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Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Appendix

Hypertension in stroke survivors and associations with national premature stroke mortality: data for 2.5 million participants from multinational screening campaigns.

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Contents

MAY MEASUREMENT MONTH

International Society of Hypertension

The World Hypertension League

PRINTED READINGS FORM

1	Please enter your site ID				
2	Please confirm that you understand that the data recorded is anonymous and you give your permission for your readings to be used for academic research purposes			☐ Yes ☐ No	
3	Please enter your Country		**4**	Please enter your City/Town	
5	Please enter today's date		**6**	Please enter the current time	
7/8	Please enter the room temperature	°C /	°F		
9	When was your blood pressure (BP) last measured? *DD / MM / YYYY*		/ /	☐ Don't know	
10/11	Please enter your month and year of birth *MM / YYYY*		/		
12	What is your sex?	☐ Male ☐ Female			
13	Are you currently on prescribed blood pressure lowering treatment?	☐ Yes ☐ No			
14	Do you have diabetes?	☐ Yes ☐ No ☐ Don't know			
15	Do you smoke?	☐ Yes ☐ No			
16	Ethnicity (self-declared)	☐ Black ☐ White ☐ South Asian ☐ Mixed ☐ East Asian ☐ Hispanic *(US ONLY)* ☐ Arabic ☐ Other			

17/*18/*19 MEASUREMENTS

	Systolic Blood Pressure (SBP)	Diastolic Blood Pressure (DBP)	Heart rate
1st measurement			
2nd measurement			
3rd measurement			

20	What type of BP machine was used to take the readings?	☐ Mercury ☐ Aneroid ☐ Semi automated wrist ☐ Semi automated upper arm ☐ Fully automated wrist ☐ Fully automated upper arm ☐ Other; specify here
21	What is the manufacturer name and model type?	
22	Which arm was used to take the blood pressure?	☐ Left ☐ Right
23	Have you had a heart attack in the past?	☐ Yes ☐ No
24	Have you had a stroke in the past?	☐ Yes ☐ No
25	Are you pregnant?	☐ Yes ☐ No
26	Please enter your weight	_____ Kilograms (kg) OR _____ Pounds (lbs.)
27	Please enter your height	____ ' ____ " Feet & inches OR _____ Centimeters (cm)
28	Do you consume alcohol?	☐ Never or rarely ☐ Less than once a week ☐ Regularly

NB: Do not record any personal data that would identify the patient e.g. name, address.

Questionnaire in 2017 May Measurement Month campaign

PRINTED READINGS FORM

PLEASE COMPLETE IN BLOCK ONLY CAPITALS, IN BLACK INK AND INSERT ONLY X IN THE CHECKBOX FIELDS

[X]

ABOUT THE SCREENING SITE

*1	Country	
*2	City/Town/Village name	
3	Site ID and/or email address	
4	Where is your screening site?	☐ Hospital/clinic ☐ Pharmacy ☐ Workplace ☐ Public area (outdoors) ☐ Public area (indoors) ☐ Other
*5	Date of measurement (dd/mm/yy)	/ /
*6	Time of measurement in 24hr clock format (e.g. 14:25)	:
7	Temperature at the site of screening	☐ °C ☐ °F

ABOUT THE PARTICIPANT

*8	Please confirm that you understand that the data recorded is anonymous and you give your permission for your readings to be used for academic research purposes	☐ Yes ☐ No
9	Ethnicity** (self-declared)	☐ Black ☐ White ☐ South Asian ☐ East Asian ☐ South-East Asian ☐ Arabic ☐ Hispanic (US ONLY) ☐ Mixed ☐ Other
10	Have you ever had your blood pressure measured?	☐ Yes ☐ No
11	If so, have you had your blood pressure measured in the last 12 months?	☐ Yes ☐ No
12	Did you participate in May Measurement Month 2017?	☐ Yes ☐ No
13	Have you ever been diagnosed with high blood pressure by a health professional (except in pregnancy)?	☐ Yes ☐ No
14	Are you currently taking prescribed medication to treat high blood pressure?	☐ Yes ☐ No ☐ Don't know
*15	How old are you in years? (Estimate if unknown)	☐ Mark with X if estimated
*16	What is your sex?	☐ Male ☐ Female ☐ Other
17	Are you pregnant?	☐ Yes ☐ No
18	Are you currently fasting?	☐ Yes ☐ No
19	Do you have diabetes?	☐ Yes ☐ No ☐ Don't know
20	Do you use tobacco?	☐ Yes ☐ No
21	Do you consume alcohol?	☐ Never / rarely ☐ 1-3 times per month ☐ At least once per week
22	Have you had a heart attack in the past?	☐ Yes ☐ No ☐ Don't know
23	Have you had a stroke in the past?	☐ Yes ☐ No ☐ Don't know

MEASUREMENTS

24	Weight (estimate if not measured)	Kilograms (kg) OR Pounds (lbs)	☐ Mark with X if estimated
25	Height (estimate if not measured)	' _" Feet & inches OR Centimeters (cm)	☐ Mark with X if estimated
26	What type of BP machine is being used to take the readings?		☐ Automated ☐ Not automated
27	What is the manufacturer name and model type?		
28	Which arm is being used to take the blood pressure?		☐ Left ☐ Right

		Systolic Blood Pressure (SBP)	Diastolic Blood Pressure (DBP)	Heart rate
*29	1st measurement			
30	2nd measurement			
31	3rd measurement			

* These questions must be answered in order to be submitted for May Measurement Month

NB: Do not record any personal data that would identify the patient e.g. name, address.

** South Asian – with origins of: India, Pakistan, Bangladesh, Nepal, Bhutan, Maldives and Sri Lanka
    East Asian – with origins of: Mainland China, Hong Kong, Macau, Taiwan, Japan, Mongolia, North Korea and South Korea, China, Hong Kong, Japan, Macau, Mongolia, North Korea, South Korea, Taiwan
    South-East Asian – with origins of: Cambodia, Laos, Myanmar (Burma), Thailand, Vietnam and Malaysia, Brunei (on the island of Borneo), Indonesia, the Philippines, Singapore and East Timor

Questionnaire in 2018 May Measurement Month campaign

Methods for multiple imputation

This section gives further details of the multiple imputation method used, modifying from the 2018 MMM campaign.[1]

Analyses were undertaken using Stata version 14·2. The imputation models were designed and implemented by TB and SC, with input from NP.

A total of 2 515 365 individuals were screened, of whom 1 822 013 (72·4%) had all 3 readings recorded, as shown in table S1.

	Total participants	Proportion
Participants with one BP reading	373 540	14·9%
Participants with two BP readings	317 794	12·6%
Participants with three BP reading	1 822 013	72·4%

Table S1: Number of BP readings per participant

1,829,218 (72·7%) individuals had a mean of the second and third readings available. This is higher than the figure above, as 5,187 individuals with reading 2 and reading 3 were missing reading 1. The blood pressure used in our definition of hypertension and subsequent analyses is calculated as the mean of the second and third readings (denoted *sbpa* and *dbpa*).

