RESEARCH ARTICLE

Factors associated with hypertension and diabetes among risk-assessed patients in a Pasig City health center

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ABSTRACT

Background: Non-communicable diseases (NCDs) are among the growing public health problems globally which cause premature and preventable deaths. They remain as leading causes of mortality in the Philippines, specifically hypertension and Type 2 Diabetes Mellitus (T2DM).

Objective: This study aimed to determine the factors associated with high risk for hypertension and T2DM among patients who were risk-assessed in the Center for Dialysis, Healthy Lifestyle, Ambulatory Surgery, Maternity Clinic and Newborn Care of Pasig City (CHAMP) Health Center from January to December 2020.

Methodology: An analytical cross-sectional study design was utilized to determine the factors associated with hypertension and T2DM among risk-assessed patients. Secondary data from the NCD registry of the City Health Department of Pasig was obtained through a one-time collection.

Results: Among the 77 patients included in the study, 19.48% were classified as high-risk for hypertension and T2DM. Through a simple logistic regression, no variable was statistically significant at a 5% level of significance which means there is no sufficient basis to conclude that there is an association between the factors with high risk for hypertension and T2DM. Looking at the characteristics of the participants, 74% were obese and more than half had no regular exercise; they may still be at risk for NCDs because being at non-high-risk does not eliminate risk completely.

Conclusion: Policies or strategies regarding access to health centers for risk assessment should not be neglected even during a communicable disease pandemic because this may lead to a misreporting of high-risk individuals.

Keywords: *non-communicable disease (NCD), hypertension, Type 2 Diabetes Mellitus (T2DM), risk assessment, risk status*

Introduction

Non-communicable diseases (NCDs) are chronic diseases that result from various factors that could be lifestyle-related, environmental, and genetic [1]. Developing these NCDs can be attributed to risk factors which can be prevented and controlled. Risk factors, that could be modifiable or non-modifiable, are defined as any aspect of an individual's lifestyle, environment, and inherited characteristics that are associated with increased disease occurrence [2].

In the Philippines, hypertension has been the second leading cause of morbidity from 2016-2018 with a rate of 567.79 per 100,000 population [3]. It is recognized as a major problem because of its high prevalence but low level of awareness and appropriate treatment. On another note, the country was reported to have a Type 2 Diabetes Mellitus (T2DM) prevalence of 5.8% in a 2016 WHO report [4]. The rising prevalence of T2DM can be associated with rapid urbanization as well as the westernization of Filipino culture [5].

Studies show that non-modifiable factors, such as age and sex can increase the likelihood of hypertension and diabetes [6,7]. Specifically in Filipinos, older age is one of the many factors associated with increased odds of hypertension and diabetes [8,9]. Males were found to have more risk factors (i.e., smoking, alcohol consumption, etc.) compared to

females which result in a higher number of male T2DM patients. Multiple studies have also shown that alcohol consumption, smoking status, physical activity, and body mass index are associated with increased risk of developing hypertension and T2DM [10-12]. However, for anthropometric measurements and stress, there is insufficient evidence and inconsistent study results to conclude that both factors increase the risk for hypertension and diabetes. By identifying the risk factors, more sustainable solutions will be created by wise resource allocation, and the root cause of developing NCDs will be addressed. Since Pasig City has minimal analysis of data for NCD and COVID-19, this research can serve as a stepping stone for them to prioritize more preventive strategies for NCDs during a communicable disease pandemic. During this time, health sectors have directed their focus on the curative side of medicine due to the influx of medicinal needs. This research can aid in helping them redirect their focus and not merely provide a band-aid solution to the recurring problem of NCDs.

The study aimed to determine the factors associated with risk for hypertension and T2DM among patients who were risk-assessed in CHAMP from January to December 2020. Moreover, it sought to identify the proportion of patients at high risk of hypertension and T2DM in CHAMP, as well as the association of non-modifiable and modifiable factors to high risk of hypertension and T2DM.

