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Research Article

The Contributions of Hypertension Diagnosis and Blood Pressure Control to Subjective Life Expectancy in a Representative Sample of Older U.S. Adults

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Abstract

Objectives: High blood pressure (BP) or hypertension, a major risk factor for death and disease, is pervasive among older adults. While reducing BP to targeted levels can prevent adverse outcomes, rates of successful BP control remain suboptimal, and it is unclear whether older adults recognize its proven benefits. The current study sheds light on older adults' beliefs about the consequences of hypertension and benefits of BP control by examining how their self-reports of hypertension diagnosis and BP control, as well as measured BP, contribute to subjective life expectancy (SLE), their perceived probability of surviving to a target age.

Methods: In a representative sample of U.S. adults aged 50–89 from the 2006–2014 Health and Retirement Study (n = 18,979 respondents), we analyze SLE using generalized linear regression.

Results: Diagnosed hypertension is associated with lower SLE, regardless of measured BP. Among diagnosed hypertensives, those who self-report controlled BP expect to live longer than those who do not. Finally, about 1 in 10 older adults have high measured BP but have never been diagnosed with hypertension, and most diagnosed hypertensives with uncontrolled measured BP self-report their BP as controlled.

Discussion: Older adults appear to recognize the harmful effects of hypertension and the benefits of BP control, but often lack knowledge of their own hypertension and BP control statuses. Health communications should continue to stress the value of BP control, although improvements may require increased hypertension awareness and BP monitoring.

Keywords: Biomarkers, Blood pressure monitoring, Health beliefs, Hypertension awareness, Subjective survival expectations

A clear majority of older adults in the United States has high blood pressure (BP) or hypertension (Fryar et al., 2017; Ostchega et al., 2020), the single most important risk factor for mortality and disability worldwide (Stanaway et al., 2018). Hypertension harms health by elevating risk of cardiovascular disease and its complications, including heart attack and stroke, and among older adults, it may also contribute to cognitive and functional decline (Buford, 2016). Risk of adverse outcomes due to hypertension is drastically diminished when BP is reduced to targeted levels or "controlled" with lifestyle modifications and medication (Ettehad et al., 2016; Zhou et al., 2018). Yet, estimates indicate that about half of hypertensive adults in the United States have uncontrolled high BP (Fryar et al., 2017).

The reasons for uncontrolled BP are multifaceted (Whelton, 2015). Some hypertensive adults are undiagnosed

and therefore not on treatment. Others are diagnosed, but have uncontrolled BP due to difficulties with medication adherance (i.e., not taking medication as prescribed) or to undertreament (i.e., being prescribed insufficient or ineffective medication). The Common-Sense Model of Self-Regulation (CSM), a theoretical framework explaining behavioral responses to health threats, suggests that how well an individual manages a health condition depends in part on their beliefs about its potential health consequences and about the benefits of treatment (Hagger et al., 2017; Leventhal et al., 1980, 2016). Beliefs may be especially important for the management of chronic, asymptomatic conditions like hypertension (Leventhal et al., 2005). Research drawing on the CSM shows that diagnosed hypertensives who endorse the value of treatment are more likely to adhere to physician recommendations than others, for example (Chen et al., 2011; Hekler et al., 2008; Meyer et al., 1985; Ross et al., 2004). More generally, the CSM implies that if people do not view hypertension as a serious health condition, or if they do not recognize the benefits of controlled BP, they may be undermotivated to be screened for hypertension and, if diagnosed, to adhere to treatment or monitor outcomes, undermining their chances at successful BP control.

Despite the fundamental importance of beliefs to the management of hypertension, few studies have examined perceptions of hypertension's consequences for health and longevity, or beliefs about the benefits of BP control, particularly in population-based samples. The majority of U.S. adults appear to be aware that hypertension poses risks such as heart attack and stroke (Ahuja et al., 2018). Less is known about perceptions of BP control, although studies of self-rated health (SRH) show that diagnosed hypertensives rate their health similarly regardless of whether or not their objectively measured BP is controlled (Barger & Muldoon, 2006; Hayes et al., 2008). The insensitivity of SRH to measured BP control may signify that individuals do not fully appreciate the health benefits of controlled BP; however, at least two other explanations are possible.

First, this finding could reflect poor awareness of BP control status. Because hypertension generally occurs without symptoms, people may not know how well their efforts at treatment are working without frequent BP monitoring (Gee et al., 2014), and less than half of hypertensive adults check their BP regularly (Ostchega et al., 2017; Tang et al., 2020). Some also believe sensations like headache and dizziness signify their BP is elevated (Meyer et al., 1985), so they may assume their BP is controlled so long as symptoms are absent. To understand beliefs about the benefits of hypertension treatment, studies must therefore consider not only the effect of objectively measured BP control status on personal health evaluation, but also the effect of subjective BP control.

Second, the insensitivity of SRH to BP control found in prior work could stem from the nature of SRH, which is influenced not only by perceived health risk, but also by symptoms, treatments, and other factors (Jylhä, 2009). Those with well-controlled hypertension may report reduced SRH despite recognizing the health benefits of successful treatment simply because they require ongoing care. To concentrate on beliefs about the consequences of hypertension and the benefits of controlled BP for health, studies must benchmark perceptions against concrete potential outcomes, such as mortality risk or death.

