Is quality of life associated with compliance to pharmacoterapy in patients with chronic kidney disease undergoing maintenance hemodialysis?

Existe associação entre qualidade de vida e adesão à farmacoterapia em pacientes com doença renal crônica em hemodiálise?

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ABSTRACT

Objective: To analyzed the association of quality of life and compliance to drug treatment in chronic kidney disease patients.

Methods: The Short Form Health Survey was used to evaluate the quality of life of these patients, and the therapeutic complexity index was verified. The Morisky-Green test and the Brief Medication Questionnaire were applied to check compliance to drug therapy.

Results: A total of 197 patients were included. The Morisky-Green test and Brief Medication Questionnaire showed that most patients had low compliance to treatment (50.3% and 80.6%, respectively). Compliance was highly associated with gender (male) and slightly associated with complexity of therapy, mental health, and social aspects.

Conclusion: We observed a slight association between compliance to pharmacotherapy and quality of life and complexity of therapy, and a strong association with gender.

Keywords: Renal insufficiency, chronic; Medication adherence; Quality of life; Renal dialysis

INTRODUCTION

Chronic kidney disease (CKD) is a worldwide public health problem due to its increased prevalence, high costs, and mortality rate. (1-2) According to the Brazilian
Society of Nephrology (SBN) census, the estimated total number of patients under dialytic treatment in Brazil, in 2015, was 111,303, and 90% of them were treated free of charge by the Unified Health System (SUS – Sistema Único de Saúde).(5)

Patients on dialysis deal with a painful long-term treatment and its complications, which impacts their quality of life and that of their families.(4-6)

Adding to the abovementioned factors, it is expected that high number of comorbidities and, consequently, a high therapeutic complexity have an important impact on compliance.(7)

Regarding drug therapy, some factors may hinder compliance of these patients, such as therapeutic complexity, adverse reactions induced by the drugs, and lack of understanding regarding the prescribed therapy.(8) Therefore, it is imperative to evaluate the impact on quality of life and therapeutic complexity index (TCI) on compliance to pharmacotherapy to assure drug efficacy and improve outcome in CKD patients.

### OBJECTIVE

To evaluate the association between quality of life of chronic kidney disease patients, therapeutic complexity index, and compliance to pharmacotherapy.

### METHODS

This cross-sectional study was developed in a philanthropic hospital located in the state of Minas Gerais, Brazil. Ethical approval was obtained (641.045/2014, CAAE: 30249814.1.0000.5545), and an Informed Consent was obtained from all individual participants enrolled in the study. A total of 209 end-stage renal disease patients (>18 years old) on hemodialysis were eligible for inclusion. We invited these patients to participate; 22 refused and 197 patients were enrolled. Data collection was carried out from August to November of 2014.

The interviews were performed individually in the hemodialysis room after the patients signing the Informed Consent Form. Each interview lasted, in average, 30 minutes.

The socioeconomic and demographic variables were gender, ethnicity, age, marital status, schooling level, comorbidities, private health insurance, transportations, household income (using the Brazilian minimum monthly wage of 2014 as basis, US$ 180.00), and employment situation.

The 36-Item Short Form Health Survey (SF-36), version 2, validated for Brazilian Portuguese was used to evaluate the quality of life of the CKD patients. This form has 36 items measuring eight scales of lifestyle: vitality (VIT), physical functioning (PF), bodily pain (BP), general health perceptions (GHP), physical role functioning (PRF), emotional role functioning (ERF), social role functioning (SRF), and mental health (MH). The questionnaire portrays a score from 0 to 100, in which 0 corresponds to the worst health status, and 100 to the best health status.(9)

In order to evaluate compliance to drug therapy, two questionnaires were used: the four item Morisky-Green Test (MGT) and the Brief Medication Questionnaire (BMQ).(10) The analysis was performed for 196 out of 197 patients, since one patient was not on any medication. The MGT measures compliance of patients through four questions with dichotomous answers (“yes” and “no”), “No” is considered the expected answer for patients with good compliance; thus if there were no “yes” answer (positive), patients were included in the Compliance Group, and Non-Compliance was considered one to four positive answers.(10) On the other hand, BMQ evaluates compliance to the drug therapy through three domains that identify barriers to compliance to drug regimen (seven questions), beliefs (two questions), and recall of medication treatment (two questions). Scores ≥1 indicate a potential non-compliance in any domain. Compliance was classified as high (no positive answer), probable (one positive answer), probable low compliance (two positive answers) and low (three or more positive answers) in any domain.(10)

The pharmacotherapeutic profile showed that it is possible to verify the presence of polypharmacy and to determine the TCI. The presence of polypharmacy was evaluated, considered as the simultaneous usage of five or more medicines.(11) The TCI was calculated according to Acurcio et al.,(12) including measurements of number of medicines, frequency, and type of actions required for self-administration. The TCI was calculated considering only medication regimens dependent on patient action. Thus medicines used during and/or after dialysis sessions were disregarded. One patient was excluded from the calculation since he was not on any medicine.

### Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 16.0 software. Normality was tested by the Kolmogorov-Smirnov test. The Mann-Whitney test was used to evaluate the difference between the questionnaire domains of the SF-36 and the gender variables, MGT and each domain of the BMQ (regimen, belief, and...
memory), and the TCI with MGT and BMQ. The established significance level was 5% (p<0.05).

The odds ratio (OR) was estimated using compliance as outcome, with the respective 95% of confidence interval (95%CI) using logistic regression. We included in the multivariate model the variables with p<0.2 for the univariate analysis, and those with plausibility to be inserted according to the literature. The stepwise backward method was used in order to insert the variables, and only the significant variables with p<0.5 remained. The explanatory variables used in the multivariate model were age, gender, race, number of comorbidities, hemodialysis time, functional capability, therapeutic complexity index, general state, mental health, pain, vitality, social role functioning, emotional role functioning, and physical role functioning.

RESULTS

The majority of the population of the study was male (61.4%); the mean age was 56.5±13.2 years; 72.1% were retired due to disability, and 66.5% with monthly family income below two Brazilian minimum wages. Only 33.0% had private health insurance (Table 1).

Table 2. Values yielded from domains of the 36-Item Short Form Health Survey and comparison with the gender variable

| Domains                          | Total value | Women (n=76) | Men (n=121) | p value* |
|----------------------------------|-------------|-------------|-------------|----------|
| Physical functioning             | 60 (25-80)  | 47.5 (20-71.3) | 70 (40-85) | 0.002    |
| Physical role functioning        | 0 (0-50)    | 0 (0-50)    | 25 (0-50)   | 0.071    |
| Bodily pain                      | 62 (22-100) | 41 (22-100) | 100 (30-100)| 0.013    |
| General health perceptions       | 55 (45-67)  | 52 (40-62.8) | 57 (50-67)  | 0.012    |
| Vitality                         | 65 (55-75)  | 60 (55-75)  | 65 (55-75)  | 0.033    |
| Social role functioning          | 100 (62.5-100) | 100 (62.5-100)| 100 (62.5-100)| 0.412    |
| Emotional role functioning       | 33.3 (33.3-100) | 33.3 (33.3-100) | 33.3 (33.3-100) | 0.766    |
| Mental health                    | 76 (60-82)  | 72 (60-89)  | 80 (74-96)  | 0.017    |

Data expressed in medians (Quartiles 25-75%).
* Statistical test: Mann-Whitney.

Table 3. Comparison of compliance to pharmacotherapy by the Morisky-Green Test with the 36-Item Short Form Health Survey domains

| Domains                          | Compliance (n=99) | Non-compliance (n=98) | p value* |
|----------------------------------|-------------------|-----------------------|----------|
| Physical functioning             | 70 (0-100)        | 50 (0-100)            | 0.011    |
| Physical role functioning        | 25 (0-100)        | 0 (0-100)             | 0.014    |
| Bodily pain                      | 100 (0-125)       | 31.50 (0-100)         | <0.001   |
| General health perceptions       | 62 (20-134)       | 45 (20-80)            | <0.001   |
| Vitality                         | 70 (25-375)       | 55 (15-325)           | <0.001   |
| Social role functioning          | 100 (25-100)      | 62.5 (13-113)         | <0.001   |
| Emotional role functioning       | 33.3 (0-100)      | 33.3 (0-100)          | 0.501    |
| Mental health                    | 88 (20-100)       | 60 (8-100)            | <0.001   |

Data expressed in medians (Quartiles 25-75%).
* Statistical test: Mann-Whitney.
with the SF-36 domains, a significant difference was noticed, as shown on table 3.

