Online-Only Supplementary Materials

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Table S1. International Classification of Diseases (ICD) codes to identify cardiovascular events

	ICD-9	ICD-10
Myocardial infarction	410.x	I21.x, I22.x
Stroke	430, 431, 433, 434, 436	I60, I61, I63, I64
Heart failure exacerbation	428.x	I50.x

Table S2. Baseline characteristics by antihypertensive medication groups in VA nursing home residents (continued)

	No medication (n=8,718)	1-2 medication (n=20,544)	≥3 medication (n=7,372)	P-value
Ethnicity				
Hispanic	562 (6.4)	1,233 (6.0)	375 (5.1)	0.001
Not Hispanic	8156 (93.6)	19311 (94.0)	6997 (94.9)	
Region				
Pacific	1,811 (20.8)	3,471 (16.9)	1,104 (15.0)	<.001
Continental	1269 (14.6)	2925 (14.2)	1065 (14.4)	
Midwest	2103 (24.1)	5544 (27.0)	2165 (29.4)	
Southeast	1509 (17.3)	3849 (18.7)	1380 (18.7)	
North Atlantic	2026 (23.2)	4755 (23.1)	1658 (22.5)	
SBP category				
<110 mmHg	1417 (16.3)	2212 (10.8)	645 (8.7)	<.001
110~129 mmHg	4566 (52.4)	9556 (46.5)	2915 (39.5)	
130~149 mmHg	2,340 (26.8)	7,012 (34.1)	2,782 (37.7)	
≥150 mmHg	395 (4.5)	1764 (8.6)	1030 (14.0)	
Fall in 30 days	2584 (30.3)	6206 (30.9)	2187 (30.2)	0.441
Statin usage	2,223 (25.5)	10,074 (49.0)	4,632 (62.8)	<.001
Glucose lowering drugs	1,586 (18.2)	7,622 (37.1)	4,135 (56.1)	<.001
Diabetes	2526 (29.0)	9635 (46.9)	4747 (64.4)	<.001
Osteoarthritis	2034 (23.3)	5573 (27.1)	2124 (28.8)	<.001
COPD	1334 (15.3)	3667 (17.8)	1544 (20.9)	<.001
Metastatic Cancer	1355 (15.5)	2169 (10.6)	469 (6.4)	<.001

Notes: Data was mean (standard deviation) or n (%) and compared using Kruskal-wills or chi-square test. Abbreviation: SBP, systolic blood pressure; COPD, chronic obstructive pulmonary disease.

