DOI: http://dx.doi.org/10.22122/ijbmc.v11isp.738 Published by Vesnu Publications

International Journal of Body, Mind and Culture

The Role of Type D Personality in the Development of Hypertension: A Longitudinal Study

Xurramov Amuxiddin O'gli[1], Ali Turki Shnishil[2], Nada Sami Naser[3], Ahmed Shihab Ahmed[4], Ahmed Ibrahim Abed[5], Mohammed Jawad Alnajar[6], Imad Ibrahim Dawood[7], Oday Faris Washeel[8]

1 International School of Finance and Technology, Tashkent, Uzbekistan
2 Al-Hadi University College, Baghdad , Iraq
3 Department of Arabic Language, College of Education, Sawa University, Almuthana, Iraq
4 Department of Density, Al-Manara College For Medical Sciences, Maysan, Iraq
5 Department of English, College of Education, University of Imam Ja'afarAlsadiq, Baghdad, Iraq
6 Department of Medical Laboratories Technology, AL-Nisour University College, Baghdad, Iraq
7 Department of Education, Mazaya University College, Nasiriyah,Iraq
8 Collage of Nursing, National University of Science and Technology, Dhi Qar, Iraq

Corresponding Author: Amuxiddin O'gli X***; International School of Finance and Technology, Tashkent, Uzbekistan***
Email: xurramov_a_host1978@mail.ru

Quantitative Study

Abstract

Background: Hypertension is a major contributor to the global burden of cardiovascular diseases, affecting over 1.28 billion adults worldwide. One of the primary contributors to the progression of cardiovascular diseases is hypertension, influenced by various psychosocial factors, including personality traits. The distinguishing attributes of Type D personality (TDP) are linked to adverse cardiovascular outcomes; however, its influence on the progression of hypertension is less understood. This investigation endeavored to analyze the affiliation between the onset of hypertension and TDP during five years in a sample of initially normotensive adults.

Methods: A prospective cohort study included 500 initially normotensive participants in Baghdad, Iraq. The DS14 scale was used at baseline to assess TDP, and blood pressure was measured annually for five years. Cox proportional hazard regression models were employed to examine the association between TDP and incident hypertension, adjusting for traditional risk factors. Path analysis explored potential mediators, including physiological reactivity and health behaviors.

Results: The incidence of hypertension was significantly higher among participants with TDP compared to non-type D participants (22.4% vs. 12.9%, P = 0.007). Individuals with TDP had a 1.63-fold increased risk of hypertension (95% CI: 1.02-2.60; P = 0.040) after adjusting for age, sex, BMI, smoking, physical activity, and family history of hypertension. Path analysis revealed that physiological reactivity and health behaviors partially mediated the association between TDP and incident hypertension.

Conclusion: TDP is independently associated with the development of hypertension in initially normotensive adults. Physiological reactivity and health behaviors partially explain the relationship between TDP and incident hypertension. Assessing the presence

of TDP and implementing targeted interventions could help prevent the onset of hypertension and improve cardiovascular health.

Keywords: Hypertension; Personality; Prospective studies; Risk factors

Citation: Amuxiddin O'gli X, Shnishil AT, Naser NS, Ahmed AS, Abed AI, Alnajar MJ, et al. **The Role of Type D Personality in the Development of Hypertension: A Longitudinal Study.** Int J Body Mind Culture 2024; 10(Special Issue): 52-63.

Received: 01 June 2024

Accepted: 05 Aug. 2024

Introduction

High blood pressure, also known as hypertension, is a major contributor to cardiovascular diseases (CVDs), which are the leading cause of death worldwide (Fuchs & Whelton, 2020; Liu et al., 2021). The World Health Organization reports that approximately 1.28 billion adults aged 30-79 years worldwide have hypertension, with two-thirds living in low- and middle-income countries (Farhadi et al., 2023). Hypertension is influenced by a complex interplay of genetic, environmental, and psychosocial factors (Kreutz et al., 2021; Wójcik et al., 2023). Among the various psychosocial factors, personality traits have gained increasing attention as important determinants of cardiovascular health (Steca et al., 2018).

