaluated psychological distress by using the K6 questionnaire, health-related quality of life (HRQOL) by using the EQ-5D questionnaire, and clinical parameters. Among the 72 patients, we also evaluated changes in K6 scores in 58 patients at 1-year follow-up.

**Results** The mean K6 score was  $3.7 \pm 3.7$  and 2 subjects (2.8 %) were defined as having psychological distress. K6 scores were significantly correlated with body fat percentage, albumin level, and EQ-5D scores in total subjects. K6 scores were also significantly and negatively correlated with EQ-5D scores in men and women. In the 1-year follow-up group, changes in K6 scores were weakly and negatively correlated with changes in EQ-5D scores.

**Conclusion** Psychological distress was closely associated with HRQOL in patients on chronic hemodialysis. Coping strategies for psychological distress might be useful in improving HRQOL in patients on hemodialysis.

**Keywords** Psychological distress · HRQOL · Hemodialysis · K6 questionnaire · EQ-5D questionnaire

## Introduction

The number of patients on chronic hemodialysis has been dramatically increasing and over 300,000 patients are reported to be on chronic hemodialysis in Japan [1]. In addition to medical treatment, lifestyle factors, such as physical activity, diet, and a depressed mental state, are also considered to be important. For example, we have previously reported in a cross-sectional study that physical activity over 4 METs on non-hemodialysis treatment days is closely associated with health-related quality of life (HRQOL) [2].

There have been some reports that evaluated psychological distress and/or depressive state in patients on chronic hemodialysis [3–9]. The K6 questionnaire is an index of psychological distress and an excellent measurement method [10–14]. Using the standard back-translation method, the Japanese version of K6 has been developed, and it has been validated [10]. However, there are no reports that accurately evaluated psychological distress using the K6 questionnaire in patients on chronic hemodialysis in Japan.

Using the K6 instrument, we evaluated psychological distress and its relationship to clinical factors, including HRQOL, in a cross-sectional and longitudinal study with 1-year follow-up.

## Subjects and methods

### Subjects

In the first analysis, we used data on 45 men ( $71.0 \pm 12.2$  years) and 27 women ( $69.3 \pm 11.0$  years)

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among 91 patients who met the following criteria: (1) wanted to be enrolled voluntarily in the cross-sectional study in 2012 at Innoshima General Hospital, Onomichi, Japan; (2) received anthropometric, body composition parameter, HRQOL, and psychological distress measurements; and (3) provided written informed consent (Table 1). In the second analysis, among these 72 patients, we used data on 58 patients on hemodialysis who wanted to undergo a 1-year follow-up.

Ethical approval for this study was obtained from the Ethical Committee of Innoshima General Hospital, Onomichi, Japan (Innoshima General Hospital, Hiroshima, Japan: H24-3-28 and H25-2-27).

Clinical parameter measurements

Anthropometric and body composition parameters, such as height, body weight and body fat percentage (%), psychological distress using the K6 questionnaire, and HRQOL using the EQ-5D questionnaire were measured as described in our previous reports [2]. Subjects with higher K6 scores are defined with higher psychological distress,

and with higher EQ-5D scores are defined with higher HRQOL.

Blood pressure measurements

Resting systolic and diastolic blood pressures (SBP and DBP) were measured indirectly using a mercury sphygmomanometer placed on the arm without blood access after at least 15 min of rest.

Blood sample and assays

Before hemodialysis, blood samples were collected in order to determine albumin, high-density lipoprotein (HDL) cholesterol, triglyceride, and blood glucose levels.

