

## ORIGINAL RESEARCH

# Prevalence, awareness, treatment and control of hypertension in an elderly population in Greece

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## ABSTRACT

**Introduction:** Hypertension is a major public health problem and its prevalence increases with age. Despite an aging population, only a limited number of population-based studies, and fewer Greek studies, have focused exclusively on the elderly. The objective of this study was to investigate the prevalence, awareness, treatment and control of hypertension in the rural residents of Paliouri village in Greece who were aged 65 years and older.

**Methods:** In total there were 171 participants (response rate 89.5%). Six blood pressure (BP) measurements were obtained in two visits and hypertension was defined as a mean systolic BP  $\geq 140$  mmHg and/or mean diastolic BP  $\geq 90$  mmHg, and/or current use of an antihypertensive medication.

**Results:** The prevalence of hypertension was 89%. Of the 137 hypertensive patients, 89.8% were aware of their disease, 89.1% were receiving treatment, and the hypertension of 32.8% was controlled. Awareness of hypertension was significantly higher among those with a high frequency of BP measurements, a history of coronary or other chronic disease, lower education, and those living with a spouse.



**Conclusion:** The findings indicate that hypertension is highly prevalent in this Greek elderly population. Similarly high is the awareness and treatment of hypertension. However, the control rates were relatively low, suggesting that the local health system requires a greater orientation to the prevention and control of hypertension.

**Key words:** cross sectional study, elderly, epidemiology, Greece, hypertension.

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## Introduction

Population aging is the most important demographic change worldwide, with an increase in not only the absolute number of older adults, but also a higher proportion of older adults in the overall population. This was originally a phenomenon of the developed world; however, recently developing countries have shown the highest rates of increase<sup>1,2</sup>. An important consequence of the increase in the number of the elderly in a population is that these individuals are more likely to have illnesses and/or chronic conditions that require a higher level of medical and social services.

Arterial hypertension is one of the most frequent chronic health conditions in Western countries. According to the National Health and Nutrition Examination Survey (NHANES) approximately 65% of people older than 65 years have hypertension<sup>3</sup>. Despite strong evidence that high blood pressure (BP) is an important and curable risk factor for cardiovascular disease and mortality in the elderly<sup>4-6</sup>, few population-based studies have focused exclusively on this age group<sup>7-11</sup>. Likewise, fewer still and none in a Greek population, have studied the factors associated with the awareness and treatment of hypertension among older adults ( $\geq 65$  years). The aim of the present study was to estimate the prevalence, awareness, treatment and control of hypertension in the total elderly population of a Greek village, and to detect the factors associated with awareness of hypertension.

## Methods

### *Study area and population*

The study used a cross-sectional survey in the village Paliouri in northern Greece, located in Cassandra, Chalkidiki, 120 km from Thessaloniki. Paliouri is a typical coastal Greek village with 826 residents. The study was conducted in collaboration with the Primary Health Care Center of Cassandra and the Second Propedeutic Department of Internal Medicine, Aristotle University of Thessaloniki, Greece. All adults who were  $\geq 65$  years (a total of 191 in the local registry database) were contacted by telephone and invited to participate. Reminders were sent to non-responders, also by telephone, at least twice during the study period.

### *Subject evaluation*

A well-trained medical doctor evaluated all participants in a GP's office over two visits. The survey was conducted from March to June 2006 and 95% of the subjects were evaluated during the spring. The initial visit involved a 15 to 20 min interview to obtain socio-demographic data (age, sex, marital and educational status, and monthly family income), information on habits (smoking and alcohol consumption), medical history (hereditary and personal), and details of drug treatment for hypertension or other diseases. More specific information was collected about the frequency and location (clinic or home) of BP monitoring before the study, and the number and type of devices used for home BP monitoring.



All anthropometric measurements (weight, height and waist circumference) were performed without shoes and in light clothing. Waist circumference was measured in centimetres at the narrowest part of the torso. Body mass index (BMI) was calculated as weight (kg) divided by standing height (m<sup>2</sup>). All participants were invited to attend a second visit 7 to 14 days later to have their BP re-measured.

