Dermatoglyphics of Women With Systemic Arterial Hypertension

Gabriela Sartori[1], Fabiane Pertille[1], Adriano Alberti[2], Bruna B. da Silva[2], Fabiana M. Dallacosta[1], Graciele Fin[1], Renan Souza[1], Clarissa M. Comim[2], Rudy J. Nodari Júnior[3]

[1] Laboratory of Exercise Physiology, Postgraduate Program in Biosciences and Health, University of West Santa Catarina, Joaçaba, Brazil

[2] Research Group on Neurodevelopment of Childhood and Adolescence, Laboratory of Experimental Neuroscience, Postgraduate Program in Health Sciences, University of South Santa Catarina, Palhoça, SC, Brazil

[3] Department of Research, Salus Dermatoglifia, Joaçaba, SC, Brazil

Received: 03 May 2022; Accepted: 11 May 2023

Abstract- Systemic arterial hypertension is a clinical condition of great risk in the development of cardiovascular diseases and it has a high impact on public health. The disease is influenced by modifiable and non-modifiable factors. In that context, Dermatoglyphics is a method of analysis of fingerprints as a mark of biological individuality and that can be related to health, sports, and the prognosis of diseases due to being able to point out the individual with the potential to develop certain diseases. This study aimed to investigate the characteristics of the fingerprints of women with systemic arterial hypertension by comparing them with a control group, which does not present the disease. Thus, we intend to find a dermatoglyphic pattern for Brazilian women with systemic arterial hypertension. The sample in the study consisted of 732 women, 366 with a positive clinical diagnosis for systemic arterial hypertension, and 366 individuals forming a control group, which did not present systemic arterial hypertension. All individuals in the sample are of equivalent age and the fingerprints were collected from all fingers. The method used to determine the profile of the individuals is the computerized dermatoglyphic. It was used, for the collection of fingerprints, of the Dermatoglyphic Reader®, which presents results of 400% more precision. There was a statistically significant difference between the groups, and when the Adjusted Residue Analysis was performed, the Ulnar Loop figure on fingers 4 and 5 of the left hand, and fingers 1 and 5 of the right hand, was predominant in the group of women with hypertension. These results demonstrate the existence of a dermatoglyphic mark, characteristic of patients with systemic arterial hypertension. Therefore, it can be concluded that the analysis of fingerprints of the hands by the Dermatoglyphic method can demonstrate the potential that women could have developing systemic arterial hypertension.

Acta Med Iran 2023;61(7):386-393.

Keywords: Hypertension; Dermatoglyphics; Prognosis; Prevention

Introduction

Systemic arterial hypertension (SAH) is a clinical condition that has been affecting people worldwide, being an important risk factor in the development of cardiovascular diseases (1,2). Its prevalence is high, and its control rate is low, causing one of the most important burdens to the public health system in Brazil and the world. Besides that, it can lead to disability and loss of quality of life. The disease, henceforward called SAH, is present when systolic pressure reaches values equal to or greater than 140 mmHg and diastolic pressure reaches values equal to or greater than 90 mmHg. It is usually silent and progresses slowly, affecting the functioning of various organs (1).

Considered a chronic disease, SAH is a preventable and controllable disease that causes considerable mortality and morbidity, due to the damage caused to organs (3). Cardiovascular diseases cause 17 million deaths per year worldwide and SAH is responsible for

Corresponding Author: A. Alberti
Research Group on Neurodevelopment of Childhood and Adolescence, Laboratory of Experimental Neuroscience, Postgraduate Program in Health Sciences, University of South Santa Catarina, Palhoça, SC, Brazil
Tel: +98 55483279-1167, E-mail address: adrianoalberti90@hotmail.com

45% of deaths from heart disease and 51% due to stroke (2) (WHO, 2013). SAH is one of the most important risk factors related to cardiovascular morbidity and mortality (4).

Genetic predisposition is a factor considered in the diagnosis of hypertension, since people who have it in the family, may have a chance of developing the disease. With the advances in research and techniques of genetic manipulation, knowledge about collective health, in addition to considering environmental influences on the health and disease process, started to point to the emergence of a possible genetic approach (5).

The dermatoglyphic method observes the fingerprints as biological individuality, being able to identify a rare pattern or mark for diseases (6). This method is related to the number of lines and the drawings found in the fingerprints, which materialize as a mark that reveals the Biological individuality, as they are immutable: once formed during pregnancy, the fingerprint will remain the same, being an indisputable and differentiating mark of each human being (7).

