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Gender Differences in Hypertension and Hypertension Awareness Among Young Adults

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Abstract

Previous research has shown that men have higher levels of hypertension and lower levels of hypertension awareness than women, but it remains unclear if these differences emerge among young adults. Using the National Longitudinal Study of Adolescent to Adult Health (Add Health), this study examines gender differences in hypertension and hypertension awareness among U.S. young adults, with special focus on factors that may contribute to observed disparities (N = *14,497*). Our results show that the gender disparities in hypertension status were already evident among men and women in their twenties: women were far less likely to be hypertensive compared to men (12% vs. 27%). The results also reveal very low levels of hypertension awareness among young women (32% of hypertensive women were aware of their status) and even lower levels among men (25%). Finally, this study identifies key factors that contribute to these observed gender disparities. In particular, health care use, while not related to the actual hypertension status, fully explains the gender differences in hypertension awareness. The findings thus suggest that regular medical visits are critical for improving hypertension awareness among young adults and reducing gender disparities in cardiovascular health.

Hypertension is a leading risk factor for cardiovascular and cerebrovascular disease and mortality (Ezzati et al. 2008). Despite decades of public health education, hypertension awareness remains problematic, with only about two-thirds of adults and the elderly aware of their hypertension status (Ong et al. 2007) and known differences between men and women (Cutler et al. 2008; Hayes and Taler 1998; Sandberg and Ji 2012; Vitale et al. 2010). While hypertension prevalence is highest in older populations, almost 20 percent of young adults are hypertensive (Nguyen et al. 2011). Few studies, however, have examined gender differences in hypertension or hypertension awareness among young adults and the determinants of these differences.

Given that high hypertension prevalence and low hypertension awareness among U.S. men and women often originate in early adulthood, determining gender patterns in hypertension and hypertension awareness and what factors contribute to these patterns in this life stage is critical for improving hypertension control and reducing cardiovascular disease risk. Using data from the fourth wave of the National Longitudinal Study of Adolescent to Adult Health

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(Add Health), we examine gender differences in hypertension and hypertension awareness among young U.S. adults. In this study we have two research aims: (1) to document emerging gender disparities in hypertension among a sample of young adults and (2) to examine gender disparities in hypertension awareness.

Gender Differences in Hypertension and Hypertension Risk Factors

Rates of hypertension in the United States have increased or persisted over the last several decades both among the elderly and among young adults (Hajjar and Kotchen 2003). Several studies have shown that men younger than 65 consistently have higher levels of hypertension compared to women of the same age group. This difference is particularly pronounced in early adulthood—for instance, one study found that among 18- to 29-year-old white adults, just 1.5 percent of women but over 5 percent of men reported hypertension (for black women and men, the proportions were 4% and 10%, respectively) (Cutler et al. 2008).

Observed gender differences in hypertension, which exist in human and animal populations, are due to both biological and behavioral factors (Sandberg and Ji 2012). The biological factors include sex hormones, chromosomal differences, and other biological sex differences that are protective against hypertension in women (Sandberg and Ji 2012; Vitale et al. 2010; Vitale, Mendelsohn, and Rosano 2009). These biological factors become evident during adolescence and persist through adulthood until women reach menopause, at which point gender differences in hypertension become correspondingly smaller or nonexistent.

Behavioral risk factors for hypertension include high body mass index (BMI) (Brown et al. 2000; Ford and Cooper 1991; Hu et al. 2004) and, to a lesser degree, smoking (Halimi et al. 2002; Niskanen et al. 2004) and low physical activity (Haapanen et al. 1997; Hu et al. 2004). Men and women differ in these key behavioral risk factors in somewhat complex ways. A recent study found that men and women had the same mean BMI of 28.7 (Ogden et al. 2012). BMI distribution varies by gender, however, with women having a higher prevalence of obesity than men (Flegal et al. 2010), especially higher-grade obesity (Flegal et al. 2012). On the other hand, men have a higher prevalence of overweight than women (Flegal et al. 2010; Flegal et al. 2012). Smoking prevalence is lower among women than men, although this gender difference has narrowed over the previous decades (Agaku, King, and Dube 2013; Waldron 1991). In contrast, physical activity tends to be higher among men than women (Haskell et al. 2007; National Center for Health Statistics [NCHS] 2012). Taken together, these behavioral differences suggest that competing behavioral factors (e.g., obesity, physical activity) may differentially close the gender gap in hypertension, while others (e.g., smoking) may increase the disparity.