The study was conducted in accordance with the principles of the Helsinki Declaration<sup>12</sup>. All subjects gave informed consent and the procedures followed were in accordance with institutional guidelines and approved by the review board of the collaborating university hospital.

## ***Blood pressure measurements***

Blood pressure was measured according to international guidelines<sup>13,14</sup>. Measurements were taken using a standard mercury sphygmomanometer with bladder size 12 x 35 cm, or another appropriate sized cuff if required. The subject remained at rest in the sitting position for at least 5 min before the BP was measured in both arms at the level of the heart. If there was a difference between arms, the measurements were taken in the arm with the highest BP. First (appearance) and the fifth (disappearance) Korotkoff sounds were recorded as indicative of the systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. Blood pressure was evaluated on two occasions with a 7 to 14 day interval between them. At every visit, three BP measurements were taken with at least 1 min interval between them. In the analysis, only the average BP of the second clinic visit was used. Subjects who were only examined on the initial visit were excluded from the analysis. Consumption of caffeine and smoking was prohibited for at least 30 min before the measurements.

## ***Definitions***

Hypertension was defined according to the guidelines of European Society of Hypertension<sup>13</sup> and the Joint National Committee (JNC) VII<sup>14</sup> as SBP  $\geq$ 140 mmHg and/or DBP  $\geq$ 90 mmHg, and/or current treatment with

antihypertensive drugs. Awareness of hypertension was described as any prior diagnosis of hypertension according to a health professional or the patient's health record<sup>10</sup>. Treatment for hypertension was defined as current use of antihypertensive drugs; and hypertension control was defined as treated hypertension with SBP <140 and DBP <90 mmHg<sup>10</sup>. In order to avoid the misclassification of non-hypertensive individuals taking cardiovascular medication for other indications a diagnosis of 'treated hypertension' was made only if the subject reported a prior diagnosis of hypertension and was using antihypertensive agents.

Participants were classified in 3 groups according to BMI values: normal (BMI <25), overweight (BMI  $25 \geq$  to <30) and obese (BMI  $\geq$ 30). Abdominal obesity was defined as waist circumference  $\geq$ 88 cm for females and  $\geq$ 102 cm for males<sup>15</sup>.

## ***Statistical analysis***

Analysis was performed using the Statistical Package for Social Sciences v16 for Windows (SPSS Inc; www.spss.com). Results are expressed for continuous variables as mean  $\pm$  standard deviation (M $\pm$ SD) and for qualitative variables as frequencies. To determine whether each variable had a normal distribution, the Kolmogorov-Smirnov algorithm was used when the sample was  $\geq$ 50, and Shapiro-Wilk when the sample was <50. Student's *t*-test or the Mann-Whitney *U*-test was used to estimate differences between mean values. Comparison of frequencies was performed by Pearson's  $\chi^2$  with Yates' correction where appropriate (continuity correction was used to improve the fit to exact probability) and Kendall's tau b test or the Kruskal-Wallis test for variables with more than 2 groups. A probability value of  $p < 0.05$  was considered statistically significant. In addition, 95% confidence intervals (95% CI) were given where relevant, estimated using confidence interval analysis (CIA)<sup>16</sup>. The Wilson test was used for solitary percentages and the Newcombe test to estimate differences in paired proportions.



## Results

Of the target population of 191 aged  $\geq 65$  years identified from the local registry, 171 agreed to participate (89.5%). Of these participants, four who were bedridden and unable to participate were excluded. Six subjects with only one visit for measurement of BP as well as seven normotensive patients who were taking antihypertensive drugs for another cardiovascular disease and who had no history of hypertension were also excluded. The working sample, therefore, was 154 people (80.6%). There were no statistically significant differences between participants included and excluded from the study in terms of mean age ( $74.2 \pm 5.8$  versus  $74.9 \pm 6.2$ ,  $p = 0.498$ ) and sex ratio (males' participation 97/104, 93.3% versus females' participation 74/87, 85.1%, CI 95% -6, 17.8).

