Revista de la Facultad de Medicina

ORIGINAL RESEARCH
DOI: https://doi.org/10.15446/revfacmed.v69n3.83646
Received: 21/11/2019 Accepted: 16/05/2020

Risk of cardiovascular disease according to the Framingham score in patients with high blood pressure from Píllaro, Ecuador. 2017-2018

Riesgo cardiovascular según la escala de Framingham en pacientes hipertensos de Píllaro, Ecuador. 2017-2018

Patricio Alejandro Abril-López[1] Vladimir Vega-Falcón[1] Iván Pimienta-Concepción[1] Álvaro Adrián Molina-Gaibor[2] Miguel Jacob Ochoa-Andrade[3]

[1] Universidad Regional Autónoma de los Andes - Faculty of Medical Sciences - Medical Program - Ambato - Ecuador.
[2] Universidad de Guayaquil - Faculty of Medical Sciences - Medical Program - Guayaquil - Ecuador.
[3] Universidad UTE - Faculty of Health Sciences Eugenio Espejo - CENBIO Biomedical Research Center - Quito - Ecuador.
Corresponding author: Miguel Jacob Ochoa Andrade. Centro de Investigación Biomédica CENBIO, Facultad de Ciencias de la Salud Eugenio Espejo, Universidad UTE. Quito. Ecuador. Email: a8_miguel@hotmail.com.

Abstract

Introduction: Cardiovascular disease (CVD) is the main cause of morbidity and mortality worldwide. The use of the Framingham Risk Score is of great importance for predicting CVD risk.
Objective: To estimate the 10-year CVD risk in adult patients diagnosed high blood pressure (HBP) who visited the outpatient service of the San Miguelito de Píllaro Health Center, in Tungurahua, Ecuador, using the Framingham Risk Score (2008).
Materials and methods: Cross-sectional, observational, prospective and descriptive study conducted in 120 HBP patients aged 30 to 74 years who visited the outpatient service between January and October 2017. Data were obtained from the review of medical records, which were in turn updated during the execution of the study. The Framingham risk score was used to calculate the 10-year CVD risk. A descriptive analysis of the data was performed in Epi Info 7, using absolute frequencies and percentages.
Results: Of the 120 patients, 59.17% were women. Furthermore, 15% of the participants had been diagnosed with type 2 diabetes mellitus, 13.33% had a history of smoking, 47.50% had elevated systolic blood pressure, and 39.17% had hypercholesterolemia. CVD risk was low (≤ 1% Framingham score), intermediate (10-19%), and high (≥ 20%) in 15%, 29.16%, and 59.16% of participants, respectively. None of them had a very low CVD risk (≤1%).
Conclusion: The Framingham risk score was useful to estimate CVD risk in the study population treated in the primary health care setting. Consequently, more extensive use of this instrument in different health units is recommended to obtain better estimates of CVD risk and, as a result, achieve the implementation of health prevention and health care actions that improve the prognosis in the medium and long term, and thus the quality of life of these patients.
Keywords: Heart Disease Risk Factors; Cardiovascular Risk Score; High Blood Pressure; Primary Health Care (MeSH).

Abril-López PA, Vega-Falcón V, Pimienta-Concepción I, Molina-Gaibor AA, Ochoa-Andrade MJ. Risk of cardiovascular disease according to the Framingham score in patients with high blood pressure from Píllaro, Ecuador. 2017-2018. Rev. Fac. Med. 2021;69(3):e83646. English. doi: https://doi.org/10.15446/revfacmed.v69n3.83646.

Resumen

Introducción. Las enfermedades cardiovasculares (ECV) son la principal casusa de morbimortalidades a nivel mundial; el uso de la escala de Framingham es de gran importancia para predecir el riesgo de ECV.
Objetivo. Determinar el riesgo de ECV a 10 años en pacientes adultos con diagnóstico de hipertensión arterial (HTA) que asistieron al servicio de consulta externa del Centro de Salud de San Miguelito de Píllaro, Tungurahua, Ecuador, utilizando la escala de riesgo de Framingham (2008).
Materiales y métodos. Estudio transversal, observacional, prospectivo y descriptivo realizado en 120 pacientes con edades entre 30 y 74 años y con diagnóstico de HTA que asistieron al servicio de consulta externa entre enero y octubre de 2017. Los datos se obtuvieron a partir de la revisión de las historias clínicas, las cuales, a su vez, fueron actualizadas durante la ejecución del estudio. El riesgo de ECV a 10 años se determinó según el puntaje obtenido en la escala Framingham. Se realizó un análisis descriptivo de los datos en el programa Epi Info 7 utilizando frecuencias absolutas y porcentajes.
Resultados. De los 120 pacientes, 59.17% eran mujeres. Además, 15% de los participantes había sido diagnosticado con diabetes mellitus tipo 2, 13.33% tenía antecedentes de tabaquismo, 47.50% tenía presión arterial sistólica elevada y 39.17% tenía hipercolesterolemia. El riesgo cardiovascular fue bajo (≤1% puntaje Framingham), intermedio (10-19%) y alto (≥20%) en 15%, 29.16% y 59.16% de los participantes, respectivamente. Ninguno tuvo riesgo muy bajo (≤1%).
Conclusión. La escala Framingham fue útil para estimar el riesgo cardiovascular de los participantes en el contexto de la atención primaria de salud, por lo que se recomienda un uso más amplio de este instrumento en las diferentes unidades de salud con el fin de obtener una mejor estimación del riesgo de ECV y así lograr la implementación de acciones de prevención y atención en salud que mejoren su pronóstico en el mediano y largo plazo, y, por tanto, la calidad de vida de estos pacientes.
Palabras clave: Enfermedades cardiovasculares; Hipertensión; Atención primaria de salud (DeCS).

