Original Article

The Impact of Reusable Dialyzer Membrane on End-Stage Renal Disease Patients’ Quality of Life: A Multicenter Study in Jakarta, Indonesia

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ABSTRACT. Data from 8th Report of the Indonesian Renal Registry in 2015 reported that there was an increase in the prevalence of hemodialysis (HD) patients in Indonesia. Measures had been taken to reduce the cost of HD such as utilizing reusable dialyzer membrane. However, little is known on the impact of reusable dialyzer membrane on patients’ quality of life (QOL), and hence, this study was conducted. We conducted a multicenter study at Cipto Mangunkusumo Hospital, Koja District Hospital, and Cengkareng District Hospital with a total of 389 patients. Cipto Mangunkusumo Hospital represented single-use dialyzer group while, Koja and Cengkareng District Hospital represented reusable dialyzer group. Face-to-face interviews were conducted using Kidney Disease QOL-Short Form 36 questionnaires. Single-use dialyzer group’s scores were significantly higher than reusable dialyzer group’s scores in the following dimensions: kidney disease component summary (KDCS; 74.2 vs. 66.3; P <0.001), physical component summary (PCS; 70.6 vs. 55.2; P <0.001), mental component summary (MCS; 76.1 vs. 70.7; P = 0.023), and overall health rating (73.4 vs. 64.9; P <0.001). In the linear regression model, reusable dialyzer was still a strong predictor in KDCS (coefficient β = −9.3; P <0.001) and PCS (coefficient β = −17.2; P <0.001). Reusable dialyzer was associated significantly with patients’ QOL impairment. Unemployment, age, and illiteracy also showed significant association with patients’ QOL.

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Introduction

The cost of hemodialysis (HD) for patients with end-stage renal disease (ESRD) is an economic burden to developing countries, including Indonesia. According to the 8th Report of Indonesian Renal Registry in 2015, there was an increase of HD patients from
11,689 patients in 2014 to 30,554 patients in 2015. The Indonesian National Health Insurance System reported that 2.2 trillion Indonesian Rupiah (IDR); equivalent to 145 million United States Dollars (USD) was claimed for ESRD in 2014 and 2.7 trillion IDR (equivalent to 180 million USD) was claimed for ESRD in 2015.

To achieve cost efficiency in HD practice, methods for reusing dialyzer membrane were attempted. HD sessions were performed twice a week as regulated by The Indonesian Association of Nephrology and The National Health Insurance due to limited financial support. Practice of reusing dialyzer membrane was initiated in the United States in the 1980s. It was suggested that the reuse practice was more affordable than the single-use practice, with 14.97% of cost saving. However, the cheaper cost of reuse practice notwithstanding, studies suggested some controversies regarding the patients’ morbidity and mortality affected by the dialyzer membrane reuse, including blood contamination of residual germicides which could worsen patients’ clinical outcomes. A systematic review by Galvao et al stated that there was no significant difference between reusable and single-use dialyzer in the aspect of mortality risk.

Previous studies focused on the association between dialyzer membrane and mortality or morbidity of ESRD patients. However, the main goal of HD is to achieve optimal quality of life (QOL) of patients with ESRD, but there is still a knowledge gap on the association between dialyzer membrane and patients’ QOL. There have been no previous studies which focused on this matter.

It is important to identify the association between dialyzer membrane and ESRD patients’ QOL, and a previous study showed that dialyzer reuse could alter leukocyte activity which may affect patients’ clinical manifestations. It is hypothesized that there is an association between dialyzer membrane and ESRD patients’ QOL. This study was conducted to fill this knowledge gap on the association between dialyzer membrane and ESRD patients’ QOL.

Methods

Study design and setting
This was a cross-sectional study which aimed to determine the association between dialyzer membrane and ESRD patients’ QOL. The study was conducted during December 2017 to April 2018 at three public hospitals in Jakarta: Cipto Mangunkusumo National Referral Hospital, Cengkareng District Hospital, and Koja District Hospital. During the study, patients with ESRD at Cipto Mangunkusumo Hospital underwent HD with single-use dialyzer membrane, while patients with ESRD at Cengkareng District Hospital and Koja District Hospital underwent HD with dialyzer membrane reuse. In Indonesia, the regulation states that the maximum number of times a dialyzer can be reused seven. However, in certain conditions, such as more than 20% of membrane leakage, the reusable dialyzer membrane must be changed into a new dialyzer membrane. Ethical approval of this study protocol was issued by the Health Research Ethics Committee, Faculty of Medicine, Universitas Indonesia – Cipto Mangunkusumo Hospital with the letter’s reference number being 229/UN2.F1/ETIK/2017.