Imputation model

To account for missing blood pressure measurements *sbpa* and *dbpa,* we used multiple imputation by chained equations (MICE) which assumed missingness was dependent on the observed data only (MAR).

Multiple imputation was conducted using the mi impute chained routine in Stata for those with complete data on age, sex, ethnicity and antihypertensive medication status. The imputation model included the following variables: sex, age (as a restricted cubic spline with five knots), sex by age interaction, antihypertensive medication, known hypertension, ethnicity, region, income, sbp1, sbp2, sbp3, dbp1, dbp2, dbp3, sbpa, dpba, BMI (as a 4-level categorical variable), heart rate (measures 1, 2, and 3), temperature, temperature[2], the hour of the day of measurement, awareness of hypertension, diabetes, stroke, myocardial infarction, smoking status, alcohol intake, screening site type, pregnancy status, fasting status, measurement arm and day of the week.

Thus, following guidance provided by White *et al,* the imputation model included all variables selected to be in the analysis.[2] Variables which were used to compute the variables within the analysis model (e.g. sbp1, sbp2, sb3, dbp1, bp2, bp3) were also included following the just another variable (JAV) approach as described by Seaman et al.[3] We also explored a passive imputation approach for imputation of interactions and non-linear effects and results did not vary.

A total of 25 imputations were created, corresponding to one imputation per percent missing data on the mean of the second and third blood pressure measures. Following imputation, we assessed the Monte Carlo error of estimates to confirm this gave adequate precision of estimates.[1] The Monte Carlo errors of estimates were <10% of their standard errors indicating adequate precision. A burn-in of 10 iterations was chosen for each imputation chain meaning that imputed data sets were stored at every 10th iteration of the chain. An assessment of the predicted values from each iteration in a trace pot confirmed this was adequate and chains had converged.

Results of analyses on the imputed data were pooled across imputed data sets using Rubin's combination rules.

For individuals missing second and/or third blood pressure reading for whom the mean of second and third systolic blood pressure measurement could not be imputed using the complex MI model (due to also missing one or more of age, sex, ethnicity, and antihypertensive medication status, which we chose not to impute) we used a reduced MI model, which included sbp1, sbp2, sbp3, dbp1, dbp2, dbp2, sbpa and dbpa. The imputed data for these individuals using the reduced model was combined with the imputed data from the complex model only for the primary analysis.

In the original MMM data analyses,[1] sensitivity analysis explored the impact of alternative missing data assumptions based on the complete cases only (those participants with a mean of readings 2 & 3 available), use of the reduced imputation model for all individuals with missing data, use of complex imputation model only versus the primary analysis with the combined models. An imputation model was also run, identical to the model used in 2017,[4] only for those with age and sex recorded, incorporating age, sex (with an interaction) and region. Results did not vary across sensitivity analyses, hence the combined imputed model was selected for use within the current manuscript.

Reference：

1. Beaney T, Burrell LM, Castillo RR, et al. May Measurement Month 2018: a pragmatic global screening campaign to raise awareness of blood pressure by the International Society of Hypertension. *Eur Heart J* 2019; **40**: 2006-17.
2. White IR, Royston P, Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Stat Med*. 2011; **30**: 377-99.
3. Seaman SR, Bartlett JW, White IR. Multiple imputation of missing covariates with non-linear effects and interactions: an evaluation of statistical methods. *BMC Med Res Methodology*. 2012; **12**: 46.
4. Beaney T, Schutte AE, Tomaszewski M, et al. May Measurement Month 2017: an analysis of blood pressure screening results worldwide. *Lancet Glob Health* 2018; **6**: e736-e43.

Table S2: Characteristics of 2 222 399 study participants with and without a history of stroke with denominators

	Previous stroke n=62 639/2 222 399 (2·8%)	No previous stroke n=2 159 760/2 222 399 (97·2%)	p value*
Sex			
Male	33 910/62 204 (54·5%)	978 585/2 143 259 (45·7%)	p<0·0001
Female	28 294/62 204 (45·5%)	1 164 674/2 143 259 (54·3%)	
Age (years)	51·1 (17·4)	45·0 (16·8)	p<0·0001
Age categories:			
<40 years	16 441/57 531 (28·6%)	843 404/2 023 161 (41·7%)	
40 to 59 years	20 567/57 531 (35·7%)	724 325/2 023 161 (35·8%)	p<0·0001
60 to 79 years	17 878/57 531 (31·1%)	411 754/2 023 161 (20·3%)	
≥80 years	2 645/57 531 (4·6%)	43 678/2 023 161 (2·2%)	
Diabetes	23 630/60 951 (38·8%)	153 009/2 079 291 (7·4%)	p<0·0001
Myocardial infarction	36 743/61 720 (59·5%)	57 830/2 146 980 (2·7%)	p<0·0001
Current smoker	31 718/62 271 (50·9%)	245 826/2 149 966 (11·4%)	p<0·0001
Alcohol consumption (at least once per week)	5 798/58 295 (10·0%)	127 751/2 000 950 (6·4%)	p<0·0001
BMI, kg/m^2	25·0 (4·9)	24·4 (4·5)	p<0·0001
BMI categories:			
Underweight	4 146/57 915 (7·1%)	127 921/1 998 889 (6·4%)	
Healthy weight	26 406/57 915 (45·6%)	1 078 360/1 998 889 (54·0%)	p<0·0001
Overweight	18 575/57 915 (32·1%)	580 426/1 998 889 (29·0%)	
Obese	8 788/57 915 (15·2%)	212 182/1 998 889 (10·6%)	