Hypertension Awareness

The ability to correctly document gender differences in hypertension is contingent on access to accurate information on individuals' blood pressure. Researchers examining hypertension typically rely on self-reports because only a small number of data sources include biomarker collection that includes blood pressure measurement. For the general population, the accuracy of self-reported morbidities in general is a known potential problem in measuring

population health (Ferraro and Farmer 1999; Giles et al. 1995; Goldman et al. 2003; McAdams, Van Dam, and Hu 2007; Zajacova et al. 2010). Studies that have compared self-reported hypertension to objective measures of systolic and diastolic blood pressure have found relatively low levels of hypertension awareness among the general U.S. population (Bowlin et al. 1993; Cutler et al. 2008; Giles et al. 1995; Ostchega et al. 2008). For example, studies from the early 1990s have found hypertension awareness to be as low as 43 percent (Bowlin et al. 1993). Using more recent data from the 2005–06 wave of the National Health and Nutrition Examination Survey (NHANES), Ostchega and colleagues (2008) showed that only 78 percent of hypertensive adults—as determined by measured blood pressure—were aware of their hypertensive status. There have not been major changes in the increasingly healthy lifestyles in the United States over the past decade and a half; thus, the improvements in hypertension awareness are most likely due to increases in the availability of screenings in nonclinical settings as well as improvements in hypertension education (Chobanian 2010). Another reason for the differences in hypertension awareness rates could pertain to the average age of the respondents. In general, older respondents tend to be more aware of their hypertensive status, while young adults tend to have particularly low hypertension awareness (Egan, Zhao, and Axon 2010). Because younger individuals tend to be healthier, they are less likely to see doctors on a regular basis, decreasing the likelihood that they will have accurate and up-to-date knowledge of their blood pressure status.

Few studies have examined the gender differences in hypertension awareness. The existing research presents mixed results; some work has found that women have higher levels of hypertension awareness than men (Egan, Zhao, and Axon 2010; Hajjar and Kotchen 2003), but other work has suggested that hypertension awareness is higher among men than women (Guo et al. 2012). From the perspective of our target population, younger adults tend to have particularly low hypertension awareness (Egan, Zhao, and Axon 2010).

Health Care Use, Hypertension, and Gender: Conceptual Framework

In addition to the biological and behavioral risk factors, there is an open debate regarding the importance of health care—whether access to care or use of care—for hypertension, as well as regarding population health disparities in general. This issue may be particularly salient among young adults, who are more likely to be uninsured and to make fewer doctor visits, especially compared to older adults. Some work supports the health commodity hypothesis, which posits that health insurance and access to health care in part explain health disparities.

Among young adults (ages 19–24), uninsured persons are more likely to have no contact with a physician or no usual source of care, to delay or miss a medical appointment, and to not fill a prescription because of cost (Callahan and Cooper 2005). Thus, persons who do not have health insurance are less likely to receive preventive care (Freeman et al. 2008; Hadley 2003), including cardiovascular preventive care (Lurie et al. 1986; Ross, Bradley, and Busch 2006). More recent research has documented that health care use is an important predictor of hypertension diagnosis and treatment (Egan et al. 2011; Egan et al. 2013; Appleton et al. 2013; Khatib et al. 2014).

Alternatively, the ineffectual commodity hypothesis argues that health insurance is not the primary pathway linking sociodemographic characteristics to health outcomes like hypertension, but rather that health inequalities are generated and perpetuated outside the health care system (Ross and Mirowsky 2000). The biological and behavioral risk factors for hypertension noted previously likely influence the cardiovascular pathologies resulting in hypertension regardless of medical contact. Among adolescents, research has shown that even with regular care, there are often delays in hypertension diagnosis (Johnson et al. 2014)—that is, having health insurance or even receiving care may not automatically result in correct diagnosis and treatment of conditions like hypertension. Furthermore, several studies have shown that access to health care does not guarantee that that there will not be differences in the type or quality of treatment or insurance coverage status (Bernheim et al. 2008; Lutfey and Freese 2005).

The importance of health care access and utilization is critical for our question because of the large gender differences in health care use. These differences emerge in adolescence and persist throughout adulthood (Courtenay 2000; Marcell et al. 2002; Williams 2003). This may be due in part to the fact that women are more likely to see health care providers for birth control and regular gynecological services (Bertakis et al. 2000), increasing the likelihood that during these screenings they will have their blood pressure taken (Schmittdiel et al. 2011). Gender differences in health care use may also emerge as a result of heteronormative masculinity scripts that dictate that men should be tough and not seek help in times of need (Jeffries and Grogan 2012; Springer and Mouzon 2011; Noone and Stephens 2008). These gender norms have important consequences for men's health and have been shown to decrease men's use of health care services, including preventative health care services (Courtenay 2000; Springer and Mouzon 2011), cancer treatments (Wenger and Oliffe 2014; Hajdarevic et al. 2011), and mental health care (Johnson et al. 2012).

