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# Survival of patients undergoing hemodialysis treatment

# Supervivencia de pacientes en tratamiento de hemodiálisis

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**ABSTRACT**

The aim of the study was to determine the factors related to survival of patients who started hemodialysis in the ICU of the Hospital General Guasmo Sur, Ecuador. The study population consisted of 193 patients and was cross-sectional and measured by clinical histories. The type of vascular access was not related to the cause of death recorded because 97% of the universe used a temporary central venous catheter. In living patients, the average time spent in dialysis sessions was 2.6 hours, with a minimum of 2 and a maximum of 4 hours. The average length of hospital stay in the survivors was 21 days, with a range of 3 to 71 days. It was reported that there is a high survival relationship with the conditional factors, 46% of the sample were deaths with cardiac involvement as the predominant cause of death, therefore sepsis.

**Descriptors**: health statistics; health economics; cost of living. (Source: UNESCO Thesaurus).

**RESUMEN**

El estudio tiene el objetivo de determinar los factores relacionados con la supervivencia de los pacientes que iniciaron hemodiálisis en UCI del Hospital General Guasmo Sur, Ecuador. De tipo transversal con una medición por historias clínicas, la población de estudio estuvo conformada con 193 pacientes. El tipo de acceso vascular se desvinculó con la causa de decesos registrados debido a que el 97% del universo utilizó catéter venoso central temporal. En los pacientes vivos tuvo 2,6 horas de promedio en las sesiones dialíticas, con mínimo de 2 y máximo de 4 horas. El tiempo de estadía hospitalaria en los sobrevivientes fue con un promedio de 21 días con un intervalo entre 3 a 71 días. Se reportó que existe una alta relación de supervivencia con los factores condicionales, el 46% de la muestra fueron decesos que presentaron afectación cardiaca predominante en la causa de muerte por consiguiente la sepsis.

**Descriptores**: estadísticas sanitarias; economía de la salud; coste de la vida. (Fuente: Tesauro UNESCO).

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**Research articles section**

## INTRODUCTION

Chronic kidney disease (CKD) is a very common pathology in critical care units affecting more than 10% of the adult population worldwide, with the need for a type of replacement therapy such as dialysis or kidney transplantation (Naber & Purohit, 2021). The global five-year survival rate is less than 50%. 10% of patients die in the first 90 days after dialysis transition and more than 20% in the first year (Kalantar-Zadeh, *et al*. 2020).

At the Latin American level, the impact of the problem is evident in the morbimortality figures, which relate cardiovascular diseases to renal failure. In a progressive, asymptomatic manner it usually arises early and when it presents multiple symptoms, the pathology progresses to a chronic stage. Renal replacement therapy is the only alternative through dialysis and/or kidney transplantation. An increase in the incidence of chronic renal failure is evidenced, by an average of 267 per million inhabitants (Matos-Trevín, *et al.* 2019).

The determinant diagnostic parameters of CKD are serum creatinine and glomerular filtration rate (GFR), in particular, the latter which is reflected through its deterioration with the result in acid-base and hydroelectrolyte balance in the critically ill patient (Gutiérrez-Parra, *et al*. 2019). Therapy is indicated in cases with renal failure who develop fluid overload, hydroelectrolytic alterations and uremic signs due to reduced glomerular filtration rate. Hemodialysis treatment is performed by means of vascular accesses such as the central venous catheter (CVC) whether temporary or permanent and the arteriovenous fistula which is associated with lower mortality as opposed to the CVC (Álvarez-Ramírez, *et al*. 2021).

The aim of this study was to determine the factors related to the survival of patients who started hemodialysis in the critical, critical surveillance and intensive care areas of the Hospital General Guasmo Sur, Ecuador.

## METHOD

A cross-sectional quantitative study was carried out with a measurement by clinical histories; it was observational, with no intervention by the researcher; analytical, corresponding to the relational level. Epidemiological design.

The study population consisted of 193 patients hospitalized from June 2021 to May 2022 in the critical areas of the Intensive Care Unit (ICU) and Emergency Critical Monitoring at the Hospital General Guasmo Sur, Ecuador.

Inclusion criteria were considered to be the following: adults from 18 years of age, people with stage 5 chronic kidney disease who started hemodialysis for the first time at the Hospital General del Guasmo Sur. The entire population that met the selection criteria was included.

The following were excluded from the study: patients with renal transplant, stage 5 chronic kidney disease patients who received peritoneal dialysis, people who started renal replacement therapy referred to the hospital center, participants who had intermittent treatment in external providers, people with acute and chronic kidney disease up to stage 4.