Abril-López PA, Vega-Falcón V, Pimienta-Concepción I, Molina-Gaibor AA, Ochoa-Andrade MJ. [Riesgo cardiovascular según la escala de Framingham en pacientes hipertensos de Píllaro, Ecuador. 2017-2018]. Rev. Fac. Med. 2021;69(3):e83646. English. doi: https://doi.org/10.15446/revfacmed.v69n3.83646.

Introduction

High blood pressure (HBP) is defined as blood pressure with systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg.[1] According to the World Health Organization (WHO), cardiovascular disease (CVD) is the leading cause of death worldwide: in 2016, ischemic heart disease and stroke caused about 15.2 million of all global deaths.[2] However, in recent years, CVD mortality has declined markedly in North America, although changes in Latin America have not been so favorable.[3]

In this regard, the WHO states that deaths related to heart disease and stroke are more frequent in low- and middle-income countries.[4] In Ecuador, according to the 2018 Statistics on Live Births and Deaths,[5] ischemic heart disease was the main cause of death in both men and women, accounting for 7 404 deaths.

Most CVD can be prevented by addressing risk factors such as smoking, poor diets, overweight, and physical inactivity.[6] Therefore, as stated by Zwaard *et al.*,[7] it is essential that people with high cardiovascular risk (CVR) be diagnosed and treated with medication and counseling to improve their lifestyle.

Consequently, establishing CVR is of the utmost importance, and although there are different tools to measure it, Framingham equations are the most used method worldwide. They were developed more than 70 years ago in the context of the Framingham Heart Study (FHS), derive from an American Caucasian population and allow estimating the absolute risk for several CVD endpoints, including coronary disease and stroke.[8,9]

Similarly, new scales for measuring CVR have been developed and validated based on the FHS. The most widely used are the traditional Framingham score, Framingham categories, new Framingham scales, multiple-risk-factor assessment equations from the American Heart Association and the American College of Cardiology, Joint British Societies CVD Risk Prediction Chart, New Zealand risk prediction tables, new Sheffield tables, Münster Heart Study PROCAM tables, Dundee Coronary Risk-Disk, West of Scotland Cardiovascular Event Reduction Tool, and the SCORE Project.[10]

The Framingham Risk Score (FRS) 2008 is a simple and common tool with external validity that has been assessed in different populations worldwide, so it is one of the most applicable methods for evaluating long-term (10-year) CVR around the globe.[8,9] This score has the advantage of using simple and commonly available predictors such as age, sex, smoking, diagnosis of type 2 diabetes mellitus (DM2), blood pressure levels, presence of antihypertensive treatment, and total cholesterol (TC) and high-density lipoprotein cholesterol (HDL-C) levels.[8,9] It should be noted that the estimate is currently thought to differ slightly within this model depending on the patient's sex and the type of prevention (primary or secondary). Likewise, it is worth remembering that HBP is an important risk factor for developing CVD and therefore estimating CVR in patients with this condition is essential to avoid complications.[8]

Since the FHS was originally designed for a Caucasian population between the ages of 30 and 70, there is still some controversy regarding the use of scores derived from it in other ethnic groups, especially in young patients, so validation is necessary. As a result, the FRS 2008 is regarded as a poor predictor of CVR in primary care in Ecuador.

In this scenario, the objective of this study was to determine the 10-year CVD risk in adult patients with a diagnosis of HBP who attended the outpatient service of the San Miguelito de Píllaro Health Center, Tungurahua, Ecuador, using the FRS 2008.

Materials and methods

Cross-sectional, observational, prospective and descriptive study.[11] All adult patients (over 18 years of age) who attended the outpatient service of the Type A San Miguelito primary care health center between January and October 2017 with a diagnosis of HBP according to the 2018 ESC/ESH Guidelines for the management of arterial hypertension (n=146) were considered.[12] Only patients aged between 30 and 74 years were included, as stipulated in the scale, so the final sample, which did not require a calculation, consisted of 120 individuals.

Data were collected between October 2 and December 22, 2017, by reviewing and updating the medical records of the 120 patients selected. The following data were obtained for each patient as established by the FRS 2008: age (being between 30 and 74 years, as this is the study population); sex (female/male); smoking history (yes/no); presence of antihypertensive treatment (yes/no); diagnosis of DM2 (yes/no); SBP levels (taken in the right arm with the patient sitting and resting for 5-10 minutes. Optimal: <120 mmHg, Normal: 120-129 mmHg, Normal-High: 130-139 mmHg, HBP 1: 140-159 mmHg, HBP 2: 160-179 mmHg and HBP 3: ≥180 mmHg), TC levels (normal <200 mg/dL, normal-high 200-239 mg/dL and high ≥240 mg/dL), and HDL-C levels (low <40 mg/dL, normal 40-59 mg/dL, and high ≥60 mg/dL).

