QUALITY OF LIFE, CLINICAL OUTCOME, PERSONALITY AND COPING IN CHRONIC HEMODIALYSIS PATIENTS

Giuseppina D’Onofrio*, Mariadelina Simeoni**, Paolo Rizza*, Mariarita Caprio*, Giovanni Mazzitelio*, Tiziana Sacco*, Elena Mazzucab, Maria Teresa Ponzino*, Annamaria Catatanionia*, Cristina Segura-Garcia*, Michele Andreuccia**, Pasquale De Fazio* and Giorgio Fuiano*

*Department of Nephrology and Dialysis, ‘Mater Domini’ University Hospital, Catanzano, Italy; **Department of Psychiatry, Health Sciences, University Hospital ‘Mater Domini’, Catanzano, Italy; †Hemodialysis Unit of Soverato, Catanzano, Italy; ‡Territorial Hemodialysis Unit of Catanzano Lido, Catanzano, Italy; §Department of Nephrology and Dialysis, Pugliese-Ciaccio Hospital of Catanzano, Catanzano, Italy

ABSTRACT

Rational: Our aim was to investigate the quality of life (QoL) in 103 patients undergoing chronic hemodialysis (HD) in an integrated assessment of clinical, personological, and adaptation parameters, also in a non-urban context.

Objectives: We collected data from all chronic HD patients attending four HD units. Clinical status was assessed by Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines and by Age-adjusted Charlson Comorbidity Index (ACCI). Patients completed the following questionnaires: Kidney Disease Quality of Life Short Form (KDQOL-SF), Pittsburgh Sleep Quality Index (PSQI). Personality profile and coping style were assessed by Temperament and Character Inventory (TCI) revised and Coping Inventory for Stressful Situation (CISS). Data were analyzed by conventional descriptive statistics. Multiple forward stepwise linear regression analyses were performed.

Main findings: Variables significantly associated with physical and mental components of KDQOL-SF were: intact parathyroid hormone (iPTH) \((p = .004; p = .0015)\), typology of cohabitant (family member or not) \((p = .022; p = .007)\), years of dialysis \((p = .022; p = .048)\). Variables associated with mental component of KDQOL-SF were: PSQI \((p = .000)\), task-coping \((p = .000)\), avoidance-coping \((p = .003)\), work status \((p = .021)\).

Principle conclusions: Our results suggest the importance of an integrated and multidirectional management of patients chronically undergoing HD and living in a non-urban context.

Introduction

Chronic Kidney Disease (CKD) is a major medical and public health problem whose prevalence is increasing worldwide.1 Patients progressing to end stage renal disease encounter several clinical issues2 only partially corrected by Renal Replacement Therapy (RRT) and involve worse survival and QoL due to symptoms such as fatigue, bone pain, tiredness, itching, weight loss, nausea, loss of appetite.3,4

Kidney transplantation is associated with better QoL,5 but the limited availability of organs and the frequent non-eligibility of patients implies that the kidney transplant is yet a niche RRT. Even peritoneal dialysis utilization is still very limited, due to unclear reasons.5

Hemodialysis (HD) ends to be worldwide the most employed RRT, involving nearly 90% of end-stage renal disease (ESRD) population.7 This therapeutic option imposes a considerable burden on both patients and their families, which can be also worsened by several other complications.8 In fact, HD patients are more likely to develop cardiovascular, skeletal, endocrine, inflammatory, neoplastic,8,9 and psychological complications.10 Recent studies have demonstrated a relationship between psychosocial variables, QoL and mortality in RRT patients leading to a poor adherence to dialysis.11

Sleep and mood disturbances are common among patients on dialysis and are significantly associated with worse survival and health-related QoL perceived.12,13

QoL is one of the major challenges in healthcare. Much has been published about QoL, and many have...
been the attempts to find a better definition of the term under the most different perspectives.

Due to the difficult quantization of its components, QoL is still considered a hard topic with obvious validation problems. However, QoL remains an aspect of great interest considering its influence on clinical outcome and survival in chronically patients. Patients with CKD suffer from a disproportionate burden of morbidity and mortality both before and after chronic dialysis initiation. Caring for all aspects that may improve the QoL in HD patients is a fundamental task and, consequently, the evaluation of the QoL in patients requiring RRT has recently become a relevant area of investigation.

Several factors involved in chronic HD, such as lifestyle change, reliance on a machine for survival and the chronic disease itself, can lead patients who are psychologically and socially unstable to adopt reactive attitudes as depression, resignation, and anxiety. Personality traits can also affect health-related QoL (HRQoL) in different disorders, because it could determine patients’ willingness to take treatment options, predispose to neuropsychiatric symptoms and affect coping strategies. Numerous deviations from normality in the personological profile of patients on HD have also been reported and supported by the evidence of specific alterations in neurohormonal levels in HD patients, according to different personological profiles. Moreover, sleep and mood disturbances are common among patients on dialysis and are significantly associated with worse survival and health-related QoL perceived. These psychological alterations inerably lead to a reduced compliance to the treatment and an increase in hospital admissions.

A major challenge for clinicians is to develop strategies to better understand and improve physical and mental health in HD patients, considering all medical and psychological variables eventually linked to QoL perceived. Furthermore, there are limited data about the relationship of socio-demographic, psychosocial, and clinical variables that may be correlated with QoL in HD patients. In fact, several studies evaluated the QoL in patients on maintenance HD but an integrated assessment of clinical, personological, and adaptation ability parameters has never been approached so far. Moreover, the social context in which the HD patient lives could influence its strategies of adaptation to the chronic illness and dependence on a dialysis machine.