The current study assesses beliefs about hypertension-related risk while addressing the limitations of prior work by examining whether and how self-reports of diagnosed hypertension and BP control, as well as objectively measured hypertension and BP control, contribute to subjective life expectancy (SLE), or the perceived probability of surviving to a target age, in a representative sample of older U.S. adults. SLE is associated with individual mortality and known risk factors (Griffin et al., 2013; Hurd & McGarry, 2002; Palloni & Novak, 2016), and unlike SRH, holds constant the health outcome on which respondents are asked to reflect. SLE can therefore provide insight into older adults' perceptions of hypertension's consequences for health and longevity, as well as their beliefs about the benefits of successful treatment or controlled BP, making it an ideal outcome for the current study.

Our analysis proceeds in three parts. First, we provide a descriptive overview of hypertension outcomes overall and across sociodemographic groups. Second, we examine relationships between diagnosed and measured hypertension and SLE. In nested regression models, we incorporate sociodemographic and health-related control variables, aiming to isolate health perceptions linked to hypertension from those stemming from correlated characteristics. Third, we gauge whether diagnosed hypertensives recognize the benefits of BP control by evaluating the relationship between self-reported BP control and SLE, adjusting for measured BP control. We also conduct robustness checks, including alternate specifications with individual fixed effects.

Method

Data

Data are from the Health and Retirement Study (HRS), a biennial panel survey of U.S. households that began in 1992 (Health and Retirement Study, 2019; RAND, 2019). Respondents are selected using a multistage, area-based probability sample of community households, and samples of newly eligible birth cohorts are incorporated at regular intervals (Sonnega et al., 2014). Since 1998, the HRS has surveyed a nationally representative sample of U.S. adults aged 50 and older. Physical measurements, including BP, were first collected from half of eligible households in 2006 and the other half in 2008 (Crimmins et al., 2008). Those who provided physical measurements in 2006 or 2008

were invited to do so again in 2010 and 2014 or 2012 and 2016, respectively, and new respondents were asked to participate after joining the study.

Our sample includes those who provided BP measurements and SLE responses at least once and on up to three occasions between 2006 and 2014; we omit data from 2016 because, at the time of writing, appropriate weighting variables were unavailable. In total, 41,125 observations from 22,397 respondents were eligible for sample inclusion; all were aged 50–89, a requirement for the SLE module. We restrict to observations with valid BP and SLE and with nonmissing HRS-constructed weights (34,019 observations from 19,443 individuals). Finally, using listwise deletion, we drop 962 observations (2.8%) for missing data on control variables. Our analytic sample thus comprises 33,057 observations from 18,979 individuals.

Measures

Subjective life expectancy

SLE was ascertained by asking respondents the percent chance they will live to a target age: "I'd like for you to give me a number from 0 to 100, where 0 means that you think there is absolutely no chance, and 100 means that you think the event is absolutely sure to happen … What is the percent chance that you will live to be [target age] or more?" Respondents aged 50–64 were asked about their probability of survival to age 75. Those aged 65–69 were asked about survival to 80 years; aged 70–74, to 85 years; 75–79, to 90 years; 80–84, to 95 years; and 85–89, to 100 years. We divide responses by 100 so that SLE is expressed as a proportion ranging from 0 to 1 in our analysis.

Diagnosed and measured hypertension

Diagnosed hypertension is a binary variable. Respondents were asked, "Has a doctor ever told you that you have high blood pressure or hypertension?" Those who said "Yes" are coded as having diagnosed hypertension regardless of their measured BP or current medication use. This variable thus reflects whether the respondent was ever diagnosed as hypertensive, rather than their ongoing hypertension status.

Measured hypertension is also a binary variable, determined using respondents' measured systolic and diastolic BP. BP was measured three times at 45-s intervals. We calculate the average systolic and diastolic BP across the three measurements and compare to the diagnostic thresholds in place when respondents were surveyed (Chobanian et al., 2003). Those with an average systolic BP of 140 milligrams per deciliter (mmHg) or higher and/or diastolic BP of 90 mmHg or higher are coded as having measured hypertension. Average BP readings below 140/90 mmHg are considered nonhypertensive.

Following prior work (Cornwell & Waite, 2012), we create a four-category variable reflecting the intersection of diagnosed and measured hypertension as follows: (a) no hypertension; (b) undiagnosed hypertension (measured hypertension only); (c) diagnosed hypertension with controlled BP (diagnosed hypertension only); and (d) diagnosed hypertension with uncontrolled BP (diagnosed and measured hypertension).

Self-reported and measured BP control

Self-reported BP control is a binary variable based on a question asked only of diagnosed hypertensives in years 2006–2012: "Is your blood pressure generally under control?" Measured BP control is a binary variable distinguishing between diagnosed hypertensives *without* measured hypertension, indicating controlled BP, and those *with* measured hypertension, indicating uncontrolled BP.

