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RESEARCH ARTICLE

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ARTERIAL HYPERTENSION AND OTHER IMPORTANT RISK FACTORS IN THE INCIDENCE OF BRAIN STROKE AND AMI

Gilberto Campos Guimarães Filho[1], Ana Carolina Teixeira Guimarães[1], Thiago de Souza Veiga Jardim[1], Ana Luiza Lima Sousa[1], Weimar Kunz Sebba Barroso de Souza[1], Idiberto José Zotarelli Filho[2,3]* and Paulo Cesar Brandão Veiga Jardim[1]

[1]Federal University of Goias (Universidade Federal de Goiás –UFG), Goiânia, Goiás - Brazil
[2]FACERES – Medical School of Sao Jose do Rio Preto – São Paulo, Brazil
[3]Zotarelli-Filho Scientific Work, Sao Jose do Rio Preto – São Paulo, Brazil

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***Corresponding author:**
Wanessa de Araújo Evangelista

ABSTRACT

Introduction: Arterial Hypertension (AH) is responsible for more than 10 million deaths per year worldwide and one of the main risk factors for the development of cardiovascular diseases is, therefore, a serious public health problem. **Objective:** To assess the correlation of AH with other risk factors and cardiovascular outcomes. **Methods:** A observational-epidemiological longitudinal study was carried out comparing patients enrolled in the service at the time of admission and after an average period of 5 years. Participants ≥18 years old, regularly monitored at the Center, up to 6 months before data collection. Demographic variables, blood pressure (BP), body mass index, risk factors, and cardiovascular outcomes were evaluated. The data were stored (Microsoft Excel) and analyzed by SPSS software. **Results:** 1,299 participants were studied, with a predominance of females (60.9%) and a mean age of 56.7 ± 13.1 years. Over time, there was a significant increase in a sedentary lifestyle, alcoholism, diabetes, dyslipidemia, and being overweight. Regarding cardiovascular outcomes, we observed an increase in brain stroke and myocardial revascularization and a lower frequency of chronic kidney disease (CKD). During follow-up, there were significant changes in the BP control indexes (from 29.6% to 39.6%; $p = 0.001$). After analyzing the Chi-Square association (X2) and the binary logistic regression analysis during the patients' admission period, the correlations between AMI and CVA with the cardiovascular risk factors were performed, obtaining $p < 0.05$ (CI 95%) with a significant statistical association to brain stroke with all risk factors, except for SAH. To the follow-up period, $p < 0.05$ (CI 95%) was obtained with a statistically significant association to the brain stroke with only the factors "smoking" and "sedentary lifestyle". In the same reasoning, $p < 0.05$ (CI 95%) was obtained with a statistically significant association to AMI with only the factors "smoking" and "dyslipidemia". Regarding the follow-up period, $p < 0.05$ (CI 95%) was obtained with a statistically significant association to AMI with only the factors “sedentary lifestyle” and “obesity”. **Conclusion:** There was a positive correlation between hypertensive, overweight, sedentary, and diabetics. Was found a good percentage of diabetics with hypertension under control and a non-exaggerated number of myocardial infarction, brain stroke, and CKD. Also, the patient follow-up process proved to be very positive, as there was an important reduction in the contributions of risk factors to brain stroke and AMI events.