We hypothesized that clinical variables currently monitored in HD patients, comorbidities, sleep quality, and psychological variables (personality traits and coping strategies) could influence physical and mental health perceived, identifying a population of patients at high risk for worse outcomes.

This cross-sectional, multicentric study is aimed at identifying predictors of functioning and well-being through the integrated assessment of all demographic, clinical, personological, and adaption variables using several validated questionnaires in a sample of HD patients living in a suburban area.

Materials and methods

We designed an observational study by collecting data from resident patients in four HD units in the Catanzaro area (“Mater Domini” Hospital of Catanzaro, Pugliese-Ciaccio Hospital of Catanzaro, Catanzaro Lido Clinic, and Soverato Hospital) between January 2013 and June 2013.

The present study was performed according to the guidelines of good clinical practice in accordance with the Declaration of Helsinki and the Ethics Committee of the “Mater Domini” Hospital of Catanzaro (Italy) approved the protocol. A written informed consent was obtained from each patient before initiating any study related procedure. Inclusion criteria envisaged all end-stage renal disease (ESRD) patients older than 45 years (that achieved the adulthood) undergoing chronic HD treatment in stable clinical conditions and able to answer to questionnaires. Since current mean age in HD patients is quite advanced the exclusion of younger patients was aimed at the assessment of a more homogeneous and representative sample of the increasingly elderly chronic HD population. This choice was also aimed to avoid any bias related to young age-based psychological factors that might produce a distorted perception of QoL (e.g., immaturity, sentimental and sexual instability, work uncertainty). A standardized cognitive assessment was preliminarily conducted with the Mini Mental State Examination (MMSE). Patients having a psychiatric history were excluded too.

To assess the clinical status, the following data extracted from each patient medical record, were collected:

**Sociodemographics**—(gender, age, educational level, marital status, living condition, additional people in the household, work activity).

**Clinical data**—underlying nephropathy, years of HD, transplant list location, vascular access, erythropoietin (EPO) therapy, type of dialysis treatment, Kt/V (the variable for dialysis efficiency assessment) according to criteria of Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines, hemoglobin, ferritin, albumin, total protein, total cholesterol, triglycerides, C-Reactive Protein (CRP), intact Parathyroid Hormone (iPTH), serum calcium, serum phosphate. The laboratory variables included in the analysis are those currently monitored.
by nephrologists in HD patients because refer to ESRD symptoms and are associated with worse outcomes.

**Age-adjusted Charlson Comorbidity Index (ACCI) Score**—The most validated index of comorbidity including 17 categories of comorbid diseases. It is a weighted index based on the mortality-adjusted risk, estimated by Cox proportional hazards model, associated with each disease, with additional points for age. This index is widely employed for estimating the prognosis in dialysis patients.

All patients were required to answer to the following questionnaires to assess QoL, coping strategies, personality, and quality of sleep (QoS):

**Kidney Disease Quality of Life Short Form (KDQOL-SF)**—A self-reported questionnaire assessing both the functioning and well-being of patients with kidney disease and on dialysis, validated for the Italian language. The questionnaire was administered in line with the Manual for Use and Scoring of the Kidney Disease Quality of Life—Short Form (KDQOL—SF 1.3). The questionnaire consists of generic and specific measures for patients with kidney disease. The generic part, used to construct the physical component summary (PCS) and mental component summary (MCS), is based on the SF-36 questions and comprised eight dimensions: physical functioning; role limitations as a result of physical health problems; pain; general health perceptions; emotional well-being; social functioning; fatigue/energy; current health status compared to the previous year. The specific part of KDQOL-SF instead consists of 43 items and explores 11 dimensions: symptom/problem list; effects of kidney disease on daily life; burden of kidney disease; work status; cognitive function; quality of social interactions; sexual function; sleep; social support; dialysis staff encouragement; and patient satisfaction. The scores on each dimension range from 0 to 100, with higher scores reflecting a better QoL.

**The Coping Inventory for Stressful Situations (CISS)**—A self-48-items tool, validated for the Italian language, comprising three scales assessing Task-oriented, Emotion-oriented, and Avoidance-oriented coping. Additionally, the Avoidance scale consists of two separate subscales evaluating Distraction and Social coping. This tool provides a dimensional description of individual main strategies to cope with stress. These strategies are essential for the adaptation to stressful life events, as it may occur in patients on HD.

**Temperament and Character Inventory Revised (TCI-R)**—A self-administered questionnaire, whose 240 items are listed in random order and grouped into facets. It is based on the assumption that there are seven principal domains of personality, some of which are regarded as “temperament” (novelty seeking, harm avoidance, reward dependence and persistence) and other as “character” (self-directedness, cooperativeness, and self-transcendence). This tool is the most validated instrument for the assessment of personality profile.

**Pittsburgh Sleep Quality Index (PSQI)**—A 19-items self-administered questionnaire that measures the sleep quality in the previous month by evaluation of seven sleep dimensions (each one scoring 0–3): subjective sleep quality; sleep latency; sleep duration; sleep efficiency; sleep disturbance; use of sleep medications; daytime dysfunction. The global PSQI is obtained by the sum of the seven scores. The threshold value for patients to be considered bad sleepers is 5. Lower values indicate a good QoS. This questionnaire has been extensively applied to HD patients for studying their known sleep disturbances.