Men's lower use of heath care, therefore, may result in higher rates of hypertension if the health commodity hypothesis holds. However, independent of health care's effect on actual hypertension, the gender patterns in health care use, especially among young adults, results in a lower probability that men will visit doctors, have their blood pressure taken, and thus be aware of their hypertension status.

Study Aims

This study pursues two main research questions. First, we examine whether there are gender differences in hypertension using objectively measured reports of hypertension as well as self-reports. We also examine the role of key known hypertension risk factors—in particular obesity and health care utilization—to explain the observed gender differences. Second, we focus on young adults with measured hypertension and examine gender differences in hypertension awareness, as well as what factors contribute to observed differences.

Methods

Sample

This study uses data from the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a nationally representative sample of U.S. adolescents drawn from 80 high schools and 52 middle schools (Harris et al. 2009). Wave IV of the Add Health survey, collected between 2007 and 2008, located 92.5 percent of the original sample and interviewed 80.3 percent of the eligible respondents, whose ages ranged from 24 to 34 years old. Our sample is restricted to respondents in Wave IV with valid population weights (N = 14,800). An additional 303 respondents who did not have valid self-reported and measured hypertension information were excluded from our study, resulting in a final sample size of 14,497 respondents.

Measures

Gender, the key predictor, was coded as a binary variable, with 1 being female and 0 being male (referent). *Measured hypertension* was ascertained by trained interviewers in three readings of systolic and diastolic blood pressure at the time of interview. Systolic and diastolic scores were constructed as the mean scores from the second and third measurements, respectively, and coded as normotensive (<140 systolic blood pressure [SBP] and < 90 diastolic blood pressure [DBP]) (referent) or hypertensive (≥140 SBP or ≥90 DBP). *Self-reported hypertension* was derived from a survey item that asked respondents to identify if a "doctor, nurse, or other health care provider ever told you [you] have or had hypertension." *Hypertension awareness* (sensitivity) was included as an additional measure defined only for those with measured hypertension. These respondents were coded as hypertensive aware (1) if they also self-reported that they were hypertensive and as not aware (0) if they did not self-report being hypertensive. We also present the means for hypertension specificity in Table 1. Specificity is the percentage of normotensive respondents who correctly reported not having been diagnosed as hypertensive (coded 1) compared to normotensive respondents who reported having been diagnosed as hypertensive (coded 0).

Behavioral Risk Factors—Tobacco use measured whether respondents were current regular smokers, operationalized as at least one cigarette a day for 30 days; former regular smokers; or never regular smokers (referent). Alcohol use—specifically binge drinking—which is common in this age category, was evaluated with the following question: "During the past 12 months, on how many days did you drink 5 or more (if male) or 4 or more (if female) drinks in a row?" The responses were coded as binge drinking zero to once a month (referent), two to eight times in a month, or three days per week or more. Drug use was coded as a dichotomous measure that captures whether in the last 12 months respondents reported using any controlled substances (sedatives, tranquilizers, stimulants, prescribed painkillers, steroids, cocaine, or marijuana) versus no substance use in the last 12 months (referent).

Anthropometric measures of height and weight were taken at the time of interview and used to calculate BMI for respondents. We used the World Health Organization (WHO) obesity

classifications to measure whether respondents were underweight (BMI < 18), healthy weight (BMI ≥18 and <25), overweight (BMI ≥25 and <30), obese class I (BMI ≥30 and <35), obese class II (BMI ≥35 and <40), or obese class III (BMI ≥ 40) (World Health Organization 2000).

Physical activity was coded using a series of questions that asked respondents how many times in the past week they had engaged in a variety of physical activities such as bicycling, skateboarding, hiking, rollerblading, team sports, aerobics, individual sports, weight training, or walking for exercise. Respondents who reported zero bouts of physical activity in the last seven days were coded as having a "low" level of physical activity, respondents who reported one to six bouts of physical activity in the past seven days were coded as "medium" activity, and respondents who reported seven or more bouts of physical activity in the past seven days were coded as "high" activity (referent).

Health Care Access and Use—Insurance coverage was coded as private insurance (referent), public insurance, or no insurance. Health care use was derived from a measure that asked respondents, "How long ago did you last have a routine check-up?" Respondents were categorized as having had a check-up in the past 6 months (referent), the past 7 to 12 months, the past 12 to 23 months, the past 24 or more months, or never/don't know.

Demographic Covariates—We also controlled for age, race/ethnicity, and marital status. Age was used as a continuous variable that ranged from 24 to 34 years of age. Race/ethnicity was coded non-Hispanic white (referent), non-Hispanic black, Hispanic, non-Hispanic Asian, or other. Marital status was dichotomized as ever having been married versus never been married (referent).

