Non-Communicable Diseases and Non-Modifiable Risk Factors: Analysis of the Situation in Three Ecuadorian Cities, 2023

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KEYWORDS
Noncommunicable Diseases, Sex Factors, Age Factors, Sex Factors, Ethnic Group, Heredity.

ABSTRACT:
Introduction: noncommunicable diseases (NCDs) have become the main causes of morbidity and mortality worldwide and their incidence and prevalence is increasing. Objective: to analyze nonmodifiable risk factors for NCDs in Azogues, Biblián and Déleg. Methodology: observational, descriptive-correlatonial study in a probabilistic sample of 993 people (men and women), over 20 years of age, residents of District 03D01, applying the survey technique, through a validated questionnaire for the detection of disease risk factors chronic-degenerative. Statistical analysis was performed in the Jamovi software, using nonparametric tests such as Chi-square of homogeneity and other coefficients to measure the effect size "Cohen's d" and the strength of association "Cramer's V". Results: median age 39 years, women (69.1%), "mestizos" (99.4%), from rural areas (64.8%), with secondary education (47.4%), married (59.9%), hypertensive (32%), diabetics (12%), chronic respiratory disease (10%), thyroid disease (5%), heart disease (2%), cancer (1%), overweight/obesity (56%), dyslipidemias (23%). Conclusions: Nonmodifiable factors such as age, ethnicity, sex and family history are determining factors in the development of NCDs, and in District 03D01 they are significantly associated ($p<0.05$), especially with diabetes and arterial hypertension.

1. Introduction

In the world, non-communicable diseases (NCDs) are becoming more and more frequent (diabetes, cardiovascular diseases, cancer, chronic respiratory diseases, among others). Studies have shown that cardiovascular conditions (heart failure, high blood pressure, hypercholesterolemia, myocardial infarction, angina pectoris, arrhythmias) are the leading cause of mortality and disability globally, generating around 41 million deaths per year and the consumption of large amounts of resources in health systems [1,2].

The World Health Organization (WHO) points out that NCDs are those pathologies that do not originate from acute infection and can cause long-term complications with the consequent need for prolonged treatment and special care due to disability [2]. Diabetes mellitus (DM) and arterial hypertension (HTN) are the non-communicable pathologies that commonly cause cardiovascular complications [1,2].

Diabetes is one of the highly prevalent and rapidly rising NCDs, the global report on diabetes published in 2016 by the WHO indicates that it is a progressive chronic pathology that brings with it the presence of several complications, disability and high costs in treatment, increasing the risk of dying prematurely [3]. For its part, worldwide in 2019 there were around 828 million people with hypertension, causing 10.8 million deaths.

In low-income countries, the prevalence of hypertension was 40% [4]. HTN is a complex pathology resulting from the imbalance between cardiac output and peripheral vascular resistance, affecting the renal, hormonal, cardiovascular and neurological systems, which have a genetic (30-50%) and environmental origin, the latter causing epigenetic modifications [5]. Similarly, obesity is an important risk factor related to hypertension, coronary heart disease and diabetes [6].

DM is considered a serious public health problem due to its high incidence and prevalence, which predisposes to the presence of kidney, cardiovascular and cerebrovascular diseases, blindness, neuropathies and

amputations [7]. In addition, 58% of all cases of diabetes are associated with a body mass index (BMI) with values equal to or greater than 25 kg/m2 [6].

In short, NCDs are due to multifactorial situations, including overweight and obesity, which can trigger lipid disorders and high blood glucose levels. The prevalence of these factors varies from one region to another, in some Latin American countries overweight is around 60% and obesity 26%, on the contrary, in Northeast Asia overweight is found in a proportion of 14% and obesity in 3% [8].

In Latin America, low- and middle-income countries are in a period of epidemiological transition boosted by the phenomena of globalization and high rates of migration from rural to urban areas, positioning NCDs as the main cause of morbidity and mortality, leaving pathologies due to nutritional and infectious deficiencies in the background [9]. In the Americas, about 5.5 million deaths are reported each year due to NCDs, of which about 15 million are premature deaths, that is, they occur in people between 30 and 69 years of age and 85% of these deaths occur in low- and middle-income countries [2].

