Original Research

Comparison of College Student Hypertension Prevalence between the JNC7 and ACC/AHA Diagnostic Criteria

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ABSTRACT

International Journal of Exercise Science 12(3): 898-903, 2019. Hypertension is highly prevalent and associated with non-communicable diseases and increased premature mortality risk. However, the impact of the new hypertension diagnostic criteria on the prevalence of hypertension diagnoses has yet to be examined among college students. The purpose of this study was to compare the prevalence of hypertension between the JNC7 and the ACC/AHA hypertension diagnostic criteria among college students. The blood pressure of 5,945 college students was assessed, and chi-square tests for independence examined differences between JNC7 and ACC/AHA criteria. The mean age of participants was 21.30 ± 1.05 years, and the majority identified as men (60.5%). Men were found to have significantly higher systolic ($p < .001$, $\eta^2 = .10$) and diastolic ($p < .001$, $\eta^2 = .04$) blood pressure, so all analyses were separated by sex. Hypertension guideline changes resulted in significant changes in hypertension categorization of both men, $\chi^2 = 7,178$, $p < .001$, $\Phi_c = .816$ and women, $\chi^2 = 4,670$, $p < .001$, $\Phi_c = .816$. Under the JNC7 guidelines, 292 (8.2%) men and 67 (2.8%) women were hypertensive. Using the ACC/AHA guidelines, 1455 (40.5%) men and 521 (22.3%) women were hypertensive. Hypertension guideline changes resulted in a significant increase in the prevalence of hypertension among college students, highlighting the potential demand for targeted prevention programs focused on fostering healthy lifestyle behaviors, i.e. physical activity and healthy eating, among students.

KEY WORDS: Blood pressure, university, young adults

INTRODUCTION

The thresholds used to diagnose hypertension were recently updated after more than 15 years. The change in guidelines saw a change from 'pre-hypertension'(6) to 'elevated' (15), the introduction of a new hypertensive crisis category, as well as a lowering of the thresholds for non-normal blood pressure categories (15). Diagnostic criteria are rarely updated, with the recent changes intended to improve quality of care and align with patients' best interests through earlier intervention concerning complications associated with hypertension (15). Such complications include heart attack, stroke, chronic heart failure, renal failure (3), as well as premature death (13). Aside from the costs to personal health, hypertension and the associated

diseases impose a considerable burden on personal/familial finances and the healthcare system. In fact, the cost of hypertension is projected as being more than $100 billion (14).

In the United States (U.S.), based on data collected in 2015 and reported by Centers for Disease Control and Prevention (CDC) and categorized using old (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) diagnostic criteria, approximately one in three adults were categorized as having hypertension with 6.4% college-aged adults (ages 18-24) categorized as having hypertension (4). National data collected by CDC also indicate that the incidence of hypertension increases with age, highlighting the need for early intervention and prevention, and that the prevalence of hypertension is higher among men and differs between racial/ethnic groups (4). There is an apparent absence of research regarding hypertension rates among college students in the U.S. However, research from overseas contradicts the popular notion that college students are at the peak of health, with the incidence of hypertension reportedly relatively low around 2-10% among students from Asia, Africa, and the Middle-East (2, 5, 8, 9). Moreover, similar to U.S. national data, the prevalence of hypertension was higher among male students (5, 9).

Existing research utilizing national U.S. data indicates that the change in diagnostic criteria, from the JNC7 to American College of Cardiology/American Heart Association (ACC/AHA) will increase the occurrence of hypertension among adults over 20 years old from 31.9% to 45.6% (11). Similarly, another study using national U.S. data reported that the prevalence of hypertension among 45-75 year olds would increase from 49.7% using the JNC8 to 63.0% using the ACC/AHA (10). Findings were mixed with respect to whether or not the changes may impact individuals differently based on age, sex, or race/ethnicity (10, 11). However, the impact of the change in diagnostic criteria on young adults, who are typically presumed to be in relatively good health, has yet to be examined. As such, given the pressure a sudden increase in hypertension among this population would place on individuals and society, it is important to understand the impact the change in diagnostic criteria has on the rate of hypertension in this population. The purpose of this study was to compare the prevalence of hypertension between the JNC7 and the ACC/AHA hypertension diagnostic criteria among college students. It is hypothesized that clinically meaningful changes in the prevalence of hypertension among college students will be observed when comparing the different diagnostic criteria.