Methodology

An analytical cross-sectional study was utilized to determine the factors associated with high risk for hypertension and T2DM among patients assessed in CHAMP. The study has been reviewed and approved by the UP Manila Research Ethics Board with the code 2021-002-UND.

Since this is the first study to be done during the COVID-19 pandemic about NCDs in Pasig City, Philippines, a total enumeration reduces the risk of missing potential insights. The study participants consisted of NCD risk-assessed patients who are 21-59 years old in CHAMP, Pasig City, from January to December 2020. No sampling was performed because all patients in CHAMP who had undergone NCD risk assessment from January to December 2020 were included, but inclusion and exclusion criteria were used to determine the study. participants. From 501 patient records available, the researchers were able to include only 77 since 214 patient records have already expired, 118 were from the vulnerable population, 81 with a medical history of hypertension and T2DM, and 11 with incomplete records.

This study utilized secondary data from the NCD registry of Pasig City. Table 1 presents the criteria for each risk factor which were adapted from the WHO Package of Essential NCD Interventions, DOH guidelines, and the Integrated NCD Risk Assessment Form (INRAF).

Data on the participants' modifiable risk factors status, age, sex, and risk status were obtained from the anonymized NCD registry of the Pasig City Health Department through a scheduled one-time collection. The identifiers in the registry were redacted through the use of cut-outs. A coding manual was utilized for data encoding via Microsoft Excel.

All the data analyses for this study were performed in STATA 14 software. Descriptive statistics were summarized first to be able to characterize the study participants. Simple logistic regression analysis was performed for each exposure variable to see their associations with the outcome variable.

Results

Frequencies and proportions were calculated per variable to determine the characteristics of the study participants (Table 2). The mean age of the participants was 41 and more than half were females. Most of the participants were non-binge alcoholic drinkers, non-smokers, and had BMI interpretations of overweight to obese. Almost 55% did not exercise regularly and about 90% were not stressed. Fifteen out of 77 participants (19.48%) were considered high risk for hypertension and T2DM.

Fifteen individuals were below 30 years old, and 62 individuals were 30 years and older. From the younger and older population respectively, 2 (13.33%) and 13 (20.97%) were at high risk. Among the 15 high-risk individuals, 13 (86.67%) of them were part of the older age group, as seen in Table 2.

Twenty-six individuals were males, and 51 individuals were females. Four (15.38%) males and 11 (27.55%) females were at high risk. Among the 15 high-risk individuals, 11 (73.33%) were females.

There were 21 binge alcohol drinkers and 56 non-binge alcohol drinkers. Only 1 (4.76%) binge alcohol drinker was classified as high risk, while 14 (25%) were non-binge alcohol drinkers at high risk. Among the 15 high-risk individuals, 14 (93.33%) were non-binge alcohol drinkers. On the other hand, 20 (32.36%) non-high-risk individuals were classified as binge-alcohol drinkers.

Table 1. *Operational Definition of Variables*

Risk Status		
	Description	**Classification**
Risk Status	Assessment of the trained health worker based on their risk screening on the participant as indicated in the INRAF. • High risk for T2DM are those with Fast Blood Sugar (FBS) ≥126 mg/dL or Random Blood sugar (RBS) ≥ 200 mg/dL with classic symptoms [27]. • High risk for hypertension are those with Stage 1 (140-159mmHg / 90-99mmHg) or Stage 2 (>160/>100 mmHg) status.12	• **High Risk:** >30% for both hypertension and T2DM • **Non-high Risk:** <30% for both hypertension and T2DM
Modifiable Factors		
Binge Alcohol Consumption Status	• **Males:** 5 or more bottles in an occasion • **Females:** 4 or more bottles in an occasion	• Binge alcoholic drinker • Non-binge alcoholic drinker
Smoking status [28]	Engagement of a participant in smoking	• **Smoker:** Current smoker, or has quit smoking but for <1 year • **Non-smoker:** Has stopped smoking for at least one year or has not smoked cigarettes but is exposed to secondhand smoke
Physical Activity [28]	Movement of the skeletal muscles which require energy [29]	• **Regular exercise:** ≥30 minutes a day • **No regular exercise:** <30 minutes a day or does not exercise at all
Body Mass Index Interpretation	Refers to the quantitative measurement of weight and height for Asian populations	• Overweight/Obese (> 23) • Not overweight/obese
Stress	Response to pressures or threat from different situations [30]	• Stressed which means there is disruption in everyday life • Not stressed