The FRS 2008 was applied to participants when they attended the outpatient clinic during the specified period (January-October 2017). The 10-year CVR was calculated using the 8 variables identified, with a score <10% considered as low risk, 10-20% as intermediate risk, and>20% as high risk.

Blood pressure was classified according to the guidelines for the prevention, detection, evaluation, and management of adult HBP in adults published by Whektron *et al.*,[13] while biochemical parameters, including CT and HDL-C, were measured using the colorimetric enzymatic method (CHOD-PAP).[14]

CVR was calculated based on the following formula: RiskFactors = (ln(Age) * AgeFactor) + (ln(TotalChol) * TotalCholFactor) + (ln(HDLChol) * HDLCholFactor) + (ln(SysBP) * SysBPFactor) + Cig + DM - AvgRisk. The following constants were considered depending on the sex of the patient:

- For women: Age Factor: 2.32888, Total Chol Factor: 1.20904, HDL Chol Factor: -0.70833, Avg Risk: 26.1931 and Risk Period Factor: 0.95012.[15]
- For men: Age Factor: 3.06117, Total Chol Factor: 1.12370, HDL Chol Factor: -0.93263, Avg Risk: 23.9802 and Risk Period Factor: 0.88936.[15]

Taking into account the scores obtained with the FRS 2008, the results were classified as follows: ≤1%: very low risk, 2%-9%: low risk, 10%-19%: intermediate risk, and ≥20%: high risk.[15,16]

Statistical analysis

Data were entered into a database created in Microsoft Excel 2016 for subsequent descriptive analysis with the Epi Info 7 software using absolute frequencies and percentages.

Ethical considerations

The study took into consideration the ethical principles for medical research involving human subjects established by the Declaration of Helsinki[17] and was approved on August 2, 2017, by the Bioethics and Research Involving Human Subjects Committee of the Universidad Regional Autónoma de los Andes by means of Minutes No. 23-08/2017_CBISH-UNIANDES. Also, the informed consent of each participant was obtained to collect the data.

Results

Table 1 summarizes the main findings obtained from the 120 patients who participated in the study.

Among the most significant findings, it was noted that no patient was classified as very low risk and that those categorized as high risk were predominant in both sexes: 32 of the 71 women (45.07%) and 39 of the 49 men (79.59%). DM2 was present in 18 patients, representing 15% of the entire sample; of these, 15 were classified as high-risk.

Table 1. Cardiovascular risk determined for the study population according to the general data obtained from the Framingham 2008 risk score.

Variables		Overall cardiovascular risk				
		Very low (%)	Low (%)	Intermediate (%)	High (%)	Total (%) (n=120)
	Total	0	11.66% (n=14)	29.16% (n=35)	59.16% (n=71)	100% (n=120)
Age	30-34 years	0	100% (n=1)	0	0	0.83% (n=1)
	35-39 years	0	100% (n=3)	0	0	2.5% (n=3)
	40-44 years	0	37.5% (n=3)	62.5% (n=5)	0	6.67% (n=8)
	45-49 years	0	30% (n=3)	60% (n=6)	10% (n=1)	8.33% (n=10)
	50-54 years	0	33.33% (n=3)	44.44% (n=4)	22.22% (n=2)	7.5% (n=9)
	55-59 years	0	0	42.86% (n=3)	57.14% (n=4)	5.83% (n=7)
	60- 64 years	0	0	30% (n=3)	70% (n=7)	8.33% (n=10)
	65-69 years	0	3.33% (n=1)	16.67% (n=5)	80% (n=24)	25% (n=30)
	70-74 years	0	0	21.43% (n=9)	78.57% (n=33)	35% (n=42)
Sex	Female	0	16.9% (n=12)	38.03% (n=27)	45.07% (n=32)	59.17% (n=71)
	Male	0	4.08% (n=2)	16.33% (n=8)	79.59% (n=39)	40.83% (n=49)
Cigarette consumption	Yes	0	0	18.75% (n=3)	81.25% (n=13)	13.33% (n=16)
	No	0	13.46% (n=14)	30.77% (n=32)	55.77% (n=58)	86.67% (n=104)
Antihypertensive treatment	Yes	0	9.09% (n=9)	29.29% (n=29)	61.62% (n=61)	82.50% (n=99)
	No	0	23.81% (n=5)	28.57% (n=6)	47.62% (n=10)	17.5% (n=21)
Diabetes mellitus type 2	Yes	0	0	16.67% (n=3)	83.33% (n=15)	15% (n=18)
	No	0	13.73% (n=14)	31.37% (n=32)	54.9% (n=56)	85% (n=102)
Systolic blood pressure	Optimal (<120 mmHg)	0	16.67% (n=2)	50% (n=6)	33.33% (n=4)	10% (n=12)
	Normal (120-129 mmHg)	0	19.04% (n=4)	33.34% (n=7)	47.62% (n=10)	17.5% (n=21)
	Normal-High (130-139 mmHg)	0	10% (n=3)	33.33% (n=10)	56.67% (n=17)	25% (n=30)
	HBP 1 (140 -159 mmHg)	0	7.7% (n=3)	30.77% (n=12)	61.53% (n=24)	32.50% (n=39)
	HBP 2 (160-179 mmHg)	0	15.38% (n=2)	0	84.61% (n=11)	10.83% (n=13)
	HBP 3 (≥180 mmHg)	0	0	0	100% (n=5)	4.16% (n=5)
Total cholesterol	Normal (<200 mg/dL)	0	12.33% (n=9)	31.51% (n=23)	56.16% (n=41)	60.83% (n=73)
	Normal-high (200-239 mg/dL)	0	14.81% (n=4)	29.63% (n=8)	55.56% (n=15)	22.5% (n=27)
	High (≥240 mg/dL)	0	5% (n=1)	20% (n=4)	75% (n=15)	16.67% (n=20)
High-density lipoprotein cholesterol (HDL)	<40 mg/dl	0	8.33% (n=3)	30.56% (n=11)	61.11% (n=22)	30% (n=36)
	40-59 mg/dl	0	12.19% (n=10)	28.05% (n=23)	59.76% (n=49)	68.33% (n=82)
	≥60 mg/dl	0	50% (n=1)	50% (n=1)	0	1.67% (n=2)

