Low Diastolic Blood Pressure and Mortality in Older Women. Results From the Women's Health Initiative Long Life Study

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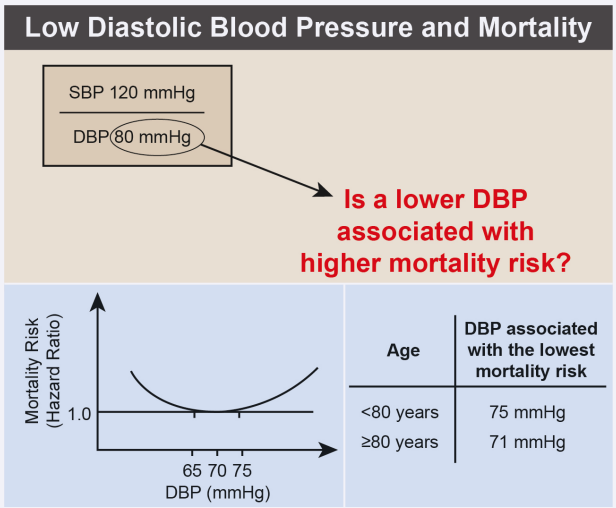
BACKGROUND
Recommended systolic blood pressure targets often do not consider the relationship of low diastolic blood pressure (DBP) levels with cardiovascular disease (CVD) and all-cause mortality risk, which is especially relevant for older people with concurrent comorbidities. We examined the relationship of DBP levels to CVD and all-cause mortality in older women in the Women's Health Initiative Long Life Study (WHI-LLS).

METHODS
The study sample included 7,875 women (mean age: 79 years) who underwent a blood pressure measurement at an in-person home visit conducted in 2012–2013. CVD and all-cause mortality were centrally adjudicated. Hazard ratios (HRs) were obtained from adjusted Cox proportional hazards models.

RESULTS
After 5 years follow-up, all-cause mortality occurred in 18.4% of women. Compared with a DBP of 80 mm Hg, the fully adjusted HR for mortality was 1.33 (95% confidence interval [CI]: 1.04–1.71) for a DBP of 50 mm Hg and 1.67 (95% CI: 1.29–2.16) for a DBP of 100 mm Hg. The HRs for CVD were 1.14 (95% CI: 0.78–1.67) for a DBP of 50 mm Hg and HR 1.50 (95% CI: 1.03–2.17) for a DBP of 100 mm Hg. The nadir DBP associated with lowest mortality risk was 72 mm Hg overall.

CONCLUSIONS
In older women, consideration should be given to the potential adverse effects of low and high DBP. Low DBP may serve as a risk marker. DBP target levels between 69 and 75 mm Hg may avoid higher mortality risk.

GRAPHICAL ABSTRACT



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While lower systolic blood pressure (SBP) reduces the risk of cardiovascular events and improves survival, the role of low diastolic blood pressure (DBP) is less clear. In 1979, it was first shown that lowering DBP may increase the risk of myocardial infarction among hypertensive patients.[1] Specifically, DBP reduction to less than 70 mm Hg in the context of SBP control resulted in increased coronary events.[2–4] Additional similar results based on observational studies and *post hoc* analyses of randomized controlled trials gave rise to the hypothesis of a J-shaped relationship between DBP and mortality.[5–9] Although this hypothesis generated some controversy in the past, it gained new interest in light of intensified SBP treatment target aims in recent blood pressure (BP) guidelines. A recent study pooling data from the SPRINT and ACCORD-BP trials reported that individuals with a DBP of less than 60 mm Hg were associated with an increased risk of cardiovascular events in patients at high cardiovascular risk and treated SBP of less than 130 mm Hg.[10] Nonetheless, the relationship between low DBP, cardiovascular disease (CVD), and mortality risk merit further investigation as the risk pattern of DBP may differ by age and concomitant comorbidity.[11]

It is widely accepted in western civilizations from midlife onward that DBP tends to decline and SBP tends to increase due to increased arterial stiffening. BP guidelines by the American College of Cardiology/American Heart Association (ACC/AHA) recommend antihypertensive treatment for adults above 65 years of age with an average SBP of 130 mm Hg or higher without taking consideration of their DBP levels.[12] More information on the potentially harmful prognostic impact of DBP levels on mortality risk by various age groups, antihypertensive treatment and preexisting comorbidities is needed. Specifically, it remains to be determined if DBP levels below 80 mm Hg are associated with an increased mortality risk in an elderly population.[13]

Given this background, the aim of this study was to examine the relationship of DBP levels with all-cause mortality and cardiovascular events (CVD) in older women participating in the Women's Health Initiative Long Life Study (WHI-LLS).

