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Relationships Between High Blood Pressure (HBP), Cardiovascular Risk Factors, Knowledge, Awareness, Attitudes, and Medication Adherence Among Adults in Armenia: A Cross-Sectional Study

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Abstract

Background: Hypertension remains one of the leading modifiable risk factors for cardiovascular morbidity and mortality worldwide. Although previous studies have examined hypertension prevalence in different populations, limited evidence is available regarding the relationships between hypertension, cardiovascular risk factors, knowledge, awareness, attitudes/perceptions, and medication adherence among adults residing in Armenia.

Objective: This study aimed to examine the relationships between high blood pressure (HBP) and demographic, anthropometric, biochemical, and familial risk factors, as well as participants' knowledge, awareness, attitudes/perceptions, and adherence to antihypertensive medication among adults living in Armenia.

Methods: A cross-sectional study was conducted using a convenience sample of 200 Armenian adults residing in Yerevan, Armenia. Data collection included demographic characteristics, medical and family history, blood pressure measurements, anthropometric assessments, lipid panel, glucose testing, and questionnaires evaluating knowledge, awareness, attitudes/perceptions, and medication adherence. Blood pressure was classified according to the study's predefined criteria. Descriptive statistics, Spearman correlation analysis, Chi-square tests, one-way analysis of variance (ANOVA), and stepwise multiple regression were performed to identify factors associated with blood pressure levels.

Results: Among the 200 participants, 56.5% were classified as prehypertensive or as hypertensive. Blood pressure levels were positively associated with increasing age, waist circumference, body mass index, systolic and diastolic blood pressure, total cholesterol, low-density lipoprotein cholesterol, triglyceride levels, waist-to-hip ratio, and a personal or family history of hypertension and heart disease. Stepwise multiple regression identified waist circumference, personal history of hypertension, total cholesterol, male sex, and older age as significant independent predictors of elevated blood pressure, explaining 52.4% of the variance in blood pressure levels. Participants demonstrated generally high knowledge regarding hypertension; however, awareness of their diagnosis and blood pressure status was comparatively low. Among individuals prescribed antihypertensive medication, only 15% achieved controlled blood pressure, while 71% exhibited low medication adherence.

Conclusions: Hypertension and prehypertension were highly prevalent among the study population and were significantly associated with several demographic, anthropometric, biochemical, and familial risk factors. Although participants generally possessed adequate knowledge regarding hypertension, awareness and adherence to antihypertensive medication remained suboptimal. These findings highlight the importance of strengthening hypertension screening, patient education, medication adherence interventions, and cardiovascular risk reduction strategies among adults in Armenia.

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Keywords

Hypertension, High blood pressure, Armenia, Cardiovascular risk factors, Knowledge, Awareness, Medication adherence, Waist circumference, lipid panel, Cross-sectional study.

1: Introduction

Hypertension (HTN) is a significant public health problem in the United States (US) and globally. An estimated 1.3 billion people worldwide are currently living with HTN, and approximately four million people die each year from hypertension-related causes (WHO, 2023). In the US, approximately 115 million people, or one in every two individuals aged 20 years and older, have HTN, with men being slightly more affected than women (Chobufo et al., 2020). In Armenia, 24.1% of the population has HTN (Roberts et al., 2012). However, in an unpublished study of blood pressure among Armenians (N = 1,846) residing in Armenia, 59% were found to have HTN (Akaragian et al., 2002). Furthermore, in 2015, the World Health Organization (WHO) reported an increase in the mortality rate due to cardiovascular disease (CVD) among Armenians living in Armenia, rising from 500.5 per 100,000 males and 344.1 per 100,000 females in 2000 to 606.9 per 100,000 males and 367.7 per 100,000 females in 2012 (WHO, 2015).

The literature review on the prevalence of HTN and its associated risk factors among Armenians and non-Armenians indicates that numerous studies have been conducted in Arab countries and the former Soviet Union (Bener et al., 2004; Jaddou et al., 2000; Young et al., 2005). Reported prevalence rates have ranged from 13.4% to 81%, with variations in body mass index (BMI), lipid panel, and blood glucose level. These differences are likely attributable to variations in study design, sampling procedures, study settings, participant characteristics, blood pressure measurement techniques, and definitions of HTN. In addition, the distribution of gender and age has varied across countries. Socioeconomic status, lower educational attainment, and a family history of high blood pressure (HBP) have also been identified as factors contributing to the prevalence of HTN (Albert et al., 2006).

Only five studies on HTN have been conducted among Armenians. Two focused on Armenians living in the diaspora (Footman et al., 2013; Roberts et al., 2013). These studies relied primarily on self-reported blood

pressure, while the remaining studies did not follow the Joint National Committee (JNC)-8 guidelines (Harhay et al., 2013). Furthermore, none of these studies examined patients' adherence to prescribed antihypertensive medication regimens. In contrast, the present study measured participants' blood pressure twice in accordance with the JNC-8 guidelines. In addition, blood samples were collected to assess lipid panel, triglyceride levels, and blood glucose concentrations. Structured questionnaires were administered to evaluate participants' knowledge of HBP, awareness of their hypertension status, attitudes toward hypertension, and adherence to prescribed antihypertensive medications. One of the major contributions of this study is the objective verification of blood pressure using the JNC-8 guidelines, thereby providing a stronger scientific basis for evaluating hypertension and its associated risk factors among adults residing in Armenia.

This study is part of a larger research project. The specific objective of this study was to determine the relationship between blood pressure, measured according to the JNC-8 guidelines, and: (1) risk factors associated with HBP, (2) knowledge, (3) awareness, (4) attitudes and perceptions toward hypertension, and (5) adherence to prescribed antihypertensive medications.

Background Information

The topic of high blood pressure (HBP), the concept of hypertension (HTN), and its correlates and associated risk factors are complex. From the patients' perspective, their level of knowledge, awareness, attitudes and perceptions toward their illness, and adherence to prescribed medications further add to this complexity. Moreover, variations in the reporting of HBP and HTN across studies make it challenging to compare findings. This section reviews the relevant research studies and discusses the issues they have identified.

Differentiation of High Blood Pressure and Hypertension

High blood pressure (HBP) can be a transient state or a spontaneous response to an immediate physiological condition. In contrast, hypertension (HTN) is a long-standing medical condition with associated clinical sequelae. This distinction is important because the proper diagnosis of HTN requires repeated blood pressure (BP) measurements over a 3-month period, in accordance with the JNC-8 guidelines, to determine the appropriate mode of treatment.

