

## Supplemental Methods 1

### Urine samples in NHANES

The NHANES has historically only collected a spot urine sample when the participant visited the MEC. No urine specimens were stored for future research prior to 1999. Urine samples in all 3 surveys were collected throughout the entire year and the seasonality of the urine spot samples was therefore not expected to be different among the surveys even though a previous balance study showed that the amount of dietary sodium excreted in the urine tended to be lowest in the summer balance period (82.6% of intake) and highest in the winter balance period (89.5% of intake) (1).

NHANES 1988–1994: A subset of the examined participants aged 20–59 y volunteered to provide a spot urine sample for analysis of environmental components (2). Stored urine samples from this convenience sample collected throughout the 6-y period were used for this study.

NHANES 2003–2006 and 2010: A spot urine sample was obtained during each participant's MEC visit and extra urine aliquots were stored frozen in vapor-phase nitrogen for future testing. We obtained a pristine (frozen but never thawed) urine aliquot.

Assessing the quality of the NHANES 1988–1994 samples: The sample volume was variable, but all samples had  $\geq 2$  mL volume (~90% of samples had  $\geq 10$  mL volume), minimizing the risk of sublimation during long-term frozen storage. All samples had been stored frozen ( $-20^{\circ}\text{C}$  to  $-70^{\circ}\text{C}$ ) and many had been re-sampled over the years, but an exact freeze/thawing history was not available. However, urine sodium has been shown to be stable indefinitely when frozen and for 45 d when stored at room temperature (3). Additionally, using 4 urine quality control (QC) pools, we verified that up to 6 freeze/thawing cycles (4 h at room temperature per cycle, freeze at  $-70^{\circ}\text{C}$ ) did not affect urine sodium concentrations. To further evaluate the quality of the approximately 20 y old urine samples [potential sample evaporation during long-term frozen storage was a concern], we measured creatinine (Roche Creatinine Plus enzymatic assay on the Hitachi Modular P clinical analyzer, (4)) in 300 samples (selected so that the original concentrations were distributed throughout the sample range of values) and assessed the Pearson correlation and agreement between the new and original results (measured at the time of the NHANES survey by using the Jaffe rate method, a colorimetric assay). We obtained reasonable correlation (Pearson  $r = 0.83$ ,  $P < 0.0001$ ) and the new results were on average 12% lower than the original results. The majority of samples (85%) showed good correlation (Pearson  $r = 0.94$ ,  $P$

<0.0001) and a smaller average difference (-7%). We therefore concluded that the long-term frozen storage didn't appear to have led to sample evaporation. The differences seen were more likely a result of small method changes over the years than a result of sample storage.

### **Laboratory methods**

Quality control data for urine sodium measurements: Two levels of QC samples (~70 and 160 mmol/L) included with each analytical run were evaluated for validity by use of a Westgard-type multi-rule QC program (5). The laboratory also included blind QC samples (low [60 mmol/L] or high [170 mmol/L] pool, labeled the same as unknown samples and unrecognized by the analyst) in each analytical run at a rate of 1 blind QC in every 20 unknown samples.

### **Estimation of 24-h urine sodium excretion from spot specimens**

Equations from the Western INTERSALT study were used for men and women (6).

Men:  $24\text{hUNa (mg/d)} = 23 \times \{25.46 + [0.46 \times \text{spot sodium (mmol/L)}] - [2.75 \times \text{spot creatinine (mmol/L)}] - [0.13 \times \text{spot potassium (mmol/L)}] + [4.10 \times \text{BMI (kg/m}^2\text{)}] + [0.26 \times \text{age (y)}]\}$ .

Women:  $24\text{hUNa (mg/d)} = 23 \times \{5.07 + [0.34 \times \text{spot sodium (mmol/L)}] - [2.16 \times \text{spot creatinine (mmol/L)}] - [0.09 \times \text{spot potassium (mmol/L)}] + [2.39 \times \text{BMI (kg/m}^2\text{)}] + [2.35 \times \text{age (y)}] - [0.03 \times \text{age}^2 \text{ (y)}]\}$ .

### **Dietary sodium intake**

Methods used to estimate 24-h dietary sodium intake are explained in detail elsewhere (7).

Briefly, data on sodium and potassium intake from the diet were assessed using 24-h dietary recalls. The first recall was administered in person, followed by a telephone recall administered 3–10 d later. Nutrient values, including sodium and potassium, were assigned to foods. Dietary sodium and potassium for each day of intake for each individual were estimated by summing the sodium and potassium consumed from each food or beverage reported for that day. Beginning in 2005, consumption of tap and bottled water was collected *during* the 24-h recall and included in estimates of individual sodium intake. In 1988–1994 and 2003–2006, but not in 2010, the sodium content of designated foods likely to be prepared at home and reported to be obtained from the store in *What We Eat in America* (WWEIA) are adjusted downward according to the typical amount of salt added during home preparation. In 2003–2006, the adjustments were based on a question at the end of the 24-h dietary recall for those who reported salt use during cooking as “never”, “rarely”, or “occasionally”. Similar to the NHANES 2003–2006,

adjustments in 1988–1994, were made for salt used in home preparation of foods, however participants were asked about preparation for each the designated foods (e.g., cooking rice in salted or unsalted water) and the salt content was adjusted accordingly. Sodium intake does not include salt added at the table.

### **Estimation of usual dietary sodium intake**

We used PCSIDE (Software for Intake Distribution Estimation, Iowa State University, Ames, Iowa) to estimate and output the best linear unbiased predictors of usual sodium intake by race and sex subgroup. Estimates were adjusted for day of the week of the dietary recall, and whether the recall was in the Mobile Examination Center or by telephone, 3–10 d later. Estimates of within individual day-to-day variance were derived from participants with more than 1 24-h dietary recall (58 % of the sample).