METHODS

Data sharing

The data, analytic methods, and study materials are made available to other researchers for purposes of reproducing the results or replicating the procedure. The data underlying our work can be obtained through 2 mechanisms. First, interested investigators can contact the Women's Health Initiative Coordinating Center. Details about the procedures for data request can be found online (www.whi.org). Second, most data from the WHI can also be obtained from BioLINCC, a repository maintained by the National Heart, Lung, and Blood Institute. The BioLINCC website (https://biolincc.nhlbi.nih.gov/home/) includes detailed information about the available data and the process to obtain such data.

Study population

The study population consisted of 7,875 women over 70 years old who enrolled in the WHI-LLS, an ancillary study to the WHI. Detailed information about the WHI has been described previously.[14–16] In brief, multiethnic postmenopausal women aged 50–79 years were recruited in 40 clinical centers nationwide between 1993 and 1998. Inclusion criteria were liberal to facilitate recruitment and enhance generalizability. However, participating women in the WHI were generally free of recent serious cardiac, pulmonary, renal, and hepatic conditions and had at least 3 years life expectancy. Other eligibility criteria included ability and willingness to provide written informed consent and an agreement to reside in the area for at least 3 years after enrollment. The LLS had a one-time in-person visit conducted between March 2012 and May 2013 consisting of a blood draw, brief clinical assessment, BP measurement, and functional status assessment of WHI participants. Institutional review boards at participating institutions approved all study protocols and all participants provided written informed consent.

For this analysis, women without medication data or with missing BP data were excluded. Our final analytic cohort consisted of 7,527 women. The average follow-up time was 5.3 years (SD 1.3 years).

Assessment of BP

BP was measured at an in-person home visit by certified staff with the use of standardized procedures and instruments.[15] Specifically, BP was measured with an aneroid sphygmomanometer and appropriate cuff size after the participant was seated and had rested for 5 minutes. This was followed by a second measurement conducted 30 seconds after the first. The average of the 2 BP values was used as the BP value for each person.

CVD and all-cause mortality outcomes

Composite CVD was defined as fatal and nonfatal myocardial infarction, stroke, heart failure, or any death of vascular etiology. Heart failure was defined as definite or possible acute and hospitalized or chronic stable. Vascular mortality was defined as death from myocardial infarction, stroke, pulmonary embolism, other cardiovascular causes, or unknown cardiovascular causes. All-cause mortality was ascertained from extracting health information from hospital records or the National Death Index. Outcomes were centrally adjudicated by trained physicians.[14–17]

Covariates

Age was assessed at enrollment into the LLS in 2012–2013. Race/ethnicity was by self-report at WHI baseline. Use of antihypertensive medications was ascertained by questionnaire collected approximately 2 years prior to the home visit for LLS. It was assumed that women on antihypertensive medications at that time would continue and women not on antihypertensive medication 2 years prior did not start in

the period between medication ascertainment and the LLS home visit. Women were classified as having diabetes based on self-report of diabetes or self-report of diabetes treatment at any time after enrollment in WHI.

Statistics

Descriptive statistics by DBP were created for baseline demographic variables. DBP was categorized as ≤60, 61 to <90, and ≥90 mm Hg.

