The Role of Personality Dimensions in the Etiopathogenesis of Primary Hypertension

**ABSTRACT**

**Background:** Although hypertension is the most important cardiovascular risk factor, we still do not understand all the factors that contribute to the disease onset. The aim of this study was to examine the association between personality dimensions and primary hypertension.

**Methods:** In total, 310 participants were recruited in a case–control design. The association of personality dimensions with primary hypertension was examined in normotensive (n = 156) and hypertensive (n = 120) patients following assessment of the 5 personality dimensions with the DECAS Personality Inventory. A binary logistic regression model was used to assess the predictive value of personality traits for hypertension, controlling for recognized confounders such as age, gender, obesity, smoking history, parental history of hypertension, and education.

**Results:** Low or very low emotional stability was almost twice as frequent in the hypertensive group (71.7%) as in the normotensive study population (43.5%). The binary logistic regression model showed that low emotional stability is a significant predictor for hypertension, the risk of being hypertensive decreasing by 7% with each point increase on the emotional stability score. Very low or low emotional stability increased the odds of being hypertensive by 3.55 times (odds ratio: 3.55, 95% CI: 2.18-9.35, \( P < .001 \)). No association between the severity of hypertension and personality traits was found.

**Conclusions:** People with low emotional stability/high neuroticism have more than 3-fold increased odds of developing primary hypertension. The assessment of personality traits could be used as a tool to identify individuals at risk to develop primary hypertension as well as patients with primary hypertension where psychotherapy could be of potential value. This study highlights the need for further research, in order to establish effective, patient-oriented prevention strategies and treatment options.

**Keywords:** Emotional stability, essential hypertension, five-factor model, neuroticism, personality dimensions

**Introduction**

Cardiovascular diseases (CVD), especially coronary heart disease (CHD) and cerebrovascular disease, remain the main cause of premature death and loss of disability-adjusted life years (DALYs) in Europe and worldwide. Even though CVD mortality has considerably decreased in the latest decades in many European countries, it still accounts for 45% of all deaths per year across Europe.\(^1,2\) Hypertension is one of the most important cardiovascular risk factor (RF) leading to high rates of CVD-related mortality.\(^1\) It is estimated that approximately 1 billion individuals are affected worldwide, which is expected to rise to approximately 1.5 billion people (one-third of the world’s population) by 2025 due to the increasing obesity and aging of the population. Therefore, hypertension is one of the world’s biggest public health problems.\(^3\)

In Europe, the general prevalence of hypertension is estimated between 35% and 40% with major discrepancy between Central and East European countries, where the prevalence is higher (Germany, 55.3%; Serbia, 47%; Czech Republic, 43.6%) and Northern and Western European countries, where the prevalence is lower (Italy, 37.7%; England, 31.5%; Sweden, 30.2%).
38.4%). In Romania, a southeastern European country, hypertension’s prevalence is 45.1%, and it is responsible, through CVD, for 62% of all deaths.4

Although the management of hypertension is improving, we still do not understand all the factors that contribute to the disease onset. The majority of hypertension risk prediction models not only incorporate shared predictors such as sex, age, body mass index (BMI), systolic blood pressure (SBP) and diastolic blood pressure (DBP), parental history of hypertension, and cigarette smoking but also inconsistently include risk predictors such as ethnicity, education level, physical activity, and lately, genetic factors.5,6 However, although more and more evidence can be found to corroborate that beside the physiological, genetic, and psychosocial factors, personality also plays a major role in the etiology of hypertension,3,7,8 none of the hypertension risk predictor models consider personality as a predictor of the development of hypertension, and only a few studies directly examine whether a relationship between hypertension and personality exists. The precise mechanism by which personality influences the appearance of hypertension is uncertain. The detrimental effects of some personality traits (neuroticism, hostility, introversion) are potentially determined by unhealthy lifestyle (e.g., smoking, unhealthy food choices, less physical activity), low adherence to behavior change recommendations or CV medication and by affecting the impact of stressful events on physiological responses.8,9

It has been widely recognized that human behavior (thinking, feeling, and acting) can be characterized by 5 basic personality traits/dimensions, known as the five-factor model (FFM) or the Big 5 personality traits: N-emotional stability/neuroticism (the tendency to experience negative emotions, sensitive/nervous vs. secure/confident), E-extroversion (outgoing/energetic vs. solitary/reserved), O-openness to experience (inventive/curious vs. consistent/cautious), A-agreeableness (friendly/compassionate vs. challenging/detached), and C-conscientiousness (efficient/organized vs. easy-going/careless).10-12 The FFM uses this dimensional approach to describe adaptive and maladaptive personality characteristics. Another approach to characterize personality is the bimodal, categorical approach, where an individual can be described as having a type D “distressed” or a non-type D personality. Type D personality has been shown to predict poor prognosis in patients with CVD and is now recognized as an important prognostic factor of this.13-17 The core traits of the type D personality, negative affectivity (NA) and social inhibition (SI), can be described in terms of the FFM of personality, where NA primarily correlates with neuroticism, while SI with extraversion (negatively) and with neuroticism.18 The capacity of FFM to integrate personality traits and concepts expressed in other theories and models determined it to become the reference system used for the description of personality.