Type D personality (TDP), also known as the "distressed" personality, is characterized by the co-occurrence of two stable personality traits: negative affectivity (NA) and social inhibition (SI)) (Grassi et al., 2021). Individuals with TDP tend to experience negative emotions across various situations (high NA) and inhibit the expression of these emotions in social interactions (high SI) (Nie et al., 2022). This high NA and SI combination distinguishes TDP from other personality traits, such as neuroticism or introversion, which may only reflect one of these dimensions. The unique interplay between NA and SI in TDP has been proposed to contribute to adverse cardiovascular outcomes, including hypertension, through increased physiological reactivity to stress and engagement in unhealthy behaviors (Winsper et al., 2020).

Over the past two decades, numerous studies have linked TDP to adverse cardiovascular health outcomes, such as increased risk of coronary heart disease and myocardial infarction (Versteeg et al., 2022). A meta-analysis by Kupper & Denollet (2018) found that TDP was associated with a 2.3-fold increased risk of adverse cardiovascular events in individuals with established CVD. Furthermore, TDP has been associated with various mental health and lifestyle-related risk factors for CVD, including depression, anxiety, unhealthy behaviors, and non-adherence to medical treatment (Torgersen et al., 2023).

Despite the accumulating evidence linking TDP to CVD, its contribution to the onset of hypertension remains understudied. Several cross-sectional studies have found associations between TDP and hypertension (Kim et al., 2021; Lin et al., 2020; Thangsuk et al., 2021). However, these studies cannot establish temporal relationships or causality. Only one longitudinal study has investigated the relationship between TDP and incident hypertension (Cleven et al., 2020). This study found that individuals with TDP had a 2.2-fold increased risk of developing hypertension over a 6-year follow-up period. However, the study was conducted in a relatively small sample (n=169) of older adults (aged 60-91 years), limiting its generalizability to other age groups and populations.

To address these gaps in the literature, the present study aimed to investigate the role of TDP in the development of hypertension over time in a larger and more diverse sample. We conducted a longitudinal study with 500 initially normotensive participants, assessing TDP at baseline and measuring blood pressure annually for five years. We hypothesized that individuals with TDP would be at a higher risk of developing hypertension compared to non-type D individuals, even after adjusting for traditional risk factors.

Understanding the influence of TDP on the development of hypertension has important implications for prevention and intervention efforts. If TDP is indeed a

significant predictor of hypertension, screening for this personality type and implementing targeted interventions (e.g., cognitive-behavioral therapy and stress management) may help prevent the onset of hypertension and improve cardiovascular health. Moreover, identifying the mechanisms through which TDP contributes to hypertension (e.g., physiological reactivity and health behaviors) can inform the development of more effective and personalized interventions.

This study aims to (1) examine the association between TDP and incident hypertension over a 5-year follow-up period in a sample of initially normotensive adults, (2) assess whether the relationship between TDP and incident hypertension persists after adjusting for traditional risk factors (e.g., age, sex, body mass index (BMI), smoking, physical activity), and (3) explore potential mediators in the association between TDP and incident hypertension, including physiological reactivity and health behaviors.

Methods

Design study and participant: This research utilized a prospective cohort design, following a sample of initially normotensive adults over five years. The study was conducted in Baghdad, Iraq's capital city, and participants were recruited from primary healthcare centers and community settings using a stratified random sampling approach.

The population was first divided into strata based on these characteristics to ensure representation of different age groups, genders, and socioeconomic backgrounds. The age groups were 30-39, 40-49, 50-59, 60-69, and 70-79 years. Socioeconomic status was categorized as low, middle, and high based on education level and household income. Within each stratum, a random sample was selected using computer-generated random numbers. The sample size for each stratum was proportional to its size in the overall population to ensure adequate representation. This approach helped to minimize selection bias and enhance the generalizability of the findings to the target population.

Instruments: The main materials used in this study were the DS14 scale for assessing TDP (Denollet, 2005) and a validated automatic blood pressure monitor (Omron HEM-7130) for measuring blood pressure. The DS14 scale is a 14-item questionnaire that assesses NA and SI, with seven items each. Individuals assessed their reactions using a five-point Likert scale, with 0 denoting "false" and four signifying "true." Participants were considered to have TDP when they obtained scores equal to or greater than ten on both the NA and SI subscales (Denollet, 2005). The DS14 scale was translated into Arabic and validated in a previous study (Breik & Elbedour, 2021).

