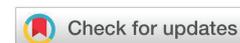




Received: 30 July, 2021
Accepted: 27 August, 2021
Published: 28 August, 2021

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Research Article

Functional impairment associated with increased severity of mental health disorders in Latin American chronic hemodialysis patients

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Abstract

Background: End-Stage Kidney Disease (ESKD) and associated complications are related with increased prevalence of psychological disorders. There is a growing trend of elderly and high comorbid individuals beginning chronic Hemodialysis Programs (HD) while there is limited knowledge about the influence of functional impairment and comorbidity burden in the prevalence of mental health disorders and life satisfaction on HD population. The purposes of this study were to report the local prevalence of psychological disorders, life satisfaction and self-reported health status as well to describe differences in functional status and comorbidity burden scores between patients with moderate/severe psychological disorders and those none/mild alterations of a Latin American chronic HD cohort.

Methods: Transversal uni-center study in 139 Ecuadorian chronic and stable HD patients. Once patients were eligible to participate six tests were applied to explore functional status (Barthel Index and PPS score), depression, anxiety and stress prevalence (DASS-21 scale) comorbidity burden (Charlson Index), self-rated health state (EQ-5D/VAS) and satisfaction with life (SWLS score) Exclusion criteria were: Time in HD less than 6 months, recent hospitalization (less than 3 months) and severe cognitive impairment. Continuous symmetric variables were described as mean \pm standard deviation or median and interquartile range if asymmetric. T-test was used for symmetric continuous variables, U-Mann-Whitney if asymmetric and chi-square for qualitative variables.

Results: A total of 79 (55%) patients were male. Mean time in HD was 73 ± 47 months, with mean age $56 \pm 15,7$ years. Prevalence of moderate/severe mental health disorders were: depression (28%), anxiety (37%) and stress (34%). Moderate/severe depressed patients scored significantly lower in Barthel Index ($p=0.048$) and those with moderate/severe stress scored significantly lower in Barthel Index ($p=0.025$) and PPS score ($p=0.030$). Time in HD > 92 months was significantly related with moderate severe/anxiety (0.044). Unsatisfaction with life was found in 20% of patients and it was significantly related with lower functional Barthel Index ($p=0.017$) and PPS score ($p=0.041$) when compared with those satisfied with life. Patients with self-rated health status $<70\%$ on EQ-5D VAS scored significantly lower in Barthel Index ($p=0.022$) and PPS score (0.003) vs those with $\geq 70\%$ score. No differences were found with age, CKD etiology, civil and laboral status.

Conclusions: Prevalence of mental health disorders is similar to other series reported. Patients with moderate/severe depression, stress, unsatisfaction with life, and low self-reported health state had worst functional status than those with none/mild alterations. Time in HD over 7.6 years was associated with higher intensity of anxiety.



Introduction

Chronic Kidney Disease (CKD) is a growing health care problem with a worldwide estimated prevalence of 29% in adult population and with more than 2 million people diagnosed with End Stage Kidney Disease (ESKD) who are on kidney transplant program and/or in dialysis treatments [1]. ESKD evolution, its associated complications (pruritus, anaemia, appetite lost, physical impairment, etc), symptomatic burden, medications with adverse effects as well as dietary and fluid restrictions may produce sudden and unpleasant changes in patient's lifestyle once they initiate in-center Hemodialysis (HD). These sudden changes accompanied with dependence feelings (to health-workers and/or to HD machines) and uncertainty about the future have been associated with increased prevalence of emotional and psychological disorders in this population [2,3].

According to several studies, ESKD patients have an increased prevalence of mental health disorders when compared with non-ESKD individual. For example, anxiety is 10% more prevalent in ESKD when compared with non-ESKD patients. Series have reported depression, anxiety and stress prevalences of 23%, 37% and 22%, respectively [3,4]. An increased prevalence of mental health disorders and decreased quality of life may worsen the natural course and evolution of ESKD patients by enhancing symptomatic perception, altering therapeutic adherence, and reducing satisfaction with life [4].

Nowadays there is an increase prevalence of elderly individuals with high comorbidity burden beginning dialysis programs with little known about the impact of functional impairment and high comorbid burden in the prevalence of mental health disorders, dissatisfaction with life and self-reported health status on ESKD population. Also, there is a lack of Latin American data reporting the prevalence of these alterations in the region.

