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ORIGINAL ARTICLE

Clinical inertia in diagnosis and treatment of hypertension in primary care: Quantification and associated factors

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Abstract

Objectives. The objective of the present study was to quantify both diagnostic and therapeutic inertia in hypertension and to identify patient-associated variables. *Patients and methods.* Cross-sectional, multicenter study of 35 424 subjects carried out in 428 health centers and/or primary care clinics in the Valencian Community, Spain, in a preventive activity conducted during 2003 and 2004. Diagnostic inertia was identified when a patient without known hypertension had high blood pressure (BP) but was labeled "normal" by the medical staff, and therapeutic inertia when treatment was not modified for a hypertensive patient on the presence of high BP values. Bivariate and multivariate statistical analyses were performed to identify patient's characteristics associated with inertia. *Results.* Diagnostic inertia was present in 32.5% (95% CI 31.4–33.6) and therapeutic inertia in 37.0% (95% CI 35.6–38.5) of the cases. Both were more frequent in cases of isolated systolic or diastolic high BP. In the multivariate models, the factors associated with diagnostic inertia were type-2 diabetes ($p=0.041$), non-smoking ($p=0.004$), previous coronary heart disease ($p=0.001$), BP values ($p<0.001$) and body mass index ($p=0.031$), whereas for therapeutic inertia they were type-2 diabetes ($p=0.003$), previous coronary heart disease ($p=0.016$) or stroke ($p<0.001$) and BP values ($p<0.001$). *Conclusions.* Clinical inertia, either diagnostic or therapeutic, was present in one of every three cases of high BP. The most frequent factors associated with clinical inertia were the presence of associated conditions, which requires lower BP goals and the BP values.

Key Words: *clinical inertia, hypertension, primary care.*

Introduction

Hypertension (HTN) is one of the major risk factors for health because of its high frequency (1,2) and its direct causal relationship with coronary heart disease (CHD) and stroke, and it also plays a central role in the development of heart failure, peripheral arterial disease and nephropathy (3,4). During the last few years, important breakthroughs have been made in the effective treatment for high blood pressure (BP), and numerous scientific societies and government agencies have developed strategies for the management of HTN (5–7). Despite these efforts, the degree of proper BP control falls greatly short of that ideal in most countries (8,9) and this has an impact on cardiovascular morbidity and mortality (10). HTN is an important public-health challenge worldwide (11). In Spain, HTN control is reached in less than 40% of those treated for HTN and only in 15% of the general population (2,12,13), and the highest risk subjects (diabetics and patients with previous cardiovascular disease or renal disease) are the ones who tend to have the lowest BP control rate (12–16).

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The reasons for the insufficient HTN control are multiple (17–31). Among them, clinical inertia (21–24) is an important issue. Clinical inertia, defined by Phillips et al. (21) as the tendency of doctors not to change or intensify treatment even if it is clinically justified, has received attention in the last few years (22,23,31). Quantitative studies (32,33), analysis of strategies for its reduction (6,21,22,30,34) and even predictive models have been carried out in primary care settings (23). In the case of HTN, this therapeutic inertia coexists with the phenomenon of "diagnostic" inertia, leading to undesirable reductions in the rates of diagnosis, and for instance treatment and control of HTN in the population. The true dimension of diagnostic inertia is even less known than that of therapeutic inertia.

The objective of the present study is to assess the frequency of diagnostic and therapeutic inertia in large sample population of adults aged 40 years or more who attended a routine healthcare check-up. The characteristics of the patients who suffer were also analyzed.

Subjects and methods

In 2003, the Health authorities of the Valencian Community launched a preventive activity in collaboration with the Valencian Society of Family and Community Medicine, the Preventive Activities Research Foundation of the Valencian Community, and the Board of Family and Community Medicine of the Department of Clinical Medicine of the University Miguel Hernández of Elche (Alicante, Spain). The campaign targeted population over 40 years of age, according the National recommendations (7), and involved 428 Primary Care Health Centers. Participants were invited by letter and, after agreement on participation, they were appointed to their respective Health Centers and underwent a medical check-up by the nursing and medical staff.