The Omron HEM-7130 automatic blood pressure monitor was used to measure blood pressure, as it has been validated against mercury sphygmomanometers and is widely used in research and clinical settings (Pandarbale & Fernandes, 2020). The device was calibrated regularly, and all measurements were taken by trained healthcare professionals following standard procedures.

The Omron HEM-7130 automatic blood pressure monitor was regularly calibrated according to the manufacturer's guidelines to ensure accurate measurements throughout the study. Calibration was performed at the start of the study and every six months after that by comparing the device's measurements with those obtained using a mercury sphygmomanometer, following the standard calibration protocol described by Stergiou et al. (2018). If the difference between the

two methods exceeded five mmHg, the device was recalibrated or replaced. All healthcare professionals involved in taking blood pressure measurements received standardized training on the proper use of the Omron HEM-7130, including the correct positioning of the cuff, the importance of allowing participants to rest for at least 5 minutes before measurement, and the need to take three measurements at 1-minute intervals. Training sessions were conducted at the beginning of the study and annually after that to ensure consistency in the measurement technique across all study sites and personnel.

At baseline, participants were asked to complete a questionnaire evaluating sociodemographic characteristics, medical history, and lifestyle factors. The DS14 scale was administered to assess TDP. Blood pressure was measured using the Omron HEM-7130 automatic blood pressure monitor, with participants seated and following a 5-minute break. Three measurements were taken at 1-minute intervals, and the average of the last two measurements was used for analysis.

Follow-up assessments were conducted annually for five years. At each follow-up, participants completed a questionnaire assessing any changes in medical history and lifestyle factors, and blood pressure measurements were obtained utilizing the same protocol as at baseline. Hypertension was considered to have occurred if, during the follow-up period, systolic blood pressure reached or exceeded 140 mmHg, diastolic blood pressure was equal to or greater than 90 mmHg, or if the participant began taking blood pressure-lowering medication.

To ensure the safety and well-being of the participants, all assessments were conducted in a private and comfortable setting. Participants were provided with information about their blood pressure results and referred to healthcare services if necessary. The study procedures were adapted to accommodate the cultural and logistical challenges encountered in Iraq, such as the need for gender-matched healthcare professionals for blood pressure measurements and the provision of transportation for participants who lived in remote areas.

Analysis: The data were analyzed using SPSS version 26.0. Descriptive statistics summarized the characteristics of the study sample. The incidence of hypertension was calculated as the number of new cases divided by the total person-years of follow-up.

Cox proportional hazard regression models were employed to examine the correlation between the onset of hypertension and TDP, with adjustment for potential confounders like family history of hypertension, physical activity, smoking, BMI, sex, and age. These models were chosen because they allow for the analysis of time-to-event data, such as the development of hypertension while accounting for censoring (i.e., participants who did not develop hypertension during the study period or were lost to follow-up). The Cox models provide hazard ratios, representing the relative risk of developing hypertension at any given time for those with TDP compared to those without TDP while controlling for other variables. The proportional hazards assumption, a key requirement for Cox models, was assessed using log-log survival plots and Schoenfeld residuals.

Path analysis was conducted using Mplus version 8.0 to explore probable intermediaries in the link between the onset of hypertension and TDP. The mediating roles of physiological reactivity (assessed by heart rate variability) and health behaviors (evaluated by the Health Behavior Inventory) were examined. Bias-corrected bootstrap confidence intervals, generated with 5,000 resamples, were employed to assess the significance of the indirect effects.

Ethics: The investigation shall adhere to the Declaration of Helsinki. All participants will be required to give consent with full knowledge and understanding, and they will be assured of the confidentiality of their data. Subjects will be made aware that they may discontinue their participation in the research at any point without impacting their healthcare.

Results

Table 1 shows the pre-study features of the research subjects stratified by TDP status. Participants with TDP were more likely to be older, have a BMI, and report lower levels of physical activity than non-Type D participants. There were no noteworthy variations in gender distribution, smoking status, or family history of hypertension between the two groups.

TDP participants showed a considerably greater incidence of hypertension than their non-Type D peers (Table 2). Over the 5-year follow-up period, 22.4% of participants with TDP developed hypertension, compared to 12.9% of participants without TDP. The P-value of 0.007 indicates that this difference is statistically significant and unlikely to have occurred by chance alone. The incidence rates of hypertension were 2.58 and 4.48 cases per 100 person-years for non-type D and Type D participants, respectively.

