REV SEN
rev-sen.ec

OPEN ACCESS

Survival and social inequality in older adults with stage 5 chronic kidney disease undergoing hemodialysis treatment.

Marcela Valladares Benitez [ID] [1], Gabriela Bonilla Q. [ID] [2], Washington Xavier Osorio Chuquitarco [ID] [3], Maria Fernanda Rivadeneira Guerrero [ID] [4], Doris Yvonne Almeida Rivera [ID] [5].

1. Geriatrics Service, San Juan de Dios Specialized Hospital, Quito-Ecuador.
2. Geriatrics Service, Macas General Hospital, Ministry of Public Health, Morona Santiago, Ecuador.
3. Department of Nephrology, Armed Forces Specialty Hospital No. 1, Quito-Ecuador.
4. Directorate of Health Education Area, Pontifical Catholic University of Ecuador, PUCE, Quito-Ecuador
5. Medical direction, Clinef Norte Nephrological Center, Quito-Ecuador.

Received: July 1, 2022
Accepted: August 12, 2023
Published: August 20, 2023
Editor: Dr. Franklin Mora Bravo.

Cite:
Valladares M, Bonilla G, Osorio W, Rivadeneira F, Almeida D. Survival and social inequality in older adults with stage 5 Chronic Kidney Disease undergoing hemodialysis treatment. REV SEN 2023;11(2):110-119. DOI: http://doi.org/10.56867/54

Abstract

Introduction: The access of older adults to hemodialysis programs is increasingly common. This study aimed to determine the survival of older adults with Chronic Kidney Disease (CKD) stage 5 on hemodialysis after five years of follow-up about social inequality and the population's clinical, biochemical, and functional characteristics.

Methods: The present observational, analytical, retrospective study was conducted at the CLINEF Norte Nephrological Center in Quito, Ecuador, from 2007-2012. Patients >64 years old with CKD 5-d were included. Clinical, nutritional, economic, sociodemographic, mortality, and overall survival (OS) variables were recorded. The sample was nonprobabilistic. Survival was measured at five years with Kaplan–Meier, and the variables' association was analyzed.

Results: 71 cases are analyzed, aged 70.7 ± 6.6 years, 64.8% men, 49.3% with income < 530 dollars. The 5-year OS was 48.9%. The variables that were significantly associated with OS were: male sex (OS 49.0 ± 2.4 months, P =0.010), absence of CVD with OS 45.3 ± 2.4 months, P =0.010), albumin > 3.51 g/dl (OS 49.7 ± 2.9 months, P =0.009), Karnofsky > 80 (OS 52.7 ± 2.2 months, P =0.002). Female sex and a history of CVD presented a statistically significant HR (HR 2.29, 95% CI 1.18 -4.43; HR 2.67, 95% CI 1.21-5.88). When adjusting for low income, together with female sex and low albumin, they maintained their association (HR 2.21, 95% CI 1.01-4.82), (P =0.044).

Conclusion: Nutritional status and functional assessment were the main factors associated with the more remarkable survival of older adults on hemodialysis. In a subanalysis, it was shown that women with low economic income have lower survival.

* Corresponding author

Email: Washington Osorio C < dr.osoriowhm@gmail.com>/Address: QGP4+QJ5, General Hospital of the Armed Forces, Quito – Ecuador. Telephone: [593] 2 396 8300.

Keywords:

MESH: Renal Dialysis, Aged, Frail Elderly, Survivorship, Income.

Chronic kidney disease (CKD) is a prevalent disease in older adults [1], and its final stage has been classified as a catastrophic disease [2, 3]. Ecuador does not have a specific registry on the morbidity and mortality of patients with chronic kidney disease or a registry for older adults. However, only some descriptive studies focus on certain localities [4].

Senescent nephropathy has been described as a new syndrome that seeks to encompass frail older adult chronic kidney patients, whose pathologies tend to be interrelated and present multiorgan complications depending on the clinical status of the CKD and functionality of the older adult (frail, prefrail, robust) [5]. Therefore, the implementation of early geriatric assessment would achieve the detection and initiation of treatments aimed at correcting all the clinical, affective, and social aspects that require intervention to improve the prognosis and quality of life of aged people [6].

There is an increase in older adult patients with CKD who require renal replacement therapies [7], and the cost is highly representative [8]. Therefore, knowing the clinical, biochemical, and functional characteristics of the older adult population related to more remarkable survival before admission to hemodialysis can benefit the patient, the health team, and the public.

In 2023, it was estimated that in Ecuador, there would be approximately 19,496 people with chronic kidney disease in the final stage, that is, 1,065 cases per million inhabitants, which is above the estimated average for Latin America (866 pmp) [9] but lower than the reported rates in the United States of 5855 pmp for black Americans and 1704 pmp for white Americans.