The FFM is currently the most widely validated dimensional model of personality.19 Since the introduction of the concept of type D personality as a vulnerability characteristic of heart patients, the attention has been focused on the relationship between personality and CVD, especially CHD,18,20 placing low emphasis upon investigating the connection between personality and primary hypertension, although hypertension is the most common and reversible RF for CVD.21 As today’s medicinal approach is dominated by personalized, evidence-based medicine, where the focus is on prevention of CVD by reducing RFs in order to avoid CVD-related morbidity, mortality, and disability,22 there is a clear need for studies investigating the relationship between personality traits and essential hypertension. The results of the few studies directly investigating the relationship between personality traits and essential hypertension are inconsistent. While on one hand evidence suggests that lower levels of conscientiousness and agreeableness, and high neuroticism,22,23 affective temperaments,24 as well as type D personality25 seem to associate with hypertension, other studies seem to find no correlation.25-28

Based on these insights, the aim of the present case-control study was to examine whether the personality dimensions described in the FFM are associated with primary hypertension, by analyzing (1) if there are differences in personality characteristics between hypertensive and normotensive individuals in terms of the FFM, (2) if personality dimensions could be considered RFs for hypertension, and (3) if personality structure influences the severity of hypertension.

Methods

Statement of Ethics

This case-control study was conducted at the Emergency Institute for Cardiovascular Diseases and Transplantation, Targu Mures, Romania. Participation was voluntary and anonymous. The study protocol was approved by the Research Ethics Committee of the George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, Romania (RECN 38/17102012). All participants provided informed written consent prior to participation, and the study was conducted in accordance with the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000).

Subjects

In the case group, 142 consecutive patients fulfilling the following inclusion criteria were recruited: (1) diagnosed essential (primary) hypertension; (2) aged between 40 and 65 years (inclusive); (3) educational level: at least 10th grade; (4) being able to understand and write the Romanian language; and (5) signed informed consent. Exclusion criteria were (1) identifiable cause of hypertension (secondary hypertension); (2) history of psychiatric illness (including, but not restricted to anxiety, depression, bipolar disorders, eating disorders, personality disorders, addiction, post-traumatic stress disorder, obsessive-compulsive disorder, schizophrenia, dementia); and (3) insufficient knowledge of the Romanian language, illiteracy or inability to read due to visual impairments. In the control group, 168 non-hypertensive controls were recruited, fulfilling the inclusion and exclusion criteria.

Patients were defined as having arterial hypertension if their blood pressure values were ≥140 mmHg SBP and/or ≥90 mmHg
DBP during 3 different blood pressure measurements in the clinic, which required the initiation of antihypertensive treatment or they were taking antihypertensive drugs and had a history of arterial hypertension.

Variables
For all participants, data including age, sex, and educational level were recorded together with details of physical activity, smoking status (never smoked, former smoker, and current smoker), weight, and height. For hypertensive patients, the diagnosis year and the highest medication-free SBP and DBP values were recorded. All interviews and anthropometric measurements were carried out by the same research assistant. Hypertension categories were defined by the highest level of blood pressure, whether systolic or diastolic: grade I SBP 140-159 mmHg and/or DBP 90-99 mmHg, grade II SBP 160-179 mmHg and/or DBP 100-109 mmHg, and grade III SBP ≥180 mmHg and/or DBP ≥110 mmHg. Obesity was considered if BMI ≥ 30 kg/m². Grade I obesity was defined as BMI 30.00-34.99 kg/m², grade II obesity as BMI 35.00-39.99 kg/m², and grade III obesity as BMI ≥ 40.00 kg/m². Patients were categorized as physically active if they accumulated at least 30 min/day, 5 days/week of moderate physical activity. 11

