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SOCIOECONOMIC STATUS AND HYPERTENSION AMONG DIALYSIS PATIENTS: Kidney Outcomes Predictions and Evaluations Study

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ABSTRACT

The objective of this study was to analyze the relationship between socioeconomic status (SES) and hypertension, one of the major underlying diagnosis of end-stage renal disease (ESRD), among dialysis patients. Age, race, gender, and smoking status were also included in the model. This was a cross-sectional study in a population of dialysis patients at the Piedmont Dialysis Center in Winston-Salem, North Carolina, USA, or at one of its three satellite clinics. There were 368 participants with mean and median age of 54.5 (s.d., 14.3) and 55.9 years, respectively. Among them 180 (48.9%) were men and 196 (53.3%) were Black. The outcome variable was prevalence of hypertension. Socioeconomic status was measured by occupation and education that were analyzed separately. Chi-square and logistic regression methods were used to perform univariate and multivariate analyses.

The prevalence of hypertension was not significantly related to SES. In the univariate and multivariate levels, race was significantly related to the prevalence of hypertension. Blacks had a higher prevalence of hypertension than whites (OR, 2.38; 95% CI, 1.50-3.77). A borderline p-value was found for occupation when age, race, and smoking status were also in the model.

Future studies with clearer temporal sequence, e.g., case-control studies, analyzing hypertensive dialysis patients as cases with normal populations as controls are very important to perform to establish the roles of socioeconomic status on the development of ESRD as it relates to hypertension.

INTRODUCTION

ESRD is defined as renal insufficiency requiring dialysis or kidney transplantation for survival. The disease causes an important public health problem. The incidence rate of treated ESRD increased from 75 per million in 1977 to 130 per million in 1987 (U.S. Renal Data System, 1989). In 1988, the total number of patients treated for ESRD in the Medicare system was 172,506 with annual medical payments of $5.4 billion (U.S. Renal Data System, 1990).

The largest single underlying cause of ESRD is diabetes. About 30% of new ESRD cases in 1988 were diabetic (U.S. Renal Data System, 1990). The second largest cause of ESRD is hypertension. Although diabetes is the largest single underlying cause of ESRD,

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hypertension plays a very important role on the development of the disease. Hypertension can cause ESRD directly or through its role as a mediator between diabetes and ESRD.

Although results have been inconsistent, a higher prevalence of hypertension may be related to lower SES (3-8). Other characteristics related to a higher prevalence of hypertension were male gender (9-12), older age (13-15), and Black ethnicity (9-11,16).

The relationship between hypertension and smoking was not consistent. Different studies showed that the prevalence of hypertension was positively related (17), negatively related (18-21), or not related (22-25) to smoking status.

With this background, the primary aim of this research is to analyze the relationship between SES and the prevalence of hypertension, one of the major underlying diagnoses of ESRD, among dialysis patients. Other risk factors that will be included in the model are age, gender, race and smoking status.

The major difference between this study and the previous ones is the fact that all study participants were ESRD patients. The unique characteristics of ESRD patients may produce different results. If there are associations between the risk factors and the prevalence of hypertension among these patients, appropriate actions to prevent the development of hypertension should be applied because this condition plays a very important role on the development of ESRD. For example, if SES is related to hypertension, it means, even in these ESRD patients who are more homogenous than the general population in term of higher morbidity, higher mortality, lower quality of life and lower SES, there is still a relationship between SES and the risk of hypertension. More aggressive prevention and treatment of hypertension among the poor should be applied to prevent them from developing ESRD caused by hypertension.

MATERIALS AND METHODS

Study Population

The Kidney Outcomes Predictions and Evaluations (KOPE) study is an ongoing observational study of ESRD begun in 1991. The study population includes treated ESRD patients receiving dialysis at the Piedmont Dialysis Center in Winston-Salem, North Caroline, USA, or at one of its three satellite clinics.

Before an out-patient dialysis was initiated, all patients were routinely seen by the Renal Advisory Team which consisted of a nephrologist, a social worker, a dietitian, and a dialysis nurse. As of January 1996, 554 patients with ESRD had been recruited into the KOPE study; of these, 186 patients did not complete the interviews. Compared to the 368 patients who had all information, these 186 patients were older with a mean age of 62.0 (s.d., 14.6) years. If, among those who did not complete the interviews, there was a differential of the prevalence hypertension among strata, the ORs could be biased. We assumed that the differential did not exist.

Study Outcomes

The study outcome is one of the the major underlying diagnoses of ESRD, i.e., hypertension. The assessment of the underlying diagnoses was performed by attending nephrologists when patients entered the dialysis centers. For new patients information was obtained at the first visit. For those who were already receiving dialysis, information about these underlying diagnoses was collected from chart abstractions of the Piedmont

Dialysis Center or one of its satellite clinics by interviewers participating in the KOPE study.