Clinical check-up included assessment of cardiovascular risk, cancer prevention program for women and review of the vaccine calendar for adults. Preventive cardiovascular risk assessment included: (i) a structured questionnaire on smoking habits, HTN, diabetes, dyslipidemia, cardiovascular diseases (7), and/or treatments for these conditions; (ii) anthropometric measurements, including weight, height and body mass index (BMI); (iii) BP measurements using a mercury sphygmomanometer according to the clinical guidelines (5–7); and (iv) fasting blood tests to measure glucose, creatinine and the lipid profile (total cholesterol, low-density cholesterol, high-density cholesterol and triglycerides). The estimated 10-year risk of cardiovascular mortality was calculated using the SCORE scale for low cardiovascular risk countries (35).

Concerning the assessment of BP values and HTN, the BP values were recorded in forms that contained the thresholds for considering HTN and how to proceed in case it was present (5–7). It was outlined that in the cases of systolic and/or diastolic BP $\geq$140/90 mmHg ($\geq$130/80 mmHg in diabetic patients), a second BP reading should be performed. *Patients with resistant HTN were excluded*. Once the examination was finished, the subject received a copy of the results with specific recommendations.

Inertia was defined if a patient showed high BP according to clinical guidelines and the physician failed to act upon it. Diagnostic inertia was defined as a failure to consider the diagnosis of HTN in a subject in the absence of diagnosis of HTN and elevated BP. On the other hand, therapeutic inertia was defined in an uncontrolled hypertensive if therapeutic action was not taken.

Statistical analysis

Clean-up and quality control of the data was performed by a group external to the research group. The final evaluation was done in the Research, Teaching, and Clinical Practice Unit of Department 18 in the Valencian Community and in the Department of Family Medicine of the University Miguel Hernández.

The sample size was calculated to be adequately representative of the Valencian population and with the following assumptions: the most unfavorable variability or $p \times q = 0.25$, a confidence level of 99%, a precision level of 0.8% and 20% loss. The minimum number of preventive check-ups to analyze was therefore calculated to be 32 398. For their selection, a consecutive sampling was used, accepting all the examinations that arrived from the different health centers until the sampling goal was reached. After the first 6 months, the sample size amounted to a total of 35 424 participants.

Quantitative variables were expressed as mean and standard deviation (SD), while qualitative variables were described as frequencies or percentages. For simple comparisons, use was made of the Student *t*-test for independent groups in the case of quantitative variables, and the chi-square test was used to correlate categorical variables. Multivariable logistic regression models were made to account for the association of the presence of diagnostic or therapeutic inertia (dependent variables) with patient characteristics. Variables included in the models were age, gender, body mass index (kg/m^2), smoking habit, dyslipidemia, type 2 diabetes, systolic and diastolic BP, SCORE risk, and past history of CHD or stroke. The odds ratios (OR) and corresponding 95% confidence intervals (CI) are presented.

The assessment of the concurrence of both diagnostic and therapeutic inertia in each primary

care health center was made using the intra-class correlation coefficient, and the lineal association was quantified using the Pearson's correlation coefficient. The evaluation of the concurrences was sought by the J.L. Fleiss criteria (36). The difference between the mean rates of the two types of inertia in each health center was computed using the Student *t*-test for paired groups. A *p*-value ≤ 0.05 was considered of statistical significance. The SPSS v12.0 was used for the statistical analysis.

Results

General characteristics of the study population

Of the initial 35 424 subjects in the preventive health study, 5.6% were excluded because of lack of BP measurement or other data essential for the analysis, leaving a final sample of 33 440 individuals. The main characteristics of the population included in the study are shown in Table I. From the total population, 26 541 subjects (79.4%) did not have a previous diagnosis of HTN and they was used to assess diagnostic inertia. Therapeutic inertia was assessed in the remaining 6899 individuals (20.6%) who had a previous diagnosis of HTN.