Personality Assessment
The standard instrument to assess the 5 factors and their lower-level traits is the Revised NEO Personality Inventory (NEO-PI-R), developed by Costa and McCrae, where NEO stands for Neuroticism, Extraversion and Openness. 14–29 The DECAS Personality Inventory was based on the NEO-PI-R questionnaire but calibrated, standardized, and validated on the Romanian population by Sava30 assessing the 5 basic dimensions of the personality according to FFM. The DECAS acronym stands for D-Deschideer (Openness), E-Extraversiune (Extraversion), C-Constiinciozitate (Conscientiousness), A-Agreabilitate (Agreeableness), S-Stabilitate Emoţională (Emotional Stability/Neuroticism). The Cronbach alpha internal consistency quotient measured on a Romanian representative sample of 1250 people ranges between 0.70 for conscientiousness and 0.75 for emotional stability/neuroticism, and between 0.79 for agreeableness and 0.92 for emotional stability/neuroticism at the 6-week test–retest. There is a good concurrent validity between the DECAS Personality Inventory and the NEO-PI-R Personality Inventory, ranging between 0.57 and 0.81.30–32 The DECAS Personality Inventory consists of 97 items of the test are distributed in 5 content scales according to FFM and 3 validation scales for data validation. The Social Desirability (SD) validation scale, known in most personality questionnaires and tests as the “lie scale” measures the degree at which the participants would put themselves into a more favorable light, which differs from their behavior in reality. The Random Answers (RA) validation scale measures the degree to which participants fill out the test items at random. The Approval (AP) validation scale measures the tendency to answer the majority of questions either with “true” or “false,” independently of the item’s content. For all 3 scales, the same interpretation principles are applied. The raw test scores are transformed into standard T quotients. T quotients above 65 identify an invalid protocol and urge caution in interpreting the results. Moreover, very low scores on the AP validation scale (T quotients under 35) highlight an invalid protocol due to the tendency of negatively answering the questionnaire items.

Statistical Analysis
Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM SPSS Corp.; Armonk, NY, USA) was used for statistical analysis. Data were labeled as categorical (dichotomous, nominal) or quantitative variables. Nominal variables were characterized by means of frequencies. Quantitative variables were tested for normality of distribution using the Kolmogorov–Smirnov test and were described by mean (SD).

To test for significant differences in the means between the hypertensive (cases) and non-hypertensive (controls) groups, independent-sample Student’s t test was run for quantitative variables. While in case of categorical features, Pearson’s chi-square tests for independence were performed. In case of obesity, Fisher–Freeman–Halton exact test was used. The personality dimensions and the clinical features found to be significantly different between the 2 groups were used as independent variables to build a binary logistic regression model in order to evaluate the predictive value of personality dimensions for hypertension, where the hypertensive/non-hypertensive groups were used as dichotomous dependent variables. To test our model for goodness of fit, both Hosmer–Lemeshow and $R^2$ were calculated.

The significance level was established as $α = 0.05$.

Results
In total, 310 participants were recruited to the study. From these, 120 of 142 (84.5%) cases and 156 of 168 (92.8%) controls passed the validation scales and obtained a valid protocol, scoring lower than 65 T quotients on all 3 validation scales and higher than 35 T quotients on the AP validation scale. In total, 276 participants with valid protocols were included in the final analysis. The demographic and clinical characteristics of the 2 participant groups are displayed in Table 1.

As an initial step to highlight the statistical differences between the mean quotients of the 5 personality dimensions for the cases and the controls, we applied the Student’s t test, and we have found statistical significance for emotional stability, where the mean quotient value was greater for the control group, 49.35 versus 43.57 ($P < .001$). For the other dimensions, we had similar mean values (Table 1). A quick survey of the scoring distribution for emotional stability clearly shows a large difference between the controls and cases. Very high or high emotional stability was observed in 29.5% of the control group, compared to 10% for the cases. Similarly, 43.5% of the controls scored low or very low, while for the cases, this number was 71.7% (Figure 1).

Besides emotional stability, the following sociodemographic and clinical features were found to be significantly different between the normotensive and hypertensive groups: gender, age, smoking, obesity, parental history of hypertension, and education. We have included these known confounders together with emotional stability into a binary logistic regression model as independent variables. The Hosmer–Lemeshow statistic did not indicate a poor fit ($P = .098$). Table 2 provides the predictive values for all the variables listed above.