HBP: high blood pressure.
Source: Own elaboration.

Regarding TC, 73 patients (60.83%) had normal levels (41 classified as high-risk), 27 (22.5%) had normal-high levels (15 classified as high-risk), and 20 (16.67%) had high levels (15 classified as high-risk).

In relation to HDL-C, 36 (30%) patients had levels <40 mg/dL (22 classified as high risk), 82 (68.33%) levels between 40 mg/dL and 59 mg/dL (49 classified as high risk), and only 2 had levels ≥60 mg/dL (one classified as low risk and the other, as intermediate risk).

As for SBP measurements, 12 (10%) patients had optimal values (4 classified as high-risk); 21 (17.5%), normal values (10 classified as high-risk); 30 (25%), normal-high values (17 classified as high-risk); 39 (32.50%), HBP 1 values (24 classified as high-risk); 13 (10.83%), HBP 2 values (11 classified as high risk); and 5 (4.16%), HBP 3 values (all classified as high risk).

About tobacco use, it was found that 15 (93.75 %) of the 16 patients who had this habit were men.

With respect to age, it was noted that most participants classified as high-risk were elderly: 33 patients in the range 70-74 years and 24 in the range 65-69 years.

Finally, 99 (82.50%) of the 120 participants reported being on antihypertensive treatment, and 61 (61.62%) of them were classified as high-risk, 29 (29.29%) as intermediate-risk, and 9 (9.09%) as low-risk. Of the 21 (17.5%) who did not receive any treatment, 10 (47.62%) were classified as high risk, 6 (28.57%) as intermediate-risk, and 5 (23.81%) as low-risk.

Discussion

Each of the variables analyzed, the results of which are reported in Table 1, is discussed separately below.

Sex

In the present study, HBP was slightly more prevalent in women than in men (59.17% vs. 40.83%). This is consistent with the findings of Sánchez Seco Higuera *et al.*,[18] who found that 53.5% of women and 46.5% of men in a sample of 662 subjects over the age of 65 from Horche (Guadalajara, Spain) had high blood pressure. It should be noted that women have protective mechanisms against CVD, but they partially lose such protection when they reach menopause, making them more susceptible to developing this type of disease.[16,19]

In spite of the above, it is noteworthy that the percentage of male participants classified as high-risk was significantly higher than that of females (79.59% vs. 45.07%), which may be influenced by tobacco use, as it was more frequent in males.

Diabetes mellitus type 2

The percentage of patients with DM2 found in the present study (15%) is considerably low, which coincides with an epidemiological study conducted in Japan, where approximately 20% of patients with high blood pressure had this disease.[20] This is relevant because, according to research conducted in Ethiopia by Akalu & Belsti,[21] a one-year increase in the duration of DM2 increases the likelihood of developing HBP by 16% (aOR: 1.16, 95%CI: 1.08-1.25).

Smoking history

The patients who reported smoking accounted for a small percentage of the study population (13.33%, n=16), although most of them (n=13) were classified as high-risk for CVD; therefore, it could be concluded that this habit, although rare, implies a higher CVR compared to non-smokers. However, in the study by Petermann *et al.*[22] carried out in Chile, no association between these variables was identified in men, but it was found that the risk decreases in female smokers (OR: 0.67 95%CI: 0.52-0.86, p=0.,002) and in former female smokers (OR: 0.77 95%CI: 0.60-0-99, p=0.040). This result contradicts most research in this matter, as few studies describe a decrease in blood pressure in smokers.[23,24]

With respect to this variable, it should be noted that Akalu & Belsti[21] assessed smoking in 378 patients with DM2 and a mean age of 56 years, finding that this population is 3.9 times more likely to develop HBP than those without this condition.

