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DIALYSIS PATIENTS;

SURVIVAL DISTRIBUTION COMPARISON AND SURVIVAL ESTIMATION OF SOCIO-ECONOMIC AND LABORATORY VARIABLES

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ABSTRACT… Objectives: The objective of this study is to compare and analyze the survival distributions of the different categories of the socio-economic and laboratory variables of the ESRD patients. Through which we can see the difference between the categories of the individual categorical variable with respect to the survival distributions. **Data Sources:** The sample of 40 patients was taken from the two hospitals of Lahore city. Jinnah Hospital Lahore. Lahore General Hospital, Lahore. **Design of the Study:** The sample methodology of the study is the convenience sampling[6]. **Data Collection:** The questionnaire was used to collect the primary data from the patients. **Period of the Study:** All the patients were followed up during the study duration of 122 days. **Materials and Methods:** To examine the significant difference in the different categories of the socio-economic and laboratory variables with respect to the survival distribution the Kaplan-Meier method is used. To illustrate the survival distributions the survival curve and hazard curve were used[2]. **Results:** All the p-values of socio-economic and laboratory are very large except the p-value of the Serum Albumin which is very small and less than 0.05 level of significance. The categories of all the laboratory variables were classified into "Normal values Range" and "Other values out of range values". The categories of the Serum Albumin are significantly different. **Conclusions:** It is concluded that the survival distributions of all the categorical variables are equal and do not differ significantly. Furthermore the laboratory variable Serum Albumin is significantly differing by the log rank test[2]. So it is clear indication that the serum albumin is not the status variable of nutrition.

Key words: Survival Distributions, End Stage Renal Disease, Socio-Economic Indicators, Laboratory Variables, Serum Albumin

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INTRODUCTION

This study was done to compare the survival distribution and survival estimates of End Stage Renal Disease patients on hemodialysis patients in Lahore City with respect to some socio-economic indicators like employment level, education level and income level; moreover the survival distribution was compared of the categories of the laboratory variables which are Serum Creatinine, Serum Calcium, Serum Phosphorus and Serum Albumin[4,5,9].

The classification of Chronic Kidney Disease has been divided into five stages. Stage 1 is the mildest and not showing all the symptoms of the disease. Whereas the stage 5 is the worst and last stage of CKD, if untreated then it will cause harmful illness with the poor condition and expectancy of life. The mild levels of chronic kidney disease (stages 1-3) are frequently asymptomatic, while severe chronic kidney disease (stages 4-5) frequently associated with symptoms of uremia but these may be quite mild until the final stages of the disease when dialysis treatment is imminent[10].

Through the dialysis treatment the toxic substances (impurities or wastes) from the blood are removed when the kidneys are unable to

remove these substances. There are two types of dialysis treatment Hemodialysis and Peritoneal dialysis[3].

Serum albumins, which contains about 55% of blood plasma protein, help regulate the osmotic pressure and hence plasma volume. The function of serum albumin is to regulate the fatty acids named a-lactalbumin and to bind these acids[1].

In the skeleton there is about 98% of the 1200 gram of calcium exist in the adult is in the form of hydroxyapatite. Whereas hydroxyapatite is a the composition of calcium, phosphorus, and hydroxide. Rest of the calcium exists in the extracellular fluid (50%) and in various tissues, and specially skeletal muscle. The normal range of calcium is maintained within a fairly narrow range from 8.5 to 10.5 mg/dl (milligram per deciliter). The normal values and reference ranges may vary among laboratories as much as 0.5 mg/dl[10].

Phosphorus is an abundant element that is extensive in its distribution throughout the body. Total body phosphorus in a 70kg man is about 700 to 800 mg, from this quantity of phosphorus 85 percent exists in the skeleton in hydroxyapatite phase and the remaining 15 percent exists in soft tissues. Phosphorus is an important part in the cellular structure, cytoplasm, and mitochondrium and also very important for numerous enzymatic processes. The normal serum phosphorus concentration is usually 3.4 to 4.5 mg/dl. This varies with the age pattern (it is higher in children than adults). There is a diurnal variation, which reaches its lowest point between 8 and 11 a.m[10].

