Quality of Life and Depression in Patients With End-stage Renal Disease: a Comparison of Renal Replacement Therapy Modalities

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Abstract

Purpose. Patients with end-stage renal disease (ESRD) face various physical and mental limitations resulting from different renal replacement therapy (RRT) modalities. Renal transplantation (Tx) is considered as the treatment that impacts most on health-related quality of life (HRQOL). This study aimed to analyze and compare the HRQOL and depression levels of patients undergoing hemodialysis (HD), peritoneal dialysis (PD) and Tx.

Methods. A single-center cross-sectional sample of 112 HD patients, 68 PD patients and 97 Tx patients participated in our questionnaire survey. The HRQOL and depression levels were assessed through the 36-Item Short-Form Health Survey (SF-36) and Mental Health Inventory (MHI-5), respectively. The multiple linear regression model was performed to examine the factors associated with each of the HRQOL scale scores.

Results. The SF-36 HRQOL of Tx patients differed significantly from that in HD and PD groups in all eight dimensions and two components (all $P < 0.001$). More than 45% of patients in each group were facing depressive symptoms. HD patients (63.4%) and PD (67.6%) patients were more depressive compared with Tx patients (45.4%, $P = 0.006$). Depression in ESRD patients contributed to a worse quality of life ($P < 0.001$). Patients ranging in age from 31 to 50, having full-time jobs, receiving Tx and without depression were associated with better HRQOL in the domain of Physical Component Scores (PCS). Patients with unemployment, dismissal or being looking for a job, receiving Tx and without depression were associated with better HRQOL in the domain of Mental Component Scores (MCS).

Conclusions. Tx patients had better HRQOL and less depressive symptoms than HD and PD patients. Depression was related to an impaired HRQOL, which was common in ESRD patients. The severity of depression in ESRD patients and the effectiveness of Tx on HRQOL improvement need to be underscored.

Introduction

Hemodialysis (HD), peritoneal dialysis (PD) and renal transplantation (Tx) are widely used renal replacement therapy (RRT) modalities in patients with end-stage renal disease (ESRD). Chronic dialysis has a significant impact on patients' health-related quality of life (HRQOL), including reduced physical and mental functioning, reduced social interaction and increased risk of depression[1]. Globally, in-center HD is the most widely used treatment for patients with ESRD, in spite of its poor outcomes on the whole [2]. As an alternative to HD, PD has been widely spread in recent years due to its lower costs and better survival rates. The promotion of PD may be important in developing countries featured with high prevalence of ESRD and limited medical resources [3, 4]. Several countries and regions such as Thailand and Hong Kong have carried out the PD-first policy, which encourages to use PD as the first choice of dialysis modalities [4]. Tx is considered to be the best option for ESRD patients as it relates to a better quality of life and extended life expectancy than dialysis, yet the use of it is fewer than 10% in many countries [2, 5]. As an important measuring tool of medical treatment, HRQOL can estimate to what extent that the physical, social and emotional well-being of a person is affected [6]. The aims of any RRT modalities are to increase HRQOL to acceptable levels and to restore health. Therefore, it is highly necessary to compare the HRQOL of ESRD patients in order to assess the efficiency of chosen RRT modalities[7]. Previous studies have reported that the change of RRT modalities has a substantial impact on patient-reported outcomes that deserves further discussion and comparison in detail [8]. The comparison studies about HD and PD demonstrated that the HRQOL tended to be better in PD patients, especially in terms of physical component, illness intrusion, social support, social function and mental health and satisfaction with care [4, 9-11]. The compared HRQOL scores of Tx patients were prominently higher than those of patients under dialysis treatment in most dimensions such as role physical, bodily pain, social function, role emotional and mental health[7, 12-18].

Literature has consistently revealed that depression is another important outcome associated with reduced HRQOL, poor medical adherence, altered immune system function, deteriorated nutritional status, increased morbidity and higher

mortality [6, 11, 19-22]. According to clinical interviews and questionnaires, one-quarter of chronic kidney disease (CKD) patients were assessed to be depressed, with the percentage even rising to 20% before the initiation of dialysis[19, 20]. It is well-recognized that depressive symptoms impair all aspects of the HRQOL of dialysis patients continuously, yet it is still contentious whether psychological outcomes of PD patients are better than that of HD patients[11, 22]. Tx patients face mental challenges before and after transplantation, yet they are generally less depressed than patients with other RRT modalities[23]. Factors related to depression in ESRD patients include age, gender, race, dialysis duration and comorbidity, which is similar to those in CKD patients [21]. Despite the detrimental impacts of depressive symptoms on both medical and psychosocial outcomes, they are usually undertreated in patients with ESRD [21, 22]. In a study of 928 ESRD patients with depression, only 34.9% were treated with antidepressants [24]. By identifying the RRT modalities that contribute to lower rates of depression and better quality of life, clinical outcomes can be effectively improved. There are still knowledge gaps requiring to be addressed. Beck Depression Inventory (BDI), Center for Epidemiological Studies Depression Scale (CES-D), Hospital Anxiety and Depression Scale (HADS) and Hamilton Depression Scale are widely used in reporting depression of patients with CKD[20].