Similarly, Arboleda-Carvajal & García-Yanés,[25] in a study of 249 people from a general population of the Amazon region of Morona Santiago (Ecuador), found that the main factor for CVR was smoking (48.6%), followed by overweight (40.2%) and low HDL-C (10.4%), which correlates with the findings of this research.

It is important to bear in mind that the present study did not evaluate the number of cigarettes smoked per day, but rather the presence or absence of consumption.

High-density total and lipoprotein cholesterol

Most (60.8%) of the participants had TC levels within the normal range and only a small percentage (16.6%) did not have an optimal result, which is similar to what has been reported by Sánchez Seco Higuera *et al.*,[18] who found that 23.3% of participants had hypercholesterolemia.

Regarding HDL-C levels, 30% of participants had results below the optimal value, 68.33% had normal values, and only 1.67% had optimal values, which is relevant because, according to a study performed in 35 patients with metabolic syndrome by Mendoza-Romo *et al.*,[26] individuals with optimal HDL-C values experience a significant beneficial change by lowering their blood pressure and therefore their CVR, whereas the latter increases in those with a decrease in HDL-C levels

The measurement of these variables is of great importance because it is possible to establish adequate diets and nutritional recommendations focused at preventing possible cardiovascular events when determining CVR in patients using the FRS 2008.[27]

Antihypertensive therapy

A large percentage of the participants in the sample analyzed were on antihypertensive treatment (82.5%). Of the 21 patients who reported not taking antihypertensive medication (17.5%), about half (47.61%; n=10) were classified as high-risk, which is concerning given that treatment is essential to avoid complications in these patients.

In this regard, Tang *et al.*,[28] in a cohort study of 2 199 patients aged 65 years or older in Canada comparing adherence rates and associations with mortality using different adherence definitions and various methods of managing concurrent drug use, found that 24.1% to 90.5% and 71.2% to 92.7% of the patients were considered adhering when using fixed interval and prescription-based interval measurement possession ratios respectively, depending on how concurrent medications were handled. This situation shows a large fluctuation that is concerning because of the lack of homogenization in the level of awareness regarding treatment.

Likewise, Tan *et al.*[29] conducted a systematic review that evaluated the effectiveness of educational interventions to improve medication adherence in adult patients diagnosed with hypertension, hyperlipidemia, and/or diabetes, and concluded that health literacy is improved through health education, improving medication adherence as well.

Age

In the present study, the predominant age range was 70 to 74 years (n=42), in which high CVR prevailed (n=33), which was to be expected given the increased number of physiological changes associated with aging that could influence this aspect.

With respect to this variable, Akalu & Belsti[21] found in their study that people over the age of 50 are more likely to have HBP, which can be attributed to the vascular changes that occur during aging and that trigger greater stiffness and thickening of the arteries. This is supported by different studies that report that the prevalence of HBP increases with age.[21,30]

Systolic blood pressure

When assessing SBP, it was found that in most participants the values were above 130 mmHg (72.49%), with a higher prevalence among older patients and in those who reported not being on antihypertensive treatment.

Based on the findings, it is confirmed that age is a factor of CVR, since SBP is more prevalent in patients over 60 years of age and is also associated with diseases such as stroke, cardiovascular disease, and increased mortality.[16,31]

Overall cardiovascular risk in the study population

When determining overall CVR according to the FRS 2008, in the present study most of the study population (59.17%) was classified as high risk; about a quarter (29.17%) was classified as moderate risk; and a small percentage (11.67%) was classified as low risk. These findings markedly differ from those found by De La Noval-Garcia *et al.*,[32] who reported a low risk (<10% according to the WHO risk classification proposal) in 93.6% of participants in a study of 1 287 people (randomly selected) between 40 and 70 years in Havana, Cuba. It should be noted, however, that this difference is most likely due, on the one hand, to the fact that each study used a different tool for risk assessment (FRS 2008 vs. WHO classification proposal) and, on the other, to sampling differences in population size and type, since the present study included a specific sample (patients with HBP) that was 10 times smaller, whereas the study of Nova-García *et al.*[32] analyzed the general population.

Furthermore, the finding of the present study in terms of global CVR also differs from the results obtained by Muñoz-Gualan & Muñoz[33] in a study carried out in 2015 in 80 apparently healthy military personnel of the 62nd Jungle Battalion "Zamora" (Ecuador), in which CVR was evaluated using the Framingham score, finding that 60% of the population was at low risk and 33.75% at moderate risk. The differences between the present study and the latter may be influenced by the physical fitness and systematic training that military participants received, which contributes to better overall health and, as a result, lower CVR.

It is also worth noting that the study by Giraldo-Trujillo *et al.*,[34] carried out in 138 Colombian workers of both sexes, found that 28.6% of men were classified as low risk and 53.5% as medium risk with the Framingham-Grundy scale, which contrasts with the present study in that most participants were classified as high risk.