Statistical analysis

Data are expressed as mean ± standard deviation (SD) values. Unpaired and paired *t* test were used to make comparisons between the two groups. Simple correlation analysis was performed to test for the significance of the

**Table 1** Clinical characteristics in patients on chronic hemodialysis

	Total			Men			Women		
	Mean ± SD	Minimum	Maximum	Mean ± SD	Minimum	Maximum	Mean ± SD	Minimum	Maximum
Number of subjects	72			45			27		
Age (years)	69.4 ± 11.7	41	89	71.0 ± 12.2	41	89	69.3 ± 11.0	45	84
Height (cm)	156.1 ± 8.7	131.5	174.1	160.6 ± 6.2	149.3	174.1	148.5 ± 6.9	131.5	161.0
Body weight (dry weight) (kg)	53.8 ± 10.9	32.7	97.0	56.1 ± 11.1	34.7	97.0	50.0 ± 9.8	32.7	74.0
BMI (kg/m <sup>2</sup> )	22.0 ± 3.5	14.8	34.1	21.6 ± 3.3	14.8	34.1	22.7 ± 3.9	16.6	31.9
Body fat percentage (%)	28.8 ± 9.6	8.5	50.1	25.9 ± 8.5	8.5	50.1	33.3 ± 9.7	14.7	50.0
Duration of hemodialysis (years)	7.4 ± 7.4	0	30	6.6 ± 6.9	0	28	8.7 ± 8.1	0	30
K6 scores	3.7 ± 3.7	0	16	3.5 ± 3.5	0	14	4.0 ± 4.1	0	16
EQ-5D scores	0.721 ± 0.210	0.052	1.000	0.749 ± 0.177	0.376	1.000	0.675 ± 0.253	0.052	1.000
SBP (mmHg)	131.1 ± 19.9	90.0	190.0	130.6 ± 20.4	90.0	190.0	132.0 ± 19.4	93.0	185.0
DBP (mmHg)	71.0 ± 11.7	48.0	105.0	70.9 ± 12.1	48.0	105.0	71.2 ± 11.2	50.0	92.0
Triglyceride (mg/dL)	98.1 ± 49.9	36.0	267.0	98.5 ± 50.5	40.0	267.0	97.4 ± 49.8	36.0	247.0
HDL cholesterol (mg/dL)	55.5 ± 17.8	23.8	116.8	53.1 ± 16.8	23.8	107.8	59.7 ± 18.9	33.5	116.8
Blood glucose (mg/dL)	129.2 ± 45.1	64.0	354.0	124.9 ± 34.4	64.0	234.0	136.4 ± 58.9	76.0	354.0
Albumin (g/mL)	3.6 ± 0.3	2.6	4.4	3.6 ± 0.3	2.6	4.4	3.7 ± 0.3	3.1	4.2

BMI body mass index (kg/m<sup>2</sup>), SBP systolic blood pressure (mmHg), DBP diastolic blood pressure (mmHg)

**Table 2** Simple correlation analysis between K6 scores and clinical parameters

	Total ( <i>n</i> = 72)		Men ( <i>n</i> = 45)		Women ( <i>n</i> = 27)	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
BMI (kg/m <sup>2</sup> )	−0.148	0.213	−0.083	0.588	−0.256	0.198
Body fat percentage	−0.271	<b>0.022</b>	−0.291	0.055	−0.356	0.068
Duration of hemodialysis (years)	0.111	0.354	−0.055	0.719	0.295	0.136
EQ-5D scores	−0.380	<b>0.001</b>	−0.362	<b>0.015</b>	−0.389	<b>0.045</b>
SBP (mmHg)	−0.140	0.240	−0.040	0.792	−0.300	0.128
DBP (mmHg)	−0.181	0.128	−0.088	0.564	−0.331	0.092
Triglyceride (mg/dL)	−0.079	0.512	−0.019	0.902	−0.165	0.412
HDL cholesterol (mg/dL)	−0.068	0.571	−0.250	0.098	0.131	0.513
Blood glucose (mg/dL)	−0.142	0.234	−0.061	0.690	−0.234	0.240
Albumin (g/mL)	−0.242	<b>0.041</b>	−0.381	<b>0.010</b>	−0.029	0.885

Bold values are statistically significant ( $p < 0.05$ )

*BMI* body mass index (kg/m<sup>2</sup>), *SBP* systolic blood pressure (mmHg), *DBP* Diastolic blood pressure (mmHg)

linear relationship among continuous variables, where  $p < 0.05$  was considered to be statistically significant.