The growing prevalence of chronic kidney disease (CKD) has become a significant public health problem in developing countries and brought about high health and economic burdens[25]. In 2012, the prevalence of CKD was estimated to be 10.8% and there were approximately 119.5 million patients with CKD in China[26]. The Chinese National Renal Data System reported that the prevalence of HD increased from 33.2 per million population (pmp) in 1999 to 237.3 pmp in 2012, which was partly on account of the expansion of basic medical insurance[27]. According to the 2016 annual report of China Kidney Disease Network (CK-NET), the age-adjusted prevalence of patients undergoing dialysis increased to 419.12 pmp. and the number of patients with prevalent dialysis was approximately 578,000[28]. Meanwhile, at the end of 2016, there were still 26,039 patients on the kidney transplantation waiting list [29]. Overall, China is confronting with several challenges caused by the increase of ESRD population, growing demands for high-quality healthcare and limited resources. The CK-NET also reported higher prevalence and incidence rates of dialysis in more economically developed regions [28]. Take Guangdong as an example, as a developed province in China, it is characterized by its sufficient awareness and effective management to ESRD. What is more, the prevail of cooking soup and Chinese traditional medicine in Guangdong province may increase the risk of being attacked by kidney disease. The purines in the decoction lead to high uric acid levels and superabundant protein may strain the kidneys. Therefore, this study focused on ESRD populations in Guangdong province, South China and aims to explore the HRQOL and depression in the context of different RRT modalities.

There were still some limitations in previous studies. First, a number of studies compared the HRQOL of ESRD patients undergoing all three RRT simultaneously, especially in China. Second, studies exploring relationship between depression and HRQOL and factors associated with these two outcomes need to be developed. Third, the expatiatory questionnaires were inclined to bore participants and impact their responses [30]. Thus, the study used Mental Health Inventory (MHI-5) composed of only 5 short items for depression screening. The accuracy of this brief instrument was well verified in previous studies [31-34]. We hypothesize that (i) the HRQOL and depression will be different due to the impacts of three kinds of RRT, and (ii) HRQOL is associated with some socioeconomic and psychosocial factors such as depression. Therefore, the present study aimed to (i) investigate the impacts of three different RRT modalities on the quality of life and depression among ESRD patients in South China, (ii) to identify the relationship between these two outcomes, and (iii) to explore other factors associated with HRQOL in ESRD patients.

Materials And Methods

Study population

The single-center cross-sectional study was conducted at Zhujiang Hospital of Southern Medical University in China from August 2018 to October 2018. A total of 277 patients aged from 18 to 80 years old were included in this study through convenience sampling, including 112 patients for HD, 68 for PD and 97 for Tx. The inclusion criteria for the study population were: ESRD patients treated with HD, PD or Tx, age above 18 years old, receiving the same RRT modality for at least three months, and physically and mentally capable of completing the survey with minimal assistance. Patients undergoing combination therapies of RRT modalities within three months and patients with comorbidity such as heart failure, cancer or acute disease etc. were excluded from the study.

Ethics approval

All of the participants gave their written consent before their inclusion in the study. The study was approved by the Ethics Committee of Zhujiang Hospital of Southern Medical University with the approval number of 2020-KY-076.

Questionnaires

The MOS 36-Item Short-Form Health Survey (SF-36) questionnaire is a generic and widely used measure related to HRQOL survey. The scores of SF-36 range from 0 to 100 and the score of 100 indicates an optimal HRQOL[35]. The SF-36 consists of 36 items, scattered in eight domains and two components. The dimensions of Physical Functioning, Role-Physical, Bodily Pain and General Health contribute to the Physical Component Summary. The dimensions of Vitality, Social Functioning, Role-Emotional and Mental Health contribute to the Mental Component Summary[36].

The Mental Health Inventory (MHI-5) scales derived from SF-36 are well-validated and reliable, which is proved to have a comparable psychometric performance to the generic psychological instruments such as the 12-item General Health Questionnaire (GHQ-12), Beck Depression Inventory (BDI) and Composite International Diagnostic Instrument-Short Form (CIDI-SF) [31-34]. Calculated by summing up the 5 short items scores, the scores of MHI-5 range from 0 to 100, and lower scores indicate more severe depressive symptoms[37]. It is verified to be effective in measuring the depression in dialysis patients as a psychological screening instrument, and the cut-off score of 70 was examined to be safe [33].