Laboratory parameters and HD treatment efficiency criteria were related to recommendation from KDOQI guidelines.

Statistics were performed with the statistical software SPSS 18.0 (SPSS Inc., Chicago IL, USA). Data were first analyzed by means of descriptive statistics: means, standard deviations, frequencies, and percentages. Multiple forward stepwise linear regression analyses was subsequently performed to ascertain the independent predictors of PCS and MCS. The explanatory variables included in the model are reported in Table 1. According to Bendel and Afifi, the significance level for variables entering the linear regression model was set at 0.2 and for removing from the model at 0.4. The level of statistical significance was set for values of $p < .05$.

**Results**

Seven out of the 110 patients approached did not meet the inclusion criteria; so only 103 were interviewed (response rate 91.5%). Table 2 shows the main demographic, socioeconomic, and clinical characteristics of the patients who completed the questionnaires.

Most patients were male (62.1%) and the average age was 66.2 years (51% of patients were in elderly age), 84.5% were retired. Only 10.7% of patients lived alone. About two thirds of the sample received no higher education level than primary school. The nephropathy responsible for ESRD was unknown in 57.3% of cases. Dialysis age was less than five years in 84.5% of patients and 18% of them was on a transplant waiting list.

Table 3 reports means and standard deviation of KDQOL-SF generic and specific dimensions, KDCS (kidney disease component summary), PCS and MCS; CISS dimensions; TCI-R domains; and PSQI score. Table 4 reports the linear regression models results. As particularly noteworthy results, we found:
Table 1. Codification of variables included in linear regression models.

| Variable                          | Codification |
|-----------------------------------|--------------|
| Gender                            | Male = 1     |
|                                   | Female = 2   |
| Age                               | 45–55 = 1    |
|                                   | 55–64 = 2    |
|                                   | 65–74 = 3    |
|                                   | >75 = 4      |
| Tipology of cohabitant            | Family = 0   |
|                                   | Other = 1    |
| Working activity                  | Active worker = 1 |
|                                   | Retired = 2  |
| Age-adjusted Comorbidity Charlson Index (ACCI) | Continuous |
| Vascular access                   | FAV = 0      |
|                                   | CVC = 1      |
| Therapy with erythropoietin       | Continuous   |
| Dialysis vintage                  | Continuous   |
| Dialysis efficacy (Kt/V)          | >1.2 < 1.4 = 0 |
|                                   | Other values = 1* |
| Hemoglobin (g/dL)                 | 11–12 = 1    |
|                                   | Other values = 0 |
| Phosphate (mg/dL)                 | 3.5–5.5 = 1  |
|                                   | Other values = 0 |
| Ferritin (mg/mL)                  | >100 = 1     |
|                                   | <100 = 0     |
|                                   | >3.5 = 1     |
|                                   | <3.5 = 0     |
| Albumin (g/dL)                    | 6–8 = 1      |
|                                   | Other values = 0 |
| Cholesterol tot.(mg/dL)           | <200 mg/dL = 1 |
|                                   | >200 mg/dL = 0 |
| Triglycerides (mg/dL)             | <180 mg/dL = 1 |
|                                   | >180 mg/dL = 0 |
| C reactive protein (g/dL)         | <3.16 = 1    |
|                                   | >3.16 = 0    |
| iPTH (pg/dL)                      | 150–300 = 1  |
|                                   | Other values = 0 |
| Calcium (mg/dL)                   | 8.4–9.5 = 1  |
|                                   | Other values = 0 |
| CISS-task                         | Continuous   |
| CISS-emotion                      | Continuous   |
| CISS-avoidance                    | Continuous   |
| TCI-R novelty seeking             | Continuous   |
| TCI-R harm avoidance              | Continuous   |
| TCI-R reward dependence           | Continuous   |
| TCI-R persistence                 | Continuous   |
| TCI-R self-directedness           | Continuous   |
| TCI-R cooperativeness             | Continuous   |
| TCI-R self-transcendence          | Continuous   |
| PSQI                              | ≤5 = 1       |
|                                   | >5 = 0       |

*KDOQI, National Kidney F. 2006.
CISS: Coping Inventory for Stressful Situations; TCI-R: Temperament and Character Revised; PSQI: Pittsburgh Sleep Quality Index.

- Variables significantly associated with both, physical and MCS were: iPTH (p = .004 and p = .0015, respectively), typology of cohabitant (family member or not) (p = .022 and p = .007, respectively), years of dialysis (p = .022 and p = .048, respectively).
- Variable significantly associated with physical component summary alone was: ACCI (p = .000).
- Variables significantly associated with MCS alone were: PSQI (p = .000), CISS-task (p = .000), CISS-avoidance (p = .003), work status (p = .021), Harm Avoidance (p = .001) and Persistence (p = .05).