Hazard ratios (HRs) and 95% confidence intervals (CIs) for risk of incident CVD and all-cause mortality were estimated from Cox proportional hazards regression models, which controlled for age, race/ethnicity, history of stroke or coronary heart disease (CHD) prior to LLS baseline, SBP, SBP^2, DBP, and DBP^2. Additional models also controlled for smoking, body mass index, and diabetes. Time to CVD or death was calculated from enrollment in the LLS to date of death or CVD event. The possibility of a nonlinear trend was assessed using quadratic terms. If the quadratic term was significant (indicating a nonlinear relationship), we calculated the HR relative to a DBP of 80 mm Hg for a set of DBP ranging from 50 to 100 mm Hg. The HR = e^k, where β_1 = coefficient of linear term, β_2 = coefficient of square term, and $k = \beta_1(\text{DBP} - 80) + \beta_2(\text{DBP}^2 - 80^2)$ and variance of k = Var $\beta_1(\text{DBP} - 80)^2$ + Var $\beta_2(\text{DBP}^2 - 80^2)^2$ + 2 Cov(β1, β2) (DBP − 80) ($\text{DBP}^2 - 80^2$). We also calculated the nadir of the curve, which is the DBP associated with lowest HR, as:

$$\text{NADIR} = -1/2(\text{linear coefficient}/\text{quadratic coefficient}).$$

We did a sensitivity analysis omitting those with history of CHD or stroke, and also did a sensitivity analysis omitting those with self-reported diabetes at any time prior to enrollment in the LLS. We also did analyses to explore if the associations with mortality differed between those who were younger or older than 80 years, and those who were on antihypertensive medications or not. The Wald statistic was significant in all models, $P < 0.0001$, indicating adequate goodness-of-fit for the Cox models.

Analyses were performed by SAS statistical software version 9.4 (SAS Institute, Cary, NC).

RESULTS

The average age of all women in our analyses was 79 years and 52% of participants were 80 years or older. Selected characteristics at LLS visit are shown by DBP categories in Table 1. Compared with women with higher DBP levels, women with low DBP (less than or equal to 60 mm Hg) were more likely to be White, have a prior history of stroke or CHD, have a lower SBP, to be slightly less likely to be on antihypertensive medication, more likely to have a body mass index of less than 25 and less likely to be a current smoker. They were also more likely to die from cardiovascular causes or stroke.

Cumulative all-cause mortality for 5 years follow-up was 18.4%, and the annualized overall mortality rate was 3.5%. Death rates were higher at both low (≤60 mm Hg) and high levels (≥90 mm Hg) of DBP compared with the 61–89 mm Hg range, with 27.8% and 25.0% death rates over time, respectively, as compared with 17.6% (Table 2).

Cox modeling indicated a quadratic (U-shaped) relationship between DBP levels and all-cause mortality in the overall sample. Specifically, the relative risk of death, compared with 80 mm Hg, was 1.50 (95% CI: 1.18–1.90) for a DBP of 50 mm Hg and 1.83 (95% CI: 1.43–2.35) for a DBP of 100 mm Hg, after controlling for age, self-reported race/ethnicity, history of CHD or stroke, antihypertensive medication use, and SBP and SBP^2 (Figure 1). Similar excess mortality risk for those with low DBP was observed after additionally adjusting for smoking, diabetes, and body mass index (HR = 1.33, 95% CI: 1.04–1.71; Table 3). Sensitivity analysis excluding those with a history of CHD or stroke showed the HR for DBP of 50 mm Hg = 1.43 (95% CI: 1.08–1.90) and the sensitivity analysis excluding those with diabetes showed a similar HR of 1.43 (95% CI: 1.07–1.92) (Table 4). Elevated risk at a DBP of 50 mm Hg was observed for those not on antihypertensive medications, as well as those on antihypertensive medications, though the CIs overlapped 1.0. Higher risk with low DBP was also observed in women both younger than 80 years (HR = 1.57, 95% CI: 0.85–2.90) and in those 80 years or older (HR = 1.31, 95% CI: 1.00–1.71) (Table 4). The nadir of the curve, which is the DBP associated with lowest HR for mortality, was 72 mm Hg in the overall population ranging from 69 to 75 mm Hg in subgroups.