**Covariates.** Data for the demographic covariates (age, sex, and race-ethnicity) were self-reported. Height and weight were measured at the MEC by trained health technicians with the use of standardized protocols and calibrated equipment and used to calculate BMI. Mean systolic BP (SBP) and diastolic BP (DBP) was estimated from up to 3 readings, obtained under standard conditions during a single physical examination at the MEC.

### **Statistical analyses**

Modification of original sampling weights for NHANES 1988–1994 and 2003–2006: The adjustment factors for the new sampling weights were based on the selection group (1–9; 4 groups with optimal BP, 4 groups with prehypertension, and 1 group with hypertension) and race-ethnicity. The selection group variable was used because the selection probabilities were different for each of the 9 groups. Given the small cell sizes, only 1 demographic variable could be added to adjust the weights.

Calculation of variance estimates: Because NHANES 2010 was only 1-y data, we could not use the generally preferred Taylor series linearization for variance estimation. However, we compared standard errors (SEM) by Taylor series and delete-1 jackknife method for NHANES 2003–2006 and they were similar. The SEM by the delete-1 jackknife method for NHANES 2010 were also comparable to the SE computed with the jackknife weights supplied in the NHANES data release.

Data exclusions: In addition to the exclusions applied a priori before sampling the specimens, we excluded 1 extreme outlier from NHANES 2003–2006 due to a very high BMI of 130 kg/m<sup>2</sup> (untreated hypertensive person). A small number of participants with missing BMI data ( $n = 5$  in NHANES 2003–2006 [2 untreated hypertensive persons and 3 persons with prehypertension] and  $n = 4$  in NHANES 2010) were not included in the analysis because BMI is needed calculate 24hUNa. Participants with missing blood pressure data ( $n = 43$  in NHANES 1988–1994 and  $n = 17$  in NHANES 2010) were not included in analyses where blood pressure was needed.

### **Supplemental Literature Cited**

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3. Young DS. Effects of preanalytical variables on clinical laboratory tests. Second edition. AACC Press 1997.
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7. U.S. Department of Health and Human Services, USDA. What We Eat in America; 2012. Accessed at <http://www.ars.usda.gov/Services/docs.htm?docid=18349> on 2 July 2013.

**Supplemental Table 1:** Descriptive information of the respondent characteristics by variable for U.S. adults 20–59 y, NHANES 1988–1994<sup>1</sup>

Variable	NHANES 1988–1994 sample <sup>2</sup>		Study sample <sup>3</sup>		P value
	Sample size	Estimate	Sample size	Estimate	
Age, %					0.55
20–29	3309	27.9	342	27.1	
30–39	3244	31.0	372	32.9	
40–49	2578	24.6	333	26.0	
50–59	1852	16.4	203	14.0	
Sex, %					0.27
Male	5185	50.1	645	52.4	
Female	5798	49.9	605	47.6	
Race-ethnicity <sup>2</sup> , %					0.85
MA	3335	5.8	330	5.9	
NHB	3484	11.7	424	11.7	
NHW	3668	73.9	447	75.6	
Other	496	8.6	49	6.8	
BMI, <i>kg/m</i> <sup>2</sup>	10963	26.4 (26.2 – 26.6)	1250	26.3 (25.8 – 26.8)	0.76
SBP, <i>mm Hg</i>	10600	116 (116 – 117)	1207	116 (115 – 118)	0.95
DBP, <i>mm Hg</i>	10591	73.6 (72.9 – 74.2)	1207	73.9 (72.8 – 75.0)	0.60
Sodium intake, <i>mg/d</i>	10658	3750 (3670 – 3830)	1250	3810 (3570 – 4060)	0.62
Caloric intake, <i>kcal</i>	10658	2330 (2280 – 2380)	1250	2350 (2230 – 2470)	0.68
Urine creatinine, <i>nmol/L</i>	10778	12.1 (11.9 – 12.4)	1249	12.0 (11.4 – 12.6)	0.68

<sup>1</sup> Sample sizes are unweighted, frequencies and mean estimates are weighted; frequencies are provided for demographic characteristics; mean estimates (95% CI) are provided for other key participant characteristics; DBP, diastolic blood pressure; MA, Mexican American; NHB, non-Hispanic black; NHW, non-Hispanic white; SBP, systolic blood pressure

<sup>2</sup> Full NHANES 1988-1994 sample, limited to adults 20–59 y of age, pregnant women excluded

<sup>3</sup> Convenience sample collected as part of NHANES 1988–1994, limited to adults 20–59 y of age, after applying our study exclusion criteria

**Supplemental Table 2.** Spearman correlation coefficients describing bivariate association between urine sodium excretion and dietary sodium intake in U.S. adults aged 20–59 y, NHANES 1988–2010<sup>1,2</sup>

<b>Dietary sodium intake, mg/d vs.</b>	<b>1988–1994</b>	<b>2003–2006</b>	<b>2010</b>
Random urine sodium, <i>mmol/L</i>	0.20 ( $<0.001$ )	0.17 ( $<0.001$ )	0.14 (0.007)
Random urine sodium/creatinine, <i>mmol/g</i>	0.13 (0.004)	0.11 (0.002)	0.19 ( $<0.001$ )
Estimated 24-hour urine sodium, <i>mg/d</i>	0.31 ( $<0.001$ )	0.35 ( $<0.001$ )	0.34 ( $<0.001$ )

<sup>2</sup> Values are Spearman correlation coefficients with *P* values for test of hypothesis that correlation is equal to 0 provided in parenthesis