Control variables

In nested regression models, we adjust for sociodemographic and health-related characteristics that are correlated with both hypertension and survival expectations, and which may therefore confound or explain the relationship between our hypertension measures and SLE (Donnelly et al., 2020; Griffin et al., 2013; Hurd & McGarry, 2002; Lee & Smith, 2016; Palloni & Novak, 2016; Roebuck Bulanda & Zhang, 2009; Whelton, 2015). Measures include age, age-squared, sex (male vs female), race/ethnicity (non-Hispanic White; non-Hispanic Black; Hispanic; other), and educational attainment (less than high school; earned a General Education Development [GED] test; completed high school; completed an Associate's degree or some college; completed a college degree or more). We also control for marital status (married; partnered; divorced or separated; widowed; never married), which relates to health behaviors (Umberson, 1992) that could influence BP and SLE. Some models also adjust for parental mortality (whether each parent is alive or deceased), as family members may share biological or behavioral traits that influence BP, and people consider parental longevity when reporting SLE (e.g., Donnelly et al., 2020; Griffin et al., 2013). Measures of health behaviors include smoking status (never; former; current), whether the respondent drinks alcohol, and body mass index (BMI). Where available, we use objective measurements of height and weight to calculate BMI; otherwise, we use self-reports (5.1% of observations). We also adjust for diagnosed conditions that are common among people with hypertension, including diabetes, heart problems, and stroke. Finally, all models control for the target age given in the SLE question.

Analysis

To account for complex sampling and selective nonresponse, as well as correlated errors between observations drawn from the same respondents over time, all analyses use HRS-constructed weighting and clustering variables. We first calculate descriptive statistics, including the prevalence of hypertension outcomes and self-reported BP control, overall and by age, gender, race/ethnicity, and education.

We then estimate a series of generalized linear regression models (GLMs) of SLE on binary indicators of diagnosed and measured hypertension. Models use logit link functions and the binomial family, which is appropriate for dependent variables expressed as proportions (Buis, 2010). Model 1 estimates independent associations of diagnosed and measured hypertension with SLE adjusting only for age, age-squared, and target age. Model 2 also controls for gender, race/ethnicity, education, and marital status. Finally, Model 3 incorporates controls for health-related measures including parental mortality status, smoking status, alcohol use, BMI, and other diagnoses (diabetes, heart problems, and stroke).

To evaluate whether the relationship between diagnosed hypertension and SLE depends on whether measured BP is high, Model 4 regresses SLE on the four-category variable distinguishing among individuals with no hypertension, undiagnosed hypertension, diagnosed hypertension with controlled BP, and diagnosed hypertension with uncontrolled BP, adjusting for the full set of controls. Using Model 4, we calculate predicted values of SLE for the four hypertension groups, predicting the subjective probability of survival to 80 years while holding age at 65 and other covariates at their means.

Finally, we examine whether self-reported BP control is associated with SLE among diagnosed hypertensives surveyed from 2006 to 2012, adjusting for measured BP control and all covariates. We then predict SLE for those with self-reported controlled and uncontrolled BP, holding target age at 80 years, respondent age at 65, and other covariates at their means.

Results

Descriptive Statistics

Table 1 presents weighted descriptive statistics. The mean age is 65.16 years (*SD* = 9.42). On average, respondents report a 0.57 (*SD* = 0.31) probability of reaching the target age. As shown in Supplementary Figure S1, 23.3% report a 50% chance of survival, the most common response. Another 10.7% are 100% certain they will survive, while 7.9% report a 0% chance of survival.

Returning to Table 1, nearly two thirds (64.0%) of respondents are hypertensive based on diagnostic history or measured BP. About 1 in 10 (10.7%) has undiagnosed hypertension, 33.2% has diagnosed hypertension with controlled BP, and 20.2% has diagnosed hypertension with uncontrolled BP. Put differently, 22.9% of those never diagnosed with hypertension have high measured BP, or undiagnosed hypertension (10.7/(36.0 + 10.7) = 0.229), and 37.8% of those with diagnosed hypertension have uncontrolled BP (20.2/(33.2 + 20.2) = 0.378). Prevalence of hypertension according to diagnostic history or measured BP is higher among older respondents, men, non-White and particularly Black respondents, and those with less education (Supplementary Table S1). Stratifying by diagnostic history shows that these groups are also more likely to have undiagnosed hypertension or diagnosed hypertension with uncontrolled BP.

