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The Prevalence of Heterozygous Familial Hypercholesterolemia among Adult Filipino Patients with Dyslipidemia at Universidad de Santa Isabel Health Services Department: An Observational Descriptive Prospective Study

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Abstract

Objectives: It is to determine the prevalence of familial hypercholesterolemia (FH) among adult Filipino patients with dyslipidemia at Universidad de Santa Isabel Health Services Department in one year. **Methods:** An observational descriptive prospective study involves Filipino patients, aged 19 years and older, with dyslipidemia. The Dutch Lipid Network (DLN) Criteria was used to diagnose FH. Prevalence data and categorical variables were expressed as percentages, while continuous variables were reported as mean and standard deviations. **Results:** 529 patients were included in the study. 302 were females, and 227 were males. 180 (34%) scored Unlikely, 100 (19%) scored Probable, 185 (35%) scored Possible, and 64 (12%) were classified under Definite Familial Hypercholesterolemia. Most of the patients diagnosed with definite FH did not have diabetes, cerebrovascular disease (CVD), and coronary artery disease (CAD). The diagnosis was not affected by gender, BMI, smoking, and alcohol consumption. Hypertension was significantly correlated to the diagnosis of FH, as most of them were already hypertensive at diagnosis. It was noted that hypertension, diabetes, CVD, and CAD were seen at an earlier age among patients with definite FH. **Conclusion:** The prevalence of heterozygous FH at 12% among dyslipidemia patients and 1.3% among the general population was described for the first time in our region. This result should raise the awareness of our healthcare providers that FH, which is a major risk factor for premature CAD and CVD, exists, and early detection and management are important.

Keywords

Prevalence, Heterozygous, Familial Hypercholesterolemia, Adult, Filipino

1. Introduction

Bicol Region comprises the southern part of Luzon and is divided into 6 provinces, namely, Albay, Camarines Norte, Camarines Sur, Sorsogon, Cantanduanes, and Masbate. The largest province is Camarines Sur. [1] [2]

Bicol Region, in general, is surrounded by a large amount of flat land and fertile soils. Hence, agriculture comprises the top aspect of its economy. [1] [2]

For the past few decades, Bicol Region has been reported to have the highest prevalence of elevated total cholesterol and low-density lipoprotein cholesterol (LDL-C) levels, according to the National Nutrition Survey of the Philippines conducted by the Food and Nutrition Research Institute in April 2014. [3]

This has always been blamed on the dietary preference of its inhabitants, as Bicolanos are fond of eating meals high in saturated fats and carbohydrates, and routinely add coconut milk to almost every dish, from rice, meat, fish, and vegetable dishes. [3] Coconut milk is high in saturated fats, namely, Lauric and Myristic Acid. [4]

Interestingly, Bicol Region ranked second for having the lowest prevalence of elevated triglyceride levels in the Philippines based on the same survey. [3] Serum triglyceride levels are more reflective of the dietary fatty acid intake. [4] This contrasting data goes beyond the dietary preference of a greasy diet, so a genetic form of dyslipidemia is a possibility.

Familial hypercholesterolemia is an autosomal dominant disorder that results in elevated low-density lipoprotein cholesterol (LDL-C) levels (typically a level above 190 mg/dL). Mutations in the gene encoding the LDL receptor (LDLR) are the most commonly identified abnormality in these patients worldwide. [3] [5]

There are two types of familial hypercholesterolemia, Homozygous and Heterozygous Familial Hypercholesterolemia. [5]

Homozygous familial hypercholesterolemia is characterized by extremely high LDL-C levels, typically ranging from 15.5 mmol/L (600 mg/dl) to 25.9 mmol/L (1000 mg/dL), and is caused by an inherited mutation from both parents. It is rare and requires therapeutic interventions in the first decade of life. It currently has an estimated prevalence worldwide of 1 in 250,000. [6]

Heterozygous familial hypercholesterolemia, on the other hand, is defined as an elevated LDL-C level (typically above 190 mg/dL), the presence of xanthomas, and a family history of premature cardiovascular disease. It is more common, with an estimated prevalence of 1 in 250 people worldwide. [5] Currently, its prevalence in Asia is unknown. [5]

There are several clinical diagnostic tools for familial hypercholesterolemia, namely the Dutch Lipid Network Criteria (DLN), the Simon Broome Register

(SBR), and the Make Early Diagnosis to Prevent Early Deaths (MEDPED) project. [1] There are contrasting data and opinions with regard to which of these diagnostic tools is the best for the clinical diagnosis of familial hypercholesterolemia. [6]

In a study done by Mengge Zhou and Dong Zhao in December 2015, they reviewed all publications done in Asia regarding familial hypercholesterolemia and showed that different countries used different diagnostic criteria for familial hypercholesterolemia. [6] [7]

The Royal College of General Practitioners Guideline on the Identification and Management of Familial Hypercholesterolemia published in August 2008 preferred the Simon Broome Register because of its simplicity. However, it was noted in the said guideline, that Simon Broome Register and DLN Criteria almost have the same sensitivity and specificity in clinically diagnosing familial hypercholesterolemia. [8]