Region and country	Number of participants	Percentage (%)	Mean age	Male n, (%)	Female n, (%)	Previous stroke n, (%)	No previous stroke n, (%)	Unknown stroke n, (%)	On antihypertensive treatment n, (%)	Not on antihypertensive treatment n, (%)	Unknown treatment statuses n, (%)
South-east Asia & Australasia	653 788	26·0	44·6	404 542 (61·9)	239 171 (36·6)	12613 (1·9)	602645 (92·2)	38530 (5·9)	131146 (20·1)	483788 (74·0)	38854 (5·9)
Philippines	448 780	17·8	44·7	282 108 (62·9)	163 409 (36·4)	9216 (2·1)	431699 (96·2)	7865 (1·8)	97823 (21·8)	340421 (75·9)	10536 (2·4)
Indonesia	160 529	6·4	44·0	963 25 (60·0)	57 475 (35·8)	2834 (1·8)	129034 (80·4)	28661 (17·9)	25521 (15·9)	107045 (66·7)	27963 (17·4)
Viet Nam	28 328	1·1	47·4	16 605 (58·6)	11 677 (41·2)	354 (1·3)	27429 (96·8)	545 (1·9)	4949 (17·5)	23221 (82·0)	158 (0·6)
Malaysia	8 982	0·4	42·3	5 406 (60·2)	3 554 (39·6)	114 (1·3)	7464 (83·1)	1404 (15·6)	1840 (20·5)	6989 (77·8)	153 (1·7)
Australia	7 169	0·3	42·8	4 098 (57·2)	3 056 (42·6)	95 (1·3)	7019 (97·9)	55 (0·8)	1013 (14·1)	6112 (85·3)	44 (0·6)
East Asia	484 514	19·3	51·0	258 362 (53·3)	224 631 (46·4)	8369 (1·7)	461693 (95·3)	14452 (3·0)	100073 (20·7)	277835 (57·3)	106606 (22)
China	416 635	16·6	50·1	223 604 (53·7)	191 911 (46·1)	6392 (1·5)	396639 (95·2)	13604 (3·3)	71168 (17·1)	239374 (57·5)	106093 (25·5)
Taiwan (China)	67 879	2·7	56·8	34 758 (51·2)	32 720 (48·2)	1977 (2·9)	65054 (95·8)	848 (1·3)	28905 (42·6)	38461 (56·7)	513 (0·8)
South Asia	463 223	18·4	42·2	191 633 (41·4)	270 268 (58·4)	26357 (5·7)	376098 (81·2)	60768 (13·1)	78837 (17·0)	321950 (69·5)	62436 (13·5)
India	394 655	15·7	42·2	165 766 (42·0)	227 697 (57·7)	22178 (5·6)	320702 (81·3)	51775 (13·1)	61647 (15·6)	279659 (70·9)	53349 (13·5)
Pakistan	30 409	1·2	44·7	10 338 (34·0)	20 031 (65·9)	3114 (10·2)	19163 (63·0)	8132 (26·7)	10769 (35·4)	11501 (37·8)	8139 (26·8)
Nepal	21 533	0·9	38·6	10 110 (47·0)	11 357 (52·7)	211 (1·0)	20557 (95·5)	765 (3·6)	2236 (10·4)	18993 (88·2)	304 (1·4)
Bangladesh	16 626	0·7	42·6	5 419 (32·6)	11 183 (67·3)	854 (5·1)	15676 (94·3)	96 (0·6)	4185 (25·2)	11797 (71·0)	644 (3·9)
Americas	297 183	11·8	49·8	175 676 (59·1)	118 365 (39·8)	3998 (1·4)	183271 (61·7)	109914 (37)	86338 (29·1)	184470 (62·1)	26375 (8·9)
Argentina	102 764	4·1	53·7	60 771 (59·1)	41 810 (40·7)	20 (0·0)	209 (0·2)	102535	33521 (32·6)	48208 (46·9)	21035 (20·5)

							(99·8)			
Colombia	57 806	2·3	41·5	33 504 (58·0)	24 230 (41·9)	1040 (1·8)	55804 (96·5)	962 (1·7)	9557 (16·5)	47492 (82·2)	757 (1·3)
Venezuela	50 294	2·0	53·8	31 563 (62·8)	18 678 (37·1)	1281 (2·6)	48980 (97·4)	33 (0·1)	20492 (40·7)	29377 (58·4)	425 (0·9)
Brazil	19 758	0·8	54·5	10 519 (53·2)	7 517 (38·1)	538 (2·7)	16218 (82·1)	3002 (15·2)	9367 (47·4)	9499 (48·1)	892 (4·5)
Ecuador	18 906	0·8	47·9	9 787 (51·8)	9 040 (47·8)	399 (2·1)	18449 (97·6)	58 (0·3)	4783 (25·3)	14069 (74·4)	54 (0·3)
Chile	14 098	0·6	46·7	8 917 (63·3)	5 040 (35·8)	155 (1·1)	12876 (91·3)	1067 (7·6)	2030 (14·4)	11060 (78·5)	1008 (7·2)
Mexico	11 255	0·5	44·9	6 879 (61·1)	4 300 (38·2)	62 (0·6)	9300 (82·6)	1893 (16·8)	1018 (9·0)	8283 (73·6)	1954 (17·4)
Uruguay	3 832	0·2	45·6	2 634 (68·7)	400 (10·4)	77 (2·0)	3585 (93·6)	170 (4·4)	1040 (27·1)	2634 (68·7)	158 (4·1)
Paraguay	3 481	0·1	40·7	1 931 (55·5)	1550 (44·5)	12 (0·3)	3450 (99·1)	19 (0·6)	487 (14·0)	2963 (85·1)	31 (0·9)
United States of America	2 427	0·1	47·2	1 496 (61·6)	928 (38·2)	90 (3·7)	2333 (96·1)	4 (0·2)	823 (33·9)	1600 (65·9)	4 (0·2)
Dominican Republic	1 883	<0·1	43·9	999 (53·1)	884 (47·0)	63 (3·4)	1793 (95·2)	27 (1·4)	1123 (59·6)	747 (39·7)	13 (0·7)
Jamaica	1 602	<0·1	45·5	1 093 (68·2)	509 (31·8)	49 (3·1)	1550 (96·8)	3 (0·2)	384 (24·0)	1203 (75·1)	15 (0·9)
Honduras	1 479	<0·1	45·0	670 (45·3)	807 (54·6)	20 (1·4)	1449 (98·0)	10 (0·7)	217 (14·7)	1258 (85·1)	4 (0·3)
Guatemala	1 434	<0·1	48·8	859 (59·9)	573 (40·0)	32 (2·2)	1382 (96·4)	20 (1·4)	549 (38·3)	879 (61·3)	6 (0·4)
Peru	1 381	<0·1	45·9	854 (61·8)	527 (38·2)	90 (6·5)	1288 (93·3)	3 (0·2)	170 (12·3)	1211 (87·7)	0 (0·0)
El Salvador	1 358	<0·1	48·1	1 061 (78·1)	297 (21·9)	23 (1·7)	1330 (97·9)	5 (0·4)	241 (17·8)	1112 (81·9)	5 (0·4)
Canada	1 053	<0·1	44·3	640 (60·8)	402 (38·2)	16 (1·5)	1016 (96·5)	21 (2·0)	159 (15·1)	883 (83·9)	11 (1·0)
Nicaragua	982	<0·1	N/A	616 (62·7)	366 (37·3)	3 (0·3)	977 (99·5)	2 (0·2)	167 (17·0)	815 (83·0)	0 (0·0)
Barbados	964	<0·1	46·5	579 (60·1)	385 (39·9)	13 (1·4)	938 (97·3)	13 (1·4)	175 (18·2)	786 (81·5)	3 (0·3)
Haiti	426	<0·1	42·6	304 (71·4)	122 (28·6)	15 (3·5)	344 (80·8)	67 (15·7)	35 (8·2)	391 (91·8)	0 (0·0)