The purposes of this study were to report the local prevalence of psychological disorders, life satisfaction and self-reported health status as well to describe differences in functional status and comorbidity burden scores between patients with moderate/severe psychological disorders and those none/mild alterations of a Latin American chronic HD cohort.

Methods

Observational transversal uni-center study in 139 Ecuadorian chronic hemodialysis patients who received HD treatment at "Clínica de los Riñones Meny Dial" in Quito-Ecuador. Inclusion criteria were time on HD treatment in the studied center for ≥ 6 months, no recent hospitalization (less than 3 months), age ≥ 18 years. Exclusion criteria were severe cognitive impairment, episode of recent hospitalization, age < 18 years old and time of dialysis treatment in study center less than 6 months. Once patients fulfilled inclusion criteria and accepted to participate in the study six psychological evaluations tests were applied in each studied patient. The different tests were applied by a psychologist professional before dialysis session in a quiet room with no time limit. Patients with visual or auditive impairment were accompanied by the formal caregiver which helped the

patients in case of difficulties for answering the tests due to visual/hearing impairment or if patients couldn't read or had difficulties to understand the questions. The duration of test response was from 40-50 min approximately. Instruments applied for screening of mental health disorders, functional status, comorbidity burden, satisfaction with life, and self-rated health state in studied population were the following:

Mental health disorders screening

Depression, anxiety and stress scale score-21 (DASS-21) [5]: Shortest version of "Depression, Anxiety and Stress Scale score" (DASS). It is a short and easy-to-answer self-report instrument composed by 21 questions that evaluate depression, anxiety and stress intensity [6]. Depression is evaluated by presence/absence of dysphoria, self-depreciation, lack of interest and anhedonia. Anxiety is explored by the presence of subjective symptoms of somatic fear, autonomic activation, episodes of situational anxiety and by the presence/absence subjective perceptions of anxious states. Stress is evaluated by the presence of hyperactivity states, irritability, difficulty to relax and notable impatience [6]. Each scale has seven items which are scrambled along the 21 questions of the test. The number of the questions that evaluate depression are: 3, 5, 10, 13, 16, 17 and 21. Those questions that evaluate anxiety are 2, 4, 7, 9, 15, 19 and 20, and those for stress evaluation are 1, 6, 8, 11, 12, 14 and 18. Each item has an established punctuation according to patient's answer and all items are summed at the end of the test giving a final score which describes the intensity of psychological alteration [6,7]. Depression severity is classified according to the obtained score as: Mild 5-6 points, moderate 7-10 points, severe 11-13 points, and extremely severe ≥ 14 points. Anxiety intensity is classified with the following score: Mild 4 points, moderate 5-7 points, severe 8-9 points and extremely severe ≥ 10 points. Finally, stress intensity is classified with the following score: Mild 8-9 points, moderate 10-12 points, severe 13-16 points and extremely severe ≥ 17 points. The instrument has a reliability of 88% in depression; 79% in anxiety and 83% in stress screening with a full test reliability of 93% [6,7].

Satisfaction with life screening

Satisfaction with life scale (SWLS) [8]: It is one of the most used instruments to measure patient's life satisfaction by evaluating subjective well-being and satisfaction with life [9]. It consists of five items that evaluate, according to patient's own global judgment, the level of satisfaction with life.

Questions used in the test to evaluate life satisfaction are: First, "In most aspects of life, is my life close to an ideal perception?", secondly, "Are my life conditions excellent?", third, "Am I satisfied with my life?", fourth, "Have I achieved, along my life, the things I consider important" and fifth, "If I could live again would I change anything of my life? [9,10]. All these questions have seven different predetermined alternative answers punctuating from 1 to 7, being 1 strongly disagree, 2 disagree, 3 slightly disagree, 4 neither agree nor disagree, 5 slightly agree, 6 agree and 7 strongly agree. At the end of test the results obtained in each question are summed with



an establish diagnosis for each range of score being from 5-9: Extremely unsatisfied, from 10-14: Unsatisfied with life, from 15-19: below average, for 20-24: Average, 25-29: very satisfied and from 30-35: extremely satisfied [11]. The reliability of this scale is high, with a Cronbach's alpha coefficient up to 82% [10,11].

