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Correlation of Diabetes, Hypertension, and Protenuria in Barangay Caluangan, Cavite and Barangay Bagong Silangan, Quezon City, Philippines

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Introduction

Today in the Philippines, the cases of diabetes, hypertension, and proteinuria have increased considerably due to the rapid industrialization of the country. A change in lifestyle causes the increase in cardiovascular disease and diabetes. Higher intake of salt and alcohol has also greatly increased the risk of hypertension.

According to the data in 2013 from the Department of Health (DOH), diabetes is one the leading causes of mortality in the Philippines. Sixty percent of the diabetic population is in Asia and is expected to rise to 300 million in 2025, with Southeast Asia having the highest number of diabetics (World Health Organization [WHO], 2004, as cited in Wu *et al.*, 2005).

Proteinuria, a condition in which an abnormal amount of protein is present in the urine, is a sign of a chronic kidney disease. Proteinuria can result in diabetes and high blood pressure, and in turn, those who have diabetes and hypertension are at risk for proteinuria. The relationship among these three diseases were correlated in this study.

This study aimed to determine the relationship among hypertension, diabetes, and proteinuria in rural (Barangay Caluangan, Cavite) and urban (Barangay Bagong Silangan, Quezon City) communities in Luzon.

Methods

Study Sites and Study Population

Barangay Bagong Silangan, Quezon City and Barangay Caluangan, Magallanes, Cavite were selected as the representatives of the urban and rural areas, respectively. Barangay Bagong Silangan is situated between latitudes 14° 41' 57.468'' N and between longitudes 121° 6' 40.459'' E. Barangay Caluangan, is situated between latitudes 14° 1' 18.001'' N and between longitudes 120° 45' 29.998'' E. According to the Philippine Statistics Authority (PSA), as of May 2010, the population of Barangay Bagong Silangan, Quezon City and Barangay Caluangan, Magallanes, Cavite is 78,222 and 1,380, respectively. Snowball sampling will be used in the study to access respondents. The study was sent to the Ethics Review Committee for approval. Consent forms were obtained from every participant before data collection.

Data Collection

Data collection followed the three levels of the WHO Stepwise Approach to Chronic Disease Factor Surveillance (STEPS)(as cited by Modesti et al., 2013), namely questionnaire, physical measurements, and biochemical measurements. Data collection was done on two separate visits to the communities. On the first visit, a questionnaire was distributed after the consent of the participants.The questionnaire included questions such as gender, age, and medical history. Physical measurements included weight in kilogram with 1.0 kg estimate and measured using a weighing scale. Height was measured in centimeters to the nearest 0.5 cm and a measurement of systolic and diastolic blood pressure taken in the dominant arm using a digital sphygmomanometer. Biochemical measurements included blood glucose levels obtained by a lancing device, and for proteinuria urine samples were collected and tested with a dipstick test. Participants were visited again after 7 days by the researchers. The same methods and instruments were used to measure blood glucose levels and systolic and diastolic blood pressure. The purpose of the second visit was to make the data more reliable and to reduce the variation to reasonable limits.

Diagnostic Criteria and Definition of Variables

Arterial hypertension was defined as a chronic occurrence of a BP ≥140/90 mmHg, and/or a self-reported usage of antihypertensive medications at the time of the interview. Diabetes was defined as having an impaired fasting glucose (FG) levels of ≥126 mg/dl (Modesti et al., 2013) or a 2-hour plasma glucose of ≥200 mg/dl (ADA, 2010) at all visits, and/or self-reported usage of hypoglycemic drugs at the time of the interview.

Statistical Methods

Data obtained from the study was expressed as mean with 95% Confidence Interval (CI) for continuous variables, and as rates with 95% CI for categorical variables. By using univariate logistic regression analysis, unadjusted odds ratios (ORs) between urban/rural location and exposure variables were determined. Age, gender, urban/rural location, level of education, diabetes, hypertension, and proteinuria were included as independent variables. Investigation on the factors independently associated with proteinuria and diabetes at multivariate logistic regression analysis to evaluate the simultaneous effect of the various exposure variables, with adjustment for any confounding variables. Variables included in the model were age, gender, marital status, employment status, location, level of education, level of income, presence of health insurance, hypertension, and diabetes. Differences between urban and rural dwellers were investigated at logistic regression analysis with urban/rural residency as dependent variable, and age, gender, level of education, hypertension, diabetes, and proteinuria as independent variables. The independent association of proteinuria with hypertension and diabetes among urban and rural residents were tested separately. Comparisons that were performed using a model of logistic regression which includes proteinuria as a dependent variable, and with hypertension, diabetes, urban/rural location, age, gender, and educational attainment categories included as independent variables.