The Pan American Health Organization (PAHO) conducted a survey in 7 Central American countries (Belize, Costa Rica, El Salvador, Honduras, Guatemala and Nicaragua), reporting a prevalence of 8.5% of diabetes mellitus and 25.3% of high blood pressure, with a higher frequency in women and people over 39 years of age who have risk factors such as: overweight, sedentary lifestyle, hypercholesterolemia, and measurements greater than the healthy maximum waist circumference [9].

In Spain, the prevalence of hypertension is 42.6%, being slightly higher in men at relatively young ages, however, as age advances, the prevalence of hypertension increases in females until at 70 years of age the frequency exceeds that reported in men. On the other hand, 63.7% knew about their condition, deducing that around 6 million people who suffer from hypertension are not diagnosed. Only a quarter (26.6%) of patients with a diagnosis receive treatment and the risk factors identified were: overweight, obesity and concomitant diabetes [10].

In the United States, the national diabetes statistics report explains that in 2018 the prevalence of this disease was 8.2% (26.9 million people), of this proportion, approximately 210 thousand people were under 20 years of age, while 10% of the entire diabetic population uses insulin as treatment within the first year after diagnosis [11].

In Mexico, the 2020 National Health and Nutrition Survey detailed that the main risk factors for hypertension are: high sodium intake, excessive and prolonged consumption of alcohol and tobacco, sedentary lifestyle, unhealthy diets, dyslipidemia, overweight, obesity and diabetes. In 2018, 49.2% of the low-income population had hypertension and of these, only 47.1% were diagnosed [4].

In Colombia, Vásquez et al [12] mention that 40% of the population over 25 years of age suffers from hypertension, causing 9.4 million deaths per year due to its complications. Risk factors include: high salt and fat consumption, lack of physical activity, low consumption of fruits and vegetables, overweight, obesity, psychological stress, low income, low schooling, poor health infrastructure, and consumption of alcohol, tobacco, and other drugs. Participants reported that at least one family member had diabetes and 41% reported having family members with hypertension, in addition, 44% of the study participants were overweight and 17% obese.

In Peru, a meta-analysis carried out by Ruíz et al. in 2022 determined that the prevalence of hypertension ranges between 20 and 25%, being associated with factors such as obesity and diabetes, with a higher frequency in men than in women, with an annual incidence of 4% in the general population, in which only half of the cases have a previous diagnosis of the disease [13].

In recent years, Chile has seen a considerable increase in the prevalence of DM. The National Health Survey (NHS) carried out in a sample of 5,412 people over 15 years of age measured BMI and classified the study subjects according to their nutritional status according to the parameters proposed by the WHO, that is: normal 18.5 to 24.9 kg/m2, overweight 25 to 29.9 kg/m2 and obesity greater than 30 kg/m2. It was found that only 13.5% had a normal BMI and most diabetics had a BMI greater than 25 kg/m2, who performed less time of physical activity, consumed excess salt and few fruits and vegetables. A family history of diabetes and several metabolic complications were also observed in the participating diabetics [14].

According to reports from the Ecuadorian Institute of Statistics and Census (INEC), during 2019 and 2020 NCDs were among the leading causes of mortality in the country and particularly in 2020 the presence of SARS-CoV-2 infection caused diabetes, hypertension and cerebrovascular pathologies to occupy the third, fourth and fifth place in overall mortality. Likewise, in 2021, COVID-19 was the leading cause of death, followed by non-communicable pathologies such as: ischemic heart disease, diabetes, hypertensive and cerebrovascular diseases [15].

A descriptive-cross-sectional study called "Prevalence of type 2 Diabetes Mellitus and its risk factors in adult individuals", carried out in the urban parishes of the city of Cuenca, Ecuador, in a sample of 318 adult individuals, with a mean age of 42.7 years, revealed that 39.7% were overweight and 23.7% obese. The prevalence of diabetes was 5.7%, demonstrating that age, family history, and BMI increase the risk of diabetes [16].

Also in Paute, Ecuador, a group of researchers published the results of a descriptive-cross-sectional study on the epidemiological behavior of diabetes in a public hospital, with the participation of 135 patients between 18 and 65 years of age, mostly women (74%). It was evidenced that 37% of the sample had normal weight, 34.1% overweight and 28.9% obese. The prevalence of diabetes was higher in women with 26.7% and the significant risk factors were: male sex (OR=3.13), hypothyroidism (OR=7.75), sedentary lifestyle (OR=6.61), overweight (OR=6.63), obesity (OR=5.38) and age with OR=1.38 [17].