Table 2. *Characteristics of Study Participants (n= 77)*

Participant characteristics	Descriptive statistics n (%) or Mean
Age (years)	**Mean = 41.1 (11.25)**
< 30 years old > 30 years old	15 (19.48%) 62 (80.52%)
Sex	
Male Female	26 (33.77%) 51 (66.23%)
Binge Alcohol Consumption Status	
Binge-alcohol drinker Non-binge alcohol drinker	21 (27.27%) 56 (72.73%)
Smoking Status	
Smoker Nonsmoker	13 (16.88%) 64 (83.12%)
Physical Activity	
Regular exercise No regular exercise	35 (45.45%) 42 (54.55%)
BMI Status	
Overweight to Obese (>23) Not overweight/ obese (<23)	57 (74.03%) 20 (25.97)
Stress	
Stressed Not Stressed	7 (9.09%) 70 (90.91%)

Table 3. *Characteristics of Study Participants*

Non-modifiable Factors			
	Risk Status		
	High-risk	**Non-high risk**	**Total**
Age			
<30 years >30 years	2 (13.33%) 13 (20.97%)	13 (86.67%) 49 (74.19%)	15 62
Total	15 (19.48%)	62 (80.52%)	77
Sex			
Male Female	4 (15.38%) 11 (21.57%)	22 (84.62%) 40 (78.43%)	26 51
Total	15	62	77
Modifiable Factors			
	Risk Status		
	High-risk	**Non-high risk**	**Total**
Modifiable Factors			
Binge Alcohol Consumption Status			
Binge Alcohol Drinker Non-binge Alcohol Drinker	1 (4.76%) 14 (25%)	20 (95.24%) 42 (75%)	21 56
Total	15	62	77
Smoking Status			
Smoker Non-smoker	3 (23.08%) 12 (18.75%)	10 (76.92%) 52 (81.25%)	13 64
Total	15	62	77
Physical Activity			
Regular Exercise No Regular Exercise	8 (22.86%) 7 (16.67%)	27 (77.14%) 35 (83.33%)	35 42
Total	15	62	77
Body Mass Index Interpretation			
Overweight to Obese Not Overweight/Obese	12 (21.05%) 3 (15%)	45 (78.95%) 17 (85%)	57 20
Total	15	62	77
Stress Level Status			
Stressed Not Stressed	0 15 (21.43%)	7 (100%) 55 (78.57%)	7 70
Total	15	62	77

There were 13 smokers and 64 non-smokers among the study participants. Three (23.08%) smokers and 12 (18.75%) non-smokers were at high risk. Among the 15 high-risk individuals, 12 (80%) were non-smokers. Ten (16.13%) non-high-risk individuals were classified as smokers.

Thirty-five out of 77 individuals had regular exercise. Eight (22.86%) participants who exercised regularly and 7 (16.67%) participants who did not exercise were at high risk. Out of the 15 high-risk individuals, 7 (46.67%) had no regular exercise. For the non-high-risk individuals, 56% had no regular exercise.