In the Armenian population, the terms HBP and HTN are often used interchangeably. However, no previous studies have verified the prevalence of HTN using objective BP measurements in accordance with the JNC-8 guidelines (Arevian et al., 2004; Roberts et al., 2012). Instead, these studies relied on patient self-reporting or a single BP measurement, which may reflect a transient "white coat" effect rather than a confirmed diagnosis of HTN. Therefore, one purpose of this study was to verify BP in the Armenian population using the JNC-8 guidelines.

Another issue identified in the literature was the variation in the BP cut-off values used to define HBP. One study used an HBP cut-off of >160/90 mmHg (Friedman et al., 2006), whereas another used a cut-off of >130/85 mmHg (Jaddou et al., 2000). These variations make comparisons across studies difficult. The present study used a BP cut-off of >140/90 mmHg, as recommended by the JNC-8 guidelines and the World Health Organization (WHO, 2015).

Risk Factors Associated with Hypertension in the Armenian Population

Studies examining the effect of risk factors on the prevalence of HTN in the Armenian population have been conducted both within and outside Armenia, with the majority carried out in the former Soviet Union and Middle Eastern countries, where Armenians also reside and share similar cultural practices. Individuals living in comparable cultural settings may be exposed to common risk factors that influence BP and contribute to the development of HTN (Bener et al., 2004; Young et al., 2005).

Reported risk factors included body mass index (BMI), lipid panel, and blood glucose level. Across these studies, the reported prevalence of HTN ranged from 13.4% to 81%. This wide variation is most likely attributable to differences in study design, sampling procedures, study settings (e.g., rural versus urban), participant characteristics (e.g., the general population versus clinical patients with CVD), BP measurement procedures, and the definitions of HTN used. Participants with HTN were also reported to have elevated total cholesterol (Total-C), triglycerides, and low-density lipoprotein cholesterol (LDL-C) levels, as well as reduced high-density lipoprotein cholesterol (HDL-C) levels.

Gender and age are additional risk factors associated with HTN. Most studies investigating the prevalence of HTN or HBP included a higher proportion of female participants than male participants. For example, studies by Arevian et al. (2004), Jaddou et al. (2000), and Mehler et al. (2001) included more than 50% female participants. Compared with U.S. born participants, the prevalence of HTN among female Arab immigrants in the United States was higher (Dallo & Borrell, 2006). Similarly, a high prevalence of HTN was reported among women in Jordan, as well as among women from Armenia, Ukraine, and Azerbaijan (Footman et al., 2013; Harhay et al., 2013).

In contrast, other studies (Bener et al., 2004; Young et al., 2005; Friedman et al., 2006; Tailakh et al., 2014) reported a higher prevalence of HTN among males. These findings demonstrate considerable variation across studies and contribute to inconsistencies regarding which sex is at greater risk for HTN.

Previous studies have also identified socioeconomic status, educational attainment, and family history of HBP or heart disease as important risk factors for HTN. Most studies indicate that lower socioeconomic status, lower educational attainment, and a family history of HTN are associated with a higher prevalence of hypertension (Albert et al., 2000). However, none of these studies specifically included Armenian participants.

Relationship of Knowledge, Awareness, and Attitudes/Perceptions to the Prevalence of Hypertension

Determinants of health behaviors include knowledge, awareness, and attitudes/perceptions (Sabouhi et al., 2011; Cockerham, 2005). However, these factors alone do not guarantee healthy behaviors, medication adherence, or hypertension (HTN) control among hypertensive patients (Sabouhi et al., 2011).

Studies conducted in Armenia, China, Germany, Poland, and the United States have reported significant positive relationships between these determinants and hypertension-related outcomes. A study conducted in China (Wu et al., 2015) found a positive association between awareness and treatment, with both being related to body mass index (BMI), educational level, family history, and previous diagnoses.

However, in Armenia, a study conducted by the United States Agency for International Development

(USAID) and the American University of Armenia (AUA) found that knowledge, awareness, and practice (KAP) scores were lowest for HTN, osteoporosis, and urinary tract infection when compared with diabetes and tuberculosis (USAID/PHER, 2008). Women had higher KAP scores than men; however, no association was found between KAP scores and participants' age, living standard, or average monthly income (USAID/PHER, 2008).

Similarly, in the United States, HTN awareness and treatment rates were higher among women than among men (Egan et al., 2010). However, findings from the National Health and Nutrition Examination Survey (NHANES) suggested that increasing HTN awareness and treatment was particularly important for men, whereas improving HTN control was a higher priority for women (Egan et al., 2010). These inconsistencies and inconclusive findings highlight the need for further research.

Adherence to Antihypertensive Medication(s)

Adherence to antihypertensive medication is reportedly very low among Armenians. Only one study (Arevian et al., 2004) examined non-adherence to antihypertensive medication among Armenian women residing in Lebanon. In that study, 41% of participants were aware that they had HTN; however, only 58.8% of those individuals reported taking their medication regularly.

The study also found that individuals with HBP had high BMI, elevated low-density lipoprotein cholesterol (LDL-C), and reduced high-density lipoprotein cholesterol (HDL-C) levels. In addition, they reported consuming large amounts of salt, engaging in limited physical activity, and having a family history of HTN (Arevian et al., 2004).

Summary of the Review of the Literature

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality in Armenia. However, data regarding the prevalence of risk factors and other contributors to HTN and CVD remain limited. Understanding the prevalence of these risk factors is a critical first step toward addressing the burden of disease within any population (Brouwer et al., 2015).

Furthermore, variations in research design and inconsistencies in findings across the available literature on HBP and HTN among Armenians residing in Armenia limit the generalizability of existing evidence. Collectively, these findings underscore the need for a comprehensive study of hypertension and its associated risk factors in Armenia.

Conceptual Framework

This study is based on Cockerham's Health Lifestyle Theory (HLT), which explains an individual's behavior in terms of positive and negative lifestyle practices that contribute to overall health status. For example, consuming foods high in salt, engaging in insufficient physical activity, smoking, excessive alcohol consumption, and infrequent medical check-ups are unhealthy lifestyle behaviors that increase the risk of developing HTN, stroke, and other adverse health outcomes, including premature death (Cockerham, 2012; Chobanian, 2003).