Another study carried out on the Ecuadorian coast, San Vicente parish, province of Manabí, in a sample of 157 diabetic or hypertensive subjects over 40 years of age, identified a prevalence of 11% for diabetes, 59% for hypertension and 30% for both pathologies at the same time. The presence of these pathologies was frequent in men and in the age group of 55 to 64 years (41%), pointing to lack of physical activity as the risk factor with the greatest presence [18].

The descriptive research of Beltrán et al. [19], carried out in Guayaquil, Ecuador, in a sample of 172 families belonging to the "Healthy Family and Communities" linkage project of the Santiago de Guayaquil University, found a prevalence of diabetes of 23.6%, where 48.3% consumed alcohol, tobacco and other drugs. Regarding the variable nutrition and food, 15.1% do not eat breakfast before going to work or study, 14% do not eat three times a day, 15% do not wash their hands before eating and 26.2% do not consume "safe water". Regarding physical activity, 70.6% of the participants indicated that they did not perform any type of physical activity.

It is essential to mention that during the last three years (from 2020 to 2023), the COVID-19 pandemic caused an interruption in the diagnosis and treatment of NCDs worldwide, this generated a negative impact and a considerable increase in the incidence and prevalence of NCDs. In the Region of the Americas, during the pandemic, more than 90% of countries stopped the provision of special health services for the management of diabetes, hypertension, and cancer screening, due to the lack of supplies, equipment, materials, and medicines to control these diseases [20]. Hence the importance of further research to demonstrate the real situation of NCDs.

In short, there are several risk factors associated with the development of NCDs, with modifiable factors being the most prevalent, however, non-modifiable factors such as age, sex at birth, ethnicity and hereditary family history may also be influential in the appearance and severity of NCDs [21]. In this context, the present research was carried out with the aim of analyzing the non-modifiable risk factors in the Ecuadorian cities of Azogues, Biblián and Déleg. The objective of the study was to determine the relationship between non-modifiable risk factors and the presence of noncommunicable diseases.

2. Material and method:

An observational, descriptive-correlational, cross-sectional study was carried out in District 03D01 of Ecuador, which includes the cities of Azogues, Biblián and Déleg.

The sample size was calculated based on a finite universe of 49,915 people over 20 years of age, using the EpiInfo® program with a confidence level of 95%, margin of error of 3% and an expected proportion of 38.8% (4,7,12, 22-29), resulting in a sample of 993 people. The sample design was a three-stage probabilistic type, which included in the final stage, the home visit using the Kish method to randomly select one person among all those living in the visited home.

The selection of participants was carried out randomly based on the following inclusion criteria: people over 20 years of age residing in the cities of Azogues, Biblián and Déleg, who agreed to be part of the study, signing the informed consent. Subjects under the influence of psychoactive substances, pregnant women, and people with intellectual disabilities certified by the corresponding Ecuadorian institution were excluded from the study.

The variables considered were: NCDs (dependent) and non-modifiable risk factors (independent), which served to formulate the null hypothesis: H0 = There is no association between non-modifiable risk factors and NCDs.

The survey technique was used, applying an instrument for the detection of risk factors for chronic-degenerative diseases, validated by Fernández-Altuna et al. [22] by means of expert judgment and factor analysis with a general agreement of 0.96 expressed by Aiken's V coefficient. The questionnaire consists of 53 questions included in 8 dimensions: a) hereditary family history, b) personal pathological history, c) current condition, c) physical activity, d) diet, e) substance use, f) rest habits, and g) physical examination.

The procedures for data collection were carried out by the research team and several highly trained collaborators (thesis students of the Nursing career at the Catholic University of Cuenca), between May 15, 2022 and March 31, 2023, taking into account the ethical principles of the Declaration of Helsinki. The research was part of the project called "Prevalence and risk factors associated with non-communicable diseases in the adult patient of District 03D01", approved by the Bioethics Committee in Research of the Health Area of the University of Cuenca (COBIAS-UCuenca) with code 2022-005EO-IE. The authors declare that they have no conflict of interest.

The data analysis plan was carried out using the Jamovi v2.3.28 program, according to the following detail:

1) Kolmogorov-Smirnov normality test and Levene homoscedasticity test;

2) Univariate analysis reflected in tables and figures that represent frequencies, percentages and measures of central tendency and dispersion, as appropriate;

3) Bivariate analysis, through hypothesis testing and association analysis using the Chi-square test ($\chi 2$), where a "p" value less than 0.05 was considered statistically significant. The strength of association between nominal variables was established using Cramer's V coefficient, while the effect size in numerical variables was estimated with Cohen's d (d).