Our results from the binary logistic regression model found that for each point increase on the emotional stability score, the chance of
being a hypertensive decreased by 7%, independently of other con-
founders (Table 2). For risk calculation (odds ratio (OR)), we have also
dichotomized the manifestation levels of emotional stability, in such
a way that very low or low levels were coded with 1, with risk, while
the medium, high, and very high levels were coded with 0, without
risk. The Hosmer–Lemeshow statistic of the updated model did not
indicate a poor fit ($P = .201$). Thus, we obtained the following OR for
low emotional stability OR: 3.55 (95% CI: 2.18-9.35), with statistical
significance ($P < .001$). Or in other words, low or very low emotional
stability should be considered as an RF for primary hypertension,
increasing the odds of being hypertensive 3.55 times.

Our regression model has also confirmed the predictive value of the
confounders known from the literature (Table 2). Each increase in
age by one point increased the odds of being hypertensive by 13.5%.
Women were found to be 55.6% less likely to develop hypertension
than men.

In our questionnaire, we had differentiated between 3 categories
of smokers: non-smoker, former smoker, and smoker. In our study

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**Table 1. Sociodemographic and Clinical Characteristics of Participants**

| Variable                              | Normotensive Group (Controls) | Hypertensive Group (Cases) | Chi-Square | P   |
|---------------------------------------|-------------------------------|---------------------------|------------|-----|
|                                       | $n = 156$                     | $n = 120$                 |            |     |
|                                       | n (%)                         | n (%)                     |            |     |
| Sex                                   |                               |                           |            |     |
| Male                                  | 56 (35.89%)                   | 68 (56.66%)               | 11.825     | <.001 |
| Female                                | 100 (64.1%)                   | 52 (43.33%)               |            |     |
| Smoking status                        |                               |                           |            |     |
| Non-smoker                            | 96 (61.53%)                   | 52 (43.33%)               | 41.216     | <.001 |
| Former smoker                         | 20 (12.82%)                   | 56 (46.66%)               |            |     |
| Active smoker                         | 40 (25.16%)                   | 12 (10%)                  |            |     |
| Education                             |                               |                           | 6.349*     | .042 |
| Grade 10                              | 20 (12.82%)                   | 28 (23.33%)               |            |     |
| High school                           | 70 (44.87%)                   | 54 (45%)                  |            |     |
| University                            | 66 (42.3%)                    | 38 (31.66%)               |            |     |
| Family history of hypertension        |                               |                           | 14.734     | <.001 |
| No family history                     | 80 (51.28%)                   | 34 (28.33%)               |            |     |
| Positive family history               | 76 (48.72%)                   | 86 (71.66%)               |            |     |
| Obesity                               |                               |                           | 38.47      | <.001 |
| Not obese                             | 2 (1.28%)                     | 4 (3.33%)                 |            |     |
| Grade 1                               | 128 (82.05%)                  | 60 (50%)                  |            |     |
| Grade 2                               | 14 (8.97%)                    | 46 (38.33%)               |            |     |
| Grade 3                               | 12 (7.69%)                    | 10 (8.33%)                |            |     |
| Physical activity                     |                               |                           | 0.349      | .555 |
| <30 min/day                           | 96 (61.53%)                   | 78 (65%)                  |            |     |
| >30 min/day                           | 60 (38.46%)                   | 42 (35%)                  |            |     |
| Independent-sample t tests            | Mean (SD)                     | Mean (SD)                 |            |     |
| Age (years)                           | 50 (8)                        | 55 (7)                    |            | .024 |
| Personality dimensions (T quotients)  |                               |                           |            |     |
| Openness                              | 49.92 (10.63)                 | 47.62 (9.39)              |            | .338 |
| Extroversion                          | 51.22 (10.66)                 | 49.09 (11.08)             |            | .428 |
| Agreeableness                         | 48.35 (7.79)                  | 46.93 (9.04)              |            | .366 |
| Consciousness                         | 47.39 (10.19)                 | 48.96 (12.36)             |            | .077 |
| Emotional stability                   | 49.35 (9.54)                  | 43.57 (7.22)              |            | .001 |

Level of significance defined as $P < .05$.
population, only former smoking proved to be a statistically significant predictor, making it 2.34 times more likely to be a hypertensive compared to non-smokers. This result might be attributed to the fact that while only 12.82% of the control group identified as former smoker, this number was 46.66% in the hypertensive group, while the percentage of active smokers was double for controls (25.16%) compared to cases (10%). Showing that while many hypertensives have given up on active smoking, still a much larger percentage of hypertensives (56.66%) have smoked at some point in time compared to the controls (37.98%).

Having a parental history of hypertension made it 3.43 times more likely to be hypertensive, 22.95% more cases having reported a family history of hypertension compared to controls. Being obese made it 2.21 times more likely to be a hypertensive, with 16.66% of controls being diagnosed with Grade II or III obesity, compared to 46.66% of cases. Education was not found to be a statistically significant predictor, the only noticeable difference in the education level distribution being that there were 10.64% more university graduates among the control group.