Table 2. Sample description (N = 103).

| Characteristic                          | Fr   | %     |
|-----------------------------------------|------|-------|
| Gender                                  |      |       |
| Male                                    | 64   | 62.1  |
| Female                                  | 39   | 37.9  |
| Age groups (years)                      |      |       |
| 45–55                                   | 32   | 31.1  |
| 55–64                                   | 20   | 19.4  |
| 65–74                                   | 28   | 27.2  |
| >75                                     | 23   | 22.3  |
| Education level                         |      |       |
| No formal education                     | 3    | 2.9   |
| Primary school                          | 41   | 39.8  |
| Secondary or higher school              | 59   | 57.3  |
| Typology of cohabitant                  |      |       |
| Family member                           | 92   | 89.3  |
| Other                                   | 11   | 10.7  |
| Working activity                        |      |       |
| Active worker                           | 16   | 15.5  |
| Retired                                 | 87   | 84.5  |
| Base nephropathy                        |      |       |
| Unknown                                 | 59   | 57.3  |
| Glomerulonephritis                      | 19   | 18.4  |
| Polycystic kidney disease               | 11   | 10.7  |
| Diabetic kidney disease                 | 11   | 10.7  |
| Other                                   | 3    | 2.9   |
| Dialysis age                            |      |       |
| >5 years                                | 87   | 84.5  |
| 5–10 years                              | 13   | 12.7  |
| >10 years                               | 3    | 2.8   |
| Inclusion in transplant list             |      |       |
| No                                      | 67   | 65    |
| Yes                                     | 36   | 35    |
| Vascular access                         |      |       |
| FAV                                      | 83   | 80.6  |
| CVC                                      | 20   | 19.4  |
| Erithropoietin                          |      |       |
| No                                      | 22   | 21.4  |
| Yes                                     | 81   | 78.6  |
| Kt/V                                    |      |       |
| <1.2/1.4                                | 87   | 84.5  |
| other values                            | 16   | 15.5  |
| Hemoglobin                              |      |       |
| 11–12 g/dL                              | 45   | 43.7  |
| Out of range values                     | 58   | 56.3  |
| Phosphate                               |      |       |
| 3.5–5.5 mg/dL                           | 66   | 64.1  |
| Other values                            | 37   | 35.9  |
| Ferritin                                |      |       |
| >100 mg/dL                              | 25   | 24.3  |
| <100 mg/dL                              | 78   | 75.7  |
| Total cholesterol                       |      |       |
| <200 mg/dL                              | 18   | 17.5  |
| >200 mg/dL                              | 85   | 82.5  |
| HDL cholesterol                         |      |       |
| >40 mg/dL                               | 42   | 40.8  |
| ≤40 mg/dL                               | 61   | 59.2  |
| LDL cholesterol                         |      |       |
| <100 mg/dL                              | 71   | 68.9  |
| >100 mg/dL                              | 32   | 31.1  |
| Triglycerides                           |      |       |
| <180 mg/dL                              | 19   | 18.4  |
| >180 mg/dL                              | 84   | 81.6  |
| iPTH                                    |      |       |
| 150–300 pg/dL                           | 78   | 75.7  |
| Other values                            | 25   | 24.3  |
| Calcium corrected                       |      |       |
| 8.4–9.5 mg/dL                           | 57   | 55.3  |
| Other values                            | 46   | 44.7  |
In our aged chronic HD population selected from a suburban area, the complete selection of personal parameters as personality, ability to adapt to stressful situations and clinical status are useful to predict patients’ functioning in a chronic illness condition. Our results showed new significant predictors of QoL: working conditions, dialysis age, living conditions, task, and avoidance coping. iPTH was the only clinical parameter correlated to a worse QoL. Surprisingly, other relevant parameters for HD patients such as hemoglobin or serum phosphate, responsible for fatigue and itching respectively, were not found to be associated with a poorer QoL in our population. Symptomatic anemia and hyper-phosphatemia widely precede the entrance in HD because tend to appear when residual renal function is about 30% of normal.

The biologic profile could not reflect the overall physical and mental burden and we believe that the control of CKD treatment challenges blunted any correlation and emphasize the importance of a multidisciplinary team approach in order to achieve a better QoL in this population by individually controlling all these factors. Presumably, patients arrive to dialysis adapted to physical symptoms.

High serum phosphate levels predict iPTH increases leading to bone and cardiovascular impairment and need prompt correction but not always serum phosphate lowering is followed by iPTH correction. Furthermore, symptomatic bone involvement with pain appearance is tardive and typically reported after HD initiation.

Despite the vastness of information we obtained, some methodological issues need to be addressed prior to proceeding with the discussion. The limits consist of

**Discussion**

Table 3. Means and standard deviations of tests.

| KDQOL-SF Specific dimensions                     | Mean | SD  |
|--------------------------------------------------|------|-----|
| Symptoms/problems                                 | 57.9 | 18.0|
| Effect of kidney disease                         | 43.2 | 20.5|
| Burden of kidney disease                         | 22.9 | 20.8|
| Work status                                      | 38.5 | 25.3|
| Cognitive function                               | 70.0 | 23.1|
| Quality of social interaction                    | 85.1 | 12.3|
| Sexual function                                  | 45.1 | 28.3|
| Sleep                                            | 58.4 | 15.8|
| Social support                                   | 67.4 | 24.8|
| Dialysis staff encouragement                     | 85.3 | 15.4|
| Patient satisfaction                             | 65.9 | 19.4|
| KDCS                                             | 55.8 | 10.3|

| KDQOL-SF generic dimension                      | Mean | SD  |
|-------------------------------------------------|------|-----|
| Physical functioning                             | 42.2 | 26.9|
| Role physical                                    | 21.2 | 33.2|
| Bodily pain                                      | 54.5 | 24.0|
| Overall health rating                            | 50.8 | 14.2|
| Emotional well-being                             | 49.1 | 18.4|
| Role emotional                                   | 34.6 | 38.4|
| Role social                                      | 52.1 | 20.4|
| Energy/fatigue                                   | 43.5 | 18.5|
| PCS                                              | 35.2 | 8.3 |
| MCS                                             | 38.5 | 9.0 |