Data collection was achieved by means of the clinical case history that includes the variables:

a) Related factors: numerical and categorical type, it was measured by the aspects below;
b) Social: sex, age, drug use.
c) Clinical: coexisting pathologies, nutritional status, days of hospitalization.
d) Laboratory tests: serum levels of determinants per blood since admission of hemoglobin(g/dl), albumin(mg/dl), leukocytes (u/mm^3), serum potassium (mmEq/L), glucose (mg/dl), creatinine(mg/dl), blood urea nitrogen (BUN per mg/dl) and urea (mg/dl).
e) Hemodialysis: session time, type of vascular access.
f) Survival: categorical type measured by discharge condition: alive or deceased (with cause of death).

For data processing, a database was created by tabulation with the Excel tool (Windows 2019 version) and IBM SPSS V28. The analysis was constructed for the qualitative variables with the

values for absolute or relative frequencies with percentages in living and deceased patients, by the mean and by the Chi-square test. The numerical variable was determined with the mean, interquartile range (IQR) and standard deviation with Mann-Whitney U test to compare the numerical variable. Survival was analyzed by the Kaplan-Meier method to determine the factors related to survival using the 95% confidence interval. A value of $p<0.05$ was considered significant.

As a limitation of the study, the number of patients during 12 months in a short period of time was considered; data from complementary imaging examinations, water balance of dialysis patients were not evaluated; it was incomplete with regard to demographic factors (location of urban or rural housing) and economic factors (nephrological follow-up and adhered pharmacological treatment) that influenced the maintenance of the therapeutic regimen despite the existence of a margin of bias; and finally, cardiac arrest as cause of death in cardiac affections without other pathologies to be mentioned.

Ethical principles were respected at all times, there was confidentiality of the data collected, in conjunction with the coordination of the Department of Statistics and Teaching, the clinical history of the SIGHOS system of the Hospital General Guasmo Sur was managed, patients were selected who met the inclusion criteria and consent was obtained by the Hospital Management, with the requirements approved in advance.

## RESULTS

The results of the research are presented:

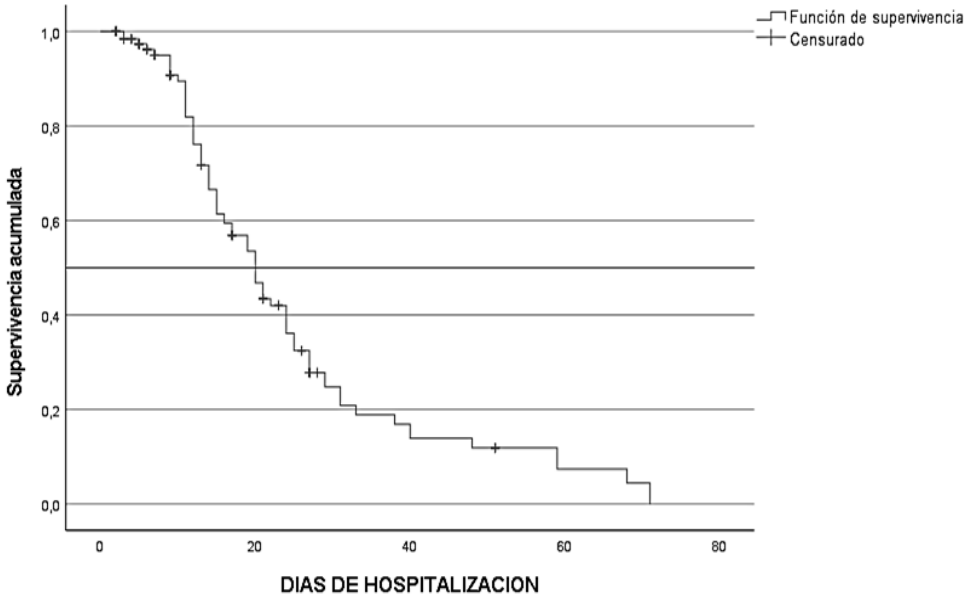
**Table 1.** Aspects related to survival in patients who started hemodialysis according to clinical condition in Hospital Guasmo Sur (Ecuador).