<sup>1</sup> To optimize resources, we randomly sampled NHANES participants 20–59 y of age for urine sodium analysis based on blood pressure and sodium intake. The 1988–1994 urine samples were a convenience sample of 2550 NHANES examinees of which we selected 1249; for NHANES 2003–2006, we selected 1241 participants from a 1/3 urine random subsample (1 excluded due to extreme BMI, 5 excluded due to missing BMI); for NHANES 2010, we included data from 525 persons from a 1/3 urine random subsample

**Supplemental Table 3:** Urine sodium concentrations in spot urine specimens from U.S. adults 20–59 y of age by demographic and health characteristics, NHANES 1988–2010<sup>1</sup>

	1988–1994					2003–2006					2010				
	Sample size	Mean	Percentiles			Sample size	Mean	Percentiles			Sample size	Mean	Percentiles		
	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>
All	1249	111 (2.9)	22.8 (0.7)	103 (9.4)	221 (9.5)	1235	112 (2.2)	20.3 (0.9)	107 (4.5)	218 (1.4)	525	110 (3.5)	20.3 (4.1)	104 (2.8)	227 (4.8)
Age, y															
20–39	713	121 (3.9)	24.0 (1.1)	120 (4.8)	233 (10.2)	611	120 (3.2)	19.8 (1.5)	124 (2.4)	232 (6.8)	285	117 (4.5)	25.2 (1.8)	111 (6.9)	233 (5.4)
40–59	536	95.1 (4.0)	& (3.0)	79.8 (7.1)	203 (7.1)	624	103 (2.9)	20.1 (3.1)	93.5 (2.2)	197 (12.4)	240	102 (5.3)	13.4 (0.7)	97.4 (10.3)	209 (7.7)
Sex															
Male	645	128 (3.7)	30.0 (2.7)	129 (14.5)	224 (2.0)	725	121 (2.7)	28.4 (3.2)	122 (6.3)	222 (3.3)	258	113 (4.7)	21.9 (1.6)	109 (5.9)	219 (10.8)
Female	604	91.0 (3.9)	17.6 (2.3)	76.2 (8.3)	200 (11.3)	510	101 (3.4)	16.6 (1.2)	92.4 (10.4)	204 (2.8)	267	107 (5.1)	& (12.4)	98.4 (5.9)	236
Race-ethnicity															
Mexican American	330	130 (4.1)	27.2 (3.7)	136 (10.0)	229 (5.3)	240	135 (4.4)	28.9 (2.8)	142 (3.1)	232 (11.5)	90	113 (6.6)	28.1 (3.9)	110 (10.7)	222 (9.9)
Non-Hispanic Black	424	140 (3.9)	29.3 (8.9) <sup>†</sup>	136 (8.5)	259 (13.4)	287	139 (3.9)	36.1 (7.0)	143 (11.4)	232 (2.9)	93	140 (7.3)	27.3 (3.9)	125 (5.7)	236 (2.4)
Non-Hispanic White	446	106 (3.6)	21.0 (3.0)	97.0 (4.8)	209 (2.2)	600	105 (2.8)	17.6 (2.8)	94.4 (3.8)	211 (5.9)	235	103 (4.7)	19.5 (2.0)	98.3 (6.1)	218 (9.0)
BMI <sup>2</sup>															
Normal weight	457	107 (4.4)	20.5 (5.6)	96.8 (5.1)	206 (2.5)	366	104 (3.9)	20.0 (1.6)	93.1 (3.9)	215 (9.8)	164	112 (6.6)	21.7 (1.4)	99.5 (0.4)	238 (3.5)
Overweight	413	112 (5.2)	22.8 (2.1)	106 (12.6)	224 (6.5)	418	110 (3.6)	18.0 (5.2)	106 (3.2)	216 (4.2)	181	101 (5.5)	& (20.2)	91.9 (19.3)	205
Obese	356	120 (6.0)	23.3 (3.2)	120 (7.6)	234 (7.6)	431	123 (3.7)	& (1.8)	128 (8.4)	221 (8.4)	173	121 (5.7)	20.4 (4.3)	125 (3.1)	221 (2.1)

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	1988–1994					2003–2006					2010				
	Sample size	Mean	Percentiles			Sample size	Mean	Percentiles			Sample size	Mean	Percentiles		
	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>
		<i>mmol/L</i>					<i>mmol/L</i>					<i>mmol/L</i>			
Blood pressure <sup>3</sup>															
Normal	507	103 (4.1)	23.2 (1.4)	95.7 (7.8)	209 (3.6)	431	112 (3.4)	20.2 (1.0)	106 (8.4)	214 (20.7)	304	108 (4.5)	22.0 (0.4)	102 (10.8)	227 (2.5)
Prehypertension	504	118.1 (4.7)	20.8 (0.9)	111.8 (9.6)	241 (12.0)	419	111.7 (3.5)	21.2 (4.7)	108.2 (3.1)	226.6 (19.2)	162	111 (6.6)	&	101 (7.4)	222 (2.8)
Hypertension	195	127 (7.0)	29.2 (3.9)	126 (17.4)	229 (13.8)	385	111 (3.6)	20.6 (1.4)	104 (12.5)	216 (9.2)	43	129 (9.9)	&	126 (24.3)	201 (18.3)
Sodium intake quartiles <sup>4</sup> , <i>mg/d</i>															
Q1: <2983	343	86.8 (5.4)	16.3 (2.3)	68.6 (17.7)	211 (28.6)	306	97.6 (4.6)	16.2 (1.3)	89.6 (6.5)	204 (3.1)	119	95.9 (7.2)	10.2 (3.8)	84.3 (2.6)	237 (10.5)
Q2: 2983 to <3662	337	99.7 (5.5)	23.1 (2.0)	86.0 (17.2)	207 (7.6)	296	109 (4.4)	23.1 (1.0)	106 (8.4)	196 (6.8)	174	116 (6.6)	21.8 (2.4)	110 (15.3)	229 (8.0)
Q3: 3662 to <4515	337	120 (5.1)	25.0 (6.6)	120 (12.5)	218 (1.4)	340	118 (4.3)	20.6 (4.4)	114 (4.4)	221 (1.3)	124	114 (6.7)	21.9 (5.6)	105 (2.0)	221 (12.0)
Q4: ≥4515	232	132 (5.7)	29.6 (8.9)	129 (6.0)	224 (18.9)	293	123 (4.0)	32.3 (2.5)	123 (5.3)	220 (8.0)	90	109 (8.1)	20.3 (2.0)	108 (7.7)	213 (5.5)

<sup>1</sup> Values are weighted means and percentiles (SE). DBP, diastolic blood pressure; SBP, systolic blood pressure.