Table S3. Baseline characteristics by systolic blood pressure levels

	SBP levels				P-value
	<110mmHg (n=4274)	110~129 mmHg (n=17037)	130~149 mmHg (n=12134)	≥150 mmHg (n=3189)	
Age, years	76.9 (8.3)	77.6 (8.5)	78.2 (8.4)	78.4 (8.5)	<.001
Sex, female	71 (1.7%)	341 (2.0%)	304 (2.5%)	106 (3.3%)	<.001
Race					
Black	592 (13.9%)	2536 (14.9%)	2292 (18.9%)	732 (23.0%)	<.001
White	3,319 (77.7%)	12,944 (76.0%)	8,742 (72.0%)	2,173 (68.1%)	
Asian	46 (1.1%)	235 (1.4%)	194 (1.6%)	50 (1.6%)	
American Indian	32 (0.7%)	129 (0.8%)	66 (0.5%)	24 (0.8%)	
Unknown	285 (6.7%)	1193 (7.0%)	840 (6.9%)	210 (6.6%)	
Ethnicity					
Hispanic	224 (5.2%)	944 (5.5%)	773 (6.4%)	229 (7.2%)	<.001
Not Hispanic	4050 (94.8%)	16093 (94.5%)	11361 (93.6%)	2960 (92.8%)	
Region					
Pacific	879 (20.6%)	2,959 (17.4%)	2,043 (16.8%)	505 (15.8%)	<.001
Continental	574 (13.4%)	2483 (14.6%)	1731 (14.3%)	471 (14.8%)	
Midwest	1119 (26.2%)	4626 (27.2%)	3220 (26.5%)	847 (26.6%)	
Southeast	715 (16.7%)	3121 (18.3%)	2317 (19.1%)	585 (18.3%)	
North Atlantic	987 (23.1%)	3848 (22.6%)	2823 (23.3%)	781 (24.5%)	
Height, cm	175.7 (9.1)	175.4 (9)	175.1 (9.2)	174.6 (8.8)	<.001
Weight, kg	84.2 (22.6)	86.5 (22.9)	87.2 (22.5)	86.1 (21)	<.001
Smoking status					
Current	1,287 (30.1%)	4,454 (26.1%)	2,795 (23.0%)	764 (24.0%)	<.001
Former	1706 (39.9%)	7084 (41.6%)	5230 (43.1%)	1337 (41.9%)	
Never	728 (17.0%)	3007 (17.6%)	2246 (18.5%)	599 (18.8%)	
Unknown	553 (12.9%)	2492 (14.6%)	1863 (15.4%)	489 (15.3%)	
SBP, mmHg	103.3 (5.3)	120.2 (5.6)	137.7 (5.5)	158.4 (8.1)	<.001
DBP, mmHg	61.7 (6.1)	67.7 (6.6)	72.8 (7.4)	77.8 (8.5)	<.001
ADL					
0	234 (5.5%)	1,036 (6.1%)	704 (5.8%)	208 (6.5%)	0.086
1-14	1876 (43.9%)	7548 (44.3%)	5468 (45.1%)	1347 (42.2%)	
15-27	1982 (46.4%)	7763 (45.6%)	5469 (45.1%)	1480 (46.4%)	
28	182 (4.3%)	690 (4.1%)	493 (4.1%)	154 (4.8%)	
Fall in 30 days	1150 (27.4%)	5091 (30.5%)	3746 (31.6%)	990 (31.8%)	<.001
CFS					
Cognitively intact	1,113 (26.0%)	4,292 (25.2%)	2,873 (23.7%)	754 (23.6%)	<.001
Mildly impaired	1750 (40.9%)	6351 (37.3%)	4228 (34.8%)	1077 (33.8%)	
Moderately impaired	749 (17.5%)	3496 (20.5%)	2797 (23.1%)	737 (23.1%)	
Severely impaired	662 (15.5%)	2898 (17.0%)	2236 (18.4%)	621 (19.5%)	
Antihypertensives					
0	1,417 (33.2%)	4,566 (26.8%)	2,340 (19.3%)	395 (12.4%)	<.001
1-2	2212 (51.8%)	9556 (56.1%)	7012 (57.8%)	1764 (55.3%)	
>=3	645 (15.1%)	2915 (17.1%)	2782 (22.9%)	1030 (32.3%)	
Statin usage	1,662 (38.9%)	7,914 (46.5%)	5,819 (48.0%)	1,534 (48.1%)	<.001
Glucose lowering drugs	1,127 (26.4%)	5,825 (34.2%)	4,949 (40.8%)	1,442 (45.2%)	<.001
Hypertension	2955 (69.1%)	13552 (79.5%)	10565 (87.1%)	2911 (91.3%)	<.001
CVD	2734 (64.0%)	11256 (66.1%)	8243 (67.9%)	2218 (69.6%)	<.001
Heart Failure	1775 (41.5%)	5803 (34.1%)	3839 (31.6%)	1099 (34.5%)	<.001
Diabetes	1583 (37.0%)	7474 (43.9%)	6078 (50.1%)	1773 (55.6%)	<.001
Osteoarthritis	1025 (24.0%)	4543 (26.7%)	3309 (27.3%)	854 (26.8%)	<.001
COPD	885 (20.7%)	3175 (18.6%)	1950 (16.1%)	535 (16.8%)	<.001
Kidney disease	1658 (38.8%)	6551 (38.5%)	5345 (44.0%)	1712 (53.7%)	<.001
Metastatic Cancer	649 (15.2%)	1944 (11.4%)	1112 (9.2%)	288 (9.0%)	<.001
Dementia	1452 (34.0%)	7201 (42.3%)	5592 (46.1%)	1512 (47.4%)	<.001

Notes: Data was mean (standard deviation) or n (%) and compared using Kruskal-wills or chi-square test. Abbreviation: SBP, systolic blood pressure; DBP, diastolic blood pressure; ADL, Activities of daily living; CFS,

Cognitive Function Scale; CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease.