Creatinine is the product of muscle creatine catabolism. It is relatively small molecule that distribute throughout total body water. The normal serum creatinine varies with the subject's body muscle mass and with the technique used to measure it[10].

METHODS

The sample of 40 patients was taken from the two hospitals of Lahore city. (1) Jinnah Hospital Lahore. (2) Lahore General Hospital, Lahore. All the patients were followed up during the study duration of 122 days. The Kaplan-Meier method was used to determine the significant difference between the categories of qualitative variables of End Stage Renal Disease patients.

(a) The sample methodology of the study is the convenience sampling. The convenience sampling is representative of the population. In this sampling method an easily accessible group of people is chosen, and everyone in that group is surveyed.

(b) This sampling method is easy to organize and relatively quick. To examine the significant difference in the different categories of the socio-economic and laboratory variables with respect to the survival distribution the Kaplan-Meier method is used. To illustrate the survival distributions the survival curve and hazard curve were used.

© The Kaplan –Meier Method on SPSS Software was applied on the collected data. To analyze the data go to ANALYZE----▸Survival----▸Kaplan –Meier. Take the time variable as the survival time then define the value “0” for the uncensored values, take censored and uncensored observation in the Status variable. The variable which is to be analyzed for the survival distribution take as the Factor. Go to Compare Factors and select all the test statistics which are Log Rank, Breslow and Tarone-Ware, then go to the Option and select the Plots of Survival and Hazard Curves after that Press OK to get the output results of the Kaplan-Meier Method.

Table-I(Continued)
Normal Range

- Serum Creatinine Level (0 - 5 mg/dl.)
- Serum Calcium (8.5 - 11.0 mg/dl)
- Serum Phosphorus Level (3.5 - 5.5 mg/dl)
- Serum Albumin (3.5 - 5g/dl)

** The remaining values other than the normal values have been taken as "Others" in the laboratory variables.

Employment Level	Unemployed
	Others
	Employed
Education Level	None
	Primary
	Middle
	Metric
	Intermediate
	Graduate
	Post-Graduate
	Other
Income Level	Less than 6000
	6000-18000
	18000-30000
	Greater than 30000
Serum Creatinine	Normal Range
	Others
Serum Calcium	Normal Range
	Others
Serum Phosphorus	Normal Range
	Others
Serum Albumin	Normal Range
	Others

Table-I. Categorical Distribution of the Socio-Economic and Laboratory Variables

RESULTS

By analyzing all the variables including socio-economic and laboratory variables in this study it is analyzed that the p-value of the log rank test of education variable is 0.920, p-value of the employment level is 0.881, p-value of the income level is 0.898, which are very high values and not less than the 0.05 so the eight levels of the education, three levels of employment and four levels of the income are equal and not significantly differ. Furthermore the p-value of the Serum Calcium Level is 0.426; p-value of the Serum Phosphorus Level is 0.363.p-value of the Serum Creatinine is 0.788 and the p-value of the Serum Albumin Level is 0.023, so all the p-values are very large except the p-value of the Serum Albumin which is very small and less than 0.05 level of significance. The categories of all the laboratory variables were classified into "Normal values Range" and "Other values out of range values". The categories of the Serum Albumin are significantly different.

Kaplan-Meier Estimates of Serum Albumin

The table-II shows that the classification of Serum Albumin as "Normal Range of Serum Albumin" and "Others out of range values of serum albumin" in the entire sample of 40 observations. Patients having Normal Range of Serum Albumin are 22 which are more than the patients having others.

Hypothesis

Ho: The survival distributions of two groups of Serum Albumin (Normal and Others) are equal.

H1: The survival distributions of two groups of Serum Albumin (Normal and Others) are not equal.