<sup>2</sup> BMI categories (kg/m<sup>2</sup>): normal (18.5–<25), overweight (25–<30), and obese (≥30)

<sup>3</sup> Blood pressure categories: normal (SBP <120, DBP <80), prehypertension (SBP 120–139 or DBP 80–89), and hypertension (SBP ≥140 or DBP ≥90)

<sup>4</sup> We categorized individuals into quartiles of sodium intake by using the best linear unbiased predictor (BLUP) values and then calculating the mean 24hUNa excretion for each intake quartile and NHANES survey period

† Estimate flagged because relative SE was ≥30% but <40%

& Estimate not provided because relative SE was ≥40%

**Supplemental Table 4:** Creatinine corrected urine sodium concentrations in spot urine specimens from U.S. adults 20–59 y of age by demographic and health characteristics, NHANES 1988–2010<sup>1</sup>

	1988–1994					2003–2006					2010					
	Sample size	Mean	Percentiles			Sample size	Mean	Percentiles			Sample size	Mean	Percentiles			
	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>		5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	
		<i>mmol/g creatinine</i>														
All	1249	106 (3.1)	23.7 (3.2)	92.2 (2.5)	226 (2.5)	1235	100 (2.2)	30.3 (3.5)	86.2 (2.6)	208 (9.8)	525	107 (3.8)	29.0 (0.8)	92.0 (7.8)	226 (19.2)	
Age, y																
20–39	713	108 (4.1)	24.8 (0.5)	92.3 (3.3)	237 (10.4)	611	98.4 (3.1)	29.0 (1.2)	82.7 (3.9)	215 (28.2)	285	109 (5.4)	27.5 (5.9)	94.8 (10.5)	232 (34.9)	
40–59	536	101 (4.7)	23.3 (2.1)	89.5 (16.4)	208 (2.1)	624	103 (3.0)	30.9 (1.2)	90.2 (2.4)	207 (4.0)	240	105 (5.4)	29.0 (0.9)	90.7 (18.1)	223 (22.8)	
Sex																
Male	645	98.5 (3.5)	25.7 (0.6)	88.0 (1.2)	206 (15.1)	725	93.6 (2.3)	29.0 (1.2)	82.6 (1.7)	194 (8.3)	258	99.4 (4.9)	29.0 (0.8)	83.9 (8.5)	216 (29.3)	
Female	604	113 (5.2)	20.6 (3.0)	97.2 (8.4)	252 (13.8)	510	108 (3.8)	30.9 (2.2)	93.3 (3.1)	228 (7.1)	267	115 (5.8)	33.6 (2.9)	99.3 (11.4)	254 (60.8)	
Race-ethnicity																
Mexican American	330	127 (6.8)	22.9 (2.0)	109 (2.1)	276 (27.7)	240	109 (4.1)	35.3 (1.0)	100 (7.0)	217 (16.1)	90	110 (7.3)	31.4 (5.2)	99.3 (25.4)	226 (14.1)	
Non-Hispanic Black	424	97.6 (4.6)	22.6 (6.6)	81.2 (5.6)	209 (12.6)	287	87.8 (3.0)	28.8 (2.7)	79.5 (6.6)	171 (8.2)	93	103 (6.0)	31.0 (5.0)	86.3 (4.0)	213 (41.0)	
Non-Hispanic White	446	104 (3.9)	22.7 (4.5)	91.8 (7.0)	226 (6.4)	600	99.3 (2.8)	29.2 (1.6)	84.3 (1.9)	207 (13.8)	235	103 (5.2)	26.2 (4.2)	88.5 (3.1)	217 (32.9)	
BMI <sup>2</sup>																
Normal weight	457	110 (5.3)	25.6 (0.7)	94.1 (4.8)	244 (25.3)	366	103 (4.1)	27.2 (2.8)	89.7 (5.5)	211 (13.6)	164	123 (8.7)	29.2 (7.5)	106 (4.5)	328 (82.3)	
Overweight	413	101 (4.5)	19.6 (2.3)	91.3 (10.2)	217 (6.3)	418	97.1 (3.4)	31.4 (2.1)	84.4 (6.0)	194 (2.6)	181	96.6 (5.3)	& (5.3)	83.8 (5.3)	219 (21.0)	
Obese	356	108 (6.5)	27.1 (0.7)	92.8 (4.8)	222 (20.6)	432	100 (3.7)	30.9 (1.1)	87.6 (19.0)	209 (2.9)	173	102 (4.8)	35.0 (8.2)	88.7 (2.5)	190 (5.8)	