| CISS                                             | Mean | SD  |
|--------------------------------------------------|------|-----|
| Task oriented coping                             | 46.4 | 12.1|
| Emotion oriented coping                          | 54.5 | 12.4|
| Social avoidance                                 | 18.1 | 19.7|
| Distraction avoidance                            | 24.7 | 5.7 |
| Avoidance oriented coping                        | 54.5 | 9.6 |

| TCI-R                                           | Mean | SD  |
|-------------------------------------------------|------|-----|
| Novelty seeking                                 | 100.3| 12.1|
| Harm avoidance                                  | 107.5| 17.4|
| Reward dependence                               | 94.0 | 13.2|
| Persistence                                     | 112.3| 19.6|
| Self-directedness                               | 123.1| 19.2|
| Cooperativeness                                 | 118.4| 19.5|

| PSQI-score                                      | Mean | SD  |
|-------------------------------------------------|------|-----|
| Total PSQI                                      | 9.3  | 3.7 |

**Table 4. Linear regression models.**

| Model | Dependent variable | Independent variables | Coefficient | SE   | p Values |
|-------|--------------------|-----------------------|-------------|------|----------|
| 1     | PCS                | Tipology of convinent | -5.525      | 2.365| .022     |
|       |                    | Age-adjusted Charlson index | -1.463      | 0.291| .000     |
|       |                    | Dialysis age (years)   | 0.516       | 0.222| .022     |
|       |                    | iPTH                   | 4.861       | 1.660| .004     |
|       |                    | PSQI                   | -3.897      | 2.111| .068     |
|       |                    | (F = 6.723; p = .001; R²=0.890) |
| 2     | MCS                | Ferritin               | 2.944       | 1.718| .090     |
|       |                    | Tipology of convinent  | -5.910      | 2.149| .007     |
|       |                    | Work status            | -4.249      | 1.804| .02      |
|       |                    | TCI-R harm avoidance   | 0.159       | 0.048| .001     |
|       |                    | TCI-R persistance      | -0.083      | 0.041| .05      |
|       |                    | Dialysis age (years)   | 0.117       | 0.066| .05      |
|       |                    | CISS-avoidance         | 0.226       | 0.074| .003     |
|       |                    | CISS-task              | 0.312       | 0.061| .000     |
|       |                    | iPTH                   | 3.890       | 1.574| .002     |
|       |                    | PSQI                   | 6.615       | 1.827| .000     |
|       |                    | Erithropoetin (dose needed) | 2.818       | 1.689| .099     |
|       |                    | Phosphate              | -2.089      | 1.443| .151     |
|       |                    | (F = 10.731; p = .001; R²=0.512) |

*p Values in bold, being <0.05, refer to each statistically significant association between variables.

PCS: physical component summary; MCS: mental component summary; TCI-R: Temperament and Character Revised; PSQI: Pittsburgh Sleep Quality Index.
the small sample size and the cross sectional procedure. Our sample can be considered representative of population of this specific suburban area in Southern Italy and includes all resident eligible patients in the four centers involved in the research, so a larger population could be assessed and long-term reevaluation could be performed to strengthen the statistical relevance.

QoL in chronic HD patients has recently became a topic of great interest, possibly due to both the increasing incidence and prevalence of patients on HD and the progressive aging of the HD population. Numerous interesting studies have been recently conducted in order to understand the determinants of the poor QoL characterizing the patient on chronic HD. More recent data have been collected from patients referred to HD units in large metropolitan areas and never in homogeneous suburban contexts. Furthermore, clinical outcomes, QoL, personality, and ability to adapt to stressful situations have never been synchronously evaluated in chronic HD patients so far. In order to understand if all these issues are interdependent and mutually influenced, we explored them in our observational multicentric study patients living in a specific geographical area in Southern Italy. This study was conducted in an interdisciplinary approach combining the expertise of nephrologists and psychiatrists. The descriptive analysis shows that the specific dimensions of KDQOL-SF with the lowest mean score were burden of CDK. MCS score (mean 38.5) and PCS score (mean 35.2) were found to be lower than in other studies reported in literature. We argued that our population was older but represents the current dialysis population. In accordance to Guerra–Guzerro study, we suppose that this result could be strictly influenced by the living condition and the difficulties that patients encounter to reach the HD unit in a suburban area. MCS score was higher than PCS in our patients similarly to other studies. According to Braga et al. reports, the difference between PCS and MCS scores was small. In both studies, the average number of years of dialysis was small suggesting that MCS is reduced at the beginning of dialysis and subsequently improves.

According to our results, multiple linear regression analysis showed that physical and mental health perceptive are strongly improved when are associated to iPTH normal values, identified in KDOQI guidelines range, longer dialysis age, and living in a family context. The longer dialysis age, as a predictor to better QoL, appears actually surprising. This results could be partially confirmed by Braga et al. who found that patients with chronic renal disease in the pre-dialysis stage had a poorer quality of life (QoF) and suffered from impaired cognitive functioning as compared to patients with ESRD on regular dialysis treatment. It has been demonstrated that conventional dialysis improves various cognitive variables (e.g., memory, attention, concentration, and information processing) in comparison with pre-dialysis stage.

Thus, better cognitive performance, observed in our sample of dialyzed patients, as compared to previous studies on ESRD patients, occurs despite or because of a longer dialysis age. A similar surprising observation had been reported in the HEMO study population by Dwyer et al.

The result associate to iPTH good control and living in a family context appear interdependent because a supportive family can greatly improve the compliance to dialysis treatment, drug therapy, and diet.