Evaluating compliance through the BMQ, the final score showed that 80.6% of patients achieved scores related to potential low compliance. In the regimen domain, 92.2% of patients showed positive potential for non-compliance (score ≥1). In the belief domain, only 12.8% of patients presented positive potential for non-compliance (score ≥1). In the “patient recall of medicine treatment” domain, which analysed a scheme of multiple doses and the difficulty of patients to remember taking their medications, 96.9% of patients showed potential non-compliance (score ≥1). However, “regimen” and “recall/memory” domains were more closely related to the potential low compliance to drug therapy. A significant difference relating BMQ and quality of life was observed, as is shown on table 4.

The TCI was compared with the compliance profile and no significant difference (p=0.953) was obtained for the MGT test, with median values of 15 (0-34), for compliance, and 15 (0-29), for non-compliance. The same result was observed for BMQ beliefs, in which the Compliance Group presented a TCI of 14 (0-34) and the Non-Compliance Group, of 16 (6-25), with p=0.422. For regimen and memory domains, a significant difference was obtained. For the regimen domain, the Compliance Group showed lower TCI levels than the Non-Compliance Group, 9 (0-32) and 14.5 (4-27),

### Table 4. Comparison between compliance to pharmacotherapy, according to Brief Medication Questionnaire (BMQ), and the do 36-Item Short Form Health Survey (SF-36) domains

| SF-36 domains          | BMQ score = 0 (compliance) | BMQ score ≥1 (non-compliance) | p value* |
|------------------------|----------------------------|-------------------------------|----------|
| **BMQ – regimen domain** |                            |                               |          |
| n=5                    |                            | n=192                         |          |
| Physical functioning   | 85 (70-90)                 | 55 (25-80)                    | 0.006    |
| Physical role functioning | 50 (25-75)              | 0 (0-50)                      | 0.061    |
| Bodily pain            | 100 (61-100)              | 0 (0-25)                      | 0.134    |
| General health perceptions | 62 (60-70)             | 55 (45-75)                    | 0.046    |
| Vitality               | 75 (65-75)                | 65 (65-75)                    | 0.164    |
| Social role functioning | 75 (62.5-100)           | 100 (62.5-100)                | 0.862    |
| Emotional role functioning | 66.7 (33.3-100)       | 33.3 (33.3-100)               | 0.909    |
| Mental health          | 76 (64-100)               | 76 (60-92)                    | 0.449    |
| **BMQ – belief domain** |                            |                               |          |
| n=172                  |                            | n=25                          |          |
| Physical functioning   | 60 (25-55)                | 60 (20-80)                    | 0.804    |
| Physical role functioning | 0 (0-50)               | 0 (0-25)                      | 0.186    |
| Bodily pain            | 72 (22-100)               | 32 (22-100)                   | 0.055    |
| General health perceptions | 55 (45-67)             | 52 (40-60)                    | 0.082    |
| Vitality               | 65 (65-75)                | 55 (65-75)                    | 0.035    |
| Social role functioning | 100 (62.5-100)          | 62.5 (62.5-100)               | 0.004    |
| Emotional role functioning | 33.3 (33.3-100)       | 33.3 (0-66.7)                 | 0.105    |
| Mental health          | 80 (64-96)                | 56 (44-72)                    | <0.0001  |
| **BMQ – memory domain** |                            |                               |          |
| n=7                    |                            | n=190                         |          |
| Physical functioning   | 45 (32.5-66.8)            | 60 (25-80)                    | 0.330    |
| Physical role functioning | 0 (0-37.5)              | 0 (0-50)                      | 0.466    |
| Bodily pain            | 100 (71.5-100)           | 61 (22-100)                   | 0.332    |
| General health perceptions | 62.5 (54-66.5)       | 55 (45-67)                    | 0.590    |
| Vitality               | 67.5 (56.3-75)            | 65 (55-75)                    | 0.894    |
| Social role functioning | 81.3 (62.5-100)         | 100 (62.5-100)                | 0.777    |
| Emotional role functioning | 100 (25-100)           | 33.3 (33.3-100)               | 0.843    |
| Mental health          | 68 (60-82)               | 76 (60-92)                    | 0.391    |
| Saúde mental           | 68 (60-82)               | 76 (60-92)                    | 0.391    |

Data expressed as medians (25th to 75th quartiles).
* Statistical test: Mann Whitney.
respectively (p=0.04), and for the memory domain, 5 (0-7) for the Compliance Group versus 15 (2-34) for the Non-Compliance Group (p<0.001).