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INTRODUCTION

According to the World Health Organization (WHO), cardiovascular diseases (CVD) are the main cause of death in the world (1). It is estimated that 17.7 million people died of CVD in 2015. In Brazil, CVD represent the main cause of death with 30.4% of deaths (2). Also, more than three-quarters, about 37%, of CVD deaths occur in low and middle-income countries and, in Brazil, CVDs are responsible for about 384 thousand deaths per year (3). According to the Canadian Heart and Brain stroke Foundation (CVA), age, sex, family history, smoking, sedentary lifestyle, unhealthy diet, Arterial Hypertension (AH), Dyslipidemia, Diabetes Mellitus (DM), and obesity are among the main cardiovascular risk factors (CVRF) for the development of CVD (4), with AH being one of the most important cardiovascular modifiable causes (5) and one of the main independent risk factor for CVD (6). Also, AH is present in 69% of patients with a first acute myocardial infarction (AMI), in 77% of patients with a first brain stroke, in 74% of patients with chronic heart failure (CHF), and in 60% of patients with arterial disease peripheral (7). When blood pressure (BP) (Systemic Arterial Hypertension - SAH) and other cardiovascular risk factors are associated, they may increase, leading to a total risk, which is greater than the sum of its components (8). Also, SAH is classified as an important predictor for the development of CVD, cerebrovascular and renal diseases, accounting for at least 40.0% of deaths from brain stroke, 25.0% of deaths from coronary artery disease, and, in combination with diabetes, 50.0% of cases of end-stage renal failure (9). Still, in this context, diabetes responds as the 5th leading cause of death worldwide (10,11). Diabetic patients have a 15% higher risk of premature death and reduced life expectancy by approximately 10 and 20 years for type I and type II diabetes, respectively (12,13). According to the 2017 International Diabetes Federation (IDF) statistics, the global prevalence of diabetes among the 20 to 79 age group is 8.8%. Also, 1 in 2 people is unaware of the disease (14). In 2030, it is estimated that diabetes affects 439 million adults before the estimate was 366 million (15.16). In this sense, the present study aimed to assess the correlation between arterial hypertension and other cardiovascular risk factors and cardiovascular events in a Reference Center for arterial hypertension and diabetes mellitus (CRHD) in a medium-sized city in the midwest region of Brazil.

METHODS

Study Design: The present study followed a Observational-Longitudinal Study, following the rules STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) (17). This is a non-concurrent cohort, with a representative sample of hypertensive patients, being monitored at the CRHD.

Power and Sample Size: The sample was calculated considering a significance level of 5%, in a 95% confidence interval, with an absolute precision of 2.5% and an estimated frequency of simultaneity of other risk factors associated with AH of 73.4 % Lessa et al., 2004 (18), with an estimated frequency of 25% of patients with pressure under control, according to Burt et al., 1995 (19). Based on these parameters, 1299 individuals were obtained.

Ethical Aspects: The research project number 128/11 was evaluated and approved by the Research Ethics Committee of the Hospital das Clínicas of the Federal University of Goiás (UFG) and all participants signed an informed consent form.

Participants and Eligibility: From an initial database of 14,000 patients registered in the CRHD, participants were randomly selected for the study. Individuals of both sexes (between 18 and 95 years old), with AH, under regular treatment, registered in the CRHD between the years 2003 to 2012, up to 6 months before the start of data collection were included. The exclusion criteria included impossibility or denial to sign the consent form, participation in other research protocols, patients with type I DM, the non-location of the subject in two home visits, and incomplete initial consultation form. The initial sample (admission phase) consisted of 1,299 participants, 123 of whom were not found in 2 attempts to count and/or refused to participate in the study, being replaced by other participants in the initial database. The final sample (home visit) was composed of 1226 individuals, with the finding of 72 deaths. Data from medical records regarding admission to the unit were analyzed and, subsequently, follow-up was performed, with new data collection, during home visits.

Clinical and anthropometric assessments: The instruments used for admission to CRHD and home visits contained information regarding anthropometric parameters, personal data, blood pressure measurements, sedentary lifestyle, smoking, alcohol consumption, DM, dyslipidemia, brain stroke, acute myocardial infarction (AMI), chronic kidney disease (CKD) and Myocardial Revascularization (MR). Smokers were those who consumed at least one cigarette per day (20). The consumption of alcoholic beverages was self-reported as present or not, without quantifying consumption. Physically active was defined as one who reported the practice of any moderate physical activity, at least 150 minutes per week. The investigation of the diet was carried out in a simplified way, being asked if it was low in sodium (≤ 5 grams per day), low in calories, low in fat, or low in fat. The use of medications was verified during the home visit, through the medical prescription and/or the visualization of the medications themselves. The presence of diabetes and dyslipidemia was determined by the evaluation of existing biochemical tests that proved the alteration, the use of specific medications, and in the absence of both, a new lipid and glycemic profile were performed, through a biochemical examination carried out in the laboratory of the Health Unit System (HUS). The cardiovascular outcomes considered were AMI; MR; STROKE; CKD and death. Their investigation was carried out through the report of the participant, family member, or companion, the existence of complementary exams, medical reports, or death certificates.