Table S4. Unadjusted incidence rate (per 1,000 person-years) for cardiovascular events and mortality by antihypertensive medication and SBP groups

	No medication (n=8,718)	1-2 medication (n=20,544)	≥3 medication (n=7,372)
CV events			
SBP category			
<110	41.1 (30.7, 53.9)	179.8 (160.2, 201)	428.3 (368.5, 495.1)
110~129	40 (34.4, 46.3)	116 (109, 123.4)	272.8 (252.1, 294.7)
130~149	44.3 (36, 53.8)	90.5 (83.4, 97.9)	212.9 (195.1, 231.9)
≥150	57 (35.3, 87.1)	104.8 (89.9, 121.5)	212.1 (182.6, 245.1)
Total	42.1 (37.8, 46.7)	111.7 (106.9, 116.5)	250.8 (238.4, 263.7)
Mortality			
SBP category			
<110	525.2 (491.9, 560.2)	511.7 (484.9, 539.7)	557.6 (504.8, 614.5)
110~129	436.5 (420.2, 453.3)	383.4 (373, 394.1)	400.5 (381, 420.8)
130~149	436.6 (413.9, 460.2)	365.1 (353.4, 377.1)	338.2 (320.5, 356.5)
≥150	603 (535, 677.2)	404.4 (379.6, 430.4)	355 (325.1, 387)
Total	456.8 (444.6, 469.3)	390.7 (383.5, 398.1)	380.4 (368.5, 392.6)

Notes: incidence was per 1,000 person-years. SBP, systolic blood pressure.

Table S5. Fully adjusted hazard ratios of SBP and DBP levels on transition probabilities by multistate modeling

	Baseline → CV event	Baseline → Death	CV event → Death
SBP levels, mmHg			
No medication			
<110	0.89 (0.70,1.14)	0.99 (0.92,1.06)	0.86 (0.63,1.17)
110~129	0.81 (0.58,1.13)	1.09 (1.00,1.19)	1.04 (0.68,1.59)
130~149	ref	ref	ref
≥150	1.22 (0.76,1.95)	1.25 (1.09,1.42) *	0.97 (0.53,1.77)
1-2 medication			
<110	1.22 (1.10,1.35) **	1.02 (0.97,1.07)	0.97 (0.85,1.11)
110~129	1.57 (1.37,1.81) **	1.18 (1.10,1.26) **	1.14 (0.94,1.37)
130~149	ref	ref	ref
≥150	1.12 (0.94,1.32)	1.03 (0.96,1.11)	1.06 (0.84,1.32)
≥3 medication			
<110	1.13 (1.01,1.27) *	1.05 (0.96,1.14)	1.20 (1.03,1.41) *
110~129	1.50 (1.26,1.77) **	1.35 (1.17,1.54) **	1.11 (0.86,1.43)
130~149	ref	ref	ref
≥150	0.98 (0.83,1.16)	1.11 (0.99,1.25)	0.98 (0.78,1.23)

Notes: Data are hazard ratios (95% confidence intervals). SBP, systolic blood pressure. Reference group was SBP of 130~149mmHg. Models adjusted for age, sex, race, height, weight, smoking status, cardiovascular disease, heart failure, activities of daily living, Cognitive Function Scale, statins, glucose lowering drugs, diabetes, osteoarthritis, COPD, kidney disease, metastatic cancer, and dementia (model 2). * P value<.05 ** P value <.001

Table S6. Sensitivity analyses of hazard ratios of SBP levels for CV events and mortality by antihypertensive medication groups