A valid social support from family and friends has been reported as a crucial tool to enhance QoL by improving adherence to therapy and social relationships. Looking at this result, in the extremely family-oriented social context, where our population lives, it appears even more significant.

Nevertheless, other studies did not find any relationship between iPTH levels and QoL but there is no doubt that iPTH is an independent factor of morbidity and it could worse QoL. In fact, Tanaka et al. showed how the iPTH has its uremic effect on multiple organs, leading even to central and peripheral neurotoxicity. Furthermore, Johansen and Chertow found that hyperparathyroidism impairs health relation QoL, causing bone damage and pain. An iPTH dysregulation could worsen QoL through its secondary effect on cardiovascular system.

The iPTH control only in part depends on HD treatment and is more strictly associated with the compliance to oral therapy with agents interfering with iPTH incretion (phosphate binders, calcimimetics, vitamin D analogues). Patients with a good compliance have presumably a better familiar environment and are motivated to respect home therapy. These aspects deserve close attention in the perspective of improving HD patients’ outcome.

We also found that MCS is correlated to a good QoS and to the condition of active worker. Our finding on QoS confirms previous reports. Sleep quality is an important and determining factor to evaluate the QoL in HD patients. A poor sleep quality has been reported in more than 50% of HD patients. Waking-up during the night and/or having breathing disorders during the sleep are common disturbances reported by 45–80% of HD patients. The loss of sleep correlates to both reduced physical and cognitive performances and is associated to a higher risk to develop anxiety and depression in patients undergoing chronic HD.
Consequently, a poor QoS might predict worse clinical outcomes in HD patients by increasing cardiovascular morbidity and mortality.58

We found a strong correlation between mental health perception and work status found in our study, even if many patients of our population were over-65 year old. We believe that this result strongly emphasizes the importance of work status as a positive determinant of QoL. A job certainly has a positive influence on the perception that individuals have a role in society, greatly increasing the self-respect.

This perception is even stronger in our area, were people tend to keep active even after retirement, often by cultivating their own garden or taking care of grandchildren or dedicating to bricolage. Usually, patients that starts HD is often considered unable to work, so we believe that much more attention should be paid to this important aspect of the life, also encouraging the development by government systems of special working channels for patients on chronic HD.

We also found a slight association between a better perception of mental health and a greater ability to adapt to stressful situations, in a task-oriented or avoidance-oriented coping behavior. This result introduces a novel concept and deserves a comment. “Coping” is defined as the cognitive and behavioral efforts to manage, reduce or tolerate external and internal demands and conflicts among them.59 In HD, external demands are the various stressors associated with the treatment. The coping method works as a modulator of stressors. Patients’ strategies to manage stressful situations could be linked to adapting to the illness condition. Our results show that coping in HD can be different, and it could suggest that the ability to use more than one modality of coping, also diversified, induces a better enhancement of coping and, therefore, an improved QoL.59

Our results seem also to indicate that personality traits could influence the perception of mental health in HD patients. It is possible that persistence and harm avoidance can directly influence firstly the acceptance of the disease and adherence to the treatment regimen and, secondly, the mental well-being. Interestingly, higher values of persistence resulted associated with worse MCS. It could be related to the tendency to perfectionism, social and working good functioning of people with high persistence, that could be more difficult when they undergo chronic HD. To our knowledge, no studies that have considered these issues are available. Further studies seem necessary to confirm these early results.26,59

In conclusion, according to our results, personality traits and coping strategies play a very important role in adapting to HD and could affect the QoL perception. The assessment of physical, mental, and social well-being in HD patients is essential to develop personalized plans of care. In this perspective, the strategies in order to improve overall patient outcome are multiple.

We suggest that HD staff should pay much more attention to improving patients QoL and should develop multidirectional strategies: (a) to install a good communication with the patient’s family; (b) to ensure a careful and periodical clinical monitoring of patients with special attention to the compliance to home therapy;60–62 (c) to early recognize patient at risk of poor outcome, by means of complete medical and psychological assessment; (d) to care patient QoS; (e) to provide patients with transport service when needed; (f) to possibly encourage patients to keep work activity or, if retired, to collaborate at family life or to spend time in the dialysis unit; and (g) to give to patients an adequate personalized psychological support, especially before the dialysis initiation.

Acknowledgements

The present study was not funded.

Disclosure statement

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

This research involving human participants who signed an informed consent to participate in the study. The results presented in this manuscript have not been published previously in whole or in part.