Sub-Saharan Africa	280 597	11·2	39·6	148 079 (52·8)	129 129 (46)	2490 (0·9)	240452 (85·7)	37655 (13·4)	24560 (8·8)	240410 (85·7)	15627 (5·6)
Kenya	64 403	2·6	39·9	35 494 (55·1)	28 882 (44·9)	318 (0·5)	32207 (50·0)	31878 (49·5)	3879 (6·0)	55791 (86·6)	4733 (7·4)
Angola	31 914	1·3	37·8	18 160 (56·9)	13 754 (43·1)	339 (1·1)	31476 (98·6)	99 (0·3)	4183 (13·1)	27607 (86·5)	124 (0·4)
Nigeria	26 302	1·1	41·1	13 005 (49·4)	10 977 (41·7)	297 (1·1)	25584 (97·3)	421 (1·6)	3543 (13·5)	22212 (84·5)	547 (2·1)
Ivory Coast	25 377	1·0	37·5	10 114 (39·9)	15 159 (59·7)	121 (0·5)	25084 (98·9)	172 (0·7)	1137 (4·5)	23994 (94·6)	246 (1·0)
Cameroon	24 976	1·0	40·3	13 412 (53·7)	11 179 (44·8)	288 (1·2)	24397 (97·7)	291 (1·2)	2360 (9·5)	22329 (89·4)	287 (1·2)
Democratic Republic of Congo	18 719	0·7	41·5	7 201 (38·5)	11 486 (61·4)	217 (1·2)	17661 (94·4)	841 (4·5)	1446 (7·7)	16382 (87·5)	891 (4·8)
Malawi	14 800	0·6	38·4	8 156 (55·1)	6 622 (44·7)	131 (0·9)	14452 (97·7)	217 (1·5)	455 (3·1)	13948 (94·2)	397 (2·7)
Zambia	11 343	0·5	36·8	6 830 (60·2)	4 498 (39·7)	138 (1·2)	11150 (98·3)	55 (0·5)	921 (8·1)	10331 (91·1)	91 (0·8)
Cabo Verde	10 638	0·4	40·4	7 357 (69·2)	3 230 (30·4)	130 (1·2)	10400 (97·8)	108 (1·0)	2015 (18·9)	8556 (80·4)	67 (0·6)
Republic of the Congo	10 011	0·4	37·3	4 738 (47·3)	5 272 (52·7)	230 (2·3)	8905 (89·0)	876 (8·8)	1113 (11·1)	8242 (82·3)	656 (6·6)
Mauritius	7 773	0·3	46·2	4 763 (61·3)	2 999 (38·6)	6 (0·1)	7766 (99·9)	1 (0·0)	4 (0·1)	2298 (29·6)	5471 (70·4)
Ghana	6 907	0·3	40·9	3 692 (53·5)	3 198 (46·3)	60 (0·9)	6579 (95·3)	268 (3·9)	828 (12·0)	5820 (84·3)	259 (3·8)
Botswana	6 256	0·3	35·7	3 329 (53·2)	2 885 (46·1)	65 (1·0)	6052 (96·7)	139 (2·2)	671 (10·7)	5512 (88·1)	73 (1·2)
South Africa	6 215	0·3	39·2	4 014 (64·6)	2 196 (35·3)	46 (0·7)	6134 (98·7)	35 (0·6)	840 (13·5)	5362 (86·3)	13 (0·2)
Mozambique	4 815	0·2	39·7	2 562 (53·2)	2 015 (41·9)	34 (0·7)	3737 (77·6)	1044 (21·7)	331 (6·9)	4274 (88·8)	210 (4·4)
Benin	2 035	<0·1	44·2	1 138 (55·9)	897 (44·1)	15 (0·7)	2001 (98·3)	19 (0·9)	286 (14·1)	1739 (85·5)	10 (0·5)
Burundi	1 897	<0·1	43·3	1 122 (59·2)	691 (36·4)	11 (0·6)	1869 (98·5)	17 (0·9)	79 (4·2)	1611 (84·9)	207 (10·9)
Niger	1 599	<0·1	43·1	713 (44·6)	885 (55·4)	1 (0·1)	475 (29·7)	1123 (70·2)	17 (1·1)	485 (30·3)	1097 (68·6)

Country										
Uganda	1 239	<0·1	36·7	662 (53·4)	577 (46·6)	5 (0·4)	1231 (99·4)	3 (0·2)	103 (8·3)	1131 (91·3)	5 (0·4)
Zimbabwe	1 155	<0·1	39·1	695 (60·2)	456 (39·5)	8 (0·7)	1130 (97·8)	17 (1·5)	106 (9·2)	1041 (90·1)	8 (0·7)
Sierra Leone	592	<0·1	44·5	297 (50·2)	295 (49·8)	22 (3·7)	565 (95·4)	5 (0·8)	66 (11·2)	502 (84·8)	24 (4·1)
Ethiopia	542	<0·1	41·8	127 (23·4)	386 (71·2)	2 (0·4)	535 (98·7)	5 (0·9)	48 (8·9)	290 (53·5)	204 (37·6)
Mali	493	<0·1	37·6	166 (33·7)	327 (66·3)	0 (0·0)	493 (100·0)	0 (0·0)	8 (1·6)	485 (98·4)	0 (0·0)
Seychelles	304	<0·1	45·1	178 (58·6)	126 (41·5)	2 (0·7)	302 (99·3)	0 (0·0)	71 (23·4)	233 (76·6)	0 (0·0)
Sao Tome and Principe	194	<0·1	44·5	107 (55·2)	87 (44·9)	1 (0·5)	173 (89·2)	20 (10·3)	38 (19·6)	150 (77·3)	6 (3·1)
Somalia	98	<0·1	41·1	47 (48)	50 (51)	3 (3·1)	94 (95·9)	1 (1·0)	12 (12·2)	85 (86·7)	1 (1·0)
Europe	189 392	7·5	50·6	112 862 (59·6)	75 472 (39·9)	7464 (3·9)	164675 (87)	17253 (9·1)	63129 (33·3)	106756 (56·4)	19507 (10·3)
Ukraine	45 812	1·8	51·0	27 346 (59·7)	18 462 (40·3)	3210 (7·0)	42439 (92·6)	163 (0·4)	27339 (59·7)	18473 (40·3)	0 (0·0)
Armenia	30 311	1·2	47·4	17 463 (57·6)	12 831 (42·3)	1604 (5·3)	28373 (93·6)	334 (1·1)	7162 (23·6)	23020 (76·0)	129 (0·4)
Georgia	16 900	0·7	54·1	11 215 (66·4)	5 685 (33·6)	518 (3·1)	16382 (96·9)	0 (0·0)	7487 (44·3)	9413 (55·7)	0 (0·0)
Italy	15 630	0·6	55·2	7 644 (48·9)	7 502 (48)	122 (0·8)	5433 (34·8)	10075 (64·5)	0 (0·0)	1 (0·0)	15629 (100·0)
Poland	12 289	0·5	41·2	7 125 (58)	5 153 (41·9)	221 (1·8)	11829 (96·3)	239 (1·9)	2207 (18·0)	9900 (80·6)	182 (1·5)
Spain	11 495	0·5	53·3	7 152 (62·2)	4 323 (37·6)	359 (3·1)	10565 (91·9)	571 (5·0)	3643 (31·7)	6999 (60·9)	853 (7·4)
United Kingdom	9 749	0·4	47·8	5 777 (59·3)	3 947 (40·5)	216 (2·2)	9266 (95·1)	267 (2·7)	1604 (16·5)	7998 (82·0)	147 (1·5)
Albania	8 054	0·3	47·1	4 914 (61)	3095 (38·4)	51 (0·6)	7962 (98·9)	41 (0·5)	1578 (19·6)	6049 (75·1)	427 (5·3)
Russia	7 591	0·3	46·8	5 480 (72·2)	2 109 (27·8)	182 (2·4)	7078 (93·2)	331 (4·4)	2295 (30·2)	5282 (69·6)	14 (0·2)
Slovenia	4 883	0·2	58·9	2 978 (61)	1 874 (38·4)	137 (2·8)	4619 (94·6)	127 (2·6)	1991 (40·8)	2837 (58·1)	55 (1·1)
Austria	4 879	0·2	53·9	2 800 (57·4)	2 079 (42·6)	156 (3·2)	4689 (96·1)	34 (0·7)	1627 (33·4)	3214 (65·9)	38 (0·8)

