

# Cardiovascular Risk Distribution in Argentina in 2018

## *Distribución del riesgo cardiovascular en la Argentina en 2018*

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### ABSTRACT

**Background:** Cardiovascular diseases are the main cause of disability and death globally. Total cardiovascular risk (CR) is the probability of having a cardiovascular event in a defined period and is determined by the combined effect of risk factors.

**Objectives:** The aim of this study was to estimate CR and describe its distribution in Argentina in 2018.

**Methods:** Cardiovascular risk was analyzed in 11,450 individuals over 30 years of age from the 4th National Risk Factor Survey (NRFS). The Framingham risk equations used to estimate and calibrate global CR classified the individuals into the following three groups: optimum CR (<5.9%), moderate CR (6 to 19.9%) and high CR (>20%). Bayesian prevalence and credibility intervals (BCI) were estimated under the non-informative beta prior distribution.

**Results:** Nationally, 60.6% of the individuals presented moderate/high CR. Moderate CR by region was distributed homogeneously. When analyzing extreme CRs, the metropolitan (47.6%) and Pampean (28.6%) regions presented the greatest incidence of high CR. The highest prevalence of optimum CR was found in the Patagonian region, followed by the Northwest, Northeast and Cuyo, all above 40%. The analysis by province showed that the greatest incidence of high CR was found in Buenos Aires (49.9%) and CABA (45.7%). At all levels, the prevalence of moderate/high CR is much higher in men, with the exception of the metropolitan region.

**Conclusions:** Geographical differences position the metropolitan region as the one with maximum CR due to the great incidence of high and moderate CR. Prevalence of high CR in men is almost 4 times greater than that registered in women.

**Key words:** Cardiovascular disease - Risk assessment - Prevention - Risk factors

### RESUMEN

**Introducción:** Las enfermedades cardiovasculares son la principal causa de discapacidad y muerte a nivel global. El riesgo cardiovascular (RC) total es la probabilidad de tener un evento cardiovascular en un periodo definido y está determinado por el efecto combinado de los factores de riesgo.

**Objetivos:** Estimar el RC y describir su distribución en la Argentina en 2018.

**Materiales y métodos:** Se analizaron 11 450 individuos mayores de 30 años provenientes de la 4° ENFR. Se realizó la estimación y calibración del RC global bajo las ecuaciones del estudio Framingham y se clasificó a los individuos en los siguientes tres grupos: RC óptimo (<5,9%), RC moderado (6 a 19,9%) y RC alto (>20%). Se estimaron prevalencias e intervalos de credibilidad bayesianos (ICB) bajo distribución beta prior no informativa.

**Resultados:** A nivel nacional, el 60,6% de los individuos presentaron RC moderado/alto. El RC moderado por región se distribuyó de manera homogénea. Al analizar los RC extremos, las regiones metropolitana (47,6%) y pampeana (28,6%) presentaron las prevalencias más elevadas de RC alto. La mayor prevalencia del RC óptimo se encontró en la región Patagonia, seguido del Noroeste, Noreste y Cuyo, todas estas fueron superiores al 40%. Por provincia, las prevalencias más elevadas de RC alto se presentaron en Buenos Aires (49,9%) y CABA (45,7%). En todos los niveles, las prevalencias de RC moderado/alto son muy superiores en varones, con excepción de la región metropolitana.

**Conclusiones:** Las diferencias geográficas posicionan a la región metropolitana como la de mayor RC debido a la alta prevalencia de RC alto y moderado. Los hombres presentaron una prevalencia de RC alto hasta 4 veces superior a la registrada en mujeres.

**Palabras clave:** Enfermedad cardiovascular – Evaluación de riesgo - Prevención - Factores de riesgo

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## INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of disability and death globally. At least three-quarters of CVD deaths occur in low- and middle-income countries, and most notably, at least 50% of CVD-related problems could be avoided by preventing cardiovascular risk (CR) factors. (1)

Total or global CR is the probability of having a cardiovascular event in a defined period and this is determined by the combined effect of risk factors (RF). Thus, a person with the same blood pressure as another can have 10 times more CR depending on the presence or absence of other RF. (2) It is not possible to estimate the CR of a person by adding individual RF, given its exponential effect. (1) Based on cohort and case-control studies, CR estimation algorithms were developed generally considering variables such as blood pressure, total cholesterol, LDL and HDL cholesterol, body mass index (BMI), smoking, antihypertensive therapy and presence of diabetes mellitus, among others. (1, 3)