| VARIABLES | FALLECIDOS 59 | | VIVOS 134 | | TOTAL 193 | | VALOR P |
|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | |
| Sexo | | | | | | | |
| Hombres | 40 | 68% | 85 | 63% | 125 | 65% | 0,56 |
| Mujeres | 19 | 32% | 49 | 37% | 68 | 35% | |
| Edad (años)* | 61 (33-82) | | 51 (17-78) | | 17 (47-64) | | <,001 ++ |
| Consumo de droga | | | | | | | |
| Alcohol | 4 | 7% | 2 | 1% | 6 | 3% | 0,12 |
| Tabaco | 0 | 0% | 3 | 2% | 3 | 2% | |
| Otros | 0 | 0% | 2 | 1% | 2 | 1% | |
| No refiere | 55 | 93% | 127 | 95% | 182 | 94% | |
| Valoración nutricional | | | | | | | |
| Desnutrición | 0 | 0% | 7 | 5% | 7 | 4% | 0,32 |
| Normopeso | 21 | 36% | 41 | 31% | 62 | 32% | |
| Sobrepeso | 23 | 39% | 54 | 40% | 77 | 40% | |
| Obesidad | 15 | 25% | 32 | 24% | 47 | 24% | |
| Días de Hospitalización* | 15 (2-51) | | 21 (3-71) | | 19 (9-25) | | <,001++ |
| Patologías coexistentes | | | | | | | |
| Hipertensión arterial | | | | | | | |
| Sí | 40 | 68% | 95 | 71% | 135 | 70% | 0,66 |
| No | 19 | 32% | 39 | 29% | 58 | 30% | |
| Cardiopatía isquémica | | | | | | | |
| Sí | 12 | 20% | 26 | 19% | 38 | 20% | 0,88 |
| No | 47 | 80% | 108 | 81% | 155 | 80% | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Diabetes Mellitus | | | | | | | |
| Sí | 20 | 34% | 84 | 63% | 104 | 54% | <,001 |
| No | 39 | 66% | 50 | 37% | 89 | 46% | |
| Evento Cerebro Vascular | | | | | | | |
| Sí | 7 | 12% | 5 | 4% | 12 | 6% | 0,03 |
| No | 52 | 88% | 129 | 96% | 181 | 94% | |
| Tuberculosis | | | | | | | |
| Sí | 2 | 3% | 10 | 7% | 12 | 6% | 0,31 |
| No | 57 | 97% | 124 | 93% | 181 | 94% | |
| COVID | | | | | | | |
| Sí | 21 | 36% | 8 | 6% | 29 | 15% | <,001 |
| No | 38 | 64% | 126 | 94% | 164 | 85% | |
| VIH | | | | | | | |
| Sí | 0 | 0% | 5 | 4% | 5 | 3% | 0,13 |
| No | 59 | 100% | 129 | 96% | 188 | 97% | |
| Tipo de acceso vascular | | | | | | | |
| Catéter venoso central permanente | 0 | 0% | 5 | 4% | 5 | 3% | 0,13 |
| Catéter venoso central temporal | 59 | 100% | 129 | 96% | 188 | 97% | |
| Tiempo de sesión de hemodiálisis (horas)* | 2,5 (2,0-3,4) | | 2,6 (2,0-4,0) | | 0,7 (2,3-3,0) | | 0,21 ++ |
| Valores de Laboratorio* | | | | | | | |
| Recuento de leucocitos (u/mm3) | 16,4+/-9,4 | | 13,1+/-8,0 | | 14,1+/-8,0 | | 0,005 ++ |
| Hemoglobina (mg/dl) | 10,8+/-3,6 | | 9,2+/-2,2 | | 9,7+/-2,8 | | 0,03 ++ |
| Albúmina (mg/dl) | 10,0+/-51,4 | | 3,3+/-0,9 | | 5,4+/-28,4 | | 0,95 ++ |
| Glucosa en ayunas (mg/dl) | 161,4+/-116,2 | | 146,1+/-83,2 | | 150,8+/-94,5 | | 0,32 ++ |
| Potasio sérico | 4,8+/-0,9 | | 5,0+/-1,0 | | 5,0+/-0,9 | | 0,18 ++ |
| BUN | 71,7+/-37,9 | | 74,1+/-36,6 | | 73,3+/-36,6 | | 0,73 ++ |
| Creatinina | 5,8+/-5,7 | | 8,0+/-36,6 | | 7,3+/-5,4 | | <,001 ++ |
| Urea | 147,8+/-83,1 | | 162,5+/-77,7 | | 158,0+/-79,5 | | 0,13 ++ |
| Causas de defunción | | | | | | | |
| Sepsis | 25 | | | 42% | | | 0,48 |
| Problemas cardíacos | 34 | | | 58% | | | |
| Cáncer en etapa terminal | 0 | | | 0% | | | |

* Mean; +/- standard deviation; IQR (Interquantile Rank) ++ Manh-Witney U.
Source: Own elaboration.