For the observation of fingerprints, science recognizes dermatoglyphics according to the method proposed by Cummins and Midlo (8). This methodology consists of identifying the figures present; Identifying nuclei and deltas; Draw Galton Line; Count number of deltas; Count number of lines.

The designs observed in the fingerprints form practically countless variations and combinations, in the arrangement of the nucleus and deltas, the shape of the design, the number of lines, and minutiae. The scheme of the arrangement of the lines in their infinite mathematical combinations is what determines the infinite statistical possibility of arrangements, consequently allowing for the close chance of zero of equality between two samples (6).

The drawings found in digital printing can be classified due to their variations, as identified in Figure 1.

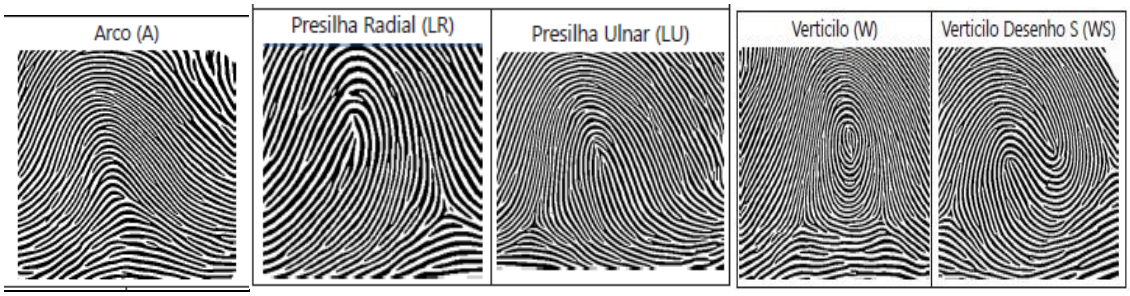

Figure 1. Drawings found by dermatoglyphics (Nodari e Fin 2016)

The arch design (A) is characterized by the absence of deltas, composed of ridges that cross the phalanx transversely, while the loop (L) presents a core and a delta, the design being like a loop, where the skin ridges from one end of the finger, curving distally concerning the other and can be classified into a radial loop (RL) and ulnar loop (UL) depending on which side the delta faces. The whorl design (W) has two deltas and a core where the central lines are concentrated around the drawing core. The whorl drawing S is formed by the baseline, marginal and nuclear lines in a way that allows the construction of two deltas and two nuclei, the nucleus being in the shape of (S) (6).

Since the fingerprint is the result of a combination of factors related to the genetic code and fetal development, it is possible, from its observation, to identify the potential characteristics an individual has. This study aimed to investigate the characteristics of the fingerprints of women with SAH, comparing them with a control group, which does not present the disease.

Materials and Methods

Selection of patients

The sample consisted of 732 women, aged between 22 and 84 years old of whom 366 had hypertension, were living in the Midwest of Santa Catarina, being treated in a cardiology clinic, and, in addition being part of the Hiperdia program. As for the control group, 366 women with no presence of the disease were selected through the database of the Exercise Physiology Laboratory of the University of the West of Santa Catarina-Unoesc.

The sample calculation for obtaining the ideal sample was based on the calculation of an infinite population, resulting in an amount of 385 individuals (9,10) (Brasil, 2014; Brunoni, 2002). According to the existing calculation methodologies (11), if there is any investigative research on the percentage of the population

to be investigated, the adopted procedure is the one that follows if, in the subsequent year, there is another percentage for the same, but that does not exceed 5 percentage points, this calculation changes, and the minimum study population will be 277 individuals, for a 95% confidence level.

The protocol chosen to analyze the genetic potential through the collection of fingerprints was the Dermatoglyphic, proposed by Cummins and Midlo (8), through the Dermatoglyphic Reader® validated by Nodari Júnior (12). For the capture, processing, and analysis of fingerprints by the Method Dermatoglyphic, a computerized process was used for dermatoglyphic reading, that is, a reader consisting of a rolling optical scanner, which collects, interprets the image and builds a drawing in binary code, which is captured by a specific treatment and reconstruction software resulting in real and binary black and white images.

The fingerprints were collected at the time of the consultation with the cardiologist and/or at the meeting of the Hiperdia program, where the patients were already diagnosed with SAH and were already undergoing treatment and medical monitoring.