To implement effective preventive strategies, tools are needed to identify subjects without known CVD and who are at high risk of developing a cardiovascular event. The higher the CR, the greater the benefit of a therapeutic intervention. An effective strategy for CVD prevention is to provide advice on a healthy lifestyle to people at high risk of an event, accompanied or not by the prescription of medications to reduce blood pressure and serum cholesterol. (4)

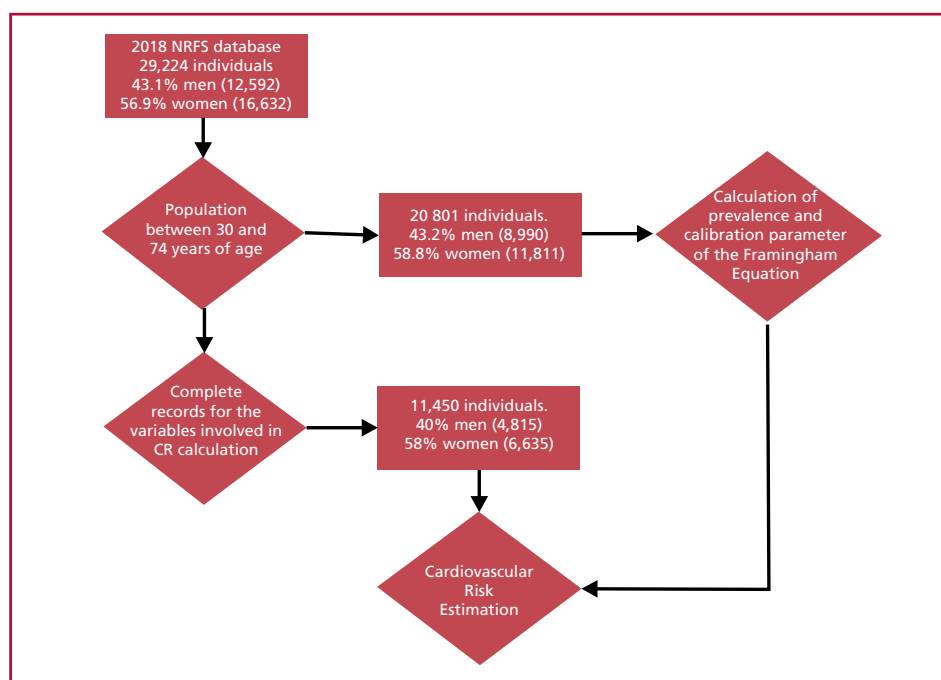
The magnitude of the benefit of a preventive intervention is determined through the evaluation of the individual's total CR, rather than by the reduction of

a single RF. The National Risk Factor Survey (NRFS), carried out periodically in Argentina since 2005, constitutes the main instrument of data collection, with national and provincial representation, referring to RF in Argentina. Even though this instrument is limited to describing the prevalence of each RF, it is a fundamental contribution to the knowledge of the population's CR for the entire Argentine territory. (5)

On the other hand, researches that address the CR calculation are only restricted to age groups or populations of specific areas (6-8) The incorporation of objective measurements in the last NRFS (5) allows estimating global CR, which was not possible in previous editions; even so, the final report does not provide global CR results. For this reason and in order to further understand the global CR situation in the Argentine population, the aim of this study was to estimate CR in the Argentine Republic in 2018 and analyze its distribution pattern in the country.

## METHODS

The analyzed data came from the 4th NRFS (29,224 individuals evaluated during 2018). (5) For this work, the database was refined and filtered according to the workflow described in Figure 1, to guarantee both the estimation of population parameters and CR. To this end, the population aged between 30 and 74 years (same age range as the Framingham cohort) was considered and from these individuals the averages and prevalence required for the calibration of the Framingham CR equations were estimated. The version used for the Framingham equation is the one based on BMI. Only individuals with complete records for the variables used in CR estimation were selected for this analysis. Sex, age (years), systolic blood pressure (mmHg), antihypertensive treatment,



**Fig. 1.** Workflow for cleansing and filtering the 2018 NRFS database.

BMI (kg/m<sup>2</sup>), presence of hyperglycemia or diabetes mellitus (self-reported or by objective measurement: ≥110 mg/dl) and smoking habits were taken into account.