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	1988–1994					2003–2006					2010				
	Sample size	Mean	Percentiles			Sample size	Mean	Percentiles			Sample size	Mean	Percentiles		
			5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>			5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>			5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>
<i>n</i>	<i>mmol/g creatinine</i>														
Blood pressure <sup>3</sup>															
Normal	507	102	23.3	91.0	223	431	98.2	31.9	85.2	203	304	103	28.7	86.3	219
		(4.2)	(3.5)	(5.3)	(13.0)		(3.3)	(1.5)	(1.0)	(3.2)		(4.4)	(3.2)	(15.0)	(1.9)
Prehypertension	504	106	24.4	89.5	226	419	103	27.2	88.7	216	162	115	28.5	105	234
		(4.9)	(3.6)	(16.3)	(2.7)		(3.5)	(1.2)	(1.1)	(13.1)		(8.0)	(5.3)	(25.9)	(28.5)
Hypertension	195	122	25.9	102	282	385	103	31.1	89.2	207	43	106	&	85.7	190
		(12.4)	(2.9)	(2.7)	(79.2)		(3.8)	(2.8)	(0.8)	(4.1)		(9.9)		(31.4)	(43.6)
Sodium intake quartiles <sup>4</sup> , <i>mg/d</i>															
Q1: <2983	343	107	16.6	91.0	257	306	96.3	27.9	80.7	221	119	93.7	&	77.2	185
		(7.6)	(1.5)	(4.0)	(71.7)		(4.7)	(4.5)	(1.1)	(41.6)		(5.9)		(9.4)	(2.9)
Q2: 2983 to <3662	337	113	26.3	93.7	245	296	118	30.8	103	230	174	119	36.0	102	269 <sup>†</sup>
		(6.7)	(1.9)	(0.7)	(78.9)		(5.4)	(11.0)	(4.9)	(9.3)		(7.9)	(4.4)	(12.4)	(95.8)
Q3: 3662 to <4515	337	94.7	21.4	81.8	225	340	91.2	28.5	83.3	179	124	94.3	21.4	83.3	211
		(5.3)	(7.5)	(13.9)	(28.0)		(3.1)	(2.0)	(6.0)	(8.0)		(6.0)	(5.3)	(13.7)	(33.1)
Q4: ≥4515	232	109	25.8	95.8	216	293	97.5	34.1	84.5	197	90	110	28.9	97.5	251
		(5.6)	(6.7)	(7.3)	(12.1)		(3.5)	(2.1)	(1.1)	(5.8)		(9.4)	(3.3)	(4.7)	(48.5)

<sup>1</sup> Values are weighted means and percentiles (SE). DBP, diastolic blood pressure; SBP, systolic blood pressure.

<sup>2</sup> BMI categories (kg/m<sup>2</sup>): normal (18.5–<25), overweight (25–<30), and obese (≥30)

<sup>3</sup> Blood pressure categories: normal (SBP <120, DBP <80), prehypertension (SBP 120–139 or DBP 80–89), and hypertension (SBP ≥140 or DBP ≥90)

<sup>4</sup> We categorized individuals into quartiles of sodium intake by using the best linear unbiased predictor (BLUP) values and then calculating the mean 24hUNa excretion for each intake quartile and NHANES survey period

<sup>†</sup> Estimate flagged because relative SE was ≥30% but <40%

& Estimate not provided because relative SE was ≥40%

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**Supplemental Table 5:** Estimated 24-h urine sodium excretion for U.S. adults 20–59 y of age by demographic and health characteristics, NHANES 1988-2010<sup>1</sup>

	1988–1994				2003–2006				2010			
	Sample size	5 <sup>th</sup>	Percentiles 50 <sup>th</sup>	95 <sup>th</sup>	Sample size	5 <sup>th</sup>	Percentiles 50 <sup>th</sup>	95 <sup>th</sup>	Sample size	5 <sup>th</sup>	Percentiles 50 <sup>th</sup>	95 <sup>th</sup>
	<i>n</i>		<i>mg/d</i>		<i>n</i>		<i>mg/d</i>		<i>n</i>		<i>mg/d</i>	
All	1249	1920 (12.2)	3070 (48.6)	4760 (135)	1235	2120 (8.2)	3230 (47.2)	4740 (44.9)	525	2120 (28.1)	3150 (15.2)	4750 (168)
Age, y												
20-39	713	1870 (36.9)	3070 (111)	4750 (115)	611	2110 (23.7)	3140 (25.6)	4720 (47.9)	285	2140 (3.9)	3220 (156)	4760 (247)
40-59	536	2090 (33.2)	3070 (74.0)	4660 (299)	624	2130 (40.0)	3320 (5.2)	4750 (111)	240	2080 (50.3)	3080 (119)	4730 (245)
Sex												
Male	645	2170 (109)	3500 (233)	5010 (123)	725	2520 (62.5)	3660 (74.4)	5030 (67.9)	258	2640 (57.6)	3780 (75.9)	5000 (176)
Female	604	1830 (42.6)	2620 (25.6)	3660 (94.0)	510	1900 (120)	2730 (60.9)	3800 (92.6)	267	2050 (75.6)	2770 (74.6)	4130 (257)
Race-ethnicity												
Mexican American	330	2100 (79.5)	3360 (70.1)	4780 (45.2)	240	2330 (17.9)	3460 (53.4)	4880 (99.6)	90	2400 (212)	3230 (4.4)	4690 (91.3)
Non-Hispanic black	424	1810 (155)	3120 (68.8)	4780 (189)	287	1830 (225)	3370 (49.4)	4760 (20.0)	93	2200 (137)	3320 (207)	5070 (108)
Non-Hispanic white	446	1870 (194)	3020 (87.5)	4750 (106)	600	2090 (56.7)	3150 (74.2)	4690 (64.3)	235	2080 (76.8)	3020 (20.4)	4690 (277)
BMI <sup>2</sup>												
Normal weight	457	1820 (46.0)	2740 (20.4)	3960 (24.3)	366	1890 (95.8)	2750 (58.8)	4040 (59.5)	164	2060 (48.5)	2870 (9.6)	4240 (147)
Overweight	413	2250 (35.0)	3270 (3.1)	4720 (329)	418	2370 (53.9)	3390 (17.6)	4480 (68.8)	181	2140 (111)	3100 (163)	4420 (123)
Obese	356	2460 (271)	3480 (63.1)	5670 (205)	431	2670 (99.8)	3740 (80.9)	5310 (223)	173	2630 (49.1)	4000 (115)	5040 (27.0)