Overall, the relative risk of CVD, compared with a DBP of 80 mm Hg, was 1.14 (95% CI: 0.78–1.67) for a DBP of 50 mm Hg and 1.50 (95% CI: 1.03–2.17) for a DBP of 100 mm Hg (Figure 2). DBP was not found to be related to the outcome of CVD in analyses excluding those with diabetes nor after excluding those with history of CHD or stroke. Finally, DBP was not associated, either in linear or quadratic relationship, with CVD events among those younger than 80 years or 80 years or older, nor among those on or not on antihypertensive medications.

DISCUSSION

In a large cohort of elderly women, death rates were found to be higher at both low and high levels of DBP, indicating a U- or J-shaped relationship of DBP to mortality. The higher mortality risk associated with low and high DBP levels was present in those with no prior history of CHD or stroke and in those without diabetes, as well as in those 80 years or older. The nadir DBP associated with lowest mortality risk was 72 mm Hg for the whole cohort. Notably, lower DBP levels were not significantly associated with a higher risk of overall CVD after adjusting for confounding variables, but the number of events was smaller so this could be due to insufficient power.

A considerable body of evidence from observational analyses of randomized trials such as SPRINT, INVEST, or from observational cohort studies such as Framingham or ARIC point to a J-shaped relationship between low DBP levels and CVD.[3,5,6,18] Interestingly, however, the majority of these studies consisted of already hypertensive individuals suggesting that a DBP level lower than 70 mm Hg was

Table 1. Selected characteristics at Long Life Study home visit by DBP (*N* = 7,527)

	DBP			
	≤60 mm Hg	61 to <90 mm Hg	≥90 mm Hg	*P*
N	672	6,619	236	
Age (mean, SD)	80.9 (6.43)	78.7 (6.83)	78.1 (6.75)	
Race/ethnicity (%)				<0.01
Black/African American	23.0	33.6	41.6	
Hispanic/Latino	14.1	17.0	12.3	
White non-Hispanic	62.9	49.3	45.8	
Antihypertensive medication use prior to BP measurement (%)	49.3	46.1	54.7	0.01
Smoking				0.02
Never smoked	56.6	54.8	50.9	
Past smoker	37.1	38.9	37.2	
Current smoker	6.3	6.4	12.0	
BMI				<0.0001
BMI <25	40.2	32.1	19.2	
25 to <30	35.8	35.9	35.5	
≥30	24.1	32.0	45.3	
Diabetes	23.8	20.3	22.5	0.08
History of CHD or stroke (%)	12.0	8.8	7.2	0.01
SBP				<0.01
<120 mm Hg	65.8	36.3	0.9	
120 to <140 mm Hg	28.4	50.9	34.3	
140 to <160 mm Hg	5.4	11.2	45.8	
≥160 mm Hg	0.5	1.8	19.1	
SBP (mean, SD)	116 (14.8)	126 (13.6)	148 (14.7)	
Death by cause (%)				
Cancer	4.1	3.6	6.0	0.13
Vascular	9.7	6.2	7.7	<0.01
CHD	3.7	2.4	3.4	0.09
Stroke	2.7	1.4	0.9	0.02

Abbreviations: BMI, body mass index; BP, blood pressure; CHD, coronary heart disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

associated with an increased risk of coronary events in this patient group.[19–24] Otherwise, results have not been uniformly consistent.[7,25] In fact, in a study of 1.3 million adults in a general outpatient population not selected for hypertension, a J-shaped relationship between DBP and adverse cardiovascular outcomes was not observed after control for potential confounders.[25] For the association between low DBP levels and mortality, the data have not been consistent at which DBP levels the mortality risk starts to increase. On-treatment data from the Systolic Hypertension in Europe Trial indicate that lowering DBP to as low as 55 mm Hg is associated with an increase in noncardiovascular but not cardiovascular mortality.[21] Nonetheless, a more prudent approach with regard to lowering DBP may be applicable to those with concomitant CHD.[5,21] Results from the CLARIFY registry, which analyzed patients with CHD and hypertension, warrant caution when lowering BP in patients with concomitant coronary artery disease as DBP of less than 70 mm Hg was found to be associated with mortality increases.[20]