2. Methodology

Study Design

This study was a subset of a larger research project. A cross-sectional descriptive research design was used to examine hypertension among Armenians residing in Armenia. Specifically, the study investigated the following:

1. Blood pressure (BP) measurements obtained in accordance with the JNC-8 guidelines.
2. Risk factors predisposing the Armenian population to hypertension (HTN) and its complications, including selected demographic characteristics such as age, sex, marital status, educational level, socioeconomic status, obesity, and family history of diabetes and high blood pressure (HBP).
3. Physiological predictors of HTN, including total cholesterol (Total-C), high-density lipoprotein cholesterol (HDL-C), triglycerides, low-density lipoprotein cholesterol (LDL-C), blood glucose level, body mass index (BMI), and waist and hip circumferences.
4. Participants' knowledge, awareness, and attitudes/perceptions regarding hypertension.

Participants

A convenience sample of 200 Armenian adults residing in Yerevan, the capital of Armenia, participated in this study. The sample consisted of 34 men (17%) and 166 women (83%), ranging in age from 21 to 78 years, with a mean age of 48.62 years (SD = 14.64).

Because Armenia has a total population of approximately 3 million, with nearly 35% of its population residing in Yerevan, the study assumed that the city's population was reasonably representative of the Armenian population as a whole.

The inclusion criteria required participants to be Armenian, 21 years of age or older, and able to read, write, and speak either Eastern or Western Armenian. The exclusion criteria included pregnant women and individuals who were not of Armenian ethnicity.

Instruments and Equipment

Six instruments were used in this study:

1. An automated blood pressure monitor.
2. An Alere Cholestech LDX Analyzer to measure lipid panel and blood glucose.
3. A stadiometer to measure height.
4. A calibrated scale to measure weight.
5. A measuring tape to assess waist circumference (WC).
6. A structured questionnaire to assess participants' knowledge, awareness, and attitudes/perceptions regarding hypertension.

Blood Pressure Measurement Using the JNC-8 Guidelines

Blood pressure was measured by a trained research assistant (RA) using an automated BP device. Participants were seated comfortably in a chair with their feet flat on the floor, their left arm resting on a table

at heart level, and the BP cuff positioned to cover approximately two-thirds of the upper arm.

Two BP measurements were obtained five minutes apart. If the first and second readings differed, a third measurement was taken. The average of the systolic and diastolic readings was recorded as the participant's final BP.

Blood pressure was classified according to the JNC-8 guidelines as follows:

- Normal BP: <120/80 mmHg
- Prehypertension: Systolic BP of 120–139 mmHg and/or diastolic BP of 80–89 mmHg
- Hypertension: Systolic BP >140 mmHg and/or diastolic BP >90 mmHg, or current use of antihypertensive medication.

Following the JNC-8 guidelines for BP measurement and using an automated BP device provided evidence of face and construct validity for blood pressure assessment.

Measurement of Height, Weight, and Body Mass Index (BMI)

Participants' height and weight were measured by the trained RA. Before measurement, participants were asked to remove their shoes and outer garments.

Height was measured in centimeters using a stadiometer while participants stood upright and faced the RA. Weight was measured in kilograms using a calibrated scale. To ensure measurement reliability, the scale was calibrated by the clinic and verified by a biomedical engineer before participant assessment.

Body mass index (BMI) was calculated by dividing weight in kilograms by the square of height in meters (kg/m^2).

Risk Factors Questionnaire

The Risk Factors Questionnaire (RFQ) collected demographic and health information identified in the medical literature as potential risk factors for hypertension. These variables included factors associated with

an increased risk of hypertension and its complications, including cardiovascular disease (CVD), stroke, and premature death.

Several of these risk factors are modifiable, including body weight, smoking, alcohol consumption, and physical activity. Others are non-modifiable, such as age, sex, and family history of hypertension. Additional variables—including financial status, socioeconomic status, and educational attainment—represent social determinants of health that may influence healthcare-seeking behavior, access to care, and overall health status.

These variables provide important information for identifying individuals at increased cardiovascular risk and may serve as indicators of both protective health behaviors and risk factors for hypertension and its complications.

The RFQ demonstrated construct and content validity, as supported by previous literature (Bauman et al., 2009; Cockerham et al., 2004; AHA, 2014; NHLBI, 2011).

Physiologic Predictors of Hypertension

Lipid Panel and Glucose Level: The blood lipid panel is considered the gold standard for assessing cardiovascular risk factors associated with hypertension (HTN) and cardiovascular disease (CVD). This study obtained and analyzed blood samples to measure total cholesterol (Total-C), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), triglycerides, and glucose level. High Total-C, high LDL-C, high triglycerides, and low HDL-C are recognized risk factors for high blood pressure (HBP), cardiovascular disease, and stroke (AHA, 2014a). For data analysis, Total-C was categorized as desirable or borderline-high; HDL-C as low or high; LDL-C as optimal, borderline-high, or high/very high; triglycerides as normal or borderline-high; and glucose as normal, prediabetes, or diabetes.

Total Blood (Serum) Cholesterol: According to the National Heart, Lung, and Blood Institute (NHLBI), desirable Total-C is <200 mg/dL, borderline-high is 200–239 mg/dL, and high is ≥240 mg/dL (NHLBI, 2012b, 2015c). Individuals with high Total-C have approximately twice the risk of developing heart disease compared with those who have optimal cholesterol levels (CDC, 2014).

HDL-C (Good) Cholesterol: Low HDL-C is defined as <40 mg/dL, whereas high HDL-C is ≥40 mg/dL (NHLBI, 2015). Low HDL-C and/or high LDL-C increase the risk of heart disease. Individuals with elevated triglyceride levels commonly have lower HDL-C levels. In addition, genetic factors, diabetes mellitus (DM), smoking, overweight status, and physical inactivity may all contribute to reduced HDL-C levels (AHA, 2014b).

LDL-C (Bad) Cholesterol: Optimal and near-optimal LDL-C levels are <129 mg/dL; borderline-high levels range from 130–159 mg/dL; and high to very high LDL-C levels are ≥160 mg/dL (NHLBI, 2015). Lower LDL-C levels are considered beneficial for cardiovascular health. Diets high in saturated and trans fats increase LDL-C levels (AHA, 2014b).

Triglycerides: Triglycerides are the most common type of fat in the body. Normal triglyceride levels vary according to age and sex. A normal triglyceride level is <150 mg/dL, whereas a borderline-high level is ≥150 mg/dL. Elevated triglyceride levels, particularly when combined with low HDL-C or high LDL-C levels, are associated with atherosclerosis, which involves the buildup of fatty deposits in arterial walls and increases the risk of HBP, heart attack, and stroke (AHA, 2014b).