The body mass index (BMI) was calculated using the Quetelet formula (21), the weight being verified with the participant without shoes, using a calibrated electronic scale, from the Toledo brand, with a precision of 100 g; and the height with an inextensible measuring tape 150 centimeters long, fixed at 50 centimeters from the floor. The BMI values were as follows: 18.5-24.99kg / m² = eutrophic, 25-29.99kg / m² = overweight, ≥ 30kg / m² = obesity, being considered overweight from 25kg/m². BP measurement at admission was performed with a calibrated aneroid sphygmomanometer, brand Preminum®. During the home visit, the BP was measured with an automatic digital sphygmomanometer, calibrated and validated, from the OMRON 710 CP brand. Both measures were performed by the VII Brazilian Guidelines on Hypertension (2020). Two measurements were taken, with an interval of 1 minute between them, being considered the average between them. The values considered normal for BP were: ≤130x80mmHg (Diabetics) and <140x90mmHg (non-Diabetics).

STATISTICAL ANALYSIS

Statistical analysis was performed using the SPSS v.20.0® software. To verify the normality of the data distribution, the Kolmogorov-Smirnov test was used. Mann-Whitney U test or Kruskal Wallis test was used to compare means between groups and Pearson or Spearman correlation coefficient was used to correlate variables. To compare means between related groups, the Wilcoxon test, Student's t-test or ANOVA, and the McNemar test was used to compare categorical variables at different times. Chi-square test (utilizado2) was used to compare proportions. For all tests, a 5% significance level and a 95% confidence interval were considered. The variables of cardiovascular outcome and risk factors were considered independent and were included in a multivariate regression model (binary logistic regression). The Odds Ratio (OR) with a 95% confidence interval (95% CI) was used to estimate possible associations between the variables and to know the probability ratio between the groups analyzed, obeying the 95% CI. The level of significance was $p \leq 0.05$.

RESULTS

The mean age was 56.7 ± 13.1 years (minimum 18 and maximum 95 years), 60.9% were female. 45.3% were in the age group over 60 years old, 63% of whom were male. As for risk factors for CVD, in addition to AH, it was observed, at the beginning of the study, that 59.4% (n = 772) were sedentary, 21.2% (n = 275) smokers, 1.3% (n = 17) alcoholics, 25.3% (n = 329) diabetics; 1.5% (n = 20) reported dyslipidemia and 66.8% (n = 858) were overweight. In the initial study sample, it was observed that 9.9% of the population had a history of brain stroke and the same percentage of AMI, 12.7% had CKD and 1.1% MR. Risk factors for CVD were also observed among men and women, except for excess weight, which was significantly higher among women (p = 0.02). Regarding the initial CV outcomes, significantly higher prevalences were observed among men about CVA (p = 0.001) and CKD (p = 0.02). The analysis of risk factors and CV outcomes to the age group (<60 years and> 60 years) did not show significant differences. At the time of admission, 914 patients (70.4%) had BP out of control targets. Among diabetics, the number of individuals (n = 295) without adequate BP control was also high, corresponding to 89.7% of those individuals. Of the 1298 participants initially analyzed, 1227 were reevaluated through home visits. The average follow-up time was 4.5 +/- 2.2 years (median of 5 years) with a maximum time of 9 years and a minimum of 1 year. Over time, there was a significant increase in the presence of CV risk factors among the participants, except for smoking where there was no change (Table 1). Regarding CV outcomes, a significantly higher number of brain strokes and MRs and a lower number of CKDs were observed during home visits (Table 2). In general, the average BMI maintained the population of both sexes classified as being overweight, with a significant increase in weight over time (Table 03).