Analytical Strategy

We first present descriptive statistics for all study variables for the total population and stratified by gender, as well as the results of F-tests performed to test for significant differences in means by gender. We then present the results from logistic regressions examining gender disparities in both objective measures of hypertension and self-reported hypertension. We use models to examine if behavioral risk factors, insurance coverage, and health care use affect gender disparities in both outcomes. Last, we present the results from a series of logistic regressions examining gender differences in hypertension awareness among hypertensive respondents and use models to examine the effect of behavioral risk factors, health care access, and health care use on gender differences in hypertension.

Sensitivity analysis removing hypotensive (<100 SBP or <60 DBP) respondents from the sample showed no significant difference in the odds ratios for either men or women; therefore these individuals were included in the referent category. Following the recommendation of Tobin et al. (2005), we adjusted for hypertension treatment by adding 10 mmHg to the SBP of respondents who reported being on hypertensive medication; however, results from analyses with and without this adjustment, and from analyses excluding respondents taking hypertensive medication, were similar. All analyses were conducted using the "svy" commands in Stata 12.0 to account for Add Health's complex sampling frame.

Results

Descriptive Statistics

Table 1 presents the descriptive statistics for all study variables for the total population and by gender. The results show that women were more likely to have graduated from college and to have been married compared to men. Women were also more likely to be at a "healthy" weight compared to men (35% of women vs. 29% of men) and less likely to be current smokers (22% of women vs. 27% of men) but were less likely to report "high" levels of physical activity (36% of women vs. 46% of men). Related to health care access and use, 18 percent of women reported having no health insurance compared to 26 percent of men. Women, however, were more likely to have recently seen a doctor: 46 percent of women reported having seen a medical professional in the past six months compared to just 30 percent of men. Moreover, just 15 percent of women reported that it had been two years or longer since they last saw a medical professional compared to 32 percent of men.

The results show stark differences in both measured and self-reported hypertension, as well as hypertension awareness, by gender. Nine percent of women self-reported being told by a medical professional that they were hypertensive compared to 12 percent of men; however, only 12 percent of women were hypertensive compared to almost 30 percent of men. In the whole sample, 27 percent of hypertensive respondents were aware of their hypertensive status, but awareness also varied by gender: 32 percent of hypertensive women were aware of their status compared to 25 percent of hypertensive men. The specificity means show that among persons who were normotensive, 84 percent correctly reported their normotensive status. Like the results for hypertension awareness, women were more likely to accurately report their normotensive blood pressure status.

Gender Disparities in Objective and Self-Reported Hypertension

Table 2 presents the results from multivariate regressions. Model 1 controls for sociodemographic characteristics, Model 2 adds controls for behavioral risk factors, and Model 3 adds controls for insurance and health care use. Panel A presents the results for measured hypertension. The results in Model 1 show that women are significantly less likely to be hypertensive than men (OR = 0.37, $p < .001$). Models 2 and 3 add controls for hypertension risk factors and health care use. These models show that BMI is significantly associated with measured hypertension, as is current smoking, but that gender disparities persist across all models.

Panel B shows gender disparities in self-reported hypertension. Similar to the results for objective measures, women are less likely to report being told by a medical professional that they are hypertensive. Given that they are less likely to *be* hypertensive, this is a logical extension of the previous model; however, the magnitude of the self-reported disparity is much smaller than the objectively-measured disparity. Being overweight or obese is associated with an increased risk of self-reported hypertension, but these measures do not affect the gender disparity. Interestingly, when controls for insurance and health care use are added in Model 3, the gender disparity actually increases from an odds ratio of 0.63 to an odds ratio of 0.53. This suppression effect suggests that the disparity in hypertension

awareness actually *increases* if we take into account gender differences in health care use. Health care use is not related to objective measures of hypertension in the previous model but is strongly related to whether respondents *know* that they are hypertensive.

Hypertension Awareness

Table 3 presents the results from multivariate logistic regressions examining gender disparities in hypertension awareness among respondents who are hypertensive. Model 1 shows that women are significantly more likely to be aware of their hypertensive status compared to men (OR = 1.35, $p < .05$). The inclusion of behavioral risk factors in Model 2 reduces the disparity such that the gender disparity is only marginally significant (OR = 1.24, $p < .10$). In Model 3, which includes controls for insurance and health care use, there is no difference in hypertension awareness between men and women. While insurance coverage is not statistically associated with hypertension awareness, respondents who have not seen a medical professional in the previous six months are significantly and substantially less likely to know they are hypertensive.

Discussion

In this study, we examined how gender differences in hypertension emerge in early adulthood. Our results provide new insights into the origins of gender disparities in both hypertension status and hypertension awareness in several ways. First, we found that the gender disparities in hypertension status observed during adulthood are already evident when men and women are in their twenties, with women far less likely to be hypertensive compared to men. Second, the results reveal that gender influences not only whether individuals are hypertensive, but also whether they are aware of their hypertensive status: women were 35 percent more likely than men to be aware of their hypertensive status. And third, we identified key factors that contribute to these observed gender disparities. In particular, health care use, while not related to the actual hypertension status, fully explains the gender differences in hypertension awareness. The findings thus suggest that regular medical visits are critical for improving hypertension awareness among young adults and reducing gender disparities in this age group.