### *Study sample characteristics*

Paliouri represents a typical Greek rural village. The characteristics of the studied population are presented (Table 1). Among the 154 subjects who were included in the analysis, 93 were men (60.4%) and 61 women (39.6%). The mean age was  $74.2 \pm 5.8$  years (range 65–94 years). According to BMI 14% were normal, 35% were overweight and 51% were obese; according to waist circumference cut-off points 71.1% (CI 95% -51.5,-31.3) had abdominal obesity. The BMI and waist circumference were significantly higher in women than men ( $32.50 \pm 5.46$  vs  $28.94 \pm 4.04$ ,  $p < 0.001$ ; and  $108 \pm 12.08$  vs  $101.7 \pm 11.02$ ,  $p < 0.01$ ) and in the younger elderly ( $< 75$  years) than the older ( $\geq 75$  years) ( $31.03 \pm 4.6$  vs  $29.20 \pm 4.63$ ,  $p < 0.01$ ; and  $106.8 \pm 11.01$  vs  $101.1 \pm 12.04$ ,  $p < 0.01$ ).

### *Prevalence, awareness, treatment and control of hypertension*

The prevalence of hypertension was extremely high 89% (88.2% in men vs 90.2% in women, CI 95%: -0.117 - 0.092);

with mean SBP and DBP levels  $145.7 \pm 19.16$  and  $83.15 \pm 11.59$  mmHg, respectively. There were no significant differences in SBP and DBP between men ( $147.3 \pm 20.4 / 84.7 \pm 12.5$ ) and women ( $143.2 \pm 16.9 / 80.9 \pm 9.7$ ),  $p = 0.082$  for SBP and  $p = 0.108$  for DBP, but SBP was significantly higher in participants  $\geq 75$  years ( $149.4 \pm 19.5 / 81.8 \pm 12.1$ ) than participants  $< 75$  years ( $142.5 \pm 18.4 / 83.9 \pm 10.3$ ),  $p = 0.028$  for SBP and  $p = 0.257$  for DBP.

The levels of awareness, treatment and control of hypertension are presented (Table 2). Of the 137 hypertensive patients, 89.8% were aware of their condition. Mean SBP was significantly lower in those who were aware of their disease, compared with those who were not ( $146.7 \pm 18.73$  vs  $158.7 \pm 19.46$ ,  $z = -2.065$ ,  $p = 0.039$ ); DBP was not significantly different ( $83.36 \pm 11.21$  versus  $88.1 \pm 16.31$ ,  $t = -1.565$ ).

Awareness of hypertension was associated with a high frequency of BP measurement ( $p = 0.007$ ), history of coronary ( $p = 0.006$ ) or other chronic disease ( $p = 0.001$ ), lower education ( $p = 0.032$ ), and living with a spouse ( $p = 0.036$ ).

Only one of the 123 individuals (0.8%) who were aware of their condition was not being treated for hypertension; of all the hypertensives only 45 (32.8%) had their hypertension controlled. Among treated hypertensives, SBP control was achieved in 41% and DBP control in 74.6%. Levels of awareness (CI 95% -0.128 - 0.064), treatment (CI 95% - 0.162-0.054) and control (CI 95% -0.159 - 0.155) were not significantly different between men and women.