Sampling methods
Total sampling approach was performed in this study. Patients with ESRD, aged ≥18 years, and underwent twice per week HD procedure for at least one year were included in this study. The diagnosis of ESRD was based on the criteria of Kidney Disease Improving Global Outcomes.

Procedures and instruments
Face-to-face interviews were conducted with ESRD patients during their routine HD visit. Prior to the interview, informed consent was obtained from all patients. The questionnaire used in this study was the Kidney Disease QOL-Short Form 36 (KDQOL-SF 36). Patients’ physical examination data and laboratory results were obtained from the most
Covariates and outcomes

The following characteristics of ESRD patients who underwent routine HD were recorded: age, sex, educational level, monthly income, ethnicity, religion, marital status, history of hospitalization, etiology of chronic kidney disease (CKD), vascular access type, duration of HD, hemoglobin, albumin, and glomerular filtration rate (GFR). Age was categorized into the following groups: <35 years, 35–60 years, and >60 years. Educational level was categorized into elementary school, junior high school, and college. Monthly income (in IDR) was categorized into <1 million, 1–3 million, 3–5 million, 5–10 million, 10–15 million, and >15 million (equal to <$65, $65–200, $200–350, $350–660, $660–1000, >$1000). Ethnicity was categorized into Javanese, Betawinese, Sundanese, and others. Religion was categorized into Islam, Christian, Buddhism, and Hinduism. Marital status was categorized into single/widowed/divorced and married. Etiology of CKD was categorized into hypertension, diabetes mellitus, glomerulonephritis, and others. Vascular access was categorized into arteriovenous fistula, femoral access, tunnel, and double-lumen catheter. Dialysis vintage was recorded as numerical data. Duration of hospitalization within the last six months was also recorded as numerical data. Hemoglobin and GFR were recorded as numerical data. The GFR was calculated based on the CKD Epidemiology Collaboration formula.9

The primary outcome of this study was the mean QOL of each group (dialyzer reuse group and single-use dialyzer group). The QOL was measured with the KDQOL-SF 36. The following are the three main dimensions of QOL measured in this questionnaire: kidney disease component (KDC), physical component (PC), and mental component (MC). Each of the components has specific dimensions. The KDC has eleven dimensions, which are symptoms, effects of kidney disease, burden of kidney disease, work status, cognitive function, quality of social interaction, sexual function, sleep, social support, dialysis staff encouragement, and patient satisfaction. The PC has four dimensions, which are physical functioning, role physical, pain, and general health perceptions. The MC has four dimensions, which are emotional well-being, role-emotional, social function, and energy/fatigue. All dimensions had scores ranging from 0 to 100.

Statistical Analysis

The categorical data are presented as frequencies (n) and percentages (%). The numerical data are presented as means and standard deviations (SDs). The numerical data of KDQOL dimensions were statistically analyzed with the numerical tests based on the normality of data distributions of each dimensions. The KDC, PC, and overall health rate dimensions were normally distributed and analyzed with unpaired t-test, while the other KDQOL dimensions were abnormally distributed and analyzed with Mann–Whitney test. Bivariate analysis using Spearman correlation test was performed to show association between patient’s characteristics and main components of QOL. Patient’s characteristics were included in the multivariate analysis to look for confounding factors. An arbitrary value of $P <0.25$ (obtained in the bivariate analysis between background characteristics and QOL) was used to include a variable of background characteristics into the multivariate analysis. The software used for statistical analysis was Statistical Package for the Social Sciences version 20.0 (IBM Corp., Armonk, NY, USA).

Results

Characteristics of end-stage renal disease patients

All 389 samples were taken from Cipto Mangunkusumo Hospital (13.6%), Koja District Hospital (42.2%), and Cengkareng District Hospital (44.2%). The Cipto Mangunkusumo Hospital represented the single use dialyzer group. The Koja and Cengkareng District Hospitals represented the dialyzer reuse group.
Table 1 shows the characteristics of patients in this study. The majority of patients were male (57.6%). Age group of 35–60 years was the largest proportion (71.5%) among the three age groups. Most of the patients had educational level of senior high school (39.1%). More than half of the patients were unemployed (63.2%). The majority of the patients had monthly income of IDR 1–3 million. Most of the patients were Javanese (35.5%). The majority of the patients had Islam as their religion. More than half of the individuals were married (87.1%). Hypertension was the most frequent etiology of ESRD (67.9%). Arteriovenous fistula was the most frequently used vascular access (76.9%). The mean dialysis vintage was 3.2 years (SD 3.1). The mean duration of hospitalization was 3.6 days (SD 8.0). The mean systolic blood pressure was 143.9 mm Hg (SD 28.1) and the mean diastolic blood pressure was 80.6 (SD 14.3). The mean body mass index (BMI) was