**Statistical analysis**

Mean and standard deviation were estimated for quantitative variables (age, BMI and systolic blood pressure) and prevalence for qualitative variables (sex, presence of smoking, diabetes/hyperglycemia and cardiovascular risk). In all cases, total and by gender values were calculated. In addition, CR was estimated by regions and provinces.

Global CR was estimated using the Framingham study equations (9), according to the following formula:

$$\hat{p} = 1 - S_0(t) e^{\sum_{i=0}^p \beta_i X_i - \sum_{i=0}^p \beta_i \bar{X}_i}$$

where S0(t) is baseline survival for a 10-year follow-up, βi are the estimated regression coefficients, Xi are RF (continuous variables only) transformed by the natural logarithm,  $\bar{x}_i$  is the corresponding mean and p is the number of RF analyzed.

Since the RF averages and prevalence in the study population are not the same as those estimated for the Framingham population, the calibration parameter for the different provinces of Argentina was estimated from the following formula, using the coefficients obtained for the calibration constant k (Table 1).

$$\sum_{i=0}^p \beta_i \cdot \bar{X}_i = k$$

Estimation of CR was carried out with the calibrated formula:

$$\hat{p} = 1 - S_0(t) e^{\sum_{i=0}^p \beta_i X_i - k}$$

Based on this approach, each individual was classified into the following categories according to the global CR: 1) optimum: <5.9%; 2) moderate: between 6% and 19.9%; and 3) high: >20%. The prevalence and Bayesian credibility intervals (BCI) under non-informative beta prior distribution were estimated at national, regional and provincial levels from total and by gender number of cases. (10) It was assumed that all participating individuals were in the first level of care. For data analysis, the R software (11) with the RStudio interface was used. (12)

**Ethical considerations**

This research work acts in accordance with the Nuremberg Code (1947), the Declaration of Helsinki (1964), Law 25,326 on the Protection of Personal Data, resolution 1480/2011 of the National Ministry of Health and resolution 012565 of the Provincial Ministry of Health.

The ARGEN IAM-ST registry protocol was approved by the Argentine Society of Cardiology Ethics Committee and that of each participating institution.

**RESULTS**

The study population consisted of 11,450 individuals (58% women). Mean age was 49.4±12.70 years and BMI was above the range considered optimum in adults (18.5 to 24.9 kg/m<sup>2</sup>) in both sexes, without significant differences. Although men presented a systolic blood pressure slightly higher than that of women (135 mmHg vs. 128 mmHg, respectively), both were found to be above the optimum value (120 mmHg). Conversely, men presented significantly higher prevalence of smoking, hyperglycemia and diabetes than women and above the population values. (Table 1).

At the national level, 60.6% of individuals presented moderate/high CR, which was statistically different in men with a prevalence of 69.1% than in women with an incidence of 54.5% (Table 2).

Table 3 shows the prevalence of the different CR categories by region; at this level, moderate CR was homogeneously distributed, with similar proportions in all regions. When analyzing the extremes (high CR and optimum CR), the central regions of the country (Metropolitan Area of Buenos Aires, with 47.6%, and the Pampean region, with 28.6%) presented the greatest prevalence of high CR, while, in the more peripheral regions, the optimum risk prevalence increased with the highest prevalence in Patagonia, followed by the Northwest, Northeast and Cuyo, all above 40%. Regarding sex variations, the differences observed at the global level were maintained, with moderate/high CR more frequent in men, except in the AMBA region, where the opposite was observed.

The analysis of the distribution by province (Table 4) revealed that the greatest incidence of high CR was in Buenos Aires (49.9%) and CABA (45.7%), values that were almost twofold that at the national level. In the rest of the provinces, in general, the prevalence decreased from north to south, with 21.7% in Santiago del Estero and 14.7% in Santa Cruz. The reverse was observed when analyzing the prevalence of optimum CR. The differences between gender evidenced at the regional level were again found at the provincial level, with prevalence of moderate/high CR much greater in men (2-3 times higher than in women), except in CABA and Buenos Aires, where the incidence of high CR was greater in women.