The process of collecting fingerprints was performed using the computerized method, and the individual to be researched supported the phalanx (ulna side) on the optical scanner of the Dermatoglyphic Reader, making a rolling, in its longitudinal axis, up to the lateral side (radio) (6). The fingerprint collection starts with the left pinky finger of the left hand, going to the left ring finger, the left middle finger, the left index finger, and the left thumb. Subsequently, it goes to the right thumb, right index finger, right middle finger, and right ring finger ending with the right (pinky)little finger.

From this stage, the interference of the evaluator occurs in the marking of the core and delta points, when then, the software makes the qualitative identification of the image and quantitative of lines. It generates the computerized spreadsheet resulting from the processed data through the computerized method, where the degree of reliability in the data processing is higher (13).

For the group of women with SAH, some inclusion criteria were considered such as female patients with a clinical diagnosis of SAH and with the collection of 10 fingerprints of the hands clearly for the capture and dermatoglyphic analysis. On the other hand, women who did not have a clinical diagnosis of SAH, who did not accept to participate in the research and/or sign the informed consent form, and who had anomalous fingerprints or missing fingers were considered excluded from the study.

The research was submitted to and approved by the Research Ethics Committee of (Unoesc), Joaçaba campus, Brazil, under the number 1.380.492. This study is also under the Declaration of Helsinki and Resolution n.466/12, and all participants signed the Free and Informed Term of Commitment.

Statistical analysis

Statistical analyzes were processed using the Statistical Package for the Social Science (SPSS), version 20.0, with a significance level of $P<0.05$. In the comparison between the groups and their quantitative variables, the Kolmogorov-Smirnov test was used to observe the distribution of normality.

After applying the test, a non-normal distribution of data was observed. As an inference, we used the non-parametric test called Mann-Whitney for comparisons between continuous variables such as the sum of the number of lines of the left-hand finger 1- thumb (MESQL1), the sum of the number of lines of the finger 2- index (MESQL2), the sum of the number of lines of the finger 3- middle finger (MESQL3), sum of the number of lines of the finger 4- ring (MESQL4), sum of the number of lines of the finger 5- minimum (MESQL5). Subsequently, we considered the sum of the total number of lines on the right hand (SQTLE). Then, we considered the right-hand sum of the number of lines of the finger 1- thumb (MDSQL1), sum of the number of lines of the finger 2- index (MDSQL2), sum of the number of lines of the finger 3- middle finger (MDSQL3), sum of the number of lines of the finger 4- annular (MDSQL4) and finally, the sum of the number of lines of the finger 5- minimal (MDSQL5. We considered the sum of the total number of lines on the right hand (SQTLD), as well as the sum of the total number of lines-both hands (SQTL).

For the comparison of categorical variables: A, RL, UL, and whorl W, left hand drawing finger 1 (MET1), finger 2 (MET2), finger 3 (MET3), finger 4 (MET4), and finger 5 (MET5) and, from the right hand, finger 1 (MDT1), finger 2 (MDT2), finger 3 (MDT3), finger 4 (MDT4) and finger 5 (MDT5), was used the Chi-square test and when found significant differences, the adjusted residual analysis was applied.

Results

The present study presents a sample of 732 women, 366 of whom were clinically diagnosed with SAH with ages ranging from 22 to 84 years old. They were compared with the control group, formed of 366 women with no hypertension, available and selected in the bank

data from the Exercise Physiology Laboratory of *Unoesc Joaçaba.*

After analyzing the data, it was observed that among the continuous variables (sum of the number of lines per finger, per hand, and both hands), there was no significant difference when comparing the women with hypertension and the control group, as shown in Table 1.

To compare categorical variables (types of design), the Chi-square test was used, which showed a significant difference between groups. Observing the significant difference between the figures manifested by the groups from the Chi-square, we opted for the recommendation made by Pereira[13] to carry out the analysis of the adjusted residues (Raj).

In this case, the data was compared with each other, observing the standard value of 1.96, that is, all the results found superior to the standard demonstrate the presence of a significant difference between the groups. The figures in the fingerprints were more frequent in the group with hypertension and in the control group, as seen in Table 2.