Own perception of health status

Visual analogue scale (EQ-5D/VAS) [12]: This is a patient's self-rated overall health status based on a visual analogue scale (VAS) ranking from 0 to 100, being 0 the worst self-rating health status and 100 the best self-rated health status [13]. This test belongs to the EQ-5D test which is one of the most used generic health-related quality-of-life instruments worldwide. EQ-5D is a standardized generic instrument composed of three components [12,13]. The first component explores the state of health, the second explores a self-rated overall health status using the visual analogue scale and the third component collects demographic information, age, sex, residence, occupation, family status and incomes contributing with general and demographic information of the studied group [14]. Due to its characteristics, the EQ-5D has achieved a great reputation for its simplicity, validity and reliability, geographic spread, high quality control of the assessment protocols and translations [15].

Functional status

Barthel Index [16]: Barthel Index (BI) is used to evaluate the capacity of a person in performing basic activities in daily life, obtaining a quantitative estimation of the subject's level of dependency and, indirectly, the impact of health problems on the dependence state [17]. Barthel Index assesses the ability of a person to perform in a dependent or independent way (as well as the magnitude of dependence) 10 basic activities of the daily life. The categories evaluated are eating, mobility, personal hygiene, the capacity of going up and down stairs, dressing skills, and sphincter control [18]. The evaluated categories have between 2 to 4 ranges and the values assigned to each range depends on how much help and time is needed to perform these activities. Each category is evaluated with different ranges and the scores of each range can be 0, 5, 10 or 15 points. The final score can range from 0 to 100 classifying the severity of dependence (functional impairment) according to the score obtained. Those with 0-24 points are totally dependent (extremely severe functional impairment), 25-49 points with severe dependence (severe functional impairment), 50-74 points moderate dependence (moderate functional impairment) 75-90 average dependence (functional impairment below average) >90 minimum dependence (minimal functional impairment) and 100 not dependence (No functional impairment) [18]. It is an easily applicable method with a high level of reliability and validity, easy to interpret and to apply. It is used method for measuring physical incapacity in clinical practice as well as in epidemiological investigation and public health, obtaining a reliability of 88% [17,18].

PPS (Palliative performance scale score) [19]: This instrument is a modification of the Karnofsky Performance

Scale. It was first introduced by Anderson and Downing in 1996 as a new tool for measurement of performance status in palliative care [20]. Its indicators are based on the performance status of the patient and has been used as prognostic tool, disease progression monitoring and in health care planning and administration. This a valuable clinical assessment tool in palliative care and many of other specialties have already incorporated PPS as standard tool in their practice [20].

The test explores five categories: Mobilization, evidence of disease, self-care, food intake, and level of consciousness. The score ranges from 0 to 100 in an interval of ten points according to the observer findings in each category. Each category contains 10 different scenarios with its respective score and the final score is obtained by selecting the scenario that best fits to patient's clinical and functional situation. It has shown a reliability around 96% [21].

Comorbidity burden

Charlson Index [22]: It was created with the objective of developing a prognostic instrument for comorbidities that, individually or combined, could affect the risk of short-term mortality [23]. Charlson comorbidity index is assessed based on the age and other 19 medical conditions which are cataloged into four groups according to the survival impact assigned to each disease, with a minimum score of 0 and maximum score of 37 [23,24]. These conditions can be obtained through clinical records, medical-administrated databases, and interviews. The total score is the sum of all clinical entities of the patient resulting in 10-year survival probability with an acceptable interobserver reliability of 95% [23,24].

Statistical analysis

Continuous symmetric variables were described as mean \pm standard deviation or median and interquartile range if asymmetric. T-test was used for comparing significative differences of medians from symmetric continuous variables, U-Mann-Whitney was used to compared significative differences in medians with non-symmetric distribution and chi-square for comparison of qualitative variables. In mental health disorders explored with DASS-21 scale, SWLS scale and self-rated health state by VAS, patients were classified according to scores obtained in each test in two groups: A pathological group and a healthy group. The divided groups which were obtained according to scores on test are specified in each instrument. Variables as age, functional impairment, comorbidity burden, sex, time on HD, were collected and compared looking for significative differences between both groups.