3. Results:

A total of 993 people with NCDs were surveyed, residents of the cities of Azogues, Biblián and Déleg in District 03D01. Regarding age, it was found that the median in the participants was 39 years with an interquartile range (IQR) of 21, with the minimum age being 20 years and the maximum age 65 years. In Azogues the median was 51 (IQR=20), in Biblián 34 (IQR=13.3) and in Déleg 34 (IQR=15). Regarding the characteristics of the sample, there is evidence of a higher participation of women (69.1%; n=685), mestizo ethnicity (99.4%; n=986), residents of rural areas (64.8%; n= 643), secondary education level (47.4%; n=471), married (59.9%; n=595), without social security affiliation (78.6%; n=780). Table 1 explains these characteristics taking into account the participants' city of residence.

Table 1. Characterization of the sample. District 03D01

	City N=993		
Variable	Quicksilver: n=337	Biblián: n=384	Délege n=272
Age			
Median	51	34	34
IQR (Interquartile Range)	20	13,3	15
	f (% of total)	f (% of total)	f (% of total)
Sex at birth			
Man	112 (11,3)	125 (12,6)	71 (7,1)
Woman	225 (22,7)	259 (26,1)	201 (20,2)
Ethnic self-identification			
White	3 (0,3)	-	-

Indigenous	-	-	2 (0,2)
Mongrel	333 (33,5)	384 (38,7)	270 (27,2)
Other	1 (0,1)	-	-
Geographical area			
Urban	183 (18,4)	139 (14,0)	28 (2,8)
Rural	154 (15,5)	245 (24,7)	244 (24,6)
Level of education			
Primary	126 (12,7)	216 (21,8)	94 (9,5)
High school	165 (16,6)	147 (14,8)	159 (16,0)
Superior	46 (4,6)	21 (2,1)	19 (1,9)
Marital status			
Single	44 (4,4)	73 (7,4)	25 (2,5)
De facto union	33 (3,3)	98 (9,9)	25 (2,5)
Married	204 (20,6)	171 (17,2)	220 (22,2)
Divorced	48 (4,8)	37 (3,7)	2 (0,2)
Widow(er)	8 (0,8)	5 (0,5)	-
Social security			
Yes	95 (9,6)	39 (3,9)	78 (7,9)
No	242 (24,4)	345 (34,7)	194 (19,5)

Note: Age, sex, and ethnicity are considered NON-modifiable factors for NCDs.

The relative and absolute frequencies of NCDs in the study population were: hypertension 32% (n=318); diabetes mellitus 12% (n=119); chronic respiratory disease 101 (10%); thyroid disease 5% (n=46); heart disease 2% (n=19); and cancer 1% (n=13); while overweight/obesity and dyslipidemia are conditions that affect 56% (n=561) and 23% of the sample, respectively.

The most common NCDs were hypertension and DM, in this sense, hypertension is present in 50.4% of the participants in Azogues, in 30.5% of the inhabitants of Déleg and in 16.9% in Biblián. Likewise, the prevalence of DM reaches 22.3% in Azogues, 7.4% in Déleg, while in Biblián the proportion of diabetics reaches 6.3%.

Table 2 presents the bivariate analysis of hypertension with four non-modifiable risk factors: age, sex at birth, ethnicity, and hereditary family history. There is a significant association ($p < 0.001$) of hypertension with age and sex, although the size of the effect is small or weak (d or $V < 0.2$), being more frequent with increasing age and in a higher proportion in men (39.9%) than in women (28.5%). On the other hand, the hereditary family history was only significant ($p < 0.05$) when the father or children also had the disease, which had a weak strength of association ($V = 0.102$).

Table 2. Bivariate analysis of hypertension and non-modifiable factors.