The implementation of health prevention and screening programs in patients at risk to avoid their progression and the increase in costs that accompany it, with the need to estimate the characteristics of the older adult population before admission to conventional hemodialysis, who benefit from the intervention to improve their survival and quality of life [10, 11].

This study aims to determine the survival of older adults with stage 5 chronic kidney disease on hemodialysis after five years of follow-up concerning social inequality and the studied population's clinical, biochemical, and functional characteristics.

Materials and methods

Study design

The study is observational and analytical. The source is retrospective.

Scenery

The study was carried out in the hemodialysis service of the CLINEF Norte Nephrology Center in Quito, Ecuador. The study period was from January 1, 2007, to December 31, 2012.

Participants

Patients over 64 with stage 5-d chronic kidney disease who received renal function replacement treatment at the study institution were included. Patients who required a change of therapy to peritoneal dialysis or underwent transplantation during the study observation period were excluded.

Variables

The variables were age, sex, place of residence, marital status, education, insurance coverage, family income, type of housing, dependent people, and history of coronary heart disease, heart failure, stroke, hypertension, or diabetes mellitus. , smoking, body mass index, estimated glomerular filtration rate by creatinine, total cholesterol, serum albumin, antihypertensive medications, use of insulin, statins, Karnofsky functionality scale (KPS), presence of fistula or catheter, date of first dialysis at the institution and the end date of observation due to death or termination of the study.

Data sources/measurements

The source was indirect. The information was collected in an electronic database created by the authors from the medical records found in the institution's archive. The biochemical measurements were part of the regular activity of the institution in which control studies are carried out monthly.

Biases

To avoid possible interviewer, information, and memory biases, the leading researcher always kept the data with a guide and records approved in the research protocol. Observation and selection bias were avoided with the application of participant selection criteria. All clinical and paraclinical variables from the period already mentioned were recorded. Two researchers independently analyzed each record in duplicate, and the variables were recorded in the database once their agreement was verified.

Study size

The sample was nonprobabilistic, by quotas, where all possible cases from the period under study were included.

Quantitative variables

Descriptive and inferential statistics were used. The results were expressed on a scale of means and standard deviations. Categorical data such as sex are presented in proportions.

Statistical analysis

Noninferential and inferential statistics are used. For the descriptive analysis, measures of central tendency and dispersion were calculated according to the measurement scale of each of the variables. Qualitative variables are presented as absolute numbers and percentages; quantitative variables are presented as medians and standard deviations.

Inferential analysis: comparing scale values between the groups was carried out with Student's t test, and the proportion values were compared with chi-square. Associations were tested using the chi-square or Fisher's exact test, OR, and 95% CI determination. The level of statistical significance was $P < 0.05$. Univariate analysis was performed through logistic regressions to estimate the association between survival and the sample variables. Overall survival at five years of follow-up was estimated using the Kaplan–Meier method. The Cox regression model was used to establish the variables that influenced survival and the impact of the economic situation. The statistical package used was SPSS 25.0 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

Results

Participants

Seventy-one analysable patients entered the study.

General characteristics of the sample

The average age of the group was 70.69 ± 6.56 years; the male sex predominated with 64.8%, primary education 40.9%, married marital status 57.9%, own home 67.5%, residence in an urban area 70%, type of IESS health insurance in 52.3%, without dependent people in the family 63.8%, average family income of 712.64 dollars with a standard deviation 677.61, whose values ranged between 50 and 4000 dollars, with a mode of 300 dollars.

A total of 84.1% of the patients were hypertensive, other diseases outside those analyzed within the variables were 62.4%, 49.4% were nonsmokers, antihypertensives were the most used drugs 83%, 47.1% of the patients had a normal BMI, 52.3% had a venous catheter as vascular access upon admission, and the primary etiology of chronic kidney disease was nephroangiosclerosis 36.4%.

The leading causes of mortality were infections (38.89%), unspecified septic shock (13.89%), infections associated with vascular access (11.11%), and pneumonia (8.33%). Acute myocardial infarction ranks second at 16.67%.

The CKD diagnosis time before HD had a mean of 28.13 months, with a standard deviation of 40.28 and a mode of 1 month. The average time on hemodialysis was 48.7 months, with a standard deviation of 31.76. Cholesterol had a mean of 172.59 mg/dl and a standard deviation of 53.98 mg/dl; the mean albumin was 3.52 gr/dl and a standard deviation of 0.5. The functionality analysis through the KPS scale averaged 74 points, with a standard deviation of 12.

Table 1. Univariate analysis of the risk of death in geriatric patients.