One of the secondary aims of the study was to determine whether the personality dimensions can be used to predict the severity of the hypertension. Out of the total hypertensive patients, there were 6 people with grade I hypertension, 28 with grade II hypertension, and 86 with grade III hypertension. Although our Pearson's chi-square test showed that personality dimensions and the severity of hypertension are related, our logistic regression model, having as independent variables the personality dimensions and as dependent variable the severity of hypertension, did not find the personality dimensions to be statistically significant predictors for the severity of hypertension.

Discussion

The present case-control study examined whether there are differences in personality between hypertensives and normotensives in terms of the FFM and if personality dimensions could be considered as RFs for primary hypertension. From the 5 personality dimensions, our results showed significant correlation between emotional stability and hypertension, even after controlling for essential confounders including gender, age, education, smoking, parental history of hypertension, and obesity. Most importantly, we found that having low emotional stability or high neuroticism increases the odds of being hypertensive 3.55 times, or in other words, a one point increase in emotional stability score decreases the odds of hypertension by 7%.

Direct comparison of our findings with other studies examining the relationship between personality and hypertension is not feasible due to the use of different personality assessment tools (e.g., using the categorical rather than the dimensional approach), participant characteristics (elderly study population, gender selectivity), but mainly because studies focusing on the association between personality traits and hypertension are lacking. Nevertheless, our results are in accordance with the current literature supporting that, individuals high in neuroticism, characterized by negative emotions and overreaction to stress, have a higher risk of developing hypertension.22,33-35 This is also supported by studies exploring the association between personality traits and metabolic syndrome, of which hypertension is one of the components, where neuroticism was associated not only with metabolic syndrome but also with significantly higher prevalence of hypertension.36,37 Similarly, high levels of neuroticism were significantly associated with CVD mortality however, these studies do not report on the relationship between neuroticism and hypertension, despite hypertension being the most relevant RF for CVD. Neuroticism level also seems to be a predictor for a range of somatic diseases, such as arthritis, diabetes, kidney/liver disease, stomach problems, and ulcers.34,35,42

How exactly personality traits such as neuroticism influence the development of physical disorders is not clearly understood yet. Nevertheless, it is well known that neuroticism can promote risky behaviors in order to release stress (e.g., smoking) as well as upregulate the response of the hypothalamic–pituitary–adrenal axis to stress.43-48 Both of these components (behavioral and biological) could contribute to the development of hypertension and consequently to the development of CVD. Furthermore, it was found...
that risky health behaviors are responsible for about 25% of the association between neuroticism and mortality.49

Although we have found no associations between hypertension and conscientiousness, growing evidence supports the relation of low conscientiousness with hypertension and other health outcomes such as diabetes, stroke, and early mortality.23,50,51 Studies suggest that high neuroticism with low conscientiousness are strong predictors of poor health outcomes.42,52

Our second aim was to examine whether personality has an effect on the severity of hypertension; however, we could not confirm this. Literature data indicating an association between personality and the severity of primary hypertension are inconsistent and scarce. There are as many studies indicating that personality dimensions have an effect on high blood pressure values53,54 as there are studies showing no significant relationship between personality and blood pressure levels.55,56 The latter are supported by our results according to which, personality had no influence on the severity of primary hypertension. This result suggests that although neuroticism/low emotional stability contributes to the appearance of hypertension, several factors work in conjunction to influence the severity of the disease, like smoking status, obesity, physical activity, genetic factors, which frequently aggregate in hypertensive individuals.57

Finally, there are some limitations to this study that should be taken into account. First, the relative small number of participants, which could explain why we have not found association between some personality dimensions like conscientiousness and hypertension, although growing evidence supports the associations of this personality dimension with health.23,50,51 Nonetheless, our findings provide ground for more extensive, multicenter, longitudinal studies further examining this relationship. Second, consecutive sampling technique was chosen for the recruitment of participants as it is considered the best of the nonprobability sampling methods at controlling sampling bias, and it is an efficient and cost-effective way to recruit study patients. However, we acknowledge that this technique is more vulnerable for selection bias compared to purposive sampling methods. Third, as the cases and controls are a heterogeneous group proven even by gender and age, this might increase the confounding bias. Fourth, although the study took into consideration a number of traditional confounders in its regression model (gender, age, education, smoking, parental history of hypertension, and obesity), there are a number of other confounders through which the association between emotional stability and hypertension could be mediated that have been not considered, for example, through alcohol, diet, and other psychosocial RFs, including stress, marital status, etc., the inclusion of which should be considered in future longitudinal studies. Fifth, as many other studies examining the potential relationship between personality and hypertension, we have not excluded participants with other cardiovascular disorders. Finally, although we cannot fully rule out the possibility of reverse causation, it seems unlikely as personality traits are relatively stable in the age group of our study population.58