Glucose: The normal fasting blood glucose range is 70–99 mg/dL. Prediabetes is defined as 100–125 mg/dL, and a fasting glucose level >126 mg/dL is considered indicative of diabetes (NHLBI, 2015c). Individuals with elevated glucose level are at greater risk of developing HBP, cardiovascular disease at a younger age, and diabetes mellitus (Filipovsky et al., 1996; NHLBI, 2011).

The Alere Cholestech LDX Analyzer (ACLDXA) was used to measure lipid panel and blood glucose level. The ACLDXA is widely used in physicians' offices, hospitals, and wellness programs in the United States. It provides accurate blood test results within approximately five minutes, allowing healthcare providers to rapidly identify CVD, diabetes, and other health risks. The analyzer requires only a 40 µL blood sample to measure HDL-C, LDL-C, Total-C, triglycerides, and glucose. The ACLDXA is certified by the Cholesterol Reference Method Laboratory Network for the measurement of Total-C, HDL-C, and LDL-C (Alere Cholestech Dx Analyzer, 2016).

Knowledge, Awareness, and Attitudes/Perceptions (KAAP) Questionnaire: The purpose of this instrument was to measure participants' levels of knowledge, awareness, and attitudes/perceptions regarding HTN (Oliveria et al., 2005; Zdrojewski et al., 2016).

The knowledge section assessed participants' understanding of HTN. The awareness section evaluated whether participants were aware that they had a medical condition requiring attention. The attitudes/perceptions section assessed participants' beliefs regarding HTN, including whether appropriate management would allow them to lead a normal life and whether uncontrolled HTN could result in serious health consequences. It also assessed participants' perceptions of their ability to control their health-related behaviors.

The knowledge component consisted of eight questions, including, "What does the term hypertension mean?", "How dangerous is HTN to your health?", and "Would lowering high BP improve a person's life?" Each question included multiple response options. Scores ranged from 0 to 9 and were categorized as low, medium, or high knowledge. The Cronbach's alpha coefficient for the knowledge section was 0.45.

The awareness section contained six items. One example was, "Has a doctor or healthcare provider ever told you that the bottom number of your BP is important to keep under control?" The Cronbach's alpha coefficient for the awareness section was 0.92.

The attitudes/perceptions section consisted of 10 questions, each with multiple response options totaling 11 possible points. Example questions included, "Can changing your lifestyle help lower your BP?" and "Do you think that high BP is an avoidable part of aging?" Reliability was assessed using internal consistency. The Cronbach's alpha coefficient was 0.81.

Morisky Medication Adherence Scale-8 (MMAS-8)

The MMAS-8 was developed by Morisky Associates (2008) and validated in a randomized pretest-posttest experimental study involving 1,367 participants. The instrument measures adherence to prescribed antihypertensive medications and evaluates factors such as forgetfulness, satisfaction, and medication complexity.

The MMAS-8 consists of eight self-reported items that assess medication-taking behaviors, memory, and habits associated with adherence. It provides insight into non-adherence to antihypertensive medications among Armenians residing in Armenia.

Predictive validity was established by Morisky in 2008, and the instrument demonstrated good internal consistency, with a Cronbach's alpha of 0.83. Scoring is as follows: the first seven items require Yes/No responses, whereas the eighth item uses a 5-point Likert-type scale. Scores are categorized as follows:

- <6: Low adherence
- 6 to <8: Medium adherence
- 8: High adherence

Procedure

Before data collection, approval was obtained from the Institutional Review Board (IRB) of the University of California, Los Angeles (UCLA) and the Ethics Committee of Erebouni Medical Center in Yerevan, Armenia.

After the purpose of the study was explained, written informed consent was obtained from each participant. Blood pressure, height, weight, BMI, waist circumference, and hip circumference were then measured, and a blood sample was collected by the research assistant (RA). Participants also completed the KAAP questionnaire.

If a participant was unable to complete the questionnaire independently, the Principal Investigator (PI) or the RA read the questions aloud and recorded the participant's responses verbatim. Participants requiring further medical evaluation based on the study findings were advised to return for follow-up care with a physician.

Data Analysis

Descriptive statistics were used to summarize demographic characteristics and other risk factors.

Continuous variables were analyzed using the independent-samples t-test, whereas categorical variables were analyzed using the Chi-square test and the Mann–Whitney U test, as appropriate.

Spearman rank correlation and stepwise multiple regression analyses were performed to examine the relationships between BP and continuous variables. Statistical analyses were conducted using SPSS version 22, with results summarized using frequencies, percentages, means, and standard deviations.

3. Results

The relationships between high blood pressure (HBP) and the following risk factors are presented: gender, age, family history, lipid panel, blood glucose, body mass index (BMI), waist circumference (WC), and hip circumference (HC).

Relationship Between HBP and Risk Factors

HBP and Gender: The results of the bivariate Chi-square analysis, presented in Table 1, showed that 44% (n = 87) of participants had normal blood pressure (BP), 23% (n = 47) were prehypertensive, and 33% (n = 66) were hypertensive.

Men (14.7%) were significantly less likely than women (49.4%) to have normal BP ($p < .001$). Men also had significantly fewer acceptable waist circumference (WC) measurements (26.5%) than women (65.1%) ($p < .001$), indicating a greater prevalence of central adiposity.

With respect to body mass index (BMI), most participants in both groups had normal BMI values. There were no statistically significant differences in BMI categories between men and women. However, men (5.9%) were significantly less likely to be obese or extremely obese than women (21.1%) ($p = .02$).

Overall, men demonstrated a greater cardiovascular risk profile than women, as evidenced by higher BP and a greater prevalence of unacceptable waist circumference. In addition, men had significantly lower HDL-C levels than women ($p < .001$). No significant gender differences were observed for total cholesterol (Total-C), LDL-C, triglycerides, or fasting glucose level (see Table 1).