Gender Differences in Measured and Self-Reported Hypertension

Our results using objectively measured blood pressure show that young women are significantly and substantially less likely to be hypertensive than men, with 27 percent of men in their late twenties being hypertensive compared to just 12 percent of women overall. We hypothesized that observed gender disparities in hypertension may be in part due to differences in behavioral risk factors, such as BMI, smoking, and physical activity. However, taking these factors into account had virtually no effect on the gender disparity in hypertension. This suggests that the gender disparity among young adults may be in part due to biological sex differences, but more research is needed to investigate other behavioral factors that may explain this early disparity. Moreover, health insurance and health care utilization had no effect on the risk of hypertension or the gender disparity in measured hypertension.

In addition to measured hypertension, we also examined how men and women differ in self-reports of hypertension and found that in this young adult sample, the gender disparity is much smaller for self-reported measures of hypertension than for objective ones, primarily because men are less likely than women to correctly report their hypertensive status. An important implication of this discrepancy is that research that relies on self-reports of hypertension most likely underestimates the gender disparity. Moreover, how recently a respondent had visited a medical professional, which was not related to measured hypertension, was strongly associated with self-reported hypertension. Taking this information into account *increased* the gender disparity in self-reported hypertension. Because women are more likely to use health care services, and therefore know about their hypertensive status, once gender differences in health care use are adjusted for, the gender disparity in self-reported hypertension looks similar to the gender disparity in measured hypertension. These results therefore lend partial support to both the ineffectual commodity and health commodity hypotheses: in line with the ineffectual commodity hypothesis, disparities in measured hypertension are largely unrelated to access to or use of health care. However, in line with the health commodity hypothesis, health care use influences whether respondents are aware of their hypertensive status, which is critical for treating and controlling hypertension.

One of the two major explanatory pathways for gender differences in hypertension is health behaviors. As briefly reviewed previously, obesity, exercise, and smoking are among the known risk factors for hypertension. At the same time, these behaviors are patterned in complex ways among men and women—specifically, men tend to have higher rates of smoking and overweight (BMI ≥ 25 and < 30), while women tend to have higher rates of physical inactivity and obesity (BMI ≥ 30). We found that both obesity and current smoking have highly significant independent effects on hypertensive status. However, these risk factors have very modest effects on explaining the gender differences in hypertension, suggesting possibly that either their effects cancel out (higher rates of obesity in women and current smoking in men), or, in contrast, that the gender differences in these behaviors are not large enough to explain the hypertension differences. The latter explanation would imply that other health behavioral, biological, or possibly social-structural or other pathways explain the gender differences better.

Gender Differences in Hypertension Awareness: The Impact of Health Care Use on Observed Disparities

Overall, the results reveal a complex and unsettling picture of hypertension awareness in the United States. While the level of hypertension awareness in the general population has improved (Egan, Zhao, and Axon 2010), awareness levels remain low among young adults, particularly among young men. Our results show that only 32 percent of hypertensive women and 25 percent of hypertensive men are aware of their hypertension. These estimates are much lower than previous estimates for older age groups, which ranged from 45 percent to 60 percent of men and 60 percent to 75 percent of women ages 18 to 49 (Cutler et al. 2008) and reached 80 percent among middle-aged and older adults (Egan, Zhao, and Axon 2010). Our much lower levels of hypertension awareness are likely due in part to the young

ages of respondents in our sample, for which the mean age is 28 years and respondents are all younger than 34 years.

The gender differences in hypertension awareness may also be larger in our study than in previous research because of the overall lower use of health care services among young adults compared to older populations. While many young women regularly interact with health care professionals to access birth control and for gynecological health, young men are not faced with similar reasons to visit health care providers. Moreover, gender norms about asking for help and seeking care reduce the likelihood that even in times of need, they will seek out health care. To be sure, several studies have demonstrated that men use health care services at a much lower rate than women (Courtenay 2000; Springer and Mouzon 2011), particularly at younger ages (Marcell et al. 2002). The result that men are much more likely to be hypertensive than women, even after controlling for BMI, smoking, and physical activity, coupled with the fact that they are less likely to be aware of their hypertension, suggests that increasing men's use of health care services may be critical for reducing gender disparities in hypertension and improving population-level health. Thus, while in line with the ineffectual commodity hypothesis, health care use does not create gender disparities in hypertension. The results of our study also support the health commodity hypothesis insofar as they reveal that seeing a doctor is critical for being aware of, and therefore taking preventative steps to reduce, blood pressure.