Table 1. Average number of lines of fingerprints of the fingers of the left and right hand, when comparing the group of women with Hypertension and the control group. *P*<0.05-level of significance

	Hypertension Group	Average Control Group	*P*
MESQL1	13.15±5.533	13.67±5.992	0.83
MESQL2	8.99±6.063	9.73±6.276	0.87
MESQL3	10.19±5.880	10.71±5.981	0.26
MESQL4	13.17±5.892	13.21±6.056	0.62
MESQL5	11.61±5.772	11.18±4.932	0.40
SQTLE	57.09±22.498	58.49±22.651	0.15
MDSQL1	15.00±5.365	15.26±5.938	0.08
MDSQL2	10.14±6.058	10.16±6.456	0.95
MDSQL3	10.72±5.673	11.08±5.980	0.23
MDSQL4	13.24±5.688	13.09±5.923	0.72
MDSQL5	11.48±5.440	11.54±5.153	0.66
SQTLD	60.57±20.951	61.13±22.487	0.41
SQTL	117.67±41.733	119.62±43.844	0.21

P<0.05–level of significance

Table 2. Types of fingerprint figures of the fingers of the left and right hand, when comparing the group with hypertension and control group

		Fingerprint figures				
		A	RL	UL	W	p
		Raj (n)	Raj (n)	Raj (n)	Raj (n)	
MET1	**Hypertension Group**	-1.2 (17)	-2.2 (4)	0.9 (217)	0.3 (137)	0.087
	Control Group	1.2 (24)	2.2 (13)	-0.9 (193)	-0.3 (131)	
MET2	**Hypertension Group**	-0.4 (33)	0.0 (75)	1.5 (161)	-1.3 (96)	0.446
	Control Group	0.4 (36)	0.0 (74)	-1.5 (140)	1.3 (111)	
MET3	**Hypertension Group**	0.5 (33)	-1.8 (19)	0.2 (253)	0.7 (60)	0.308
	Control Group	-0.5 (29)	1.8 (31)	-0.2 (248)	-0.7 (53)	
MET4	**Hypertension Group**	-0.5 (10)	-3.3 (3)	2.4 (254)	-1.2 (98)	0.003*
	Control Group	0.5 (12)	3.3 (18)	-2.4 (220)	1.2 (111)	
MET5	**Hypertension Group**	-1.0 (7)	-3.2 (3)	2.5 (319)	-0.8 (36)	0.006*
	Control Group	1.0 (11)	3.2 (17)	-2.5 (291)	0.8 (42)	
MDT1	**Hypertension Group**	-2.4 (6)	-2.9 (4)	2.6 (226)	-0.8 (129)	0.001*
	Control Group	2.4 (17)	2.9 (17)	-2.6 (189)	0.8 (138)	
MDT2	**Hypertension Group**	-0.2 (37)	-0.5 (65)	0.6 (152)	-0.1 (111)	0.943
	Control Group	0.2 (38)	0.5 (69)	-0.6 (143)	0.1 (111)	
MDT3	**Hypertension Group**	-0.5 (21)	-2.3 (11)	0.3 (280)	1.4 (53)	0.075
	Control Group	0.5 (24)	2.3 (24)	-0.3 (273)	-1.4 (40)	
MDT4	**Hypertension Group**	0.3 (7)	-2.4 (4)	1.5 (224)	-0.8 (130)	0.700
	Control Group	-0.3 (6)	2.4 (14)	-1.5 (202)	0.8 (139)	
MDT5	**Hypertension Group**	-0.4 (4)	-4.6 (1)	2.5 (323)	-0.1 (37)	0.000*
	Control Group	0.4 (5)	4.6 (23)	-2.5 (296)	0.1 (37)	

Significance level *P*<0.05. A: arch; RL: radial loop; UL: ulnar loop; W: whorl

It is possible to observe in the data presented, a significant difference in the fingers MET1, MET4, and MET5, as well as in the MDT1, MDT3, MDT4, and MDT5. We can see that MET4, MET5, MDT1, and MDT5 showed a significant difference in the group of women with hypertension, with the figure LU being more frequent. It can be observed, in MET1, MET4, MET5, MDT1, MDT3, MDT4, and MDT5, a significant result in the control group, with a greater presence of LR. This frequency is a significant difference when compared to the group with hypertension.