Risk Factors

The major risk factors analyzed in this research is SES (education and occupation). Other risk factors that will be included in the model are smoking status (never, past, and current smoker), age, gender (men or women), and race (Blacks or whites). All of the information about education level, occupation, age, gender, race and smoking status was collected using questionnaires that have been used in previous studies (Burgher, 1982; Hilbert, 1985; Hong *et* al, 1987). All questionnaires were administered by interviewers.

Statistical Methods

Chi-square and logistic regression analyses (Kleinbum *et* al, 1988; Hosmer and Lemeshow, 1989) were used to analyze the relationship between diabetes or hypertension and education level, occupation, age, race, gender and smoking status. Hypertension was treated as a dichotomous variable (present or not present). The logistic function for the n^{th} risk factor can be expressed as

$$\ln\left(\frac{P_y}{1-P_y}\right) = b_0 + b_1X_1 + b_2X_2 + \ldots + b_nX_n$$

where P_y : the probability of having disease y,
X_i : ith risk factor
b_i : log (OR_i)

For continuous variables, OR_i is the increase of odds in disease for every increase of 1 unit in X_i. For dichotomous variables, OR_i is the odds of having the disease when X_i=1 divided by the odds of having the disease when X_i=0. An adjusted OR_i is the OR we would expect to obtain if the distributions of the other variables included in the model were the same for the two groups defined by X_i.

A p-value is defined as the probability of getting an outcome at least as far from what we would expect, if H_0 were true, as was the actually observed outcome. When a significance level of 5% is specified, p-values equal or less than 5% are considered significant. However, p-values that are greater than 5% but less than 10% are presented because they are considered borderline. Results that are not significant at the level of significance of 5% but are borderline deserve special attention as they may show important trends in the data.

Equipment and Materials

All analyses were performed by SAS program (Sarle *et al*, 1990a, 1990b) using a Vax computer at the Department of Public Health Sciences and personal computers at the Coy Carpenter Library, Bowman Gray School of Medicine of Wake Forest University.

Table 1. Subject Characteristics (n=368)

	n	%
Hypertension	117	31.8
Education level:		
High School graduate or lower	248	67.4
Higher than high school graduate	120	32.6
Occupation		
Laborers	150	40.8
Clerks	116	31.5
Professionals	102	27.7
Gender		
Women	188	51.1
Men	180	48.9
Race		
Whites	172	46.7
Blacks	196	53.3
Smoking Status		
Never	138	37.5
Past	124	33.7
Current	106	28.8

Table 2. Results of Univariate (Chi-square) Analysis

	n(%)	P
Education level:		0.66
High school graduate or lower	77 (31.1)	
Higher than high school graduate	40 (33.3)	
Occupation		0.50
Laborers	44 (29.3)	
Clerks	36 (31.0)	
Professionals	37 (36.3)	
Gender		0.40
Women	56 (29.8)	
Men	61 (33.9)	
Race		0.0002
Whites	38 (22.1)	
Blacks	79 (40.3)	
Smoking Status		0.14
Never	37 (26.8)	
Past	39 (31.5)	
Current	41 (38.7)]	

Table 3. Odd Ratios in the Model with Borderline P-values from Logistic Regression Using Backward Elimination

	Hypertension (n=117)	
	OR	P
Occupation		0.08
Laborers	1.00	-
Clerks	1.34	0.31
Professionals	1.94	0.03
Age (in 5 years)	1.08	0.09
Race		0.0002
Whites	1.00	-
Blacks	2.85	0.0002
Smoking Status		0.09
Never	1.00	-
Past	1.45	0.20
Current	1.87	0.03

RESULTS

Overall, mean and median age are 54.5 (s.d., 14.3) and 55.9 years, respectively. Other characteristics are given in Table 1. Table 2 shows results of the univariate analyses. Mean age for hypertensive and non-hypertensive patients were 55.7 (s.d., 13.9) and 54.0 years (s.d., 14.6), respectively. Race was the only risk factor that was significantly related to the prevalence of hypertension (P=0.0002).

In the multivariate analyses, after controlling for age, gender, race, and smoking status, SES was not significantly related to the prevalence of hypertension. Interactions of SES (education and occupation) with race, gender, and smoking status were analyzed in these analyses. No interaction was significant.

Using backward elimination, borderline p-values were found when occupation, race, age, and smoking status were still in the model. Table 3 shows ORs for these risk factors. When the backward elimination was used to the model showed in Table 3, the final model consisted of only one risk factor, race. This model showed that race was significantly related to the prevalence of hypertension (P=0.0002). Blacks had a higher prevalence of hypertension than whites (OR, 2.38; 95% CI, 1.50-3.77).