In contrast to the impact of risk factors on actual hypertension, smoking and exercise did not play a major role in our study in determining hypertension awareness, and obesity had only a minor impact: obese young adults were more likely to be aware of their hypertensive status than their leaner hypertensive counterparts. In addition, taking into account women's higher obesity rates attenuated the gender disparity in awareness somewhat, suggesting that some part of women's higher awareness may operate via their greater probability of being obese, indicated that it may be obesity that increases awareness.

The results of this study may be limited by the operationalization of hypertension awareness. The correct reporting of diagnosed hypertension requires that the person knows that he or she is hypertensive and is also willing to report that status. Some unknown proportion of underreporting could occur among people who have been told they are hypertensive and may even remember this, but may be unwilling to report it to the interviewers. Another limitation might pertain to the differences between the measured hypertension prevalence in the Add Health data and the prevalence for comparable age groups found in NHANES (Nguyen et al. 2011). Add Health's higher prevalence of measured hypertension may reflect differences in sampling or measurement of blood pressure.

Future research should continue to investigate if there are behavioral factors that contribute to gender differences in hypertension in order to understand young men's elevated risk of hypertension beyond biological factors. Given that 19 percent of our sample was hypertensive and only 28 percent reported having been diagnosed as hypertensive, these results are cause for concern. Indeed, a large segment of the young adult population is unaware of their hypertensive status and therefore most likely not engaging in the appropriate behavioral and medical behaviors to treat and control their hypertension and

reduce their risk of cardiovascular disease. Given that hypertension and cardiovascular disease risk increases over time, interventions that target and treat the young adult population are critical for improving population health. The results presented in this study also emphasize the role of health care use for improving hypertension awareness, particularly among men, and thereby potentially improving hypertension control. Given the extremely low levels of hypertension awareness among young adults, public health policymakers should focus on interventions to improve hypertension awareness among young adults, both men and women.

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Table 1

Descriptive statistics for the total population and stratified by gender

	Total population N = 14,497	Women N = 7,697	Men N = 6,800
Women	49.23 (0.61)		
Men	50.77 (0.61)		
Education			
Less than high school	9.29 (0.76)	7.84 (0.78) ***	10.69 (0.90)
High school graduate	17.81 (0.91)	14.36 (0.84) ***	21.16 (1.21)
Some college	42.87 (0.88)	44.23 (1.06) *	41.53 (1.15)
College graduate	29.97 (1.65)	33.49 (1.76) ***	26.55 (1.78)
Race/ethnicity (%)			
Non-Hispanic white	67.19 (2.91)	67.19 (2.96)	67.20 (2.95)
Non-Hispanic black	15.62 (2.09)	15.92 (2.11)	15.34 (2.15)
Hispanic	12.06 (1.72)	12.02 (1.76)	12.09 (1.76)
Asian	3.17 (0.74)	3.05 (0.78)	3.29 (0.76)
Other race	1.95 (0.27)	1.82 (0.29)	2.08 (0.32)
Age (M)	28.84 (0.12)	28.73 (0.12) ***	28.94 (0.12)
Married, ever (%)	49.98 (1.37)	55.08 (1.52) ***	45.05 (1.48)
BMI (%)			
Under	1.42 (0.14)	2.08 (0.21) ***	0.78 (0.16)
Healthy	31.76 (0.76)	34.58 (1.06) ***	29.03 (0.89)
Overweight	29.75 (0.60)	24.89 (0.74) ***	34.47 (0.84)
Obese 1	18.56 (0.46)	16.84 (0.74) **	20.24 (0.65)
Obese 2	9.50 (0.38)	10.69 (0.56) ***	8.33 (0.48)
Obese 3	8.19 (0.40)	10.03 (0.56) ***	6.40 (0.43)
Smoking status (%)			
Never smoker	52.32 (1.17)	55.68 (1.45)	49.05 (1.18)
Former	23.36 (0.60)	22.67 (0.79)	24.02 (0.71)
Current	24.32 (0.96)	21.65 (1.12) ***	26.92 (1.04)
Physical activity level (%)			
Low	14.55 (0.49)	16.50 (0.71) ***	12.67 (0.63)
Medium	44.34 (0.63)	47.82 (0.84) ***	40.96 (0.92)
High	40.92 (0.73)	35.47 (1.00) ***	46.21 (1.00)
Insurance coverage (%)			
No insurance	22.16 (0.73)	17.82 (0.76) ***	26.36 (0.96)
Public insurance	8.16 (0.71)	12.08 (0.90) ***	4.37 (0.65)
Private insurance	69.51 (1.10)	70.00 (1.21)	69.07 (1.25)
Last regular medical			