Table 1. Weighted descriptive statistics

	Mean (*SD*) or %
Age	65.16 (9.42)
Female	53.31
Race/ethnicity: White, non-Hispanic	80.25
Black, non-Hispanic	9.19
Hispanic	7.47
Other	3.09
Educational attainment: Less than high school	13.16
GED	4.73
High school	28.58
Associate's degree or some college	25.69
College degree or higher	27.85
Marital status: Married	63.54
Partnered	4.06
Divorced or separated	14.20
Widowed	12.94
Never married	5.26
Mother alive	25.95
Father alive	11.80
Smoking status: Never smoked	43.41
Former smoker	41.87
Current smoker	14.73
Drinks alcohol	59.63
Body mass index	29.76 (6.20)
Diagnosed diabetes	19.75
Diagnosed heart problems	21.25
Diagnosed stroke	6.70
Diagnosed and measured hypertension: No hypertension	35.97
Undiagnosed hypertension	10.66
Diagnosed hypertension, controlled BP	33.21
Diagnosed hypertension, uncontrolled BP	20.15
Self-reported BP control among diagnosed hypertensives[a]	95.83
Measured BP control among diagnosed hypertensives[a]	61.28
Subjective life expectancy (SLE)	0.57 (0.31)
N observations (*N* respondents)	33,057 (18,979)

Notes: BP = blood pressure; GED = General Education Development test; *SD* = standard deviation.
[a]Evaluated for the subset of the analytic sample who had diagnosed hypertension and were surveyed in 2006–2012. *N* observations = 14,844.

The great majority of diagnosed hypertensives surveyed from 2006 to 2012 self-report their BP as controlled (95.8%, Table 1). Only 61.3%, however, have controlled BP based on objective measurements; many diagnosed hypertensives with uncontrolled *measured* BP appear to mistakenly *self-report* their BP as controlled. Indeed, only 6.5% of those with uncontrolled BP accurately report it as such. Nonetheless, measured BP is higher, on average, among those self-reporting uncontrolled BP (e.g., mean systolic BP = 146.18 mmHg, *SD* = 25.46) compared to those self-reporting their BP as

controlled (133.51 mmHg, *SD* = 20.05). Rates of self-reported BP control are high (over 90%) in all sociodemographic groups (Supplementary Table S2).

Contributions of Diagnosed and Measured Hypertension to SLE

Table 2 presents results from GLMs regressing SLE on diagnosed and measured hypertension. Model 1 demonstrates that, adjusting only for age, age-squared, and target age, older U.S. adults who are diagnosed with hypertension have 25% lower odds of expecting to survive to the target age than those without a diagnosis (odds ratio [OR] = 0.75, $p < .001$). Meanwhile, the relationship between measured hypertension and SLE is not significant (OR = 0.98, $p = .259$).

When adjusting for additional sociodemographic characteristics in Model 2, the estimated effects of diagnosed (OR = 0.77, $p < .001$) and measured (OR = 1.02, $p = .236$) hypertension on SLE change very little. Control variables demonstrate associations with SLE that are consistent with prior work, with more optimistic survival expectations evident among female, non-Hispanic Black, highly educated, and married respondents. Also consistent with expectations, Model 3 shows that having living parents and drinking alcohol predict higher SLE, whereas current smoking, higher BMI, and other diagnosed conditions predict lower SLE. The estimated effect of diagnosed hypertension on SLE is reduced in magnitude by about one third in Model 3 compared with Model 2. Even when adjusting for myriad sociodemographic and health characteristics, however, diagnosed hypertension is associated with 15% lower odds of expected survival (OR = 0.85, $p < .001$), whereas measured hypertension is not significantly associated with SLE (OR = 1.02, $p = .417$).

Model 4 shows that the inverse relationship between diagnosed hypertension and SLE holds regardless of whether measured BP is high. Compared to no hypertension, having diagnosed hypertension with either controlled BP (OR = 0.86, $p < .001$) or uncontrolled BP (OR = 0.86, $p < .001$) is associated with 14% lower odds of expected survival, and the magnitude of this effect does not differ between the two groups ($p = .876$). SLE also does not differ between those with no hypertension and those with undiagnosed hypertension (OR = 1.04, $p = .224$). These results are summarized in Figure 1, which presents predicted values of SLE based on Model 4. Holding age at 65 years and covariates at their means, those with no hypertension and undiagnosed hypertension are predicted to report probabilities of survival to age 80 of 0.62 and 0.63, respectively, whereas those with diagnosed hypertension and either controlled or uncontrolled BP are expected to report a 0.58 probability of survival. To summarize, SLE depends on hypertension diagnosis; it does not differ within diagnostic status by measured hypertension status.

Influence of Self-Reported BP Control

Table 3 shows that diagnosed hypertensives self-reporting controlled BP have higher SLE than those who report their BP to be uncontrolled (OR = 1.38, $p = .001$), holding sociodemographics, health-related characteristics, and measured BP control constant. Measured BP control is not significantly associated with SLE (OR = 0.99, $p = .767$). Figure 2 summarizes these results with predicted values of SLE. Those who self-report their BP as controlled are expected to report a 0.57 probability of survival to 80, holding age at 65 and covariates at their means, whereas those with self-reported uncontrolled BP are expected to report a survival probability of 0.49.

Robustness Checks

We performed several sensitivity analyses to assess the robustness of our results. First, because the target age provided in the survey question on SLE varied by respondent age, we estimated all regression models stratified by age group. Substantive results (not shown) were the same for those aged 50–64, for whom the target age was 75, and those aged 65–89, for whom the target age ranged from 80 to 100 years.