Table 1: Health and Risk Factor Variables Based on Gender

	Male			Female			Total		
Variable and category	*n*	%	CI	*n*	%	CI	*n*	%	CI
Blood pressure level [a]									
Normal	5	14.7	(2.8,26.61)	82	49.4	(41.79,57)	87	43.5	(36.63,50.37)
Prehypertensive	11	32.4	(16.63,48.08)	36	21.7	(15.42,27.96)	47	23.5	(17.62,29.38)
Hypertensive	18	52.9	(36.16,69.72)	48	28.9	(22.02,35.81)	66	33	(26.48,39.52)
Waist category [b]									
Acceptable	9	26.5	(11.64,41.3)	108	65.1	(57.81,72.31)	117	58.5	(51.67,65.33)
Unacceptable	25	73.5	(58.7,88.36)	58	34.9	(27.69,42.19)	83	41.5	(34.67,48.33)
BMI category [c]									
Underweight	0	0	--	3	1.8	(-0.22,3.83)	3	1.5	(-0.18,3.18)
Normal	18	52.9	(36.16,69.72)	99	59.6	(52.17,67.1)	117	58.5	(51.67,65.33)
Overweight	14	41.2	(24.63,57.72)	29	17.5	(11.69,23.25)	43	21.5	(15.81,27.19)
Obesity	2	5.9	(-2.03,13.79)	24	14.5	(9.11,19.81)	26	13	(8.34,17.66)
Extreme obesity	0	0	--	11	6.6	(2.84,10.41)	11	5.5	(2.34,8.66)
Total cholesterol [d]									
Desirable	17	50	(33.19,66.81)	79	47.6	(39.99,55.19)	96	48	(41.08,54.92)
Borderline-high	17	50	(33.19,66.81)	87	52.4	(44.81,60.01)	104	52	(45.08,58.92)
High density lipoprotein [e]									
Low	22	64.7	(48.64,80.77)	51	30.7	(23.7,37.74)	73	36.5	(29.83,43.17)
High	12	35.3	(19.23,51.36)	115	69.3	(62.26,76.3)	127	63.5	(56.83,70.17)
Low density lipoprotein [f]									
Optimal	19	55.9	(39.19,72.57)	107	64.5	(57.18,71.74)	126	63	(56.31,69.69)
Borderline-high	10	29.4	(14.1,44.73)	37	22.3	(15.96,28.62)	47	23.5	(17.62,29.38)
High-very high	5	14.7	(2.8,26.61)	22	13.3	(8.09,18.41)	27	13.5	(8.76,18.24)
Triglycerides [g]									
Normal	13	38.2	(21.9,54.57)	71	42.8	(35.24,50.3)	84	42	(35.16,48.84)
Borderline-high	21	61.8	(45.43,78.1)	95	57.2	(49.7,64.76)	116	58	(51.16,64.84)
Glucose [h]									
Normal	17	50	(33.19,66.81)	74	44.6	(37.02,52.14)	91	45.5	(38.6,52.4)
Prediabetes	10	29.4	(14.1,44.73)	60	36.1	(28.84,43.45)	70	35	(28.39,41.61)
Diabetes	7	20.6	(7,34.18)	32	19.3	(13.28,25.28)	39	19.5	(14.01,24.99)

Note. This table presents findings for $N = 200$. JNC-8 standards are applied: Normal: SBP < 120 mmHg and DBP < 80 mmHg. Prehypertensive: SBP 120 - 139 mmHg or DBP 80 – 89 mmHg. Hypertensive: SBP ≥ 140 mmHg and/or DBP≥ 90 mmHg and/or the use of antihypertensive medication(s). World Health Organization (WHO, 2008): BMI: Underweight > 18.5 kg/m², Normal ≥ 18.5-24.9 kg/m², Overweight ≥ 25.0- 29.9 kg/m², Obese ≥30.0 kg/m². Waist Circumference: Female Acceptable < 88 cm, Unacceptable > 88 cm. Male Acceptable < 102 cm, Unacceptable > 102 cm. Waist-Hip Ratio: female ≥ .85 cm, male ≥ .9 cm. National Heart, Lung, and Blood Institute (NHLBI, 2015): Total-C Desirable < 200 mg/dL, Borderline > 200-239 mg/dL, High ≥ 240 mg/dL; HDL-C: low < 40 mg/dL, high ≥ 40 mg/dL. LDL-C: optimal/near optimal < 129 mg/dL, borderline-high >130-159 mg/dL, high-very high ≥ 160 mg/dL. Triglycerides: Normal < 150 mg/dL, borderline–high≥ 150 ml/dL. Glucose-Fasting: Normal 70-99 mg/dL, Prediabetes 100-125 mg/dL, Diabetes ≥ 126. [a] χ^2 (2) = 14.11, p = .001. Cramer's V = .27. [b] χ^2 (1) = 17.31, p = .001. Cramer's V = .29. [c] χ^2 (4) = 12.06, p = .02. Cramer's V = .25. [d] χ^2 (1) = 0.06, p = .80. Cramer's V = .02. [e] χ^2 (1) = 14.06, p = .001. Cramer's V = .27. [f] χ^2 (1) = 0.89, p = .35. Cramer's V = .07. [g] χ^2 (1) = 0.24, p = .63. Cramer's V = .04. [h] χ^2 (2) = 0.57, p = .75. Cramer's V = .05.

HBP and Family History: Participants were asked if they or anybody in their family and/or close blood relatives had any of the following chronic illnesses: high BP, heart disease, high cholesterol, diabetes, and/or kidney disease. Results presented in Table 2 show that the most frequently cited chronic illness was high BP (n=74, 37%), and the least was kidney problems (n= 14) Those with a personal or family history of five or more chronic illnesses as presented in Table 3 were as follows: Over 75% reported HBP (which includes grandparents, sibling, parent and self, 60% reported heart disease, 42% diabetes, 32% high Total-C, and 22% kidney problems.

Table 2

Frequency Counts for Current Self-Reported Chronic Health Problem(s)

Variable	*N*	%
High blood pressure	74	37.0
Heart disease	51	25.5
High cholesterol	31	15.5
Diabetes	19	9.5
Kidney problems	14	7.0
No chronic health problems	5	2.5

Note. This table presents findings based on $N = 200$. Not everyone had a problem. Some respondents reported more than one problem.

Table 3

Frequency Counts for Self and Family Health History Variables

Variable and category	*n*	%
Self/family history of diabetes		
No one	117	58.5
Grandparents	20	10.0
Sibling	10	5.0
Parent	34	17.0
Self	19	9.5
Self/family history of high blood pressure		
No one	49	24.5
Grandparents	14	7.0
Sibling	6	3.0
Parent	57	28.5
Self	74	37.0
Self/family history of high cholesterol		
No one	137	68.5
Grandparents	1	0.5
Sibling	8	4.0
Parent	23	11.5
Self	31	15.5
Self/family history of heart disease		
No one	81	40.5
Grandparents	12	6.0
Sibling	11	5.5
Parent	45	22.5
Self	51	25.5
Self/family history of kidney problems		
No one	157	78.5
Grandparents	3	1.5
Sibling	8	4.0
Parent	18	9.0
Self	14	7.0

Note. This table presents findings based on $N = 200$. Not everyone had a problem. Some respondents reported more than

one problem.