Between admission and a home visit, there was a significant increase (10%) of participants with controlled BP in the segment phase (29.6 Admission-39.5-Segment with p <0.001). Of the deaths that occurred during the follow-up period, 91.7% (n = 66) were caused by cardiovascular diseases, 68.1% by AMI (Table 4). There was no statistically significant difference in deaths according to the age group (<60 years and> 60 years). After Chi-Square association analysis (X^2) and binary logistic regression analysis, AMI and CVA correlations were performed with CVRF according to Tables 5 and 6. At X^2, during the patients' admission period, p <0.05 (CI 95%) was obtained with a statistically significant association to brain stroke with all risk factors, except SAH. Regarding the patients' follow-up period, p <0.05 (CI 95%) was obtained with a statistically significant association to the CVA with only the factors "smoking" and "sedentary lifestyle" (Table 5). In the same reasoning, at X^2, during the patients' admission period, p <0.05 (CI 95%) was obtained with a statistically significant association to AMI with only the factors "smoking" and "dyslipidemia". To the follow-up period of patients, p <0.05 (CI 95%) was obtained with a statistically significant association to AMI with only the factors “sedentary lifestyle” and “obesity” (Table 6).

It was possible to observe the differences between the observed and expected counts in each association of the CVA or AMI with the risk factors, analyzing which variables presented the greatest differences, which may indicate dependence, according to Tables 5 and 6. After binary logistic regression analysis on the brain stroke data of the studied population in terms of the presence of risk factors, between the admission and follow-up period, it was found that the factor “smoking” showed an increase in the Odds Ratio (OR), from 2.56 to 2.95, and “sedentary lifestyle” showed an OR increase from 0.92 to 3.82, both representing an increase in the chances of contributing to the incidence ofb. However, after patient follow-up, most risk factors showed that they no longer contribute to the incidence of brain stroke, with emphasis on the factors “alcoholism” and “obesity” that presented OR values equal to 4.45 and 3.23 during the admission period, respectively, as shown in Table 5. Still in this type of statistical evaluation, but the relation to the AMI data of the studied population in terms of the presence of risk factors, between the admission and follow-up period, it was found that the “sedentary lifestyle” factor showed an increase in the Odds Ratio (OR), from 0.99 to 3.70, and “obesity” increased in OR from 1.25 to 3.55, both representing an increase in the chances of contributing to the incidence of AMI. However, after patient follow-up, most risk factors showed that they no longer contributed to the incidence of AMI, with emphasis on the factors “smoking” and “dyslipidemia” that had OR values equal to 2.76 and 2.10 during the admission period, respectively, as shown in Table 6.

DISCUSSION

CRHD is an institution established in the Brazilian public health system, which is based on the care and control of the hypertensive and/or diabetic population, as well as the prevention of cardiovascular outcomes, since both cause diseases with serious socioeconomic and public health impact. It is composed of a multidisciplinary team (cardiologist, endocrinologist, nutritionist, nurse, psychologist) who was still not able to reduce all risk factors for cardiovascular outcomes. The investigation showed an increase in sedentary participants (p <0.01) during the follow-up period, with 76.3% in this condition. This fact reflects a certain ineffectiveness of the service in making the population aware of the importance of the benefit of physical activity in preventing cardiovascular outcomes in hypertensive patients. The absence of a physical educator in the multidisciplinary team may have contributed to the increase in the rate of sedentary lifestyle. Similar results also found a large and growing proportion of sedentary people (22-24) and with a positive correlation with CV outcomes (25-27). In the present study, the findings showed a large number of overweight participants, with a predominance of women, as well as a positive correlation with hypertension, in both sexes. The same situation has been shown in other studies (28-31). The predominance of the female gender is probably due to the greater concern of this class, to the preventive factors, and with this greater search for health services. There is a close association between AH and DM, which often requires the management of both diseases in the same user (32,33). In this study, there was also a greater presence of DM throughout the follow-up (p <0.01), which can also be a limiting factor for better control of AH and CV outcomes (34).