Second, we assessed whether results were sensitive to the measurement of SLE, and specifically our choice to represent SLE as a continuous variable. SLE responses of 0, 50, and 100 are disproportionately common, and may reflect a general pessimism, uncertainty, and optimism about survival, respectively (Lee & Smith, 2016; Palloni & Novak, 2016). Accordingly, we repeated analyses measuring SLE with a three-category variable (less than a 50% chance of survival; a 50% chance of survival; more than a 50% chance of a survival) and using multinomial logistic regression. Results (not shown) were substantively similar to those presented above.

Finally, although we control for many sociodemographic and health characteristics, it is possible that unobserved factors correlated with hypertension and SLE bias our estimates. Because 1,106 and 3,833 respondents changed diagnosed and measured hypertension statuses across observations, respectively, we were able to explore this possibility by fitting a fixed effects specification of Model 4. This specification accounts for time-invariant individual characteristics, effectively examining the impacts of within-person changes in diagnosed and measured hypertension statuses on SLE. Results confirm a significant negative effect of diagnosed hypertension on SLE (Supplementary Table S3). The fixed effect specification is less appropriate for examining the effects of BP control on SLE among diagnosed hypertensives, as only 237 respondents changed their self-reported BP control status between surveys, limiting statistical power. Nonetheless, consistent with earlier findings, the fixed effect specification shows self-reported BP control is associated with higher SLE, although this effect is not statistically significant ($p = .100$, Supplementary Table S4).

Discussion

The current study sheds light on older U.S. adults' beliefs about the potential consequences of hypertension and the

Table 2. Generalized linear regression models of subjective life expectancy (SLE) on diagnosed and measured hypertension

	Model 1	Model 2	Model 3	Model 4
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Diagnosed hypertension	0.75 (0.72, 0.78)***	0.77 (0.74, 0.80)***	0.85 (0.82, 0.89)***	—
Measured hypertension	0.98 (0.94, 1.02)	1.02 (0.98, 1.06)	1.02 (0.98, 1.06)	—
Diagnosed and measured hypertension (Ref: No hypertension)				
Undiagnosed hypertension	—	—	—	1.04 (0.98, 1.10)
Diagnosed hyp., controlled BP	—	—	—	0.86 (0.82, 0.90)***
Diagnosed hyp., uncontrolled BP	—	—	—	0.86 (0.82, 0.91)***
Age (Centered at 65 years)	1.01 (1.01, 1.02)***	1.02 (1.01, 1.02)***	1.02 (1.02, 1.03)***	1.02 (1.02, 1.03)***
Age-squared (Centered at 65 years)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)*	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Target age (Ref: 75 years)				
80	0.78 (0.73, 0.84)***	0.79 (0.74, 0.85)***	0.79 (0.74, 0.84)***	0.79 (0.74, 0.84)***
85	0.58 (0.52, 0.65)***	0.60 (0.53, 0.67)***	0.59 (0.53, 0.66)***	0.59 (0.53, 0.66)***
90	0.33 (0.28, 0.39)***	0.33 (0.28, 0.39)***	0.32 (0.28, 0.38)***	0.32 (0.28, 0.38)***
95	0.21 (0.16, 0.26)***	0.20 (0.16, 0.25)***	0.20 (0.15, 0.25)***	0.20 (0.15, 0.25)***
100	0.13 (0.09, 0.18)***	0.12 (0.09, 0.17)***	0.13 (0.09, 0.18)***	0.13 (0.09, 0.18)***
Female	—	1.25 (1.20, 1.30)***	1.21 (1.16, 1.25)***	1.21 (1.16, 1.26)***
Race/ethnicity (Ref: White, non-Hispanic)				
Black, non-Hispanic	—	1.40 (1.30, 1.52)***	1.48 (1.38, 1.59)***	1.48 (1.38, 1.59)***
Hispanic	—	0.78 (0.71, 0.86)***	0.75 (0.68, 0.83)***	0.75 (0.68, 0.83)***
Other	—	0.79 (0.69, 0.90)**	0.83 (0.74, 0.95)**	0.83 (0.74, 0.94)**
Educational attainment (Ref: Less than high school)				
GED	—	1.05 (0.94, 1.16)	1.03 (0.93, 1.15)	1.03 (0.93, 1.15)
High school	—	1.32 (1.24, 1.41)***	1.20 (1.13, 1.28)***	1.20 (1.13, 1.28)***
Associate's degree or some college	—	1.58 (1.47, 1.68)***	1.40 (1.31, 1.49)***	1.40 (1.31, 1.49)***
College degree or higher	—	1.94 (1.79, 2.10)***	1.60 (1.48, 1.73)***	1.60 (1.48, 1.73)***
Marital status (Ref: Married)				
Partnered	—	0.92 (0.82, 1.03)	0.96 (0.86, 1.06)	0.96 (0.86, 1.06)
Divorced or separated	—	0.91 (0.85, 0.97)**	0.97 (0.91, 1.03)	0.97 (0.91, 1.03)
Widowed	—	0.89 (0.84, 0.95)**	0.93 (0.87, 0.99)*	0.93 (0.87, 0.99)*
Never married	—	0.76 (0.67, 0.85)***	0.78 (0.70, 0.87)***	0.78 (0.70, 0.87)***
Mother alive	—	—	1.24 (1.19, 1.30)***	1.24 (1.19, 1.30)***
Father alive	—	—	1.22 (1.16, 1.28)***	1.22 (1.16, 1.28)***
Smoking status (Ref: Never)				
Former	—	—	0.96 (0.93, 1.00)	0.96 (0.93, 1.00)
Current	—	—	0.63 (0.59, 0.67)***	0.63 (0.59, 0.67)***
Drinks alcohol	—	—	1.13 (1.08, 1.19)***	1.13 (1.08, 1.19)***
Body mass index	—	—	1.00 (0.99, 1.00)**	1.00 (0.99, 1.00)**
Diagnosed diabetes	—	—	0.81 (0.77, 0.85)***	0.81 (0.77, 0.85)***
Diagnosed heart problems	—	—	0.76 (0.72, 0.80)***	0.76 (0.72, 0.80)***
Diagnosed stroke	—	—	0.83 (0.76, 0.91)***	0.83 (0.76, 0.91)***
Constant	2.16 (2.05, 2.28)***	1.31 (1.21, 1.41)***	1.73 (1.52, 1.96)***	1.72 (1.52, 1.96)***
N observations	33,057	33,057	33,057	33,057
Pseudo-*R*-squared	0.1066	0.1451	0.1775	0.1775
AIC	1.0274	1.0095	0.9944	0.9945
BIC	−329614.39	−330104.34	−330528.23	−330518.19

