

Relationship Between Social Network and Hypertension in Older People in Spain

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Introduction and objectives. To investigate the association between a patient's social network and hypertension risk in older adults in Spain and to determine whether the nature of the social network is related to a patient's awareness of hypertension, to disease treatment and control, or to adherence to hypertension drug therapy.

Patients and method. Cross-sectional study of 3483 subjects representative of the non-institutionalized Spanish population aged 60 years or more. Logistic regression analysis, adjusted for sex, age, educational level, lifestyle and frequency of medical consultation, was used to derive odds ratios (ORs) for associations between characteristics of the social network (e.g., marital status, cohabitation status, frequency of contact with family members, and frequency of contact with friends and neighbors) and aspects of hypertension.

Results. The hypertension risk in married individuals and those living with others was less than in those who were unmarried (OR=0.79; 95% confidence interval [CI] 0.67-0.94) or who lived alone (OR=0.75; 95% CI, 0.61-0.93). Men who saw their friends frequently were more likely to be aware of hypertension (OR=1.57; 95% CI, 1.19-2.07). Women who saw their friends or neighbors frequently were less likely to be aware (OR=0.70; 95% CI, 0.51-0.97). No clear relationship between social network characteristics and other hypertension-related variables was observed.

Conclusions. In older adults, hypertension was associated with aspects of social integration, such as marital and cohabitation status. Among hypertensives, awareness of hypertension was partly related to the frequency of contact with family and friends or neighbors.

Key words: *Social network. Hypertension. Older adults. Spain.*

This study was partly financed by grants from the Instituto de Salud Carlos III (C3/09 and G03/065).

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Received February 23, 2005.
Accepted for publication July 8, 2005.

Relación entre la red social y la hipertensión arterial en los ancianos españoles

Introducción y objetivos. Examinar la asociación de la red social con la hipertensión arterial (HTA) y analizar si la red social está relacionada con el conocimiento del estado hipertensivo, el tratamiento y el control de la presión arterial (PA), y el cumplimiento terapéutico en los ancianos españoles.

Pacientes y método. Estudio transversal realizado en 3.483 sujetos representativos de la población española no institucionalizada ≥ 60 años. La asociación de las variables de red social (estado marital, situación de convivencia, frecuentación de familiares y frecuentación de amigos o vecinos) con los distintos aspectos de la HTA se resumió con las *odds ratio* (OR) obtenidas mediante regresión logística, ajustadas por sexo, edad, nivel de estudios, estilos de vida y frecuencia de consulta médica.

Resultados. Los individuos casados y los que vivían acompañados presentaron HTA con menos frecuencia que los no casados (OR = 0,79; intervalo de confianza (IC) del 95%, 0,67-0,94) y los que vivían solos (OR = 0,75; IC del 95%, 0,61-0,93). La probabilidad de conocer el estado hipertensivo fue mayor en los varones que veían a sus familiares con mayor frecuencia (OR = 1,57; IC del 95%, 1,19-2,07) y menor en las mujeres que veían a amigos o vecinos con mayor frecuencia (OR = 0,70; IC del 95%, 0,51-0,97). No se observó una asociación clara entre la red social y el resto de variables relacionadas con la HTA.

Conclusiones. En los ancianos, la HTA se asocia con algunas variables de integración social, como el estado civil y la situación de convivencia. Entre los hipertensos, el conocimiento del estado hipertensivo depende en parte de la frecuentación de familiares y amigos o vecinos.

Palabras clave: *Red social. Hipertensión arterial. Ancianos. España.*

INTRODUCTION

The social network refers to the set of contacts, and the nature of these contacts, that one person has

ABBREVIATIONS

BP: blood pressure.
 SBP: systolic blood pressure.
 DBP: diastolic blood pressure.
 BMI: body mass index.
 OR: odds ratio.
 CI: confidence interval.
 SD: standard deviation.

with other persons.¹ Besides being an indicator of integration within the social structure, a person's social network can also influence health status. A poorer social network is associated with a worse subjective view of health²⁻⁵ and a worse quality of life.⁶ Social isolation has also been associated with greater overall mortality and death due to cardiovascular disease, accidents and suicide.^{1,7-10} Moreover, persons with less social support have a worse prognosis after cardiovascular disease.^{7,11} Additionally, an inverse relation has been detected between social network and certain mental disorders,¹²⁻¹⁴ although an uncomfortable and stressful social interaction may also be associated with mental health.¹ Data support the possibility that the relationship between the social network and health may be explained, at least in part, by physiological mechanisms, such as alterations in the workings of the immune, neuroendocrine and cardiovascular systems.^{8,15}