| Characteristics                                      | All individuals | Single-use dialyzer | Reusable dialyzer |
|------------------------------------------------------|-----------------|---------------------|-------------------|
|                                                      | n (%) Mean (SD) | n (%) Mean (SD)    | n (%) Mean (SD)   |
| Number of patients                                   | 389 (100%)      | 53 (13.6%)          | 336 (86.4%)       |
| Gender                                               |                 |                     |                   |
| Male                                                 | 224 (57.6%)     | 23 (43.4%)          | 201 (59.8%)       |
| Female                                               | 165 (42.4%)     | 30 (56.6%)          | 135 (40.2%)       |
| Age (years)                                          |                 |                     |                   |
| <35 years                                            | 49 (11.5%)      | 5 (9.4%)            | 43 (11.3%)        |
| 35–60 years                                          | 278 (71.5%)     | 37 (69.8%)          | 241 (71.7%)       |
| >60 years                                            | 68 (17.5%)      | 11 (20.8%)          | 57 (17%)          |
| Highest educational level achieved                   |                 |                     |                   |
| Illiterate                                           | 10 (2.6%)       | 0 (0.0%)            | 10 (3.0%)         |
| Elementary school                                    | 104 (26.7%)     | 7 (13.2%)           | 97 (28.9%)        |
| Junior high school                                   | 54 (13.9%)      | 2 (3.8%)            | 52 (15.5%)        |
| Senior high school                                   | 152 (39.1%)     | 21 (39.6%)          | 131 (39%)         |
| College                                              | 69 (17.7%)      | 23 (43.4%)          | 46 (13.7%)        |
| Employment                                           |                 |                     |                   |
| Unemployed                                           | 246 (63.2%)     | 33 (62.3%)          | 213 (63.4%)       |
| Employed                                             | 143 (36.8%)     | 20 (37.7%)          | 123 (36.6%)       |
| Monthly income (Indonesian Rupiah)                   |                 |                     |                   |
| <1 million                                           | 38 (9.8%)       | 6 (11.3%)           | 32 (9.5%)         |
| 1–3 million                                          | 164 (42.2%)     | 4 (7.5%)            | 160 (47.6%)       |
| 3–5 million                                          | 99 (25.4%)      | 3 (5.7%)            | 96 (28.6%)        |
| 5–10 million                                         | 24 (6.2%)       | 11 (20.8%)          | 13 (3.9%)         |
| 10–15 million                                        | 7 (1.8%)        | 3 (5.7%)            | 4 (1.2%)          |
| >15 million                                          | 57 (14.7%)      | 26 (49.1%)          | 31 (9.2%)         |
| Ethnicity                                            |                 |                     |                   |
| Javanese                                             | 138 (35.5%)     | 27 (50.9%)          | 111 (33.0%)       |
| Betawinese                                           | 116 (29.8%)     | 9 (7.8%)            | 107 (31.8%)       |
| Sundanese                                            | 59 (15.2%)      | 6 (11.3%)           | 53 (15.8%)        |
| Others                                               | 76 (19.5%)      | 11 (20.8%)          | 65 (19.3%)        |
| Religion                                             |                 |                     |                   |
| Islam                                                | 346 (88.9%)     | 50 (94.3%)          | 296 (88.1%)       |
| Christian                                            | 32 (8.2%)       | 2 (3.8%)            | 30 (8.9%)         |
| Buddhism                                             | 6 (1.5%)        | 1 (1.9%)            | 5 (1.5%)          |
| Hinduism                                             | 5 (1.3%)        | 0 (0.0%)            | 5 (1.5%)          |
Continuation of Table 1.