Notes: AIC = Akaike information criterion; BIC = Bayesian information criterion; BP = blood pressure; CI = confidence interval; GED = General Education Development test; OR = odds ratio.
***$p < .001$. **$p < .01$. *$p < .05$.

compensatory impacts of controlled BP by examining the contributions of diagnosed hypertension and self-reported BP control, as well as measured BP, to longevity expectations or SLE. We draw motivation from the widely utilized CSM (Hagger et al., 2017; Leventhal et al., 1980, 2016), a key implication of which is that beliefs about hypertension must be understood if the rate of successful BP control among U.S. adults with hypertension, which falls around 50% (Fryar et al., 2017), is to be improved. Progress toward improved BP control is particularly crucial for older

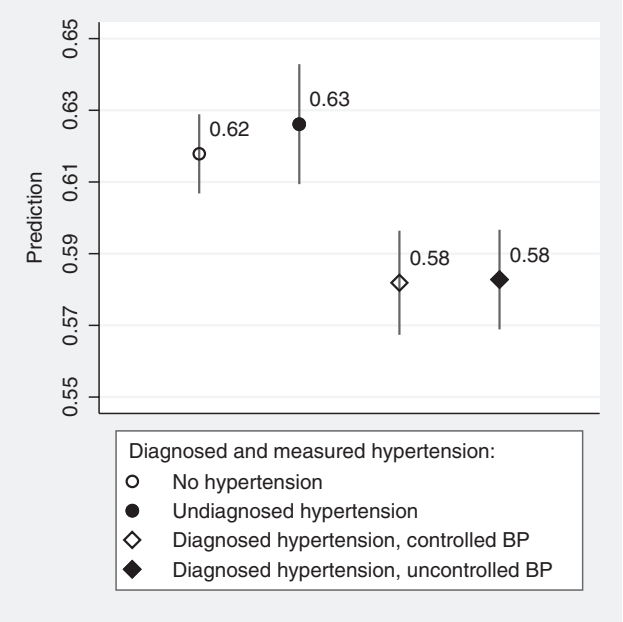

Figure 1. Predicted subjective life expectancy (SLE) by diagnosed and measured hypertension. SLE is predicted using Model 4, as shown in Table 2, holding target age at 80 years, respondent age at 65 years, and other covariates at their means. BP = blood pressure. 95% confidence intervals shown.

adults, more than half of whom have hypertension (Fryar et al., 2017; Ostchega et al., 2020) and among whom high BP may contribute not only to cardiovascular disease and related mortality, but also to cognitive and functional decline (Buford, 2016). Using nationally representative data from older U.S. adults, we identify three novel findings.

First, we uncover a striking degree of concern for longevity among older Americans diagnosed with hypertension. More precisely, those who have been diagnosed with hypertension are less likely to believe they will survive to a target age than those without a diagnosis, regardless of whether their measured BP is high. Results from multivariable models suggest this is not due to correlated sociodemographic and health-related factors alone. Furthermore, when using fixed effects to hold constant time-invariant individual characteristics, a significant negative effect of hypertension diagnosis on SLE remains, suggesting that being diagnosed with hypertension compels people to adjust their survival expectations downwards.

Second, we find that among those with a hypertension diagnosis, those who self-report their BP as controlled have significantly higher SLE compared with those who self-report their BP as uncontrolled, holding measured BP control status as well as sociodemographic and health characteristics constant. This result illustrates the importance of subjective BP control for personal health evaluation.