## Results

For the first cross-sectional analysis, clinical profiles of enrolled patients on chronic hemodialysis are summarized in Table 1. The mean K6 and EQ-5D scores were  $3.7 \pm 3.7$  and  $0.721 \pm 0.210$ , respectively (Table 1). In accordance with Kessler et al. [12], we classified subjects with scores of 13 points or more (2 patients, 2.8 %) as having psychological distress. The relationships between K6 scores and clinical parameters at baseline are indicated in Table 2. In total subjects, K6 scores were significantly and negatively correlated with body fat percentage (%), albumin level, and EQ-5D scores. K6 scores were negatively correlated with albumin level in men, and K6 scores were also negatively correlated with EQ-5D scores stratified by gender.

In the second longitudinal analysis, we compared the clinical parameters between patients on chronic hemodialysis with ( $n = 58$ ) and without ( $n = 14$ ) 1-year follow-up (Table 3). There was a significant difference in mean blood sugar level between the two groups. However, no other significant differences in parameters were noted between patients with and without follow-up. In addition, changes in clinical parameters were also evaluated at 1-year follow-up (Table 4). Body fat percentage, SBP, and DBP showed significant increases at 1-year follow-up. However, K6 and EQ-5D scores did not change over the 1-year period in this cohort.

Finally, we investigated changes in K6 scores and clinical parameters (Table 5). Changes in K6 scores were only weakly and negatively correlated with EQ-5D scores in total subjects ( $r = -0.289$ ,  $p = 0.028$ ) (Fig. 1). Therefore, improving psychological distress was associated with improving HRQOL.

**Table 3** Comparison of clinical parameters between patients on chronic hemodialysis with and without follow-up at baseline

	Follow-up (+) Mean $\pm$ SD	Follow-up (−) Mean $\pm$ SD	<i>p</i>
Number of subjects	58	14	
Age (years)	71.5 $\pm$ 10.3	65.7 $\pm$ 16.0	0.098
Height (cm)	156.0 $\pm$ 8.5	156.2 $\pm$ 10.0	0.946
Body weight (dry weight) (kg)	53.3 $\pm$ 9.5	55.9 $\pm$ 15.9	0.439
BMI (kg/m <sup>2</sup> )	21.8 $\pm$ 3.0	22.7 $\pm$ 5.2	0.398
Body fat percentage	29.3 $\pm$ 9.4	26.6 $\pm$ 10.6	0.342
Duration of hemodialysis (years)	8.0 $\pm$ 7.8	4.6 $\pm$ 4.5	0.126
K6 scores	3.4 $\pm$ 3.6	4.8 $\pm$ 4.2	0.221
EQ-5D scores	0.737 $\pm$ 0.195	0.655 $\pm$ 0.263	0.188
SBP (mmHg)	131.3 $\pm$ 19.9	130.6 $\pm$ 20.5	0.909
DBP (mmHg)	70.6 $\pm$ 11.6	72.6 $\pm$ 12.3	0.558
Triglyceride (mg/dL)	95.2 $\pm$ 47.5	109.9 $\pm$ 59.3	0.329
HDL cholesterol (mg/dL)	55.9 $\pm$ 18.6	54.2 $\pm$ 14.3	0.750
Blood glucose (mg/dL)	121.6 $\pm$ 33.2	160.8 $\pm$ 70.4	<b>0.003</b>
Albumin (g/mL)	3.6 $\pm$ 0.3	3.6 $\pm$ 0.4	0.642

Bold values are statistically significant ( $p < 0.05$ )

*BMI* body mass index (kg/m<sup>2</sup>), *SBP* systolic blood pressure (mmHg), *DBP* diastolic blood pressure (mmHg)

## Discussion

In this study, using the K6 questionnaire, we evaluated psychological distress and its relationship to clinical parameters in a cross-sectional and longitudinal analysis in patients on chronic hemodialysis. K6 scores were weakly associated with HRQOL in the group with 1-year follow-up.