Once instruments were applied to studied population, they were categorized according to the score obtained in each test as follows. For DASS-21 scale subjects who obtained a score \leq 6 points in depression scale were considered not depressed while subjects with score \geq 7 were considered depressed. For anxiety scale, subjects who obtained a score \leq 4 were considered without anxiety and those with score \geq 5 were anxious. Finally, in stress scale, subjects with a score \leq 9 were considered



not stressed while those with score ≥ 10 were considered as stressed patients.

On SWLS test for satisfaction with life screening subjects who obtained a score ≥ 20 points were catalogued as “satisfied patients” and were compared for further analysis with patients who obtained scores <20 which were considered as “unsatisfied patients”.

On EQ/5D-VAS, used as a patient’s self-rated health status, patients were divided in four groups according to self-rated score obtained. Patients with a self-rated score >80 were considered with good self-rated health, those with 60–79 were considered with mild self-rated health impairment, those with 30–59 were considered with moderate self-rated health impairment, those with 0–29 were considered with severe self-rated health impairment. For statistical analysis patients were divided in two groups according to score obtained, those with score $<70\%$ were considered with impaired self-rated health state and those with score $\geq 70\%$ were considered with good self-rated health state.

Results

A total 143 chronic hemodialysis patients were receiving treatment in study center and were initially considered for study. Four patients were excluded for the following reasons: One had severe cognitive impairment and three had received dialysis treatment for less than 6 months in the center of study. Finally, 139 patients fulfilled inclusion criteria and participated in the study.

There was a male predominance in population studied (55%), a third of patients were single and more than a half were married (52%). A third of studied population completed high-school education (32%). Psychotropics, antidepressants, benzodiazepines and antipsychotics prescription prevalence was 4% for each one of them. A quarter of patients were unemployed, 40% of patients had a formal job, 12% had visited a mental health professional previously with 7% who had visited a psychiatrist and 5% to a psychologist. Table 1 shows baseline characteristics of studied population. The studied center had previous prevalence of depression and anxiety of 12%, obtained before COVID 19 pandemic.

Prevalence of mental health disorders found in the study are shown in Table 2. To note, depression prevalence was found to be present in 28% of patients, anxiety prevalence was 37% and 34% of stress prevalence was observed. Unsatisfaction with life prevalence was 20% and 53% of studied individuals scored $<70\%$ on self-rated health state.

Age was not significantly related with prevalence of moderate/severe depression ($p=0.37$), moderate/severe anxiety ($p=0.89$) moderate/severe stress ($p=0.44$) unsatisfaction with life ($p=0.94$) and overall health status self-rating scale score ($p=0.20$).

Sex was not significantly related with prevalence of moderate/severe depression ($p=0.52$), moderate/severe anxiety ($p=0.69$) moderate/severe stress ($p=0.23$) unsatisfaction with

life ($p=0.59$) and overall health status self-rating scale score ($p=0.65$).

Time in HD treatment was significantly related with moderate/severe anxiety prevalence ($p=0.044$), these differences were observed more significantly in patients with more than 92 months in HD treatment. Time in HD was not significant related with prevalence of moderate/severe depression ($p=0.90$), moderate/severe stress ($p=0.54$) unsatisfaction with life ($p=0.21$) and overall health status self-rating scale score ($p=0.26$).

Comorbidity, measured by modified Charlson Index score, was not significant related with prevalence of moderate/severe depression ($p=0.72$), moderate/severe anxiety ($p=0.10$),

Table 1: Baseline characteristics of studied population.

Population studied (N=139)	Results
Age (years)	56(± 15.7)
Sex (%)	
-Male	(55)
Time in hemodialysis (months)	73(± 47.1)
Etiology (%)	
Diabetes	28
Hypertension	17
Glomerular	24
Others	31
Vascular Access (%)	
FAV	97
Catheter	3
Employment situation (%)	
Unemployed	25
Active	40
Retired	35
Education (%)	
Illiterate	1
High School	32
Other	67
Civil status (%)	
Single	28
Married	52
Widower	3
Other	17
Previous mental health disorder (%)	
Anxiety	12
Depression	12
Previous psychotropics prescribed (%)	
None	88
Antidepressant/Benzodiazepine/ Antipsychotic	12
Palliative Performance score. (/100)	87 (± 8.5)
Modified Charlson Index score	5 (± 2.1)
Barthel Index (/100)	93 (± 14.7)
Dry Weight (Kg)	61.1 (± 12.8)

HD: Hemodialysis. Values expressed in percentage or mean +/- standard deviation

moderate/severe stress ($p=0.76$), dissatisfaction with life ($p=0.99$) and overall health related self-rating scale score ($p=0.73$).