Regarding blood pressure (BP), several studies have shown that a worse social network is associated with higher BP levels.¹⁶⁻¹⁸ Possible explanations to account for this finding include social isolation, which can limit the receipt of social support (informational, emotional or instrumental),¹ and which is associated with an increase in BP.¹⁹⁻²¹ At the same time, the reduced level of social support could lead to the adoption of fewer habits related with a healthy lifestyle and to worse compliance with medical recommendations.^{22,23} A good social network, however, can attenuate the cardiovascular response in situations of stress, thereby avoiding the accompanying increase in BP.^{24,25}

Although studies have been carried out in Spain examining the relationship between social network and hypertension in the local and the clinical setting,²⁶ no cross-sectional studies have yet been undertaken in representative samples of older persons. The relationship between social network and hypertension in older Spanish persons is of interest because the prevalence of hypertension in the Spanish population ≥ 60 years of age is very high,²⁷ and also because Mediterranean countries, such as Spain, traditionally have very strong family links that involve looking after the elderly at home, under the protection of their

children or other members of the family, and maintaining contact with neighbors and friends. Furthermore, the relationship between social support and BP has hardly been studied in other settings outside the Mediterranean region, and one study has suggested that it may vary between cultures.²⁸ The main hypothesis that was contrasted in this study was that the rate of hypertension is lower in older Spanish persons who have a better social network.

Finally, bearing in mind the differences detected between the sexes in the influence of the social network on health,²⁹ we considered that this would also be reflected in the case of the BP. In women, it has been seen that the more brothers and sisters they have, the lower the BP, whereas among men, greater family size and participation in associations is related with lower BP levels.¹⁶ Nevertheless, the results of the different studies are heterogeneous and vary according to the origin and type of social support studied.³⁰⁻³³

The aim, therefore, of this study was to assess the relationship between social network and hypertension among older persons in Spain, and to examine whether the social network is associated with the person's awareness of hypertension, with the management and control of the BP, and with therapeutic compliance. We also studied the possible differences between sex in the relationship between the social network and these variables.

PATIENTS AND METHODS**Study Design and Subjects**

We undertook a cross-sectional study of a sample of 4000 subjects representative of the non-institutionalized Spanish population aged 60 years or more. Informed consent was obtained from all the subjects or the relatives with whom they lived. The study was approved by the Clinical Research Ethics Committee of the Hospital Universitario La Paz, in Madrid, Spain.

The details of the study have been published previously.²⁷ In brief, the study subjects were selected by probabilistic random multi-stage cluster sampling. The clusters, selected randomly from among the census section lists, were stratified by geographic region and size of the town. The households of those subjects from whom information was obtained were then selected, and the subjects grouped by sex and age. Given the study design, each subject was assigned a weighting coefficient according to their sex, age, area of residence, and size of the town. This enabled the characteristics of the Spanish population to be reconstructed for the analysis. The response rate for the study was 71%.

Study Variables

Data collection took place between October 2000 and February 2001 by means of a personal interview with a structured questionnaire and a physical examination. The interviewers underwent standardized training prior to giving the questionnaire, and taking the BP and anthropometric measurements. Of the 4000 subjects interviewed, 3483 (87.1%) provided full information for the variables used in this study. As compared with those persons who provided full, valid information for the study variables, those who failed to do so were more often men (46.2% vs 43.0%) and were older (mean, 72.7 years vs 71.8 years).

The social network was evaluated by means of several questions relating to marital status, cohabitation status, visits by relatives apart from those with whom they lived, and the frequency of contacts with friends or neighbors.⁶ The information obtained was then used to classify the subjects as married or not, living accompanied versus living alone, seeing relatives daily or almost daily versus seeing them less often, and seeing friends or neighbors daily or almost daily versus seeing them less often.

A standardized BP measurement was taken on the right arm, with the subject seated and after five minutes rest, using a suitably sized blood pressure cuff and mercury sphygmomanometer.^{27,34} The BP was measured six times for each person, on two separate occasions. The final BP used for the analysis was the average of the 12 measurements.