| Marital status                  | Number (Percentage) |
|--------------------------------|---------------------|
| Single/widowed/divorced        | 50 (12.9%)          |
| Married                        | 339 (87.1%)         |
|                                |                     |
| Etiology                       |                     |
| Hypertension                   | 264 (67.9%)         |
| Diabetes mellitus              | 77 (19.8%)          |
| Glomerulonephritis             | 13 (3.3%)           |
| Others                         | 35 (9.0%)           |
| Vascular access                |                     |
| Arteriovenous fistula          | 299 (76.9%)         |
| Femoral                        | 12 (3.1%)           |
| Tunnel and double lumen catheter| 78 (20.1%)         |
| Dialysis vintage (years)       | 3.2 (3.1)           |
| Duration of hospitalization (days in the last 6 months) | 3.6 (8.0) |
| Blood pressure                 |                     |
| SBP (mm Hg)                    | 143.9 (28.1)        |
| DBP (mm Hg)                    | 80.6 (14.3)         |
| BMI (kg/m²)                    | 22.7 (4.1)          |
| GFR (mL/min/1.73 m²)           | 8.9 (10.5)          |
| Hemoglobin (g/dL)              | 9.5 (1.7)           |

SD: Standard deviation, GFR: Glomerular filtration rate, DBP: Diastolic blood pressure, BMI: Body mass index, SBP: Systolic blood pressure.

22.7 kg/m² (SD 4.1). The mean GFR was 8.9 mL/min/1.73 m² (SD 10.5) and the mean hemoglobin was 9.5 g/dL (SD 1.7).

Kidney Disease Quality of Life

Table 2 provides a summary of mean difference between the QOL of patients on single-use dialyzer and dialyzer reuse. The three main components of QOL (KDC, PC, and MC) had significantly different mean scores between the two groups of the study patients. The single-use dialyzer group had significantly higher mean score than dialyzer reuse group in the following dimensions: burden of kidney disease, cognitive function, quality of social interaction, sleep, social support, patient satisfaction, physical functioning, role physical, general health perceptions, emotional well-being, and energy/fatigue.

Bivariate analysis of associations with KDQOL main dimensions

Table 3 provides summary of the association between patients’ characteristics and main components of the KDQOL, which are the KDC, PC, and MC. Dialyzer reuse group was significantly associated with the three main components. Age, being illiterate, being unemployed, duration of hospitalization, and GFR were significantly associated with the KDC. The following factors were significantly associated with the PC: age, being unemployed, duration of hospitalization, hypertension, dialysis vintage, and GFR. The MC score was associated with the following variables: being female, being illiterate, being unemployed, and the GFR.

Multivariate analysis of associations with KDQOL main dimensions

The linear regression model associating patients’ characteristics and KDQOL main dimensions is summarized in Table 4. After adjustment with patients’ background characteristics, dialyzer reuse was still a strong predictor and negatively associated with KDC (Coefficient β = −9.26; P <0.001) and PC (Coefficient β = −17.20; P <0.001). In the associations with the KDC, age (P = 0.013) and being unemployed (P <0.001) were the
Table 2. Distributions of quality of life between single-use dialyzer group and dialyzer reuse group.

| Quality of life dimensions                      | Single-use dialyzer group (n=53) | Dialyzer Reuse group (n=336) | P     |
|------------------------------------------------|----------------------------------|-------------------------------|-------|
| Kidney disease component summary               | 74.2 (13.1)                      | 66.3 (9.7)                    | <0.001*|
| Symptoms                                        | 79.8 (16.2)                      | 77.6 (14.2)                   | 0.116 |
| Effects of kidney disease                       | 76.9 (16.4)                      | 79.6 (14.9)                   | 0.225 |
| Burden of kidney disease                        | 71.1 (26.3)                      | 43.5 (23.6)                   | <0.001*|
| Work status                                     | 32.1 (38.1)                      | 39.9 (36.3)                   | 0.110 |
| Cognitive function                              | 85.8 (18.2)                      | 78.8 (19.9)                   | 0.006*|
| Quality of social interaction                   | 89.5 (16.7)                      | 80.1 (16.4)                   | <0.001*|
| Sexual function                                 | 55.4 (42.7)                      | 63.7 (34.1)                   | 0.249 |
| Sleep                                           | 76.8 (18.3)                      | 55.3 (14.1)                   | <0.001*|
| Social support                                  | 85.2 (16.9)                      | 69.6 (16.4)                   | <0.001*|
| Dialysis staff encouragement                    | 91.9 (14.1)                      | 89.5 (14.2)                   | 0.188 |
| Patient satisfaction                            | 62.9 (15.5)                      | 51.3 (7.1)                    | <0.001*|
| PC summary                                      | 70.6 (22.7)                      | 55.2 (17.5)                   | <0.001*|
| Physical functioning                            | 71.5 (27.7)                      | 60.6 (27.2)                   | 0.002*|
| Role – physical                                 | 66.0 (37.7)                      | 26.3 (36.0)                   | <0.001*|
| Pain                                            | 75.9 (22.0)                      | 75.5 (21.2)                   | 0.793 |
| General health perceptions                      | 68.9 (18.1)                      | 58.6 (15.0)                   | <0.001*|
| Mental component summary                        | 76.1 (21.6)                      | 70.7 (18.9)                   | 0.023*|
| Emotional well-being                            | 81.6 (17.0)                      | 75.8 (17.6)                   | 0.014*|
| Role – emotional                                | 66.0 (40.5)                      | 60.0 (40.5)                   | 0.460 |
| Social function                                 | 79.5 (24.5)                      | 79.2 (21.2)                   | 0.547 |
| Energy/fatigue                                  | 77.3 (20.2)                      | 67.2 (15.8)                   | <0.001*|

