

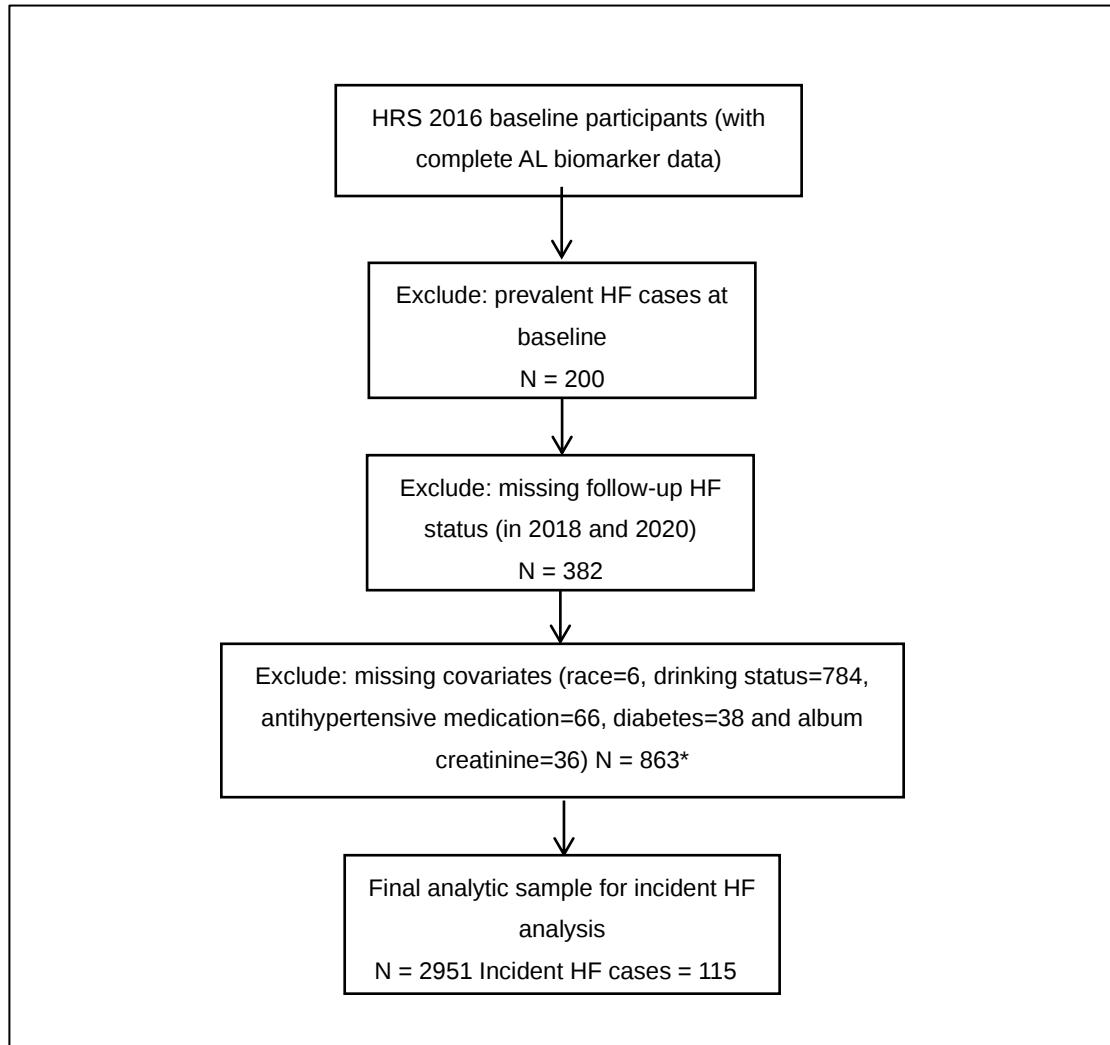


Figure S1. Participant flow diagram for the analysis of incident heart failure in the HRS cohort (2016–2020).

*Note: Missing counts for individual covariates are not mutually exclusive; The total of 863 reflects participants with ≥ 1 missing covariate. The final analytic sample ($n = 2951$) represents participants with complete covariates information included in the fully adjusted models.