DISCUSSION

Although the relationship was not consistent, results from previous population-based studies (individual or aggregate analyses) suggest that SES may be related to risks of hypertension through its role in affecting access to medical care, working and housing conditions, exposure to recognized risk factors, and behavioral factors. Based on results from these dialysis patients, there is not enough evidence to show that SES is related to the prevalence of hypertension. A weak relationship between the prevalence of hypertension and occupation (P=0.08) was found when age, race, and smoking status were also in the logistic model. This indicated the importance of future investigations to establish the relationship.

In this study, the true relationship may have been obscured because dialysis patients are very different from the general population and may share some comorbidities other than hypertension (Luke, 1992) that are related to lower SES. In fact, results from patients in this study who had information about comorbidity showed that they had on the average 3.4 comorbidities when they entered the study. There was a patient with 11 comorbidities and only 5 patients with no comorbidity (unpublished data). ESRD patients, regardless of hypertension status, tend to have lower SES than the general population (Brancati *et al*, 1992). This may also mean that ESRD patients have a more homogenous SES than the general population.

Not all of the patients with hypertension go on to develop ESRD. Similarly, only about 30% of patients with diabetes go on to develop diabetic glomerulosclerosis, which usually progresses to ESRD some 15 to 25 years after the onset of diabetes (Luke, 1992). In this study, SES was assessed when ESRD patients were receiving dialysis, long after the onset of diabetes or hypertension. Except for education, occupation may have changed during this time period. Among the elderly, it was not readily apparent what their occupations were. Although some suggested that occupational status be based on the last position held prior to retirement (Hollingshead, 1975), others have felt that the last job held may not be an accurate reflection of the person's occupational status (Liberatos *et al*, 1988). This could reduce the inverse impacts of occupation on the risk of hypertension.

Educational attainment varies by age cohort of the individual. This resulted in a decline in the value of education as measured by occupational attainment (Susser *et al*, 1985). Because occupational attainment might be related to risks of diabetes and hypertension, the impacts of education on risks of diabetes and hypertension might also be reduced. This may explain the insignificant relationships of education with prevalences of diabetes and hypertension in these ESRD patients.

Some confounders not included in the analyses may also weaken the true relationship. These potential confounders were not included because they were not available in the study. Body mass index (BMI) is one of those potential confounders that may have underestimated relationships. BMI was significantly positively related to incidence of hypertension (Nilsson *et al*, 1994) in Sweden. If, in these ESRD patients, BMI is positively related to SES then the relationship between BMI and hypertension will be underestimated.

This study was difficult to compare with previous ones because of two key factors. First, the study of the relationships of occupation and education with the risk of hypertension in ESRD patients has never been conducted before. Second, education and occupation might be measured differently in different studies. Even revisions of a classification system made comparisons over time somewhat difficult (Cameron and Jones, 1985).

Finally, because the sample size is not large, the probability of detecting a true relationship is low. An estimate of power was obtained by using a program developed by Dupont and Plummer (Dupont and Plummer, 1990). Based on results from this study, a larger sample size is needed to have enough power to detect differences of the magnitude observed in this study.

CONCLUSION

Among ESRD patients, the prevalence of diabetes or hypertension was not significantly related to SES. A higher number of comorbidities among these patients may relate to the lower SES that results in a more homogenous population in term of SES. The low power (small sample size) may also explain the non-significant relationship.

To obtain further understanding of the relationship of SES and diabetes or hypertension among ESRD patients, future studies with clearer causal inferences are needed. These studies may be focused on analyses of how SES can affect the susceptibility of ESRD among hypertensive patients. In this case we can perform case-control studies with hypertensive ESRD patients as cases and hypertensive patients without ESRD as controls. Although cohort studies are better than case-control ones in term of the temporal sequence, the rarity of ESRD makes these studies less feasible.

Other case-control studies at individual levels using hypertensive ESRD patients as cases will also be useful to investigate the relationship between SES and ESRD caused by hypertension. In these studies, normal people or patients with conditions unrelated to ESRD, diabetes, or hypertension (e.g., skin diseases) can serve as controls. They are better than patients in this study because they do not have ESRD so that certain biases can be avoided. Case-control studies with individual-based analyses investigating these issues have never been performed before.

Finally, case-control studies with individual-based analyses investigating the relationship between SES and ESRD will also be very useful. Cases are all ESRD patients regardless of hypertension status and controls are normal people or patients with conditions unrelated to ESRD. This type of studies with individual-based analyses have never been conducted before.

Power and confounders should be considered very carefully in the future case-control studies. This study provides important data for power calculation. Potential confounders such as BMI, dietary pattern, physical activity, alcohol consumption, and psychosocial factors will probably make the relationship clearer.

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