Finally, table 5 presents the logistic regression analysis results, showing the association between MGT regimen versus TCI (OR=0.856) and age (OR=0.934); BMQ beliefs versus SRF (OR=1.021) and MH (OR=1.029); and BMQ-recall versus male sex (OR=9.354) and TCI (OR=0.524), as well as an association between MGT and general health perception (OR=1.026), MH (OR=1.026) and TCI (OR=1.053).

| Categories                  | p value* | OR     | 95%CI  |
|-----------------------------|----------|--------|--------|
| MGT compliant               |          |        |        |
| General health perceptions  | 0.011    | 1.026  | 1.006-1.047 |
| Mental health               | 0.001    | 1.026  | 1.011-1.041 |
| TCI                         | 0.019    | 1.053  | 1.008-1.101 |
| BMO regimen                 |          |        |        |
| TCI                         | 0.004    | 0.856  | 0.771-0.952 |
| Age                         | 0.005    | 0.934  | 0.891-0.980 |
| BMO beliefs                 |          |        |        |
| Social role functioning     | 0.014    | 1.021  | 1.004-1.038 |
| Mental health               | 0.004    | 1.029  | 1.009-1.049 |
| BMO recall                  |          |        |        |
| Gender                      |          |        |        |
| Female                      | -        | 1.00   |        |
| Male                        | 0.047    | 9.354  | 1.027-85.232 |
| TCI                         | 0.004    | 0.524  | 0.337-0.816 |

In the multivariate model, age, sex, race, number of comorbidities, hemodialysis time, functional capability, therapeutic complexity index, general state, mental health, pain, vitality, social functioning, emotional functioning, and physical functioning. Reference variable for Brief Medication Questionnaire: compliance.

* p test: OR: odds ratio; 95% CI: 95% of confidence interval; MGT: Morisky-Green test; TCI: therapeutic complexity index; BMO: Brief Medication Questionnaire.

II DISCUSSION

Until the present, the association of quality of life with compliance to pharmacotherapy has been poorly reported, despite the value of this information in the end-stage renal disease population.(13) The relation between quality of life and treatment compliance has an important impact on the healthcare system, since non-compliance leads to an increase of new cases of end-stage renal disease population. Comparing compliance with quality of life scores, both general state and MH of the quality of life and TCI scores slightly increased the chance of compliance by MGT. Moreover, the compliance measurement using the BMQ (regimen domain) showed that the increased age and the TCI reduced the chance of compliance. Regarding the belief domain, the increase of SRF and MH values showed a slight increase in the chance of compliance. On the other hand, regarding the memory domain, being female and having higher TCI scores were highly associated with non-compliance. This result indicates that despite the association between quality of life and compliance, the main factors associated with compliance, especially recall, are the TCI and female sex. This result indicates that the perception of patients regarding their own health, SRF, and MH have a slight association with treatment compliance. Currently, data on patients undergoing hemodialysis are rare in the literature. A recent systematic review identified a positive relation between therapeutic compliance and quality of life in diabetic patients, which suggests that health professionals should take social aspects into consideration in order to have better clinical outcomes.(15) Similar results were found for hypertensive patients regarding SRF and MH.(16)

DeOreo et al., found that patients who missed approximately two dialysis treatments per month, that is, who did not comply with the non-pharmacological treatment, showed better scores for mental and physical health, which demonstrates that when the patient is feeling mentally and physically well, he or she tends to skip the hemodialysis sessions.(13) According to our results in which we evaluate the compliance to treatment with oral drugs, the patient tends to comply more to the pharmacological treatment when showing the same conditions.

The negative association between compliance and TCI in this study has been shown previously in a systematic review by Ghimere et al., in hemodialysis patients.(17) Before addressing complexity, it is important to relate negative attitudes of patients regarding pharmacotherapy.(18) In the present study, these attitudes might be related mainly to the belief domain of compliance, and be explained by poor quality of life of the patients over MH and SRF.

Comparing the quality of life scores with the variable sex, females showed more commitment in all domains and the recall domain was strongly associated with the compliance profile. Physiological changes, such as hypothalamic and ovarian dysfunction caused by the disease and intensified by hemodialysis, made females more limited in their daily activities with a low perception as to their general health status.(19) This result contradicts the data obtained in previous studies, in which no significant difference was noted in any dimension of the SF-36 regarding the variable sex(20) or shown in the male gender as a disadvantage for better quality of life scores.(21)
Regarding the drug therapy compliance profile analyzed by MGT and BMQ, the results obtained from these instruments were contradictory. Using MGT, half of the patients presented compliance profile, while using the BMQ, the majority of patients presented with a potential low compliance to the treatment. This divergence confirms the hypothesis that there is no gold standard for measuring compliance to pharmacological treatment.\(^9,22,23\)