*Means P <0.05, PC: Physical component.

Table 3. Bivariate analysis of background characteristics and main components of quality of life.

| Variables                               | R       | P       |
|-----------------------------------------|---------|---------|
| Kidney disease component                |         |         |
| Dialyzer reuse                         | −0.21   | <0.001* |
| Age                                     | −0.19   | <0.001* |
| Female                                  | 0.04    | 0.422   |
| Illiterate                              | −0.10   | 0.045*  |
| Unemployed                              | −0.26   | <0.001* |
| Income <1 million                       | −0.03   | 0.533   |
| Javanese                                | 0.06    | 0.260   |
| Islam                                   | 0.02    | 0.718   |
| Single/widowed/divorced                 | 0.08    | 0.134   |
| Duration of hospitalization             | −0.13   | 0.008*  |
| Hypertension                            | 0.06    | 0.216   |
| Arteriovenous fistula                   | 0.01    | 0.848   |
| Dialysis vintage                        | 0.08    | 0.104   |
| SBP                                     | 0.02    | 0.644   |
| DBP                                     | 0.02    | 0.746   |
| BMI                                     | 0.08    | 0.115   |
| Hemoglobin                              | −0.01   | 0.819   |
| GFR                                     | −0.11   | 0.026*  |
| PC                                      |         |         |
| Reusable dialyzer                       | −0.27   | <0.001* |
| Age                                     | −0.17   | 0.001*  |
significant predictors for the KDC. In the associations with the PC, age \((P = 0.024)\), being unemployed \((P = 0.001)\), and hypertension \((P = 0.004)\) were the significant predictors for the PC. Being unemployed contributed to the large impairment of the means scores in the KDC (Coefficient \(\beta = -5.29\)) and PC (Coefficient \(\beta = -6.79\)). In the impairment of the MC scores, it was in the second place (Coefficient \(\beta = -6.10\)) behind being illiterate (Coefficient \(\beta = -14.44\)).

**Discussion**

Maximizing patient’s QOL is one of the primary goals in chronic maintenance HD.\(^7\) HD itself could impair the patients’ QOL.\(^10\) Therefore, it is important to fill the knowledge gap in the relationship between dialyzer membrane and ESRD patients’ QOL.

The most unique feature of the patients’ characteristics was the most frequent etiology of ESRD, which was hypertension (67.9%).
This result was supported by Masina et al\textsuperscript{11} who showed that the most common cause of ESRD in their population was hypertension (40.9\%). However, these data were self-reported and need further confirmation because De Nicola and Zoccali\textsuperscript{12} stated that there was big gap between prevalence of CKD and its most prevalent risk factor such as hypertension and diabetes, which means that there are still some unknown risk factors.

In general, this study’s scores of main components such as PC and MC in both groups were higher than a study by Fukuhara\textsuperscript{13} (35.5 and 43.2, respectively) and Vasilieva\textsuperscript{14} (36.9 and 44.2, respectively). The mean score of single-use dialyzer was significantly higher than dialyzer reuse in KDC, PC, and MC. The mean score of single-use dialyzer was also significantly higher than dialyzer reuse in the following dimensions of KDC: burden of kidney disease, cognitive function, quality of social interaction, sleep, social support, and patient satisfaction. In the bivariate analysis using correlation test, the result showed that dialyzer reuse was negatively associated with KDC, PC, and MC. All the questions regarding these dimensions explored if patients’ daily activities were affected due to their kidney