	Total population N = 14,497	Women N = 7,697	Men N = 6,800
check-up (%)			
Lt 6 months	37.94 (0.67)	45.95 (0.86) ***	30.18 (0.78)
6 to 12 months ago	21.28 (0.53)	24.68 (0.78) ***	17.98 (0.67)
1 to 2 yrs	14.56 (0.40)	12.87 (0.56) ***	16.19 (0.70)
2 yrs or more	23.82 (0.72)	15.27 (0.71) ***	32.10 (1.04)
Unknown	2.41 (0.17)	1.23 (0.22) ***	3.45 (0.29)
Hypertensive (%)	19.78 (0.51)	11.91 (0.60) ***	27.42 (0.81)
Self-reported hypertension (%)	10.94 (0.41)	9.00 (0.51) ***	12.82 (0.65)
Hypertension awareness (Sensitivity) [a]	27.49 (1.18)	32.63 (1.75) ***	25.32 (1.62)
Normotensive awareness (Specificity) [b]	83.89 (0.49)	91.18 (0.52) ***	76.51 (0.81)

Notes: Source = Wave IV National Longitudinal Study of Adolescent to Adult Health.

† p ≤ .10;

* p ≤ .05;

** p ≤ .01;

*** p ≤ .001.

[a] Sample size for hypertension awareness is 2,769.

[b] Sample size for specificity is 12,978.

Table 2

Odds ratios for gender differences in both objectively measured and self-reported hypertension

	Objective measures of hypertension			Self-reported hypertensive diagnosis		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Female	0.37 (0.33, 0.43)***	0.34 (0.30, 0.40)***	0.35 (0.30, 0.40)***	0.69 (0.58, 0.82)***	0.63 (0.53, 0.75)***	0.53 (0.44, 0.64)***
Education (College grad or more)						
Less than high school	1.27 (1.04, 1.56)*	1.07 (0.86, 1.33)	1.07 (0.85, 1.34)	1.44 (1.08, 1.91)*	1.29 (0.94, 1.76)	1.23 (0.88, 1.71)
High school graduate	1.23 (1.02, 1.49)*	1.00 (0.81, 1.24)	1.00 (0.81, 1.24)	1.37 (1.07, 1.75)*	1.13 (0.87, 1.47)	1.12 (0.86, 1.47)
Some college	1.17 (1.01, 1.36)*	0.97 (0.83, 1.14)	0.97 (0.82, 1.14)	1.34 (1.10, 1.63)**	1.14 (0.91, 1.42)	1.10 (0.88, 1.37)
Race/ethnicity (Non-Hispanic white)						
Non-Hispanic black	1.08 (0.94, 1.24)	1.02 (0.90, 1.17)	1.02 (0.90, 1.17)	1.39 (1.17, 1.65)***	1.23 (1.03, 1.48)*	1.13 (0.94, 1.35)
Hispanic	0.91 (0.74, 1.12)	0.87 (0.69, 1.08)	0.86 (0.69, 1.08)	0.99 (0.73, 1.34)	0.91 (0.87, 1.64)	0.88 (0.65, 1.21)
Asian	1.13 (0.85, 1.49)	1.24 (0.92, 1.68)	1.23 (0.92, 1.69)	1.08 (0.62, 1.77)	1.19 (0.87, 1.64)	1.21 (0.89, 1.65)
Other race	1.28 (0.83, 1.96)	1.24 (0.83, 1.85)	1.28 (0.83, 1.86)	1.05 (0.62, 1.77)	1.01 (0.63, 1.62)	1.02 (0.65, 1.59)
Age	1.09 (1.05, 1.13)***	1.08 (1.05, 1.12)***	1.08 (1.05, 1.12)***	1.04 (1.00, 1.09)	1.04 (0.99, 1.08)	1.03 (0.98, 1.08)
Married, ever	0.91 (0.80, 1.03)	0.87 (0.77, 0.99)	0.88 (0.77, 0.99)*	1.04 (0.88, 1.21)	1.00 (0.85, 1.18)	0.96 (0.82, 1.13)
BMI (Healthy)						
Underweight		0.65 (0.34, 1.27)	0.66 (0.34, 1.28)		0.71 (0.27, 1.88)	0.69 (0.26, 1.83)
Overweight		1.78 (1.47, 2.14)***	1.97 (1.48, 2.15)***		1.59 (1.27, 2.01)***	1.59 (1.26, 2.00)***
Obese 1		2.67 (2.19, 3.25)***	3.02 (2.19, 3.26)***		2.53 (2.02, 3.18)***	2.53 (2.01, 3.18)***
Obese 2		3.61 (2.86, 4.55)***	3.42 (2.86, 4.55)***		3.62 (2.71, 4.83)***	3.66 (2.74, 4.89)***
Obese 3		5.30 (4.22, 6.65)***	5.64 (4.23, 6.67)***		5.84 (4.49, 7.61)***	5.86 (4.49, 7.63)***
Smoking status (Never regular smoker)						
Former smoker		1.06 (0.91, 1.24)	1.06 (0.90, 1.16)		0.93 (0.77, 1.13)	0.94 (0.78, 1.15)
Current smoker		1.24 (1.06, 1.45)**	1.23 (1.05, 1.43)**		0.98 (0.81, 1.17)	1.03 (0.86, 1.23)
Physical activity level (High)						
Low		1.09 (0.93, 1.29)	1.09 (0.93, 1.29)		1.18 (0.95, 1.47)	1.22 (0.98, 1.52)†