Together, these two results suggest that older U.S. adults recognize both the harmful potential consequences of hypertension and the benefits of successful treatment or BP control. From the perspective of the CSM, this may be the desired outcome. Perceiving a condition to be a serious health threat while also understanding that it can be ameliorated with treatment may promote help-seeking, medication adherence, and outcome monitoring, resulting in better disease outcomes (Hagger et al., 2017). In the case of hypertension, such beliefs and behaviors should promote BP control.

Our third finding, on the other hand, is cause for concern. We find that many older U.S. adults lack

Table 3. Generalized linear regression model of subjective life expectancy (SLE) on self-reported and measured blood pressure (BP) control among diagnosed hypertensives

	OR (95% CI)
Self-reported BP control	1.38 (1.16, 1.65)**
Measured BP control	0.99 (0.94, 1.05)
Age (Centered at 65 years)	1.03 (1.02, 1.04)***
Age-squared (Centered at 65 years)	1.00 (1.00, 1.00)
Target age (Ref: 75 years)	
80	0.75 (0.68, 0.83)***
85	0.57 (0.49, 0.66)***
90	0.31 (0.25, 0.40)***
95	0.22 (0.15, 0.31)***
100	0.16 (0.10, 0.26)***
Female	1.19 (1.12, 1.27)***
Race/ethnicity (Ref: White, non-Hispanic)	
Black, non-Hispanic	1.50 (1.37, 1.65)***
Hispanic	0.77 (0.67, 0.89)**
Other	0.94 (0.77, 1.15)
Educational attainment (Ref: Less than high school)	
GED	0.98 (0.85, 1.13)
High school	1.21 (1.12, 1.30)***
Associate's degree or some college	1.44 (1.31, 1.58)***
College degree or higher	1.56 (1.41, 1.74)***
Marital status (Ref: Married)	
Partnered	1.02 (0.89, 1.16)
Divorced or separated	0.91 (0.83, 1.00)
Widowed	0.91 (0.84, 0.99)*
Never married	0.85 (0.74, 0.97)*
Mother alive	1.29 (1.21, 1.38)***
Father alive	1.32 (1.21, 1.45)***
Smoking status (Ref: Never)	
Former	1.00 (0.94, 1.06)
Current	0.67 (0.60, 0.74)***
Drinks alcohol	1.08 (1.01, 1.16)*
Body mass index	1.00 (0.99, 1.00)
Diagnosed diabetes	0.81 (0.76, 0.86)***
Diagnosed heart problems	0.75 (0.71, 0.79)***
Diagnosed stroke	0.76 (0.70, 0.84)***
Constant	1.16 (0.89, 1.51)
N observations	14,844
Pseudo-*R*-squared	0.1645
AIC	0.9340
BIC	−136440.54

Notes: AIC = Akaike information criterion; BIC = Bayesian information criterion; CI = confidence interval; GED = General Education Development test; OR = odds ratio.
***$p < .001$. **$p < .01$. *$p < .05$.

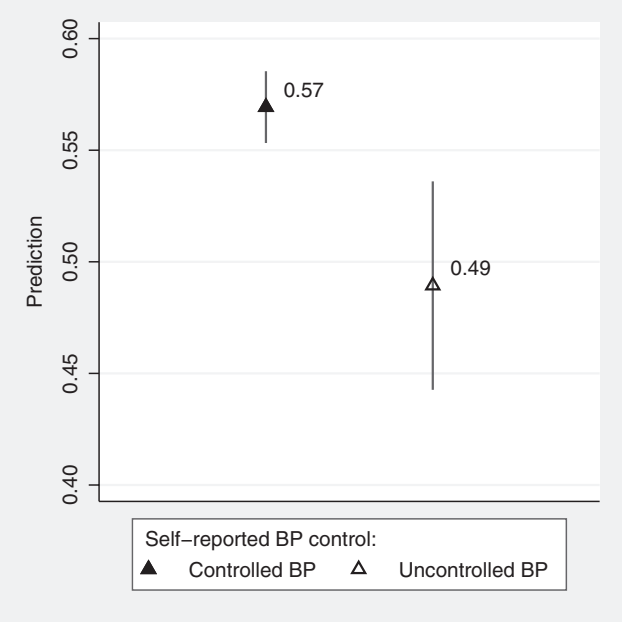

Figure 2. Predicted subjective life expectancy (SLE) by self-reported blood pressure (BP) control among diagnosed hypertensives. SLE is predicted using the model shown in Table 3, holding target age at 80 years, respondent age at 65 years, and other covariates at their means. 95% confidence intervals shown.

knowledge of their own hypertension and BP control statuses. Roughly 1 in 10 had high measured BP, but had never been diagnosed with hypertension. Among previously undiagnosed people, a hypertension diagnosis may have been warranted for around 22.9% overall, and the percentage is even higher among older age groups, men, non-White and particularly Black respondents, and those with less education. Awareness of BP control status is also poor across the population of older U.S. adults, as indicated by the low accuracy of self-reported BP control among diagnosed hypertensives. Most troubling, just 6.5% of those with high measured BP self-report their BP as uncontrolled. People who do not know their hypertension or BP control statuses cannot manage their health effectively; enhancing awareness has the potential to improve outcomes (Edwards, 2018).