**DISCUSSION**

The prevalence pattern for moderate and high CR

**Table 1.** Summary of the study population characteristics

Variable	Total	Men	Women
Mean age (years)	49.4 ± 12.7	49.3 ± 12.5	49.5 ± 12.8
Mean BMI (kg / m <sup>2</sup> )	29 ± 5.9	29 ± 5.1	29 ± 6.4
Mean systolic pressure (mmHg)	132 ± 21	135.9 ± 19.8	129.2 ± 21.4
Prevalence of smoking habit (%)	22.4 (21.9-23)	26.7 (25.8-27.6)	19.2 (18.5-19.9)
Prevalence of hyperglycemia and diabetes (%)	14.7 (13.6-15.9)	16.9 (15.1-18.9)	13.2 (11.8-14.7)

Continuous variables are expressed as mean±standard deviation. Presence/absence variables are expressed as percentage and total number of cases.

**Table 2.** Prevalence of total and by gender CR categories

Cardiovascular risk	Total			Men			Women		
	n	Prevalence	95% BCI	n	Prevalence	95% BCI	n	Prevalence	95% BCI
Optimum	4,508	39.4	38.5- 40.3	1,486	30.9	29.6-32.2	3,022	45.5	44.4-46.7
Moderate	4,133	36.1	35.2-37	1,899	39.4	38.1-40.8	2,234	33.7	32.5-34.8
High	2,809	24.5	23.8-25.3	1,430	29.7	28.4-31	1,379	20.8	19.8-21.8

BCI: Bayesian Credibility Intervals

**Table 3.** Distribution of categories by geographical region

Region	Cardiovascular risk	Total			Men			Women		
		n	Prevalence	95% BCI	n	Prevalence	95% BCI	n	Prevalence	95% BCI
Northwest	Optimum	1,026	45	43-47	297	30.3	27.4-33.2	729	56.2	53.5-58.9
	Moderate	841	36.9	34.9-38.9	418	42.5	39.5-45.6	423	32.6	30.1-35.2
	High	413	18.1	16.6-19.7	268	27.3	24.6-30.1	145	11.2	9.6-13
Northeast	Optimum	830	45	42.7-47.3	251	32.2	29-35.5	579	54.4	51.4-57.3
	Moderate	675	36.6	34.4-38.8	317	40.7	37.2-44.1	358	33.6	30.8-36.5
	High	340	18.5	16.7-20.3	212	27.2	24.2-30.4	128	12.1	10.2-14.1
Metropolitan	Optimum	223	16.3	14.4-18.3	173	29.4	25.8-33.1	50	6.5	4.9-8.4
	Moderate	495	36.2	33.7-38.7	225	38.2	34.3-42.1	270	34.7	31.4-38.1
	High	651	47.6	44.9-50.2	192	32.6	28.9-36.4	459	58.9	55.4-62.3
Pampean	Optimum	1,217	36.4	34.8-38.1	432	30.9	28.5-33.4	785	40.4	38.2-42.6
	Moderate	1,172	35.1	33.5-36.7	524	37.5	35-40	648	33.4	31.3-35.5
	High	954	28.6	27-30.1	443	31.7	29.3-34.2	511	26.3	24.4-28.3
Cuyo	Optimum	409	42.5	39.4-45.7	111	28.4	24.1-33	298	52.3	48.2-56.4
	Moderate	366	38.1	35-41.2	153	39.1	34.3-43.9	213	37.4	33.5-41.4
	High	187	19.5	17.1-22.1	128	32.7	28.2-37.4	59	10.5	8.1-13.1
Patagonian	Optimum	803	48.6	46.2-51	222	33.1	29.6-36.7	581	59.3	56.2-62.3
	Moderate	584	35.4	33.1-37.7	262	39.1	35.4-42.8	322	32.9	30-35.9
	High	264	16	14.3-17.8	187	27.9	24.6-31.4	77	7.9	6.3-9.7

BCI: Bayesian Credibility Interval

categories (60.6%) in the Argentine population analyzed in 2018 is higher than that reported for Chile (4%) (13), Ecuador (4%) (14), Colombia (16%) (15), Uruguay (35%) (16) and Peru (51%) (17). Although there are slight differences regarding the prevalence of optimum CR, most studies agree that it is the predominant category at a general level, and that there is a differential distribution by sex, with lower CR in women. Studies such as that of Sandoya et al. (16) state that the Framingham score overestimates CR in women, and that the calibration of the algorithm by population RF parameters and CVD incidence tends to correct this bias. Currently, local studies such as the one by Gulayin et al. (18) place the Framingham score among the best predictors of CR for this population, taking into account cohort studies such as that of the Center of Excellence in Cardiovascular Health for South America (CESCAS), which allow estimating the prevalence of CVD.