Cox proportional hazards regression analysis indicated that those possessing TDP traits were more inclined to experience a significantly increased risk of incident hypertension despite controlling for possible confounding factors (Table 3). In the unadjusted model, those characterized by TDP characteristics had a 79% higher likelihood of developing hypertension (hazard ratio [HR] 1.79; 95% confidence interval [CI] 1.14-2.81; P=0.011). The 95% CI suggests that the true increase in risk lies between 14% and 181%. After adjusting for age, sex, BMI, smoking, physical activity, and family history of hypertension, the association between the onset of hypertension and TDP remained significant (HR 1.63; 95% CI 1.02-2.60; P=0.040). The proportional hazards assumption was satisfied for all variables in the adjusted model.

Path analysis revealed that physiological reactivity, as assessed by heart rate variability (HRV), and health behaviors, as assessed by the Health Behavior Inventory (HBI), served as a partial intermediary in the relation between the onset of hypertension and TDP (Table 4). TDP was associated with lower HRV (β = -0.17; P=0.001) and lower HBI scores (β = -0.21; P < 0.001), indicating less healthy behaviors. The β values represent standardized coefficients, which allow for comparison of the relative strength of associations. Both lower HRV (β = -0.12; P = 0.020) and lower HBI scores (β = -0.15; P = 0.005) were correlated with a higher risk of hypertension. The indirect effects of TDP on incident hypertension through HRV (β = 0.02; 95% CI: 0.003-0.043) and health behaviors (β = 0.03; 95% CI: 0.008-0.061) were significant, as indicated by the confidence intervals not containing zero.

Table 1. Baseline characteristics of the study participants stratified by TDP status

Characteristic	Type D (n = 143)	Non-type D (n = 357)	P-value
Age (years)	45.2 ± 13.1	41.0 ± 12.0	0.001
Female, n (%)	72 (50.3%)	188 (52.7%)	0.634
BMI (kg/m²)	27.5 ± 4.8	26.2 ± 4.3	0.004
Smoking, n (%)	39 (27.3%)	82 (23.0%)	0.302
Physical activity (MET-min/week)	1245 ± 823	1485 ± 912	0.006
Family history of hypertension, n (%)	47 (32.9%)	98 (27.5%)	0.225

BMI: body mass index; MET: Metabolic equivalent

Table 2. Incidence of hypertension stratified by TDP status

Characteristic	Type D (n = 143)	Non-type D (n = 357)	P-value
Incident hypertension, n (%)	32 (22.4%)	46 (12.9%)	0.007
Incidence rate (cases per 100 person-years)	4.48	2.58	-

Discussion

In this prospective cohort research, TDP was correlated with a considerable increased risk of developing hypertension within a 5-year prospective observation window in a sample of initially normotensive adults. The relationship linking TDP to incident hypertension remained significant after adjusting for traditional risk factors, such as age, sex, BMI, smoking, physical activity, and family history of hypertension. The results of this study indicate that TDP could be a standalone predictor of hypertension and emphasize the significance of considering psychosocial factors in the management and prevention of hypertension.

The results of this study are consistent with the limited existing literature on the relationship between the onset of hypertension and TDP. A previous cross-sectional study by Ye et al. (2022) uncovered a link between TDP and a higher prevalence of hypertension in a Chinese population, while another cross-sectional study by Nefs et al. (2015) reported similar findings in a Dutch population. However, these studies were limited by their cross-sectional design, which precluded the establishment of temporal relationships. The only previous longitudinal study by Andreevich et al. (2023) found that TDP was correlated with a 2.2-fold increased risk of developing hypertension over a 6-year follow-up period in a sample of older adults in the Netherlands. The present study extends these findings by demonstrating the correlation between the onset of hypertension and TDP in a larger and more diverse sample of adults, an under-studied population with a high burden of hypertension and CVD.