Sample Size Determination

G*Power was used for the determination of sample size. It was determined that a minimum of 40 participants, distributed as 20 diabetic and 20 non-diabetic patients, will be needed to detect at least 80% of the power of the test at two-sided 95% confidence interval (Ayodele et al., 2011). Student's t-test was used to determine the difference of the two means, and the Pearson's Chi-squared test determined the likelihood of the difference between means occurring by chance. Analysis of variance was used to analyze the difference between means. Statistical Package for the Social Sciences 24 software (SPSS, Chicago, IL, USA) was used for statistical analysis (Modesti et al., 2013).

Results

Association among DM, HPN, and proteinuria level among urban and rural communities

The distribution of the presence or absence of diabetes, hypertension, both diabetes and hypertension, and proteinuria level and the type of community is presented in the following table.

Table 1 Association between the diseases among urban and rural communities

Medication Condition	Urban	Rural	Total
Diabetic			
No	20	20	40
Yes	20	20	40
Hypertensive			
No	22	27	49
Yes	18	13	31
Both Diabetic and Hypertensive			
No	28	29	57
Yes	12	11	23
Proteinuria			
No	34	30	64
Yes	6	10	16

Fisher-exact tests revealed no association between the place of residence of the respondents and the presence or absence of diabetes (p = 1.0), the presence or absence of hypertension (p = 0.3588), presence or absence of both diabetes and hypertension (p = 1.0), and the presence or absence of proteinuria (p = 1.0). This suggested that the presence or absence of diabetes, hypertension, and proteinuria level was independent on the type of community an individual was residing.

Relationship on the Patient's Demographic and Environment and Other Attributes to the Common Risk Factor of the Diseases among Urban and Rural Areas

The table below displays the p-values utilizing T-test, Chi-square test, and Fisher-exact test between the demographic profile of the respondents and the presence of diabetes, hypertension, and proteinuria level.

Table 2 Age Distribution

Age (*years)*	**Urban**	**Rural**	**Overall**
Mean (± SD)	43.25 (± 10.44)	41.18 (± 14.47)	42.21 (± 12.58)
Median	43	42	42.50
Minimum	24	19	19
Maximum	68	76	76
Mean age (Diabetic)	46.25 (±10.08)	45.30 (±15.45)	45.78 (±12.89)
Mean Age (Hypertensive)	43.28 (±12.57)	45.6 (±13.35)	44.26 (±12.19)
Mean Age (Diabetic and Hypertensive)	47.42 (±11.76)	46.91 (±13.91)	47.17 (±12.54)
Mean Age (With Proteinuria)	49.00 (±9.47)	48.00 (±12.17)	48.38 (±10.91)

The median age was 42.50 years, which entails that more than half of the respondents were at least 43 years of age. The result of the *t*-test showed no significant difference on the average age between the respondents on these two communities (p = 0.464). The result of the *t*-test showed no significant difference on the average age of diabetic respondents living between urban and rural communities (p = 0.819). Likewise, for hypertensive respondents, the result of the *t*- test still showed no significant difference on the age of hypertensive respondents living between urban and rural communities (p = 0.607). Moreover, for both diabetic and hypertensive respondents, there is no significant difference on the average age of the respondents living between urban and rural communities (p = 0.925). *t*-test also showed no significant difference on the proteinuria levels on the average age of these respondents living between urban and rural communities (p = 0.866).