The population demographic and social data in this study were similar to the Brazilian Dialysis Census and other national studies, showing the prevalence of males, low educational level, and monthly income below two minimum wages.\(^9,13,24-27\) The low monthly income reported by patients may be related to retirement income and government financial aid for diseases, since half of the study population was at working age, which explained retirement caused by limitations from the disease. As expected, the higher prevalent diseases (hypertension and diabetes mellitus) have been the major causes of CKD development.\(^26,29\)

Considering the quality of life scores, the results pointed out some problems mainly regarding PF, showing that physical status affects the performance of daily and work activities in CKD patients. Similar results were also found in another Brazilian study.\(^30\) However, Mortari et al.,\(^31\) found low scores for the PF, and for the GHP domain. Another domain that showed a high impact was ERF. This result was similar to other data in the literature, in which the most affected domains were PRF and ERF.\(^32\) Then again, in this study, the domain SRF had the maximum score and showed the best score, indicating that physical health or emotional problems do not interfere in the social life of end-stage renal disease patients.

The extreme values can be justified according to the type of variable that is obtained through SF-36, which is a categorical variable and does not allow a large diversity of intermediary values, or those close to “floor” and “ceiling”. Moreover, these results highlighted that the population is heterogeneous in relation to quality of life. This can be explained according to the broad social and economic diversity of the studied population, in addition to different phases and time of treatment.

Finally, the use of indirect methods of assessing compliance is assumed as a limitation, since it may present recall and information bias. Additionally, the cross-sectional design does not establish causality. Therefore, new longitudinal studies should be designed to evaluate the impact of quality of life on treatment compliance, so that intervention strategies are established in nephrology services, improving quality of life and consequently, compliance to treatment.

## CONCLUSION

Non-compliance to drug therapy may be associated with worse quality of life and high therapeutic complexity. Beyond improving therapeutic complexity, strategies should be based on mental health and social role functioning to improve compliance.

## REFERENCES

1. Madeiro AC, Machado PD, Bonfim IM, Braqueais AR, Lima FE. Adherence of chronic renal insufficiency patients to hemodialysis. Acta Paul Enferm. 2010;23(4):546-51.
2. Salgado Filho N, Brito DJ. Chronic kidney disease: the great epidemic of this millennium. J Bras Nefrol. 2006;28(3 Suppl 2):1-5.
3. Sociedade Brasileira de Nefrologia. Censo de Diálise SBN 2016 [Internet]. São Paulo: Sociedade Brasileira de Nefrologia; 2016 [citado 2016 Out 21]. Disponível em: http://censo-sbn.org.br/censosAnteriores
4. Borrelli S, Minutolo R, De Nicola W, De Simone E, Zito B, et al. Quality of life of hemodialysis patients in central and southern Italy: cross-sectional comparison between Hemodiafiltration with endogenous reinfusion (HFR) and Bicarbonate Hemodialysis. G Ital Nefrol. 2016;33(3):pii: gin/33.3.8.
5. Pérez-Sáez MJ, Montero N, Redondo-Pachón D, Crespo M, Pascual J. Strategies for an Expanded use of Kidneys from Elderly Donors. Transplantation. 2017;101(4):727-45. Review.
6. Sattar S, Khan N, Ahmad F, Adnan F, Danish SH. Post-dialysis effects in patients on haemodialysis. J Pak Med Assoc. 2016;66(6):781-8.
7. Ghimire S, Peterson GM, Castelino RL, Jose MD, Zaidi ST. Medication Regimen Complexity and Adherence in Haemodialysis Patients: an Exploratory Study. Am J Nephrol. 2016;43(3):318-24.
8. Hansen SK. Noncompliance. Nephrology Nurs J. 2001;28(6):653-5.
9. Ciconelli RM, Ferraz MB, Santos WS, Meinalo I, Quaresma MR. Brazilian-Portuguese version of the SF-36. A reliable and valid quality of life outcome measure. Rev Bras Reumatol. 1999;39(3):143-50.
10. Ben AJ, Neumann CR, Mongue SS. Teste de Morisky-Green e Brief Medication Questionnaire para avaliar adesão a medicamentos. Rev Saude Publica. 2012;46(2):279-89.
11. Secoli SR. [Polypharmacy: interaction and adverse reactions in the use of drugs by elderly people]. Rev Bras Enferm. 2010;63(1):136-40. Portuguese.
12. Auricio FA, Silva AL, Ribeiro AO, Rocha NP, Silveira MR, Klein CH, et al. Complexidade do regime terapêutico prescrito para idosos. Rev Assoc Med Bras (1992). 2006;52(5):356-9.
13. DeOreo PB. Hemodialysis patient-assessed functional health status predicts continued survival, hospitalization, and dialysis-attendance compliance. Am J Kidney Dis. 1997;30(2):204-12.
14. Guirarducci NV, Alves KB, Santos TR, Baldoni AQ, Sanches-Giraud C. Pharmacotherapy of patients in substitutive renal therapy: an adherence approach. Rev Bras Farm Hosp Serv Saude. 2016;7(3):8-12.
15. Gusmai LF, Novato TS, Nogueira LS. [The influence of quality of life in treatment adherence of diabetic patients: a systematic review]. Rev Esc Enferm USP. 2015;49(5):639-46. Review.
16. Souza AC, Borges, JW, Moreira TM. Quality of life and treatment adherence in hypertensive patients: systematic review with meta-analysis. Rev Saude Publica. 2016;50:71. Review.
17. Ghimire S, Castelino RL, Loufas NM, Peterson GM, Zaidi ST. Nonadherence to medication therapy in haemodialysis patients: a systematic review. PLoS One. 2015;10(12):e0144119. Review.
18. Neto L, Martini A, Andreucci VE, Gallieni M, Roy LA, Brancaccio D; MigliorDialisi Study Group. Regimen complexity and prescription adherence in dialysis patients. Am J Nephrol. 2011;34(1):71-8.
19. Ahmed SB, Ramesh S. Sex hormones in women with kidney disease. Nephrol Dial Transplant. 2016;31(11):1767-95. Review.
20. Santos PR. Relação do sexo e da idade com o nível de qualidade de vida em rinsen crônicos hemolíticos. Rev Assoc Med Bras (1992). 2006;52(5):356-9.
21. Sayin A, Mutluay R, Sindel S. Quality of life in hemodialysis, peritoneal dialysis, and transplantation patients. Transplant Proc. 2007;39(10):3047-53.