Discussion

It is known that the development of SAH has a strong influence on heritability, and genetic influence is one of the non-modifiable risk factors for the disease. However, there was no information on where this heritability could be observed Oliveira *et al.,* (14), which could be extremely helpful with the prognosis of the disease. The reason is that SAH is an essential aggravating factor for cardiovascular diseases and is a polygenic disease that has influence by genetic and environmental order (1).

In the search for studies Wijerathne *et al*., (15) that related Dermatoglifia and SAH in different databases, we found 17 types of research considered relevant by several scientists, but in none of them was the computerized method Dermatoglífico® Reader, which has an accuracy four times greater when compared to the traditional method (paper, ink, and magnifying glass). For that reason, we defend that this work can be instrumentally more reliable than those presented in those studies Wijerathne *et al*., (15), for it confirmed the existence of the relationship between SAH and dermatoglyphics.

This research, with a sample of 732 women, revealed a significant difference in the dermatoglyphic marks of patients with SAH when compared to a control group formed by healthy individuals for SAH. Regarding the qualitative dermatoglyphic characteristics (types of the drawing), the investigated individuals with SAH showed a predominance of the figure (UL) in MET5, MET4, MDT1, and MDT5.

In quantitative characteristics (number of lines), there was no significant difference between the groups. From this result, we have the information that the fingerprint can be a genetic marker and fetal development for the prognosis of SAH based on qualitative characteristics. The results showed a dermatoglyphic pattern for the potential development of SAH in Brazilian women.

In another study Nodari Junior *et al.*, (6). involving men and women with hypertension from the Midwest region of Santa Catarina, Brazil, with a sample of 268 individuals, 134 with SAH and 134 healthy for the same, revealed the highest prevalence of (UL) in patients with SAH, with the differences being in the fingers: MET5, MDT4, and MDT5. In the control group, the significant difference was with (A) and (RL). This study was considered a pilot for the development of the current research on women with hypertension.

Studies Kulkarni *et al.,* (16) on dermatoglyphics and SAH with 200 individuals with hypertension, and 200 individuals from the control group (104 men and 96 women in each group) a traditional dermatoglyphic method (ink, paper, and magnifying glass) was used and the results found presented a high number of (W) and low presence of (UL) in both hands in patients with SAH. Those results differ from the results found with Brazilian women only, which presented a high index of (UL) in hypertensive women.

In another study, Kachhave (17) with 120 individuals (60 with SAH and 60 in the control group) the result obtained detected the low presence of (LU), similar to our study Kulkarni *et al.*, (16), but yet maintained the differentiation of the results found in this study when considering women with hypertension in Brazil.

The investigation we carried out was restricted to women, due to the specific characteristics of each gender, and understanding that they are different. We considered that it is also necessary to conduct the research separately (women and men) since important situations for the development of SAH such as gestational SAH and menopause are not present in men.

It is important to consider that this study makes observations of data only from women, with a significant sample, which had not been done so far in the comparison between dermatoglyphics and SAH. Thus, it is possible to say that Brazilian women have an identified dermatoglyphic pattern and that it can be used to investigate the potential for the development of the disease in women hitherto healthy for it.

SAH is a disease with significant phenotypic influence, and several differences are considered (18). The effect of phenotypic factors involves different mechanisms, such as increased aortic stiffness, metabolic syndrome, and endothelial dysfunction, in addition to possible different clinical conditions such as visceral obesity and metabolic disorders (18). However, the clinical manifestations of SAH can be determined by the variability of genetic variants. In SAH familiarity is present in 90% of cases, where the influence of specific

genes is demonstrated in family studies, it is possible to say that the prevalence of maternal transmission is a strong contributor to the development of SAH in the human population (19).

In a study Bulagouda *et al.,* (20) with 100 patients with SAH and 100 individuals without records of the disease, divided into men and women, the impressions collected were from the palm of the hands and the result presented was a low number of (UL), the figures are repeated, but differ from the study made in Brazil.

In another investigation Tafazoli *et al*., (21) with a group of Iranians from the province of Fars, the understanding was that the characteristics of those people are peculiar and differentiated them from the others. The study results displayed a higher index of (L), even though not specifying which loop variation was found, and a greater presence of (A) and (W) in the control group. In the study of Brazilian women, (L) is present in both groups, differentiating them by their variation, whereas (UL) is often more present in the group of women with hypertension.