It is also noteworthy that, compared with the studies described above, the overall CVR was significantly higher in the present study, which may be due to the fact that these studies were performed in populations different from the FHS (Caucasians aged between 30 and 60 years). This heightens debates over the FRS 2008's utility in different ethnic groups, particularly among young patients.[30,35]

On the other hand, in a study carried out in 2014 with 208 women between 35 and 74 years old from Havana, Rodríguez-Blanco *et al.*[36] found that the most frequent factors of overall CVR were smoking (44.71%) and SBP≥140 mmHg (28.36%),[36] results that differ from those of the present research.

In general, the findings of this study are consistent with those reported in the literature; however, even though the population analyzed here presents with a large number of risk factors, they are not the ones that predispose it to high CVR, but rather the association of some of them in the same patient. In addition, the changes that the body goes through over time, both structural and functional, predispose to the development of CVD,[30] indicating the importance of taking preventive measures and conducting a comprehensive follow-up of patients.

Final remarks

In 2018, the ESC/ESH guidelines recommended using the SCORE scale in European and North American populations to assess CVR in patients without known CVD with a 10-year risk estimate, for which it is important to know the hypertension-mediated organ damage.[12] Thus, the stratification of CVR according to this tool can help detect patients who require timely comprehensive management, eliminating the predictors of death. This is considered a substantial contribution to Ecuador's national primary health care program.

It is essential to bear in mind that although CVR prediction equations are widely accepted, there is evidence showing that they cannot be applied directly to all populations; therefore, defining the most suitable model to use in the Ecuadorian population is a priority. To this end, the study by Muñoz *et al.*,[37] in which external validation of the Framingham and PROCAM models was performed in 1 013 Colombian patients aged 30 to 74 years and free of cardiovascular events at the time of enrollment to the cohort (1984 to 1996), can be used as a guide. In that study, the authors concluded that the FRS 2008 should be used with caution in low- and intermediate-risk Colombian populations with no previous history of CVD because it overestimated the risk and demonstrated a low capacity for discrimination between low- and high-risk patients.

Similarly, it should be noted that in Ecuador, the Ministry of Public Health[1] recommended using the Globorisk tool to assess CVR in the country because it was developed in a multi-ethnic population, Latin Americans (Mexico) being representative; it allows calculation without laboratory values, makes an estimate for 11 countries, and is free of charge. However, the FRS 2008 calibrated by Muñoz *et al.*[37] continues to be used since it has been widely disseminated in recent years, the health personnel is familiar with its use,[38] and has been endorsed by 2 consensuses of the Colombian Society of Cardiology, as reported by Muñoz *et al.*[39] This model should be calibrated for use in the Ecuadorian population with local epidemiological data, which would pave the way for future studies determining the most appropriate scale for usage in the country.

Limitations

One of the limitations of this study is that different age ranges, the standardization approach, and the lack of cross-validation of laboratory tests make it difficult to compare the results obtained with those of other studies of similar characteristics in the absence of standardization.

Another limitation is that it is unknown whether the FRS 2008 is the most suitable instrument for estimating the CVR in Ecuador since the epidemiological characteristics of Ecuadorians are different from those of Americans, the population for which this instrument was designed, and absolute CVD mortality is higher in the USA.[7,38]

Finally, while FRS 2008 is a valuable tool for predicting CVD risk, it has numerous limitations that must be noted before applying its results, such as the fact that it is an estimation algorithm rather than a medical examination. In addition, the original cohort did not include a young population, making it an inaccurate tool in this age group, and, finally, it does not include other possible factors of CVR.

Moreover, the cross-sectional nature of the present study makes it difficult to better address the direction of causality between variables,[35,40,41] so it is suggested to conduct additional studies by delving into the relational and explanatory levels of research within the CVR line of research.

Conclusions

The FRS 2008 proved to be a useful tool for estimating CVR in primary health care in the study population. Therefore, a wider use of this tool is recommended in the different health units of Ecuador in order to obtain a better estimate of CVD risk, which will allow for the implementation of prevention and health care actions to improve prognosis in the medium and long term, and, consequently, the quality of life of these patients.

Conflicts of interest

None stated by the authors.

Funding

None stated by the authors.

Acknowledgments

To the "San Miguelito" Health Center of Píllaro, Ecuador, for their support in the collection of the data used in this study and to the anonymous reviewers for their suggestions to improve the final report of this research.