Prevalence of clinical inertia

Among the "normotensive group", 6764 had elevated BP values. In 2199 (32.5%) of these cases, the physician did not re-schedule the patient for a second BP reading nor give recommendation for future BP checking. Thus, the percentage of detected diagnostic inertia was 32.5% (95% CI 31.4–33.6) (Figure 1). In the hypertensive group, 4303 had elevated BP values. In 1594 (37.0%) of these cases, the physicians did not take any specific action. Then, therapeutic inertia was present in 37.0% (95% CI 35.6–38.5) (Figure 2). In 67 (15.3%) Health Care Centers there were no diagnostic or therapeutic inertia detected. Different levels of clinical inertia were detected in the remaining Centers, with some overlap of both diagnostic and therapeutic (r=0379, $p<0.001$; intra-class correlation coefficient: 0.379 [0.289–0.463], $p<0.001$).

The physician's adherence to clinical guidelines in the cases of abnormally high BP was also assessed. The percentage of non-hypertensive patients with high BP in which a second BP measurement was done was 16.4% (95% CI 15.5–17.3), whereas a second BP reading was taken only in 13.6% (95% CI 12.6–14.6) of those hypertensive patients with BP not at goal.

Table I. Descriptive data corresponding to 33 440 subjects included in the study.

	n (%) or Mean* (SD)	95% CI
Age (years)*	54.6 (10.4)	54.5–54.8
Male	13349 (39.9%)	39.4–40.4
Body mass index (kg/m^2)*	27.8 (4.4)	27.8–27.9
Arterial hypertension	6899 (20.6%)	20.2–21.1
Systolic BP (mmHg)*	128.1 (17.5)	127.9–128.3
Diastolic BP (mmHg)*	77.7 (10.5)	77.6–77.8
Dyslipidemia	4392 (13.1%)	12.8–13.5
Total cholesterol (mg/dl)*	209.6 (37.7)	209.2–210.0
Type 2 diabetes	1980 (5.9%)	5.7–6.2
Fasting glucose (mg/dl)*	99.5 (26.4)	99.2–99.8
Smokers	7532 (22.5%)	22.1–23.0
Cardiovascular heart disease	1401 (4.2%)	4.0–4.4
Stroke	787 (2.4%)	2.2–2.5
Cardiovascular risk (SCORE table)	2.0 (2.9)	2.0–2.0
High SCORE risk	3377 (10.1%)	9.8–10.4

SD, standard deviation; BP, blood pressure.

Characteristics of the patients which suffer inertia

The highest frequencies of both diagnostic and therapeutic inertia were seen in those with isolated high systolic or diastolic BP, and lowest in those with both systolic and diastolic elevated BP ($p<0.001$).

Qualitative and quantitative variables associated with clinical inertia in the bivariate analysis are shown in the Tables IIa and IIb, respectively. Diagnostic inertia was more frequent in females ($p=0.011$), and those with dyslipidemia ($p=0.011$), type 2 diabetes mellitus ($p<0.001$), CHD ($p<0.001$) or stroke ($p<0.001$). Diagnostic inertia was more frequent in those with SCORE risk <5% ($p<0.001$). Therapeutic inertia share also some characteristics present in diagnostic: dyslipidemia ($p<0.001$), type 2 diabetes ($p<0.001$), CHD ($p<0.001$) or stroke ($p<0.001$).

In the multivariate analysis, diagnostic inertia was independently associated with the presence of diabetes mellitus, smoking habit and previous CHD, as well as systolic and diastolic BP values, and lower body mass index (Table III). These factors accounted for 69.1% of the variability. Meanwhile, factors independently associated with therapeutic inertia were diabetes mellitus, previous CHD or stroke and BP values, which accounted for 74% of the variability (Table III).