In our search involving dermatoglyphics and SAH, the emphasis was on the brand found in the group of people with SAH, since this brand indicates the potential of the individual to develop the disease. But in the study with Brazilian women, a significant difference was found in the control group, presenting a high frequency of (RL), which we can interpret as a protective mark for SAH, since healthy individuals for it, find this pattern dermatoglyphic.

It is perceived in an Indian survey by Deepa (22) with 200 individuals, a significant difference in the number of lines, which until then had not been presented, and this quantitative difference was not found in Brazilian women. A large study (23) focused on the characteristics present since birth and resumed the evaluation after adulthood, found a prevalence of (W) in the right hand. In contrast to that, the dermatoglyphic pattern in the study carried out with Brazilian women includes both hands and the design (W) does not appear even as a protective mark, nor as a predictor for SAH.

The contradictions between the findings on dermatoglyphics can be associated with the different methods used: the traditional one (ink, paper, and magnifying glass) and the computerized one, which uses the Dermatoglyphic Reader®, for the collection, description, and analysis of fingerprints. The results in the present study display a differential for dermatoglyphics in SAH, since it replaces the use of the ink, paper, and magnifying glass method of the traditional collection of dermatoglyphics, with the computerized method Nodari Junior *et al.*, (12), which is statistically four times more accurate.

In addition to the sample selection, the computerized collection of fingerprints provided greater precision in the dermatoglyphic analysis alongside being about ten times more agile in the collection process (12). This method presents itself as an important tool to optimize the analysis and allow greater reliability in the counting and marking of lines and drawings.

The results presented in the studies (16,17) analyze a specific racial or ethnic group, and other studies (21,23) have already carried out their research in different places and different from this one with the focus being the women. There are researches of the most diverse ethnicities and with pointed differences. Besides that, we can find the analysis (24) with high and low-altitude peoples in Argentina, finding differences in their dermatoglyphic patterns, which was also found in the population of Ethiopia (25) and China (26).

However, our study differs because it helps to understand the differences found in the dermatoglyphic patterns in patients with SAH. Suffice it to say that there are still no broader anthropological studies, differentiating continents, but previously a probable existence is anticipated, since in this study the result obtained differs from the others. Moreover, the method used is reliable, having been utilized in other significant health studies (27).

In the sample observed by this study, the data was collected in the Midwest of Santa Catarina, Brazil, which has a population with multiracial characteristics and different ethnicities, with a predominantly mixed ethnical European descent.

Realizing the importance of the results indicated with the identification of marks on the fingerprints of women with hypertension, building a dermatoglyphic pattern for Brazilian women with the disease, we have a strong prognostic tool for it, being able to identify the potential for the development of SAH.

The data investigated and presented in this study demonstrated through the dermatoglyphic method, with the use of the Dermatoglyphic Reader®, shows that women with SAH present in their fingerprints a mark of biological individuality that differs them from healthy women for hypertension.

Another important fact is that the investigation made from the dermatoglyphics, using the Dermatoglyphic Reader® is an extremely simple, low-cost, non-invasive technique that can already be done from the individual's birth. Therefore, this method can provide the mapping for the existence or not of potentialities for the development

of polygenic diseases and/or chromosomes and syndromes that present the genetic factor influencing their development. Subsequently, it can provide knowledge to act on with preventive actions and habits.

The results we found indicate a dermatoglyphic pattern present in Brazilian women with SAH, with this pattern suggesting a prognostic form of SAH and identifying the potential to develop the disease in the future. Besides, we also found a protective pattern for the same disease detected in the control group, which can be understood as possibly a non-genetic and fetal development indication for the development of SAH. Dermatoglyphics presents itself as an important health prognostic tool, identifying the individual's potential to develop the disease.

It is important to mention that there is a significant difference between the brand found for individuals with SAH according to ethnicity or race. It is our understanding that the pattern found for Brazilian women should not be used to identify the potential development of SAH in other people.

We suggest the use of this methodology in primary health care when it is possible to identify potential vulnerabilities and take palliative and preventive treatment for the disease since the number of hypertensive women is high. SAH is an important risk factor for diseases in the cardiovascular system and causes a high number of mortalities, and morbidity and may result in more complications. It can be even more damaging when targeting organs function which results in more hospitalizations, therefore burdening the public health system.

Based on the screening carried out in public health, the AB teams, with or under the support of the Hiperdia program, can improve the prevention work in which the potential for the disease is independent. It can reduce expenses with hospitalizations and provide a better quality of life for the population.

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