The DLN Criteria is the preferred clinical diagnostic tool by many guidelines worldwide, namely, the European Society of Cardiology, the National Lipid Association in the USA, the International FH Foundation, and the European Atherosclerosis Society, along with the Philippine Clinical Practice Guidelines for the Management of Dyslipidemia 2015 Update, because it relies on the history and physical examination findings. The disadvantage of this diagnostic criterion in our setting is the limitation of the availability and cost of the genetic test. [5] [9]

The DLN Criteria consists of the family history, clinical history, physical examination, cholesterol levels, and genetic tests. Patients were categorized into definite, probable, possible, and unlikely based on their scores. [5]

Familial hypercholesterolemia is considered a significant risk factor for atherosclerotic cardiovascular disease because it is a hereditary disease. And the patients already have an elevated LDL-C level since birth. The patients are then exposed longer to elevated cholesterol, and this is associated with a higher risk for premature coronary artery disease and cerebrovascular disease. Hence, if early detection is done, these premature diseases can be prevented and treated earlier. [6]

A number of prevalence studies of familial hypercholesterolemia in acute coronary syndrome patients were done. One specific example of this is the study done by De Backer *et al.*, entitled Prevalence and Management of Familial Hypercholesterolemia in Coronary Patients in January 2015. In this study, they used a modified version of the DLN Criteria to diagnose familial hypercholesterolemia. [6] [7] [8]

It was found in these studies that the prevalence of familial hypercholesterolemia among CAD patients was very high compared to the general population, specifically in those with premature coronary artery disease and cerebrovascular disease. Identification of patients with familial hypercholesterolemia is significant so that early treatment can be done and hence, the prevention of premature coronary artery disease and cerebrovascular disease can be made. Also, by iden-

tifying the index familial hypercholesterolemia patients, at-risk relatives could also be screened and treated earlier. [6] [7] [9]

In a study by Zamora, MD, Ph.D., 2.5 million patients, aged 7 and over, were recruited between 2006 and 2014, and showed an overall prevalence of definite familial hypercholesterolemia at 0.58%. Likewise, it was found in this study that premature coronary artery disease was three times higher in patients with familial hypercholesterolemia than in the general population. [7]

Familial hypercholesterolemia is generally underestimated worldwide, resulting in a lack of information on its implication for premature morbidity and mortality. It is therefore most of the time undiagnosed, and treatment is only started once patients already have comorbidities. [6] [7] [9]

In a review done by Mengge Zhou and Dong Zhao in December 2015, they reviewed manuscripts about familial hypercholesterolemia done in Asian populations. They only mentioned prevalence studies which were from Japan at 1 in 900 in 1977, Christian Lebanese at 1 in 85 in 1979, and China at 28 in 100. It was also found that there is a lack of knowledge and awareness regarding familial hypercholesterolemia among clinicians all over Asia. [9] [10]

The latest update on the Clinical Practice Guidelines for the Management of Dyslipidemia in the Philippines 2015, stated that the prevalence of familial hypercholesterolemia in Asia is unknown and that there is only one study of familial hypercholesterolemia done among Filipino patients, pertaining to the study done by Punzalan *et al.* [5]

In our institution, dyslipidemia is also an underdiagnosed disease and is usually ignored. The focus is primarily on the coronary and cerebrovascular manifestations of the disease, overlooking the possibility of what could have caused them, especially in those very young patients.

This study aims to determine the prevalence of familial hypercholesterolemia among adult Filipino patients with dyslipidemia at the Universidad de Sta. Isabel Health Services Department. Identifying patients with familial hypercholesterolemia is significant because it is associated with premature cardiovascular disease and cerebrovascular disease. Hence, it is an important target for primary prevention of atherosclerotic cardiovascular disease. Also, when these index patients with familial hypercholesterolemia are identified in the community, screening and possible treatment of at-risk relatives would be done earlier and easier.

1.1. General Objective

To have a baseline prevalence study of heterozygous familial hypercholesterolemia in Camarines Sur, Philippines.

1.2. Specific Objectives

1) To determine the prevalence of heterozygous familial hypercholesterolemia among adult Filipino patients with dyslipidemia seen at the Universidad de Sta. Isabel Health Services Department.

2) To describe the profiles of patients diagnosed with Definite Familial Hypercholesterolemia using the DLN criteria.

2. Methodology

2.1. Study Design

An observational descriptive prospective study.

2.2. Study Population

The study included patients seen by the main investigator at the Universidad de Sta. Isabel Health Services Department. They included adult Filipinos, age 19 years or older, with dyslipidemia, seen and examined between June 2016 and June 2017. Patients were excluded if their lipid profile results were done outside the institution. A total of five hundred twenty-nine study subjects were recruited and included in the study. Table 1 shows the baseline characteristics of the study population who were included in the study.

The researcher used the total enumeration of the patients admitted to the Universidad de Sta. Isabel Health Services Department. Purposive sampling was used in the conduct of the research study.

2.3. Ethics Statement

The Research Ethics Board Panel of the Universidad de Santa Isabel Health Services Department approved the study protocol in accordance with the Declaration of Helsinki.

Table 1. Baseline characteristics of study population.