Discussion

In the present study conducted in a wide sample of subjects aged $\geq$40 years old, high frequencies of both diagnostic and therapeutic inertia have been detected. Likewise, low adherence to clinical guidelines recommendations, in those cases in which a second BP measurement was required because of the presence of high BP, has also been detected (5–7). In one in three cases, the physicians did not take any action in the presence of high BP, neither in the case of non-hypertensive subjects (diagnostic inertia) nor in the case of HTN (therapeutic inertia). The failure

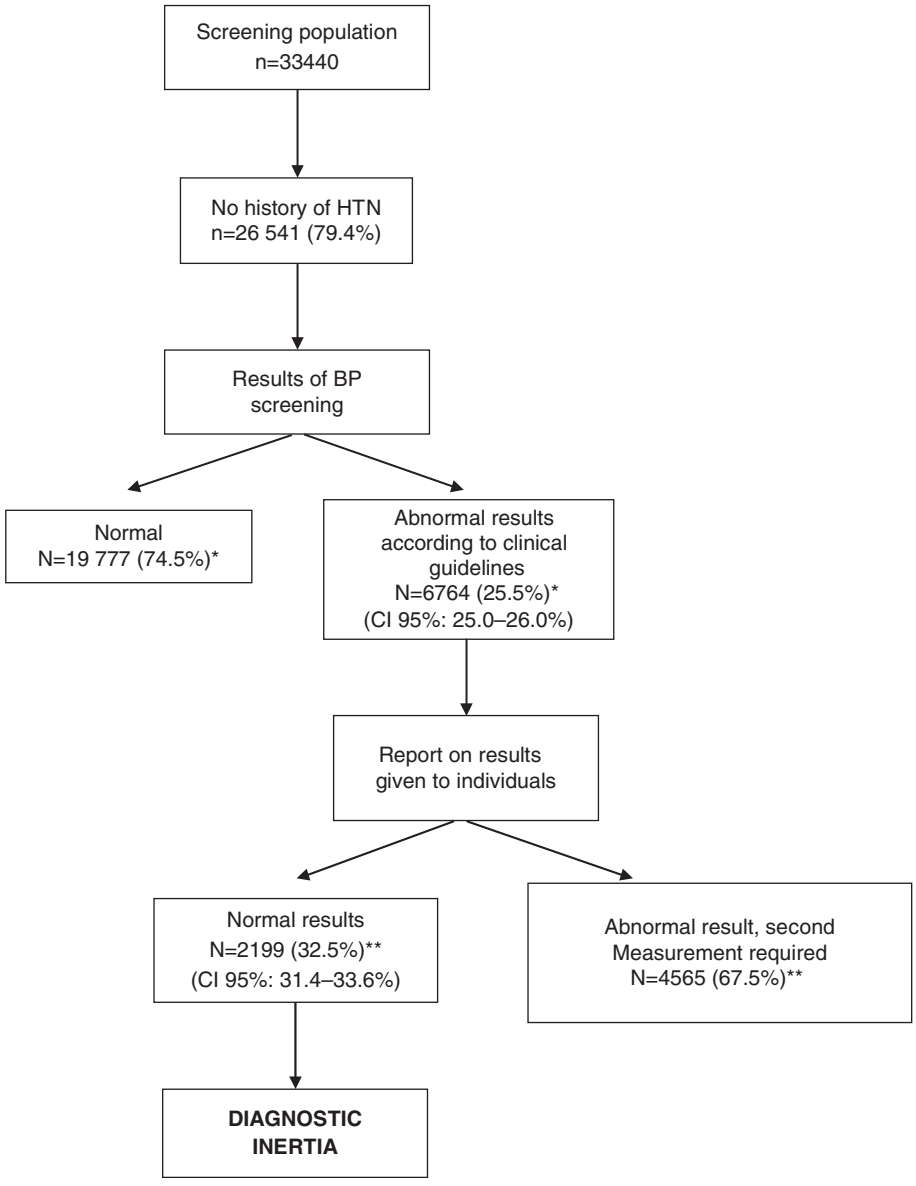

Figure 1. Quantification of diagnostic inertia in medical check-ups. CI, confidence intervals of 95%; *n*=sample size; HTN, arterial hypertension. *Percentage calculated from total number of people with no history of HTN; **percentages calculated from total number of people with abnormal BP reading.

to modify treatment in the presence of lack of BP control was slightly more common than the failure to recognize or declare new cases of HTN. Moreover, in both cases, inertia was strongly associated with high cardiovascular risk status (such as diabetes mellitus, CHD or stroke). This is worrisome, because these patients are those in which a more strict BP control is recommended.