A person was considered to have hypertension if the systolic blood pressure (SBP) was ≥ 140 mm Hg, the diastolic blood pressure (DBP) was ≥ 90 mm Hg, or if the person was currently receiving treatment with antihypertensive drugs.³⁵ Awareness of hypertension was recorded by asking whether the subject's physician had ever said that the BP was high. A person was considered to be on antihypertensive therapy if they stated that they were taking drugs to control the BP at the time of the interview. A person who was taking antihypertensive drugs was considered to have the BP controlled when the SBP was < 140 mm Hg and the DBP was < 90 mm Hg. Therapeutic adherence was evaluated by means of the Morisky-Green test,³⁶ which includes 4 questions about the following aspects: whether they ever forget to take the drugs, whether they take the drugs at the correct time, whether they stop the treatment when they feel better, and whether they stop taking the treatment if they feel ill. A person was considered to adhere to treatment if the answers to all four questions were correct, and not to adhere if one or more answers were unsuitable.^{36,37}

The socio-demographic variables considered were sex, age, and educational level (no formal education, primary, secondary, and university). Variables associated with lifestyle for this study were: smoking (never

smoked, ex-smoker, and current smoker), alcohol consumption (moderate consumption: ≤ 30 g daily for men and ≤ 20 g daily for women; excessive consumption: those who surpassed the limits for moderate consumption) and physical activity during leisure time (none, occasional, and regular). Weight and height were also measured using standardized procedures,³⁸ and the body mass index (BMI) was calculated. Three groups of subjects were formed: low and normal weight (< 25), overweight (25-29.9), and obese (≥ 30). Finally, the subjects were asked about the frequency of their visits to their doctor (never, once a year, twice a year, every 2 or 3 months, once a month or more often).

Statistical Analysis

The χ^2 test was used to compare the percentages of persons with hypertension, those who were aware of their hypertension status, were on antihypertensive medication, whose BP was controlled, and who adhered to drug therapy, between categories of the social network variables, and between men and women. Logistic regression models were constructed to calculate the odds ratio (OR), with its corresponding 95% confidence interval (CI), relating the association of the social network with the different aspects of hypertension. The OR was adjusted for age, sex, level of education, lifestyle, and frequency of visits to the physician. All the variables were modeled using dummy variables for the categories described above. To examine the differences between men and women in the association of the social network with the different aspects of hypertension we used interaction terms, constructed as the product of the sex for each of the social network variables. Statistical significance was set at $P \leq .05$, except for the interaction terms, for which it was set at $P \leq .10$. Data analysis was performed with the SAS statistical package, version 8.02 (2001).³⁹

RESULTS

The sample was composed of 3483 participants, 1985 (56.98%) women and 1498 (43.02%) men. The mean \pm standard deviation (SD) of the age was 72.4 ± 7.7 for the women and 71.0 ± 8.0 years for the men. Overall, 68.0% of the participants aged 60 years or older had hypertension. Of these, two thirds were already aware of the fact, and 85.5% were receiving drug therapy for their hypertension, though only 30.1% of these had their BP controlled. Of the participants on antihypertensive medication, 63.6% adhered to their treatment.

Table 1 shows the variables associated with hypertension, in relation with the main components of the social network. The married men and women, or

TABLE 1. Percentages of Persons With Hypertension, Awareness of Hypertension, Receiving Antihypertensive Drug Therapy, Hypertension Control, and Therapeutic Adherence, According to the Social Network Variables and Sex

	Hypertension		Awareness		Treatment		Control		Adherence	
	Men (n=1498)	Women (n=1985)	Men (n=992)	Women (n=1375)	Men (n=587)	Women (n=931)	Men (n=485)	Women (n=814)	Men (n=477)	Women (n=800)
Marital status										
Married	64.4*	66.2*	59.1	71.4*	82.4	86.2	25.9*	33.6	67.4	63.9
Not married	73.9	71.8	60	64.9	82.7	88.7	36.7	29.3	63.8	63.2
Cohabitation status										
Live accompanied	65.2*	67.9*	59.3	69	83.1	87.1	27.6	31.2	67.4	63.6
Live alone	77.4	73.7	59	64	77.1	89.3	34.4	31.3	59.4	64.6
Visits by relatives										
Daily or nearly daily	67.5	70.5	64.0*	67.8	81.4	87.7	28.5	30.1	67.5	66.1
Less often	64.9	67.9	54.2	67.6	83.8	87.5	27.9	32.6	65.5	60.2
Visits by friends or neighbors										
Daily or nearly daily	66.3	69.5	60.8*	67.5	82.1	87.9	27.2	31.4	65.5	64.7
Less often	65.8	68.4	49.6	68.9	86	86.4	36.2	30.5	75.5	58.5

P*<.05.TABLE 2. Odds Ratio (95% Confidence Interval) of Having Hypertension for Each Social Network Variable, in the Overall Sample and According to Sex***

	Total (n=2367)	Men (n=992)	Women (n=1375)	<i>P</i> Interaction by Sex
Married	0.79 (0.67-0.94)†	0.69 (0.51-0.93)†	0.85 (0.68-1.06)	0.33
Living accompanied	0.75 (0.61-0.93)†	0.61 (0.39-0.94)†	0.81 (0.63-1.03)	0.23
Seeing relatives daily or nearly daily	1.12 (0.97-1.30)	1.12 (0.90-1.40)	1.11 (0.91-1.36)	0.87
Seeing friends or neighbors daily or nearly daily	1.02 (0.83-1.24)	0.94 (0.68-1.31)	1.08 (0.83-1.39)	0.74

*Odds ratio adjusted for age, level of education, physical activity, body mass index, smoking, alcohol, and frequency of medical visits. In the total sample they are also adjusted for sex.