The suboptimal management of patients with AH and/or DM, demonstrated here by the low control of CVRFs, except smoking, is consistent with previous reports from developing countries. Cross-sectional studies conducted in Poland (35) and China (36), less developed countries, found that among patients with DM and AH, only 1.4 and 5.6%, respectively, achieved control of blood pressure, diabetes, and cholesterol and that treatment optimization reduces CV outcomes (37,38). The same was also observed in developed countries and with a shorter follow-up time than our study (median of 5 years) (39,40). Coronary heart disease is one of the cardiovascular outcomes with the highest prevalence and lethality in AH (37). When the incidence of AMI was identified, it was observed that this was the second most frequent complication (10.5%) among those studied. Robust and multicenter studies have shown results similar to ours, in showing the correlation of risk factors with CV outcomes and confirmed that traditional risk factors explain more than 90% of the risk attributable to AMI (41-43). Despite the research by Flint et al showing a low prevalence of myocardial infarction and brain stroke in a population of AH, there was a direct and independent relationship between them (44). The same was presented in our study. Blood pressure is a powerful determinant of the risk of ischemic brain stroke and intracranial hemorrhage and there is evidence that controlling blood pressure levels reduces the risk of brain stroke (45). Also, however, the present study showed that during the patients' admission period a statistically significant association (p<0.05) of the brain stroke was obtained with all risk factors, except for AH, revealing that

Table 1. Presence of Cardiovascular Risk Factors at admission and follow-up

	ADMISSION (n=1299)		FOLLOW-UP (n=1227)		
Variables	N	%	N	%	p*
Sedentary lifestyle					
Yes	772	59.4	936	76.3	<0.00
No	527	40.6	291	23.7	
Smoking					
Yes	275	21.2	268	21.8	0.73
No	1024	78.8	959	78.2	
Ethics					
Yes	17	1.3	157	12.8	<0.00
No	1282	98.7	1070	87.2	
Diabetes Mellitus					
Yes	329	25.3	415	31.9	<0.00
No	970	74.7	812	66.2	
Dyslipidemias					
Yes	20	1.5	367	29.9	<0.00
No	1279	98.5	860	70.1	
Overweight					
Yes	858	66.1	875	71.3	<0.00
No	427	32.9	352	28.7	

* *Teste de McNemar*

Table 2. Distribution of cardiovascular outcomes at admission and follow-up

	ADMISSION (n=1299)		FOLLOW-UP (n=1227)		
Variables	N	%	N	%	p*
Stroke					
Yes	128	9.9	152	12.4	0.003
No	1171	90.1	1075	87.6	
AMI					
Yes	128	9.9	129	10.5	0.372
No	1171	90.1	1098	89.5	
CKD					
Yes	165	12.7	129	10.5	<0.00
No	1134	87.3	1098	89.5	
MR					
Yes	14	1.1	79	6.4	<0.00
No	1285	98.9	1148	93.6	

* *McNemar* test **Stroke - Brain stroke; AMI - Acute myocardial infarction; CKD - Chronic Kidney Disease; MR- Myocardial revascularization.

Table 3. Evolution of BMI at admission and follow-up according to sex

BMI	ADMISSION	FOLLOW-UP	p*
	n=1298 Mean - SD	n=1226 Mean – SD	
Male	27.2 ± 5.1	27.6 ± 5.2	<0.00
Female	28.9 ± 6.6	29.3 ± 6.6	<0.00

* *Wilcoxon Signal Testing*

Table 4. Distribution of the number and percentage of deaths in the follow-up

Variables	N	%
Cardio death	3	4.2
Stroke death	14	19.4
AMI death	49	68.1
Other	6	8.3
Total	72	5.5 (1299)

Table 5. Association between cardiovascular outcome of brain stroke with risk factors