Serum Albumin	Total	N of Events	Censored		Overall Comparisons			
			N	%		x^2	df	Sig.
Normal	22	8	14	63.6%	Log Rank (Mantel-Cox)	5.149	1	.023
Others	18	1	17	94.4%	Breslow (Generalized Wilcoxon)	3.144	1	.076
Overall	40	9	31	77.5%	Tarone-Ware	4.184	1	.041

Table-II. Case Processing Summary

CONCLUSIONS

The p-value of the Log Rank (Mantel-Cox) from the table-II is less than the level of significance 0.05, so it is concluded that we reject Ho, and conclude that the survival distributions of two groups of Serum Albumin (Normal and Others) are not equal and survival distribution of the two groups of the serum albumin are significantly different.. But according to the p-values of the Breslow (Generalized Wilcoxon) null hypothesis is accepted and the p-value of Tarone-Ware is less than the 0.05, so in the similar way the survival distributions of two groups of Serum Albumin (Normal and Others) are not equal.

SURVIVAL FUNCTION

The Figure-1 of survival function is basically the step function of the probabilities of survivals, the survival curve of the "others" which is the serum albumin out of the normal range values, lies above and remains constant till the end of the study because in this category only one event occurred in this category and survival rate is better. The survival curve of the normal category of the serum albumin values goes down as time increases because the most events occurred in this category, it seems to be very awkward that patients have the normal values of serum albumin but have the danger area for the patient as results shows. Though its a inverse relationship of the normal category with the survival rates of the ESRD patients. The survival rates are very worse than the "others" category.

Hazard Function

Hazard function in Figure-2 shows that as the time increases the hazard function of the "Other" category remain the same during the whole study durations. But in the category of "Normal" the hazard increases slightly and keep its trend upwards as it shows that by increasing the time period the deaths occurred in that normal category of the serum albumin level.

S_ALB Categories		Time	Status	Estimate
Normal	1	49.000	0	.955
	2	54.000	0	.909
	3-9	55-60	1	.
	10	67.000	0	.839
	11	84.000	0	.769
	12	98.000	0	.699
	13	108.000	0	.629
	14	115.000	1	.
	15	116.000	0	.551
	16	116.000	1	.
	17	118.000	0	.459
	18-22	119-122	1	.
Others	1	14.000	0	.944
	2-18	56-122	1	.

Table-III. Survival Estimates of Serum Albumin

*** Table-III is the output of SPSS but in the modified form. The cases which are censored have been written in the form of intervals. e.g.(3-9), (18-22)& (2-18).*

DISCUSSIONS

It is concluded that the survival distributions of all the categorical variables are equal and do not differ significantly. Furthermore the laboratory variable Serum Albumin is significantly differing by the Log Rank Test and Tarone-Ware Test. So in this study the main focus is to justify the significantly different behaviors of the survival distributions of the laboratory variable that is Serum Albumin and it has been discussed in the details. There were 8 out of 9 events in the normal category of the serum albumin which is the clear indication that the serum albumin is not the status variable of nutrition. Very large or normal serum albumin level in the patient's body does not mean that the

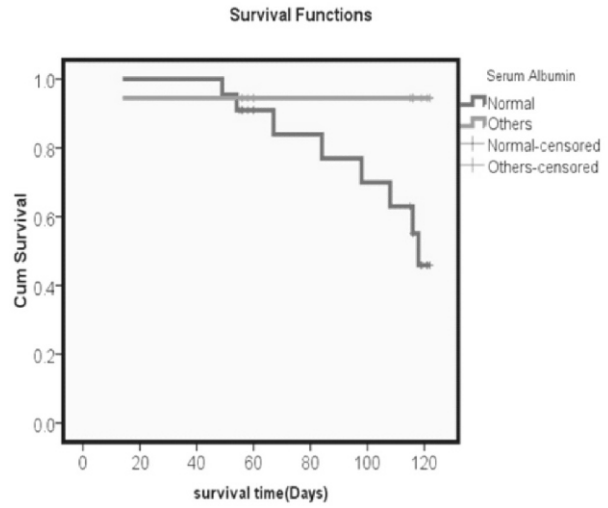

Figure-1.
Along x-axis Survival Time in days.
Along y-axis Survival Rates.
The graph of survival function is the output of the SPSS and can be obtained by checking the option in the SPSS. Whereas the method to run this statistical analysis has been given in this paper under the heading of Methods.