**Table 1: Characteristics of the studied population**

Patient characteristic	Mean $\pm$ SD or <i>n</i> (%)			Significance, $\chi^2$ or tau
	All <i>n</i> 154	Men <i>n</i> 93	Women <i>n</i> 61	
Mean age (years)	74.3 $\pm$ 5.8	74.1 $\pm$ 6.0	74.3 $\pm$ 5.6	–
Systolic blood pressure (mmHg)	147.3 $\pm$ 20.4	143.2 $\pm$ 16.9	145.7 $\pm$ 19.2	–
Diastolic blood pressure (mmHg)	84.7 $\pm$ 12.5	80.9 $\pm$ 9.7	83.2 $\pm$ 11.6	–
Body mass index (kg/m <sup>2</sup> )	30.2 $\pm$ 4.7	28.9 $\pm$ 4.0	32.5 $\pm$ 5.5	5.50***
Waist circumference (cm)	104.2 $\pm$ 11.8	101.7 $\pm$ 11.0	108.0 $\pm$ 12.1	-3.29**
Years of education:				
< 6 years	61 (39.6)	24 (25.8)	37 (60.7)	0.363***
6 years	84 (54.4)	60 (64.5)	24 (39.3)	
> 6 years	9 (5.8)	9 (9.7)	0 (0)	
Health insurance	151 (98.1)	91 (97.8)	60 (98.4)	
Alcohol intake:				
0–7 units/week	113 (73.4)	53 (57.0)	60 (98.4)	-7.52***
8–14 units/week	29 (18.8)	28 (30.1)	1 (1.6)	
>14 units/week	12 (7.8)	12 (12.9)	0 (0)	
Smoking status:				
Current smoker	18 (11.7)	18 (19.4)	0 (0)	0.648***
Ex-smoker	50 (32.5)	49 (52.6)	1 (1.6)	
Non-smoker	86 (55.8)	26 (28)	60 (98.4)	
Diabetes mellitus	30 (19.5)	16 (17.2)	14 (23)	
Heart disease	54 (35.1)	34 (36.6)	20 (32.8)	
Myocardial infarction	10 (6.5)	9 (9.7)	1 (1.6)	
Dyslipidemia	29 (18.8)	15 (16.1)	14 (23)	
Chronic renal failure	3 (1.9)	1 (1.1)	2 (3.3)	
Stroke	11 (7.1)	7 (7.5)	4 (6.6)	

$P < 0.01$ , \*  $p < 0.001$

Heart disease: past history of either bypass, angioplasty, myocardial infarction, angina or heart surgery.

**Table 2: Prevalence, awareness, treatment and control of hypertension by age and sex**

Hypertension	Total	Aged under 75 years <i>n</i> (%)		Aged 75 years or over <i>n</i> (%)	
		Men	Women	Men	Women
Prevalence	137/154 (89.0)	42/49 (85.7)	28/33 (85.7)	40/44 (90.9)	27/28 (96.1)
Awareness	123/137 (89.8)	38/42 (90.5)	26/28 (92.9)	34/40 (85)	25/27 (92.6)
Treatment	122/137 (89.1)	38/42 (90.5)	26/28 (92.9)	33/40 (82.5)	25/27 (92.6)
Control	45/137 (32.8)	16/42 (38.1)	8/28 (28.6)	11/40 (27.5)	10/27 (37)
Control under treatment	45/122 (36.9)	16/38 (42.1)	8/26 (30.8)	11/33 (33.3)	10/25 (40)



## ***Severity of hypertension***

Classification of hypertension according to Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure<sup>14</sup> showed that among the patients receiving treatment, 36.9% (CI95% 28.8-45.7%) were controlled, 37.7% (CI95% 29.6-46.6) had hypertension stage 1 and 25.4% had hypertension stage 2. Patients with uncontrolled hypertension were more likely and statistical significantly (CI 95% 3.7- 34.0) to have stage 1 hypertension (59.7%, CI 95% 48.6-70.0) than stage 2, (40.3%, CI 95% 30.0-51.4).

## ***Drug treatment of hypertension***

Study participants were followed up by various GPs. The number and types of antihypertensive medication received are presented (Table 3). In all, 29% of the patients receiving antihypertensive drugs were taking only one, 40.2% two and 30.3% at least 3 drugs. Among the patients receiving 2 drugs, the most common two combinations were a diuretic with an angiotensin-converting enzyme inhibitor (42.9%), and a diuretic with an angiotensin II receptor antagonist (22.2%).

## ***Type of blood pressure monitoring***

All participants reported that they had measured their BP at least once in the previous 2 years, and 89% once in the past 3 months. Of the 154 participants, 8.2% were measuring their BP once each year and 12.3% only if they had symptoms (headache or dizziness). Although 63.6% of the total population had a personal manometer, only 40.1% could measure their BP independently. Of the type of devices used for home BP monitoring, 65.5% owned a manual sphygmomanometer and 34.5% an electronic device. Regarding sex-related frequency of BP measurement, men were measuring their BP more often than women (at least once a month, 75% vs 51.7% (CI 95% 7.4 - 38.1)). Women reported measuring their BP more often when they had symptoms (headache or dizziness) (8% men vs 19% women, CI 95% -23.6 - 0).