Hungary	4 474	0·2	50·1	2 650 (59·2)	1 824 (40·8)	209 (4·7)	4265 (95·3)	0 (0·0)	1699 (38·0)	2775 (62·0)	0 (0·0)
Republic of Ireland	2 967	0·1	52·1	1 918 (64·6)	1046 (35·3)	37 (1·3)	1663 (56·1)	1267 (42·7)	823 (27·7)	2130 (71·8)	14 (0·5)
Lithuania	2 397	0·1	46·2	1 414 (59)	927 (38·7)	3 (0·1)	373 (15·6)	2021 (84·3)	369 (15·4)	1427 (59·5)	601 (25·1)
Switzerland	2 172	<0·1	49·4	1 484 (68·3)	688 (31·7)	44 (2·0)	2088 (96·1)	40 (1·8)	449 (20·7)	1704 (78·5)	19 (0·9)
Belgium	1 845	<0·1	51·8	1 195 (64·8)	644 (34·9)	53 (2·9)	1783 (96·6)	9 (0·5)	469 (25·4)	1368 (74·2)	8 (0·4)
Romania	1 831	<0·1	51·8	1 143 (62·4)	676 (36·9)	64 (3·5)	1751 (95·6)	16 (0·9)	576 (31·5)	806 (44·0)	449 (24·5)
Bosnia and Herzegovina	1 428	<0·1	53·6	865 (60·6)	561 (39·3)	46 (3·2)	845 (59·2)	537 (37·6)	615 (43·1)	798 (55·9)	15 (1·1)
Portugal	1 251	<0·1	59·8	561 (44·8)	386 (30·9)	58 (4·6)	878 (70·2)	315 (25·2)	477 (38·1)	464 (37·1)	310 (24·8)
Serbia	946	<0·1	57·3	474 (50·1)	472 (49·9)	106 (11·2)	840 (88·8)	0 (0·0)	83 (8·8)	863 (91·2)	0 (0·0)
Germany	911	<0·1	62·5	469 (51·5)	441 (48·4)	14 (1·5)	275 (30·2)	622 (68·3)	234 (25·7)	261 (28·7)	416 (45·7)
Greece	541	<0·1	59·0	247 (45·7)	292 (54)	14 (2·6)	526 (97·2)	1 (0·2)	181 (33·5)	358 (66·2)	2 (0·4)
Luxembourg	430	<0·1	51·9	259 (60·2)	171 (39·8)	16 (3·7)	413 (96·1)	1 (0·2)	94 (21·9)	334 (77·7)	2 (0·5)
Denmark	234	<0·1	62·7	121 (51·7)	113 (48·3)	19 (8·1)	168 (71·8)	47 (20·1)	105 (44·9)	126 (53·9)	3 (1·3)
France	194	<0·1	41·9	59 (30·4)	103 (53·1)	0 (0·0)	0 (0·0)	194 (100·0)	0 (0·0)	0 (0·0)	194 (100)
Sweden	178	<0·1	44·2	109 (61·2)	68 (38·2)	5 (2·8)	172 (96·6)	1 (0·6)	22 (12·4)	156 (87·6)	0 (0·0)
Northern Africa and Middle East	146 668	5·8	36·4	58 169 (39·7)	85 260 (58·1)	1348 (0·9)	130926 (89·3)	14394 (9·8)	9637 (6·6)	121439 (82·8)	15592 (10·6)
Sudan	85 192	3·4	34·9	35 519 (41·7)	47 560 (55·8)	577 (0·7)	77544 (91·0)	7071 (8·3)	2464 (2·9)	73942 (86·8)	8786 (10·3)
United Arab Emirates	37 514	1·5	36·7	14 835 (39·6)	22 350 (59·6)	212 (0·6)	34541 (92·1)	2761 (7·4)	3386 (9·0)	31685 (84·5)	2443 (6·5)
Oman	13 623	0·5	40·6	3 265 (24)	9 601 (70·5)	356 (2·6)	9385 (68·9)	3882 (28·5)	1952 (14·3)	8086 (59·4)	3585 (26·3)

Libya	7 279	0·3	44·3	3 068 (42·2)	4 206 (57·8)	172 (2·4)	7060 (97·0)	47 (0·7)	1433 (19·7)	5759 (79·1)	87 (1·2)
Egypt	941	<0·1	37·4	570 (60·6)	370 (39·3)	12 (1·3)	929 (98·7)	0 (0)	146 (15·5)	793 (84·3)	2 (0·2)
Lebanon	820	<0·1	50·2	406 (49·5)	413 (50·4)	17 (2·1)	622 (75·9)	181 (22·1)	222 (27·1)	407 (49·6)	191 (23·3)
Israel	762	<0·1	24·7	264 (34·7)	493 (64·7)	2 (0·3)	753 (98·8)	7 (0·9)	23 (3)	694 (91·1)	45 (5·9)
Saudi Arabia	537	<0·1	39·6	242 (45·1)	267 (49·7)	0 (0·0)	92 (17·1)	445 (82·9)	11 (2·1)	73 (13·6)	453 (84·4)
Worldwide	2 515 365	100	45·4	1 349 323 (53·6)	1142 296 (45·4)	62639 (2·5)	2159760 (85·9)	292966 (11·7)	493720 (19·6)	1736648 (69·0)	284997 (11·3)

*Missing sex record and sex as "other" were not displayed here. Proportions may not be added up 100 % as rounded to one decimal place.