Univariate analysis

No survival differences were observed by sex (OR 2.32, CI 0.94-5.74) ($P = 0.06$). There were also no differences in survival by age categories between those younger and older than 75 (OR 1.18, CI 0.46-3.02) ($P = 0.72$). There were no survival differences by marital status (single, divorced, and widowed) versus (married, cohabiting union) (OR 1.49, CI 0.63-3.52) ($P = 0.36$). There were no differences in mortality by type of family income (OR 1.32, CI 0.52-3.37) ($P = 0.55$). Of the comorbidities, only the group with a cerebrovascular event had higher mortality OR 5.0 95% CI 1.01 -24.69 ($P = 0.048$). The type of vascular access was not related to survival (OR 1.91, CI 0.81-4.46) ($P = 0.13$). The functionality assessed by the KPS scale more significant than 80% had no impact on survival (OR 2.28, CI 0.97-5.37) ($P = 0.058$); however, when analyzing the KPS variable as a quantitative variable in logistic regression, a relationship was observed that was significant for survival (-0.049) ($P = 0.012$). Albumin was significantly positively related to survival (-1.92) ($P = 0.001$). BMI and cholesterol showed no relationship with survival (Table 2).

Kaplan and Meier estimate

The variables related to prolonged survival were male sex (49.02 months) (Figure 1), absence of a history of CVD (45.32 months) (Figure 2), albumin greater than 3.51 g/dl (49.67 months) (Figure 3) and KPS greater than or equal to 80 (52.65 months) (Figure 4).

Cox regression

When performing a bivariate Cox analysis, it was observed that both female sex and a history of CVD presented a statistically significant HR (HR 2.29, 95% CI 1.18 - 4.43, $P = 0.013$; HR 2.67, 95% *CI* 1.21-5 -88, $P = 0.026$). Likewise, serum albumin and KPS levels were significantly associated with survival. In the multivariate analysis, albumin and KPS remained significant ($P < 0.01$). In the multivariate analysis adjusted for economic income, female sex (HR 2.21, 95% CI 1.01-4.82, $P = 0.003$) and albumin ($P = 0.044$) remained associated with survival. Figures 5 and 6. The KPS lost statistical significance ($P = 0.053$).

Category	Variable	Survival		OR (95% CI)	*P* value
		Yes (N, %)	No N, %)		
Sex	Male	32 (36.8)	25 (28.7)	2.32 (0.94- 5.74)	0.06
	Female (Reference)	11 (12.6)	20 (23.0)		
Age	Under 75 years	32 (38.8)	32 (36.8)	1.19 (0.46-3.02)	0.72
	75 and over 24 (Reference)	11 (12.6)	13 (14.9)		
Level of instruction	Illiterate/primary	21 (24.1)	22 (25.3)	0.99 (0.43-2.30)	0.99
	Secondary/higher (Reference)	21 (24.1)	24 (27.6)		
Family presence	Accompanied	28 (35.4)	20 (25.3)	1.49 (0.63-3.52)	0.36
	Alone	15 (19.0)	16 (20.3)		
Family income	Greater equals $ 530	19 (30.2)	14 (22.2)	1.32 (0.52-3.37)	0.55
	Minor $ 530 (Reference)	16 (25.4)	14 (22.2)		
Comorbidities	HTA (No/yes)	5 (10.1)	9 (6.3)	0.52 (0.16-1.72)	0.52
	DM2 (No/yes)	25 (31.6)	21 (26.5)	0.92 (0.39-2.16)	0.85
	Coronary artery disease (No/yes)	39 (50.0)	34 (43.6)	0.92 (0.17-4.87)	0.93
	ICC (No/yes)	32 (40.0)	31 (39.7)	0.91 (0.33-2.48)	0.86
	CVD (No/yes)	40 (51.3)	28 (35.9)	5.00 (1.01-24.69)	0.048*
Smoking	Never	21 (26.9)	17 (21.8)	1.04 (0.45-2.42)	0.91
	Before and current (Reference)	21 (26.9)	19 (24.2)		
Medicines	Statins (Yes/no)	4 (5.1)	6 (7.6)	0.41 (0.11-1.44)	0.16
	Insulin (Yes/no)	17 (21.5)	13 (16.5)	1.07(0.45-2.54)	0.86
	Antihypertensives (Yes/No)	36 (45.6)	29 (36.7)	1.11 (0.36, 3.38)	0.85
vascular access	Catheter	26 (32.9)	17 (21.5)	1.91 (0.81-4.46)	0.13
	Fistula (Reference)	17 (21.5)	19 (24.1)		
KPS Functional Assessment	Greater equals 80	25 (31.6)	11 (13.9)	2.29 (0.97-5.37)	0.058
	Under 80 (reference)	18 (22.8)	25 (31.6)		

Table 2. Association between survival and variables (Logistic regressions with B value, standard deviation, n=88).

Variable	b	Standard deviation	P value
BMI	-0.21	0.047	0.64
Cholesterol	-0.002	0.004	0.72
Albumin	-1.92	0.565	0.001*
KPS	-0.049	0.020	0.012*

KPS: Karnofsky Functional Scale

Figure 1. Survival is associated with sex.