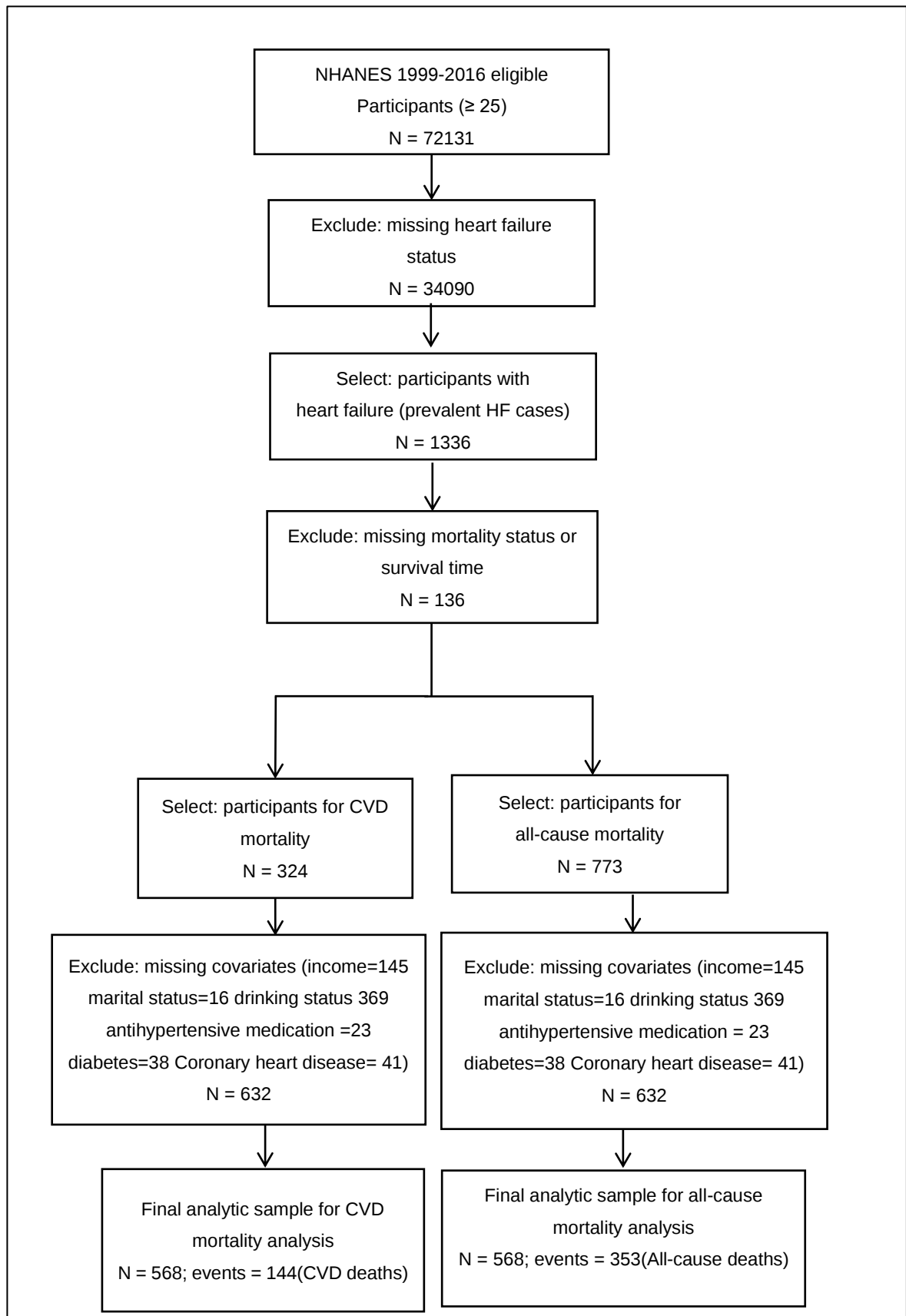


Figure S2. Participant flow diagram for the analysis of cardiovascular and all-cause mortality in the NHANES cohort (1999–2016).

*Note: Missing counts for individual covariates are not mutually exclusive; the total of 632 reflects participants with ≥ 1 missing covariate. The final analytic sample ($n = 568$) represents participants with complete covariates information included in the fully adjusted models.

Table S1. Characteristic of Allostatic Load.