Statistical analysis

Categorical variables were presented using counts and percentages. The HRQOL scores of eight dimensions in three RRT groups were presented using median values with interquartile range (IQR). Chi-square test was employed to compare sociodemographic characteristics and depression scores in three RRT groups. HRQOL scores were compared with the Kruskal-Wallis H test and Bonferroni's test. Logistic regression analysis was conducted to calculate the odds ratios of depression. Mann-Whitney U test was used to compare the HRQOL of patients with and without depression. The effects of RRT, patient characters and depression on two components of HRQOL were analyzed by using univariate analyses. Spearman correlation tests were performed for the ordinal data and Kruskal-Wallis H test were performed for the nominal data. Significant variables in univariate analyses were input into the multiple linear regression analysis. All statistical analyses were performed using SPSS version 20.0. $P \leq 0.05$ indicated statistical significance.

Results

The sociodemographic characteristics were described in Table 1. Three groups differed significantly in age, education level, occupation, insurance and annual household income. Nearly 60% of HD patients were older people, while the majority of PD and Tx patients aged from 31 to 50 years old. The number of patients with a full-time job was significantly higher in the Tx group, and the Tx group also showed higher education level and annual household income. Patients with a university degree or above were 17.9% (n=20), 22.1% (n=15) and 45.4% (n=44) in HD, PD and Tx group, respectively. In terms of annual household income, 10.3% of Tx patients' annual household income exceeded 300,000 RMB, the percentages of which were no more than 2% in HD and PD patients. Among all groups, most of the patients had Urban

Employee Basic Medical Insurance, and the Tx group showed the highest percentage of patients with Urban Residents Basic Medical Insurance (29.9%) and New Rural Co-operative Medical Scheme (20.6%).

Table 2 described the median values with interquartile range of non-normally distributed data of HRQOL in eight dimensions. The highest Mental Component Scores were for the Tx group, with an average score of 306(249-343.25). This number was 204.92(149.38-297.63) for HD patients and 198.08(143.13-275.96) for PD patients ($P<0.001$). This sequence also applied to the Physical Component Scores and eight dimensions (all $P<0.001$). Bonferroni adjustments (Table 3) were repeated in eight dimensions and indicated a significant difference in HD patients versus Tx patients, as well as PD patients versus Tx patients ($P<0.001$). As Figure 1 demonstrated, the median values of HRQOL in Tx patients were much higher than those of the other two groups in each dimension.

As shown in Figure 2, the percentages of depression in three groups were high in all groups but significantly different ($P=0.006$). HD patients (63.4%) and PD patients (67.6%) were distinctly more depressive than Tx patients (45.4%). Odds ratios for depression in HD patients (2.072 for multivariate analysis, $p=0.023$) and PD patients (2.223 for multivariate analysis, $p=0.021$) compared with Tx patients were illustrated in Table 4. The Mann-Whitney U test indicated a significantly worse HRQOL of patients with depression compared with those without depressive symptoms in each dimension and component (all $P<0.001$).

Univariate analysis (Table 5) showed that education level, occupation, annual household income, RRT modality and depression affected both physical component and mental component of SF-36 HRQOL scores (all $P<0.05$), while age only effected Physical Component Scores. Gender, marital status and insurance had no significant effect on HRQOL. A multivariate linear regression was then performed (Table 6). As for Physical Component Scores, the HRQOL of patients with a full-time job ($P=0.038$) and aged from 31 to 50 ($P=0.041$) were notably higher than that of the reference category. With respect to Mental Component Scores, the HRQOL of patients with unemployment, dismissal or upon job hunting were notably higher than that of the reference category. In both components of SF-36, patients with HD (coefficient=-64.536, $P<0.001$; coefficient=-37.747, $P<0.001$) and PD (coefficient=-74.399, $P<0.001$; coefficient=-54.516, $P<0.001$) were inclined to have lower quality of life compared with Tx group, while depression (coefficient=-71.431, $P<0.001$; coefficient=-110.906, $P<0.001$) was another main contributor to an impaired HRQOL.

Discussion

This single-center cross-sectional study focused on the HRQOL and depression of ESRD patients in Guangdong province, South China, where the unique cooking culture of brewing a liquid preparation with medicinal herbs might contribute to high incidence of ESRD. The research found that RRT variation and depression were two determinant factors of ESRD patients' HRQOL in South China. High percentages of depression were revealed in all groups. This study suggested better HRQOL in middle-aged patients of PCS, which was consistent with a study in Nepal [30]. Moreover, we found that unemployed patients had worse HRQOL in terms of MCS. The dialysis-dependent life restricted their work capacity and resulted in a negative effect on their HRQOL mentally.