22. Obreli-Neto PR, Baldoni AO, Guidoni CM, Bergamini D, Hernandez KC, Luz RT, et al. [Methods for estimating adherence to the pharmacotherapy]. Rev Bras Farm. 2012;93(4):403-10. Portuguese.

23. Marzec LN, Maddox TM. Medication adherence in patients with diabetes and dyslipidemia: associated factors and strategies for improvement. Curr Cardiol Rep. 2013;15(11):418. Review.

24. Braga SF, Paixoto SV, Gomes IC, Acucio FA, Andrade EI, Cherciglia ML. [Factors associated with healthrelated quality of life in elderly patients on hemodialysis]. Rev Saude Publica. 2011;45(6):1127-36. Portuguese.

25. Santos PR, Pontes LR. Change in the level of quality of life in end-stage kidney patients during a 12 months follow-up. Rev Assoc Med Bras. 2007;53(4):329-34.

26. Terra FS, Costa AM, Figueiredo ET, Morais AM, Costa RD. [The main complications presented by the chronic renal patients during hemodialysis]. Rev Bras Clin Med. 2010;8(3):187-92. Portuguese.

27. Silva AC, Coelho DM, Diniz GC. [Quality of life of patients with chronic kidney disease undergoing dialysis]. Sinapse Múltipla. 2012;1(2):103-13. Portuguese.

28. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney Int Suppl. 2013;3(1):1-150.

29. Magalhães AC, Coelho GD, Azevedo MA, Lazzari DD, Jung W. Quality of life of patients with chronic renal failure hemodialysis – to kidney transplant. Rev Enferm UFFE online. 2013;7(9):5442-52.

30. Barbosa LM, Júnior MP, Bastos KA. [Predictors of quality of life in chronic hemodialysis patients]. J Bras Nefrol. 2007;29(4):222-9. Portuguese.

31. Mortari DM, Menta M, Scapini KB, Rockemback CW, Duarte A, Leguisamo CP. [Quality of life in individuals with end-stage chronic kidney disease undergoing hemodialysis]. Scient Med (Porto Alegre). 2010;20(2):156-60. Portuguese.

32. Santos PR. [Correlation Between Laboratory Markers and Quality of Life Level in Chronic Hemodialysis Patients]. J Bras Nefrol. 2005;27(2):70-5. Portuguese.