Patients who presented moderate/severe depression, moderate/severe stress, dissatisfaction with life, and an overall self-rated score below 80% scored significant lower in instruments used for functional status assessment when compared with fellows with none/mild depression, none/mild stress, satisfaction with life and overall self-rated score $\geq 70\%$. Barthel index score was significantly lower in patients with moderate/severe depression vs those with none/mild depression (88.2 ± 16.9 vs 93.7 ± 13.6 , $p=0.048$). Barthel Index score was lower in patients with moderate/severe stress vs fellows with none/mild stress (89 ± 15.6 vs 93.8 ± 14.1 , $p=0.025$) as well as PPS score (84.6 ± 11 vs 88 ± 6.6 , $p=0.030$). Patients with dissatisfaction with life scored significantly lower in Barthel index vs fellows satisfied with life (84.1 ± 19.7 vs 94.1 ± 12.8 , $p=0.017$). PPS score was also significantly lower in patients unsatisfied with life vs those satisfied with life (82.9 ± 11.3 vs 87.9 ± 7.4 ; $p=0.041$) according to SWLS score. In patients with self-rated health-status score $< 70\%$ on VAS Barthel index was significantly lower vs those with self-rated health-status $\geq 70\%$ (89.1 ± 16.4 vs 94.9 ± 12.7 ; $p=0.022$) as with PPS score (84.5 ± 10.6 vs 89 ± 5.1 ; $p=0.003$).

Presence of moderate/severe anxiety wasn't related with Barthel index score in patients ($p=0.29$) neither PPS score ($p=0.07$). Moderate severe depression wasn't significantly related with PPS score ($p=0.06$). Table 3 shows variables significantly related prevalence of moderate/severe mental health disorders studied as well with dissatisfaction with life and self-rated health state $< 70\%$.

Discussion

This study shows the relationship between a prolonged time in dialysis and a significant increase in prevalence of moderate/severe anxiety (> 7.6 years), as well as the relationship of impaired functional status and the increased

Table 2: Results of instruments applied on chronic hemodialysis patients for screening of mental health disorders.

Instruments applied:	None-Mild Score %	Moderate Score %	Severe Score %	Extremely Severe Score %
DASS-21 (Depression)	0-8 72	(7-10) 11	(11-13) 13	(≥ 14) 4
DASS-21 (Anxiety)	(0-4) 63	(5-7) 19	(8-9) 11	(≥ 10) 7
DASS-21 (Stress)	(0-9) 66	(10-12) 16	(13-16) 14	(≥ 17) 4
Satisfaction with life scale score (SWLS) (%)	≥ 20 (Satisfied) 81	15-19 (Below average) 8	10-14 (Unsatisfied) 4	5-9 (Extremely Unsatisfied) 7
EQ-5D/VAS Patient's self-rated health score/100 (%)	$\geq 80\%$ (Good health) 47	40-79% (Mild impairment) 18	30-59% (Moderate impairment) 29	$\leq 29\%$ (Severe impairment) 6

DASS-21: Depression, anxiety, stress scale score. VAS: Visual analogue scale from test EQ-5D

Table 3: Variables significantly related with mental health disorders, dissatisfaction with life and impaired health-status perception in chronic hemodialysis population studied.

Variables related with mental health disorders, life satisfaction and impaired health-status: Moderate/severe depression:	p-value
• Functional impairment: - Lower Barthel Index score vs none/mild depression).	0.048 ^p
Moderate/severe anxiety:	
- Time on HD (> 92 months) vs those with none/mild anxiety	0.044 [*]
Moderate/severe stress	
• Functional impairment: - Lower Barthel Index vs those with none/mild stress	0.025 ^p
- Lower Palliative performance scale score vs those with none/mild stress	0.030 ^p
*Unsatisfaction with life:	
• Functional impairment: - Lower Barthel Index vs those satisfied with life	0.017 ^p
- Lower Palliative Performance Scale score vs those satisfied with life.	0.041 ^p
*Self-rated health-status $< 70\%$	
• Functional impairment - Lower Barthel Index vs those scored $\geq 70\%$	0.022 ^p
- Lower Palliative Performance scale score vs those scored $\geq 70\%$	0.003 ^p

*Satisfaction with life scale score (SWLS). *Euro-QOL visual analogue scale (EQ-5D/VAS). ^p: p-value calculated with t-student. ^{*}: p-value calculated with U-Mann-Whitney test

prevalence of moderate/severe mental health disorders (depression and stress), dissatisfaction with life and decreased self-rated health state in a cohort of Latin American chronic hemodialysis patients.