†*P*<.05.

those who lived with somebody else, were less often hypertensive than those who were single or who lived alone. Among the men who had hypertension, the percentage of those who were aware of their hypertensive status was greater among those who saw their relatives and friends or neighbors daily or almost daily than among those who did so less frequently. The women who were married and had hypertension were more often aware of their hypertension status

than the single women. Finally, fewer married men had their BP controlled than single men.

Blood Pressure

After adjusting for sex, age, level of education, lifestyle, and frequency of visits to the physician, the participants who were married or who lived with somebody else were less often hypertensive than those

TABLE 3. Odds Ratio (95% Confidence Interval) of Being Aware of the Hypertension Status for Each Social Network Variable in Persons With Hypertension in the Total Sample and According to Sex*

	Total (n=3483)	Men (n=1498)	Women (n=1985)	<i>P</i> Interaction by Sex
Married	1.09 (0.88-1.34)	0.86 (0.61-1.22)	1.23 (0.93-1.61)	0.21
Living accompanied	1.12 (0.88-1.42)	0.89 (0.56-1.41)	1.21 (0.91-1.61)	0.28
Seeing relatives daily or nearly daily	1.18 (0.98-1.41)	1.57 (1.19-2.07)*	0.92 (0.72-1.17)	0.004
Seeing friends or neighbors daily or nearly daily	0.86 (0.67-1.11)	1.19 (0.79-1.78)	0.70 (0.51-0.97)*	0.04

*Odds ratio adjusted for age, level of education, physical activity, body mass index, smoking, alcohol, and frequency of medical visits. In the total sample they are also adjusted for sex.

†*P*<.05.

TABLE 4. Odds Ratio (95% Confidence Interval) of Having Antihypertensive Drug Therapy for Each Social Network Variable in Persons With Known Hypertension, in the Total Sample and According to Sex*

	Total (n=1519)	Men (n=588)	Women (n=931)	P Interaction by Sex
Married	0.95 (0.67-1.35)	1.40 (0.77-2.54)	0.90 (0.57-1.42)	0.24
Living accompanied	1.18 (0.78-1.79)	1.93 (0.89-4.17)	1.01 (0.60-1.68)	0.20
Seeing relatives daily or nearly daily	0.97 (0.72-1.32)	0.92 (0.56-1.49)	1.03 (0.69-1.55)	0.91
Seeing friends or neighbors daily or nearly daily	0.97 (0.63-1.49)	0.88 (0.39-2.00)	1.09 (0.65-1.83)	0.70

*Odds ratio adjusted for age, level of education, physical activity, body mass index, smoking, alcohol, and frequency of medical visits. In the total sample they are also adjusted for sex.

TABLE 5. Odds Ratio (95% Confidence Interval) of Hypertension Control for Each Social Network Variable, in Persons With Known Hypertension and With Antihypertensive Drug Therapy, in the Total Sample and According to Sex*

	Total (n=1299)	Men (n=485)	Women (n=814)	P Interaction by Sex
Married	0.93 (0.73-1.22)	0.61 (0.37-1.02)	1.08 (0.77-1.51)	0.02
Living accompanied	0.84 (0.61-1.15)	0.65 (0.32-1.33)	0.85 (0.59-1.23)	0.40
Seeing relatives daily or nearly daily	0.91 (0.72-1.17)	0.96 (0.62-1.47)	0.87 (0.64-1.18)	0.54
Seeing friends or neighbors daily or nearly daily	0.82 (0.59-1.14)	0.45 (0.24-0.86)*	1.06 (0.71-1.58)	0.19

*Odds ratio adjusted for age, level of education, physical activity, body mass index, smoking, alcohol, and frequency of medical visits. In the total sample they are also adjusted for sex.

† $P < .05$.

who were single or who lived alone, respectively (Table 2). Visits to or by relatives, friends or neighbors was not associated with the presence of hypertension. No differences were noted between sex in the associations detected (P for the interaction $> .10$ in all cases).