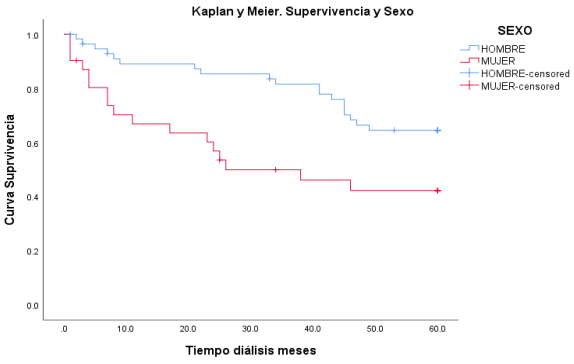


Figure 2. Survival is associated with a history of vascular cerebral events.

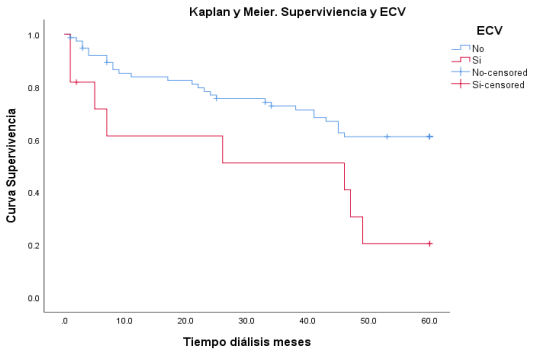


Figure 3. Survival associated with serum albumin level.

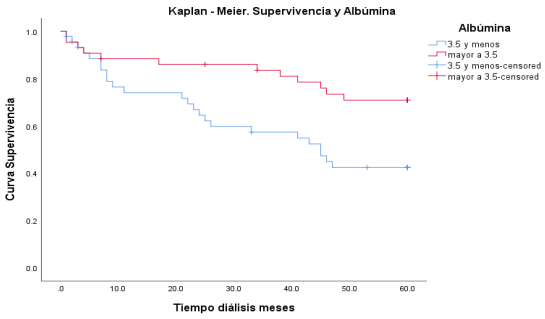


Figure 4. Survival associated with the Karnosfsky functional scale.

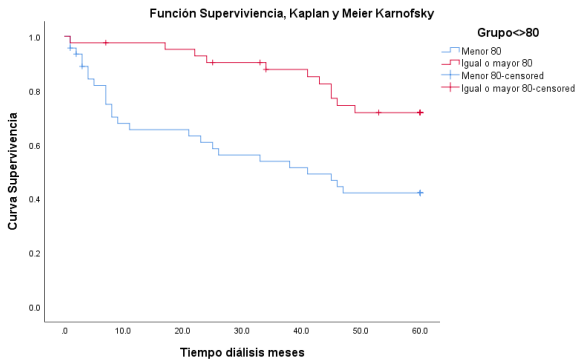
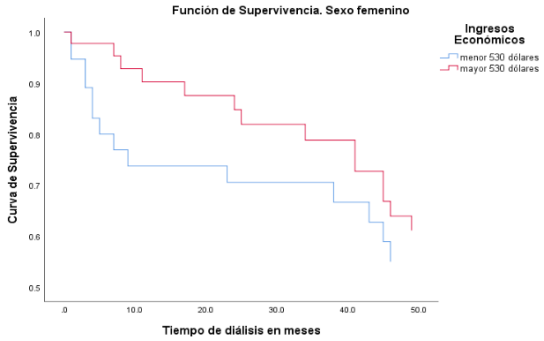


Figure 5. Multivariate Cox regression adjusted for female sex and income.



The survival curve in both the bivariate and multivariate analyses shows a loss of proportional risk due to the crossing of the survival curves after 40 months, which suggests that survival does not improve after that time; however, the number of patients who remained alive until that date must be taken into account (Figure 7).

Figure 6. Multivariate Cox regression adjusted for serum albumin and income.

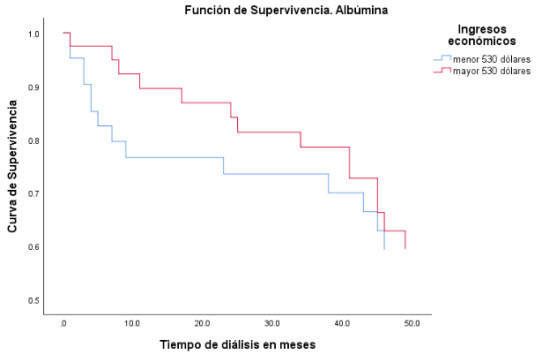
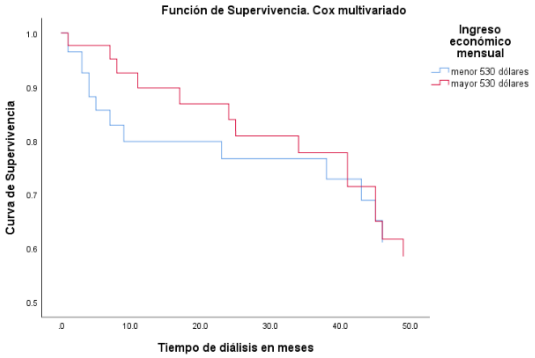


Figure 7. Multivariate Cox regression adjusted for multivariate and economic income.