	Objective measures of hypertension			Self-reported hypertensive diagnosis		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Medium		1.02 (0.91, 1.15)	1.03 (0.91, 1.16)		1.01 (0.85, 1.19)	1.04 (0.88, 1.23)
Insurance coverage (Private insurance)						
No insurance			1.07 (0.91, 1.26)			0.94 (0.78, 1.14)
Public insurance			0.90 (0.67, 1.20)			1.13 (0.97, 1.77) †
Last regular medical check-up (Less than 6 months ago)						
6 to 12 months ago			0.95 (0.78, 1.16)			0.65 (0.52, 0.82) ***
1 to 2 years			0.99 (0.84, 1.18)			0.57 (0.45, 0.73) ***
2 yrs or more			0.96 (0.81, 1.13)			0.41 (0.33, 0.50) ***
Unknown/never			0.85 (0.59, 1.22)			0.45 (0.25, 0.80) **

Notes: Source = Wave IV National Longitudinal Study of Adolescent to Adult Health; N=14,497.

† P ≤ .10;

* p ≤ .05;

** p ≤ .01;

*** p ≤ .001.

Table 3

Odds ratios for gender disparities in hypertension awareness

	Hypertension awareness		
	Model 1	**Model 2**	**Model 3**
Female	1.35 (1.05, 1.73)*	1.24 (0.97, 1.61)†	1.02 (0.78, 1.35)
Education (College grad or more)			
Less than high school	0.98 (0.60, 1.59)	0.97 (0.57, 1.65)	1.04 (0.61, 1.77)
High school graduate	0.92 (0.63, 1.34)	0.89 (0.59, 1.33)	0.93 (0.61, 1.43)
Some college	1.27 (0.93, 1.74)	1.20 (0.86, 1.67)	1.21 (0.86, 1.71)
Race/ethnicity (White)			
Non-Hispanic black	1.43 (1.08, 1.90)*	1.32 (0.97, 1.78)	1.19 (0.87, 1.65)
Hispanic	1.13 (0.76, 1.69)	1.08 (0.69, 1.67)	1.06 (0.69, 1.65)
Asian	1.15 (0.73, 1.81)	1.23 (0.77, 1.97)	1.23 (0.78, 2.76)
Other race	1.52 (0.80, 2.87)	1.37 (0.72, 2.64)	1.46 (0.78, 2.76)
Age	1.00 (0.94, 1.07)	1.00 (0.93, 1.07)	1.01 (0.94, 1.08)
Married, ever	1.30 (1.04, 1.64)*	1.24 (0.98, 1.57)†	1.15 (0.90, 1.48)
BMI (Healthy)			
Underweight		0.81 (0.16, 4.23)	0.62 (0.09, 4.17)
Overweight		1.06 (0.71, 1.58)	1.04 (0.70, 1.54)
Obese 1		1.42 (0.97, 2.08)†	1.43 (0.96, 2.13)†
Obese 2		1.67 (1.12, 2.50)*	1.61 (1.05, 2.47)*
Obese 3		2.56 (1.66, 3.94)***	2.56 (1.63, 4.00)***
Smoking status (Never regular smoker)			
Former smoker		0.95 (0.71, 1.27)	0.98 (0.71, 1.33)
Current smoker		0.88 (0.66, 1.18)	0.96 (0.72, 1.28)
Physical activity level (High)			
Low		1.14 (0.84, 1.57)	1.27 (0.93, 1.74)
Medium		1.01 (0.66, 1.18)	1.04 (0.79, 1.37)
Insurance coverage (Private insurance)			
No insurance			0.88 (0.65, 1.20)
Public insurance			1.22 (0.76, 1.96)
Last regular medical check-up (Less than 6 months ago)			
6 to 12 months ago			0.64 (0.46, 0.88)**
1 to 2 years			0.52 (0.37, 0.73)***
2 yrs or more			0.31 (0.23, 0.43)***
Unknown/never			0.25 (0.09, 0.66)**

Notes: Source = Wave IV National Longitudinal Study of Adolescent to Adult Health.

N = 2,769.

† p ≤ .10;

* p ≤ .05;

** p ≤ .01;

*** p ≤ .001.