We found 193 patients hospitalized during the 12-month period who started hemodialysis for the first time during their hospital stay. It was determined by variables, corresponding to the age of the total population group with a RIC of 17 minimum of 47 and maximum of 64, in the living patients the mean of 51 years predominated. The 94% of the universe, did not report drug use as a habitual history. There was a difference of 40% with overweight corresponding to the nutritional assessment. HT existed in 70% as a pathology associated with the total group and did not develop in 30% of the sample studied, in the deceased patients it represented 68% and pneumonia due to COVID-19 represented 36% of the deaths (Table 1).




Graph 1. Kaplan Meier plot for survival in days of hospitalization in the study population.
Source: Own elaboration.

The temporary central venous catheter was the most commonly used for renal patients in critical areas, representing 97% of the vascular accesses, except for the permanent central venous catheter, which occupied 3% of those affected and dialysis was not applied through arteriovenous fistula. The average time in dialysis therapy of the survivors was 2.6 hours with a minimum of 2 and a maximum of 4 hours (Graph 1).

In addition, the days of hospitalization were evaluated, with an average of 21 days in the living patients, with the total sample showing 19 days of ICR. The laboratory parameters with the highest mortality figures were leukocyte count of 16.4 +/- 9.4 and fasting glucose of 161.4 +/- 116.2 with the highest standard deviation. The prevailing cause of death was cardiac alteration which occupied 58%. The maximum of the surviving population was 71 days of hospitalization and a minimum of 3 days. From the second day to the first 51 days, 59 deaths were recorded with an average of 15 days. The RIC of the population studied was 19 days with a minimum of 9 and a maximum of 25 days, as shown in the following figure the survival function (Figure 1).

## DISCUSSION

In a study among 291 Intensive Care Units in France, dialysis with intermittent frequency at the beginning of therapy evidences a decrease in rehabilitation of renal function (Bonnassieux, *et al.* 2018). Unlike that, the frequency of therapy has no relationship in survival because at the beginning it is on a daily basis, and becomes tri-weekly subsequent to patient assessment to the set in laboratory parameters with favorable ranges.

With analysis in a hospital in Cusco-Peru, has lower survival people who presented left atrial dilatation evidenced by echocardiography imaging tests (Loaiza-Huallpa, *et al*. 2019). So much so that, it does not compare with the imaging exams that were reported incomplete in the sample history, despite highlighting the 20% with ischemic heart disease in deceased patients.

There is a delimiting factor in the clinical history of the patient's economic situation, which closely influences adherence and treatment management. Therefore; a late referral to the external provider and domicile are major risk factors for death in the first three months of dialysis initiation (Fouda, *et al*. 2017). It is appreciated that the cause of death were cardiac problems and sepsis, compared to the study of (Ganguli, *et al.* 2022), which reveals the causes of death by uremia, therefore, catheter sepsis related to the large number of patients present poor adherence to treatment because they reside in areas far from the city.

On the other hand; it is explained that chronic renal patients in stage 5 increase mortality in hemodialysis with the conditions of: advanced age, diabetes mellitus and renal failure without the possibility of transplantation (Pinares-Astete, *et al.* 2018). Likewise, it is highlighted that the most frequent pathology is arterial hypertension in the numbers of deceased patients, with an older age group, in contrast, with the living patients who started hemodialysis.

In contrast, total white blood cell count, red blood cell count and serum albumin influence the survival time of hemodialysis patients. Hyperglycemia, leukocytosis, uremia, and exorbitant BUN, creatinine, and albumin values predominate in the deceased patients, in contrast to the patients who survived (Ebrahimi, *et al*. 2019).

## CONCLUSION

It was reported that there is a high relation of survival with conditional factors, 46% of the sample were deaths that presented cardiac involvement predominant in the cause of death, therefore sepsis. Regarding social conditions, the most affected sex was the male gender, therefore, age was unable to influence survival. For drug use, it was reported that the highest frequency predisposed to death with inequality in living patients who had less exposure to the risk agent. Related to nutritional status, the surviving population was overweight 40%, consequently, to normal weight 31% and obesity 24%. The clinical condition related to concomitant diseases such as arterial hypertension was 71% in the living renal patients, in addition to diabetes mellitus which occupied 63% of those who did present, followed by ischemic heart disease with 19%, tuberculosis 7%, COVID 6%, cerebrovascular event and HIV with 4%. The type of vascular access was not related to the cause of death recorded because 97% of the universe used a temporary central venous catheter. In living patients, the average time spent in dialysis sessions was 2.6 hours, with a minimum of 2 and a maximum of 4 hours. The average length of hospital stay in the survivors was 21 days, with a range of 3 to 71 days.

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## CONFLICT OF INTEREST

There is no conflict of interest with persons or institutions related to the research.

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