The latest American report on HTN (JNC 7th report) indicates the need to solve the problem of clinical inertia because of its large influence on inadequate BP control (6). The report points out some strategies focused on the medical team and the patients, including reminder mechanisms, printing of the threshold values to consider high BP, electronic systems to help make appropriate decisions, or a deep implication of the nursing and pharmacy staff, measures that have been demonstrated to be effective (41–44). It could be said overcoming clinical inertia could be a good way to control BP (45). In a clinical trial that compared three strategies to improve BP control, the introduction of information about health education for the patient, with better information from doctors and nurses, resulted in an improvement in the overall BP control (46). In the present study, despite the fact that this was a population screening program to detect cardiovascular risk factors and that the BP limits were clearly printed out on the patients' information sheets, the frequency of inertia was still high. Despite increased implementation of electronic health records, randomized controlled trials evaluating computerized reminder systems for preventive care measures are infrequent (47).

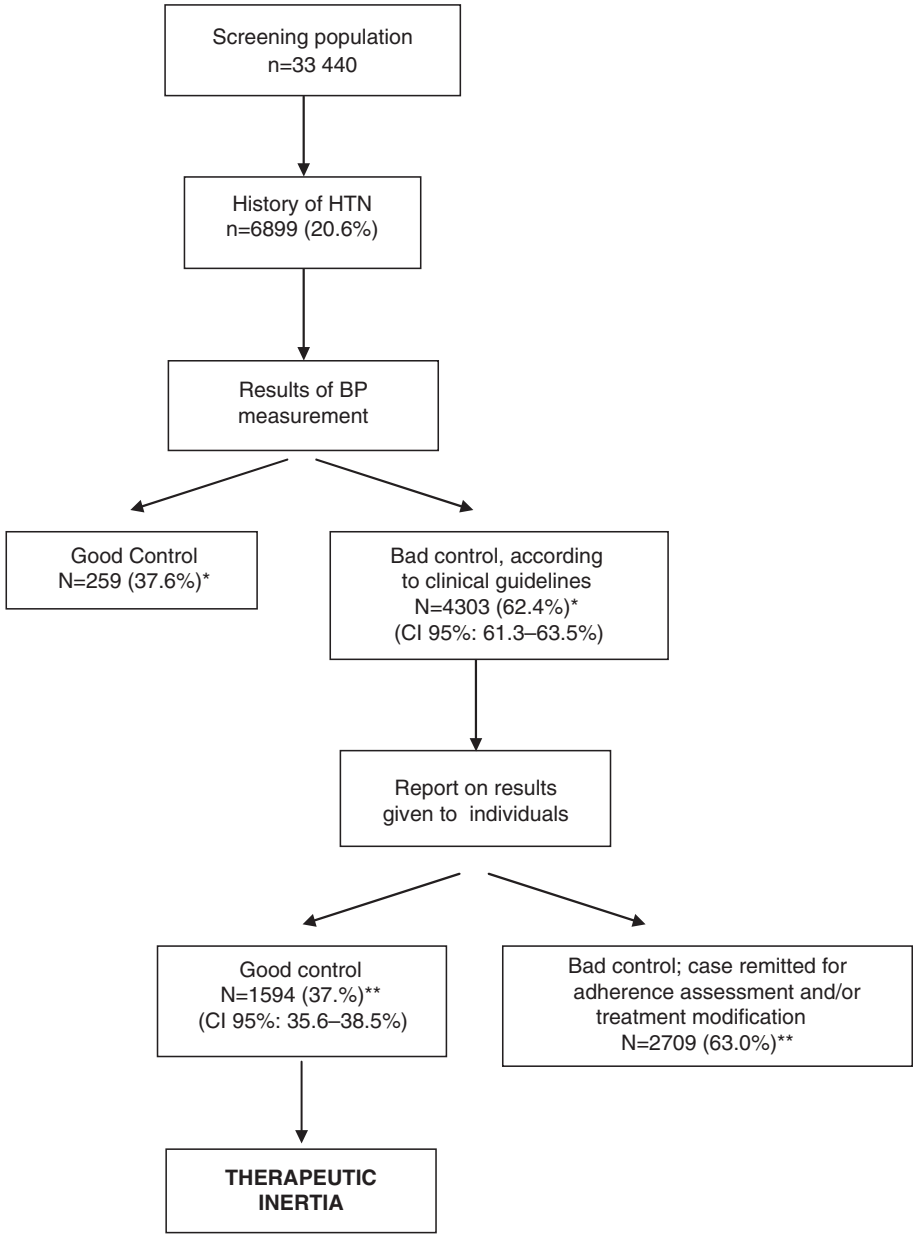

Figure 2. Quantification of therapeutic inertia in medical check-ups. CI, confidence intervals of 95%; *n*=sample size; HTN, arterial hypertension. *Percentages calculated from total number of people with history of HTN; **percentages calculated from total number of people with bad control.

Likewise, the adherence to the clinical guidelines was very low in those cases in which a second BP measurement is recommended, i.e. when high BP is detected. In these cases, only one in seven subjects had their BP measured twice. The Komajda study (37) showed the importance of following the guidelines, concluding that a strict adherence to these is the best indicator of a good prognosis for patients with cardiovascular disease. The present results are in agreement showing that in those cases in which a second BP reading was taken; the frequency of both diagnostic and therapeutic inertia was lower than in those in which this was not done.