Factors	
Mean Age (years)	59 ± 14
Mean BMI	24.5 ± 3.6
Mean LDL - C (mmol/L)	3.73 ± 1.34
Mean Triglycerides (mmol/L)	1.75 ± 1.11
Mean HDL - C (mmol/L)	1.06 ± 0.43
Mean BUA (umol/L)	368 ± 141
Sex	n/N (%)
Male	227/529 (43)
Female	302/529 (57)
Hypertension	419/529 (79)
Diabetes	157/529 (30)
Coronary Artery Disease (CAD)	201/529 (38)
Cerebrovascular Disease (CVD)	126/529 (24)
Smoking	190/529 (36)
Alcoholic Beverage Drinker	207/529 (39)

This table shows the baseline characteristics of the study population.

All the patients' information was kept confidential and will only be used for the purpose of the study.

The data gathering of the study does not include the patient's name or any identification of personal information. Other information that can affect the patient's financial status or lead to social discrimination was not included.

The study subjects who were included in the study were asked to sign an informed consent. The investigator, prior to the start of the interview and/or gathering of data, explained the purpose of the study, its benefits, and possible risks.

2.4. Diagnosis of Familial Hypercholesterolemia

The patients who satisfied the inclusion criteria were assessed for the presence of familial hypercholesterolemia using the Dutch Lipid Network (DLN) Criteria.

The researcher chose to exclude patients with lipid profile results done outside the institution to minimize machine bias. Universidad de Santa Isabel Health Services Department laboratory used the Dimension Xpand Clinical Chemistry System for the lipid profile tests of the patients included in the study.

2.5. Analysis of Data

Prevalence was expressed as a percentage. The total sample population was used as a reference against the number of Unlikely, Possible, Probable, and Definite familial hypercholesterolemia.

For the secondary objectives of this study, the results for categorical variables were expressed as percentages and compared using the chi-square test, while the continuous variables were reported as mean and standard deviations.

3. Results

Five hundred twenty-nine patients were collected during the data-gathering period, of which 302 were female, and 227 were males. Age ranged between 19 to 96 years old.

From the 529 subjects, 180 (34%) scored Unlikely, 185 (35%) scored Possible, 100 (19%) scored Probable, and 64 (12%) were classified under Definite Familial Hypercholesterolemia. (Figure 1)

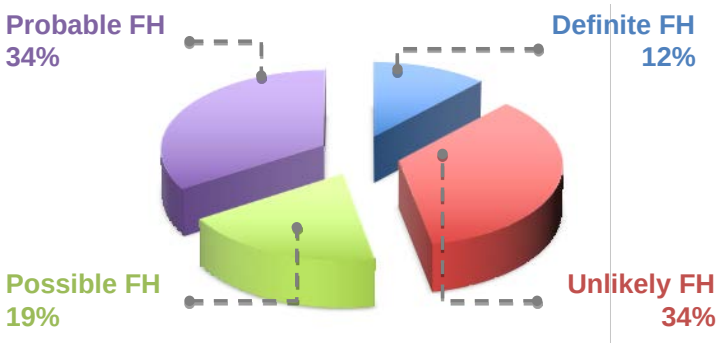

Figure 1. Prevalence of heterozygous familial hypercholesterolemia using the DLN Criteria.

Of the 302 female study subjects, 32 (11%) scored with definite, 56 (18%) with probable, 127 (42%) with possible, and 87 (29%) with unlikely familial hypercholesterolemia. And from the 227 male study subjects, 32 (14%) scored with definite, 44 (19%) with probable, 58 (26%) with possible, and 93 (41%) with unlikely familial hypercholesterolemia.

Of the five thousand admissions under Internal Medicine in our institution, the estimated prevalence of definite familial hypercholesterolemia in the general population is at 1.3%.

One hundred ninety study subjects were smokers and 339 subjects deny smoking. Of the 190 study subjects who smoke, 25 (13%) scored with definite, 32 (17%) with probable, 53 (28%) with possible, and 80 (42%) with unlikely familial hypercholesterolemia. And from the 339 study subjects who deny smoking, 39 (12%) scored with definite, 68 (20%) with probable, 132 (39%) with possible, and 100 (29%) with unlikely familial hypercholesterolemia.

Two hundred and seven subjects drink alcoholic beverages and 322 subjects deny drinking alcoholic beverages. Of the 207 study subjects who drink alcoholic beverages, 31 (15%) scored with definite, 39 (19%) with probable, 54 (26%) with possible, and 83 (40%) with unlikely familial hypercholesterolemia. And from the study subjects who deny drinking alcoholic beverages, 33 (10%) scored with definite, 61 (19%) with probable, 131 (41%) with possible, and 97 (30%) with unlikely familial hypercholesterolemia.

Four hundred nineteen subjects had hypertension. Of the 419 study subjects with hypertension, 59 (14%) had a score of definite, 74 (18%) had probable, 147 (35%) had possible, and 139 (33%) had unlikely familial hypercholesterolemia. And from the 110 study subjects not hypertensive, 5 (4%) had definite, 26 (24%) had probable, 38 (35%) had possible, and 41 (37%) had unlikely familial hypercholesterolemia scores.

One hundred fifty-seven subjects had diabetes mellitus. Of the 157 study subjects with diabetes, 25 (16%) scored with definite, 32 (20%) with probable, 44 (28%) with possible, and 56 (36%) with unlikely familial hypercholesterolemia. And from the 372 non-diabetic study subjects, 39 (11%) had a definite, 68 (18%) had probable, 141 (38%) had possible, and 124 (33%) had unlikely familial hypercholesterolemia.