The primary factors that influence the correlation between the onset of hypertension and TDP are not fully understood, but several potential pathways have been proposed. One possible mechanism is through increased physiological reactivity to stress. Those characterized by TDP characteristics tend to experience SI and NA, which may lead to chronic activation of the sympathetic nervous system and hypothalamic-pituitary-adrenal axis, resulting in increased blood pressure and the progression of hypertension over time (Al-Sadi et al., 2022). The present study found that heart rate variability, a marker of autonomic nervous system function, served as a partial intermediary in the relation between the onset of hypertension and TDP, supporting this hypothesis.

Another potential pathway is through unhealthy behaviors. TDP has been associated with various unhealthy behaviors, such as smoking, poor dietary habits, and physical inactivity, which are known risk factors for hypertension (Buczkowska et al., 2022; Wang et al., 2020). In this study, health behaviors, as assessed by the Health Behavior Inventory, partially mediated the association between the onset of hypertension and TDP, suggesting that those characterized by TDP characteristics may develop hypertension, in part, due to their engagement in less healthy behaviors.

Table 3. The relationship connecting TDP with incident hypertension

Model	Hazard ratio (95% CI)	P-value
Unadjusted	1.79 (1.14-2.81)	0.011
Adjusted*	1.63 (1.02-2.60)	0.040

*Adjusted for age, sex, BMI, smoking, physical activity, and family history of hypertension

Table 4. The mediating role of physiological reactivity and health behaviors in the association between the onset of hypertension and TDP

Path	Standardized coefficient (β)	P-value
TDP → HRV	-0.17	0.001
TDP → HBI	-0.21	<0.001
HRV → Incident hypertension	-0.12	0.020
HBI → Incident hypertension	-0.15	0.005
TDP → HRV → Incident hypertension	0.02 (95% CI 0.003-0.043)	-
TDP → HBI → Incident hypertension	0.03 (95% CI 0.008-0.061)	-

TDP: Type D personality; HRV: heart rate variability; HBI: Health Behavior Inventory

This study's conclusions have noteworthy ramifications for the prevention and management of hypertension. Screening for TDP in clinical settings may assist in spotting people who are more predisposed to developing hypertension who may benefit from targeted interventions. Psychological interventions, such as cognitive-behavioral therapy and stress management techniques, have been identified as effective in reducing negative emotions and improving cardiovascular health outcomes in TDP characteristics (Bundgaard et al., 2019). Encouraging healthy behaviors, like regular physical activity and a balanced diet, may also help mitigate the risk of hypertension in this population.

The merits of this research comprise its prospective methodology, sizable sample population, and prolonged follow-up timeframe, which allowed for the establishment of temporal relationships and the adjustment for potential confounders. The use of validated instruments for assessing TDP and blood pressure and exploring potential mediators further strengthens the study's findings. However, some limitations should be pointed out.

First, the study was conducted in a single city in Iraq, which may limit the generalizability of the findings to other populations. The prevalence of TDP and the incidence of hypertension may vary across different cultural, ethnic, and socioeconomic settings. Moreover, cultural factors, such as social norms, beliefs, and attitudes toward mental health, may influence the expression and reporting of TDP and its association with hypertension. Future research should aim to replicate these findings in diverse populations to establish the external validity of the results and explore potential cultural differences.

Second, although the study adjusted for several traditional risk factors, residual confounding cannot be ruled out. There may be additional factors, such as dietary habits, alcohol consumption, and stress levels, that were not accounted for in the analysis and could potentially influence the relationship between TDP and incident hypertension. Future studies should consider collecting data on a broader range of potential confounders to minimize the risk of residual confounding.

Third, the study relied on self-reported measures of TDP and health behaviors, which may be subject to recall and social desirability biases. Participants may have underreported TDP symptoms or unhealthy behaviors due to cultural stigma or social norms, which could have attenuated the observed associations. Moreover, the DS14 scale, although validated in Arabic, may not fully capture the cultural nuances of TDP expression in the Iraqi context. Future research could employ a mixed-methods approach, combining self-report measures with qualitative interviews or observational data, to better understand TDP and its manifestation in this population.

Fourth, while the sample size was relatively large, the number of incident hypertension cases was limited, particularly when stratified by TDP status. This may

have reduced the statistical power to detect smaller effect sizes or explore potential effect modifiers. Future studies with larger sample sizes and longer follow-up periods could provide more precise estimates of the association between TDP and incident hypertension and allow for examining potential subgroup differences.