Concerning the characteristics of the patients in which diagnostic or therapeutic inertia was present, they shared many similarities. Both diagnostic and therapeutic inertia were more frequent in patients with type 2 diabetes mellitus, CHD or stroke, and lower (although abnormally high) BP, characteristics that included situations with lower BP thresholds recommended or BP values near the normal values. These may reflect that the physicians did not accepted the guideline recommendations in terms of obtaining more BP values urgently in subjects with diabetes or previous cardiovascular disease, as well as the tolerance for slightly high BP values. The former can explain the worst clinical BP control in high-risk patients usually found in epidemiological and cross-sectional studies (12–16). Tolerance to small increments of BP values at the time of diagnosis

Table IIa. Qualitative variables associated with clinical inertia; bivariate analysis.

		Diagnostic inertia			Therapeutic inertia		
		n	%	*p*	*n*	%	*p*
Gender	Male	1043	31.1	0.011	682	35.5	0.774
	Female	1156	34.0		912	35.1	
Dyslipidemia	No	1929	32.0	0.011	1046	33.3	<0.001
	Yes	270	36.6		548	39.7	
Type 2 diabetes	No	2071	32.1	<0.001	1099	31.5	<0.001
	Yes	128	41.0		495	48.2	
Smoker	No	1769	33.5	0.002	1410	35.5	0.377
	Yes	430	29.1		184	33.6	
Coronary heart disease	No	2108	32.1	<0.001	1258	32.4	<0.001
	Yes	91	48.7		336	53.1	
Stroke, %	No	2136	32.2	0.001	1437	33.9	<0.001
	Yes	63	45.7		157	56.3	
CV risk by SCORE table	<5%	1784	33.1	<0.001	810	31.5	0.993
	≥5%	298	26.9		361	31.5	

BP, blood pressure; HT, hypertension; CV, cardiovascular.

Table IIb. Quantitative variables associated with clinical inertia; bivariate analysis.