METHODS

Participants
Five thousand nine hundred and eighty-six students, staff, and faculty at a large Northeastern University in the U.S. completed a pre-consultation questionnaire online prior to completing an objective fitness assessment between September 2015 and April 2018. Participants older than 25 years were excluded in order to exclude all staff, faculty, and more mature students. Forty-one participants older than 25 years of age were removed to allow analyses of only college-aged students. Analyses were conducted on the remaining 5,945 participants. All participants provided informed written consent, and trained technicians administered tests. The Pennsylvania State University Institutional Review Board approved this study, and research

was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science (12).

Protocol
Prior to the fitness assessment participants completed an electronic pre-test questionnaire (BSDI, Califon, NJ), which was linked to the fitness assessment data using an identification number.

Participants self-reported age and sex in the pre-consultation questionnaire. Before their visit to the facility, students were instructed to abstain from caffeine for eight hours, alcohol for 24 hours, smoking and food intake for two hours, and exercise for at least three hours. Blood pressure was the first measure taken for the fitness assessment. It was measured via auscultation by trained technicians using a Littmann II stethoscope and an appropriately sized ADC blood pressure cuff that was sized so that the bladder encircled 80% of the upper right arm. Prior to measurement, the subject sat for five minutes with their feet flat on the floor. Measurements were taken with the arm supported at heart level. Participants were categorized using JNC7 (6) and ACC/AHA (15) guidelines.

Statistical Analyses
Descriptive statistics were computed to characterize the sample. Independent samples t-tests examined differences in blood pressure between sexes. Chi-square tests for independence were used to examine differences in the categorization between the JNC7 and ACC/AHA hypertension guidelines. All analyses were run using SPSS 24.0 (IBM, Armonk, NY), with significance levels set at $p < .05$.

RESULTS

The mean age of participants was 21.30 ± 1.05 years, and the majority were men ($n = 3{,}599$, 60.5%). Based on data collected from similar populations at the same university participants were likely predominantly non-Hispanic white (16)

Statistically significant differences were found between men and women in relation to both systolic blood pressure (SBP) and diastolic blood pressure (DBP), with men found to have higher blood pressure in both cases. Men had significantly higher SBP (119.96 ± 9.39 vs. 113.47 ± 9.12, $p < .001$, $\eta^2 = .10$) and DPB (75.80 ± 8.09 vs. 72.40 ± 8.07, $p < .001$, $\eta^2 = .04$), so all subsequent analyses were separated by sex.

Normal hypertension categorization did not change in men (37.8%) or women (63.6%) between the JNC7 and ACC/AHA diagnostic criteria. However, the change in diagnostic thresholds had a significant impact on the number of men and women diagnosed as elevated or above.

A chi-square test for independence indicated a significant change in the categorization of hypertension among men when comparing the JNC7 and ACC/AHA guidelines, χ^2 (9, $n = 3{,}589$) $= 7{,}178$, $p < .001$, $\Phi_c = .816$ (Figure 1a). All men categorized as stage 1 using the JNC7 (7.4%) were categorized as stage 2 using the ACC/AHA. The biggest change was observed among men

categorized as pre-hypertension using the JNC7 (54.1%), most of whom (59.9%) were categorized as stage 1 hypertension under the ACC/AHA, increasing the prevalence of stage 1 hypertension from 7.4% using the JNC7 to 32.4% using the ACC/AHA Overall, the prevalence of hypertension among men increased from 8.2% to 40.3%.