SBP levels, mmHg	In full cohort [a]		By medication groups at week 4 [b]		Residents with dementia [c]		Residents lived >6 months [d]	
	CV events	Mortality	CV events	Mortality	CV events	Mortality	CV events	Mortality
No medication								
<110	0.81(0.58,1.13)	1.19(1.10,1.29)**	0.91(0.63,1.29)	1.22(1.11,1.34)**	0.91(0.53,1.55)	1.10(0.97,1.25)	0.85(0.58,1.25)	1.15(1.04,1.28)*
110~129	0.89(0.71,1.12)	1.00(0.94,1.07)	0.93(0.72,1.21)	1.02(0.95,1.09)	0.88(0.62,1.25)	0.95(0.87,1.03)	0.90(0.68,1.17)	1.00(0.92,1.08)
130~149	ref	ref	ref	ref	ref	ref	ref	ref
≥150	1.28(0.82,1.99)	1.31(1.16,1.48)**	1.28(0.76,2.16)	1.19(1.03,1.39)*	0.77(0.35,1.70)	1.20(1.01,1.42)*	1.29(0.77,2.15)	1.25(1.07,1.47)*
1-2 medications								
<110	1.44(1.26,1.65)**	1.33(1.25,1.41)**	1.46(1.27,1.68)**	1.38(1.29,1.47)**	1.68(1.32,2.12)**	1.27(1.15,1.41)**	1.29(1.09,1.52)*	1.20(1.11,1.30)**
110~129	1.15(1.04,1.27)*	1.05(1.01,1.09)*	1.15(1.04,1.28)*	1.06(1.01,1.10)*	1.25(1.07,1.47)*	1.01(0.95,1.07)	1.12(1.00,1.25)*	1.02(0.97,1.07)
130~149	ref	ref	ref	ref	ref	ref	ref	ref
≥150	1.16(0.99,1.36)	1.08(1.01,1.15)*	1.14(0.96,1.35)	1.08(1.01,1.17)*	1.40(1.10,1.80)*	1.09(0.99,1.20)	1.09(0.91,1.31)	1.10(1.01,1.19)*
≥3 medications								
<110	1.37(1.16,1.61)**	1.42(1.27,1.58)**	1.41(1.19,1.69)**	1.48(1.31,1.66)**	1.60(1.15,2.23)*	1.49(1.21,1.84)**	1.29(1.05,1.58)*	1.26(1.09,1.46)*
110~129	ref	ref	ref	ref	ref	ref	ref	ref
130~149	1.06(0.95,1.19)	1.09(1.02,1.17)*	1.08(0.96,1.22)	1.10(1.02,1.19)*	1.22(1.00,1.49)	1.11(0.99,1.25)	1.07(0.94,1.21)	1.07(0.98,1.17)
≥150	0.99(0.84,1.17)	1.02(0.92,1.12)	1.00(0.85,1.19)	1.04(0.93,1.15)	1.04(0.79,1.36)	1.07(0.91,1.24)	1.01(0.84,1.22)	0.99(0.88,1.12)

Notes: Data are hazard ratios (95% confidence intervals). SBP, systolic blood pressure. Reference group was SBP of 130~149mmHg. Models adjusted for age, sex, race, height, weight, smoking status, cardiovascular disease, heart failure, and activities of daily living (model 1). * P value<.05 ** P value <.001

[a] Median follow-up time was 0.51 years (mean 1.07 years) for cardiovascular events and 1.30 years (mean 1.57 years) for mortality in the full cohort.

[b] A total of 34,352 residents with complete information of antihypertensive medication at week 4 were included in this analysis.

[c] A total of 15,757 residents who had dementia at admission were included in this analysis.

[d] A total of 29,977 residents who lived more than 6 months after admission were included in this analysis.