Table 4. *Simple Logistic Regression Analysis for Each Factor*

Variable	Coefficient	Std. error	p-value	Crude Odds Ratio
Age	0.013	0.026	0.61	1.01
Sex				
Male Female	Reference 0.41	0.64	0.65	- 1.51
BMI Status				
Not overweight/ obese Overweight to Obese	Reference 0.41	0.71	0.56	- 1.51
Binge Alcohol Consumption Status				
Non-binge alcoholic drinker Binge-alcoholic drinker	Reference -1.90	1.07	0.08	- 1.51
Smoking Status				
Nonsmoker Smoker	Reference 0.26	0.73	0.72	- 1.3
Physical Activity				
No regular exercise Regular exercise	Reference -0.39	0.58	0.50	- 0.68
Stress				
Not Stressed Stressed	Reference -1.43	1.48	0.34	- 0.24

Fifty-seven individuals had BMI interpretations of overweight to obese, 12 (21.05%) of whom were classified as high-risk. Meanwhile, 3 (15%) who were not overweight or obese were also classified as high-risk. Among the high-risk and non-high-risk individuals, 12 (80%) and 45 (73%) had BMI interpretations of overweight to obese, respectively.

Only 7 individuals were classified as stressed and none of them was classified as highrisk. All the 15 high-risk individuals were unstressed.

Simple logistic regression was performed to determine the association of each explanatory factor with high risk for hypertension and T2DM. The cross-tabulation for high risk for hypertension and T2DM and the predictor variable stress hada zero-cell count. This led to a non-convergence in the simple logistic regression analysis. Thus, the penalized likelihood procedure by Firth was used for this particular predictor variable with the intent to reduce the shrinkage effect brought about by the small sample size [13].

Looking at the p-values, the associations of the exposure variables with high risk for hypertension and T2DM were not statistically significant. At 0.05 level of significance, it can be concluded that the slope coefficient is not zero and that the final logit model from the regression analysis is preferred over the intercept-only model. Factoring the results from previous literature [14], the researchers suggest a large effect size for the post hoc power analysis using G*Power version 3.1.9.7. With a significance criterion of α=.05 and power=.80, the 77 records analyzed in this study were sufficient with this effect size for logistic regression.

Discussion

Since the start of COVID-19, several hospitals have been designated as COVID-19 referral centers resulting in a decrease in the available services, halted and delayed follow-up consultations and monitoring of NCD management, and relapse in recovery programs [15].

Only 77 remained after applying the inclusion and exclusion criteria. In the analysis of the association between the risk factors and high risk for hypertension and T2DM, no association showed statistical significance (p-values < 0.05). However, the descriptive statistics of the participants give insight on the need for public health intervention for preventing NCDs.

Non-modifiable Factors Affecting Risk for Hypertension and T2DM

Age

Older adults are more likely to have increased risk for hypertension and T2DM due to the physiological and molecular changes that take place in the body [16]. Results in this study showed that the mean age of the participants was 41 years old. Additionally, 13 out of the 15 high-risk individuals had ages of 30 years old and above, although age showed insignificant results in the analysis. Given a younger population among those assessed in CHAMP, they may have a relatively healthier lifestyle with 73% non-binge alcoholic drinkers, 83% nonsmokers, 45% physically active, and 91% - unstressed individuals, or simply, they have a higher capability of taking care of themselves given the ongoing pandemic.

Sex

This is most often affected by physiological and hormonal differences. In some cases, men show a higher risk compared to females; while some researches prove that females are at higher risk [10,17]. In this study, 11 of the 15 participants who were at high risk for hypertension and T2DM were females, however, no significant association was found in the analysis.

Modifiable Factors Affecting Risk for Hypertension and T2DM

Body Mass Index Interpretation

This is an important quantitative measurement as it can serve as a starting point to prevent medical health problems. Due to the pandemic, government assistance provided to families with instant noodles and canned goods may contain bisphenol-A. Processed food can be detrimental for patients suffering from cardiovascular disease and can also result in renal complications for T2DM [15]. In a study conducted by the Liggins Institute, even if two-thirds of their participants were obese, there was no significant association between obesity and T2DM [18]. In this study, even if statistics yielded an insignificant result, there were about 74% overweight to obese individuals which is an alarming percentage. Among these individuals, 12 were at high risk for hypertension and T2DM. Nutrition programs and health maintenance are still to be continued as a study done at the Philippine General Hospital revealed that restricted mobility and limited access to food choices resulted in malnutrition because people resorted to purchasing cheap and convenient food items that have longer shelf lives [15].