## **Discussion**

This study showed the prevalence of hypertension in this elderly rural population to be extremely high (89%). However, despite the levels of awareness and treatment of hypertension being similarly high (approximately 89%), BP was poorly controlled at only 32%. The proportion of those taking combined therapies in our study was also relatively high (70%).

At the present time, 8 epidemiological studies<sup>7,17-23</sup> have been conducted in Greece, with only 4 of them reporting data specific to the elderly: two local studies (Didima<sup>18</sup> and Nemea<sup>7</sup> study), the EPIC study<sup>21</sup> and the only national study, Hypertenshell<sup>17</sup>, which reported only on the prevalence of hypertension among the elderly. The findings according to prevalence, awareness, treatment and control of hypertension in previous Greek studies are presented (Fig1).

## ***Prevalence of hypertension***

Our results are similar to Nemea, a study that also focused on an elderly, rural Greek population. The higher prevalence of hypertension in our study, the most recent one, may be explained by the fact that the prevalence of hypertension tends to increase with the passage of time<sup>24-26</sup>

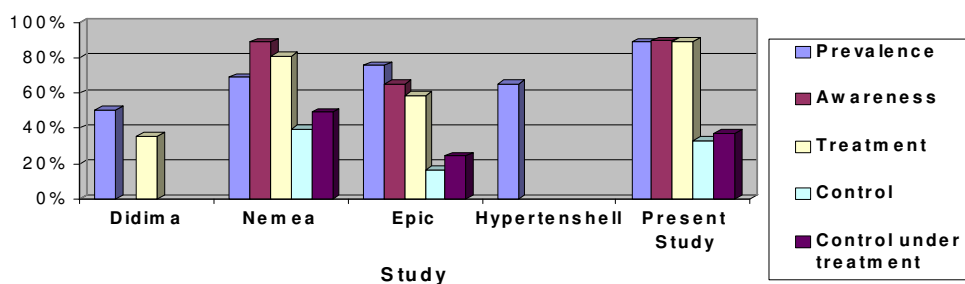
The prevalence of hypertension in the elderly (>60 or >65 years) according to studies in America<sup>3,24,27</sup> and Europe<sup>8-11,25,28-30</sup>, varies from 64.8% in Italy (the results of a local study conducted exclusively in the elderly in 1992 in 3 Italian villages<sup>8</sup>) to 80.5% in England (the results of a national study carried out in 2001 that exclusively studied the elderly<sup>11</sup>). Therefore, although our study's prevalence seems very high, it is not significantly different from the studies of European countries (England 80.5%<sup>11</sup>, Portugal 78.9%<sup>29</sup>, France 78.2%<sup>10</sup>).



**Table 3: Types and combinations of antihypertensive medications used**

Combination among patients N =122	Antihypertensive type n (%)					
	ACE inhibitors	CCBs	β-blockers	ARBs	Diuretics	Others
Total	57 (46.7)	45 (36.9)	31 (25.4)	39 (32)	80 (65.6)	6 (4.9)
1 type (n=36)	8 (22.2)	6 (16.7)	3 (8.3)	10 (27.8)	9 (25)	0 (0)
2 types (n=49)	27 (55.1)	11 (22.4)	7 (14.3)	14 (28.6)	37 (75.5)	2 (4.1)
≥ 3 types (n=37)	22 (59.5)	28 (75.7)	21 (56.8)	15 (40.6)	34 (91.9)	4 (10.8)

ACE, Angiotensin-converting enzyme; ARBs, angiotensin II receptors antagonists; β-blockers, beta blockers; CCBs, calcium channel blockers.