One hundred twenty-six subjects had a history of cerebrovascular disease (CVD). Of the 126 study subjects who had CVD, 19 (15%) scored with definite, 26 (21%) with probable, 47 (37%) with possible, and 34 (27%) with unlikely familial hypercholesterolemia. And of the 403 study subjects, who did not have a history of CVD, 45 (11%) had a score of definite, 74 (19%) had probable, 138 (34%) had possible, and 146 (36%) had unlikely familial hypercholesterolemia.

Two hundred and one subjects had a history of coronary artery disease (CAD). Of the 201 study subjects who had a history of CAD, 30 (15%) had a score of definite, 35 (17%) had probable, 66 (33%) had possible, and 70 (35%) had unlikely familial hypercholesterolemia. And from the 328 study subjects, who did not have a history of CAD, 34 (10%) had a score of definite, 65 (20%)

had probable, 119 (36%) had possible, and 110 (34%) had unlikely familial hypercholesterolemia.

Table 2 shows the summary of the prevalence of the subcategory of familial

Table 2. Prevalence of each subcategory of familial hypercholesterolemia using the DLN Criteria based on demographic and clinical profiles.

	Unlikely	Possible	Probable	Definite
	n/N (%)	n/N (%)	n/N (%)	n/N (%)
Age (Years)				
19 - 26	0 (0%)	3 (0.6%)	1 (0.2%)	0 (0%)
27 - 35	0 (0%)	4 (0.8%)	8 (2%)	7 (1%)
36 - 44	1 (0.2%)	10 (2%)	26 (5%)	21 (4%)
45 - 53	18 (3%)	30 (6%)	24 (5%)	16 (3%)
54 - 62	43 (8%)	55 (10%)	24 (5%)	13 (3%)
63 - 71	56 (11%)	40 (8%)	8 (2%)	5 (0.9%)
72 - 80	39 (7%)	33 (6%)	5 (0.9%)	2 (0.4%)
81 - 89	20 (4%)	9 (2%)	2 (0.4%)	0 (0%)
89 - 96	3 (0.6%)	1 (0.2%)	2 (0.4%)	0 (0%)
Gender				
Male	93(18%)	58 (11%)	44 (8%)	32 (6%)
Female	87 (16%)	127 (24%)	56 (11%)	32 (6%)
BMI				
Underweight	3 (0.5%)	2 (0.4%)	2 (0.4%)	1 (0.2%)
Normal	79 (15%)	67 (13%)	27 (5%)	17 (3%)
Overweight	38 (7%)	44 (8%)	23 (4%)	11 (2%)
Obese I	49 (9%)	60 (11%)	36 (7%)	23 (4%)
Obese II	11 (2%)	12 (2%)	12 (2%)	12 (2%)
Smoker				
Yes	80 (15%)	53 (10%)	32 (6%)	25 (5%)
No	100 (19%)	132 (25%)	68 (13%)	39 (7%)
Alcoholic Beverage Drinker				
Yes	83 (16%)	54 (10%)	39 (7%)	31 (6%)
No	97 (18%)	131 (25%)	61 (12%)	33 (6%)
Hypertension				
Yes	139 (26%)	147 (28%)	74 (14%)	59 (11%)
No	41 (8%)	38 (7%)	26 (5%)	5 (0.9%)
Diabetes Mellitus				
Yes	56 (11%)	44 (8%)	32 (6%)	25 (5%)
No	124 (23%)	141 (27%)	68 (13%)	39 (7%)
CVD				
Yes	34 (6%)	47 (9%)	26 (5%)	19 (4%)
No	146 (28%)	138 (26%)	74 (14%)	45 (9%)
CAD				
Yes	70 (13%)	66 (12%)	35 (7%)	30 (6%)
No	110 (21%)	119 (22%)	65 (12%)	34 (6%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

hypercholesterolemia based on the DLN criteria, namely, unlikely, possible, probable, and definite familial hypercholesterolemia, based on the age, gender, BMI, smoking and alcoholic beverage drinking habits, presence of hypertension, diabetes, CVD, and CAD.

Definite familial hypercholesterolemia was highest among the 36 to 44 years age group at 4% (21 of 529), among those with BMI classified under Obese I at 4% (23 of 529), among non-smokers at 7% (39 of 529), and hypertensive study subjects at 11% (59 of 529).

There was an equal number of definite familial hypercholesterolemia among male and female study subjects at 6% each (32 of 529), alcoholic and non-alcoholic beverage drinkers at 6%, and those with or without a history of coronary artery disease (CAD) at 6%.

Definite familial hypercholesterolemia was more common among non-diabetics and those without a history of cerebrovascular disease (CVD).

Table 3 shows the summary table of the test of a significant relationship between the demographic and clinical profiles of the study population to familial hypercholesterolemia using the chi-square test.

As shown in the table, age, gender, BMI, smoking and alcoholic beverage drinking history, and hypertension were significantly correlated with familial hypercholesterolemia. The computed chi-square test of all these mentioned variables was higher than the tubular value. The significance level was set at 0.05.

Table 4 shows the demographic and clinical profiles of the female study subjects classified under definite familial hypercholesterolemia. There were 32 female study subjects who were classified under definite familial hypercholesterolemia.