Relatedly, we show that objectively measured hypertension and BP control statuses do not contribute to longevity expectations independently of diagnosis and self-reported BP control. This may be because, unlike biological markers of health that have previously been shown to influence subjective evaluations of health (Jylhä et al., 2006; Thyagarajan et al., 2019), high BP is largely asymptomatic. It may therefore not factor into beliefs about health above and beyond its correlation with diagnostic and perceived treatment outcomes. This result highlights the importance of evaluating self-reported health measures alongside objective indicators to distinguish the effects of beliefs about personal health risk from those of knowledge (or lack thereof) about personal health status.

Our findings are relevant to prior research on the wide-ranging impacts of diagnostic labeling. Medical sociologists have long observed the importance of diagnosis for subjective experiences of health and illness (Brown, 1995; Conrad & Barker, 2010). While a diagnosis can legitimate an illness in the eyes of others, it may also provoke anxiety and fear, negatively affecting psychological well-being independently of disease-related limitations and symptoms (Ogedegbe, 2010). CSM research likewise finds that perceiving a health condition to have potentially dire consequences can adversely affect mental health as well as disease-specific outcomes through denial and avoidance (Hagger et al., 2017). Health communications that emphasize the efficacy and availability of hypertension treatment may offset the negative mental health impacts of diagnosis and encourage health agency among patients.

Several limitations to the current study warrant mention. To ascertain objective hypertension and BP control statuses, we use average BP from three readings taken during a single interview for the HRS. This may result in some misclassification, as clinical guidelines recommend two or more separate office visits to diagnose hypertension (Chobanian et al., 2003). However, the BP collection procedures followed for the HRS are similar to those used for other high-quality population studies (Centers for Disease Control, 2020; Guyer et al., 2017). Estimates of hypertension prevalence in the HRS are also comparable to those obtained from the corresponding age group in the National Health and Nutrition Examination Study, which is currently the primary resource for monitoring hypertension in the U.S. population (Fryar et al., 2017; Whelton, 2015).

Next, to measure subjective BP control status, we rely on responses to a survey question that asked respondents whether their BP was "generally" under control. Answers may not fully reflect respondents' knowledge about their BP, although studies using more granular measures likewise obtain low prevalence of self-reported uncontrolled BP (Gee et al., 2014). Future research should evaluate in more detail how accurately people can estimate their current BP, as well as whether they can recall their physician-designated BP goal.

We also leave it to future research to evaluate whether and how beliefs about hypertension vary across sociodemographic groups. Our descriptive results show that there are many people living with undiagnosed hypertension and uncontrolled high BP among older age groups, men, non-White, and less educated older adults. Outcomes for Black respondents are particularly troubling, which is consistent with previous research demonstrating stark differences between White and Black Americans in rates of hypertension, BP control, and adverse cardiovascular outcomes (Delgado et al., 2012; Tajeu et al., 2020; Whelton, 2015). Studies should examine whether perceptions of hypertension-related risk vary by race/ethnicity, and if so, the reasons for such differences.

The strengths of this study include its reliance on a nationally representative sample, its employment of both self-reported and measured indicators of hypertension and BP control, and its innovative use of SLE to understand beliefs about health. SLE is familiar to many scholars of aging, having previously been used to examine how future time perceptions influence subjective well-being and consequential aging-related decisions, such as when to retire (Hoppmann et al., 2017; van Solinge & Henkens, 2010). We instead examine whether and how high BP, and personal knowledge thereof, contributes to SLE, which proxies for perceived health-related risk. For our study, the use of SLE has advantages over SRH, which is known to be influenced by symptoms, treatments, and other factors not inherently related to beliefs about health risk (Jylhä, 2009).

The current study is among the first to indicate that older U.S. adults are aware not only of the deleterious impacts of hypertension on health and longevity, but also the benefits of BP control. This may be a positive result, as hypertension is a serious but treatable condition that health psychology theories like the CSM suggest must be recognized as such to encourage prevention, screening, and treatment (Hagger et al., 2017; Leventhal et al., 1980, 2016). Health communications should continue balancing negative messages about hypertension with positive statements regarding the proven benefits of BP control and the steps required to achieve it. Our findings also underscore the need for improved self-awareness of hypertension and BP control statuses, the latter of which is particularly poor. Medical practitioners may enhance patient outcomes by stressing target BP levels, by keeping patients informed of their progress, and by recommending regular use of home BP monitoring devices (Levine et al., 2016; Ostchega et al., 2017; Tang et al., 2020). Of course, we must also emphasize the importance of prevention. Upstream factors related to social and economic inequality and racism must be addressed to stop hypertension from developing in the first place (Hicken et al., 2013). In the meantime, with a clear majority of older Americans, as well as many younger adults, currently experiencing hypertension (Fryar et al., 2017; Ostchega et al., 2020), detection, treatment, and BP control must be key objectives for public health.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Conflict of Interest

None declared.

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Author Contributions

M. Zacher, J. Wang, and S. E. Short conceptualized and designed the study. J. Wang managed the data and conducted the analysis. M. Zacher led the writing and supervised the analysis. All authors reviewed and revised drafts and approved the final manuscript.

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