Discussion

The present study found an overall survival of 48.9% of the older adult patients studied. Martínez et al. In 2016, they reported a 5-year survival rate of 43.47% in a Spanish population of 69 older adults on dialysis therapy [12]. Hussain et al. 2013 studied English patients over 70 years of age with CKD, observing a survival of 46% and 31.22% at 24 and 40 months of follow-up, respectively [13]. In Latin America, survival studies reported in older adults are scarce in Peru. Pinares et al. 2018 observed 604 patients of all ages (51.95±16.17) with a collection period of approximately 20 years, observing 47% survival at five years of follow-up [14]. Araujo et al. (2012) conducted a study in the Brazilian population with 31,298 patients of all ages on RRT, in which a survival of 66.5% was observed at three years of follow-up in patients on HD [15]. In Chile, Ríos et al., in 2016, studied a population of 459 older adult patients; at 40 months of follow-up, the overall survival was 26.22% [16]. The survival reported in our study was higher compared to a series of Spanish and English studies, whose health systems are inclusive, as in Latin American studies. Another important observation is the number of the population with dialysis access. The Latin American Registry of Dialysis and Renal Transplantation of 2015 indicates that Peru has a lower number of patients on dialysis (315.3 pmp in 2015) [17]. Brazil has the fifth highest GDP in the region; despite this, the population with access to dialysis reaches 707.8 pmp. In the case of Ecuador, although its GDP for 2015 was 3600, the number of patients on RRT reached 705 pmp, which makes us think about the importance of preventive strategies for CKD and adequate selection of patients eligible for treatment. TSR, which allows savings in public spending.

In the present study, the factors related to survival were male sex, absence of a history of CVD, albumin greater than 3.51 mg/dl, and KPS greater than or equal to 80 points.

An unexpected finding of the present study was the more remarkable survival in men, with a 2.32 times greater chance of surviving. Because being a man is a risk factor for CKD, they would be expected to have higher mortality [18]. In other studies, sex had no relationship with survival [12], while in others, mortality was higher

in women [7]. Our study showed that the group of women had a higher risk of mortality, and of this, the group of single, widowed, or divorced women was more affected; although it was not statistically significant, it is possibly related indirectly due to the absence of family support, in addition to a possible relationship with gender inequality, an aspect that would be interesting to address in another study. The United Nations Development Program (UNDP) indicated that Ecuador, for 2012, obtained 89th place (186 countries) in the Gender Equality Index, which indicates that there are still deep cultural and social gaps to change [19]. Functionality was significantly affected in the female group, presenting a Karnofsky score of less than 80 (P=0.000). Furthermore, it was observed that this group presented lower albumin levels; although the association was not statistically significant, it would support the hypothesis that this population group has a greater social risk.

Age was not a factor related to survival, possibly because there was a more significant number of patients under 75; the heterogeneity of both groups was not statistically significant. Ríos et al. (2016) conducted a prospective study with 459 older adults on HD; in this study, it was observed that survival was considerably reduced with older age [16]. The same findings were found in several studies carried out in Peru and Spain [12, 14].

Regarding the comorbidities that were studied, HBP, DM2, CHF, and coronary heart disease were not associated with survival; the only comorbidity of importance was CVD. This variable is related to higher mortality with statistical significance; however, when performing the analysis, multivariate Cox analysis was observed to lose significance, possibly due to the small number of patients with CVD in our study. Other survival studies did not find significant differences, while ischemic heart disease did affect survival (P=0.004) [12].

Within the etiology of CKD, it was observed that nephroangiosclerosis due to HTN is the first cause, followed by diabetic kidney disease. The present findings are consistent with other research [16]. In Spain, they found unknown etiology as the first cause of CKD in older adults (28.1%), followed by DM2 (28%) and vascular causes (26%) [20].