Awareness of Blood Pressure

Multivariate analysis showed no association in either the men or the women between marital status, or whether the participant lived accompanied or alone, and awareness of the hypertension status. However, the men who saw their relatives daily or almost daily were more often aware of their hypertension than those who had less contact with relatives. This association was not detected in the women (P for the interaction =.004). Among the women, a greater frequency of contact with friends or neighbors was associated with less awareness of their hypertension (Table 3).

Antihypertensive Drug Therapy

Multivariate analysis showed that men with hypertension who lived with somebody else more often received antihypertensive drug therapy than those who lived alone, although the difference was not statistically significant (OR=1.93; 95% CI, 0.89-4.17). This association was not seen in the women. No association was found in either the men or the women between

marital status or visits to or by relatives and friends or neighbors, and antihypertensive drug therapy (Table 4).

Blood Pressure Control

Multivariate analysis showed that men with pharmacologically treated hypertension who saw their friends or neighbors daily or almost daily had their BP controlled less often than those who had less contact with friends or neighbors (OR=0.45; 95% CI, 0.24-0.86). Visits to or by relatives was not associated with BP control, either in the men or in the women (Table 5).

Treatment Adherence

Multivariate analysis showed that neither marital status nor whether the participant lived accompanied or alone were associated with treatment adherence. The hypertensive participants who saw their relatives daily or almost daily more often adhered to their antihypertensive treatment than those who had less contact with their relatives, although the difference was not statistically significant (OR=1.21; 95% CI, 0.96-1.53). The percentage of men who adhered to their antihypertensive medication and who saw their friends or neighbors daily or almost daily was lower than those who saw them less often, though again the difference was not statistically significant. In the women, this association was the opposite (P for the interaction =.07) (Table 6).

TABLE 6. Odds Ratio (95% Confidence Interval) of Adhering to Antihypertensive Drug Therapy, for Each Social Network Variable, in Persons With Known Hypertension and With Antihypertensive Drug Therapy, in the Total Sample and According to Sex

	Total (n=1277)	Men (n=477)	Women (n=800)	P Interaction by Sex
Married	1.13 (0.86-1.48)	1.18 (0.72-1.94)	1.14 (0.82-1.59)	0.85
Living accompanied	0.97 (0.71-1.33)	1.22 (0.63-2.39)	0.94 (0.66-1.35)	0.37
Seeing relatives daily or nearly daily	1.21 (0.96-1.53)	1.09 (0.73-1.64)	1.26 (0.94-1.70)	0.51
Seeing friends or neighbors daily or nearly daily	1.04 (0.75-1.44)	0.63 (0.31-1.25)	1.23 (0.84-1.81)	0.07

*Odds ratio adjusted for age, level of education, physical activity, body mass index, smoking, alcohol, and frequency of medical visits. In the total sample they are also adjusted for sex.

DISCUSSION

Among older Spanish persons, those who are married or live with somebody else more often have hypertension than those who are not married or who live alone. This finding thus extends to a Mediterranean country, in this case Spain, the findings of other studies outside this setting.¹⁶⁻¹⁸ Furthermore, in another study in Spain, involving 236 patients with hypertension from a primary health care center, it was noted that those who had a low social network had increased BP measurements as compared with those who had wider social networks.²⁶ Regarding the characteristics associated with marriage, persons with mild hypertension who reported greater satisfaction and cohesion with their partner had a lower BP in a three-year follow-up study.⁴⁰ Likewise, Gump et al¹⁸ observed that the BP was lower when there existed partner interaction than when the interaction was with other persons.

Awareness of the status of hypertension varied according to whether the person saw friends and neighbors. The percentage of men with hypertension who were aware of the fact was greater among those who saw their friends or neighbors daily or nearly daily, although their BP control was worse. Among the women with hypertension, those who saw their friends or neighbors daily or nearly daily were less aware of their hypertensive status. Keeping up this link with friends or neighbors may reflect that the women were less concerned about their health in general and their BP in particular. It is also possible that some social network variables modify the effect of others. For instance, living alone is more common among women; although this fact was not associated in our study with visits to or by friends, the influence of friends may vary at the more basic level of the social network, which is the cohabitation status. Examination of this possibility would require stratifying the analysis simultaneously in 2 social network variables; however, our study lacked the statistical power to undertake this reasonably. Finally, the very few references concerning the relationship between social network and awareness of

hypertensive status do not enable us to situate our results within a suitable context.

The association between antihypertensive therapy and the social network appears to differ according to sex. English men with hypertension were more likely to receive treatment if they were widowed or divorced, lived with somebody else, or received less social support.³¹ English women were more likely to receive treatment if they received less social support, and no association was observed depending on their cohabitation status.³¹ No statistically significant association was detected in our study, in either the men or the women, between antihypertensive therapy and cohabitation status.