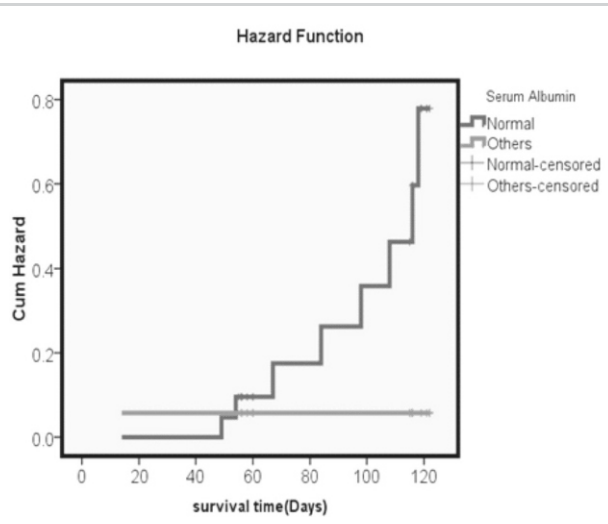

Figure-2.
Along x-axis Survival Time in days.
Along y-axis Hazard Rates.
The graph of Hazard function is the output of the SPSS and can be obtained by checking the option in the SPSS. Whereas the method to run this statistical analysis has been given in this paper under the heading of Methods.

patient is in a good condition or getting proper nutrition. The events that are the deaths, mostly occurred in the normal category, which has the good quantity of serum albumin in the patient's body and the level of serum albumin has normal values.

The p-value of the Log Rank (Mantel-Cox) from the table-II is less than the level of significance 0.05, so it is concluded that we reject Ho, and conclude that the survival distributions of two groups of Serum Albumin (Normal and Others) are not equal and survival distribution of the two groups of the serum albumin are significantly different. But according to the p-values of the Breslow (Generalized Wilcoxon) null hypothesis is accepted and further the p-value of Tarone-Ware is less than the 0.05, so in the similar way the survival distributions of two groups of Serum Albumin (Normal and Others) are not equal.

According to Steinman TI(2000)[7]. "It is still unknown if the serum albumin can be effectively raised in the chronic dialysis patient. Also unknown is whether an increase in the serum albumin level can alter long-term morbidity and mortality. We should not be using serum albumin as an indicator of adequate dialysis or nutritional status since the causes of hypo albuminemia are multifactorial. It is recommended that the serum albumin level be eliminated as an indicator of nutritional status in the ESRD patient." Moreover Yeun JY and Kaysen GA, (1998)[11], "The recent studies are unable to show any relation between dialysis adequacy and Serum albumin level. Further, Serum albumin level appears to be a poor marker of nutritional status in dialysis patients when compared with other measures of nutrition, such as subjective global assessment score, anthropometry, and dietary intake.". Srivaths PR, Wong C, and Goldstein SL,(2009)[8] "Traditional measures, such as height, weight and serum albumin concentration, may not be accurate indicators to assess the nutritional status of children receiving maintenance hemodialysis". So here from this study it can be clearly seen that the 8 out of 9 events "deaths" from the whole data occurred in the serum albumin normal range category which seems to be very strange that patients are dying with normal serum albumin level. Through the hypothesis the survival

distribution of the two categories are significantly different. But as we came to know by the past studies that normal or more serum albumin level in the body is not sure to be taken as source variable of the nutritional status. It might be possible that the serum albumin level in the ESRD patient's body is quite normal or in a good position, but due to the co-morbidities such as hypertension, diabetic, other muscular and lungs diseases and excessive treatment of dialysis there will be so many lacks and deficiencies in the patient's body, and these reasons effects the survival status of the patients.

CONCLUSIONS

It is concluded that the survival distributions of all the categorical variables are equal and do not differ significantly. Furthermore the laboratory variable Serum Albumin is significantly differing by the log rank test and the taron-ware test. So in this study the main focus is to justify the significantly different behaviors of the survival distributions of the laboratory variable that is Serum Albumin and it has been discussed in the details. There were 8 out of 9 events in the normal category of the serum albumin which is the clear indication that the serum albumin is not the status variable of nutrition. Very large or normal serum albumin level in the patient's body does not mean that the patient is in a good condition or getting proper nutrition. The events that are the deaths mostly occurred in the normal category, which has the good quantity of serum albumin in the patient's body and the level of serum albumin has normal values.

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