Based on age, definite familial hypercholesterolemia has the highest prevalence, at 25% (8 out of 32), between the ages of 54 to 62 years. And based on

Table 3. Relationship between the demographic and clinical profile of the study population to heterozygous familial hypercholesterolemia.

Profile	Computed X^2	Tabular Value	Degree of Freedom	Significance Level	Interpretation
Age	168.87	36.415	24	0.05	Significant
Gender	17.09	7.81	3	0.05	Significant
Smoking	10.87	7.81	3	0.05	Significant
Alcoholic Beverage Drinking	13.69	7.81	3	0.05	Significant
BMI	21.40	21.03	12	0.05	Significant
CVD	4.14	7.81	3	0.05	Not Significant
CAD	3.00	7.81	3	0.05	Not Significant
Hypertension	8.63	7.81	3	0.05	Significant
Diabetes Mellitus	6.22	7.81	3	0.05	Not Significant

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

Table 4. Demographic and clinical profiles of female study subjects classified under definite familial hypercholesterolemia.

	n/N (%)
Age (Years)	
19 - 26	0/32 (0%)
27 - 35	4/32 (13%)
36 - 44	7/32 (22%)
45 - 53	6/32 (19%)
54 - 62	8/32 (25%)
63 - 71	5/32 (16%)
72 - 80	2/32 (6%)
81 - 89	0/32 (0%)
89 - 96	0/32 (0%)
BMI	
Underweight	1/32 (3%)
Normal	10/32 (31%)
Overweight	3/32 (9%)
Obese I	13/32 (41%)
Obese II	5/32 (16%)
Smoking History	
Smoker	1/32 (3%)
Non Smoker	31/32 (97%)
Alcoholic Beverage Drinker	
Yes	2/32 (6%)
No	30/32 (94%)
Hypertension	
Yes	28/32 (87%)
No	4/32 (13%)
Diabetes Mellitus	
Yes	7/32 (22%)
No	25/32 (78%)
CVD	
Yes	7/32 (22%)
No	25/32 (78%)
CAD	
Yes	10/32 (31%)
No	12/32 (69%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

BMI, it was noted to be highest for those study subjects under Obese I at 41% (13 out of 32).

The majority of the female study subjects with definite familial hypercholesterolemia were non-smokers and non-alcoholic beverage drinkers.

There were 28 out of 32 female study subjects (87%) with definite familial hypercholesterolemia who have hypertension. Seven out of 32 female study subjects with definite familial hypercholesterolemia have diabetes, 7 out of 32 (22%)

have cerebrovascular disease, and 10 out of 32 (31%) have coronary artery disease.

Table 5 shows the demographic and clinical profiles of the male study subjects classified under definite familial hypercholesterolemia. There were 32 male study subjects who were classified under definite familial hypercholesterolemia.

Based on age, definite familial hypercholesterolemia has the highest prevalence, at 44% (14 out of 32), between the ages 36 to 44 years among male study

Table 5. Demographic and clinical profiles male study subjects classified under definite familial hypercholesterolemia.

	n/N (%)
Age (Years)	
19 - 26	0/32 (0%)
27 - 35	3/32 (9%)
36 - 44	14/32 (44%)
45 - 53	10/32 (31%)
54 - 62	5/32 (16%)
63 - 71	0/32 (0%)
72 - 80	0/32 (0%)
81 - 89	0/32 (0%)
89 - 96	0/32 (0%)
BMI	
Underweight	0/32 (0%)
Normal	7/32 (22%)
Overweight	7/32 (22%)
Obese I	12/32 (37%)
Obese II	6/32 (19)
Smoking History	
Smoker	24/32 (75%)
Non Smoker	8/32 (25%)
Alcoholic Beverage Drinker	
Yes	29/32 (91%)
No	3/32 (9%)
Hypertension	
Yes	29/32 (91%)
No	3/32 (9%)
Diabetes Mellitus	
Yes	16/32 (50%)
No	16/32 (50%)
CVD	
Yes	12/32 (38%)
No	20/32 (62%)
CAD	
Yes	19/32 (59%)
No	14/32 (41%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

subjects. And based on BMI, it was noted to be highest for those study subjects under Obese I at 37%% (12 out of 32).

The majority of the male study subjects with definite familial hypercholesterolemia were smokers and alcoholic beverage drinkers.

There were 29 out of 32 male study subjects (91%) with definite familial hypercholesterolemia who have hypertension. Sixteen out of 32 (50%) of the male study subjects with definite familial hypercholesterolemia have diabetics, 12 out of 32 (38%) have cerebrovascular disease, and 19 out of 32 (59%) have coronary artery disease.

Table 6 shows the demographic and clinical profiles of the hypertensive study

Table 6. Demographic and clinical profiles of hypertensive study subjects classified under definite familial hypercholesterolemia.