Table 4

Nonparametric Spearman Correlations for Risk Factor Variables with Blood Pressure Level

Variable	Blood pressure level [a]	r_s^2 expressed as percentage
Demographic factors		
Age	.54****	29.2
Gender	-.26****	6.8
Married	.19**	3.6
Physiologic factors		
Mean SBP	.91****	82.8
Mean DBP	.73****	53.3
Body Mass Index	.44****	19.4
Waist circumference	.59****	34.8
Hip circumference	.48****	23.0
Total cholesterol	.35****	12.3
High-density lipoprotein	-.19**	3.6
Low-density lipoprotein	.30****	9.0
Triglycerides	.33****	10.9
Glucose	.14*	2.0
Waist-hip ratio	.42****	17.6

Note. $N = 200$.[a] Blood pressure level: 1 = *normal,* 2= prehypertensive, 3 = *hypertensive*. * $p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$.

Relationship Between HBP and Knowledge, Awareness, Attitudes/Perceptions (KAAP) and Taking Medications:

The second major area of investigation was the relationship between HBP and KAAP. The knowledge questionnaire had 9 possible correct answers, and awareness was worth 6 points. The total knowledge score ranged from 3 to 9 (M = 8.24, SD = 1.06), with 8 of 89% of respondents answering 9 questions correctly. Awareness scores ranged from 0 to 6 (M = 2.40, SD = 2.46). Results presented in Table 5 showed that most participants (73%) were not aware of their HTN based upon information received from their doctors, and (59%) were not informed about their systolic and diastolic BPs. Furthermore, they were not informed about the importance of systolic and diastolic BP (see Table 5).

Table 5

Total and Individual Item Scores for the Knowledge Questionnaire and Awareness of Blood Pressure Questionnaire

Variable and category	*n*	%
Total knowledge score [a]		
3	1	0.5
4	1	0.5
5	4	2.0
6	8	4.0
7	21	10.5
8	59	29.5
9	106	53.0
Knowledge hypertension meaning		
Incorrect	10	5.0
Correct	190	95.0
Knowledge hypertension danger		
Incorrect	45	22.5
Correct	155	77.5
Knowledge HBP lowering		
Incorrect	22	11.0
Correct	178	89.0
Knowledge BP two number		
Incorrect	9	4.5
Correct	191	95.5
Knowledge normal BP top		
Incorrect	9	4.5
Correct	191	95.5
Knowledge BP normal bottom		
Incorrect	11	5.5
Correct	189	94.5
Knowledge BP measures important		
Incorrect	18	9.0
Correct	182	91.0
Knowledge people lower BP		
Incorrect	17	8.5

Correct	183	91.5
Knowledge lowering BP helps health		
Incorrect	11	5.5
Correct	189	95.5
Awareness Scale Score [b]		
0	85	42.5
1	9	4.5
2	19	9.5
3	17	8.5
4	10	5.0
5	18	9.0
6	42	21.0
Awareness HTN Told By MD		
Unaware	146	73.0
Aware	54	27.0
Awareness MD Told Reading		
Unaware	118	59.0
Aware	82	41.0
Awareness MD Told SBP		
Unaware	100	50.0
Aware	100	50.0
Awareness MD Told DBP		
Unaware	105	52.5
Aware	95	47.5
Awareness MD Told Systolic Important		
Unaware	119	59.5
Aware	81	40.5
Awareness MD Told Diastolic Important		
Unaware	132	66.0
Aware	68	34.0

Note. This table presents findings for $N = 200$.

[a] Total Knowledge Score: $M = 8.24$, $SD = 1.06$. [b] Total Awareness Score: $M = 2.40$, $SD = 2.46$.

Regarding the prevalence of HBP by (1) awareness of HBP, (2) by being treated for HBP, and (3) by whether or not being controlled through medicines, a one-way analysis of variance was conducted. Results of ANOVA showed significant differences in BP levels by awareness (F=1.55, p=.001), but not by total knowledge. Scheffé post hoc tests found awareness

scores higher among hypertensive respondents (p<.001) than in the normal pre-hypertensive group. To determine whether participants in the normal, prehypertensive, and hypertensive groups were taking their medications, bivariate Chi-square tests were performed. Results presented in Table 6 showed that 80.3% (n=53) of hypertensive participants were taking their medicines, no pre-hypertensive participants were taking their prescribed medicines, and 9 (10.3%) of those who had normal BP were taking their medicines (see Table 6).

Table 6

Blood Pressure Level and Medication Use (N = 62)

Blood pressure level [a]	Use medication		Do not use medication	
	n	%	*n*	%
Normal	9	10.3	78	89.7
Prehypertensive	0	0.0	47	100.0
Hypertensive	53	80.3	13	19.7

Note. This table presents findings for $N = 62$. JNC-8: Normal: SBP < 120 mmHg and DBP < 80 mmHg. Prehypertensive: SBP 120 - 139 mmHg or DBP 80-89 mmHg. Hypertensive: SBP ≥ 140 mmHg and/or DBP of ≥ 90 mmHg and/or use of antihypertensive medication(s). [a]χ^2 (2, n = 200) =113.47, p = .001. Cramer's V = .75.

With respect to being aware of having HBP, taking medicines, and having their BP controlled, Table 7 shows that 66 of respondents said "yes," 36% were normotensive upon assessment, and 64% were hypertensive. Among the 62 participants who reported being on prescribed medication(s), 85% had HBP on assessment, and only 15% of the participants had their BP under control with BP medications (see Table 7).

Table 7

Prevalence of High Blood Pressure by Awareness, Treatment, and Controlled Frequency

	Awareness of HTN[a] (*N* = 66)		Prescribed BP Medication(s) (*N* = 62)	
	N	%	*n*	%
BP < 140/90 (Controlled)	24	36.0	9	15
BP ≥ 140/90 (Hypertensive)	42	64.0	53	85

Note. [a]Awareness = Based on "MD Told." Normal and prehypertensive BP < 140/90 mmHg. Hypertensive BP ≥ 140/90 mmHg.