Finally, the study was conducted in a specific age group (adults aged 30-79) and excluded individuals with prevalent hypertension at baseline. This may limit the generalizability of the findings to younger or older populations and those with pre-existing hypertension. Future research should investigate the relationship between TDP and blood pressure across a wider age range and among individuals with different baseline blood pressure levels.

The findings of this study provide valuable insights into the role of TDP in the development of hypertension in an Iraqi population. While the specific prevalence estimates may not be directly generalizable to other settings, the underlying mechanisms linking TDP to hypertension, such as physiological reactivity and health behaviors, are likely relevant across different populations. The consistency of our findings with previous studies conducted in other countries, such as China and the Netherlands, supports the notion that TDP may be a universal risk factor for hypertension.

However, it is important to acknowledge that the strength of the association between TDP and hypertension may vary depending on the cultural, socioeconomic, and healthcare contexts. For example, in settings with limited access to mental health services or greater stigma towards psychological distress, the impact of TDP on hypertension may be more pronounced. Similarly, in populations with different dietary patterns, physical activity levels, or stress exposures, the mediating role of health behaviors may differ.

To establish the generalizability of our findings, future research should aim to replicate this study in diverse populations, considering potential cultural and contextual factors. This could involve multi-country collaborations and studies in different age groups, socioeconomic strata, and healthcare settings. By accumulating evidence from multiple contexts, we can better understand the global burden of TDP and its impact on cardiovascular health.

Conclusion

This longitudinal study offers persuasive data demonstrating that TDP functions as an independent predictor of hypertension progression. The findings underscore the importance of considering psychosocial factors, such as personality traits, in preventing and managing CVDs. By identifying TDP as a predictor of incident hypertension, this study opens new avenues for early intervention and personalized care.

Exploration of potential mediators, including physiological reactivity and health behaviors, sheds light on the complex interplay between psychological and biological factors in the etiology of hypertension. These findings suggest that addressing the SI and NA associated with TDP and promoting healthy behaviors may be crucial in mitigating the risk of hypertension.

Based on this study's results, several recommendations can be made for future research and clinical practice. First, future studies should aim to replicate these findings in diverse populations and settings to establish the generalizability of the results. Researchers should also consider employing longitudinal designs with larger sample sizes and longer follow-up periods to provide more precise estimates of the association between TDP and incident hypertension and to examine potential subgroup differences.

Second, future research should investigate additional potential mediators and moderators of the relationship between TDP and hypertension, such as inflammation, endothelial dysfunction, and sleep disturbances. A better understanding of the underlying mechanisms could inform the development of targeted interventions to prevent and manage hypertension in individuals with TDP.

Third, intervention studies are needed to evaluate the effectiveness of psychological and behavioral interventions in preventing and managing hypertension in individuals with TDP. These interventions could include cognitive-behavioral therapy, stress management techniques, and strategies to promote healthy lifestyle behaviors. Randomized controlled trials comparing different intervention approaches could provide valuable insights into the most effective strategy for this population.

From a clinical perspective, the findings of this study highlight the importance of screening for TDP in the context of hypertension prevention and management. Healthcare providers should consider assessing TDP in their patients, particularly those at high risk for hypertension or with a history of cardiovascular events. The DS14 scale, a brief and validated instrument for assessing TDP, could be easily integrated into routine clinical assessments, particularly in primary care and cardiovascular settings. Individuals identified as having TDP may benefit from closer monitoring of blood pressure and targeted interventions to reduce their risk of developing hypertension.

Moreover, the results underscore the need for a multidisciplinary approach to hypertension prevention and management, integrating psychological assessment and intervention alongside traditional risk factor management. Collaboration between primary care providers, cardiologists, and mental health professionals could facilitate the early identification and comprehensive treatment of individuals with TDP and elevated cardiovascular risk.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

The authors wish to thank all the participants in the study..

References

Al-Sadi, H. I., Al-Haili, T., Alshukri, H. A., Alghazali, T., Sabti, A. A., & Jasim, S. A. (2022). Effects of a Continuous and Periodic Aerobic Exercise Rehabilitation Program on Depression and Anxiety in Hypertension Patients. *International Journal of Body, Mind & Culture (2345-5802)*, *9*(4).