		Brain stroke									
		Admission (n=1299)					Follow-up (n=1227)				
		No	Yes	X^2	p-value	Odds Ratio (OR)	No	Yes	X^2	p-value	Odds Ratio (OR)
Tabagism	No	935	89	7,35	0,007		855	104	9,63	0,002	
	Yes	236	39			2.56	220	48			2.95
Etilism	No	1163	119	36,00	<0,001		944	126	2,88	0,089	
	Yes	8	9			4.45	131	26			1.02
Sedentary lifestyle	No	469	58	1,325	0,250		234	57	18,21	<0,001	
	Yes	702	70			0.92	841	95			3.82
DM	No	868	102	1,88	0,169		715	97	0,43	0,511	
	Yes	303	26			1.52	360	55			0.93
Dyslipidemia	No	1157	122	9,28	0,002		752	108	0,07	0,782	
	Yes	14	6			2.12	323	44			0.85
Obesity	No	326	53	10,27	0,001		264	40	0,22	0,638	
	Yes	845	75			3.23	811	112			0.89
Arterial hypertension	No	592	579	0,148	0,701		523	552	0,817	0,366	
	Yes	67	61			0.87	68	84			0.90

X^2: Chi-square test

Table 6. Association between the cardiovascular outcome of AMI and risk factors

		AMI									
		Admission (n=1299)					Follow-up (n=1227)				
		No	Yes	X^2	p-value	Odds Ratio (OR)	No	Yes	X^2	p-value	Odds Ratio (OR)
Tabagism	No	935	88	8.613	0.003		863	96	1.181	0.277	
	Yes	235	40			2.76	235	33			0.86
Etilism	No	1154	127	0.307	0.58		957	113	0.020	0.888	
	Yes	16	1			0.94	141	16			0.80
Sedentary lifestyle	No	469	58	1.307	0.253		249	42	6.229	0.013	
	Yes	701	70			0.99	849	87			3.70
DM	No	871	98	0.274	0.601		732	80	1.116	0.291	
	Yes	299	30			0.96	366	49			0.98
Dyslipidemia	No	1155	123	5.237	0.022		775	85	1.212	0.271	
	Yes	15	5			2.10	323	44			0.95
Obesity	No	333	46	3.119	0.077		272	32	0.993	<0.001	
	Yes	837	82			1.25	826	97			3.55
Arterial hypertension	No	593	577	0.036	0.850		530	568	0.045	0.833	
	Yes	66	62			0.85	61	68			0.86

X^2: Chi-square test

AH does not act isolated way, but associated with other comorbidities. Regarding the patients' follow-up period, a statistically significant association ($p<0.05$) of the brain stroke was obtained with only the factors "smoking" and “sedentary lifestyle”, showing that the follow-up process had an impact on the improvement of some comorbidities, such as etilism, DM, dyslipidemia, obesity, and AH. In the same reasoning, during the patients' admission period, a statistically significant association ($p<0.05$) to AMI was obtained with only the factors "smoking" and "dyslipidemia", showing the important relationship of these comorbidities with atherosclerotic processes. Regarding the patients' follow-up period, there was a statistically significant association of AMI with only the factors “sedentary lifestyle” and “obesity”, revealing that the follow-up process had an impact on the improvement of other comorbidities such as etilism, smoking, DM, dyslipidemia, and AH. Besides, the present study showed that brain stroke was the most frequent complication among hypertensive patients, both at the beginning and during follow-up, even in those with better BP control. The explanation for this fact may be the ineffective control of AH obtained by the service, greater accuracy in the diagnosis of brain stroke, and eventually the greater association with other comorbidities, such as overweight, sedentary lifestyle, and advancing age. Achieving control of behavioral and metabolic risk factors can avoid more than three-quarters of the global brain stroke load (46). AH is closely related to CKD, which may be the cause or consequence of kidney disease (47). A study by Kumar et al showed 3.8% of CKD, associated with AH and/or DM (48). In a historical cohort with more than 11 years in the segment, there was an increase in the prevalence of renal failure (49). The increase in age and appearance and other CV risk factors contribute to the growth of the global burden of chronic kidney disease (6,50). Our study, surprisingly, observed a significant decrease in the percentage of individuals with CKD, from 12.7% to 10.5%, a fact for which we have not found a logical justification. The improved survival of patients with several chronic diseases also led to an increased incidence of CKD in these groups. As the global burden of this condition increases, aiming at improving health literacy, both locally and nationally, it can improve the results of this group of patients. Practically, encouraging shared decision-making and patient involvement whenever possible can be a useful first step (37,47). Our study showed, during the 5-year follow-up, as the main cause of death, AMI (68.1%), followed by brain stroke (19.4%). A similar result was observed in the robust NHANES III study (51). This finding can be attributed to reasons such as the worsening of risk factors such as advancing age, increased sedentary lifestyle, overweight, DM, dyslipidemia, and non-adherence to drug and non-drug treatment. Such circumstances show that just controlling blood pressure is not enough to reduce CV outcomes. The significant increase in factors and cardiovascular risk and complications shown in this study, over a median of 5 years, maybe explained by the aging of the studied population, since age is one of the main risk factors for AH and consequently their cardiovascular outcomes (52).

