Is there an Association Between Comorbidities and Income or Literacy in Incident Dialysis Patients Living in Contagem, Brazil?

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Abstract: Socioeconomic disparities are suspected to play an important role in the development of non-communicable chronic diseases and increase the risk for mortality and morbidity among patients with end-stage renal disease. This study aimed to investigate a possible association between educational levels, monthly per capita income and prevalence of clinical comorbidities found in patients at the initiation of the hemodialysis therapy. A sample of 214 patients was analyzed. Patients were stratified according to their educational level in two groups: ≤ 4 and > 4 years of formal education. For the monthly per capita income the following groups were considered: < US$300.00, ≥ US$300.00 and < US$450.00 and ≥ US$450.00. There was no statistical significant difference regarding the prevalence of comorbidities when comparing different educational levels. Similar results were found when monthly per capita income was analysed. In spite of that, there was an elevated frequency of patients with ≤ 4 years of formal education (73.36%, $p<0.05$) and with a monthly per capita income below US$450.00 (80.84%, $p<0.05$) among those initiating hemodialysis therapy. In conclusion, despite the fact that there was no statistical association between the prevalence of comorbidities and socioeconomic factors our data indicated that disadvantage populations might be at elevated risk to initiate dialysis therapy in the city of Contagem, Brazil.

Keywords: Disadvantaged populations, end-stage renal disease, literacy, per capita income.

INTRODUCTION

Chronic diseases constitute a major global health burden. In Brazil, non-communicable chronic diseases are the leading cause of morbidity and mortality and account for 72% of all deaths [1]. Following this trend, the number of patients with end-stage renal disease is rapidly increasing. In 2010 the number of patients on dialysis therapy increased 30% compared to 2006 (70,872 to 92,091) [2, 3].

To face this challenge, the Brazilian public health system, Sistema Único de Saúde (SUS), has increased its efforts to accomplish the State duty of providing full health coverage to all Brazilian citizens. In 1994, the Brazilian Government started the Family Health Strategy, a national program build to expand primary health care interventions using geographic targeting to reach the poorest areas of the country including the suburban neighborhoods in metropolitan areas [4].

However, in spite of all the efforts made, socioeconomic disparities and access to qualified healthcare services are still unacceptably large in Brazil [1]. These disparities are suspected to play an important role in the development of non-communicable chronic diseases and increase the risk for mortality and morbidity among disadvantage populations. In this study disadvantaged populations were considered to be those with low educational levels and/or income [4-7].

In this setting, this study aimed to investigate a possible association between socioeconomic markers and clinical comorbidities found in patients initiating hemodialysis therapy.

PATIENTS AND METHODS

This descriptive retrospective study consists of a convenience sample of 214 patients living at the city of Contagem, State of Minas Gerais, Brazil, and being provided hemodialysis therapy by the SUS.

All patients who have requested free public transportation to the Municipal Commission of Nephrology and have started the hemodialysis treatment by SUS from April 2007 to January 2012 were included in this study. At the city of Contagem, free public transportation is provided to patients on dialysis treatment. All participants were interviewed at the Municipal Commission of Nephrology at the time of initiation of hemodialysis therapy.

The research protocol consisted of 2 parts: a clinical and a socioeconomic assessment. The clinical evaluation was performed by a nephrologist. It consisted of a complete physical exam and the analysis of complementary laboratory exams. The reference physician was asked to provide a detailed medical history containing the list of medications in use, comorbidities and current laboratory exams of the renal

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function and serology for Hepatitis B, Hepatitis C and HIV infection. Chronic renal failure needing dialysis treatment was defined as a glomerular filtration rate below 10 mL per minute for non-diabetic patients and 15 mL per minute for diabetic patients and a clinical history of chronic renal failure superior to 3 months. This clearance could either be measured *via* urine collection or estimated from the serum creatinine level using the Cockcroft and Gault formula. The following conditions were registered to the patient records based on the medical history provided by the reference physician: hypertension, Diabetes Mellitus, diabetic neuropathy, chronic kidney disease - mineral and bone disorder, diabetic retinopathy, dyslipidemia, peripheral arterial disease, stroke, osteoporosis, myocardial infarction, heart failure and angina pectoris. The diagnosis of diabetic feet, amputations and epigastric pain were defined during the clinical evaluation.

The socioeconomic assessment consisted of a social worker visit to the home location of the patient. Data were collected in order to evaluate the educational levels and the monthly per capita income of the patient.

We investigated a possible association between educational levels, the monthly per capita income and the prevalence of clinical comorbidities found at the initiation of the hemodialysis therapy. Patients were stratified according to their educational level in two groups: ≤ 4 and > 4 years of formal education. For the monthly per capita income the following groups were considered: < US$300.00, ≥ US$300.00 and < US$450.00 and ≥ US$450.00.

Statistical Analysis

The values are expressed as median and standard deviation (SD), when appropriate. Dichotomous variables were compared by the Chi-square test. The level of significance was set at $p<0.05$. Analysis was performed using the software STATA 11 (Stata Corp, College Station, TX, USA).