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	1988–1994				2003–2006				2010			
	Sample size	Percentiles			Sample size	Percentiles			Sample size	Percentiles		
	<i>n</i>	5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>	5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>	<i>n</i>	5 <sup>th</sup>	50 <sup>th</sup>	95 <sup>th</sup>
		<i>mg/d</i>				<i>mg/d</i>				<i>mg/d</i>		
Blood pressure <sup>3</sup>												
Normal	507	1820 (40.9)	2810 (127)	4230 (62.5)	431	2070 (43.0)	3010 (9.1)	4380 (186)	304	2080 (70.5)	2950 (47.0)	4380 (44.6)
Prehypertension	504	2280 (62.1)	3320 (180)	5100 (309)	419	2170 (56.7)	3470 (61.8)	4860 (25.3)	162	2330 (89.4)	3610 (236)	4890 (130)
Hypertension	195	2210 (125)	3630 (252)	5290 (605)	385	2470 (55.8)	3480 (9.9)	5380 (167)	43	2280 (216)	3990 (336)	5020 (286)
Sodium intake quartiles <sup>4</sup> , <i>mg/g</i>												
Q1: <2983	343	1880 (82.4)	2610 (45.6)	3540 (33.5)	306	1850 (50.8)	2660 (16.6)	4140 (86.1)	119	1880 (192)	2640 (38.7)	3860 (298)
Q2: 2983 to <3662	337	1830 (107)	2740 (45.1)	4090 (125)	296	2070 (90.3)	3030 (37.2)	4170 (85.1)	174	2170 (37.9)	2960 (38.7)	4390 (328)
Q3: 3662 to <4515	337	1870 (126)	3310 (36.7)	4680 (260)	340	2200 (30.3)	3460 (53.7)	4840 (61.7)	124	2090 (312)	3540 (392)	4960 (229)
Q4: ≥4515	232	2350 (97.8)	3630 (190)	5180 (228)	293	2630 (189)	3730 (32.5)	5050 (29.1)	90	2890 (13.0)	3840 (133)	4910 (29.8)

<sup>1</sup> Values are weighted percentiles (SE). DBP, diastolic blood pressure; SBP, systolic blood pressure.

<sup>2</sup> BMI categories (kg/m<sup>2</sup>): normal (18.5–<25), overweight (25–<30), and obese (≥30)

<sup>3</sup> Blood pressure categories: normal (systolic blood pressure [SBP] <120, diastolic blood pressure [DBP] <80), prehypertension (SBP 120–139 or DBP 80–89), and hypertension (SBP ≥140 or DBP ≥90)

<sup>4</sup> We categorized individuals into quartiles of sodium intake by using the best linear unbiased predictor (BLUP) values and then calculating the mean 24hUNa for each intake quartile and NHANES survey period

**Supplemental Table 6:** Epidemiologic studies that have assessed sodium intake using urine excretion as a biomarker

Study	Time period	Sodium intake		Population	Biomarker	Reference
		Men	Women			
		<i>mg/d</i>				
INTERSALT	1985–1987	2232–4012	2538–3035	U.S. men & women 20–59 y	Single 24-h urine	1
INTERMAP	1998–1999	4202	3272	U.S. men & women 40–59 y	2 timed 24-h urines	2
CARDIA	1990–1991	4430	3584	U.S. black men & women 25–37 y	3 consecutive 24-h urines	1
CARDIA	1990–1991	4550	3612	U.S. white men & women 25–37 y	3 consecutive 24-h urines	1
CDC/NIH	2011	3540	3090	U.S. men & women 18–39 y	Single 24-h urine	3
Calibration study						
Systematic review	1957–2003	3911	3084	U.S. men & women	Single 24-h urine	4
British FSA surveys	1984–2008	3894	2966	UK men & women	Single or multiple 24-h urine	5
NHANES	1988–1994	3581	2688	U.S. men & women 20–59 y	Estimated 24hUNa <sup>1</sup> excretion (single spot urine)	6
NHANES	2003–2006	3716	2804	U.S. men & women 20–59 y	Estimated 24hUNa excretion (single spot urine)	6
NHANES	2010	3806	2915	U.S. men & women 20–59 y	Estimated 24hUNa excretion (single spot urine)	6