Regarding vascular access, contrary to what was described in other studies, it was observed that the venous catheter was associated with better outcomes. This survival result, different from what was expected, could be because 52.3% of the patients in this study were admitted to hemodialysis with a central venous catheter, and 26.13% had no previous diagnosis of CKD and were undergoing emergency dialysis, making emergency placement necessary. This finding suggests the lack of preventive control, early detection, and timely nephrological referral to provide specific treatment and early AVF placement, which would prevent disease progression. Ríos et al. (2016) had a similar finding: 73.4% started dialysis with a central venous catheter; however, the four groups studied had a higher risk of mortality (HR 1.37 to 1.95) [16]. It would be understood that AVF would be the preferred access; however, De Alarcón et al. (2015) indicate that older adults present episodes of hypotension and arrhythmias, typical situations in HD sessions, which makes the creation and maturation of AVF difficult [7]. On the other hand, Arhuidese et al. (2019), in their retrospective study carried out on 124,421 adults over 75 years of age in the USA, indicated that AVF is the best vascular access method for HD; however, patients who do not tolerate surgical intervention or enter urgent HD and whose life expectancy is greater than four months can receive a central catheter and change to AVF when their clinical status allows it. In turn, if life expectancy is less than four months, quality of life must be prioritized, and the best treatment should be decided according to the type of patient [21].

The decrease in serum albumin (the average in our population is 3.5 mg/dl) was associated with increased mortality. This finding agrees with the descriptions of Gracia et al., which indicate that hypoalbuminemia doubles the risk of mortality due to infections and sudden death [22, 23].

In the present study, to measure the functional capacity to perform routine activities before admission to HD, the KPS was used, resulting in those who had a score greater than or equal to 80 having more remarkable survival; this finding is similar to the study carried out in Brazil by Modesto et al. (2018), in 9905 patients of all ages on PD, observing HRs of 4.31 and 26.8 when the KPS was less than 80 and 50, respectively [24]. Kurella et al. (2009) studied 3702 institutionalized older adults and assessed functionality for ABVD before RRT, observing that 39% of the patients maintained their previous functionality three months after starting dialysis, and one year later, 58% died, and only 13% of patients retained their functionality [25]. This result has important implications since individualization prioritizes baseline functionality when deciding whether a patient would benefit from RRT.

Regarding the socioeconomic variables, when carrying out the logistic regressions of area of residence, type of housing, and economic income, they did not show a significant association with survival. This result is contradictory to other studies. In Argentina, Marinovich et al., in 2012, observed higher mortality in the group with the worst socioeconomic status [26]; this finding could explain why the Public Health Network has full coverage in RRT treatments. However, in the Cox multivariate analysis, economic income as an intervening variable showed that patients with more excellent resources than $530 survived longer. This combination of results provides support for the premise that economic status influences survival and the incidence of CKD [27, 28].

Regarding the health care coverage variable, it was observed that neither insurance was significantly associated with survival, most likely because both insurances come from the state. Considering the findings of other countries in which health insurance is not universal, we can deduce that survival is lower, such as in Mexico, where survival in patients who belong to the Mexican Social Security Institute (62% of the population) has a survival of 32 months despite having full RRT coverage [29]. In Colombia, Sanabria et al. (2008) indicated that better health insurance decreased the risk of death of dialysis patients [30].

When analyzing the causes of death of the observed patients, it was determined that the first cause was infections, followed by AMI.

This finding could be related to hypoalbuminemia in 78.4% of the study population [22].

It is necessary to consider a series of significant limitations of this study. First, since it was retrospective, some data could not be collected. Second, given the small sample size, caution should be used when making interpretations of the mentioned variables.

One of the most important contributions of this study was knowing that the risk of death was not associated with age; therefore, when considering admission to HD, the factors that were significant in our study were taken into account, such as functionality, nutritional status, and social status. These details and many others can be obtained through comprehensive geriatric assessment. It is also essential to make evident the current situation that due to the lack of a preventive health system and the late referral to the Nephrologist, a large percentage of patients enter dialysis urgently without a prior diagnosis of CKD, the cost of which falls on the state and society.

In conclusion, the survival of older adults undergoing HD is related to being male and having higher income, absence of a history of CVD, albumin greater than 3.51 g/dl, and Karnofsky score greater than 80 points. Female patients with low baseline functionality, hypoalbuminemia, and lower income had higher mortality at five years of follow-up.

Conclusion

In the present study, nutritional status and functional assessment were the significant factors associated with more remarkable survival of the aged people in the hemodialysis programme. In a subanalysis, it was demonstrated that the male sex has more remarkable survival in geriatric age in hemodialysis programs as well as those under 80 years of age, patients with the absence of a vascular cerebral event, and those with better economic income.

Abbreviations

CKD: Chronic kidney disease.
RRT: Renal replacement therapy.

Supplementary information

Supplementary materials have not been declared.

Thanks

Does not apply.

Author contributions

Marcela Valladares Benítez: Data curation, Formal analysis, Funding acquisition, Research, Methodology, Project administration, Resources, Software, Writing – original draft.
Gabriela Bonilla Q: Conceptualization, Supervision, Validation, Visualization, Writing: review and editing.
Washington Xavier Osorio Chuquitarco: Conceptualization, Supervision, Validation, Visualization, Writing: review and editing.
María Fernanda Rivadeneira Guerrero: conceptualization, supervision, validation, visualization.
Doris Yvonne Almeida Rivera: Conceptualization, Supervision, Validation, Visualization.
All the authors have read and approved the final version of the manuscript.