Binge Alcohol Consumption Status

Alcoholic consumption not only increases blood pressure but also increases the levels of triglyceride, central adiposity, and uric acid [19]. However, there is also a known protective factor of alcoholic consumption in the metabolic syndrome [20]. In this study, no association can be concluded. This may be due to the answers in the Integrated NCD Risk Assessment (INRA) forms being lost in translation upon transferring to the NCD registry. Further, it was not clearly stated who were classified as non-alcoholic and moderately consuming alcohol, as opposed to the classification in the NCD registry. Additionally, out of the 21 binge alcoholic drinkers, only 1 was at high risk for hypertension and T2DM. This may mean that interventions regarding this exposure factor are not a high priority as of the situation.

Smoking Status

Smoking is considered one of the major risk factors for NCDs [21]. Numerous studies show that individuals who smoke are more likely to develop NCDs like hypertension and T2DM, heart disease, and several cancers [8,22]. Contrastingly, researchers in China studied blood pressure and smoking status survey data and found that nicotine has an immediate effect on sympathetic nervous activities, but its long-term effects are yet to be concluded. They proceeded to conclude that smoking was not a risk factor for hypertension [23]. Similarly, a study in the Philippines did not find any correlation between smoking and high fasting blood glucose levels [20]. In this study, 13 individuals were reported to be smokers and only 3 of them were at high risk for hypertension and T2DM. However, no such conclusion regarding this predictor variable can be made. Lockdown restrictions may have lessened cigarette street vendors and potential buyers. Data may show that interventions for smoking and its harmful effects are not of priority for reducing the risk for hypertension and T2DM.

Physical Activity

Physical inactivity could be one of the main reasons for the emergence of multiple NCDs [24]. On the contrary, a study in the Philippines was able to reveal that there is no association between physical activity and increased fasting blood glucose levels, a possible indicator of T2DM [20]. In the analysis of data in this study, nothing could be concluded due to statistically insignificant results. The physical activity section of the INRA forms could have contributed to inaccurate responses from the patients as it was not clearly stated in the form what "physical activity" entails. However, it is worthy to note that more than half of the patient records were reported to have had no

regular exercise. This may have been brought about by the pandemic as people had to employ a work-from-home setting. Because of this, the simple physical activity of the participants pre-pandemic has been reduced further to what can be done in the house. Moreover, 7 out of the 42 participants who reported to have had no regular exercise, and 8 participants who exercised regularly, were at high risk for hypertension and T2DM. This may mean that interventions regarding physical activity may be of aid in reducing risk for NCDs.

Stress

Some studies have found psychosocial and psychological stress to be associated with a higher likelihood of developing NCDs [24]. The researchers hoped to look more deeply into this variable and its effects on the risk for hypertension and T2DM patients who have steered away from acquiring care even if their conditions are severe because of fear of contracting COVID-19 [26]. However, in this study, there was a zero-cell count in the 2x2 table for this predictor variable. The Firth penalized likelihood procedure was implemented but it yielded statistically insignificant results. Like the physical activity section of the INRA forms, the stress section of the questionnaire could have been received differently.

Conclusion

The study primarily aimed to determine the factors associated with high risk for hypertension and T2DM among risk-assessed patients in CHAMP. Through a simple logistic regression analysis (α=0.05), there is no sufficient evidence to prove the association of the risk factors with being at high risk for hypertension and T2DM. The insignificant results could be due to the small sample size as well as lockdown restrictions causing fewer risk-assessed patients in CHAMP, which leads to the underreporting of cases. The information from this study may aid in the prioritization of targets for preventive measures especially during a communicable disease pandemic where NCDs present significant co-morbidities and heightened risk for acquiring COVID-19. The study gives insight on which health system building blocks need further action, particularly, service delivery, information, medical products, and leadership.

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