Table S7. Hazard ratios of SBP levels and changes for CV events and mortality by antihypertensive medication groups

		CV events	Mortality
No medication			
SBP levels, mmHg	<110	0.81 (0.57,1.15)	1.31 (1.20,1.43) **
	110~129	0.91 (0.71,1.17)	1.04 (0.98,1.11)
	130~149	ref	ref
	≥150	1.27 (0.79,2.04)	1.27 (1.11,1.44) **
SBP changes	Decreasing	ref	ref
	Stable/increasing	1.32 (1.07,1.64) *	0.80 (0.76,0.85) **
1 or 2 medications			
SBP levels, mmHg	<110	1.43 (1.24,1.65) **	1.48 (1.38,1.57) **
	110~129	1.15 (1.04,1.27) *	1.10 (1.05,1.15) **
	130~149	ref	ref
	≥150	1.15 (0.97,1.36)	1.05 (0.98,1.13)
SBP changes	Decreasing	ref	ref
	Stable/increasing	1.08 (0.99,1.18)	0.77 (0.74,0.80) **
≥3 medication			
SBP levels, mmHg	<110	1.43 (1.20,1.70) **	1.60 (1.43,1.80) **
	110~129	1.10 (0.98,1.23)	1.16 (1.08,1.25) **
	130~149	ref	ref
	≥150	0.99 (0.84,1.17)	0.98 (0.89,1.09)
SBP changes	Decreasing	ref	ref
	Stable/increasing	0.94 (0.85,1.05)	0.75 (0.70,0.80) **

Notes: Data are hazard ratios (95% confidence intervals). SBP, systolic blood pressure. SBP levels were 4 categories with reference group of SBP 130~149mmHg. SBP changes were stable/increasing trajectory (random SBP slope ⩾0 mmHg/week) versus decreasing trajectory (reference, random SBP slope < 0 mmHg/week). Models adjusted for age, sex, race, height, weight, smoking status, cardiovascular disease, heart failure, and activities of daily living (model 1). * P value<.05 ** P value <.001