Non-modifiable risk factors							
Category	HTN-Age f (%)				χ^2	p	d (Cohen)
YES	318 (32,0)				83,5	0,001	0,0841*
NO/DON'T KNOW	675 (68,0)						
Total	993 (100)						
	HTN-Sex at birth						
	Man f (%)		Woman f (%)		χ^2	p	V for Cramer
YES	123 (39,9)		195 (28,5)		17,8	0,001	0,134*
NO/DON'T KNOW	185 (60,1)		490 (71,5)				
Total	308 (100)		685 (100%)				
	HTN-ethnic self-identification						
	Mongrel f (%)	Indigenous f (%)	White f (%)	Other f (%)	χ^2	p	V for Cramer
YES	316 (32,0)	-	2 (66,7)	-	3,08	0,798	0,0394
NO/DON'T KNOW	671 (68,0)	2 (100)	1 (33,3)	1 (100)			

Total	987 (100)	2 (100)	3 (100)	1 (100)			
	HTN-Hereditary family history						
	Father f (%)	Mother f (%)	Sibling f (%)	Child f (%)			V for Cramer
YES	58 (18,2)	103 (32,4%)	33 (10,4)	36 (11,3)			
NO/DON'T KNOW	260 (81,8)	215 (67,6%)	285 (89,6)	282 (88,7)			
p	0,001	0,424	0.721	0,016			0,102*
Total	318 (100)	318 (100)	318 (100)	318 (100)			

Note: χ2= Chi-square. p = asymptotic significance. d (Cohen) = effect size. V = strength of association. *Weak association or small effect size.

Similarly, a significant association ($p<0.05$) was found between DM and the four non-modifiable risk factors that were analyzed, however, in the hereditary family history there was no statistical significance with maternal disease. In terms of age, the strength of association is moderate, and DM is more frequent in older ages, in women (12.6%) than in men (10.7%), in mestizos and in those who have parents (54.6%), children (11.8%) and siblings (9.2%) with the disease (see Table 3).

Table 3. Bivariate analysis: diabetes and NON-modifiable factors.

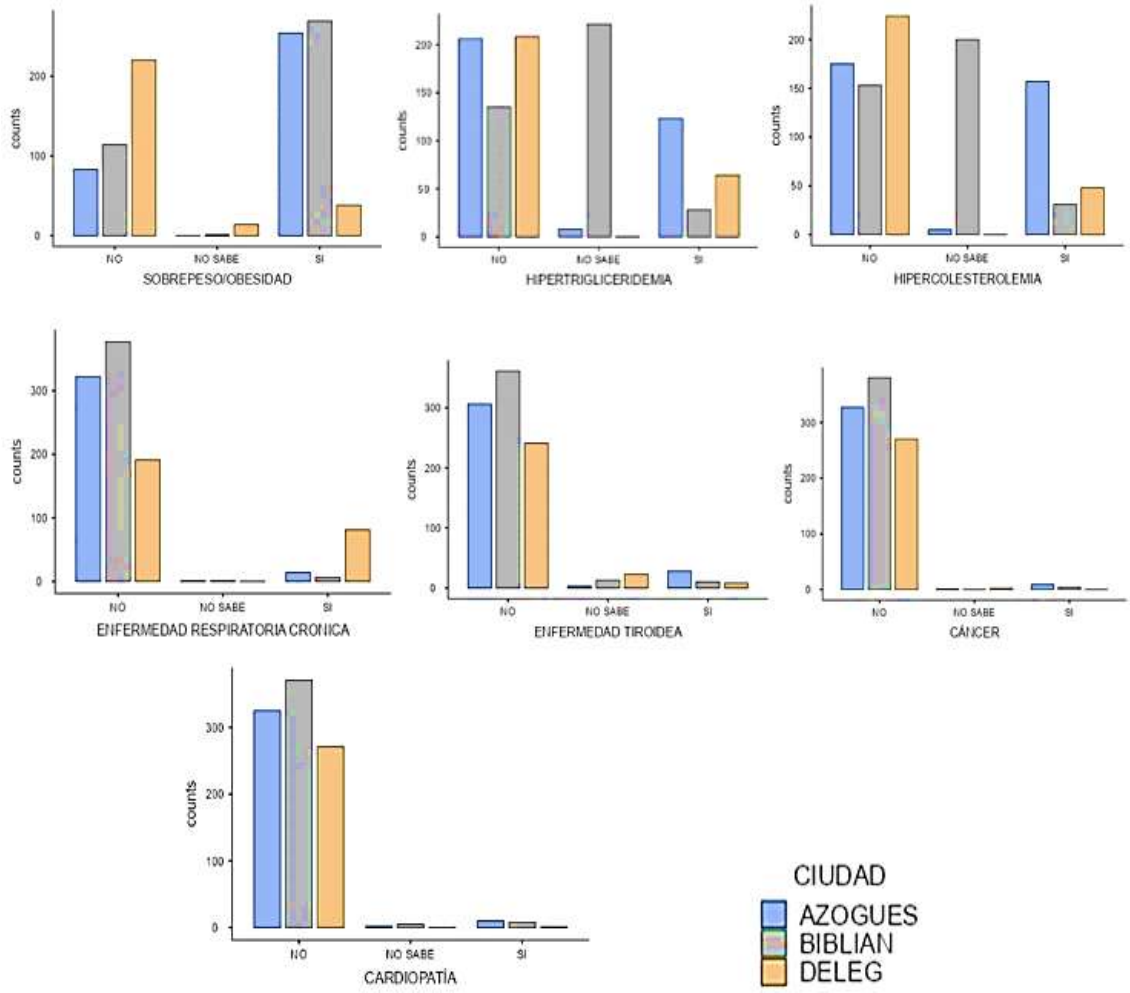
	Non-modifiable risk factors						
	Diabetes-Age						
Category	f (%)				χ2	p	d (Cohen)
YES	119 (12,0)						
NO/DON'T KNOW	874 (88,0)				201	0,001	0,203**
Total	993 (100)						
	Diabetes-Sex at birth						
	Man f (%)		Woman f (%)		χ2	p	V for Cramer
YES	33 (10,7)		86 (12,6)				
NO/DON'T KNOW	275 (89,3)		599 (87,4)		7,30	0,026	0,0858*
Total	308 (100)		685 (100)				
	Diabetes-Ethnic Self-Identification						
	Mongrel f (%)	Indigenous f (%)	White f (%)	Other f (%)	χ2	p	V for Cramer
YES	119 (12,1)	-	-	-			
NO/DON'T KNOW	868 (87,9)	2 (100%)	3 (100)	1 (100)	39,6	0,001	0,141*
Total	987 (100)	2 (100)	3 (100)	1 (100)			
	Diabetes-Hereditary family history						
	Father f (%)	Mother f (%)	Sibling f (%)	Child f (%)			V for Cramer
YES	65 (54,6)	43 (36,1)	11 (9,2)	14 (11,8)			
NO	54 (45,4)	76 (63,9)	108 (90,8)	105 (82,2)			
p	0,001	0,228	0,004	0,001			0,157*
Total	119 (100)	119	119	119			