Compared with HD and PD groups, Tx patients significantly enjoyed a better quality of life and suffered less from psychological problems. The results verified that treatment modality was one of the most important factors affecting HRQOL psychological states of ESRD patients, and Tx was superior to the other two treatments, which was in accordance with the previous studies [2, 7, 12-18]. It is of necessity to increase the access to Tx, whereas there still exists a remarkably prominent variation in the access to and the use of Tx across the world. Data from the US Renal Data system showed that in 2013, more than 50% of patients with ESRD received Tx in Nordic countries, while the use of Tx was less than 10% in some Asian countries [2]. The resource constraints and inequities in access to Tx remain to be a tough challenge in developing countries, where the government supports for Tx such as increasing the number of cadaver donors and live donors requires further development. It is interesting to find that the HRQOL of HD patients was

comparable to that of PD patients in this study. This finding differed from the results of a number of previous studies in China that revealed a better quality of life in PD patients [13-15, 38-40] 10. In 2015, approximately 90% of patients with dialysis were receiving HD [39]. The 2016 annual report of CK-NET suggested that the cost of drugs was the leading expenditure for PD patients (34.48%), while the major cost for HD patients was the direct cost of dialysis [28]. The Zero-Markup Drug Policy removing the mark-up for sale of drugs has contributed to fewer financial incentives when hospitals and doctors prescribe PD. Consequently, it is reasonable to infer that the entrenched culture of HD and less financial incentives for PD in China tend to retain the healthiest patients on HD. Thus, patients undergoing PD may have a worse health status when HD is the first choice for most ESRD patients. In fact, PD plays an important role in achieving comprehensive dialysis coverage, and the growth of use has been seen in China over the past years. Nevertheless, the underutilization of automated PD is still severe [41]. Factors related to modality, patients, education, government policies and economic burden should be taken into consideration in the development of PD-First or PD-Favored policy [4]. For instance, the use of PD was 8% in the US in 2009 and it increased to 10% in three years as a result of the reimbursement policy favoring PD [2] .

The results concerning depression in this study were in line with several previous studies [6, 8, 11, 19-22]. A clinical screening diagnosis may contribute to a better evaluation of psychological states and understanding of patient-reported outcomes, which also needs to be considered in renal replacement therapy decisions. Further studies are expected to investigate how to treat with depression in ESRD patients and whether these treatments are effective in improving HRQOL[8]. Systematic assessments and intervention strategies need to be developed. Psychopharmacological interventions are commonly used in ESRD patients with depressive symptoms, and Cognitive Behavioral Intervention (CBI) is recognized as an acceptable and efficient method to alleviate depression in recent years[22, 42]. The study of Reid et al. [43] reported themes of dialysis patients, including a renewed dialysis-dependent self, restrictions brought by dialysis, regaining the control of life, building and improving the relationships with medical personnel, which can be used to conduct an intervention framework to cope with depression, improve patients' experience and get rid of maladaptive behaviors [43]. However, barriers to depression treatments are also considerable, including the high medical burden, poor adherence to behavioral treatments such as home exercises, and the limitation of psychotherapy resources in nephrology centers[21]. In addition, the ambiguous responsibility to manage depression may be another urgent challenge [21]. As several studies have reported, many dialysis patients believed that renal providers served the function of depression treatment, while most nephrologists insisted that it was the primary care providers who should take the responsibility [44, 45]. It might be essential to reconcile the viewpoint of patients and medical care providers and make efforts to facilitate cooperation.

A major contribution of this study is that we were the first to conduct a direct comparison of HRQOL and depression in HD patients, PD patients and TX patients and investigate the impairment of HRQOL due to depression in South China. Our findings suggested that the severity of depression in ESRD patients and the effectiveness of Tx on HRQOL improvement should be attached more importance in clinical treatment and care. The limitations of this study were as follows. First, how HRQOL was changed by the predictors over time was not investigated longitudinally in this cross-sectional study. In the process of confronting and adapting disease, patients' assessment criteria, priority and definition of HRQOL may change, which is called 'response shift', especially for those with chronic diseases such as renal disease [46]. Therefore, studies investigating the response shift in patients with ESRD are supposed to be conducted, so as to understand the change of patients' self-reported HRQOL better and to perform the therapy of psychological intervention. Second, besides RRT modalities, depression and sociodemographic characteristics, other Patients Reported Outcomes (PRO) and clinical conditions such as comorbid situations and laboratory data will play an critical role in impacting patients' HRQOL. Further researches should explore the comprehensive effects of possible factors on HRQOL including satisfaction, quality of care, family supports, treatment adherence, clinical conditions, etc. Besides, future studies are expected to further develop strategies to improve HRQOL and integrate them into the treatment and care for ESRD patients [12, 47]

Conclusions

Our study revealed that Tx patients had better HRQOL and less depressive symptoms than HD and PD patients. RRT modality was a vital factor of HRQOL, the effectiveness of which needs to be underscored. Depression was another important factor related to an impaired HRQOL, which was common in ESRD patients while being overlooked and undertreated. The effectiveness of Tx and the severity of depression in patients with ESRD deserve more emphasis. Furthermore, strategies for favoring Tx and interventions for depression are expected to be developed. Further studies are suggested to involve more factors, understand the real change of HRQOL and investigate the efficiency of treatments for improving HRQOL and reducing depression in ESRD patients.

Declarations

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Conflicts of interest/Competing interests:

FY, ZY, LC, JYT and PSW declare that they have no conflict of interest. All authors have no other relevant financial interests to declare.

Availability of data and material:

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Code availability:

SPSS version 20.0.