Table 3 Gender distribution

Gender	**Urban**	**Rural**	**Overall**
Female			
Diabetic	15	20	35
Hypertensive	12	13	25
Diabetic + Hypertensive	8	11	19
(with proteinuria)	6	10	16
Male			
Diabetic	5	0	5
Hypertensive	6	0	6
Diabetic + Hypertensive	4	0	4
(with proteinuria)	0	0	0

73 (91.25%) respondents from both communities were females, with 33 of them from the urban community, while the respondents from the rural community were all females. Among the female respondents, 35 were diabetic, 25 were hypertensive, 19 were both diabetic and hypertensive, and 16 (20.0%) were with proteinuria. The remaining 7 (8.75%) respondents were males from the urban community. Out of these 7 males, 5 (71.4%) were diabetic, 6 (85.7%) were hypertensive, and 4 (57.1%) were both diabetic and hypertensive. Table 3 presents the gender distribution of all respondents from each community. Fisher-exact tests revealed a significant difference on diabetic respondents (p = 0.0471) and hypertensive respondents (p = 0.028). This indicated that female respondents having diabetes or hypertension were more prevalent than male respondents. However, the Fisher-exact tests exposed no significant difference on the proportions of gender distribution of respondents having both diabetes and hypertension (p = 0.0937) and having proteinuria (p = 1.000).

Table 4 Relationship with Physical and Medical Conditions

Clinical Baseline Characteristics	Medical Condition (p-value)			
	Diabetic	**Hypertensive**	**Both Diabetic and Hypertensive**	**Proteinuria**
Weight (kg)	0.593	0.578	0.865	0.464
Height (cm)	0.702	0.053	0.415	0.530
BMI	0.365	0.663	0.698	0.364
Waist (cm)	0.635	0.670	0.524	0.433
Systolic	0.003**	0.000**	0.000**	0.015*
Diastolic	0.008**	0.001**	0.001**	0.000**
BG (mg/dL)	0.000**	0.000**	0.000**	0.000**

**Significant **Highly Significant*

Adult respondents were more likely to have diabetes, both diabetes and hypertension, and proteinuria compared to younger respondents. Furthermore, the gender of the respondents was associated with the presence of hypertension. This suggests that female respondents tend to have hypertension compared to male respondents. This is relative to the study conducted by Jimeno *et al.* (2015), where it was seen that the national prevalence of diabetes in the Philippines at 40 to 49 years is at 8.2%, while the prevalence at age 30 to 39 is at 3.8% . It was concluded that older respondents were more likely to have diabetes than younger respondents. The study also concluded that diabetes was slightly more common among women at 7.4% versus 7.0% for males. Also, in a study conducted by Kiblasan *et al.* (2015), there were 50 hypertensive young adult respondents with 90% of the respondents' age ranging from 30 to 40 years old, while the remaining 5% of the respondents were 25 to 29 years old. The findings showed that as an individual grows older, the possibility of having hypertension increases.

Discussion

Fisher-exact tests revealed no association between the place of residence of the respondents and the presence or absence of diabetes ($p = 1.0$), the presence or absence of hypertension ($p = 0.3588$), presence or absence of both diabetes and hypertension ($p = 1.0$), and the presence or absence of proteinuria ($p = 1.0$). This implied that the presence or absence of diabetes, hypertension, and proteinuria level was independent on the type of community an individual was residing.

It can be seen from the table above that the age of the respondent was statistically significant. Adult respondents were more likely to have diabetes, both diabetes and hypertension, and proteinuria compared to younger respondents. Furthermore, the gender of the respondent was associated with the presence of hypertension. This implies that female respondents tend to have hypertension compared to male respondents. It was concluded that older respondents were more likely to have diabetes than younger respondents. The study also concluded that diabetes was slightly more common among women at 7.4% versus 7.0% for males. The findings showed that as an individual grows older, the possibility of having hypertension increases.

Conclusion

The findings of this study reaffirmed that the systolic and diastolic blood pressure and blood glucose level of an individual significantly affect proteinuria level. With regards to the age, gender, marital status, occupation, educational background, and presence or absence of health insurance of respondents having diabetes and hypertension, the results indicated that the demographic factors did not have any correlation in having proteinuria. However, there is a correlation between respondents having both hypertension and diabetes and their income and a correlation between respondents having hypertension and their occupational status. The type of community where an individual resides has no correlation with the presence or absence of diabetes, hypertension, and proteinuria. The significant difference that was observed between the age of the respondents suggested that adult respondents were more likely to have diabetes, both diabetes and hypertension, and proteinuria as compared to younger respondents. Furthermore, the gender of the respondents and the presence of hypertension were found to be associated, denoting that hypertension is more prevalent among females as compared to males. Based on the findings, there is no significant difference on the prevalence of the disease in rural and urban communities. Therefore, there should be no bias in providing health care planning. Public health planning should focus on both communities on where they need most help with their disease and medication, in order to help curb the rising mortality rate associated with the diseases.

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