Note: χ2= Chi-square. p = asymptotic significance. d (Cohen) = effect size. V = strength of association. *Weak association or small effect size. **Moderate effect size or association.

Regarding the rest of the NCDs, it was evidenced that in Azogues 75% suffer from overweight/obesity, while approximately 42% have high levels of cholesterol and triglycerides. In Biblián, a 70% prevalence of overweight/obesity and 8% of dyslipidemia was recorded, while in Déleg, 14% had a high BMI and about 21% had hypercholesterolemia and hypertriglyceridemia. The results also revealed that chronic respiratory disease is present in 30% of Déleg's sample, 4% in Azogues and 2% in Biblián. 8% of respondents from Azogueños

and 3% of participants from Biblián and Déleg stated that they had thyroid disease. On the other hand, the prevalence of heart disease in subjects with Azogues was 3%, in Biblián 2% and in Déleg less than 1%. With regard to cancer, 3% of the sample from Azogues reported having the disease, 1% in Biblián and in Déleg a prevalence of less than 1% was reported. Comparisons between cities for each pathology can be seen in Figure 1.

Figure 1. Other NCDs and associated conditions, by city of residence. In the original Spanish language.



The degree of association between non-modifiable factors and less prevalent NCDs (chronic respiratory disease, thyroid disease, heart disease, cancer, overweight/obesity and dyslipidemias) in the cities of District 03D01 is shown in Table 4, with significant differences in the prevalence of: thyroid disease, overweight/obesity and dyslipidemias with increasing age. In relation to sex, statistical significance ($p<0.05$) was found with: thyroid disease (female), heart disease (male), cancer (female) and hypertriglyceridemia (male), all of them with a weak strength of association. Ethnicity was not significantly associated with any of the NCDs analyzed, while hereditary family history correlated with chronic respiratory disease and overweight/obesity ($p<0.001$).