**Figure 1: Comparison of present study with other Greek studies according to prevalence, awareness, treatment, control and control-under-treatment of hypertension in the elderly in Greece<sup>7,17,18,21</sup>.**

### Awareness of hypertension

In studies conducted in the developed world, the frequency of awareness of hypertension ranged from 56.5% in England<sup>25</sup> to 89% in Nemea, Greece<sup>7</sup>. The awareness of hypertension in our study was extremely high at 89.8% and this is similar to awareness found in the Nemea survey<sup>7</sup>. The high rate of awareness in our study could be attributed to Greece's free public health system and the easy access of the rural population to health services. In rural, in contrast to urban regions of Greece<sup>31</sup>, primary health care is well

established and there is a doctor responsible for a specific population. Finally, awareness of hypertension was associated with a high frequency of BP measurement, a history of coronary or other chronic disease, lower education, and living with a spouse.

### Treatment of hypertension

Similar to awareness, the rate of hypertension treatment was very high (89.1%), partially reflecting the implementation of guidelines for the treatment of hypertension. It is noteworthy



that aware hypertensives were more likely to receive drug treatment than their counterparts in the surveys of other countries. Treatment rates in the elderly in other developed countries vary from 30.6% in Canada to 62.7% in the USA<sup>3,7-9,11,24,25,27-29</sup>. Most of the Mediterranean countries have treatment proportions of approximately 55%<sup>9,10,25,28-30</sup>, while in Greece this varies from 35.6% in the Didima study<sup>18</sup> to 80.9% in the Nemea study<sup>7</sup>. It must be noted that in the present study, drug treatment was recorded according the health record, contrary to other studies which depended on patient-provided information<sup>24,32</sup>. The extremely low proportion of untreated aware patients (0.8%) in contrast to 5.3%–29% in the rest of the developed regions<sup>3,7-9,24,25,27-30</sup>, indicates an aggressive attitude among Greek doctors, who seem to prefer earlier drug treatment. This attitude has also been reported in the previous Greek studies (Didima and Nemea)<sup>7,18</sup>.

## Control of hypertension

Only one out of three hypertensives had successfully controlled BP. In accordance with previous reports<sup>9-11,18, 5,27-30</sup>, even in the USA (control 27.4%)<sup>24</sup>, our study (control 32.8%) and the Nemea study (control 39.8%) suggest relatively high worldwide control rates among the elderly. This may partly be due to the perceived high rates of awareness in both of the studies. The proportions of combined therapy were also relatively high in our study, with only 29% of the pharmacologically treated hypertensive patients receiving only one drug. This is lower than has been reported in the elderly in Italy (72%)<sup>8</sup> and Germany (53%)<sup>33</sup>. The high prevalence of combination therapy in our study may be responsible, at least in part, for the better control in Paliouri (32.8%), compared with these other studies (Italy 17.6%<sup>8</sup> and Germany 22%<sup>33</sup>). Reports from large clinical trials suggest that the majority of hypertensive patients require two or more antihypertensive agents to reach the target BP<sup>14</sup>.

## Strengths and limitations

Our study has some unique characteristics. First, all inhabitants were contacted, and an especially high response rate was achieved, among the highest in similar studies. Second, our study focused exclusively on the elderly, adding information about a group that is under-researched. Third, we provide data about factors associated with hypertension awareness, an issue of scarce and limited information. Finally, the vast majority of subjects (95%) was evaluated in spring, thus avoiding seasonal BP variations that could affect the results.

The interpretation of our findings is limited by the small size of our study population (the elderly of a small village). Our study also has the inherent limitation of studies into the elderly (over the age of 65) – that those with cardiovascular disease have already died and those still living are survivors. Likewise, because the overall number of unaware hypertensives was relatively small, any subgroup analysis should be interpreted with caution.

## Conclusion

In conclusion, this study provides data that suggests hypertension is an important public health issue among the Greek elderly population. Despite high rates of awareness and treatment, control rates are disappointingly low. To manage this important problem the local health system must be more oriented to the prevention and control of high BP. Systematic prevention, together with greater efforts towards regular and strict surveillance and management in already diagnosed hypertensives may lead to better BP control and a subsequent reduction of cardiovascular events in this high risk population.

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