	Male	Female	Total
Age (Years)	n/N (%)	n/N (%)	n/N (%)
19 - 26	0/29 (0%)	0/28 (0%)	0/57 (0%)
27 - 35	3/29 (10%)	2/28 (7%)	5/57 (9%)
36 - 44	13/29 (45%)	6/28 (21%)	19/57 (33%)
45 - 53	8/29 (28%)	6/28 (21%)	14/57 (25%)
54 - 62	5/29 (17%)	7/28 (25%)	12/57 (21%)
63 - 71	0/29 (0%)	5/28 (18%)	5/57 (9%)
72 - 80	0/29 (0%)	2/28 (7%)	2/57 (4%)
81 - 89	0/29 (0%)	0/28 (0%)	0/57 (0%)
89 - 96	0/29 (0%)	0/28 (0%)	0/57 (0%)
BMI			
Underweight	0/29 (0%)	0/28 (0%)	0/57 (0%)
Normal	7/29 (24%)	9/28 (32%)	16/57 (28%)
Overweight	5/29 (17%)	2/28 (7%)	7/57 (12%)
Obese I	11/29 (38%)	12/28 (43%)	23/57 (40%)
Obese II	6/29 (21%)	5/28 (18%)	11/57 (19%)
Smoking History			
Smoker	21/29 (72%)	1/28 (4%)	22/57 (39%)
Non Smoker	8/29 (28%)	27/28 (96%)	35/57 (61%)
Alcoholic Beverage Drinker			
Yes	26/29 (90%)	1/28 (4%)	27/57 (47%)
No	3/29 (10%)	27/28 (96%)	30/57 (53%)
Diabetes Mellitus			
Yes	15/29 (52%)	4/28 (14%)	19/57 (33%)
No	14/29 (48%)	24/28 (86%)	38/57 (67%)
CVD			
Yes	10/29 (34%)	7/28 (25%)	17/57 (30%)
No	19/29 (66%)	21/28 (75%)	40/57 (70%)
CAD			
Yes	17/29 (59%)	10/28 (36%)	27/57 (47%)
No	12/29 (41%)	18/28 (64%)	30/57 (53%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

subjects classified under definite familial hypercholesterolemia. There were 29 male and 28 female hypertensive study subjects who were classified under definite familial hypercholesterolemia.

Based on age, hypertensive study subjects with definite familial hypercholesterolemia have the highest prevalence, at 33% (19 out of 57), between the ages of 36 to 44 years. And based on BMI, it was noted to be highest for those study subjects under Obese I at 40% (23 out of 57).

The majority of the hypertensive study subjects with definite familial hypercholesterolemia were non-smokers at 61% (35 out of 57) and non-alcoholic beverage drinkers at 53% (30 out of 57).

There were 38 out of 57 hypertensive study subjects (67%) with definite familial hypercholesterolemia who have diabetes. Forty out of 57 (70%) of the hypertensive study subjects with definite familial hypercholesterolemia have CVD and 30 out of 57 (53%) have coronary artery disease.

Table 7 shows the demographic and clinical profiles of the diabetic study subjects classified under definite familial hypercholesterolemia. There were 16 male and 7 female diabetic study subjects who were classified under definite familial hypercholesterolemia.

Based on age, diabetic study subjects with definite familial hypercholesterolemia have the highest prevalence, at 35% (8 out of 23), between the ages of 36 to 44 years. And based on BMI, it was noted to be highest for those study subjects under Obese I at 35% (5 out of 23).

The majority of the diabetic study subjects with definite familial hypercholesterolemia were smokers at 52% (12 out of 23) and alcoholic beverage drinkers at 61% (14 out of 23).

There were 19 out of 23 diabetic study subjects (83%) with definite familial hypercholesterolemia who have hypertension. Three of 23 (13%) of the diabetic study subjects with definite familial hypercholesterolemia have CVD and 14 out of 23 (61%) have coronary artery disease.

Table 8 shows the demographic and clinical profiles of the study subjects classified with a history of cerebrovascular disease (CVD) under definite familial hypercholesterolemia. There were 12 male and 7 female study subjects with a history of CVD who were classified under definite familial hypercholesterolemia.

Based on age, study subjects with CVD classified under definite familial hypercholesterolemia have the highest prevalence, at 26% (5 out of 19), between the ages of 45 to 53 years and 54 to 62 years. And based on BMI, it was noted to be highest for those study subjects under Overweight and Obese I, both at 27% (7 out of 19).

The majority of the study subjects who have CVD with definite familial hypercholesterolemia were smokers at 58% (11 out of 19) and alcoholic beverage drinkers at 68% (13 out of 19).

There were 17 out of 19 (89%) study subjects with CVD classified under definite familial hypercholesterolemia that have hypertension. Three of 19 (16%) of

Table 7. Demographic and clinical profiles of diabetic study subjects classified under definite familial hypercholesterolemia.