Using the K6 questionnaire, we have previously evaluated psychological distress of public health nurses [15], school teachers [16], and medical doctors [17] in Kagawa Prefecture, Japan, in a cross-sectional study, and 5.9, 8.2,

and 6.0 %, respectively, were defined as having psychological distress [15–17]. In community dwelling Japanese, the prevalence of psychological distress has been reported to be 6.7 % [18]. In an evaluation of psychological distress and/or depression in patients on chronic hemodialysis in a cross-sectional study, Martinez and Custodio [3] reported that mental health evaluated by using the General Health Questionnaire (GHQ) was significantly associated with

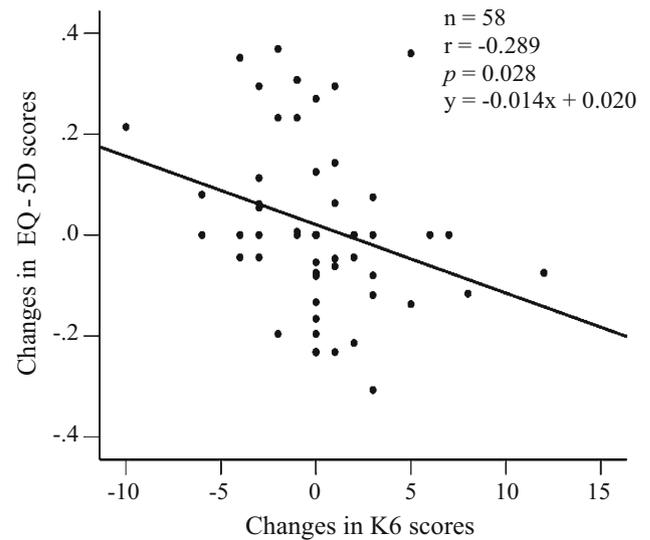
spiritual well-being. Chiang et al. [4] also reported that age-standardized prevalence of depression was 20.6 % by using the Taiwanese Depression Questionnaire. Zalai et al. [5] showed in their review that symptoms of clinical depression were found in approximately 25 % of patients on hemodialysis. By using a qualitative research design approach, support of psycho-social-economic aspects should be enhanced in patients on dialysis [6]. Among Japanese, Esaki et al. [7] reported that the levels of anxiety, insomnia, and depression in patients on hemodialysis were higher than those in healthy individuals by using the General Health Questionnaire-28 (GHQ-28). Preljevic et al. [8] showed that depressive and anxiety disorders were

**Table 4** Changes in clinical parameters in patients on chronic hemodialysis with 1-year follow-up (n = 58)

	Baseline Mean ± SD	Follow-up Mean ± SD	p
Age (years)	71.5 ± 10.3		
Height (cm)	156.0 ± 8.5		
Duration of hemodialysis (years)	8.0 ± 7.8		
Body weight (dry weight) (kg)	53.3 ± 9.5	53.5 ± 9.9	0.672
BMI (kg/m <sup>2</sup> )	21.8 ± 3.0	22.0 ± 3.3	0.248
Body fat percentage (%)	29.3 ± 9.4	31.0 ± 9.9	<b>0.036</b>
K6 scores	3.4 ± 3.6	3.6 ± 4.2	0.737
EQ-5D scores	0.737 ± 0.195	0.756 ± 0.208	0.397
SBP (mmHg)	131.3 ± 19.9	139.0 ± 19.9	<b>0.040</b>
DBP (mmHg)	70.6 ± 11.6	76.4 ± 10.9	<b>0.010</b>
Triglyceride (mg/dL)	95.2 ± 47.5	101.0 ± 60.6	0.320
HDL cholesterol (mg/dL)	55.9 ± 18.6	56.0 ± 17.3	0.919
Blood glucose (mg/dL)	121.6 ± 33.2	124.3 ± 36.5	0.517
Albumin (g/mL)	3.6 ± 0.3	3.6 ± 0.3	0.748

Bold values are statistically significant (p < 0.05)

BMI body mass index (kg/m<sup>2</sup>), SBP systolic blood pressure (mmHg), DBP diastolic blood pressure (mmHg)



**Fig. 1** Simple correlation analysis between changes in K6 scores and changes in EQ-5D scores in patients on chronic hemodialysis with 1-year follow-up

