

SUPPLEMENTAL MATERIAL

Supplemental Methods

Missing outcome data

Activities of daily living (ADLs) were recorded by self-report from 1989-2011. In 1989-1999, they were recorded once every year. Between 2000 and 2004, these activities were reported using a different, incomparable question. In 2005-2011, the questions were recorded each half year, again using the original question. In the entire CHS cohort of 5,888 participants, this amounted to 41.1% missing half-year values total, 50.0% of which were due to missing half years between 1989-1999, 41.5% of which were due to the incompatible question between 2000-2004, and 8.4% of which were due to neither. In our subset of 4,902 participants, the missing values was similar with 41.7% missing half-year values total, 49.9% of which were due to missing half years between 1989-1999, 41.9% of which were due to the incompatible question between 2000-2004, and 8.2% of which were due to neither.

Mortality data was complete for 100% of the participants in CHS, and thus no imputation was required for the YOL data.

Imputation of missing ADL data

We imputed missing ADL data similarly to a previously reported imputation of self-rated health.¹ Observed ADL difficulty was designated to be 0 if the person reported no difficulties and 1 if the person reported difficulty in one or more activities of daily living (eating, walking around the home, getting out of bed, dressing, bathing, or toileting). We then replaced the observed ADL difficulty value with the probability that a person with this observed ADL value would be healthy (excellent, very good, or good self-rated health). Since 77% of participants with no ADL difficulties reported being healthy, 46% participants with ADL difficulties reported being healthy, and 0% of participants of participants who had died could report being healthy, values were set to 77, 46, and 0. These probabilities were calculated from the entire CHS dataset of 5,888 participants.² Missing ADL data were then imputed on this scale via linear interpolation of each participant's observed data over time, and were then rounded back to the original binary scale. Since all the ADL data was missing between 2000 and 2004, we applied an additional adjustment to these years so that the average imputed values in these years fell on a straight line between the average ADL values in 1999 and 2005.

YAL and YOL calculation

Vital status—designated to be 1 if a participant was alive and 0 if the participant had died—was determined at baseline and each half year after baseline. This resulted in a baseline value and 36 half year values per person. These values were then summed, minus the first and last values divided by two, to provide a trapezoidal estimate for years of life (YOL) under the curve in half years.³ To put the value back on the yearly scale, we once again divided by two.

YAL was calculated in a similar manner, the only difference being that instead of using vital status data, imputed ADL status was employed.

Variable Definitions

Smoking: ascertained by self report

Arthritis: diagnosis by a physician.

Cancer: ascertained by self report

Diabetes: according to the American Diabetes Association guidelines – diabetes if taking insulin or oral hypoglycemics or if fasting glucose values are ≥ 126 . Impaired fasting glucose if fasting glucose is 110-125 and no insulin or oral hypoglycemic medication.

eGFR was calculated based on creatinine calibrated to the Cleveland clinic: $eGFR_{creat}(mL/min/1.73m^2) = 186.3 * \text{serum creatinine}^{-1.154} * \text{age}^{-0.203} * 1.212$ [if black] * 0.742 [if female]

Systolic blood pressure was the average zero muddler systolic blood pressure: average of the first and second corrected reading (corrected for zero value).

Anti-hypertensive medication use: Participants were asked to bring in meds used in the last two weeks.

Antihypertensive medications: Beta-blockers, Calcium-channel blockers, Diuretics, Vasodilators, Beta-blockers with Diuretics, Angiotensin converting enzyme inhibitors, Angiotensin converting enzyme with diuretics, Vasodilators with Diuretics, Angiotensin Type 2 Antagonists, Angiotensin Type 2 Antagonists with Diuretics.

Prevalent Stroke, CHF and CHD were self-reported at baseline. Confirmation was sought for MI and CHF from information collected at entry and review of hospital and physician's records; furthermore, Incident Stroke, CHF and CHD were reviewed and adjudicated by committee.