The exact mechanisms explaining a potential J- or U-shaped relationship between DBP levels and mortality risk are not yet fully understood. It has been hypothesized that a higher load of comorbidities such as presence of obstructive coronary artery disease, increased arterial stiffness, and age potentially necessitate higher levels of DBP for adequate organ function and may be attributable to the reported findings and we found that women with a low DBP were more likely to have a prior history of stroke or CHD, suggesting reverse causality.[5,19] However, we controlled for this confounder as well as others that are related to both the exposure (low DBP) and outcome and the results were

Table 2. Death and CVD event rates by DBP categories

DBP	≤60 mm Hg	61 to <90 mm Hg	≥90 mm Hg	Total
Deaths				
N	436	6,855	236	7,527
n events	121	1,208	59	1,388
%	27.8%	17.6%	25.0%	18.4%
Annualized rates	5.49%	3.33%	4.98%	3.50%
(95% CI)	(3.35–7.63)	(2.90–3.75)	(2.21–7.76)	(3.08–3.91)
CVD event				
N	436	6,855	236	7,527
n events	53	624	28	705
%	12.2%	9.1%	11.9%	9.4%
Annualized rates	2.45%	1.76%	2.46%	1.82%
(95% CI)	(1.00–3.90)	(1.45–2.07)	(0.48–4.43)	(1.51–2.12)

CVD was defined as fatal and nonfatal myocardial infarction, stroke, heart failure, or any death of vascular etiology. Abbreviations: CI, confidence interval; CVD, cardiovascular disease; DBP, diastolic blood pressure.

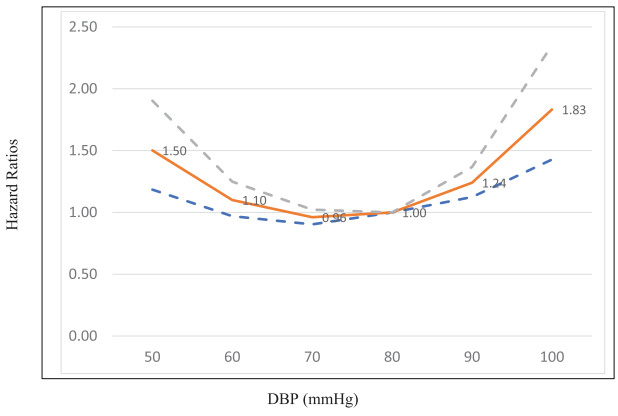

Figure 1. Hazard ratios (95% confidence interval) of death for levels of DBP compared with a DBP of 80 mm Hg. Controlling for age, race, and ethnicity, antihypertensive medication, history of stroke or CHD, SBP, and SBP[2]. Line: hazard ratios; upper dotted line: upper limit of 95% confidence interval; lower dotted line: lower limit of 95% confidence interval. Abbreviations: CHD, coronary heart disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

stronger and significant among women who had no prior history of CHD or stroke. From a pathophysiological perspective, low DBP may trigger the activation of inflammation and immune pathways, e.g., plasma soluble urokinase plasminogen activator receptor has been strongly associated with low DBP and was reported to be a good biomarker of vulnerable plaque.[26,27] Low DBP levels (i.e., <70 mm Hg) have also been found to be associated with subclinical myocardial damage (i.e., higher levels of high-sensitivity cardiac troponin-T) and coronary events.[5] Consequently, it was recommended that overly aggressive antihypertensive treatment with lowering of DBP to less than 70 mm Hg should be avoided in older hypertensive patients with concomitant CHD as coronary blood flow may be critically reduced which eventually leads the way to ischemic events and a higher mortality risk.[5,21,28] This concern is also reflected by recent data from the HOPE Trial which indicated a potential harm due to intensive BP treatment among participants who had a baseline SBP ≤131.5 mm Hg before the onset of intensive BP treatment.[29] The 2018 European Society of Cardiology/European Society of Hypertension (ESC/ESH) guideline for the management of arterial hypertension recommends that in older patients treated for hypertension, the impact of BP lowering on the well-being of the patient should be closely monitored, because the increased risk of adverse events with lower BP values could be more pronounced in older patients in a real-life setting than in the closely monitored conditions of randomized controlled trials. Consequently, the ESC sets a DBP treatment target range of 70–79 mm Hg and does not advise to lower DBP below 70 mm Hg in patients with coronary artery disease receiving BP-lowering drugs.[13]