References

1. Ecuador. Ministerio de Salud Pública. Hipertensión arterial: Guía de Práctica Clínica (GPC). Quito: Ministerio de Salud Pública; 2019.
2. Organización Mundial de la Salud (OMS). Las 10 principales causas de defunción, Ginebra: OMS; 2018 [cited 2019 Nov 1]. Available from: https://bit.ly/3hIpq4s.
3. GBD 2017 Causes of Death Collaborators. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392(10159):1736-88. https://doi.org/gfhx3t.
4. World Health Organization (WHO). Hearts. Technical package for cardiovascular disease management in primary health care. Geneva: WHO; 2016 [cited 2021 Jul 15]. Available from: https://bit.ly/3wHCF9I.
5. Ecuador. Instituto Nacional de Estadísticas y Censos (INEC). Estadístico de Nacidos Vivos y Defunciones del 2018. Quito: INEC; 2018 [cited 2019 Nov 1]. Available from: https://bit.ly/3Bi5gpN.
6. Wallisch C, Heinze G, Rinner C, Mundigler G, Winkelmayer WC, Dunkler D. External validation of two Framingham cardiovascular risk equations and the Pooled Cohort equations: A nationwide registry analysis. Int J Cardiol. 2019;283:165-70. https://doi.org/gnpw.
7. Zwaard AV, Geraedts A, Norder G, Heymans MW, Roelen CAM. Framingham score and work-related variables for predicting cardiovascular disease in the working population. Eur J Public Health. 2019;29(5):832-7. https://doi.org/gnnw.
8. Majed B, Tafflet M, Kee F, Haas B, Ferrieres J, Montaye M, *et al.* External validation of the 2008 Framingham cardiovascular risk equation for CHD and stroke events in a European population of middle-aged men. The PRIME study. Prev Med. 2013;57(1):49-54. https://doi.org/f43bmc.
9. Andersson C, Johnson AD, Benjamin EJ, Levy D, Vasan RS. 70-year legacy of the Framingham Heart Study. Nat Rev Cardiol. 2019;16(11):687-98. https://doi.org/ggf7b4.
10. Morales-Pérez C, León-Regal ML, Álvarez-Hernández R, Brito-Pérez de Corcho Y, de Armas-García JO, Muñoz-Morales A. Valor predictivo del cálculo de riesgo cardiovascular global. Rev. Finlay. 2017;7(4):260-7.
11. Supo J, Zacarías H. Metodología de la investigación científica: Para las Ciencias de la Salud y las Ciencias Sociales. 3rd ed. Arequipa: Editorial BIOESTADISTICO EEDU EIRL.
12. Williams B, Mancia G, Spiering W, Agabiti-Rosei E, Azizi M, Burnier M, *et al.* Guía ESC/ESH 2018 sobre el diagnóstico y tratamiento de la hipertensión arterial. Rev Esp Cardiol. 2019;72(2):160.e1-e78.
13. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison-Himmelfarb C, *et al.* 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the