Nevertheless, our study provides valuable information on the relationship between personality traits and hypertension, highlighting the strong association between low emotional stability/high neuroticism and essential hypertension as well as its strong predictive value for the presence of hypertension, independently of other disease confounders, such as age, gender, BMI, smoking, and family history.

Furthermore, the results of this study add to the small body of evidence indicating that personality traits significantly contribute not only to the development of CVD but also to its most relevant RF, hypertension. There is an unfulfilled need to understand the underlying biological and behavioral pathways by which low emotional stability and other personality traits can influence disease development. Moreover, longitudinal, prospective studies investigating the potential beneficial effect of early, tailored psychological intervention in disease prevention are necessary. Such studies could provide highly valuable information especially for prehypertensive patients, with high normal blood pressure (130-139/85-89 mmHg), where lifestyle changes may have the potential to reduce the risk of progressing to established hypertension and further reduce their CV risk. Personality assessment could help with the identification of potential barriers to lifestyle changes and adherence to medication. Furthermore, personality assessment outcomes for patients with CV RFs should be considered to be used as risk modifiers in CV risk prediction, especially for patients where risk levels are near decisional thresholds.

The authors strongly believe that in order to provide high-quality healthcare, the focus should be centered on the patient. Personality assessment should be considered as part of routine care for the prevention and early diagnosis, as well as for the effective treatment of hypertension and other somatic diseases, and in order to direct/perso...
1. Townsend N, Wilson L, Bhatnagar P, Wickramasinghe K, Rayner M, Nichols M. Cardiovascular disease in Europe: epidemiological update 2016. Eur Heart J. 2016;37(42):3232-3245. [CrossRef]

2. Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: the Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J. 2016;37(29):2315-2381. [CrossRef]

3. Kaplan NM. Systemic hypertension: mechanisms and diagnosis. In: Bonow ROMD, Zipes DP, Libby P, eds. Braunwald’s Heart Disease. A Textbook of Cardiovascular Medicine. 9th ed. Philadelphia: Elsevier Saunders; 2012:935-954.

4. Dorobantu M, Tautu OF, Dimulescu D, et al. Perspectives on hypertension’s prevalence, treatment and control in a high cardiovascular risk east European country: data from the SEPHAR III survey. J Hypertens. 2018;36(3):690-700. [CrossRef]

5. Echouffo-Tcheugui JB, Batty GD, Kivimäki M, Kengne AP. Risk models to predict hypertension: a systematic review. PLoS One. 2013;8(7):e67370. [CrossRef]

6. Sun D, Liu J, Xiao L, et al. Recent development of risk-prediction models for incident hypertension: an updated systematic review. PLoS One. 2017;12(10):e0187240. [CrossRef]

7. Davies M. Blood pressure and personality. J Psychosom Res. 1970;14(1):89-104. [CrossRef]

8. Cuffee Y, Ogedegbe C, Williams NJ, Ogedegbe G, Schoenthaler A. Psychosocial risk factors for hypertension: an update of the literature. Curr Hypertens Rep. 2014;16(10):483. [CrossRef]

9. McCubbin JA, Loveless JP, Graham JG, et al. Emotional dampening in persons with elevated blood pressure: affect dysregulation and risk for hypertension. Ann Behav Med. 2014;47(1):111-119. [CrossRef]

10. Cuevas AG, Williams DR, Albert MA. Psychosocial factors and hypertension: a review of the literature. Cardiol Clin. 2017;35(2):223-230. [CrossRef]

11. McCubbin JA, Nathan A, Hibdon MA, Castillo AV, Graham JG, Switzer FS. 3rd. Blood pressure, emotional dampening, and risk behavior: implications for hypertension development. Psychosom Med. 2018;80(6):544-550. [CrossRef]

12. Turner AJ, Smyth N, Hall SJ, et al. Psychological stress reactivity and future health and disease outcomes: a systematic review of prospective evidence. Psychoneuroendocrinology. 2020;114:104599. [CrossRef]