Authors' contributions:

FY designed the study and performed the questionnaire survey. ZY and FY analyzed the data and drafted the manuscript. LC and JYT critically revised the manuscript. PSW provided critical review, advice and consultation throughout the writing of the manuscript. All authors approved the final version of the manuscript.

References

1. Yang, F., et al., Health-related quality of life of Asian patients with end-stage renal disease (ESRD) in Singapore. *Value in Health*, 2015. 24(9): p. 2163-2171.
2. Robinson, B.M., et al., Factors affecting outcomes in patients reaching end-stage kidney disease worldwide: Differences in access to renal replacement therapy, modality use, and haemodialysis practices. *Lancet*, 2016. 388(10041).
3. Chaudhary, K., H. Sangha and R. Khanna, Peritoneal Dialysis First: Rationale. *Clinical Journal of the American Society of Nephrology Cjasn*, 2011. 6(2): p. 447-456.
4. Liu, F.X., et al., A Global Overview of the Impact of Peritoneal Dialysis First or Favored Policies: An Opinion. *Peritoneal Dialysis International: Journal of the International Society for Peritoneal Dialysis*, 2015. 35(4): p. 406-420.

5. Matas, A.J., Increased ESRD and mortality risk for kidney donors? *Nature Reviews Nephrology*, 2014. 10(3): p. 130-131.
6. Finkelstein, F.O., D. Wuerth and S.H. Finkelstein, Health related quality of life and the CKD patient: challenges for the nephrology community. *KIDNEY INTERNATIONAL*, 2009. 76(9): p. 946-952.
7. P, R., et al., Health related quality of life (HRQOL) of kidney transplanted patients: variables that influence it. *Clinical Transplantation*, 2000. 14(3): p. 199-207.
8. Finkelstein, F.O., et al., Assessing and improving the health-related quality of life of patients with ESRD. *Nature Reviews Nephrology*, 2012. 8(12): p. 718-724.
9. Griva, K., et al., Quality of life and emotional distress between patients on peritoneal dialysis versus community-based hemodialysis. *Qual Life Res*, 2014. 23(1): p. 57-66.
10. Wong, C.K.H., et al., Health-related quality of life and health utility of Chinese patients undergoing nocturnal home haemodialysis in comparison with other modes of dialysis. *NEPHROLOGY*, 2019. 24(6): p. 630-637.
11. Jun, H., et al., Better Quality of Life of Peritoneal Dialysis compared to Hemodialysis over a Two-year Period after Dialysis Initiation. *SCIENTIFIC REPORTS*, 2019. 9(10266).
12. Franke, G.H., et al., Aspects of Quality of Life through End-Stage Renal Disease. *Quality of Life Research*, 2003. 12(2): p. 103-115.
13. Klarenbach, S.W., et al., Economic evaluation of dialysis therapies. *Nat Rev Nephrol*, 2014. 10(11): p. 644-52.
14. Evans, R.W., et al., The quality of life of patients with end-stage renal disease. *N Engl J Med*, 1985. 312(9): p. 553-9.
15. Jansz, T.T., et al., Health-related quality of life compared between kidney transplantation and nocturnal hemodialysis. *PLOS ONE*, 2018. 13(e02044059).
16. Splinter, A., et al., Children on dialysis as well as renal transplanted children report severely impaired health-related quality of life. *Quality of Life Research*, 2018. 27(6): p. 1445-1454.
17. Auneau-Enjalbert, L., et al., Comparison of longitudinal quality of life outcomes in preemptive and dialyzed patients on waiting list for kidney transplantation. *QUALITY OF LIFE RESEARCH*, 2019.
18. Álvares, J., et al., Quality of life of patients in renal replacement therapy in Brazil: comparison of treatment modalities. *Quality of Life Research*, 2012. 21(6): p. 983-991.
19. Hedayati, S.S., et al., Association between major depressive episodes in patients with chronic kidney disease and initiation of dialysis, hospitalization, or death. *JAMA*, 2010. 303(19): p. 1946-1953.
20. Palmer, S., et al., Prevalence of depression in chronic kidney disease: systematic review and meta-analysis of observational studies. *Kidney International*, 2013. 84(1): p. 179-191.
21. Shirazian, S., et al., Depression in Chronic Kidney Disease and End-Stage Renal Disease: Similarities and Differences in Diagnosis, Epidemiology, and Management. *Kidney International Reports*, 2017. 2(1): p. 94-107.
22. Sheng, G.Z. and G. Konstadina, Anxiety and depression in patients with end-stage renal disease: impact and management challenges – a narrative review. *International Journal of Nephrology & Renovascular Disease*, 2018. Volume 11: p. 93-102.
23. Veater, N. and L. East, Exploring depression amongst kidney transplant recipients: A literature review: EXPLORING DEPRESSION AMONGST KIDNEY TRANSPLANT RECIPIENTS: A LITERATURE REVIEW. *Journal of Renal Care*, 2016. 42.
24. Lopes, A.A., et al., Screening for depression in hemodialysis patients: Associations with diagnosis, treatment, and outcomes in the DOPPS. *Kidney International*, 2004. 66(5): p. 2047-2053.
25. Nugent, R.A., et al., The burden of chronic kidney disease on developing nations: a 21st century challenge in global health. *Nephron Clinical Practice*, 2011. 118(3): p. 269-277.