A stronger step-wise multiple regression test removed all non-significant and redundant variables (Hess-Biber &

Leavy, 2011). Results presented in Table 8 showed that the five-variable model was significant (p=.001) and accounted for 52% of the variance in BP levels. These were: BP levels were higher with (1) greater WC (b=.25, p=.001); (2) personal history of HBP (b=.36, p=.001); (3) higher Total-C (b=.15, p=.006); (4) being male (b=-.16, p=.003); and (5) older age (b=.16, p=.02).

Table 8

Prediction of Blood Pressure Level Based on Selected Variables: Stepwise Multiple Regression

Variable	*B*	*SE*	β	*p*
Intercept	-0.45	0.37		.22
Waist Circumference	0.01	0.00	.25	.001
High Blood Pressure q14	0.64	0.11	.36	.001
Total Cholesterol	0.00	0.00	.15	.006
Gender [a]	-0.38	0.13	-.16	.003
Age	0.01	0.00	.16	.02

Note. This table is an additional analysis based on $N = 200$. Final Model: F (5, 194) = 42.71, p = .001. R^2 = .524. Candidate variables = 37. [a] Coding: 0 = *Male* 1 = *Female*

Regarding self-reported adherence in taking their BP medication(s), the Morisky Medication Adherence Scale (MMAS-8) was used. Of the 62 participants who were prescribed anti-hypertensive medications, 71% had low adherence scores (see Table 9).

Table 9

Frequency Counts for Morisky Medication Adherence Scale-8 Variables

Variable and category	*n*	%
Total adherence score		
Low adherence	44	71.0
Moderate adherence	17	27.4
High adherence	1	1.6
Forget		
Yes	34	54.8
No	28	45.2
Forget 2 weeks		
Yes	36	58.1
No	26	41.9

Stopped taking medication		
Yes	23	37.1
No	39	62.9
Leave home forget		
Yes	27	43.5
No	35	56.5
Took medication yesterday		
Yes	36	58.1
No	26	41.9
Feels well stops medication		
Yes	40	64.5
No	22	35.5
Feel hassled taking medication		
Yes	48	77.4
No	14	22.6
Frequency of remembering taking medication		
All the time	24	38.7
Usually	19	30.6
Sometimes	16	25.8
Once in a while	3	4.8

Note. This table presents findings for $N = 62$.

In Summary, of the 200 participants, 56.5% (n=113) were either pre-hypertensive or hypertensive. 33% (n=66) of 56.5% (n=113) had HBP. BP levels were positively and significantly associated with age, systolic and diastolic BP, waist circumference, hip circumference, Total-C, LDL-C, triglycerides, waist-to-hip ratio, and self- and family history of HBP and heart disease. Only a fraction of HBP respondents had their BPs controlled, and more than half of HBP participants did not adhere to their anti-hypertensive medications.

4. Discussion

The findings are discussed in the following order: the prevalence of hypertension (HBP) and prehypertension; the relationships between HBP and its associated risk factors (demographic characteristics, lipid panel, BMI,

waist circumference, and glucose level); participants' knowledge of hypertension, awareness, attitudes/perceptions; and adherence to prescribed antihypertensive medication(s).

Prevalence of Hypertension

The findings of this study showed that more than 50% of the sample were either hypertensive or prehypertensive. This finding is similar to those reported in the United States (CDC, 2016) and among Armenians residing in Los Angeles, California (Naccashian, 2017). However, previous studies conducted in Armenia (Footman et al., 2013; Roberts et al., 2012) reported a lower prevalence of hypertension, whereas studies among Lebanese Armenians (Arevian et al., 2004) reported a substantially higher prevalence. These inconsistencies may be attributable to differences in study populations, blood pressure measurement methods, and the blood pressure cut-off values used to define hypertension.

Regarding the prevalence of prehypertension, this study found a lower prevalence (24%) than that reported among Armenians living in Arab countries (37.7%) (Tailakh et al., 2013) and in the United States (29%) (CDC, 2016).

Gender and Age

In this study, the prevalence of HBP was higher among men than among women, in contrast to findings reported in previous studies (Arevian et al., 2004; Footman et al., 2013). Differences in the age distribution of study participants may partially explain these inconsistent findings. Participants in the present study were generally younger than those included in previous studies of Armenians (Arevian et al., 2004; Footman et al., 2013; Harhay et al., 2013; Kumbasar et al., 2013; Roberts et al., 2012).

The observation that blood pressure increases with age is consistent with established physiological and medical evidence (AHA, 2017; Arevian et al., 2004; NHLBI, 2015b, c). The higher BP observed among men in this study is also consistent with their greater waist circumference and central adiposity compared with women. These findings agree with previous studies (AHA, 2017; Bener et al., 2004; NHLBI, 2016a; Tailakh et al., 2013). In the present study, waist circumference was the strongest predictor of HBP, consistent with previous research (Dong et al., 2016; NHLBI, 2012a; Toth et al., 2014).

Lipid Findings and HBP

As anticipated, HBP was positively associated with LDL-C and negatively associated with HDL-C. These findings are consistent with those reported among Armenians residing in Lebanon (Arevian et al., 2004). Significant gender differences were also observed in HDL-C levels, with men having significantly lower HDL-C levels (M = 36.91) than women (M = 46.77). Similar findings have been reported among Armenians living in Turkey (Kumbasar et al., 2013), populations in the United States (AHA, 2016), and Korea (Kim et al., 2011).

Further research is needed to determine why Armenian men have lower HDL-C levels than women. Overall, the lipid findings of this study support the physiological relationship between HBP and LDL-C and HDL-C levels (NHLBI, 2012a, 2016). These lipid parameters remain among the gold-standard predictors of hypertension in the United States (NHLBI, 2012a).

Inherited Risk Factors

Inherited risk factors, including a family history of chronic illnesses such as HBP and heart disease, were significantly associated with HBP in this study. These findings are consistent with previous studies conducted worldwide (Albert et al., 2006; Arevian et al., 2004; CDC, 2015; Ranasinghe et al., 2015).

This association is supported by medical evidence indicating that individuals with parents or other close blood relatives who have HBP are at an increased lifetime risk of developing hypertension themselves (AHA, 2017; CDC, 2015; Tailakh et al., 2013).