Table S3: Participant characteristics in each country

	Mean systolic/diastolic blood pressure, mm Hg		Proportion of participants with hypertension	
	Previous stroke n = 52 261	No previous stroke n = 1 712 340	Previous stroke n = 52 261	No previous stroke n = 1 712 340
Reading 1	132·7/81·8	125·1/79·1	80·6%	38·3%
Reading 2	130·3/79·9	123·2/78·1	79·4%	35·4%
Reading 3	128·6/78·6	122·2/77·3	78·7%	34·2%
Mean of reading 2&3	129·6/79·4	122·9/77·9	78·6%	33·3%

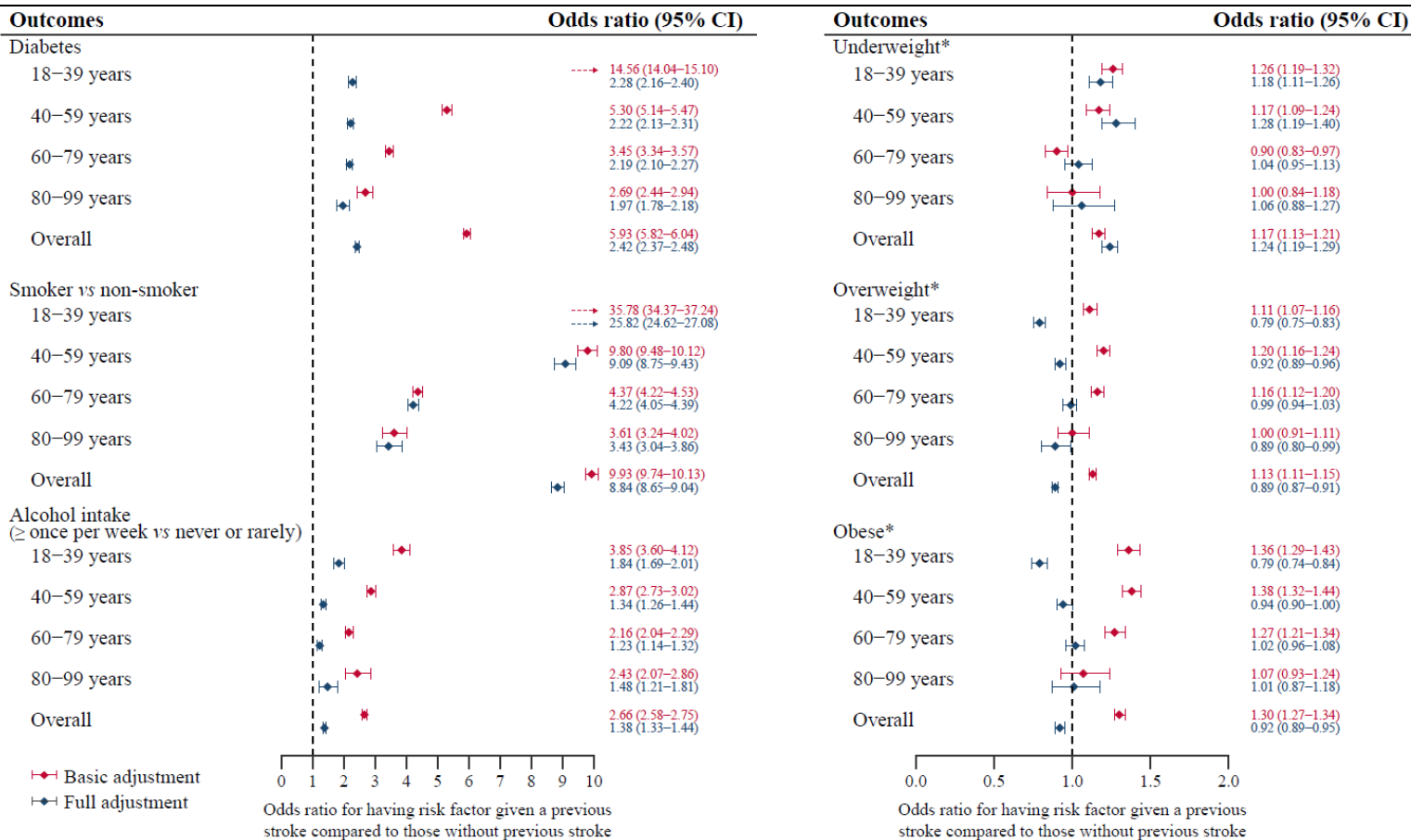Data based on those participants with all three blood pressure readings.

Table S4: Differences in serial and mean blood pressure readings and the proportions of participants with hypertension in those with and without a history of stroke

Excluding those missing medication records			
	Participants with a previous stroke	**Participants without a previous stroke**	**p-value***
Proportion with hypertension, of all participants	71·8%	33·6%	p<0·0001
Proportion on medication, of participants with hypertension	90·2%	55·2%	p<0·0001
Proportion with controlled blood pressure, of participants on medication	72·9%	61·4%	p<0·0001
Proportion with controlled blood pressure, of participants with hypertension	65·2%	31·9%	p<0·0001
Assuming those missing medication records were on medication			
	Participants with a previous stroke	**Participants without a previous stroke**	**p-value***
Proportion with hypertension, of all participants	72·8%	38·0%	p<0·0001
Proportion on medication, of participants with hypertension	90·7%	61·2%	p<0·0001
Proportion with controlled blood pressure, of participants on medication	73·6%	68·8%	p<0·0001
Proportion with controlled blood pressure, of participants with hypertension	66·1%	39·1%	p<0·0001

Age-sex standardised according to the World Health Organization world standard population assuming an equal male to female ratio.

*p-values comparing those with and without a previous stroke were calculated from Chi-square tests.