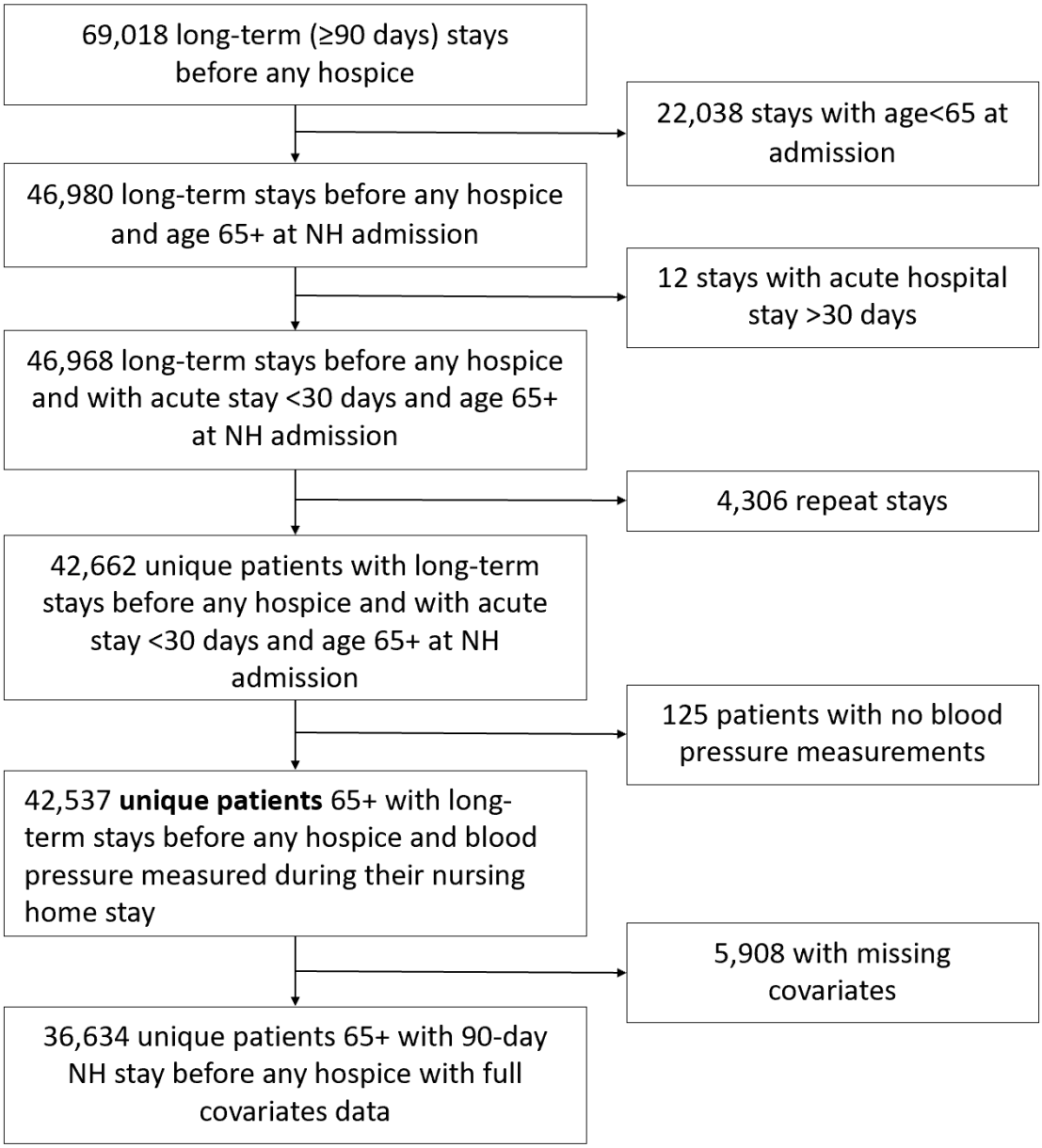

Figure S1. Flow chart of study population

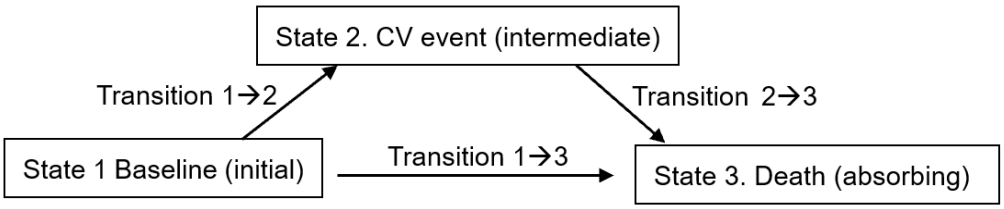

Figure S2. Diagram of multistate model for CV event

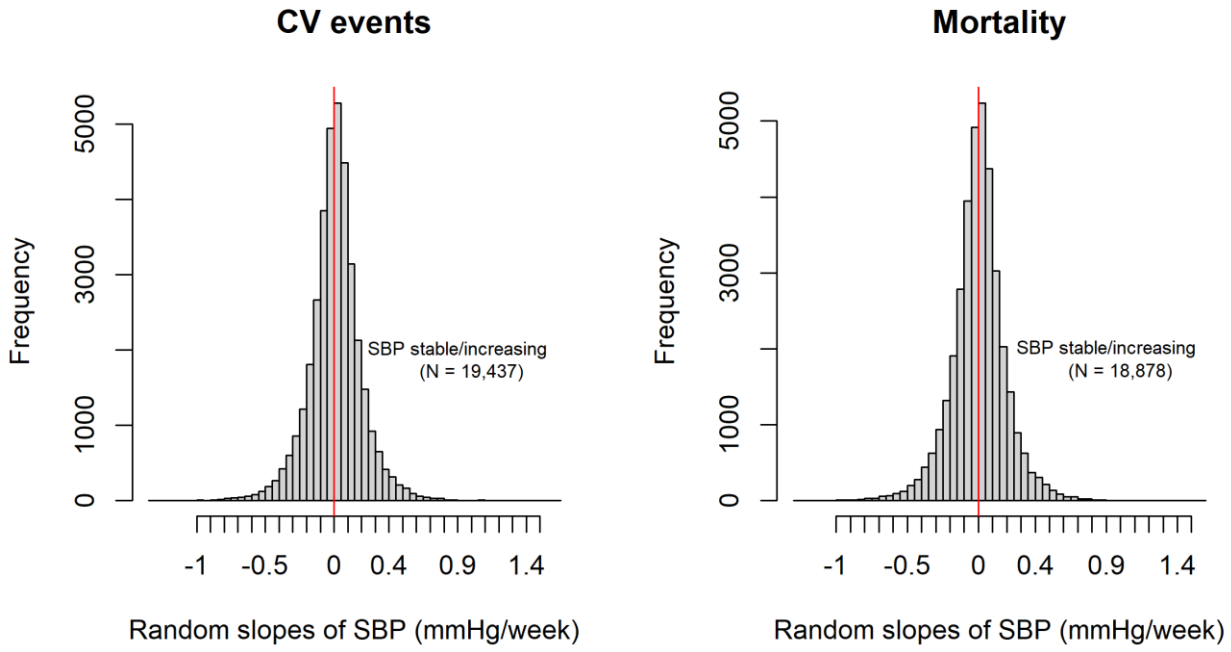

Figure S3. Random SBP slopes during follow-up period for CV events (left) and mortality (right). SBP, systolic blood pressure. Slopes were estimated using linear mixed effect modeling. Cut-off value was marked as red vertical line and a slope ≥0mmHg/week was defined as a SBP stable/increasing trajectory.

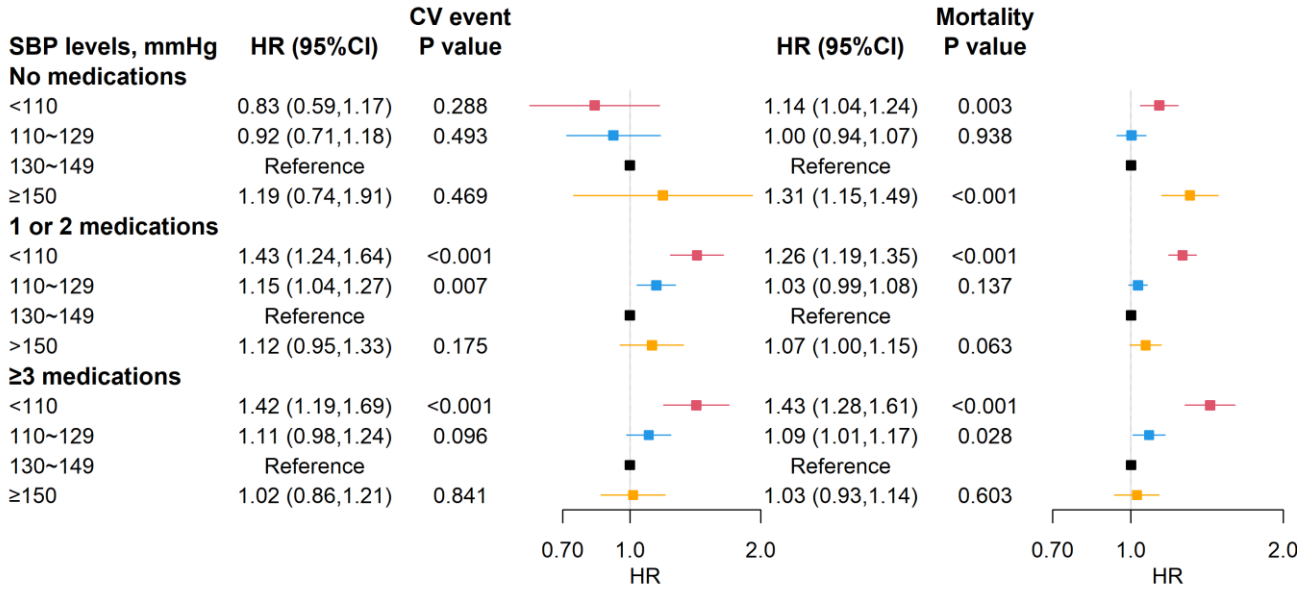

Figure S4. Fully adjusted hazard ratios of SBP levels for CV events and mortality by antihypertensive medication groups. SBP, systolic blood pressure. Blood pressure is in units of mmHg. Reference group was SBP of 130~149mmHg. Models adjusted for age, sex, race, height, weight, smoking status, cardiovascular disease, heart failure, activities of daily living, Cognitive Function Scale, statins, glucose lowering drugs, diabetes, osteoarthritis, COPD, kidney disease, metastatic cancer, and dementia (model 2). * P value<.05 ** P value <.001