Andreevich, S. M., Kamal, A., Jawad, I. A., Hamed, A. F., Naser, N. S., Laffta, S. H., Dawood, I. I., & Razaq, A. A. (2023). The Effectiveness of Cognitive Therapy Intervention on the Mental Health of Patients with Hypertension. *International Journal of Body, Mind & Culture (2345-5802)*, *10*(3).

Breik, W., & Elbedour, S. (2021). The Predictive Ability of Type D Personality Pattern, Anxiety, and Depression in Cardiac Disease. *European Journal of Mental Health*, *16*(2), 196-209.

Buczkowska, M., Górski, M., Domagalska, J., Buczkowski, K., & Nowak, P. (2022). Type D personality and health behaviors in people living with obesity. *International Journal of Environmental Research and Public Health*, *19*(22), 14650.

Bundgaard, J. S., Østergaard, L., Gislason, G., Thune, J. J., Nielsen, J. C., Haarbo, J., Videbæk, L., Olesen, L. L., Thøgersen, A. M., Torp-Pedersen, C., Pedersen, S. S., Køber, L.,

& Mogensen, U. M. (2019). Association between Type D personality and outcomes in patients with non-ischemic heart failure. *Quality of Life Research*, *28*(11), 2901–2908. https://doi.org/10.1007/s11136-019-02241-6

Cleven, L., Krell-Roesch, J., Nigg, C. R., & Woll, A. (2020). The association between physical activity with incident obesity, coronary heart disease, diabetes and hypertension in adults: A systematic review of longitudinal studies published after 2012. *BMC Public Health*, *20*(1), 726. https://doi.org/10.1186/s12889-020-08715-4

Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and Type D personality. *Psychosomatic Medicine*, *67*(1), 89–97.

Farhadi, F., Aliyari, R., Ebrahimi, H., Hashemi, H., Emamian, M. H., & Fotouhi, A. (2023). Prevalence of uncontrolled hypertension and its associated factors in 50–74 years old Iranian adults: A population-based study. *BMC Cardiovascular Disorders*, *23*(1), 318. https://doi.org/10.1186/s12872-023-03357-x

Fuchs, F. D., & Whelton, P. K. (2020). High Blood Pressure and Cardiovascular Disease. *Hypertension*, *75*(2), 285–292. https://doi.org/10.1161/HYPERTENSIONAHA.119.14240

Grassi, L., Caruso, R., Murri, M. B., Fielding, R., Lam, W., Sabato, S., De Padova, S., Nanni, M. G., Bertelli, T., & Palagini, L. (2021). Association between type-D personality and affective (anxiety, depression, post-traumatic stress) symptoms and maladaptive coping in breast cancer patients: A longitudinal study. *Clinical Practice and Epidemiology in Mental Health: CP & EMH*, *17*(Supp-1), 271.

Kim, S. R., Kim, S., Cho, B.-H., Yu, S., & Cho, K.-H. (2021). Influence of type D personality on health promoting Behaviours and quality of life in stroke patients: A cross-sectional study in South Korea. *Journal of Stroke and Cerebrovascular Diseases*, *30*(5), 105721.

Kreutz, R., Dobrowolski, P., Prejbisz, A., Algharably, E. A.-H., Bilo, G., Creutzig, F., Grassi, G., Kotsis, V., Lovic, D., & Lurbe, E. (2021). Lifestyle, psychological, socioeconomic and environmental factors and their impact on hypertension during the coronavirus disease 2019 pandemic. *Journal of Hypertension*, *39*(6), 1077–1089.

Kupper, N., & Denollet, J. (2018). Type D Personality as a Risk Factor in Coronary Heart Disease: A Review of Current Evidence. *Current Cardiology Reports*, *20*(11), 104. https://doi.org/10.1007/s11886-018-1048-x

Lin, Y.-H., Chen, D.-A., Lin, C., & Huang, H. (2020). Type D Personality Is Associated with Glycemic Control and Socio-Psychological Factors on Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *Psychology Research and Behavior Management*, *Volume 13*, 373–381. https://doi.org/10.2147/PRBM.S245226

Liu, J., Bu, X., Wei, L., Wang, X., Lai, L., Dong, C., Ma, A., & Wang, T. (2021). Global burden of cardiovascular diseases attributable to hypertension in young adults from 1990 to 2019. *Journal of Hypertension*, *39*(12), 2488–2496.