Financing

The studies, laboratory tests, and intradialytic measurements constituted the regular activity of the hemodialysis unit and were not a cost to the patients. The authors provided the administrative costs of this research.

Availability of data or materials

The data sets generated and analyzed during the current study are not publicly available due to participant confidentiality.

Statements

Ethics committee approval and consent to participate

The study was approved by the Board of Directors of the CLINEF Dialysis Clinic; CEISH approval is not required for observational study samples carried out before August 2, 2022, the effective date in the official registry of ministerial agreement 00005-2022, of the "Regulation Substitute for the Regulation for the Approval and Monitoring of Ethics Committees for Research in Human Beings (CEISH) and Health Care Ethics Committees (CEAS)".

Consent for publication

Not required for studies that do not publish patient photographs, tomography scans, or X-ray studies.

Conflicts of interest

The authors declare no conflicts of interest.

Author information

Does not apply.

References

1. Mora J, Slon F, Castano I, Izquierdo D, Arteaga J, Martínez N. Chronic kidney disease in the elderly patient. Spanish Journal of Geriatrics and Gerontology 2017;52(3):152-158. <Dialnet.es/6185103>

2. Calderon C, Urrego J. Dialysis in the elderly mortality, quality of life and complications. Acta Med Colomb. 2014;39(4):300-301. <Scielo.co/S0120>.

3. Guzman K, Fernandez de Cordova JC, Mora F, Vintimilla J. Prevalence and factors associated with chronic kidney disease. Medical Rev of Hosp Gen Mexico. 2014;77(3):108–13. <Elsevier/S0185106314000055>

4. Abril R, Sanchez J. Characteristics of chronic kidney disease in Ecuador from 2009 to 2012. [Graduate thesis]. University of Cuenca; 2014. <http://dspace.ucuenca.edu.ec/bitstream/123456789/21006/1/TESIS.pdf>

5. Musso CG, Jauregui JR, Macias JF. Frailty phenotype and chronic kidney disease: a review of the literature. Int Urol Nephrol. 2015;47(11):1801–7. < Springer/10.1007 >PMID: 26411428

6. Aiello F, Dueñas EP, Musso CG. Senescent Nephropathy: The New Renal Syndrome. Healthcare (Basel). 2017;5(4):81. doi: <10.3390/healthcare5040081>PMID: 29143769

7. De Alarcón S, Roca R, Alvarez G, Navarro J, Perez F, Garcia MÁ, et al. Renal replacement treatment in the aged people. Dialysis and Traspl [Internet]. 2015;31(1):12–6. doi: < 10.1016/S1886-2845(10)70005-9 .

8. Pazmino L, Lucio R. Analysis of costs and financing of the most frequent treatments of Chronic Kidney Failure in Ecuador, from the point of view of society, in 2014. [Degree thesis]. PUCE; 2016. < Repositorio.puce.ec/12629/ >

9. Ministry of Public Health. Summary of progress of the Kidney Health program [Internet]. Quito, Ecuador; 2015. <Msp.gob.ec>

10. Verberne WR, Dijkers J, Kelder JC, Geers ABM, Jellema WT, Vincent HH, et al. A cohort study evaluates dialysis versus conservative care in older patients with advanced chronic kidney disease. BMC Nephrol. 2018;19(1):1–11. <BMCnephrol/10.1186>

11. Martinez HL, Restrepo CA, Arango F. Quality of life and functional status of elderly with chronic kidney disease stage 5 in dialysis therapy. Colombian Medical Act. 2015;40(1):13–9. <Scielo.co/S0120-24>

12. Martínez Y, Toapanta NG, Nava N, Barbosa F, Montes R, Guerrero M. Survival of elderly patients (≥70 years) with chronic disease stages 4-5: Dialysis vs. conservative treatment. Nephrology [Internet]. 2016;36(3):283–91. doi: <10.1016/j.nefro.2015.11.006>

13. Hussain JA, Mooney A, Russon L. Comparison of survival analysis and palliative care involvement in patients aged over 70 years choosing conservative management or renal replacement therapy in advanced chronic kidney disease. Palliat Med [Internet]. 2013;27(9):829–39. doi: <10.1177/0269216>

14. Pinares-Astete F, Meneses V, Bonilla J, Angeles P, Cieza J. Long-term survival in patients with stage 5 chronic kidney disease treated by hemodialysis in Lima, Peru. Peru Medical Act. 2018;35(1):20–7. <Scielo.pe/S1728>

15. Szuster DA, Caiaffa WT, Andrade EI, Acurcio Fde A, Cherchiglia ML. Survival of patients in dialysis in SUS in Brazil [Survival analysis of dialysis patients in the Brazilian Unified National Health System]. Cad Saude Publica. 2012 Mar;28(3):415-24. Portuguese. doi: <10.1590/s0102-311x2012000300002> PMID: 22415174.