13. Visseren FLJ, Mach F, Smulders YM, et al. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice: developed by the Task Force for cardiovascular disease prevention in clinical practice with representatives of the European Society of Cardiology and 12 medical societies with the special contribution of the European Association of Preventive Cardiology (EAPC). Eur Heart J. 2021;42(34):3227-3337. [CrossRef]

14. Costa PT, McCrae RR. The NEO Personality Inventory manual; Odessa, FL: Psychological Assessment Resources; 1985.

15. McCrae RR, John OP. An introduction to the five-factor model and its applications. J Pers. 1992;60(2):175-215. [CrossRef]

16. Matthews G, Deary IJ, Whiteman MC. Personality Traits. Cambridge: Cambridge University Press; 2003.

17. Kupper N, Denollet J. Type D personality as a risk factor in coronary heart disease: a review of current evidence. Curr Cardiol Rep. 2018;20(11):104. [CrossRef]

18. De Fruyt F, Denollet J. Type D personality: a five-factor model perspective. Psychol Health. 2002;17(5):671-683. [CrossRef]

19. McCrae RR, Terracciano A. Personality Profiles of Cultures Project. Universals features of personality traits from the observer’s perspective: data from 50 cultures. J Pers Soc Psychol. 2005;88(3):547-561. [CrossRef]

20. Kupper N, Denollet J. Type D personality as a prognostic factor in heart disease: assessment and mediating mechanisms. J Pers Assess. 2007;89(3):265-276. [CrossRef]

21. World Health Organization (WHO). Prevention of Cardiovascular Disease. Geneva: World Health Organization; 2007.

22. Turiano NA, Pitzer L, Armour C, Karlamangla A, Ryff CD, Mroczek DK. Personality trait level and change as predictors of health outcomes: findings from a national study of Americans (MIDUS). J Gerontol B Psychol Sci Soc Sci. 2012;67(1):4-12. [CrossRef]

23. Terracciano A, Strait J, Scuteri A, et al. Personality traits and circadian blood pressure patterns: a 7-year prospective study. Psychosom Med. 2014;76(3):237-243. [CrossRef]

24. Eory A, Gonda X, Lang Z, et al. Personality and cardiovascular risk: association between hypertension and affective temperaments—a cross-sectional observational study in primary care settings. Eur J Gen Pract. 2014;20(4):247-252. [CrossRef]

25. Oliva F, Versino E, Gammino L, et al. Type D personality and essential hypertension in primary care: a cross-sectional observational study within a cohort of patients visiting general practitioners. J Nerv Ment Dis. 2016;204(1):43-48. [CrossRef]

26. Mommersteeg PM, Herr R, Bosch J, Fischer JE, Loerbroks A. Type D personality and metabolic syndrome in a 7-year prospective occupational cohort. J Psychosom Res. 2011;71(5):357-363. [CrossRef]

27. Ringoir L, Pedersen SS, Widdershoven JWMP, Pop VJM. Prevalence of psychological distress in elderly hypertension patients in primary care. Neth Heart J. 2014;22(2):71-76. [CrossRef]

28. Wiltink J, Beutel ME, Till Y, et al. Prevalence of distress, comorbid conditions and well being in the general population. J Affect Disord. 2011;130(3):429-437. [CrossRef]

29. Costa PT, Mac Crae RR. NEO Personality Inventory-Revised (NEO PI-R). Odessa, FL: Psychological Assessment Resources; 1992.

30. Sava F. DECAS Personality Inventory. Timișoara: Editura Art Press; 2008.

31. Sava F. Maladaptive schemas, irrational beliefs, and their relationship with the Five-Factor Personality model. J Cogn Behav Psychother. 2009;9(2):135-147.