Our findings add the following aspects to current literature. First, we found that mortality risk increased with lower DBP levels compared with a DBP of 80 mm Hg. On the other hand, low DBP was not statistically significantly associated with CVD risk, although there was some indication that low DBP posed excess CVD risk in those who had a prior history of CHD or stroke, but the number of incident CVD events in this smaller group was lower than all-cause deaths and thus this analysis had lower power. Second, we found the mortality risk to increase at a DBP lower than 75 mm Hg (nadir) for those on antihypertensive medication and at a DBP lower than 69 mm Hg (nadir) for those not on antihypertensive medications. These results are comparable and consistent with prior evidence.[22,23,30] Third, our data suggest that low DBP levels are associated with a higher mortality risk in women younger than 80 years, as well as in those at older ages (80 years or older), and in women without a history of CHD or stroke. These findings complement prior data from a tertiary-care hypertension clinic showing that low DBP

Table 3. Adjusted hazard ratios[a] (HR, 95% confidence interval) of death and CVD for various levels of DBP compared with a DBP of 80 mm Hg

	All-cause mortality		CVD	
	Minimally adjusted model[a]	Fully adjusted model[b]	Minimally adjusted model[a]	Fully adjusted model[b]
n events/*N*	1,388/7,527	1,349/7,354	795/6,983	693/7,354
% events	18.4	18.3%	10.1%	9.4%
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
DBP				
50 mm Hg	1.50 (1.18–1.90)	1.33 (1.04–1.71)	1.25 (0.87–1.81)	1.14 (0.78–1.67)
60 mm Hg	1.10 (0.97–1.25)	1.05 (0.92–1.20)	1.04 (0.86–1.25)	0.99 (0.81–1.21)
70 mm Hg	0.96 (0.90–1.02)	0.96 (0.90–1.02)	0.96 (0.88–1.05)	0.95 (0.86–1.04)
80 mm Hg	1	1	1	1
90 mm Hg	1.24 (1.12–137)	1.21 (1.09–1.33)	1.17 (1.01–1.34)	1.17 (1.01–1.35)
100 mm Hg	1.83 (1.43–2.35)	1.67 (1.29–2.16)	1.53 (1.06–2.20)	1.50 (1.03–2.17)
Nadir	73 mm Hg	72 mm Hg	68 mm Hg	69 mm Hg

CVD was defined as fatal and nonfatal myocardial infarction, stroke, heart failure, or any death of vascular etiology. Abbreviations: BMI, body mass index; CHD, coronary heart disease; CI, confidence interval; CVD, cardiovascular disease; DBP, diastolic blood pressure; HR, hazard ratio; SBP, systolic blood pressure

[a]Adjusted for history of stroke or CHD, age, race/ethnicity, antihypertensive medications, SBP, and SBP^2.

[b]Adjusted for history of stroke or CHD, age, race/ethnicity, antihypertensive medications, SBP and SBP^2, smoking, diabetes, and BMI.

Table 4. Adjusted hazard ratios (HR, 95% confidence interval) of death for various levels of DBP compared with a DBP of 80 mm Hg