| Variables                                      | Coefficient $\beta$ | $P$  |
|------------------------------------------------|---------------------|------|
| Kidney disease component                       |                     |      |
| Reusable dialyzer                              | −9.26               | <0.001* |
| Age                                            | −0.10               | 0.013* |
| Illiterate                                     | −3.78               | 0.281 |
| Unemployed                                     | −5.29               | <0.001* |
| Single/widowed/divorced                        | −1.28               | 0.412 |
| Duration of hospitalization                    | −0.06               | 0.364 |
| Hypertension                                   | 2.21                | 0.051 |
| Dialysis vintage                               | −0.10               | 0.560 |
| BMI                                            | 0.22                | 0.081 |
| GFR                                            | 0.05                | 0.325 |
| PC                                             |                     |      |
| Reusable dialyzer                              | −17.20              | <0.001* |
| Age                                            | −0.18               | 0.024* |
| Illiterate                                     | −3.61               | 0.524 |
| Unemployed                                     | −6.79               | <0.001* |
| Duration of hospitalization                    | −0.23               | 0.052 |
| Hypertension                                   | 5.90                | 0.004* |
| Arteriovenous fistula                          | 2.77                | 0.221 |
| Dialysis vintage                               | 0.01                | 0.964 |
| SBP                                            | −0.05               | 0.085 |
| BMI                                            | 0.07                | 0.752 |
| GFR                                            | −0.0                | 0.979 |
| Mental component                               |                     |      |
| Reusable dialyzer                              | −5.11               | 0.109 |
| Female                                         | −2.26               | 0.294 |
| Illiterate                                     | −14.44              | 0.019* |
| Unemployed                                     | −6.10               | 0.005* |
| Javanese                                       | 1.88                | 0.356 |
| Dialysis vintage                               | 0.02                | 0.962 |
| GFR                                            | 0.07                | 0.488 |

* $P$ <0.05, GFR: Glomerular filtration rate, PC: Physical component, BMI: Body mass index, SBP: Systolic blood pressure.
disease. Therefore, dialyzer reuse impairs patients’ daily activities.

The PC and MC questions explore the patients’ self-perception on their physical and mental well-being. The World Health Organization also defines QOL as “individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns.”

Single-use dialyzer group had significantly higher score than the dialyzer reuse group in the following dimensions of PC and MC: physical functioning, role physical, general health perceptions, emotional well-being, and energy/fatigue. Based on this result, ESRD patients on dialyzer reuse had poorer self-perception of their life.

To the best of our knowledge, there have been no previous studies which focused on the relationship between dialyzer reuse and QOL. A study by Rao et al. showed that leukocyte function was altered by dialyzer reuse and recommended that further studies should be performed to confirm the effect on the clinical outcome. A study by Collins et al. stated that no-reuse practice had lower mortality risk compared with reuse practice.

In the association with KDC, multivariate analysis showed that age and being unemployed were the significant predictors for KDC and both associated negatively with KDC. The association with PC, age, being unemployed, and hypertension was negatively associated with PC. In the association with MC, being illiterate and unemployed associated negatively with MC. These results were supported by a study by Seica et al. which stated that age and low socioeconomic status were significantly associated with lower QOL scores. However, Seica et al. stated that higher educational level was associated with lower QOL score, which contradicted our finding that showed that being illiterate was associated with lower QOL score. Regarding duration of hospitalization, the result of this study was supported by Oliveira et al. which showed that duration of hospitalization was significantly associated with PC.

This study showed that dialysis vintage was a significant positive predictor for PC. This result was in contradiction with a study by Bayoumi et al. which showed that there was insignificant association between dialysis vintage and PC. The study by Bayoumi et al. showed that the significant association was found between dialysis vintage and social aspect. Another study by Joshi et al. also showed that HD duration was a significant predictor for social dimension of QOL.

We recommend a further prospective study to observe patients’ QOL and to confirm the causal relationship between dialyzer membrane and patients’ QOL.

**Limitation of the Study**

The limitation of the study is that we were unable to gather the data of Kt/V for every patient and hence omitted it from the statistical analysis. A study performed by Imelda et al. in Indonesia showed that >68% of HD patients reached Kt/V > 1.8 in a twice per week HD.

**Conclusion**

In conclusion, our results suggest that dialyzer reuse impairs ESRD patients’ QOL. However, adjustment with patients’ characteristics showed that age, socioeconomic status, duration of hospitalization, and dialysis vintage could also affect patients’ QOL.

**Conflict of interest:** None declared.

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