RESULTS

The etiology of the CKD and the baseline socioeconomic characteristics at the time of the initiation of the hemodialysis therapy are summarized in Table **1**.

The most common comorbidities were hypertension (189; 88.32%), Diabetes Mellitus (87; 40.65%), diabetic neuropathy (58; 27.10%), chronic kidney disease - mineral and bone disorder (48; 22.43%) and diabetic retinopathy (43; 20.09%), Tables **2** and **3**.

We found no statistical significant difference regarding the prevalence of comorbidities when comparing the groups ≤ 4 and > 4 years of formal education (Table **2**).

There was a significant statistic difference in the prevalence of diabetic retinopathy when we compared the different per capita income groups (p=0.02) (Table **3**). However this difference was not statistical significant when Chi square was performed to compare the two most prevalent groups for diabetic retinopathy, (< US$300.00, 26.97%; ≥ US$450.00, 24.39%; p=0.832).

DISCUSSION

Currently, there is a trend pointing towards an increase in the number of patients with chronic kidney disease (CKD) in Brazil. In our country the increasing number of patients with poor controlled diabetes mellitus, hypertension and obesity is critically contributing to transform end-stage renal disease in an epidemic of elevated costs [1, 2, 5, 8, 9].

Table 1. Socioeconomic characteristics at the time of the initiation of the hemodialysis therapy.

Characteristics	Frequency (%) (n=214)	p[&]
Age (years)*	61.26 ± 13.28	
Gender		0.92
Male	106 (49.53)	
Female	108 (50.47)	
Employment status		<0.05
Retired	168 (78.50)	
Unemployed	43 (20.10)	
Employed	3 (1.40)	
Educational level		<0.05
≤ 4 years of formal education	157 (73.36)	
> 4 years of formal education	57 (26.64)	
Monthly per capita income		<0.05
< US$300.00	89 (41.59)	
≥ US$300.00 and < US$450.00	84 (39.25)	
≥ US$450.00	41 (19.16)	
Etiology of CKD		
Hypertensive nephroesclerosis	110 (51.40)	
Diabetic nephropathy	87 (40.65)	
Polycystic kidney disease	4 (1.88)	
Unknown	13 (6.07)	

[&]The Chi-square test was used to compare the frequencies of each event. The level of significance was set at p < 0.05
*Median ± Standard deviation.

Studies performed in several locations have suggested that morbidity and mortality due to non-communicable chronic diseases are greatest in disadvantaged populations once socioeconomic iniquities are suspected to be an important risk factor to trigger sustained unhealthy lifestyle habits [1, 7, 10-15].

In the past decades, Brazil has undergone rapid changes in major social determinants of health. Nevertheless we still face serious problems involving equity, quality, and efficiency of healthcare services [8, 16]. Currently, it´s well known that the progression of CKD can be delayed or even halted by various clinical measures. However, vulnerable populations with low socioeconomic conditions may be least able to be reached by health promotion and prevention policies [6, 10].

Table 2. Prevalence of comorbidities at the time of initiation of the hemodialysis therapy and the educational level.

Signs and Symptoms	≤ 4* (%) (n= 157)	>4* (%) (n= 57)	Total (%) (n=214)	p[&]
Hypertension	138 (87.90)	51 (89.47)	189 (88.32)	0.82
Diabetes Mellitus	62 (39.49)	25 (43.86)	87 (40.65)	0.64
Diabeticneuropathy	43 (27.39)	15 (26.32)	58 (27.10)	1.00
Chronic Kidney Disease - Mineral and Bone Disorder	34 (21.66)	14 (24.56)	48 (22.43)	0.71
Diabetic retinopathy	29 (18.47)	14 (24.56)	43 (20.09)	0.34
Dyslipidemia	27 (17.20)	10 (17.54)	37 (17.29)	1.00
Peripheral arterial disease	23 (14.65)	13 (22.81)	36 (16.82)	0.21
Stroke	21 (13.38)	8 (14.04)	29 (13.55)	1.00
Osteoporosis	18 (11.46)	8 (14.04)	26 (12.15)	0.64
Myocardial infarction	14 (8.92)	9 (15.79)	23 (10.75)	0.21
Heart failure	14 (8.92)	9 (15.79)	23 (10.75)	0.21
Diabetic feet	16 (10.19)	6 (10.53)	22 (10.28)	1.00
Angina pectoris	14 (8.92)	4 (7.02)	18 (8.41)	0.79
Amputation	11 (7.01)	5 (8.77)	16 (7.48)	0.77
Epigastric pain	8 (5.10)	2 (3.51)	10 (4.67)	0.73
Hepatitis B virus infection	4 (2.55)	2 (3.51)	6 (2.80)	1.00
Hepatitis C virus infection	3 (1.91)	2 (3.51)	5 (2.34)	0.61
HIV infection	1 (0.64)	1 (1.75)	2 (0.93)	1.00

*Years of formal education.
[&]The Chi-square test was used to compare the frequencies of each event. The level of significance was set at $p < 0.05$.