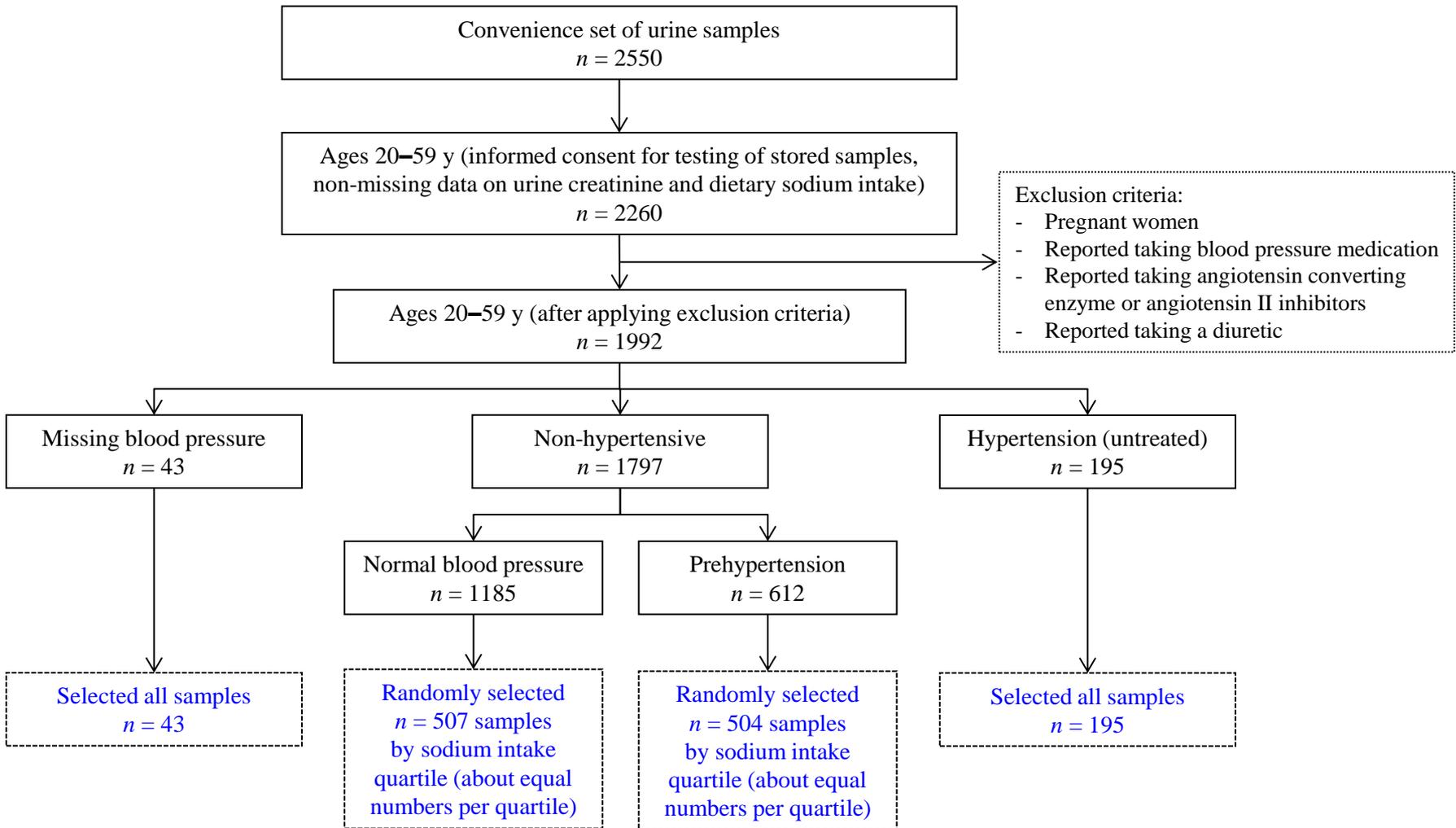
<sup>1</sup> 24hUNa, 24-h urine sodium

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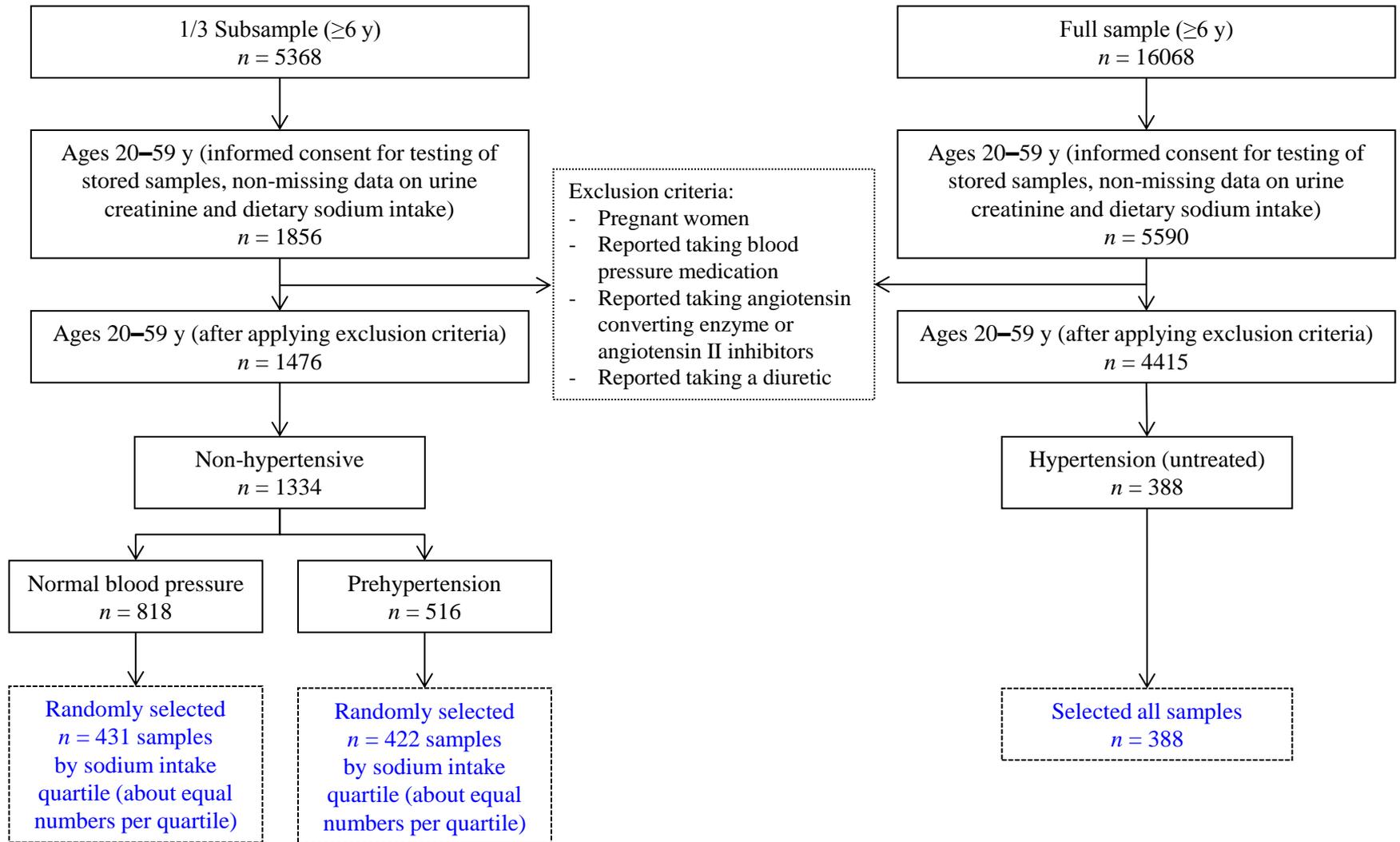
**Supplemental Figure 1.** Sampling scheme for study participants in NHANES 1988–1994