32. Sava FA, Popa R. Personality types based on the Big Five model: a cluster analysis over the Romanian population. Cogn Brain Behav Interdiscip J. 2011;15(3):359-384.
33. Spiro A, Aldwin CM, Ward KD, Mroczek DK. Personality and the incidence of hypertension among older men: longitudinal findings from the Normative Aging Study. Health Psychol. 1995;14(6):563-569. [CrossRef]
34. Youssi S, Matthews G, Amelang M, Schmidt-Rathjens C. Personality and disease: correlations of multiple trait scores with various illnesses. J Health Psychol. 2004;9(5):627-647. [CrossRef]
35. Goodwin RD, Cox BJ, Clara I. Neuroticism and physical disorders among adults in the community: results from the National Comorbidity Survey. J Behav Med. 2006;29(3):229-238. [CrossRef]
36. Sutin AR, Costa PT, Uda M, Ferrucci L, Schlessinger D, Terracciano A. Personality and metabolic syndrome: the Vietnam Experience Study. J Psychosom Res. 2010;32(4):513-519. [CrossRef]
37. Mommersteeg PMC, Pouwer F. Personality as a risk factor for the metabolic syndrome: a systematic review. J Psychosom Res. 2012;73(5):326-333. [CrossRef]
38. Phillips AC, Batty GD, Weiss A, et al. Neuroticism, cognitive ability, and the metabolic syndrome: the Vietnam Experience Study. J Psychosom Res. 2010;69(2):193-201. [CrossRef]
39. Shipley BA, Weiss A, Der G, Taylor MD, Deary IJ. Neuroticism, extraversion, and mortality in the UK Health and Lifestyle Survey: a 21-year prospective cohort study. Psychosom Med. 2007;69(9):923-931. [CrossRef]
40. Wilson RS, Krueger KR, Gu L, Bienias JL, de Leon CFM, Evans DAJP. Neuroticism, extraversion, and mortality in a defined population of older persons. Psychosom Med. 2005;67(6):841-845. [CrossRef]
41. Friedman HS, Booth-Kewley SJ. The disease-prone personality: a meta-analytic view of the construct. Am Psychol. 1987;42(6):539. [CrossRef]
42. Goodwin RD, Friedman HS. Health status and the five-factor personality traits in a nationally representative sample. J Health Psychol. 2006;11(5):643-654. [CrossRef]
43. Contrada RJ, Cather C, O’Leary A. Personality and health: dispositions and processes in disease susceptibility and adaptation to illness. In: Handbook of Personality: Theory and Research. 2nd ed. New York: Guilford Press; 1999:576-604.
44. Cooper ML, Agocha VB, Sheldon MS. A motivational perspective on risky behaviors: the role of personality and affect regulatory processes. J Pers. 2000;68(6):1059-1088. [CrossRef]
45. Futterman AD, Kemenye ME, Shapiro D, Fahey JL. Immunological and physiological changes associated with induced positive and negative mood. Psychosom Med. 1994;56(6):499-511. [CrossRef]
46. Phillips AC, Carroll D, Burns VE, Drayson M. Neuroticism, cortisol reactivity, and antibody response to vaccination. Psychophysiology. 2005;42(2):232-238. [CrossRef]
47. Lahey BB. Public health significance of neuroticism. Am Psychol. 2009;64(4):241-256. [CrossRef]
48. Garcia-Banda G, Chelliew K, Fornes J, Perez G, Servera M, Evans P. Neuroticism and cortisol: pinning down an expected effect. Int J Psychosom. 2014;91(2):132-138. [CrossRef]
49. Mroczek DK, Spiro A, Turiano N. Do health behaviors explain the effect of neuroticism on mortality? Longitudinal findings from the VA normative aging study. J Res Pers. 2009;43(4):653-659. [CrossRef]
50. Bogg T, Roberts BWJ. Conscientiousness and health-related behaviors: a meta-analysis of the leading behavioral contributors to mortality. Psychol Bull. 2004;130(6):887-919. [CrossRef]
51. Weston SJ, Hill PL, Jackson JJ. Personality traits predict the onset of disease. Soc Psychol Pers Sci. 2015;6(3):309-317. [CrossRef]
52. Friedman HS, Kern ML. Personality, well-being, and health. Annu Rev Psychol. 2014;65:719-742. [CrossRef]
53. Hozawa A, Ohkubo T, Tsuji I, et al. Relationship between personality and self-measured blood pressure value at home: the ohasama study. Clin Exp Hypertens. 2002;24(1-2):115-123. [CrossRef]
54. Rutledge T, Linden W. Defensiveness and 3-year blood pressure levels among young adults: the mediating effect of stress-reactivity. Ann Behav Med. 2003;25(1):34-40. [CrossRef]
55. Waal-Manning HJ, Knight RG, Spears GF, Paulin JM. The relationship between blood pressure and personality in a large unsel ected adult sample. J Psychosom Res. 1986;30(3):361-368. [CrossRef]
56. Köhler T, Scherbaum N, Richter R, Böttcher S. The relationship between neuroticism and blood pressure reexamined: an investigation of a non-clinical sample of military conscripts. Psychother Psychosom. 1993;60(2):100-105. [CrossRef]
57. Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). J Hypertens. 2013;31(7):1281-1357. [CrossRef]
58. Roberts BW, DeVecchio WF. The rank-order consistency of personality traits from childhood to old age: a quantitative review of longitudinal studies. Psychol Bull. 2000;126(1):3-25. [CrossRef]