	No History of CHD or stroke[a]	No History of diabetes[b]	Not on antihypertensive medications[c]	On antihypertensive medications[c]	<80 years old[d]	≥80 years old[d]
n events/*N*	1,133/6,699	1,005/5,831	575/3,929	774/3,425	279/3,581	1,070/3,773
% deaths	16.9	17.2	14.6	22.6	7.8	28.4
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
DBP						
50 mm Hg	1.43 (1.08–1.90)	1.43 (1.07–1.92)	1.37 (0.93–2.01)	1.33 (0.97–1.81)	1.57 (0.85–2.90)	1.31 (1.00–1.71)
60 mm Hg	1.10 (0.95–1.07)	1.09 (0.93–1.28)	0.97 (0.79–1.19)	1.10 (0.94–1.29)	1.49 (1.08–2.04)	1.03 (0.89–1.19)
70 mm Hg	0.97 (0.91–1.05)	0.97 (0.90–1.04)	0.87 (0.79–0.96)	1.00 (0.93–1.08)	1.14 (0.98–1.31)	0.94 (0.88–1.01)
80 mm Hg	1	1	1	1	1	1
90 mm Hg	1.19 (1.07–1.32)	1.20 (1.07–1.35)	1.46 (1.24–1.73)	1.09 (0.96–1.24)	1.01 (0.81–1.27)	1.23 (1.10–1.38)
100 mm Hg	1.63 (1.24–2.14)	1.68 (1.25–2.26)	2.72 (1.78–4.17)	1.30 (0.92–1.83)	1.18 (0.66–2.10)	1.76 (1.32–2.35)
Nadir	73 mm Hg	73 mm Hg	69 mm Hg	75 mm Hg	75 mm Hg	71 mm Hg

Abbreviations: BMI, body mass index; CHD, coronary heart disease; CI, confidence interval; DBP, diastolic blood pressure; HR, hazard ratio; SBP, systolic blood pressure.

[a]Adjusted for age, race/ethnicity, antihypertensive medications, SBP and SBP^2, smoking, diabetes, and BMI.

[b]Adjusted for history of stroke or CHD, age, race/ethnicity, antihypertensive medications, SBP and SBP^2, smoking, and BMI.

[c]Adjusted for history of stroke or CHD, age, race/ethnicity, SBP and SBP^2, smoking, diabetes, and BMI.

[d]Adjusted for history of stroke or CHD, age, race/ethnicity, antihypertensive medications, SBP and SBP^2, smoking, diabetes, and BMI.

levels may be particularly harmful for younger individuals independent of CVD history.[31] Low DBP levels in these patients groups should be followed-up carefully and treatment decisions should be based upon other preexisting comorbidities. Fourth, while in our study low DBP posed excess mortality risk in those without diabetes, we did not find significant mortality increases below DBP <80 mm Hg in those with diabetes. These findings concur with prior meta-analyses which showed no harmful results when lowering DBP to <80 mm Hg in patients with type 2 diabetes.[32]

Strengths of our analysis include a large, well-characterized cohort with long-term follow-up and standardized BP

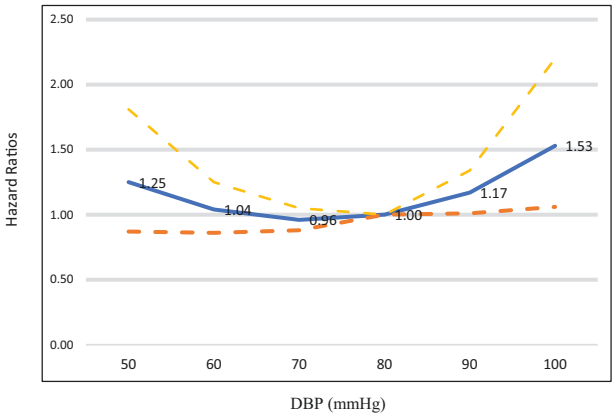

Figure 2. Hazard ratios (95% confidence interval) of composite CVD for levels of DBP compared with a DBP of 80 mm Hg. Controlling for age, race, antihypertensive medication, SBP, SBP^2, DBP, and DBP^2. Line: hazard ratios; upper dotted line: upper limit of 95% confidence interval; lower dotted line: lower limit of 95% confidence interval. Abbreviations: CVD, cardiovascular disease; DBP, diastolic blood pressure; SBP, systolic blood pressure.

assessment. On the other hand, exposure assessment was based on a one-time in-person home visit and our study population consisted of relatively healthy elderly women which limits generalizability. Another limitation of this analysis is that assessment of antihypertensive medication use was not done at the same time when BP was measured, thus associations found should be viewed in this light. Results are based on an observational cohort consisting of elderly women and causal inferences cannot be made.

In conclusion, consideration should be given to the potential adverse effects of low DBP measurements. In this large cohort of elderly women, DBP levels in the range between 69 and 75 mm Hg are associated with lower mortality risk.

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DISCLOSURE

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