Little evidence exists concerning the relationship between BP control and social network. Among the English men, living alone versus living with somebody else was associated with worse control of the BP, though this association was not seen in the English women.³¹ In our study, the men who saw their friends daily or nearly daily had worse BP control than the men who saw their friends less often. This finding is consistent with the results of a study carried out in North Carolina, USA, in which black men with poorly controlled BP perceived greater approval from their friends than the men whose BP was controlled; these differences were less marked among the white men.³⁰ Regarding the women with hypertension, none of the social network variables studied was associated with BP control in our study.

Regarding compliance, the percentage of persons with hypertension who adhered to their antihypertensive therapy was greater in those who saw their relatives daily or nearly daily. Several factors have been associated with therapeutic adherence in persons with hypertension: the relationship between the health care professional and the patient, the chronic character and few symptoms of high blood pressure, prolonged complex treatment with possible side effects, and the social and demographic characteristics of the patient.^{37,41} As well as these factors, family ties may also improve therapeutic adherence and, consequently, the prognosis of the hypertension. Our results are in line

with some previous studies examining therapeutic adherence and family support,^{22,30} but not with others.²³

Concerning the differences between sex in the associations found in this study, men are usually considered to obtain more benefit from marriage than women, who usually receive greater benefit from their relationships with friends or relatives.^{1,24} Although we detected numerous differences in the study depending on the sex of the participant, involving awareness and control of the hypertension, we failed to see any clear pattern in these differences. The importance of the different social network variables may not be “neutral” and a particular variable may differ, not only according to sex,²⁹ but also according to culture, which would account for the contradictions in the results so far reported.³⁰⁻³³ Moreover, although the analysis includes a good number of adjustment variables, other factors that were not considered, such as the attitude taken towards the hypertension and the role of each sex, may play a part in the differences between the sexes in the relationship between the social network and the various aspects of hypertension.

Correct interpretation of the results requires certain methodological aspects to be taken into account. First, the cross-sectional design of the study does not enable us to ensure that the social network variables actually studied really explain the presence of hypertension and the other associated variables. Second, persons who were institutionalized were excluded from the study, as is done with most population-based studies in older persons. Given that a poor social network is a reason for institutionalization, the exclusion of these persons may have led to the relationship between social network and the aspects of hypertension studied being underestimated. Third, the BP is a continuous variable that we dichotomized for the purposes of this study. After reanalyzing the data using BP as a continuous variable, we confirmed that in both men and women the mean SBP was significantly lower in those who were married and those who lived with somebody else. However, for the DBP the differences were very slight and not statistically significant. Fourth, although certain study variables were self-reported, evidence exists for the reliability of the information reported concerning lifestyle,^{42,43} chronic diseases^{44,45} and the use of health care services.⁴⁶ On the other hand, although the Morisky-Green questionnaire tends to overestimate therapeutic adherence, it has been validated for the diagnosis of the person with hypertension who fails to adhere to therapy^{31,47} and there is no evidence to suggest that its validity varies according to the social network, so that it is unlikely to have affected our results much. Furthermore, BP, weight, and height were measured in a standardized fashion and by trained personnel. Finally, comparison of our results with those of other studies could be

limited by the different ways of measuring the social network reported. Although evidence suggests that our questions permit the main social ties of the participants to be evaluated,⁴⁸ only the source and the frequency of the social contacts were characterized. Future studies should include other dimensions of the social network, such as the size of the network or the number of persons involved, the density or extent of the relationships established, the geographical distance between individuals, the duration of the social relationship, and the direction or reciprocity of the interpersonal contact.

In conclusion, hypertension in older persons is associated with certain variables related with social integration, such as marital status and whether the person lives alone or accompanied. Among those who had hypertension, awareness of their hypertensive status depended partly on the frequency of the visits to or by relatives and friends or neighbors. It is therefore possible that hypertension and therapeutic adherence may act as mediators of the relationship between the social network and cardiovascular death and disease. Finally, marked differences were found in the associations studied according to the sex of the participant, although no clear systematic pattern seemed to be present.