Nefs, G., Speight, J., Pouwer, F., Pop, V., Bot, M., & Denollet, J. (2015). Type D personality, suboptimal health behaviors and emotional distress in adults with diabetes: Results from Diabetes MILES–The Netherlands. *Diabetes Research and Clinical Practice*, *108*(1), 94–105.

Nie, J., Li, W., Long, J., Zeng, P., Wang, P., & Lei, L. (2022). Emotional resilience and social network site addiction: The mediating role of emotional expressivity and the moderating role of type D personality. *Current Psychology*, *41*(4), 2264–2276. https://doi.org/10.1007/s12144-020-00745-w

Pandarbale, S. S., & Fernandes, C. (2020). A Comparative Study of Automated v/s Manual Measurement of Blood Pressure. *Journal of Evolution of Medical and Dental Sciences*, *9*(35), 2511–2515.

Steca, P., Baretta, D., Greco, A., D'Addario, M., & Monzani, D. (2018). Associations between personality, sports participation and athletic success. A comparison of Big Five in sporting and non-sporting adults. *Personality and Individual Differences*, *121*, 176–183.

Stergiou, G. S., Alpert, B., Mieke, S., Asmar, R., Atkins, N., Eckert, S., Frick, G., Friedman, B., Graßl, T., Ichikawa, T., Ioannidis, J. P., Lacy, P., McManus, R., Murray, A.,

Myers, M., Palatini, P., Parati, G., Quinn, D., Sarkis, J., … O'Brien, E. (2018). A Universal Standard for the Validation of Blood Pressure Measuring Devices: Association for the Advancement of Medical Instrumentation/European Society of Hypertension/International Organization for Standardization (AAMI/ESH/ISO) Collaboration Statement. *Hypertension*, *71*(3), 368–374. https://doi.org/10.1161/HYPERTENSIONAHA.117.10237

Thangsuk, P., Pinyopornpanish, K., Jiraporncharoen, W., Buawangpong, N., & Angkurawaranon, C. (2021). Is the association between herbal use and blood-pressure control mediated by medication adherence? A cross-sectional study in primary care. *International Journal of Environmental Research and Public Health*, *18*(24), 12916.

Torgersen, K. S., Sverre, E. C. B., Weedon-Fekjær, H., Andreassen, O. A., Munkhaugen, J., & Dammen, T. (2023). Risk of recurrent cardiovascular events in coronary artery disease patients with Type D personality. *Frontiers in Psychology*, *14*, 1119146.

Versteeg, H., Schiffer, A. A., & Pedersen, S. S. (2022). Personality Factors in Cardiovascular Disease: The Big Five and Type D Personality. In S. R. Waldstein, W. J. Kop, E. C. Suarez, W. R. Lovallo, & L. I. Katzel (Eds.), *Handbook of Cardiovascular Behavioral Medicine* (pp. 471–501). Springer New York. https://doi.org/10.1007/978-0-387-85960-6_19

Wang, Y., Zhang, S., Zhang, G., Yu, B., Gao, X., Dai, Z., Yang, X., Qiu, X., Qiao, Z., & Zhou, J. (2020). Association between type D personality and in-stent restenosis in patients treated with percutaneous coronary intervention: A mediation analysis of dietary patterns. *Journal of Psychosomatic Research*, *138*, 110244.

Winsper, C., Bilgin, A., Thompson, A., Marwaha, S., Chanen, A. M., Singh, S. P., Wang, A., & Furtado, V. (2020). The prevalence of personality disorders in the community: A global systematic review and meta-analysis. *The British Journal of Psychiatry*, *216*(2), 69–78.

Wójcik, M., Alvarez-Pitti, J., Kozioł-Kozakowska, A., Brzeziński, M., Gabbianelli, R., Herceg-Čavrak, V., Wühl, E., Lucas, I., Radovanović, D., & Melk, A. (2023). Psychosocial and environmental risk factors of obesity and hypertension in children and adolescents—A literature overview. *Frontiers in Cardiovascular Medicine*, *10*, 1268364.

Ye, Q., Liu, L., Wang, Y., Li, L., Wang, Z., Liu, G., Lin, P., & Li, Q. (2022). Association of Type D personality and mild cognitive impairment in patients with hypertension. *Frontiers in Psychology*, *13*, 974430.