		Diagnostic inertia			Therapeutic inertia		
		Mean	SD	*p*	Mean	SD	*p*
Age	Inertia no	56.2	9.8	<0.001	62.5	9.5	0.001
	Inertia yes	57.1	9.7		63.5	9.7	
SBP (mmHg)	Inertia no	147.6	13.7	<0.001	151.1	14.5	<0.001
	Inertia yes	140.4	8.6		137.8	9.7	
DBP (mmHg)	Inertia no	88.3	9.4	<0.001	87.7	9.8	<0.001
	Inertia yes	82.3	7.9		80.9	7.4	
Total Cholesterol (mg/dl)*	Inertia no	216.8	39.0	<0.001	211.6	36.2	0.001
	Inertia yes	213.3	37.4		207.7	35.7	
Fasting glucose (mg/dl)	Inertia no	102.7	29.4	0.016	112.3	34.0	<0.001
	Inertia yes	100.9	28.2		116.9	38.2	
Body Mass Index (kg/m^2)	Inertia no	29.0	4.3	<0.001	30.5	4.8	<0.001
	Inertia yes	28.3	4.1		30.3	4.7	
SCORE CV risk	Inertia no	3.1	3.6	<0.001	4.7	4.6	0.001
	Inertia yes	2.6	2.9		4.2	3.6	

SD, standard deviation; BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; CV, cardiovascular.

was observed in subjects free from cardiovascular disease in which SCORE risk assessment was <5%. More aggressive HTN diagnosis and treatment following the guideline recommendations may have a significant impact in the prevention of cardiovascular disease (38–40).

The size and characteristics of the population sample, as well as the design of the study, allow us to obtain valid results for the Valencian Community. All the Health Care Centers and members of the medical teams of the region took part, eliminating any possible bias dependent on active subjects (in

Table III. Variables associated with inertia; multivariate analysis.

	OR (95% CI)	*p*
Diagnostic inertia		
Type 2 diabetes (Yes/No)	1.32 (1.01–1.73)	0.041
Smoker (No/Yes)	1.23 (1.07–1.43)	0.004
Coronary heart disease (Yes/No)	1.90 (1.37–2.63)	0.000
Systolic BP (1 mmHg of increment)	0.94 (0.93–0.94)	0.000
Diastolic BP (1 mmHg of increment)*	0.92 (0.91–0.93)	0.000
Body mass index (1 kg/m^2 of increment)*	0.98 (0.97–1.00)	0.031
Therapeutic inertia		
Type 2 diabetes (Yes/No)	1.31 (1.10–1.57)	0.003
Coronary heart disease (Yes/No)	1.31 (1.05–1.63)	0.016
Stroke (Yes/No)	1.98 (1.44–2.72)	0.000
Systolic BP (1 mmHg of increment)*	0.91 (0.90–0.92)	0.000
Diastolic BP (1 mmHg of increment)*	0.93 (0.92–0.93)	0.000

BP, blood pressure; OR, odds ratio; CI, confidence interval. Independent variables: age, gender, history of smoking, dyslipidemia, and type 2 diabetes, coronary heart disease, stroke, systolic BP and diastolic BP. *Increment above the threshold.

this case the physician and medical team). Some limitations, however, arise from our study, which should be taken into account. Data on social and demographic characteristics of physicians (age, gender, years of experience), or the Health Care Centers (type of population covered, level of education or number of patients assisted per physician each day) has not been collected. These factors, which influence usual clinical practice, could have an impact in the presence of clinical inertia, which was not measured. The cross-sectional design of the study allows us to obtain epidemiological associations but not cause–effect relationships. Finally, a potential selection bias could be present because of the recruitment method (letter invitation), and the fact that most healthy people are most likely to decline participation in preventive health campaigns. However, we believe that this does not affect the main objectives of our study, i.e. the quantification of the phenomenon of inertia in the presence of high BP values.

From the present study, we can conclude that the phenomenon of clinical inertia is frequent in HTN, and there is a real unmet need for a wide, multi-factorial approach to tackle this problem, which should include actions on the structure, organization and specific training of medical teams. These measures could improve HTN diagnosis and control, and thus reduce HTN-induced morbidity and mortality.

Declaration of interest: The authors have no conflicts of interest that are directly relevant to the content of this study.

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