26. Zhang, L., et al., Prevalence of chronic kidney disease in China: a cross-sectional survey. *Lancet*, 2012. 379(9818): p. 815-22.
27. Zhang, L. and L. Zuo, Current burden of end-stage kidney disease and its future trend in China. *Clin Nephrol*, 2016. 86 (2016)(13): p. 27-28.
28. Zhang, L., et al., China Kidney Disease Network (CK-NET) 2016 Annual Data Report. *Kidney International Supplements*, 2020. 10: p. e97-e185.
29. Jiefu, H., Report on Organ Transplantation Development in China (2015–2018). 2020, Beijing: Tsinghua University Press.
30. Mahato, S., et al., Factors associated with quality of life among chronic kidney disease patients in Nepal: A cross-sectional study. *Health and Quality of Life Outcomes*, 2020. 18.
31. Berwick, D.M., et al., Performance of a five-item mental health screening test. *Medical Care*, 1991. 29(2): p. 169-176.
32. McCabe, C.J., et al., Measuring the mental health status of a population: A comparison of the GHQ-12 and the SF-36 (MHI-5). *BRITISH JOURNAL OF PSYCHIATRY*, 1996. 169(4): p. 517-521.
33. van den Beukel, T.O., et al., Comparison of the SF-36 Five-item Mental Health Inventory and Beck Depression Inventory for the screening of depressive symptoms in chronic dialysis patients. *NEPHROLOGY DIALYSIS TRANSPLANTATION*, 2012. 27(12): p. 4453-4457.
34. Trainor, K., J. Mallett and T. Rushe, Age related differences in mental health scale scores and depression diagnosis: Adult responses to the CIDI-SF and MHI-5. *JOURNAL OF AFFECTIVE DISORDERS*, 2013. 151(2): p. 639-645.
35. Ware, J., et al., SF36 Health Survey: Manual and Interpretation Guide. Lincoln, RI: Quality Metric, Inc, 1993, 1993. 30.
36. Ware, J.J.E., SF-36 health survey update. *Spine*, 2000. 25(24): p. 3130-3139.
37. Ware, J., M.A. Kosinski and J. Dewey, How to Score Version 2 of the SF-36® Health Survey. Lincoln, QualityMetric Incorporated, 2000.
38. Zheng, Z.H., et al., Multicenter investigation of quality of life (QOL) in hemodialysis (HD) and peritoneal (PD) dialysis patients in southern China. *JOURNAL OF THE AMERICAN SOCIETY OF NEPHROLOGY*, 2002. 13S: p. 707A-707A.
39. Zhang, A., et al., Comparison of quality of life and causes of hospitalization between hemodialysis and peritoneal dialysis patients in China. *HEALTH AND QUALITY OF LIFE OUTCOMES*, 2007. 5(49).
40. Zhang, X., et al., COMPARISON OF QUALITY OF LIFE BETWEEN HEMODIALYSIS AND PERITONEAL DIALYSIS PATIENTS IN A TERTIARY HOSPITAL IN CHINA. *VALUE IN HEALTH*, 2012. 15(7): p. A645-A645.
41. Wilkie, M. and S. Davies, Insights on Peritoneal Dialysis in China. *Perit Dial Int*, 2018. 38(Suppl 2): p. S16-S18.
42. Lerma, A., et al., Brief cognitive behavioural intervention for depression and anxiety symptoms improves quality of life in chronic haemodialysis patients. *Psychol Psychother*, 2017. 90(1): p. 105-123.
43. Reid, C., J. Seymour and C. Jones, A Thematic Synthesis of the Experiences of Adults Living with Hemodialysis. *CLINICAL JOURNAL OF THE AMERICAN SOCIETY OF NEPHROLOGY*, 2016. 11(7): p. 1206-1218.
44. Weisbord, S.D., et al., Comparison of Symptom Management Strategies for Pain, Erectile Dysfunction, and Depression in Patients Receiving Chronic Hemodialysis: A Cluster Randomized Effectiveness Trial. *Clinical Journal of the American Society of Nephrology*, 2013. 8(1): p. 90-99.
45. Green, J.A., et al., Renal provider perceptions and practice patterns regarding the management of pain, sexual dysfunction, and depression in hemodialysis patients. *Journal of Palliative Medicine*, 2012. 15(2): p. 163.
46. Sprangers, M. and C.E. Schwartz, Integrating response shift into health-related quality of life research: a theoretical model. *SOCIAL SCIENCE & MEDICINE*, 1999. 48(11): p. 1507-1515.
47. Griva, K., et al., Quality of life and emotional distress in patients and burden in caregivers: a comparison between assisted peritoneal dialysis and self-care peritoneal dialysis. *QUALITY OF LIFE RESEARCH*, 2016. 25(2): p. 373-384.