	Health and Retirement Study			National Health and Nutrition Examination Survey			
	No heart failure	Heart failure	<i>P</i> value	CVD death	All-cause death	Survival	<i>P</i> value *
Systolic blood pressure, mmHg	129.14 ± 22.59	134.47 ± 26.46	0.006	135.92 ± 25.57	135.21 ± 25.50	132.31 ± 21.06	0.200
Diastolic blood pressure, mmHg	77.57 ± 11.65	77.12 ± 12.63	0.653	64.96 ± 17.54	64.45 ± 17.60	70.64 ± 14.52	<0.001
Total cholesterol, mg/dL	190.67 ± 41.57	174.09 ± 40.42	<0.001	184.90 ± 48.67	184.22 ± 46.88	184.02 ± 47.53	0.933
High-density lipoprotein, mg/dL	57.81 ± 18.67	53.04 ± 18.45	0.002	49.26 ± 16.85	50.32 ± 17.63	45.45 ± 15.61	0.518
Resting pulse, beats/minute	70.59 ± 15.14	70.53 ± 17.74	0.961	71.99 ± 13.58	71.39 ± 12.98	71.32 ± 12.61	0.667

Glycosylated hemoglobin, mg/dL	5.72(5.41-6.17)	6.02(5.57-6.78)	<0.001	5.90(5.50-6.70)	5.90(5.50-6.70)	5.80(5.40-6.45)	0.822
Serum albumin, g/dL	4.00(3.80-4.20)	3.80(3.60-4.10)	<0.001	4.10(3.80-4.30)	4.10(3.80-4.30)	4.10(4.00-4.40)	<0.001
C-reactive protein, mg/L	2.24(1.11-4.76)	3.00(1.61-5.74)	<0.001	0.50(0.20-1.10)	0.45(0.19-1.07)	0.61(0.17-2.00)	0.142
Body Mass Index, kg/m²	33.08 ± 5.84	34.85 ± 5.66	<0.001	29.62 ± 6.76	30.13 ± 7.13	32.30 ± 8.42	<0.001

* Group differences were analyzed using independent t-tests for normally distributed continuous variables, Mann–Whitney U test or Kruskal–Wallis for non-normally distributed variables, and chi-square (χ^2) for categorical outcomes. CVD=cardiovascular disease.

Table S2. Association between allostatic load (AL) and outcomes in the HRS and NHANES cohorts (Excluding participants who developed the outcome within the first 2 years of follow-up).

	AL Group	OR	95%CI	P value
HRS	Low vs Medium	0.97	0.42-2.22	0.948
	Low vs High	1.40	0.66-2.99	0.385
	AL Group	HR	95%CI	P value
NHANES CVD-death	Low vs Medium	1.02	0.62-1.68	0.942
	Low vs High	1.62	1.05-2.52	0.031
NHANES All-cause death	Low vs Medium	1.06	0.78-1.44	0.717
	Low vs High	1.37	1.03-1.81	0.032

HRS=Health and Retirement Study; NHANES=National Health and Nutrition Examination Survey; AL=Allostatic Load; HR=Hazard Ratio; OR=Odds Ratio; CI=Confidence Interval.

Adjusted for included age, sex, race, education levels, married status, family income, smoking, drinking, coronary heart disease, antihypertensive medication, diabetes, and serum creatinine.

Table S3. Association between allostatic load and incident heart failure in the HRS cohort (Multiple Imputation Analysis).

	N/Case	OR	95%CI	P value
Model 1				
Low AL (0-2)		Reference		
Medium AL (3)	1059/29	1.50	0.99-2.29	0.056
High AL (≥ 4)	1002/103	2.26	1.54-3.33	<0.001
Model 2				
Low AL (0-2)		Reference		
Medium AL (3)	1058/29	1.57	1.02-2.41	0.038
High AL (≥ 4)	999/103	2.33	1.55-3.48	<0.001
Model 3				
Low AL (0-2)		Reference		
Medium AL (3)	842/22	1.41	0.91-2.17	0.123
High AL (≥ 4)	823/81	1.86	1.22-2.82	0.004

HRS=Health and Retirement Study; AL=Allostatic Load; OR=Odds Ratio; CI=Confidence Interval.