A chi-square test for independence indicated a significant of change in the categorization of hypertension among women when comparing the JNC7 and ACC/AHA guidelines, χ^2 (9, n = 2,335) = 4,670, p < .001, Φ_c = .816 (Figure 1b). All women categorized as stage 1 using the JNC7 (2.2%) were categorized as stage 2 using the ACC/AHA. The biggest change was observed among women categorized as pre-hypertensive using the JNC7 (33.5%), most of whom (58.1%) were categorized as stage 1 using the ACC/AHA, increasing the prevalence of stage 1 hypertension from 2.2% using the JNC7 to 19.4% using the ACC/AHA. Overall, the prevalence of hypertension among women increased from 2.8% to 22.3%.
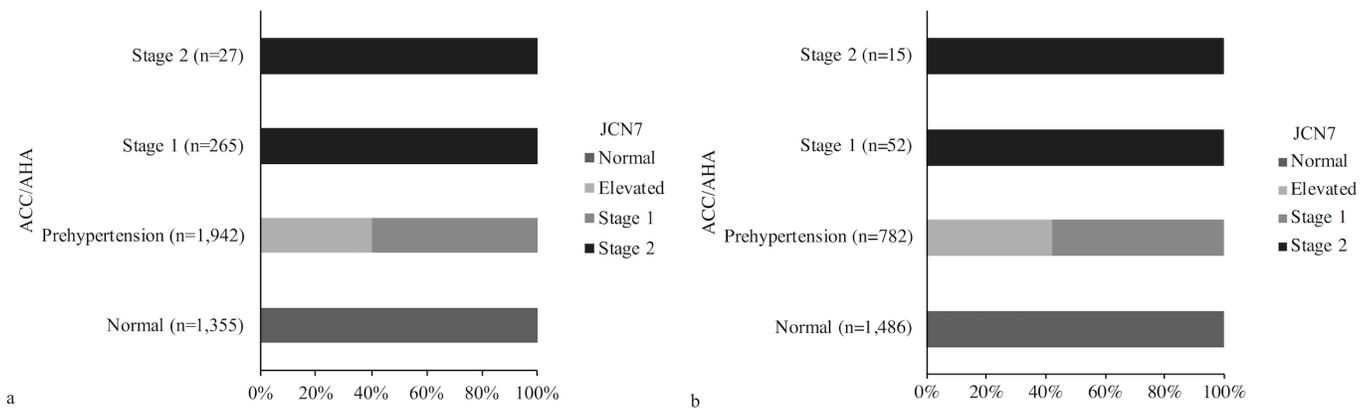
Figure 1. JNC7 vs. ACC/AHA hypertension categorization. a) represents men; b) represents women.

DISCUSSION

The change in guidelines had a significant impact on the prevalence of hypertension among college students. The biggest change was observed among those categorized as pre-hypertensive using the JNC7, among whom more than half were categorized as having stage 1 hypertension using the ACC/AHA. Ultimately the change in guidelines resulted in nearly five times as many men, and eight times as many women being categorized as having hypertension. This is a considerably larger relative increase in the prevalence in hypertension than that observed in more mature adults (10, 11). The prevalence of hypertension using the JNC7, was similar to that reported in other countries (2, 5, 8, 9), suggesting the impact of using the ACC/AHA criteria on college students in these countries would likely be similar at other predominantly non-Hispanic white institutions.

The findings of this study are concerning given the increased burden that a higher prevalence of hypertension will presumably place on the healthcare system. Such an increase in prevalence may increase pressure on medical professionals to have difficult conversations about lifestyle choices or increase rates of prescribing medicine if medical professionals do not have the time to have such conversations with patients. Non-pharmacological interventions can play an

important role in the treatment and prevention of hypertension both in conjunction with and independent from pharmacological therapy (7). Weight loss, improvement in dietary quality, and reduction in sodium intake, decreased alcohol consumption, and increased physical activity are examples of lifestyle changes medical professionals can either prescribe to patients or refer patients to specialists to obtain further advice. Aside from treatment of individuals identified has being hypertensive, societal level or policy changes targeting these behaviors could aid in both the treatment and prevention of hypertension (15). For example, a shift in college policies to provide equitable physical activity opportunities in order to promote physical activity could assist with both hypertension treatment and prevention.

This study is not without its limitations, namely generalizability due to the predominantly white relatively affluent sample. Thus, future researchers may want to consider replicating the study in more diverse populations with respect to race/ethnicity, socio-economic status, geographic location, and age, as well as assessing other contributing factors such as family health history, sedentary behavior, substance use, and mental health which may contribute to hypertension. In addition, blood pressure was measured only once. The wellness center will adopt the new American College of Sports Medicine protocol (1) in the Fall of 2019 following an update to the data management system.

Changes in hypertension diagnostic thresholds resulted in a significant increase in the prevalence of hypertension among college students, indicating that the changes achieved the intended goal of identifying at-risk individuals earlier. However, the capacity of the healthcare system to fulfill the aim of early intervention and/or prevention remains unknown. Regardless, there appears to be a clear need for prevention programs targeted at improving the lifestyle behaviors of college students to in order to benefit students themselves as well as society as a whole.

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