Tables

Table 1

Sociodemographic characteristics of HD patients, PD patients and Tx patients

Variables	HD(n=112)	PD(n=68)	Tx(n=97)	χ^2	P-value
Gender[n(%)]				0.262	0.877
Male	55(49.1)	35(51.5)	51(52.6)		
Female	57(50.9)	33(48.5)	46(47.4)		
Age[n(%)]				32.994	<0.001**
≤30	10(8.9)	6(8.8)	13(13.4)		
31-50	43(38.4)	50(73.5)	62(63.9)		
≥51	59(52.7)	12(17.6)	22(22.7)		
Education level [n(%)]				28.565	<0.001**
Primary school and below	30(26.8)	13(19.1)	6(6.2)		
Middle school	62(55.4)	40(58.8)	47(48.5)		
College graduate and above	20(17.9)	15(22.1)	44(45.4)		
Marital status[n(%)]				3.584	0.465
Single	7(6.3)	9(13.2)	12(12.4)		
Married	97(86.6)	56(82.4)	80(82.5)		
Divorce or widowed	8(7.1)	3(4.4)	5(4.2)		
Occupation [n(%)]				69.083	<0.001**
Full-time job	10(8.9)	11(16.2)	34(35.1)		
Part-time job	17(15.2)	11(16.2)	13(13.4)		
Unemployment, dismissal or be looking for a job	21(18.8)	14(20.6)	10(10.3)		
Retirement	48(42.9)	5(7.4)	9(9.3)		
Others	16(14.3)	27(39.7)	31(32)		
Insurance[n(%)]				28.136	<0.001**
Urban Employee Basic Medical Insurance	64(57.1)	38(55.9)	45(46.4)		
Urban Residents Basic Medical Insurance	29(25.9)	6(8.8)	29(29.9)		
New Rural Co-operative Medical Scheme	9(8.0)	10(14.7)	20(20.6)		
Others	10(8.9)	14(20.6)	3(3.1)		
Annual household income(10,000RMB)[n(%)]				21.455	0.002
<3	46(41.1)	44(64.7)	33(34.0)		
3-8	27(24.1)	7(10.3)	21(21.6)		
8-12	17(15.2)	9(13.2)	12(12.4)		
≥12	22(19.6)	8(13.1)	31(32.0)		

**Statistically significant for P<0.001

HD hemodialysis, *PD* peritoneal dialysis, *Tx* renal transplantation

Table 2

The SF-36 scores of HD patients, PD patients and TX patients

	HD	PD	TX	Kruskal-Wallis H	P-value
PF	75(50-88.75)	75(55-90)	90(85-95)	46.485	<0.001**
RP	0(0-50)	0(0-43.75)	75(25-100)	47.228	<0.001**
BP	61.5(41-80)	54(42-73.5)	84(62-100)	47.298	<0.001**
GH	42(25-52)	33.5(20-49.5)	62(51-77)	76.070	<0.001**
VT	50(35-60)	52.5(40-60)	65(50-80)	35.832	<0.001**
SF	62.5(37.5-75)	50(37.5-75)	75(75-93.75)	48.041	<0.001**
RE	33.33(0-100)	33.33(0-100)	100(66.67-100)	28.083	<0.001**
MH	64(48-76)	60(48-72)	72(58-84)	16.718	<0.001**
PCS	189(141-256)	165(132.5-253.25)	309(246.5-337)	83.149	<0.001**
MCS	204.92(149.38-297.63)	198.08(143.13-275.96)	306(249-343.25)	47.958	<0.001**

**Statistically significant for P<0.001

HD hemodialysis, *PD* peritoneal dialysis, *Tx* renal transplantation, *PCS* Physical Component Scores, *MCS* Mental Component Scores, *PF* physical functioning, *RP* role-physical, *BP* bodily pain, *GH* general health, *VT* vitality, *SF* social functioning, *RE* role-emotional, *MH* mental health

Table 3

The Bonferroni's test of the SF-36 scores' of HD patients, PD patients and TX patients

	PD-HD		PD-TX		HD-TX	
	Test statistic	P-value	Test statistic	P-value	Test statistic	P-value
PF	-7.007	1.000	-71.008	<0.001**	-64.004	<0.001**
RP	2.347	1.000	-67.442	<0.001**	-65.095	<0.001**
BP	3.207	1.000	-70.754	<0.001**	-67.546	<0.001**
GH	15.193	0.650	-96.432	<0.001**	-81.239	<0.001**
VT	-6.680	1.000	-62.477	<0.001**	-55.797	<0.001**
SF	27.571	0.070	-82.392	<0.001**	-54.820	<0.001**
RE	9.447	1.000	-55.361	<0.001**	-45.914	<0.001**
MH	16.206	0.562	-49.048	<0.001**	-32.842	<0.001**