Adjusted for included age, sex, race, education levels, married status, family income, smoking, drinking, coronary heart disease, antihypertensive medication, diabetes, and serum creatinine.

Table S4. Association between allostatic load (AL) and mortality outcomes among individuals with heart failure in the NHANES cohort (Multiple Imputation Analysis).

	HR	95%CI	P value
<i>CVD-death</i>			
Model 1			
AL score = medium	0.97	0.92-1.03	0.321
AL score = high	0.98	0.94-1.03	0.407
Model 2			
AL score = medium	1.03	0.97-1.10	0.259
AL score = high	1.12	1.07-1.18	<0.001
Model 3			
AL score = medium	1.06	0.99-1.12	0.074
AL score = high	1.12	1.06-1.18	<0.001
<i>All cause-death</i>			
Model 1			
AL score = medium	1.19	1.15-1.23	<0.001
AL score = high	1.07	1.04-1.10	<0.001
Model 2			
AL score = medium	1.35	1.30-1.40	<0.001
AL score = high	1.29	1.25-1.33	<0.001
Model 3			

AL score = medium	1.34	1.29-1.39	<0.001
AL score = high	1.31	1.26-1.36	<0.001

NHANES=National Health and Nutrition Examination Survey; AL=Allostatic Load; HR=Hazard Ratio; CI=Confidence Interval.

Adjusted for included age, sex, race, education levels, married status, family income, smoking, drinking, coronary heart disease, antihypertensive medication, diabetes, and serum creatinine.

Table S5. Association between allostatic load (AL) and outcomes in the NHANES cohort
(Grouping data into three survey cohorts: 1999–2004, 2005–2010, and 2015–2016)

Wave (Years)	AL Group	HR	95%CI	P Value
<i>CVD-death</i>				
1999-2004	Low vs High	1.37	(0.59-3.18)	0.460
	Medium vs High	2.87	(0.96-8.58)	0.059
2005-2010	Low vs High	0.79	(0.39-1.62)	0.519
	Medium vs High	1.47	(0.85-2.56)	0.168
2015-2016	Low vs High	1.31	(0.08-21.89)	0.848
	Medium vs High	1.71	(0.27-10.82)	0.568
<i>All-cause death</i>				
1999-2004	Low vs High	1.09	(0.60-1.98)	0.766
	Medium vs High	2.13	(1.05-4.31)	0.036
2005-2010	Low vs	1.06	(0.71-1.59)	0.765

	High			
	Medium vs High	1.27	(0.90-1.80)	0.170
2015-2016	Low vs High	1.79	(0.44-7.30)	0.416
	Medium vs High	1.76	(0.54-5.68)	0.347

NHANES=National Health and Nutrition Examination Survey; AL=Allostatic Load;
HR=Hazard Ratio; CI=Confidence Interval.

Adjusted for included age, sex, race, education levels, married status, family income, smoking,
drinking, coronary heart disease, antihypertensive medication, diabetes, and serum creatinine.

Table S6. Association between allostatic load (AL) and mortality outcomes among individuals with heart failure in the NHANES cohort (excluding participants with coronary heart disease (CHD)).

	HR	95%CI	P value
<i>CVD-death</i>			
Model 1			
AL score = medium	1.10	0.74-1.64	0.636
AL score = high	1.29	0.93-1.81	0.139
Model 2			
AL score = medium	1.18	0.76-1.81	0.460
AL score = high	1.45	1.01-2.09	0.049
Model 3			
AL score = medium	1.22	0.61-2.44	0.565
AL score = high	1.71	1.01-2.89	0.046
<i>All cause-death</i>			
Model 1			
AL score = medium	1.21	0.95-1.55	0.129
AL score = high	1.31	1.06-1.63	0.014
Model 2			
AL score = medium	1.28	0.97-1.69	0.079
AL score = high	1.49	1.18-1.90	0.001

Model 3			
AL score = medium	1.41	0.95-2.08	0.086
AL score = high	1.70	1.22-2.39	0.002

NHANES=National Health and Nutrition Examination Survey; AL=Allostatic Load;
HR=Hazard Ratio; CI=Confidence Interval.

Adjusted for included age, sex, race, education levels, married status, family income, smoking, drinking, coronary heart disease, antihypertensive medication, diabetes, and serum creatinine.