The differences at the provincial level were greater than those observed regionally, and it should be noted that Buenos Aires and CABA presented values that were far apart from those in the rest of the provinces

(the greatest incidence of high CR and the lowest of optimum/moderate CR). This coincides, in part, with what was reported by the 4th NRFS (5), where RF at the provincial level showed marked differences based on socioeconomic factors. Thus, it was seen that as income increased, the presence of smoking decreased but that of diabetes increased, two powerful factors when defining CR. On the contrary, with lower income, the presence of obesity increased and overweight decreased. On the other hand, Pou et al. (19) identified urban clusters with high and low CVD mortality rate, and that in some of them (for example, in the central region) the main cluster with a high CVD mortality rate coincides with the high prevalence of moderate and high CR for both genders. Although there is a coincidence between both phenomena, and the cause-effect relationship is clear regarding the prevention of CVD, prospective design studies are required in order to attribute the specific effect size to the population and thus correct the estimated CR, as already mentioned by Gulayin et al. (18), who suggested studying the CESCAS cohort for longer periods of time.

Regarding sex differences, men presented greater

**Table 4.** Distribution of CR categories discriminated by province

Region	Province	Cardiovascular risk	Total			Men			Women			
			n	Prevalence	95% BCI	n	Prevalence	95% BCI	n	Prevalence	95% BCI	
Northwest	Catamarca	Optimum	171	44.9	40-49.9	58	32.8	26.1-39.8	113	55.6	48.8-62.3	
		Moderate	140	36.8	32.1-41.7	68	38.3	31.4-45.5	72	35.6	29.2-42.3	
		High	70	18.5	14.8-22.6	52	29.4	23-36.3	18	9.3	5.7-13.6	
	Jujuy	Optimum	204	45.9	41.3-50.5	53	29.2	22.9-35.9	151	57.6	51.6-63.5	
		Moderate	171	38.5	34-43	84	45.9	38.8-53.1	87	33.3	27.8-39.1	
		High	70	15.9	12.6-19.4	46	25.4	19.4-31.9	24	9.5	6.2-13.3	
	La Rioja	Optimum	129	45.5	39.7-51.2	39	32	24.1-40.4	90	55.8	48.2-63.4	
		Moderate	112	39.5	33.9-45.2	56	45.6	37-54.3	56	35	27.9-42.4	
		High	43	15.4	11.4-19.8	28	23.2	16.3-31	15	9.8	5.8-14.8	
	Salta	Optimum	229	46	41.7-50.4	70	30.7	25-36.8	159	59	53.1-64.8	
		Moderate	183	36.8	32.6-41.1	103	45	38.7-51.5	80	29.9	24.6-35.5	
		High	86	17.4	14.2-20.8	56	24.7	19.3-30.4	30	11.4	7.9-15.5	
	Santiago del Estero	Optimum	111	40.6	34.9-46.4	35	29.3	21.6-37.6	76	49.7	41.8-57.5	