**Statistically significant for P<0.001

HD hemodialysis, *PD* peritoneal dialysis, *Tx* renal transplantation, *PCS* Physical Component Scores, *MCS* Mental Component Scores, *PF* physical functioning, *RP* role-physical, *BP* bodily pain, *GH* general health, *VT* vitality, *SF* social functioning, *RE* role-emotional, *MH* mental health

Table 4

Odds ratios of depression compared with TX patients				
	Univariate analysis	P-value	Multivariate analysis ^a	P-value
HD	2.086	0.009*	2.072	0.023*
PD	2.519	0.005*	2.223	0.021*
Tx	-	0.006*	-	0.025*

^a Adjustment for gender, age, education level, marital status, occupation, insurance and annual household income

*Statistically significant for P<0.05

HD hemodialysis, *PD* peritoneal dialysis, *Tx* renal transplantation

Table 5

Univariate analysis of the effects of sociodemographic characteristics on the quality of life

	PCS				MCS			
	Correlation Coefficients	P-value	Kruskal-Wallis H	P-value	Correlation coefficients	P-value	Kruskal-Wallis H	P-value
Gender***	-0.107	0.076	-	-	-0.091	0.130	-	-
Age***	-0.197	0.001*	-	-	-0.088	0.146	-	-
Education level***	0.256	<0.001**	-	-	0.195	<0.001*	-	-
Marital status****	-	-	1.875	0.392	-	-	1.263	0.532
Occupation****	-	-	41.779	<0.001**	-	-	26.846	<0.001*
Insurance****	-	-	2.816	0.421	-	-	0.133	0.988
Annual household income***	0.248	<0.001**	-	-	0.209	<0.001**	-	-
RRT****	-	-	83.146	<0.001**	-	-	47.958	<0.001**
Depression***	-0.518	<0.001**	-	-	-0.717	<0.001**	-	-

*Statistically significant for P<0.05

**Statistically significant for P<0.001

***Ordinal data, Correlation Coefficients and P-value for Spearman's correlations

****Nominal data, P-value for Nonparametric Tests

Table 6

Multivariate linear regression model for SF-36 HRQOL scores

	PCS (F=21.861,P<0.001**)			MCS (F=27.986, P<0.001**)		
	Coefficient	95%CI	P-value	Coefficient	95%CI	P-value
Age						
≤30	28.999	(-2.041,60.039)	0.067	11.367	(-18.109,40.842)	0.448
31-50	28.406	(1.129,55.684)	0.041*	14.932	(-10.970,40.834)	0.257
Education level						
Primary school and below	-4.425	(-30.271,21.420)	0.736	-17.872	(-42.415,6.670)	0.153
Middle school	-10.178	(-29.012,8.655)	0.288	-2.457	(-20.342,15.427)	0.787
Occupation						
Full-time job	23.522	(1.256,45.789)	0.038*	6.409	(-14.735,27.553)	0.551
Part-time job	-8.651	(-32.859,15.556)	0.482	-7.322	(-30.310,15.665)	0.531
Unemployment, dismissal or be looking for a job	-13.192	(-36.859,10.510)	0.274	-23.194	(-45.702,-0.686)	0.043*
Retirement	-7.128	(-35.326,21.071)	0.619	-4.114	(-30.892,22.663)	0.762
Annual household income(10,000RMB)						
<3	-16.572	(-38.111,4.968)	0.131	-6.961	(-27.415,13.492)	0.503
3-8	5.868	(-17.756,29.492)	0.625	4.687	(-17.746,27.120)	0.681
8-12	8.365	(-16.687,33.417)	0.511	8.424	(-15.365,32.213)	0.486
RRT						
HD	-64.536	(-84.096,-44.977)	<0.001**	-37.747	(-56.321,-19.174)	<0.001**
PD	-74.399	(-94.721,-54.077)	<0.001**	-54.516	(-73.814,-35.219)	<0.001**
Depression(no depression)	-71.431	(56.151,86.710)	<0.001**	-110.906	(97.397,125.415)	<0.001**

The reference category of age is the group of patients over 50 years old. The reference category of education level is the group of patients whose education level is college graduate and above. The reference category of occupation is the group of patients with other occupation. The reference category of annual household income is the group of patients whose annual household income is less than 30,000RMB. The reference category of RRT is Tx.

*Statistically significant for P<0.05

**Statistically significant for P<0.001

PCS Physical Component Scores, MCS Mental Component Scores, RRT renal replacement therapy, HD hemodialysis, PD peritoneal dialysis, Tx renal transplantation

Figures

Figure 1

The SF-36 scores of HD patients, PD patients and Tx patients. HD hemodialysis, PD peritoneal dialysis, Tx renal transplantation, PF physical functioning, RP role-physical, BP bodily pain, GH general health, VT vitality, SF social functioning, RE role-emotional, MH mental health

Figure 2

The percentage of depression in HD patients, PD patients and Tx patients. HD hemodialysis, PD peritoneal dialysis, Tx renal transplantation