In this study, we investigated educational level and the monthly per capita income as possible socioeconomic markers for the development of complications in patients with end stage renal disease living in the city of Contagem, Brazil. To our knowledge, this was the first study analyze socioeconomic markers in this population.

In our sample, the frequency of patients with ≤ 4 years of formal education (73.36%, p<0.05) and with a monthly per capita income below US$450.00 (80.84%, p<0.05) was elevated. These data suggest that there is a high prevalence of socioeconomic disadvantaged patients among those which are initiating hemodialysis therapy in the city of Contagem, Brazil.

There was an increased prevalence of diabetic retinopathy (p=0.02) in the groups of patients with a lower (< US$300.00, 26.97%) and higher (≥ US$450.00, 24.39%) monthly per capita income compared to the intermediate group (≥ US$300.00 and < US$450.00, 10.71%). However this difference was not statistical significant when we compared the lower and higher monthly per capita groups separately (p=0.832). Adding to that, we found no statistical significant difference regarding the prevalence of comorbidities when comparing the groups with ≤4 and > 4 years of formal education.

In spite of a well-established protocol and inclusion criteria, some aspects of the study may have decreased the strength of our findings. Differently from our results, other studies associated lower socioeconomic conditions with an increased risk for the development of diabetes mellitus and its associated complications [17-19]. Low educational levels was also associated by other authors to a lower compliance to the prescriptions resulting in an increased rate of myocardial infarction [20, 21]. A possible explanation for these differences relies in the size of our sample. The selection criteria in this study included only patients who were starting hemodialysis treatment and have requested free public transportation to the Municipal Commission of Nephrology. This resulted in a reduced sample size and have consequently reduced the power of our analysis. A multicenter study with a larger and randomized sample is necessary in order to better clarify this issue with results representative of the Brazilian population.

CONCLUSION

In conclusion, there was no statistical association between the prevalence of comorbidities and socioeconomic factors. However, there were a significantly higher proportion of patients with ≤ 4 years of formal education and a monthly per capita income below US$450.00 initiating hemodialysis therapy in the city of Contagem, Brazil. This could indicate that disadvantage populations might be at elevated risk to initiate dialysis therapy at the city of Contagem, Brazil. Further studies with larger samples are necessary to define the role of routine socioeconomic assessment as a tool to understand the possible factors involved in the progression of CKD in developing countries.

Table 3. Prevalence of comorbidities at the time of initiation of the hemodialysis therapy and the monthly per capita income.

Signs and Symptoms	< US$300.00 (%) (n=89)	≥ US$300.00 and < US$450.00 (%) (n=84)	≥ US$450.00 (%) (n=41)	Total (%) (n=214)	p[&]
Hypertension	75 (84.27)	76 (90.48)	38 (92.68)	189 (88.32)	0.29
Diabetes Mellitus	42 (47.19)	29 (34.52)	16 (39.02)	87 (40.65)	0.23
Diabetic neuropathy	29 (32.58)	20 (23.81)	9 (21.95)	58 (27.10)	0.31
Chronic Kidney Disease -Mineral and Bone Disorder	20 (22.47)	19 (22.62)	9 (21.95)	48 (22.43)	1.00
Diabetic retinopathy	24 (26.97)	9 (10.71)	10 (24.39)	43 (20.09)	0.02
Dyslipidemia	16 (17.98)	15 (17.86)	6 (14.63)	37 (17.29)	0.92
Peripheral arterial disease	15 (16.85)	15 (17.86)	6 (14.63)	36 (16.82)	0.92
Stroke	11 (12.36)	10 (11.90)	8 (19.51)	29 (13.55)	0.49
Osteoporosis	10 (11.24)	10 (11.90)	6 (14.63)	26 (12.15)	0.86
Myocardial infarction	7 (7.87)	10 (11.90)	6 (14.63)	23 (10.75)	0.48
Heart failure	7 (7.87)	11 (13.10)	5 (12.20)	23 (10.75)	0.50
Diabetic feet	12 (13.48)	6 (7.14)	4 (9.76)	22 (10.28)	0.39
Angina pectoris	10 (11.24)	6 (7.14)	2 (4.88)	18 (8.41)	0.43
Amputation	7 (7.87)	5 (5.95)	4 (9.76)	16 (7.48)	0.75
Epigastric pain	6 (6.74)	3 (3.57)	1 (2.44)	10 (4.67)	0.53
Hepatitis B virus infection	3 (3.37)	2 (2.38)	1 (2.44)	6 (2.80)	1.00
Hepatitis C virus infection	2 (2.25)	3 (3.57)	0 (0.00)	5 (2.34)	0.53
HIV infection	1 (1.12)	1 (1.19)	0 (0.00)	2 (0.93)	1.00

[&]The Chi-square test was used to compare the frequencies of each event. The level of significance was set at $p < 0.05$.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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