Table 4. Bivariate analysis: Other NCDs and non-modifiable factors. District 03D01

ENT	Age p (d)	Sex at birth p (V)	Ethnic group p (V)	Hereditary family history			
				Father p (V)	Mother p (V)	Bros. p (V)	Children p (V)
Chronic respiratory disease (n=101)	0,391 (0,0018)	0,059 (0,0754)	0,995 (0,0188)	0,286 (0,0502)	0.001 (0.208)**	0.001 (0.156)*	0.001 (0.405)**
Thyroid disease (n=46)	0.008 (0.0098)*	0.017 (0.0906)*	0,997 (0,0169)	-	-	-	-

Heart disease (n=19)	0,272 (0,0026)	0.038 (0.0812)*	1,000 (0,0090)	0,250 (0,0521)	0,691 (0,0336)	0,093 (0,0633)	0,993 (0,0111)
Cancer (n=13)	0,663 (0,000)	0.017 (0.0906)*	1,000 (0,0070)	0,131 (0,0597)	0,477 (0,0420)	0,050 (0,0691)	0,389 (0,0436)
Overweight/obesity (n=561)	0.001 (0.0350)*	0,696 (0,0270)	0,441 (0,0542)	0.001 (0.151)*	0.001 (0.200)*	0.001 (0.159)*	0.001 (0.184)*
Hypercholesterolemia (n=236)	0.001 (0.0833)*	0464 (0,0393)	0,468 (0,0532)	-	-	-	-
Hypertriglyceridemia (n=215)	0.001 (0.0853)*	0.001 (0.171)*	0,807 (0,0390)	-	-	-	-

Note: p = asymptotic significance. d (Cohen)= effect size. V = strength of association. *Weak association or small effect size. **Moderate effect size or association.

4. Discussion:

Worldwide, NCDs are the leading cause of death and permanent disability, in 2019 these diseases were among the top 10 causes of mortality [2,23]. Age, sex at birth, ethnicity, and hereditary family history are NON-modifiable factors that, when combined with modifiable factors, enhance the development of NCDs [21]. The present study carried out in the Ecuadorian cities of Azogues, Biblián and Déleg offers a situational analysis of NCDs and their association with non-modifiable factors in a sample of 993 people.

The sociodemographic characteristics establish a range of participation between 20 and 65 years of age (median of 39 years), mostly women (69.1%), mestizos (99.4%), rural areas (64.8%), married (59.9%), with secondary education (47.4%). The findings partially coincide with what was reported in Oaxaca, Mexico, where the sample had an age range of 20 to 60 years (average 39 years), 82.2% women, 64% married, although 37.8% of the sample had no degree of education [24]. In Peru, Sánchez et al. [25] published a study on risk factors for cardiovascular disease (which is a type of NCD) in a sample of 158 subjects with contrasting sociodemographic characteristics, where the mean age of the participants was 70.7 ±13.1 years, with a slight predominance of female participation (58.2%), explaining that approximately at 60 years of age, gender differences begin to decrease due to the presence of other comorbidities that equate the risks of NCDs.

The presence or absence of certain NCDs and related metabolic conditions (overweight/obesity and dyslipidemias) were investigated. The prevalences found in the 993 participants were: hypertension 32%, DM 12%, chronic respiratory disease 10%, thyroid disease 5%, heart disease 2%, cancer 1%, overweight/obesity 56% and dyslipidemia 23%. Azogues is the city with the highest proportions in all pathologies except chronic respiratory disease. When comparing this study with the Latin American context, in Mexico the prevalence of hypertension is 49.4% [4], which is different. Likewise, a study conducted in Antioquia, Colombia, in 194 people, showed prevalences that do not agree with District 03D01 of Ecuador, 20.9% of hypertension and 9.2% of DM, significantly associated with: marital status, age, family history, and sex at birth [12].

Barboza Palomino [7] in a sample of 412 adults aged 18 to 64 years, residing in Ayacucho, Peru, registers similar percentages of dyslipidemia prevalence (29.6%), while Díaz Ramírez [26] in the Venezuelan municipality of Sucre, reported relative frequencies of overweight/obesity of 54% in men and 46% in women, with a greater impact on people with limited economic resources. with incomplete secondary school, under forty years of age. In Cuba, Hernández et al. [27], in a sample of 1,200 people, 43.3% of obesity (predominantly male) and 21.21% of hypertension were found, values that are lower than those recorded in District 03D01 of Ecuador. In this context, PAHO/WHO [20] points out that the prevalence of NCDs has increased considerably since 2020 due to the COVID-19 pandemic, caused by the delay in the diagnosis and treatment of these pathologies, especially in low- and middle-income countries.