However, it must be considered that the collection of retrospective data (admission period in the CRHD) may have represented a bias, which originated the part of the numbers found. In a cohort conducted with 1.3 million participants, the authors showed a positive correlation between hypertensive individuals and CV outcomes (STROKE and AMI) as well as CV risk factors (Age, smoker, hypercholesterolemia, overweight, and DM) (53). The same was observed in our study, which had a population with similar anthropometric data, but with a higher prevalence of DM, CVA, and AMI, as this is research carried out at a reference center in AH and DM. Although our study showed a 10% increase in the rate of blood pressure control, there was an increase in their CV outcomes, suggesting that treating AH is not limited only to blood pressure values, but also the control of the metabolic profile and other FRCVs such as weight and sedentary lifestyle. The present study also presents blood pressure analysis as a strong point in the follow-up period, using the standardized measurement with an automated oscillometric device, calibrated and validated, on a scale close to the population level. This verification, being carried out by trained professionals, can minimize the risk of “white coat hypertension” in our cohort. As the data in the present study came from a comprehensive electronic medical record (HYPERDIA), all routine ambulatory blood pressure readings for all participants in the cohort were included, which allowed a granular estimate of the hypertension burden. This work presents the limitations inherent to studies that use part of the data collected retrospectively. An important example is the possibility of an underestimation of metabolic changes that were referred to in the first evaluation and that were information effectively obtained through measurements at the follow-up visit, which may simulate falsely higher values in the second evaluation. Despite this, on the whole, the information provided is consistent, which makes it possible to indicate ways for an improvement in the primary care of the population in one of the areas of greatest need and importance, which are cardiovascular diseases. The need for a critical reassessment of these projects is clear, but for this, it is essential to reorganize all primary care. This must be based on a better working relationship, with the valorization of health professionals (creation of a formal career in the health area), the restructuring of multidisciplinary teams, with defined competencies, and the restructuring of the service itself, with decentralized facilities, functioning in alternative schedules, valuing health promotion and home visits (54). Ultimately, early and effective diagnosis and treatment, improving disease control and reducing CV outcomes, through standardization of treatment protocols, a better understanding of what works and what does not, and dissemination of best practices in primary care.

CONCLUSION

There was a positive correlation between hypertensive, overweight, sedentary, and diabetics. The low prevalence of dyslipidemias and smokers, the good percentage of diabetics with hypertension under control, and the unreasonable number of outcomes (IM, CVA, and

CKD) draws attention and represents a differential factor that may be a consequence of the multidisciplinary strategy adopted by the program. Also, the patient follow-up process proved to be very positive, as there was an important reduction in the contributions of risk factors to brain stroke and AMI events.

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