Several studies have demonstrated similar prevalence of anxiety and depression in chronic dialysis population as the ones showed in our study [25-27]. These studies have also shown that stress prevalence was lower (20%-25%) than the one found in our study where it was the second most prevalent mental health alteration (34%).

The higher stress prevalence found in this cohort may be explained for several reasons. First, the COVID-19 pandemic outbreak. COVID-19 has significantly increased the prevalence of stress in HD population due to the different new stressful situations associated with the disease (isolation, death of closer relatives, lack of current and validated information, etc) [3,25,28]. This study was performed during COVID-19 pandemic, almost one year after its outbreak, so this new stressful situations in current life have directly influenced in studied population resulting in a higher prevalence of stress when compared with other series that were developed before COVID-19 outbreak [25-27]. Secondly, this higher stress prevalence may be due to absence of accurate tools to face stress in the hemodialysis patients studied and third, other studies have used different instruments with different specificity and sensibility on detecting mental health disorders [25-27].

Chronic dialysis patients have become older and more comorbid in the last years. Several factors such as aging, high comorbidity burden, ESKD associated comorbidities and ESKD progression are associated with the presence of considerable



functional impairment [1]. Other series have indirectly linked the association of functional impairment and high comorbidity burden with higher prevalence of mental health disorders such as anxiety and depression [26–29]. In our study we have demonstrated a significantly lower scores on functional status tests of patients with moderate/severe depression and stress vs those without or mild alterations. Also, functional status was significantly lower in patients who showed moderate/severe dissatisfaction with life as in those who showed a lower self-rated health-state score, exposing the link between functional impairment with mental health disorders prevalence, low self-rated health state and dissatisfaction with life which have influence in quality of life and early mortality on HD patients [25–29].

Our study shows that there is a significant link between a higher moderate/severe anxiety prevalence in patients with a prolonged time in dialysis (over 7.6 years). Previous series haven't found any relation between time in dialysis treatment and an increased prevalence of anxiety [3,4]. This difference observed in our study could be explained by the fact that local transplant programs are neither effective nor active, resulting in prolonged stays on dialysis treatment whereas previous studies were developed in Spain [3,4], country known for their effective and very active transplant program that avoid such prolonged stays on dialysis treatments [30].

Limitans of the study were a small sample size, only HD population studied, which could compromise external validity, also, COVID-19 pandemic outbreak was another important limitation due to the forced use of personal special equipment (facemasks, face-shields) that negatively committed the communication with patients. Also, fear of getting infected with COVID-19 disease was another limitation which was caused for the fact of being in a small quiet room for solving the tests causing annoying and disturbance to studied patients. One more limitation was the lack of time for test response due to the rush of patients to begin dialysis session.

The strengths of the study were a homogenous population studied, the use of validated instruments to measure the pathologies analyzed and the fact that functional impairment was objectively measured and compared between pathological and non-pathological groups to analyze the presence of significant differences.

To conclude, this study demonstrates a clear relationship between a decreased functional status and a higher prevalence of moderate/severe stress and depression, dissatisfaction with life and low self-reported health-state as well as an increased prevalence of moderate/severe anxiety in patients with HD stays longer than 7.6 years. We consider that specific programs of premature identification and effective intervention in this rising elderly, functional impaired and high comorbid chronic dialysis population, might decrease the severity of mental health disorders, dissatisfaction with life, and low self-reported health-state. We suggest that psychological services should provide effective tools to deal with stressful situations

to hemodialysis patients. More research studies are needed in this topic.

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Citation: Santacruz J, Santacruz S, Coloma G, Reinoso P, Sulbarán C, et al. (2021) Functional impairment associated with increased severity of mental health disorders in Latin American chronic hemodialysis patients. *Arch Renal Dis Manag* 6(1): 003-009. DOI: <https://dx.doi.org/10.17352/2455-5495.000035>