References

1. James MT, Hemmelgarn BR, Tonelli M. Early recognition and prevention of chronic kidney disease. The Lancet. 2010;375:1296–1309.
2. Block GA, Klassen PS, Lazarus JM, Ofsthun N, Lowrie EG, Chertow GM. Mineral metabolism, mortality, and morbidity in maintenance hemodialysis. J Am Soc Nephrol. 2004;15:2208–2218.
3. Evans RW, Manninen DL, Garrison LP, et al. The Quality of life in patients with End - Stage Renal Disease. N Engl J Med. 1985;312:553–559.
4. Thong MSY, Van Dijk S, Noordzij M, et al. Symptom clusters in incident dialysis patients: Associations with clinical variables and quality of life. Nephrol Dial Transplant. 2009;24:2218.
5. Jofré R, López-Gómez JM, Moreno F, Sanz-Guajardo D, Valderrábano F. Changes in quality of life after renal transplantation. Am J Kidney Dis. 1998;32:93–100.
6. Burkart J. The future of Peritoneal Dialysis in the United States: Optimizing its use. Clin J Am Soc Nephrol. 2009;4:130–131.
7. Fleming GM. Renal replacement therapy review: Past, present and future. *Organogenesis*. 2011;7:2–12.
8. Thomas R, Kanso A, Sedor JR. Chronic kidney disease and its complications. *Kidney Dis Hypert*. 2009;32:329–344.
9. Kaku Y, Ookawara S, Miyazawa H, et al. Approximation of corrected calcium concentrations in advanced chronic kidney disease patients with or without dialysis therapy. *Nephron Extra*. 2015;5:39–49.
10. Hedayati SS, Yalamanchili V, Finkelstein FO. A practical approach to the treatment of depression in patients with chronic kidney disease and end-stage renal disease. *Kidney Int*. 2012;81:247–255.
11. Cukor D, Cohen SD, Peterson RA, Kimmer PL. Psychosocial aspects of chronic disease: ESRD as a paradigmatic illness. *J Am Soc Nephrol*. 2007;18:3042–3055.
12. Anand S, Johansen KL, Grimes B, et al. Physical activity and self-reported symptoms of insomnia, restless legs syndrome, and depression: The comprehensive dialysis study. *Hemodial Int*. 2013;17:50–58.
13. El Harraqui R, Abda N, Bentata Y, Haddiya I. Evaluation and analysis of insomnia in chronic hemodialysis. *Pan Afr Med J*. 2015;19:221.
14. Blake C, Codd MB, Cassidy A, O'Meara YM. Physical function, employment and quality of life in end-stage renal disease. *J Nephrol*. 2000;13:142–149.
15. Kimmel PL. Psychosocial factor in dialysis patients. *Kidney Int*. 2001;59:1599–1613.
16. Rizzo MA, Frediani F, Granata A, et al. Neurological complications of hemodialysis: State of the art. *J Nephrol*. 2012;25:170–182.
17. Oeyen S, De Corte W, Benoit D, et al. Long-term quality of life in critically ill patients with acute kidney injury treated with renal replacement therapy: A matched cohort study. *Crit Care*. 2015;19:289.
18. Nolan CR. Strategy for improving long term survival in patients with ESRD. *J Am Soc Nephrol*. 2005;2:512–517.
19. Roumelioti ME, Argyropoulos C, Buysse DJ, et al. Sleep quality, mood, alertness and their variability in CKD and ESRD. *Nephrol Clin Pract*. 2010;114:c277–c287.
20. Bedduh S, Bruns FJ, Saul M, Seddon P, Zeidel ML. A simple comorbidity scale predicts clinical outcomes and costs in dialysis patients. *Am J Med*. 2000;108:609–613.
21. Lee JE, Kim K, Kim JS. Factors influencing quality of life in adult end-stage renal disease patients undergoing hemodialysis. *J Nurs Res*. 2015;23:181–188.
22. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12:189–198.
23. KDOQI, National Kidney Foundation. Clinical Practice guidelines and clinical practice recommendations for anemia in chronic kidney disease. *Am J Kidney Dis*. 2006;47:S11–S145.
24. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J Chronic Dis*. 1987;40:373–383.
25. Klersy C, Callegari A, Giorgi I, Sepe V, Efficace E, Politi P. Italian translation, cultural adaptation and validation of KDQOL-SF, version 1.3, in patients with severe renal failure. *J Nephrol*. 2007;20:43–51.
26. Endler NS, Parker JD. Multidimensional assessment of coping: A critical evaluation. *J Pers Soc Psychol*. 1990;58:844–854.
27. Gilbar O, Or-Han K, Plivazky N. Psychological distress among end-stage renal disease patients. *J Psychosom Res*. 2005;58:471–476.
28. Cloninger CR. Temperament and personality. *Curr Opin Neuropiobiol*. 1994;4:266–273.
29. Cloninger CR, Bayon C, Svrakic DM. Measurement of temperament and character in mood disorders: A model of fundamental states as personality types. *J Affect Disord*. 1998;51:21–32.
30. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28:193–213.
31. Bendel RB, Afifi AA. Comparison of stopping rules in forward “stepwise” regression. *J Am Stat Assoc*. 1977;72:46–53.
32. Qunibi WY. Consequences of hyperphosphatemia in patients with end-stage renal disease (ESRD). *Kidney Int*. 2004;64:58–512.
33. Johns TA, Yee J, Jules TS, et al. Interdisciplinary care clinics in chronic kidney disease. *BMC Nephrol*. 2015;16:161.
34. Tomasello S, Dhupar S, Sherman R. Phosphate binders, K/DQOQ guidelines, and compliance: The unfortunate reality. *Dial Transplant*. 2004;33:236–242.
35. Ghonemy TA, Allam HM, Elokely AM, et al. Chronic pain in hemodialysis patients. Role of bone mineral metabolism. *AJM*. 2015. [Epub ahead of print]. doi: http://dx.doi.org/10.1016/j.ajme.2015.12.002.
36. Flythe JE, Powell JD, Poulton CJ, et al. Patient-reported outcome instruments for physical symptoms among patients receiving maintenance dialysis: A systematic review. *Am J Kidney Dis*. 2015;66:1033–1046.
37. Espahbodi F, Hosseini H, Mirzade MM, Shafaa AB. Effect of psycho education on depression and anxiety symptoms in patients on hemodialysis. *Iran J Psychiatry Behav Sci*. 2015;9:227.
38. Vasilopoulou C, Bourtsi E, Giaole S, Koutelkos I, Theofilou P, Polikandrioti M. The impact of anxiety and depression on the quality of life of hemodialysis patients. *Glob J Health Sci*. 2015;8:46027.
39. Seica A, Segall L, Verzan C, et al. Factors affecting the quality of life of haemodialysis patients from Romania: A multicentric study. *Nephrol Dial Transplant*. 2009;24:626–629.
40. Fukushima S, Lopes AA, Bragg-Gresham, et al. Health-related quality of life among dialysis patients on three continents: The dialysis outcomes and practice patterns study. *Kidney Int*. 2003;64:1903–1910.
41. Moreno F, Lopez Gomez JM, Sanz-Guajardo D, Jofre R, Valderraban F. Quality of life in dialysis patients. A Spanish multicentre study. Spanish Cooperative Renal Patients Quality of Life Study Group. *Nephrol Dial Transplant*. 1996;11:125–129.
42. Guerra-Guerrero V, Sanhueza-Alvarado O, Cáceres-Espina M. Quality of life in people with chronic hemodialysis: Association with socio-demographic, medical-
43. Kutner NG. Assessing end-stage renal disease patients’ functioning and well-being: Measurement approaches and implications for clinical practice. *Am J Kidney Dis.* 1994;24:321–333.