Table S5: Sensitivity analyses comparing assumptions regarding antihypertensive medication record missingness in calculating hypertension, treatment and control parameters after multiple imputation and age-sex standardisation in participants with and without a previous stroke (%)

Outcomes	Odds ratio (95% CI)	Outcomes	Odds ratio (95% CI)
Diabetes		**Underweight***	
18–39 years	14.56 (14.04–15.10) / 2.28 (2.16–2.40)	18–39 years	1.26 (1.19–1.32) / 1.18 (1.11–1.26)
40–59 years	5.30 (5.14–5.47) / 2.22 (2.13–2.31)	40–59 years	1.17 (1.09–1.24) / 1.28 (1.19–1.40)
60–79 years	3.45 (3.34–3.57) / 2.19 (2.10–2.27)	60–79 years	0.90 (0.83–0.97) / 1.04 (0.95–1.13)
80–99 years	2.69 (2.44–2.94) / 1.97 (1.78–2.18)	80–99 years	1.00 (0.84–1.18) / 1.06 (0.88–1.27)
Overall	5.93 (5.82–6.04) / 2.42 (2.37–2.48)	Overall	1.17 (1.13–1.21) / 1.24 (1.19–1.29)
Smoker *vs* non-smoker		**Overweight***	
18–39 years	35.78 (34.37–37.24) / 25.82 (24.62–27.08)	18–39 years	1.11 (1.07–1.16) / 0.79 (0.75–0.83)
40–59 years	9.80 (9.48–10.12) / 9.09 (8.75–9.43)	40–59 years	1.20 (1.16–1.24) / 0.92 (0.89–0.96)
60–79 years	4.37 (4.22–4.53) / 4.22 (4.05–4.39)	60–79 years	1.16 (1.12–1.20) / 0.99 (0.94–1.03)
80–99 years	3.61 (3.24–4.02) / 3.43 (3.04–3.86)	80–99 years	1.00 (0.91–1.11) / 0.89 (0.80–0.99)
Overall	9.93 (9.74–10.13) / 8.84 (8.65–9.04)	Overall	1.13 (1.11–1.15) / 0.89 (0.87–0.91)
Alcohol intake (≥ once per week *vs* never or rarely)		**Obese***	
18–39 years	3.85 (3.60–4.12) / 1.84 (1.69–2.01)	18–39 years	1.36 (1.29–1.43) / 0.79 (0.74–0.84)
40–59 years	2.87 (2.73–3.02) / 1.34 (1.26–1.44)	40–59 years	1.38 (1.32–1.44) / 0.94 (0.90–1.00)
60–79 years	2.16 (2.04–2.29) / 1.23 (1.14–1.32)	60–79 years	1.27 (1.21–1.34) / 1.02 (0.96–1.08)
80–99 years	2.43 (2.07–2.86) / 1.48 (1.21–1.81)	80–99 years	1.07 (0.93–1.24) / 1.01 (0.87–1.18)
Overall	2.66 (2.58–2.75) / 1.38 (1.33–1.44)	Overall	1.30 (1.27–1.34) / 0.92 (0.89–0.95)

Basic adjustment
Full adjustment

Odds ratio for having risk factor given a previous stroke compared to those without previous stroke
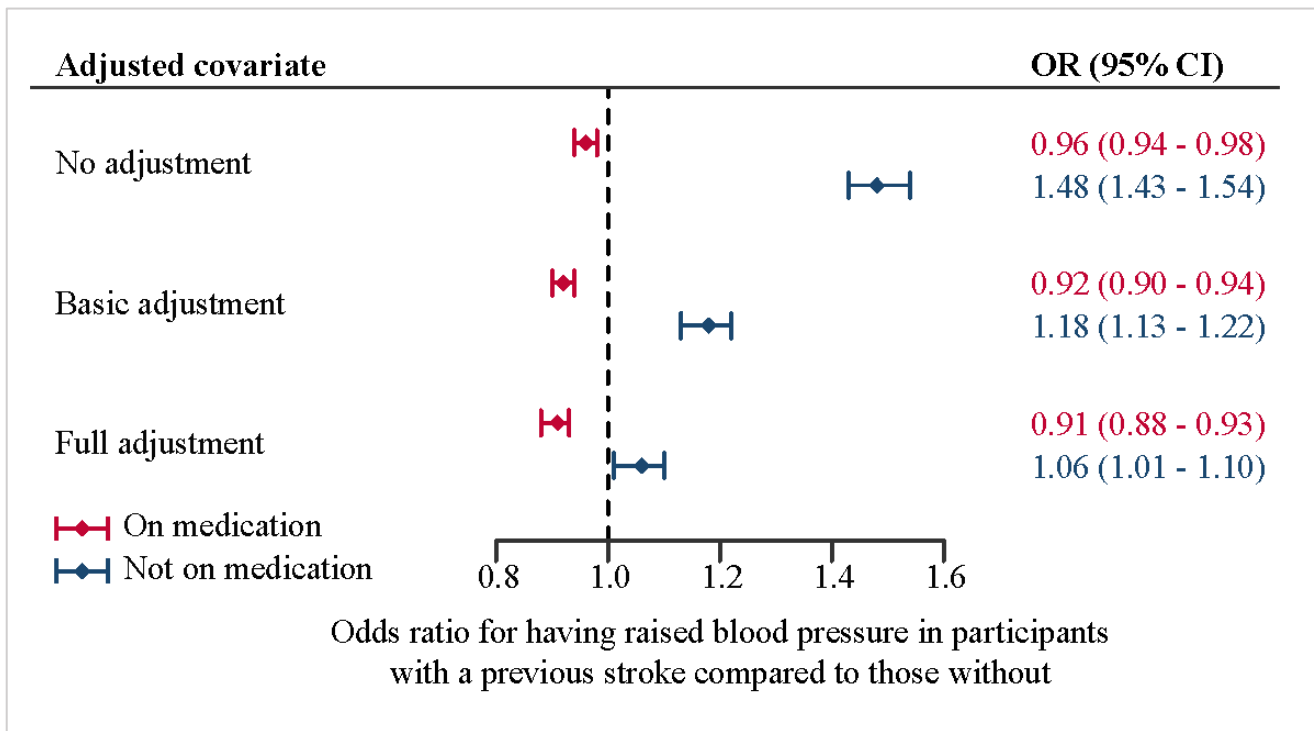
Basic adjustment: adjusted for sex in age strata and an additional adjustment for age was adjusted in the overall sample.

Full adjustment: adjusted for sex, antihypertensive medication use, diabetes, smoking, alcohol intake, and BMI categories in age strata and an additional adjustment for age was adjusted in the overall sample.

*Body mass index categories analysed as binary outcomes compared to the healthy weight as the reference group.

Figure S1: Forest plot of adjusted odds ratios for cardiovascular risk factors given a history of stroke from basic and fully adjusted mixed-effects logistic regression models in four age groups and overall sample

Unadjusted and adjusted ORs amongst participants taking antihypertensive medication (red) and not taking antihypertensive medication (blue).

Basic adjustment: adjusted for age and sex.

Full adjustment: adjusted for age, sex, diabetes, smoking, alcohol intake, and BMI categories.