REFERENCES

1. Stansfeld S. Social support and social cohesion. In: Marmot M, Wilkinson R, editors. *Social determinants of health*. Oxford: Oxford University Press, 1999; p. 155-78.
2. Ferrando J, Nebot M, Borrell C, Egea L. Apoyo social y estado de salud percibido en población anciana no institucionalizada de más de 60 años. *Gac Sanit* 1996;10:174-82.
3. Preston DB. Marital status, gender roles, stress, and health in the elderly. *Health Care Women Int*. 1995;16:149-65.
4. Melchior M, Berkman LF, Niedhammer I, Chea M, Goldberg M. Social relations and self-reported health: a prospective analysis of the French Gazel cohort. *Soc Sci Med*. 2003;56:1817-30.
5. Okamoto K, Tanaka Y. Gender differences in the relationship between social support and subjective health among elderly persons in Japan. *Prev Med*. 2004;38:318-22.
6. López García E, Banegas Banegas JR, Graciani Pérez-Regadera A, Herruzo Cabrera R, Rodríguez Artalejo F. Social network and health-related quality of life in older adults: a population-based study in Spain. *Qual Life Res*. 2005;14:511-20.
7. Vogt TM, Mullooly JP, Ernst D, Pope CR, Hollis JF. Social networks as predictors of ischemic heart disease, cancer, stroke and hypertension: incidence, survival and mortality. *J Clin Epidemiol*. 1992;45:659-66.
8. Berkman L, Glass T. Social integration, social networks, social support and health. En: Berkman L, Kawachi I, editors. *Social epidemiology*. New York: Oxford University Press; 2000. p. 137-73.
9. Nebot M, Lafuente JM, Tomás Z, Borrell C, Ferrando C. Efecto protector del apoyo social en la mortalidad en población anciana. Un estudio longitudinal. *Rev Esp Salud Pública*. 2002;76:673-82.
10. Rodríguez Laso A. El efecto de las relaciones sociales sobre la mortalidad en las personas mayores. El estudio “Envejecer en Le-