prevention, detection, evaluation, and management of high blood pressure in adults: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Hypertension. 2018;71(6):1269-1324.
14. Colestat enzimático. Método enzimático para la determinación de colesterol en suero o plasma. Wiener Laboratorios; 2000 [cited 2020 Apr 18]. Available from: https://bit.ly/36H81CO.
15. D'Agostino RB, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, *et al.* General Cardiovascular Risk Profile for Use in Primary Care The Framingham Heart Study. Circulación. 2008;117(6):743-53. https://doi.org/dthnkd.
16. Zilberman JM. Menopausia: hipertensión arterial y enfermedad vascular. Hipertens Riesgo Vasc. 2018;35(2):77-83. https://doi.org/gntm.
17. World Medical Association (WMA). WMA Declaration of Helsinki – Ethical principles for medical research involving human subjects. Fortaleza: 64th WMA General Assembly; 2013.
18. Sánchez-Seco Higuera P, Delgado-Delgado P, Retuerta-Ameztoya P, Viejo-Martínez S, Díaz-García RM, López-Doriga de la Vega A. Prevalencia de factores de riesgo cardiovascular en la población anciana de la zona básica de salud de Horche (Guadalajara). SEMERGEN - Medicina de Familia. 2011;27(3):118-22. https://doi.org/f2mk8j.
19. Bhupathiraju SN, Hu FB. Epidemiology of Obesity and Diabetes and Their Cardiovascular Complications. Circ Res. 2016;118(11):1723-35. https://doi.org/f8rc79.
20. Tatsumi Y, Ohkubo T. Hypertension with diabetes mellitus: Significance from an epidemiological perspective for Japanese. Hypertens Res. 2017;40(9):795-806. https://doi.org/gbmzrc.
21. Akalu Y, Belsti Y. Hypertension and its associated factors among type 2 diabetes mellitus patients at Debre Tabor general hospital, northwest Ethiopia. Diabetes Metab Syndr Obes. 2020;13:1621-31. https://doi.org/gj2q7p.
22. Petermann F, Durán E, Labraña AM, Martínez MA, Leiva AM, Garrido-Méndez A, *et al.* Factores de riesgo asociados al desarrollo de hypertensión arterial en Chile. Rev Med Chile. 2017;145(8):996-1004. https://doi.org/gnsg.
23. Primatesta P, Falaschetti E, Gupta S, Marmot MG, Poulter NR. Association between smoking and blood pressure: evidence from the health survey for England. Hypertension. 2001;37(2):187-93. https://doi.org/grj2.
24. Goldbourt U, Medalie JH. Characteristics of smokers, non-smokersand ex-smokers among 10,000 adult males inIsrael. II. Physiologic, biochemical and genetic characteristics. Am J Epidemiol. 1977;105(1):75-86. https://doi.org/grjz.
25. Arboleda-Carvajal MS, García-Yanés AR. Riesgo cardiovascular: análisis basado en las tablas de Framingham en pacientes asistidos en la unidad ambulatoria 309, IESS - Sucúa. Revista Med. 2017;25(1):20-30. https://doi.org/ggf48j.
26. Mendoza-Romo MA, Montes-Acuña JF, Zavala-Cruz GG, Nieva-de Jesus RN, Ramírez-Arreola MC, Andrade-Rodríguez HJ. Efecto de DiabetIMSS sobre el riesgo cardiovascular, la tensión arterial y el colesterol-HDL en pacientes con síndrome metabólico. Rev Med Inst Mex Seguro Soc. 2017;55(1):32-9.
27. Sociedad Interamericana de Cardiología (SIAC). ACC19 - Nuevas Guías de Prevención Primaria ACC/AHA 2019. Buenos Aires: (SIAC); 2019 [cited 2019 Nov 1]. Available from: https://bit.ly/3hJbzuA.
28. Tang KL, Quan H, Rabi DM. Measuring medication adherence in patients with incident hypertension: a retrospective cohort study. BMC Health Serv Res. 2017;17(1):135. https://doi.org/f9qb6k.
29. Tan JP, Cheng KKF, Siah RC. A systematic review and meta-analysis on the effectiveness of education on medication adherence for patients with hypertension, hyperlipidaemia and diabetes. J Adv Nurs. 2019;75(11):2478-94. https://doi.org/ghqjx5.
30. Osorio-Bedoya EJ, Amariles P. Hipertensión arterial en pacientes de edad avanzada: una revisión estructurada. Rev Colomb Cardiol. 2018;25(3):209-21. https://doi.org/gntj.
31. Álvarez-Fernández C, Vaquero-Abellán M, Ruíz-Gandara A, Romero-Saldaña M, Álvarez-López C. Factores de riesgo cardiovascular en la población en situación de riesgo de pobreza y exclusión social. Aten Primaria. 2017;49(3):140-9. https://doi.org/gntn.
32. de la Noval-García R, Armas-Rojas NB, de la Noval-González I, Fernández-González Y, Pupo-rodríguez HB, Dueñas-Herrera A, *et al.* Estimación del Riesgo Cardiovascular Global en una población del Área de Salud Mártires del Corynthia. La Habana, Cuba. Rev Cuban Cardiol Cir Cardiovasc. 2011;17(1):62-8.
33. Muñoz-Gualan AP, Muñoz G. Cuantificación del riesgo de enfermedad cardiovascular, según el score Framingham, en el personal militar durante el año 2015. REMCB. 2018;39(1):31-7. https://doi.org/gnth.
34. Giraldo-Trujillo JC, Martinez JW, Granada-Echeverry P. Aplicación de la escala de Framingham en la detección de riesgo cardiovascular en empleados universitarios, 2008. Rev Salud Publica. 2011;13(4):633-43.
35. León-Tito AA. Estudio comparativo para la estimación del riesgo cardiovascular, mediante la aplicación del test Framingham 2008 y PCR ultrasensible en un grupo de pacientes del Hospital de atención Integral del adulto mayor, Quito. [Tesis]. Quito: Facultad de Medicina, Pontificia Universidad Católica Del Ecuador; 2015.
36. Rodríguez-Blanco S, Almeida-Gómez J, Cruz-Hernández J, Ulloa R, Martínez-Ávila D, Pérez-Guerra J. Riesgo cardiovascular global en mujeres pertenecientes a un área de salud de Centro Habana. Revista Finlay. 2014 [cited 2020 Apr 15];4(1). Available from: https://bit.ly/3yY81dM.
37. Muñoz OM, Rodríguez NI, Ruiz Á, Rondón M. Validación de los modelos de predicción de Framingham y PROCAM como estimadores del riesgo cardiovascular en una población colombiana. Rev Colomb Cardiol. 2014;21(4):202-12. https://doi.org/f2v686.
38. Hermansson J, Kahan T. Systematic Review of Validity Assessments of Framingham Risk Score Results in Health Economic Modelling of Lipid-Modifying Therapies in Europe. Pharmacoeconomics. 2018;36(2):205-13. https://doi.org/gc2mvh.
39. Muñoz OM, García ÁA, Fernández-Ávila D, Higuera A, Ruiz ÁJ, Aschner P, *et al.* Guía de práctica clínica para la prevención, detección temprana, diagnóstico, tratamiento y seguimiento de las dislipidemias: evaluación del riesgo cardiovascular. Revista Colombiana de Cardiología. 2015;22(6):263-9. https://doi.org/f3g67m.
40. Jahangiry Farhangi MA, Rezaei F. Framingham risk score for estimation of 10-years of cardiovascular diseases risk in patients with metabolic síndrome. J Health Popul Nutr. 2017;36(1):36. https://doi.org/gckn6g.
41. World Health Organization (WHO). Preventing noncommunicable diseases (NCDs) by reducing environmental risk factors. Geneva: WHO; 2017 [cited 2021 Jul 16]. Available from: https://bit.ly/3ilAsLU.