44. Braga SF, Peixoto SV, Gomes IC, Acurcio A, Andrade EI, Cherchiglia ML. Factors associated with health-related quality of life in elderly patients on hemodialysis. *Rev Saude Publica.* 2011;45:1127–1136.

45. Walters BA, Hays RD, Spritzer KL, Fridman M, Carter WB. Health-related quality of life, depressive symptoms, anemia, and malnutrition at hemodialysis initiation. *Am J Kidney Dis.* 2012;40:1185–1194.

46. Hart RP, Pederson JA, Czerwinski AW, Adams RL. Chronic renal failure, dialysis, and neuropsychological function. *J Clin Neuropsychol.* 1983;5:301–312.

47. Rozeman CA, Jonkman EJ, Poortvliet DC, et al. Encephalopathy in patients on continuous ambulatory peritoneal dialysis and patients on chronic haemodialysis. *Nephrol Dial Transplant.* 1992;7:1213–1218.

48. Teschan PE, Bourne JR, Reed RB, Ward JW. Electrophysiological and neurobehavioral responses to therapy: The National Cooperative Dialysis Study. *Kidney Int Suppl.* 1983;13:558–565.

49. Dwyer JT, Larive B, Leung J, et al. Nutritional status affects quality of life in Hemodialysis (HEMO) Study patients at baseline. *J Ren Nutr.* 2002;12:213–223.

50. Kimmel PL, Peterson RA, Weihs KL, et al. Aspects of quality of life in hemodialysis patients. *J Am Soc Nephrol.* 1995;6:1418–1426.

51. Kalantar-Zadeh K, Kopple JD, Block G, Humphreys MH. Association among SF-36 quality of life measures and nutrition, hospitalization, and mortality in hemodialysis. *J Am Soc Nephrol.* 2001;12:2797–2806.

52. Mingardi G, Cornalba L, Cortinovis E, Ruggiata R, Mosconi P, Apolone G. Health-related quality of life in dialysis patients. A report from an Italian study using the SF-36 Health Survey. DIA-QOL Group. *Nephrol Dial Transplant.* 1999;14:1503–1510.

53. Tanaka M, Yamazaki S, Hayashino Y, et al. Hypercalcaemia is associated with poor mental health in haemodialysis patients: Results from Japan DOPPS. *Nephrol Dial Transplant.* 2007;22:1658–1664.

54. Johansen KL, Chertow GM. Chronic kidney disease mineral bone disorder and health-related quality of life among incident end-stage renal disease patients. *J Ren Nutr.* 2007;17:305–313.

55. Coppolino G, Lucisano G, Rivoli L, et al. Serum β-cross-laps as predictor of long-term parathyroid hormone levels in hemodialysis patients. *J Investig Med.* 2015;63:539–544.

56. Ibrahim S, Hossam M, Belal D. Study of non-compliance among chronic hemodialysis patients and its impact on patients’ outcomes. *Saudi J Kidney Dis Transplant.* 2015;26:243–249.

57. Sabet R, Naghizadeh MM, Azari S. Quality of sleep in dialysis patients. *Iran J Nurs Midwifery Res.* 2012;17:270–274.

58. Iliescu EA, Yeates KE, Holland DC. Quality of sleep in patients with chronic kidney disease. *Nephrol Dial Transplant.* 2004;19:95–99.

59. Folkman S. Personal control and stress and coping processes: A theoretical analysis. *J Pers Soc Psychol.* 1984;46:839–852.

60. Cianfrone P, Simeoni M, Comi N, et al. How to improve duration and efficiency of the antiproteinuric response to Ramipril: RamiPROT – a prospective cohort study. *J Nephrol.* 2015. [Epub ahead of print]. doi: 10.1007/s40620-015-0256-3.

61. Simeoni M, Cianfrone P, Comi N, et al. Is it feasible to improve the duration and the efficiency of Ramipril anti-proteinuric response? *G Ital Nefrol.* 2015;32:pii: in/32.1.9.

62. Cuccurullo M, Evangelista C, Vilasi A, et al. Proteomic analysis of peritoneal fluid of patients treated by peritoneal dialysis: effect of glucose concentration. *Nephrol Dial Transplant.* 2011;26:1990–1999.