	Male	Female	Total
Age (Years)	n/N (%)	n/N (%)	n/N (%)
19 - 26	0/16 (0%)	0/7 (0%)	0/23 (0%)
27 - 35	0/16 (0%)	3/7 (43%)	3/23 (13%)
36 - 44	7/16 (44%)	1/7 (14%)	8/23 (35%)
45 - 53	5/16 (31%)	1/7 (14%)	6/23 (26%)
54 - 62	4/16(25%)	1/7 (14%)	5/23 (22%)
63 - 71	0/16 (0%)	1/7 (14%)	1/23 (4%)
72 - 80	0/16 (0%)	0/7 (0%)	0/23 (0%)
81 - 89	0/16 (0%)	0/7 (0%)	0/23 (0%)
89 - 96	0/16 (0%)	0/7 (0%)	0/23 (0%)
BMI			
Underweight	0/16(0%)	1/7 (14%)	1/23 (4%)
Normal	3/16 (19%)	1/7 (14%)	4/23 (17%)
Overweight	3/16 (19%)	2/7 (29%)	5/23 (22%)
Obese I	6/16 (37%)	2/7 (29%)	8/23 (35%)
Obese II	4/16 (25%)	1/7 (14%)	5/23 (22%)
Smoking History			
Smoker	12/16 (75%)	0/7 (0%)	12/23 (52%)
Non Smoker	4/16 (25%)	7/7 (100%)	11/23 (48%)
Alcoholic Beverage Drinker			
Yes	14/16 (88%)	0/7 (0%)	14/23 (61%)
No	2/16 (12%)	7/7 (100%)	9/23 (29%)
Hypertensive			
Yes	15/16 (94%)	4/7 (57%)	19/23 (83%)
No	1/16 (6%)	3/7 (43%)	4/23 (17%)
CVD			
Yes	3/16 (19%)	0/7 (0%)	3/23 (13%)
No	13/16 (81%)	7/7 (100%)	20/23(87%)
CAD			
Yes	9/16 (56%)	0/7 (0%)	9/23 (39%)
No	7/16 (44%)	7/7 (100%)	14/23 (61%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

the study subjects who have CVD classified under definite familial hypercholesterolemia have diabetes and 10 out of 19 (53%) have coronary artery disease.

Table 9 shows the demographic and clinical profiles of the study subjects with coronary artery disease (CAD) classified under definite familial hypercholesterolemia. There were 19 male and 10 female study subjects with CAD who were classified under definite familial hypercholesterolemia.

Based on age, study subjects who have CAD with definite familial hypercholesterolemia have the highest prevalence, at 34% (10 out of 29), between the ages of 45 to 53 years. And based on BMI, it was noted to be highest for those study subjects under Obese I at 34% (10 out of 29).

Table 8. Demographic and clinical profiles of CVD study subjects classified under definite familial hypercholesterolemia.

	Male	Female	Total
Age (Years)	n/N (%)	n/N (%)	n/N (%)
19 - 26	0/12 (0%)	0/7 (0%)	0/19 (0%)
27 - 35	3/12 (25%)	0/7 (0%)	3/19 (16%)
36 - 44	4/12 (33%)	0/7 (0%)	4/19 (21%)
45 - 53	4/12 (33%)	1/7 (14%)	5/19 (26%)
54 - 62	1/12 (8%)	4/7 (57%)	5/19 (26%)
63 - 71	0/12 (0%)	1/7 (14%)	1/19 (5%)
72 - 80	0/12 (0%)	1/7 (14%)	1/19 (5%)
81 - 89	0/12 (0%)	0/7 (0%)	0/19 (0%)
89 - 96	0/12 (0%)	0/7 (0%)	0/19 (0%)
BMI			
Underweight	0/12 (0%)	0/7 (0%)	0/19 (0%)
Normal	3/12 (25%)	1/7 (14%)	4/19 (21%)
Overweight	6/12 (50%)	1/7 (14%)	7/19 (27%)
Obese I	3/12 (25%)	4/7 (57%)	7/19 (27%)
Obese II	0/12 (0%)	1/7 (14%)	1/19 (5%)
Smoking History			
Smoker	10/12 (83%)	1/7 (14%)	11/19 (58%)
Non Smoker	2/12 (17%)	6/7 (86%)	8/19 (42%)
Alcoholic Beverage Drinker			
Yes	12/12 (100%)	1/7 (14%)	13/19 (68%)
No	0/12 (0%)	6/7 (86%)	6/19 (32%)
Hypertensive			
Yes	10/12 (83%)	7/7 (100%)	17/19 (89%)
No	2/12 (17%)	0/7 (0%)	2/19 (11%)
Diabetic			
Yes	3/12 (25%)	0/7 (0%)	3/19 (16%)
No	9/12 (75%)	7/7 (100%)	16/19 (84%)
CAD			
Yes	9/12 (75%)	1/7 (14%)	10/19 (53%)
No	3/12 (25%)	6/7 (86%)	9/19 (47%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

The majority of the study subjects who have CAD with definite familial hypercholesterolemia were smokers at 52% (15 of 29) and alcoholic beverage drinkers at 57% (17 of 29).

There 28 out of 29 (97%) study subjects who had CAD with definite familial hypercholesterolemia are hypertensive. 9 out of 29 (31%) of the study subjects who had CAD with definite familial hypercholesterolemia have diabetes and 10 out of 29 (34%) have CVD.

4. Discussion

In the result of this study, 64 (12%) of the study population, and 1.3% of the

Table 9. Demographic and clinical profiles of CAD study subjects classified under definite familial hypercholesterolemia.