Figure S2: Unadjusted and adjusted odds ratios for raised blood pressure given a history of stroke stratified by use of antihypertensive medication from mixed-effects logistic regression models
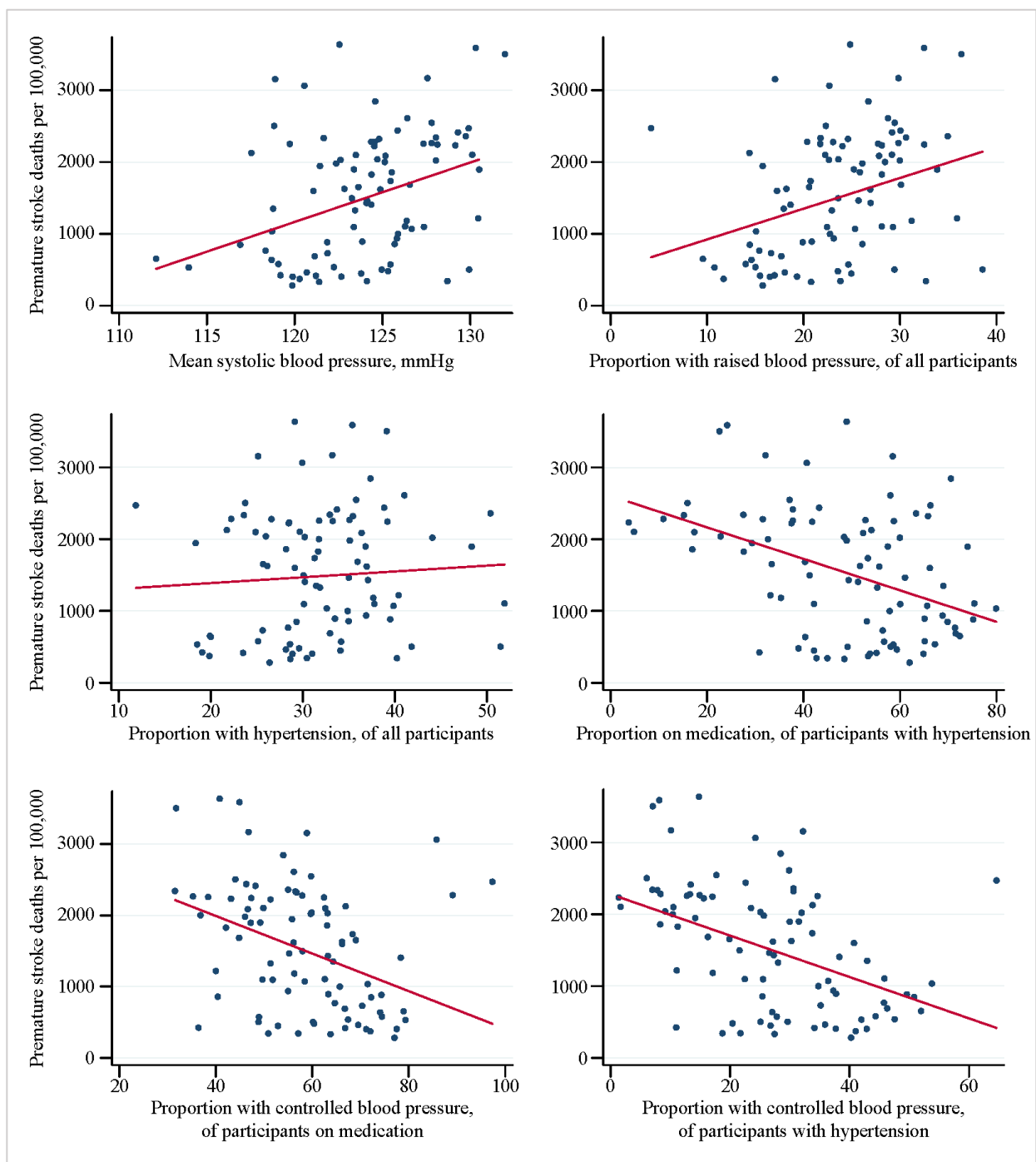
Figure S3: Scatter plots and predicted regression lines of national age-standardised premature stroke mortality from the Global Burden of Disease and age-standardised BP levels and parameters of hypertension management from May Measurement Month from multivariable linear regression

Excluding those missing medication records						
	Univariable linear regression			**Multivariable linear regression**		
	Mean change in premature stroke mortality per unit increase (95% CI)	**p-value**	**R-squared**	**Mean change in premature stroke mortality per unit increase (95% CI)**	**p-value**	**R-squared**
Mean systolic blood pressure, mmHg	84·6 (39·2 to 130·0)	<0·0001	0·139	89·8 (50·6 to 129·0)	<0·0001	0·449
Proportion with raised blood pressure, of all participants	50·4 (24·1 to 76·7)	<0·0001	0·146	40·2 (17·0 to 63·5)	0·001	0·391
Proportion with hypertension, of all participants	7·5 (-17·1 to 32·1)	0·540	0·004	12·1 (-9·3 to 33·4)	0·263	0·304
Proportion on medication, of participants with hypertension	-21·4 (-33·2 to -9·7)	<0·0001	0·153	-22·7 (-36·0 to -9·3)	0·001	0·401
Proportion with controlled blood pressure, of participants on medication	-31·4 (-46·6 to -16·2)	<0·0001	0·186	-25·8 (-39·9 to -11·7)	0·001	0·415
Proportion with controlled blood pressure, of participants with hypertension	-31·8 (-43·8 to -19·9)	<0·0001	0·248	-31·9 (-45·0 to -18·8)	<0·0001	0·464
Assuming those missing medication records were on medication						
Mean systolic blood pressure, mmHg	84·3 (38·8 to 129·9)	<0·0001	0·138	85·1 (46·2 to 124·0)	<0·0001	0·441
Proportion with raised blood pressure, of all participants	49·1 (22·6 to 75·6)	<0·0001	0·138	37·8 (14·6 to 61·0)	0·002	0·385
Proportion with hypertension, of all participants	5·8 (-10·9 to 22·5)	0·490	0·006	0·7 (-14·5 to 15·9)	0·928	0·297
Proportion on medication, of participants with hypertension	-13·5 (-24·8 to -2·2)	0·019	0·069	-18·2 (-29·3 to -7·2)	0·002	0·377
Proportion with controlled blood pressure, of participants on medication	-20·0 (-36·5 to -3·5)	0·018	0·070	-22·0 (-36·4 to -7·5)	0·003	0·364
Proportion with controlled blood pressure, of participants with hypertension	-17·6 (-28·4 to -6·7)	0·002	0·109	-19·5 (-29·7 to -9·3)	<0·0001	0·411

Multivariable models adjusted for age-standardised proportions of male participants, current smokers, consuming alcohol one or more times per week, diabetes, and the proportion overweight or obese.

Table S6: Sensitivity analyses comparing assumptions regarding antihypertensive medication missingness in univariable and multivariable linear regression models of national premature stroke mortality against age-standardised MMM national BP-parameters