		Moderate	104	38	32.4-43.8	52	43.1	34.5-51.9	52	34.2	27-41.8	
		High	59	21.7	17.1-26.8	34	28.5	20.9-36.7	25	16.8	11.3-23	
Tucumán	Optimum	182	45.8	40.9-50.6	42	28.5	21.6-35.9	140	56.2	50-62.2		
	Moderate	131	33	28.5-37.7	55	37.1	29.6-44.9	76	30.7	25.1-36.5		
	High	85	21.5	17.6-25.7	52	35.1	27.7-42.9	33	13.5	9.6-18		
Northeast	Corrientes	Optimum	211	44.8	40.4-49.3	60	30.7	24.5-37.2	151	55.1	49.2-60.9	
		Moderate	184	39.1	34.8-43.5	88	44.7	37.9-51.7	96	35.1	29.6-40.9	
		High	76	16.3	13.1-19.7	49	25.1	19.4-31.4	27	10.1	6.9-14	
	Chaco	Optimum	206	48.1	43.4-52.9	70	37.2	30.5-44.1	136	56.8	50.6-63	
		Moderate	140	32.8	28.4-37.3	66	35.1	28.5-42	74	31.1	25.4-37.1	
		High	82	19.3	15.7-23.2	53	28.3	22.1-34.8	29	12.4	8.6-16.9	
	Formosa	Optimum	179	39.8	35.4-44.4	48	26.2	20.2-32.7	131	49.4	43.5-55.4	
		Moderate	186	41.4	36.9-45.9	84	45.5	38.4-52.6	102	38.6	32.8-44.5	
		High	85	19	15.5-22.8	53	28.9	22.6-35.6	32	12.4	8.7-16.6	
	Misiones	Optimum	234	47.2	42.8-51.6	73	35.1	28.8-41.6	161	56.1	50.3-61.7	
		Moderate	165	33.3	29.3-37.5	79	37.9	31.5-44.5	86	30.1	25-35.5	
		High	97	19.7	16.3-23.3	57	27.5	21.7-33.7	40	14.2	10.4-18.4	
	Metropolitan and Pampeana	CABA	Optimum	92	19.7	16.2-23.4	69	34.5	28.1-41.1	23	8.8	5.8-12.5
			Moderate	164	34.9	30.7-39.2	68	34	27.6-40.6	96	35.7	30.1-41.4
			High	215	45.7	41.2-50.2	64	32	25.8-38.6	151	55.9	50-61.7
Buenos Aires		Optimum	263	14.2	12.6-15.8	219	28.1	25-31.3	44	4.2	3.1-5.4	
		Moderate	669	36	33.8-38.2	310	39.8	36.4-43.2	359	33.3	30.5-36.1	
		High	927	49.9	47.6-52.1	251	32.2	29-35.5	676	62.6	59.7-65.5	
Cordoba		Optimum	341	44.5	41-48	96	29	24.3-34	245	56.3	51.6-60.9	
		Moderate	266	34.7	31.4-38.1	129	38.9	33.8-44.2	137	31.6	27.3-36	
		High	160	20.9	18.1-23.9	107	32.3	27.4-37.4	53	12.4	9.4-15.6	
Entre Rios		Optimum	282	44.9	41.1-48.8	85	32.6	27.1-38.3	197	53.8	48.7-58.9	
		Moderate	226	36	32.3-39.8	94	36	30.3-41.9	132	36.1	31.3-41.1	
		High	120	19.2	16.2-22.4	83	31.8	26.3-37.6	37	10.3	7.4-13.6	
La Pampa		Optimum	116	46.2	40.1-52.4	35	35	26.1-44.4	81	53.9	46-61.8	
		Moderate	89	35.6	29.8-41.6	31	31.1	22.5-40.3	58	38.8	31.2-46.7	
		High	46	18.6	14-23.6	35	35	26.1-44.4	11	7.9	4.2-12.7	
Santa Fe	Optimum	346	47	43.4-50.6	101	32.4	27.3-37.6	245	57.9	53.2-62.5		
	Moderate	253	34.4	31-37.9	117	37.5	32.2-42.9	136	32.2	27.9-36.7		
	High	137	18.7	16-21.6	95	30.5	25.5-35.7	42	10.1	7.4-13.2		
Cuyo	Mendoza	Optimum	147	43.9	38.7-49.2	38	28.9	21.6-36.8	109	53.9	47.1-60.7	
		Moderate	120	35.9	30.9-41.1	49	37	29.1-45.3	71	35.3	28.9-42	
		High	68	20.5	16.3-24.9	46	34.8	27-43	22	11.3	7.3-15.9	