	Male	Female	Total
Age (Years)	n/N (%)	n/N (%)	n/N (%)
19 - 26	0/19 (0%)	0/10 (0%)	0/29 (0%)
27 - 35	2/19 (11%)	1/10 (10%)	3/29 (10%)
36 - 44	7/19 (37%)	1/10 (10%)	8/29 (28%)
45 - 53	7/19 (37%)	3/10 (30%)	10/29 (34%)
54 - 62	3/19 (16%)	3/10 (30%)	6/29 (21%)
63 - 71	0/19 (0%)	2/10 (20%)	2/29 (7%)
72 - 80	0/19 (0%)	0/10 (0%)	0/29 (0%)
81 - 89	0/19 (0%)	0/10 (0%)	0/29 (0%)
89 - 96	0/19 (0%)	0/10 (0%)	0/29 (0%)
BMI			
Underweight	0/19 (0%)	0/10 (0%)	0/29 (0%)
Normal	5/19 (26%)	3/10 (30%)	8/29 (28%)
Overweight	4/19 (21%)	1/10 (10%)	5/29 (17%)
Obese I	6/19 (31%)	4/10 (40%)	10/29 (34%)
Obese II	4/19 (21%)	2/10 (20%)	6/29 (21%)
Smoking History			
Smoker	15/19 (79%)	0/10 (0%)	15/29 (52%)
Non Smoker	4/19 (21%)	10/10 (100%)	14/29 (48%)
Alcoholic Beverage Drinker			
Yes	17/19 (89%)	0/10 (0%)	17/29 (57%)
No	2/19 (11%)	10/10 (100%)	12/29 (41%)
Hypertensive			
Yes	18/19 (95%)	10/10 (100%)	28/29 (97%)
No	1/19 (5%)	0/10 (0%)	1/29 (3%)
Diabetic			
Yes	9/19 (47%)	0/10 (0%)	9/29 (31%)
No	10/19 (53%)	10/10 (100%)	20/29 (69%)
CVD			
Yes	9/19 (47%)	1/10 (10%)	10/29 (34%)
No	10/19 (53%)	9/10 (90%)	19/29 (66%)

CVD = Cerebrovascular Disease. CAD = Coronary Artery Disease.

general Internal Medicine Admission of our institution fulfilled the criteria of definite familial hypercholesterolemia using the DLN criteria, excluding the genetic testing. This result should raise the awareness of our healthcare providers that familial hypercholesterolemia exists in our setting, and may even be more common than what is known worldwide. Early detection and management of familial hypercholesterolemia especially for those with a high likelihood of inheriting the disease cannot be over-emphasized.

In this study, the prevalence of heterozygous familial hypercholesterolemia at 12% was described for the first time in the Bicol Region, which is considered the Region with the highest prevalence of elevated total cholesterol and LDL-C levels

based on the 8th National Nutrition Survey of the Philippines done by the Food and Nutrition Research Institute on April 2014. The high prevalence rate obtained from this study may be due primarily to the fact that the researcher gathered a study population already diagnosed with dyslipidemia, and hence concentrated the population. Hence, this may have over-estimated the diagnosis, and it is recommended for future studies to increase the population, and to include all adults admitted to the institution, regardless of their lipid profile result.

According to numerous published studies [1]-[6] [10] [11] [12] [13], familial hypercholesterolemia is a major risk factor for cardiovascular disease and premature coronary artery disease, and yet very much under recognized and under diagnosed worldwide. The same thing is true in the Philippines and in Bicol Region in particular. This study made the healthcare practitioners in our institution to be aware of familial hypercholesterolemia, its implication on premature coronary artery disease and cerebrovascular disease, and the importance of its early detection and management.

This study also found that definite familial hypercholesterolemia was not associated with gender, BMI, smoking or alcoholic beverage drinking habits, and the presence of diabetes, cerebrovascular disease (CVD), and coronary artery disease (CAD). Hypertension, however, was significantly correlated to the presence of definite familial hypercholesterolemia. It was also noted that hypertension, diabetes, cerebrovascular disease (CVD), and coronary artery disease (CAD) occurred very early in patients with definite familial hypercholesterolemia.

The study was done in a single tertiary hospital with only a 150-bed capacity. The study population was also limited to the adult population, which was the scope of expertise of the primary researcher.

Another variable that limited the scope of the study is the unavailability of the genetic test in our setting. Also, the population below 35 years of age seldom had their lipid profiles checked unless they are already symptomatic.

The researchers recommend that a local registry for familial hypercholesterolemia patients and their at-risk relatives be established in order to assist in cascade screening so that early recognition and treatment can be done.

It is also recommended that the study population diagnosed with probable and definite familial hypercholesterolemia, even without the genetic test, is counseled and their family members advised with regards to the risk of inheriting said disease, so that early diagnosis and prevention can be done.

Further study should be conducted with a larger number of study populations. Collaboration with Pediatricians can be carried out so that pediatric patients could be included in the study population. Also, the general population could be used as a study population where study subjects can be chosen by randomization so that even those asymptomatic can be included, and hence, primary prevention can be done.

5. Conclusions

This study showed that familial hypercholesterolemia exists in 12% of patients with dyslipidemia and 1.3% in the general population.

We have recorded a higher prevalence of heterozygous familial hypercholesterolemia compared to the worldwide prevalence. This study showed that familial hypercholesterolemia is an under recognized and under treated disease in our region, and probably in the Philippines as well.

Familial hypercholesterolemia may merely be treated as plain and simple dyslipidemia by most clinicians today. This study however should raise awareness of this dangerous genetic disease, as its implication to premature coronary artery disease and cerebrovascular disease is massive. This awareness is the key to the prevention of these fatal complications.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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