Blood pressure categories: normal (systolic blood pressure [SBP] <120, diastolic blood pressure [DBP] <80), prehypertension (SBP 120–139 or DBP 80–89), and hypertension (SBP  $\geq$ 140 or DBP  $\geq$ 90)

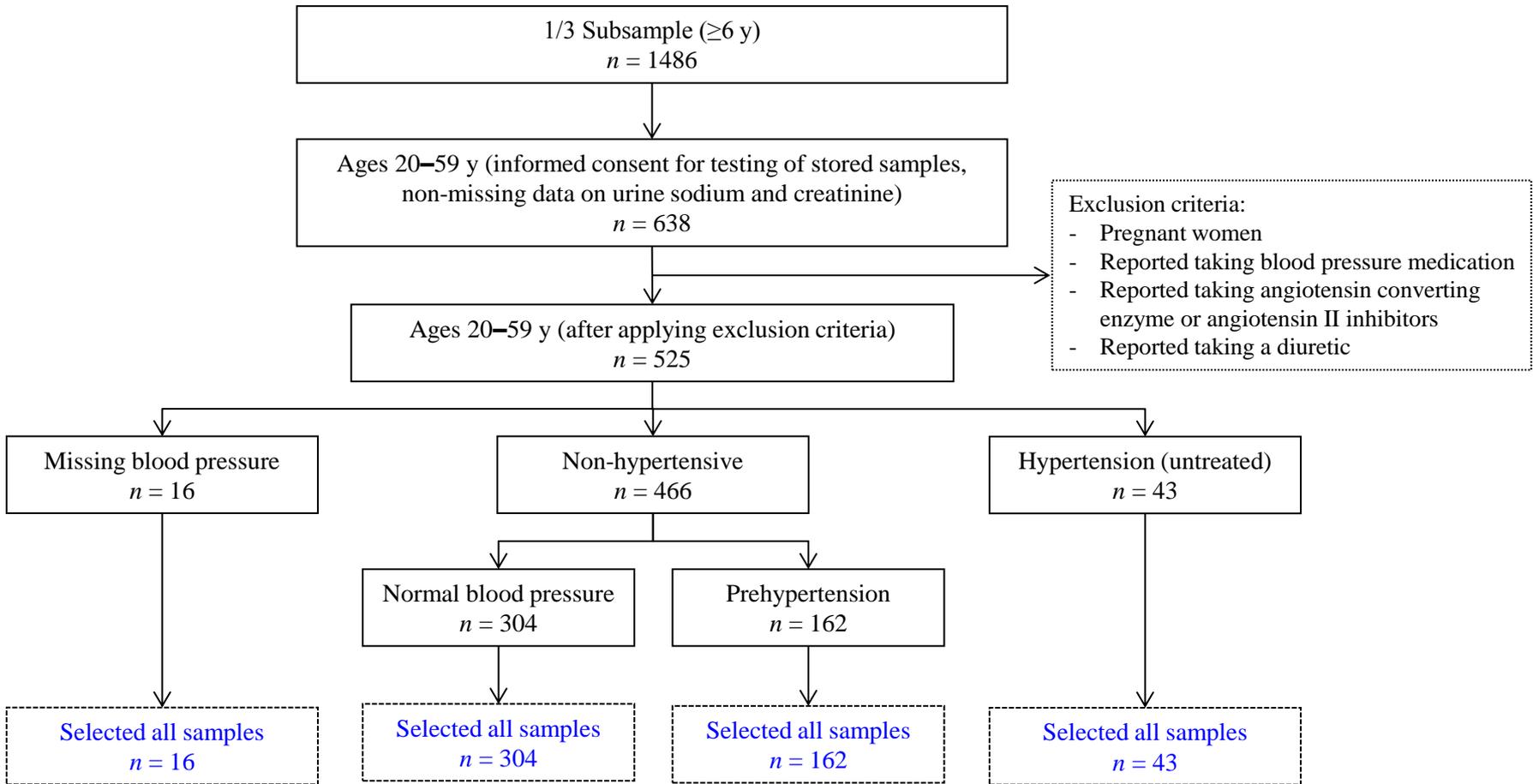
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**Supplemental Figure 2.** Sampling scheme for study participants in NHANES 2003–2006



Blood pressure categories: normal (systolic blood pressure [SBP]  $<120$ , diastolic blood pressure [DBP]  $<80$ ), prehypertension (SBP  $120$ – $139$  or DBP  $80$ – $89$ ), and hypertension (SBP  $\geq 140$  or DBP  $\geq 90$ )

Supplemental Figure 3. Sampling scheme for study participants in NHANES 2010



Blood pressure categories: normal (systolic blood pressure [SBP] <120, diastolic blood pressure [DBP] <80), prehypertension (SBP 120–139 or DBP 80–89), and hypertension (SBP ≥140 or DBP ≥90)