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Region	Province	Cardiovascular risk	Total			Men			Women			
			n	Prevalence	95% BCI	n	Prevalence	95% BCI	n	Prevalence	95% BCI	
	San Juan	Optimum	127	43.5	37.9-49.2	36	29.6	22-37.9	91	53.8	46.3-61.2	
		Moderate	108	37.1	31.7-42.7	47	38.4	30.1-47.1	61	36.3	29.2-43.6	
		High	57	19.7	15.4-24.5	40	32.8	24.9-41.2	17	10.5	6.4-15.5	
	San Luis	Optimum	135	40.4	35.2-45.6	37	27.5	20.4-35.3	98	49.3	42.4-56.1	
		Moderate	138	41.2	36.1-46.5	57	42	33.9-50.3	81	40.8	34.1-47.7	
		High	62	18.7	14.7-23	42	31.2	23.7-39.1	20	10.4	6.6-15	
	Patagonian	Chubut	Optimum	207	49.5	44.8-54.3	56	35.4	28.2-42.9	151	58.2	52.2-64.1
			Moderate	147	35.2	30.7-39.9	67	42.2	34.7-49.9	80	31	25.6-36.8
			High	64	15.5	12.2-19.1	36	23	16.8-29.8	28	11.1	7.6-15.2
Neuquen		Optimum	127	46.9	41-52.8	42	33.1	25.3-41.4	85	59.3	51.2-67.1	
		Moderate	101	37.4	31.7-43.2	51	40	31.8-48.5	50	35.2	27.6-43.1	
		High	43	16.1	12-20.7	35	27.7	20.4-35.7	8	6.2	2.9-10.7	
Rio Negro		Optimum	294	48.8	44.9-52.8	80	33.5	27.7-39.5	214	59.1	54-64.1	
		Moderate	208	34.6	30.9-38.4	88	36.8	30.8-42.9	120	33.2	28.5-38.2	
		High	100	16.7	13.9-19.8	72	30.2	24.6-36.1	28	8	5.4-11	
Santa Cruz		Optimum	109	49.1	42.6-55.6	26	29.7	20.8-39.4	83	62.2	53.9-70.2	
		Moderate	81	36.6	30.4-43	36	40.7	30.8-50.9	45	34.1	26.3-42.2	
		High	32	14.7	10.4-19.6	27	30.8	21.8-40.6	5	4.4	1.7-8.5	
Tierra del		Optimum	66	47.9	39.7-56.1	18	33.3	21.8-46	48	57.6	47.1-67.9	
Fuego		Moderate	47	34.3	26.7-42.3	20	36.8	24.9-49.6	27	32.9	23.4-43.2	
		High	25	18.6	12.6-25.4	17	31.6	20.3-44.1	8	10.6	5-17.9	

BCI: Bayesian Credibility Interval

prevalence of high CR, which coincides with the pattern reported by Castillo et al. (7), Masson et al. (20) and Vicario et al. (21) in different cities of Argentina. Castillo et al. (7) attribute the differences between sexes in the estimated CR to the greater accumulation of RF (hypercholesterolemia, smoking, reduced HDL cholesterol, hypertension and a family history of coronary cardiovascular disease) in men. They accumulate approximately 20% of moderate and high CR prevalence, in contrast with women, who only represent 5% in a group of hospital employees in the city of Posadas, Misiones.

In a random sample in the city of Funes, Santa Fe. Lamas et al. (8) also reported increased prevalence of RF in men, some statistically significant such as hypertension, smoking, and excess weight, and others not, as hypercholesterolemia and waist circumference above normal values. Masson et al. (20) report similar prevalence for moderate and high CR, close to 21% (2% high) at a general level, and 34% and 5% in men and women, respectively, in a cardiovascular prevention clinic at Hospital Italiano of Buenos Aires. Finally, the Characterization and Analysis of Risk in Individuals with Metabolic Syndrome in Argentina (CARISMA) study, (21) the one with the most extended spatial coverage, given that it recruited patients from most of the geographical regions of Argentina, estimates a moderate and high CR of 37.8% at a general level, without expanding in the differences by gender or regional distribution. These results coincide

with the NRFS report (5), where it is observed that, in general, cardiovascular RF occur more frequently in men, who are attributed a higher CR. In this sense, the present work constitutes the first large-scale contribution describing CR in Latin America by considering the information of the 4th NRFS in the Framingham score, which allows the characterization of CR in the Argentine population over 30 years of age.

#### Study limitations

Among the limitations of the study, we can mention the memory bias caused by self-reported diabetes mellitus and the misclassification bias, given by the more conservative cut-off point of the 2018 NRFS (110 mg/dl of glucose) compared with the one proposed by D'Agostino et al. (126 mg/dl glucose). (9) This discrepancy could influence the results, particularly in the estimation of CR.

#### CONCLUSIONS

A strong contrast was evidenced in both the geographical and gender distribution of the global CR estimated by the Framingham score. Geographical differences position the metropolitan region as the one with the greatest CR due to the high prevalence of high and moderate CR. In addition, regarding the disparity between genders, men presented a high CR prevalence up to 4 times greater than women.

This situation highlights the importance of implementing health policies that not only aim to control

individual RF, but also allow the identification of global CR in order to prevent it and direct the appropriate treatment to the population groups at greater risk, acknowledging that it is determined by a confluence of two or more risk factors and not by the presence of only one.

#### Conflicts of interest

None declared.

(See authors' conflicts of interest forms on the website/ Supplementary material)

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