**Table 5** Simple correlation analysis between changes in K6 scores and changes in clinical parameters at 1-year follow-up

	Total (n = 58)		Men (n = 36)		Women (n = 22)	
	r	p	r	p	r	p
ΔBody weight (kg)	-0.210	0.114	-0.228	0.182	-0.202	0.368
ΔBMI(kg/m <sup>2</sup> )	-0.232	0.079	-0.257	0.130	-0.213	0.342
ΔBody fat percentage	-0.187	0.161	-0.230	0.178	-0.120	0.594
ΔEQ-5D scores	-0.289	<b>0.028</b>	-0.250	0.142	-0.330	0.133
ΔSBP (mmHg)	0.123	0.358	0.214	0.211	-0.012	0.957
ΔDBP (mmHg)	-0.055	0.681	0.039	0.823	-0.188	0.402
ΔTriglyceride (mg/dL)	-0.011	0.936	0.006	0.973	-0.052	0.820
ΔHDL cholesterol (mg/dL)	-0.079	0.555	-0.327	0.051	0.225	0.313
ΔBlood glucose (mg/dL)	0.060	0.652	-0.018	0.915	0.152	0.500
ΔAlbumin (g/mL)	-0.110	0.412	-0.147	0.391	-0.028	0.902

The bold highlighted value is statistically significant (p < 0.05)

BMI body mass index (kg/m<sup>2</sup>), SBP systolic blood pressure (mmHg), DBP diastolic blood pressure (mmHg), Δ changes in parameters with 1-year follow-up

common in dialysis patients by using the Short Form 36, and BMI indicates that special attention should be given to  $BMI \leq 21 \text{ kg/m}^2$ . Depression also had a significant negative association with serum albumin level [9]. In this study, we firstly and accurately evaluated psychological distress by using the K6 questionnaire, and only 2 patients (2.8 %) were defined as having psychological distress. K6 scores were significantly correlated with body fat percentage, albumin level, and EQ-5D scores in total subjects in the first cross-sectional analysis. In addition, K6 scores were correlated with albumin level in men, and also correlated with EQ-5D scores in both genders.

In a longitudinal analysis, Davison and Jhangri [19] reported that psychosocial adjustment to illness was highly correlated with HRQOL by the Kidney Dialysis Quality of Life Short Form. Mittal et al. [20] showed negative changes in physical and mental health were higher in hemodialysis patients than those in the general population in a study with 2-year follow-up. In this study, we evaluated the relationship between changes in K6 scores and changes in EQ-5D scores. Body fat percentage, SBP and DBP were significantly increased with 1-year follow-up. Although significant changes in K6 scores and EQ-5D scores were not noted because of this cohort analysis, changes in K6 scores were weakly and negatively correlated with EQ-5D scores. Thus, improving psychological distress might be weakly correlated with improving HRQOL. In fact, social support is reported to be important for both peritoneal dialysis patients and hemodialysis patients according to a study with 1-year follow-up [21]. Social factors are also related to life satisfaction in outpatients on hemodialysis among Japanese [22]. Mahdavi et al. [23] suggested that relaxation training improves and prevents psychological problems in patients on chronic hemodialysis in an intervention study. Taking these results together, it is reasonable to suggest that proper coping strategies for psychological distress might result in improving HRQOL in patients on chronic hemodialysis.

There are some potential limitations in this study. First, 72 patients on chronic hemodialysis in the cross-sectional study voluntarily underwent measurements. Among the 72 patients, 58 patients in the second longitudinal analysis also voluntarily underwent measurements. Therefore, they may have been more health conscious than the average dialysis patient. Second, we could not identify the mechanism for the relationship between K6 scores and HRQOL. Third, the small sample size makes it difficult to validate this study. In fact, the prevalence of psychological distress in patients on chronic hemodialysis was less than that in previous reports. Nonetheless, it seems reasonable to suggest that improving psychological distress might result in improved HRQOL in some patients on hemodialysis. To confirm this clearly, further prospective investigation and large sample

size studies in patients on chronic hemodialysis are urgently required.

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**Conflict of interest** There is no conflict of interest.

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