- ganés". Tesis doctoral. Madrid: Universidad Autónoma de Madrid; 2004.
11. Mookadam F, Arthur HM. Social support and its relationship to morbidity and mortality after acute myocardial infarction: systematic overview. *Arch Intern Med.* 2004;164:1514-8.
 12. Stansfeld S, Furher R, Shipley MJ. Types of social support as predictors of psychiatric morbidity in a cohort of British Civil servants (Whitehall II Study). *Psychol Med.* 1998;28:881-92.
 13. Zunzunegui MV, Beland F, Otero A. Support from children living arrangements, self-rated health and depressive symptoms of older people in Spain. *Int J Epidemiol.* 2001;30:1090-9.
 14. Lahuerta C, Borrell C, Rodríguez-Sanz M, Pérez K, Nebot M. La influencia de la red social en la salud mental de la población anciana. *Gac Sanit.* 2004;18:83-91.
 15. Brunner E, Marmot M. Social organization, stress, and health. En: Marmot M, Wilkinson R, editors. *Social determinants of health.* Oxford: Oxford University Press; 1999. p. 17-43.
 16. Bland SH, Krogh V, Winkelstein W, Trevisan M. Social network and blood pressure: a population study. *Psychosom Med.* 1991;53:598-607.
 17. Hanson BS, Isacson SO, Janzon L, Lindell SE, Rastam L. Social anchorage and blood pressure in elderly men: a population study. *J Hypertens.* 1988;6:503-10.
 18. Gump BB, Polk DE, Kamarck TW, Shiffman SM. Partner interactions are associated with reduced blood pressure in the natural environment: ambulatory monitoring evidence from a healthy, multiethnic adult sample. *Psychosom Med.* 2001;63:423-33.
 19. Dressler WW, Mata A, Chavez A, Viteri FE, Gallagher P. Social support and arterial pressure in a central Mexican community. *Psychosom Med.* 1986;48:338-50.
 20. Strogatz DS, James SA. Social support and hypertension among blacks and whites in a rural, southern community. *Am J Epidemiol.* 1986;124:949-56.
 21. Strogatz DS, Croft JB, James SA, Keenan NL, Browning SR, Garrett JM, et al. Social support, stress, and blood pressure in black adults. *Epidemiology.* 1997;8:482-7.
 22. Marín-Reyes F, Rodríguez-Morán M. Apoyo familiar en el apego al tratamiento de la hipertensión arterial esencial. *Salud Pública Mex.* 2001;43:336-9.
 23. Wang PS, Bohn RL, Knight E, Glynn RJ, Mogun H, Avorn J. Noncompliance with antihypertensive medications: the impact of depressive symptoms and psychosocial factors. *J Gen Intern Med.* 2002;17:504-11.
 24. Glynn LM, Christenfeld N, Gerin W. Gender, social support, and cardiovascular responses to stress. *Psychosom Med.* 1999;61: 234-42.
 25. Allen K, Blascovich J, Mendes WB. Cardiovascular reactivity and the presence of pets, friends, and spouses: the truth about cats and dogs. *Psychosom Med.* 2002;64:727-39.
 26. Menéndez Villalva C, Montes Martínez A, Gamarra Mondelo T, Nuñez Losada C, Alonso Fachado A, Buján Garmendia S. Influencia del apoyo social en pacientes con hipertensión arterial esencial. *Aten Primaria.* 2003;31:506-13.
 27. Banegas JR, Rodríguez-Artalejo F, Ruilope LM, Graciani A, Luque M, de la Cruz-Troca JJ, et al. Hypertension magnitude and management in the elderly population of Spain. *J Hypertens.* 2002;20:2157-64.
 28. Daniels A, Hoffman M, Lombard C, Steyn K, Levitt NS, Katzenellenbogen J. Blood pressure and social support from Mamre, South Africa, during social and political transition. *J Human Hypertens.* 1999;13:689-93.
 29. Fuhrer R, Stansfeld SA. How gender affects patterns of social relations and their impact on health: a comparison of one or multiple sources of support from «close persons». *Soc Sci Med.* 2002;54:811-25
 30. Williams CA, Beresford SA, James SA, laCroix AZ, Strogatz DS, Wagner EH, et al. The Edgecombe County High Blood Pressure Control Program: III. Social support, social stressors, and treatment dropout. *Am J Public Health.* 1985;75:483-6.
 31. Shah S, Cook DG. Inequalities in the treatment and control of hypertension: age, social isolation and lifestyle are more important than economic circumstances. *J Hypertens.* 2001;19:1333-40.
 32. Wyke S, Ford G. Competing explanations for associations between marital status and health. *Soc Sci Med.* 1992;34:523-32.
 33. Wielgosz AT. Impact of the social environment on blood pressure in women. *Can J Cardiol.* 1996;12:D13-5.
 34. O'Brien E, Petrie J, Littler W, de Swiet M, Padfield PL, Altman D, et al. An outline of the revised British Hypertension Society protocol for the evaluation of blood pressure measuring devices. *J Hypertens.* 1993;11:677-9.
 35. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension.* 2003;42:1206-52.
 36. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self-reported measure of medication adherence. *Med Care.* 1986;24:67-74.
 37. Gascón JJ, Sánchez-Ortuño M, Llor B, Skidmore D, Saturno PJ. Why hypertensive patients do not comply with the treatment: results from a qualitative study. *Fam Pract.* 2004;21:125-30.
 38. Gutiérrez-Fisac JL, López E, Banegas JR, Graciani A, Rodríguez-Artalejo F. Prevalence of overweight and obesity in elderly people in Spain. *Obes Res.* 2004;2:710-5.
 39. SAS/STAT Guide for personal computers, version 8.2. Cary, NC: SAS Institute ed; 2001.
 40. Baker B, Szalai JP, Paquette M, Tobe S. Marital support, spousal contact and the course of mild hypertension. *J Psychosom Res.* 2003;55:229-33.
 41. Stanton AL. Determinants of adherence to medical regimens by hypertensive patients. *J Behav Med.* 1987;10:377-94.
 42. Colditz GA, Martin P, Stampfer MJ, Willett WC, Sampson L, Rosner B, et al. Validation of questionnaire information on risk factors and disease outcomes in a prospective cohort study of women. *Am J Epidemiol.* 1986;123:894-900.
 43. Bowlin SJ, Morrill BD, Nafziger AN, Jenkins PL, Lewis C, Pearson TA. Validity of cardiovascular disease risk factors assessed by telephone survey: the Behavioral Risk Factor Survey. *J Clin Epidemiol.* 1993;46:561-71.
 44. Harlow SD, Linet MS. Agreement between questionnaire data and medical records. The evidence for accuracy of recall. *Am J Epidemiol.* 1989;129:233-48.
 45. Bush TL, Miller SR, Golden AL, Hale WE. Self-report and medical record report agreement of selected medical conditions in the elderly. *Am J Public Health.* 1989;79:1554-6.
 46. Roberts RO, Bergstralh EJ, Schmidt L, Jacobsen SJ. Comparison of self-reported and medical record health care utilization measures. *J Clin Epidemiol.* 1996;49:989-95.
 47. García Pérez AM, Leiva Fernández F, Martos Crespo F, García Ruiz AJ, Prados Torres D, Sánchez de la Cuesta Alarcón F. ¿Cómo diagnosticar el cumplimiento terapéutico en atención primaria? *Med Fam.* 2000;1:13-9.
 48. Glass TA, Mendes de Leon CF, Seeman TE, Berkman LF. Beyond single indicators of social networks: a LISREL analysis of social ties among the elderly. *Soc Sci Med.* 1997;44:1503-17.