Relationship Between HBP and Waist Circumference

Results of the stepwise multiple regression analysis indicated that waist circumference was the strongest predictor of HBP. The relationship between HBP and waist circumference may be explained by the accumulation of abdominal fat, which is closely associated with increased cardiovascular risk. Visceral fat is metabolized by the liver and contributes to increased cholesterol production, thereby increasing the risk of hypertension (Ladeiras-Lopes et al., 2016).

The positive association between waist circumference and HBP observed in this study is consistent with findings reported by Kumbasar et al. (2013), Naccashian (2017), and Dong et al. (2016).

Relationship Between HBP and Body Mass Index

No significant relationship was found between HBP and BMI in this study. However, previous studies have reported a positive association between BMI and HBP (Arevian et al., 2004; Daderian-Huckabay et al., 2003; Roka et al., 2015), with the exception of a study involving Armenian adults residing in Kyrgyzstan (Young et al., 2015).

Gender differences were not observed for BMI in the present study; however, previous research has reported significant gender differences in BMI (CDC, 2016; NHLBI, 2016b). The reasons for these inconsistencies remain unclear and warrant further investigation.

Relationship Between HBP and Glucose Level

A significant but weak positive correlation was found between HBP and blood glucose level. This finding is consistent with studies conducted in the United States and Turkey (Erem et al., 2009; Huffman et al., 2012), as well as studies involving Armenians residing in Lebanon (Arevian et al., 2004) and Los Angeles, California (Naccashian, 2017).

In the present study, more women than men were classified as prediabetic or diabetic based on fasting glucose level. In contrast, other studies (CDC, 2016; Naccashian, 2017) reported a higher prevalence of prediabetes among men. One possible explanation is the difference in weight classification observed between men and women.

Relationship Between Knowledge, Awareness, Attitudes/Perceptions, and Hypertension

Objective measurements of HBP were not associated with participants' knowledge of hypertension but were significantly associated with awareness of having been informed by a healthcare professional that they

had HBP.

The findings indicate that Armenians residing in Armenia demonstrated relatively high knowledge scores regarding HBP. However, knowledge alone was not associated with adherence to prescribed antihypertensive medication(s). These findings suggest that knowledge alone is insufficient to influence health-related behavior (Bastable, 2014; Lira et al., 2006).

Awareness of an HTN diagnosis was significantly and positively associated with HBP. However, among participants who had been prescribed antihypertensive medication(s) (30%; n = 60), only 15% (n = 9) had controlled BP, whereas 75% (n = 45) demonstrated low medication adherence. These findings are consistent with previous studies involving Armenians residing in Middle Eastern countries (Arevian et al., 2004; Egan et al., 2020; Roberts et al., 2012).

Several factors may contribute to poor medication adherence. First, hypertension is often referred to as a "silent killer" because it frequently produces few or no symptoms, leading patients to underestimate the importance of regular medication use. Second, participants may not fully understand the long-term consequences of discontinuing treatment without consulting their healthcare provider. Third, the high cost of medications in Armenia may discourage consistent medication use, causing some individuals to take their medication only when symptoms occur or to conserve their medication until they feel unwell. Finally, limited follow-up visits with healthcare providers may reduce opportunities to reinforce adherence.

The latter two explanations are consistent with findings from Armenia reported by USAID/PHCR (2008), which showed that although approximately 50% of respondents had preventive health visits during the preceding 12 months, many did not adhere to their prescribed medications because of financial constraints.

Implications of the Study and Suggestions for Future Research

This study contributes to the existing body of knowledge by emphasizing the importance of: (1) improving patient education regarding hypertension; (2) regularly monitoring BP among individuals at increased risk and assessing adherence to prescribed antihypertensive medications; and (3) using major predictors of hypertension to identify individuals at high risk and implement early preventive interventions.

The major predictors identified in this study include waist circumference, lipid panel (particularly elevated Total-C), family history of hypertension and heart disease, male sex, and increasing age.

Future studies should replicate this research using a larger and more representative sample to improve the generalizability of the findings to the Armenian population. Additional research is also needed to determine the most effective methods of educating Armenians about the prevention of chronic diseases such as hypertension and its complications. Furthermore, culturally appropriate interventions should focus on increasing public awareness, improving health education, and promoting regular BP monitoring. Free community health screening programs throughout Armenia may help increase awareness of prevention strategies for hypertension, diabetes, and hyperlipidemia.

Research on medication adherence is particularly important given the low adherence observed in this study. Potential strategies to improve adherence include (1) encouraging the use of seven-day pill organizers and (2) providing educational materials that emphasize taking prescribed medications as directed rather than discontinuing treatment when symptoms improve or independently adjusting medication dosages.

5. Summary and Conclusion

This study aimed to describe the prevalence of high blood pressure (HBP) and its relationship with risk factors, including lipid panel, blood glucose level, waist circumference (WC), and personal or family history of hypertension (HTN) and heart disease among adults residing in Armenia. Other variables examined in relation to HBP included participants' knowledge, awareness, attitudes and perceptions regarding HBP, as well as adherence to prescribed antihypertensive medication(s).

A convenience sample of 200 native Armenians residing in Yerevan was included in the study. The results showed that approximately one-half of the participants were either prehypertensive or hypertensive. Fewer men than women had normal blood pressure. Among participants diagnosed with HTN, adherence to prescribed antihypertensive medication(s) was low. Waist circumference was identified as the strongest predictor of HBP, followed by a personal or family history of HBP, elevated total cholesterol (Total-C), male sex, and older age.

The findings of this study have important implications for patient education, healthcare providers, and health policymakers. They highlight the need for improved hypertension awareness, early identification of individuals at increased risk, and interventions that promote medication adherence and healthy lifestyle behaviors to reduce the burden of hypertension and its associated complications.

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Declarations

Ethics Approval and Consent to Participate

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Ethical approval was obtained from the University of California, Los Angeles (UCLA) Institutional Review Board (IRB) and the Ethics Committee of Erebouni Medical Center, Yerevan, Armenia, before participant recruitment. Written informed consent was obtained from all participants prior to enrollment.

Consent for Publication

Not applicable. This manuscript does not contain any individual participant data, photographs, or other identifiable personal information requiring separate consent for publication.

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Competing Interests

The author declares that there are no competing interests related to this study.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available because they contain participant information but may be available from the corresponding author upon reasonable request, subject to applicable ethical and institutional requirements.

Author Contributions (CRediT)

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(Retired Director, UCLA Health)

- Conceptualization
- Study design
- Data collection
- Data analysis
- Interpretation of results
- Writing – original draft
- Writing – review and editing

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