16. Rios A, Herrera P, Morales A, Reynolds E, Fernandez MB, Gonzalez F. Analysis of survival in elderly patients who start chronic hemodialysis in the Chilean Health Service. Rev Med Chil. 2016;144(6):697–703. <Scielo.cl/144.6.2>

17. Gonzalez-Bedat M, Rosa-Diez G, Ferreiro A. The Latin American Registry of Dialysis and Renal Transplantation: the importance of developing national registries in Latin America. Nefrol Latinoam. 2017;14(1):12–21. doi: <10.1016/j.nefrol.2016.12.002>

18. Sellares V, Rodriguez D. Chronic kidney disease. Nephrology up to date. 2022/05/17. <https://www.nefrologiaaldia.org/es-articulo-enfermedad-renal-cronica-136>

19. Ferreira C, Garcia K, Macias L, Perez A, Tomsich C. Women and men of Ecuador in Cifras III strategic information series. INEC, Ecuador;2013. <Ines/Books/Woman>

20. Spanish Registry of Kidney Patients. 2006 report on dialysis and kidney transplant in Spain. Nefrología (Madr.) 2009(29):6:525-533. Available at: <Scielo.es/S0211>.

21. Li J, Lu H, Xie Z, Li Q, Shi H. Outcomes of arteriovenous graft vs. fistula for hemodialysis access in elderly individuals: A systematic review and meta-analysis. Exp Ther Med. 2023 July 6;26(2):399. doi: <10.3892/etm.2023.12098>. PMID: 37522056; PMCID: PMC10375446.

22. Gracia C, Gonzalez E, Barril G, Sanchez R, Egido J, Ortiz A, et al. Protein-energy wasting syndrome in chronic kidney disease: prevalence and clinical implications Related editorial: Protein-energy wasting syndrome in chronic kidney disease Carolina Gracia-Iguacel et al. Rev Nefrol [Internet]. 2014;34(4):507–19. <Scielo.es/v34n4

23. Chen JB, Cheng BC, Yang CH, Hua MS. An association between time-varying serum albumin level and the mortality rate in maintenance hemodialysis patients: a five-year clinical cohort study. BMC Nephrol. 2016 Aug 20;17(1):117. doi: 10.1186/s12882-016-0332-5. PMID: 27542730; PMCID: PMC4992318.

24. Modesto AP, Usvyat L, Calice-Silva V, Spigolon DN, Figueiredo AE, de Moraes TP, et al. The Karnofsky performance status impacts survival and its dynamics during the terminal year of peritoneal dialysis patients. Perit Dial Int [Internet]. 2018;38(1):24–9. PMID: <28765166> DOI:10.3747/pdi.2015.00241

25. Kurella Tamura M, Covinsky KE, Chertow GM, Yaffe K, Landefeld CS, McCulloch CE. Functional status of elderly adults before and after initiation of dialysis. N Engl J Med. 2009 October 15;361(16):1539-47. doi: 10.1056/NEJMoa0904655 . PMID: 19828531; PMCID: PMC2789552.

26. Marinovich S, Lavorato C, Rosa-Diez G, Bisigniano L, Fernández V, Hansen-Krogh D. Lack of income is associated with lower survival in chronic hemodialysis. Nefrología (Madr.) 2012;32(1):79-88.< Scielo.es/S0211>

27. Flores J. Chronic kidney disease: epidemiology and risk factors. Rev. Med. Clín. Condes 2010;21(4):502-507. <bvsalud/869493>

28. McClellan WM, Flanders WD. Risk factors for progressive chronic kidney disease. J Am Soc Nephrol. 2003 Jul;14(7Suppl2):S65-70. doi: 10.1097/01.asn.0000070147.10399.9e. PMID: 12819305.

29. Mercado FJ, Correa ME. Living with hemodialysis and without social security: the voices of kidney patients and their families. Public Health Mexico [Internet]. 2015;57(2):155–60. <Scielo.mx/S0036>

30. Sanabria M, Munoz J, Trillos C, Hernandez G, Latorre C, Diaz CS, et al. Dialysis outcomes in Colombia (DOC) study: comparing patient survival on peritoneal dialysis vs. hemodialysis in Colombia. Kidney Int Suppl. 2008 Apr;(108):S165-72. doi: <10.1038/sj.ki.5002619> PMID: 18379541.

DOI: Digital Object Identifier. PMID: PubMed Identifier.

Editor's Note

REV SEN remains neutral concerning jurisdictional claims over published maps and institutional affiliations.