The statistical analysis allowed us to reject the null hypothesis (H0) in the correlations of NCDs with non-modifiable factors, highlighting that, in the cities of Azogues, Biblián and Déleg, there was a statistically significant association between DM and the 4 factors analyzed (age, sex, ethnicity and hereditary family history). HTN correlated with age, sex, and hereditary family history. Chronic respiratory disease only showed statistical significance with family history. Thyroid disease correlated with age and sex (female). Heart disease and cancer were only significantly associated with sex (male in heart disease and female in cancer). Metabolic conditions such as overweight/obesity were associated with age and family pathological history, while

dyslipidemia correlated with age and sex (male). In addition, it was observed that, with increasing age, the degree of association for NCDs increases.

In the publication by Tenahua et al. [24], 31% of the participants answered affirmatively when asked about the presence of a hereditary family history of NCDs, which is a percentage similar to that found in our study (32%) for hypertension, but is lower than that observed in DM (54.6%). Likewise, a study carried out in Loja, Ecuador by Carrión Ruiz et al. [28] for the screening of cardiovascular risk factors in a group of 228 participants, it was found that 53.3% had a family history of hypertension, 54.82% of diabetes mellitus, 29.38% of dyslipidemia, and 13.59% of obesity, these are proportions of greater magnitude than what was seen in our research, except for the hereditary family history of DM, which is similar. Uyaguari et al. [29], in Cuenca, Ecuador, showed that the variables sex, age, and family history of DM were significantly related ($p<0.001$) to the risk of developing diabetes mellitus 2, something similar to the results of the present study.

Although modifiable risk factors generate a greater impact, it must be considered that modifiable risk factors such as age, sex, ethnicity (in certain cases) and hereditary family history increase the probability of suffering from NCDs, this suggests a timely intervention of health systems, aimed at facing these factors that cannot be modified. but that can be attenuated through the implementation of strategies, plans, programs and public policies aimed at the practice of healthy lifestyles. The described establishes the benefits and benefits of this research, being an added value the probabilistic sample design that will allow inferences and generalizations to be made to the entire population.

Finally, the limitations of the research are reflected in the difficulty in getting the collaboration of the participants in their homes, also in the time to answer the questions of the questionnaire, which on average was 60 minutes, which generated distractions and a feeling of tiredness. Another limitation reflected in the study is that, as it is a self-report instrument, there may be memory bias and the possibility of underreporting of non-communicable pathologies. Therefore, it is suggested to carry out other studies to correct these errors and submit them to comparison.

5. Conclusions:

After the analysis of the scientific literature and the application of the instrument to achieve the objective of the study, it is concluded that:

NCDs have a multifactorial origin, where environmental factors encompassed in lifestyle intervene, but non-modifiable factors such as age, ethnicity, sex at birth and hereditary family history are also determinant. In the three Ecuadorian cities of District 03D01, the median age of the participating population was between 34 years (Biblián and Déleg) and 51 years (Azogues), that is, young adults, married, from the rural sector, mostly women, self-identified as mestizos, with a secondary education.

HTN and DM are the two most prevalent pathologies in the selected sample. Overall, one-third of participants have hypertension and twelve out of every hundred people suffer from DM. The economic and social burden of these two diseases is very high and leaves sequelae on the health of those who suffer from it and the relatives who accompany the patient. In addition, in District 03D01 there are other NCDs such as: chronic respiratory disease, thyroid disease, heart disease and cancer, which do not exceed ten percent. However, overweight/obesity is present in more than half of the population and dyslipidemias in a fifth of the residents of Azogues, Biblián and Déleg.

Non-modifiable risk factors are entities that are present in the participating population with their own particularities for each disease. Thus, hypertension was significantly associated with three of the four non-modifiable factors in the study (age, sex, and family history), with a predominance in older ages, men, and those who have a father or child with the disease. DM correlated with the four non-modifiable factors, i.e., in the inhabitants of the cities of District 03D01, being elderly, being female, being mestizo, and having direct relatives (father and siblings), predisposes to the onset of diabetes.

By virtue of the above, the null hypothesis is rejected: "There is no association between non-modifiable risk factors and NCDs", and the alternative hypothesis is accepted: "There is an association between non-modifiable risk factors and NCDs".

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