References

1. Diehr P, Patrick DL, Spertus J, Kiefe CI, McDonell M, Fihn SD. Transforming self-rated health and the sf-36 scales to include death and improve interpretability. *Medical Care*. 2001;39:670-680
2. Diehr P. Methods for dealing with death and missing data, and for standardizing different health variables in longitudinal datasets: The Cardiovascular Health Study. *UW Biostatistics Working Paper Series. Working Paper 390*. July 2013
3. Diehr P, Psaty BM, Patrick DL. Effect size and power for clinical trials that measure years of healthy life. *Statistics in Medicine*. 1997;16:1211-1223

Table S1. Linear regression results of adjusted cardiovascular imaging risk factors for percentage of YOL spent in an able state for male and female participants in CHS

% Years of Life Without ADL Difficulty								
Cardiovascular Imaging	Males (n=2,133)				Females (n=2,769)			
	Model 1		Model 2		Model 1		Model 2	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Percent (95% CI)	P value	Percent (95% CI)	P value
Abnormal LVEF (<55%)	-5 (-7.7, -2.3)	<0.001	-3.6 (-6.3, -0.8)	0.012	-0.8 (-4.8, 3.2)	0.679	2.1 (-1.9, 6.2)	0.299
LA Dimension (per SD= 0.67)	-0.8 (-1.7, 0.2)	0.104	-0.5 (-1.4, 0.5)	0.336	-0.8 (-1.8, 0.1)	0.086	-0.4 (-1.3, 0.5)	0.401
Peak E velocity (per SD= 0.19)	-0.4 (-1.4, 0.6)	0.422	-0.1 (-1.1, 0.8)	0.82	-0.6 (-1.4, 0.2)	0.156	-0.3 (-1.2, 0.5)	0.419
Peak A velocity (per SD= 0.23)	-0.2 (-1.2, 0.8)	0.678	0.1 (-0.9, 1)	0.848	-0.9 (-1.7, 0)	0.057	-0.5 (-1.4, 0.4)	0.277
E/A ratio		0.078		0.444		0.702		0.786
<0.7	-2.2 (-4.6, 0.3)	0.08	-1.1 (-3.5, 1.3)	0.369	-1 (-3.2, 1.3)	0.4	0.1 (-2.1, 2.3)	0.939
0.7, <1.5	Ref	--		--	Ref	--	Ref	--
≥1.5	-2.9 (-6.3, 0.5)	0.096	-1.8 (-5.2, 1.6)	0.305	-0.2 (-4.2, 3.8)	0.92	1.4 (-2.5, 5.3)	0.488
LV Mass (per SD=51.17)	-1.1 (-2.2, -0.1)	0.037	-0.3 (-1.4, 0.8)	0.567	-0.9 (-2.2, 0.4)	0.198	0.4 (-0.9, 1.7)	0.535
LV RWT (per SD=0.08)	-0.6 (-1.7, 0.6)	0.331	-0.7 (-1.8, 0.4)	0.212	0 (-1.1, 1)	0.933	0.2 (-0.8, 1.2)	0.687
IMT (per SD= 0.34)	-2.5 (-3.4, -1.5)	<0.001	-1.5 (-2.5, -0.6)	0.001	-1.9 (-2.9, -1)	<0.001	-1.1 (-2.1, -0.1)	0.03

Model 1 adjusted for age, race, and BMI. Model 2 additionally adjusted for smoking, arthritis, cancer, diabetes ADA status, eGFR, antihypertensive medication use, systolic blood pressure, congestive heart failure, stroke, and coronary heart disease (myocardial infarction, angina, coronary artery bypass grafting, or angioplasty). ADL, Activities of Daily Living; LVEF, Left ventricular Ejection Fraction; LA, Left Atrium; SD, Standard Deviation; E, Early Filling; A, Atrial Filling; RWT, Relative Wall Thickness; IMT, Carotid Intima-Media Thickness.

Table S2. Linear regression results of adjusted biomarkers risk factors for percentage of YOL spent in an able state for male and female participants in CHS

Biomarkers	% of Years of Life Without ADL Difficulty							
	Males (n=2,133)				Females (n=2,769)			
	Model 1		Model 2		Model 1		Model 2	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Percent (95% CI)	P value	Percent (95% CI)	P value
hsCRP (per 2-fold increase)	-1 (-1.6, -0.4)	0.002	-0.4 (-1, 0.3)	0.282	-1.4 (-2, -0.8)	<0.001	-0.9 (-1.6, -0.3)	0.003
Fibrinogen (per SD= 65.80)	-1.5 (-2.4, -0.6)	0.001	-0.9 (-1.8, 0)	0.049	-0.5 (-1.3, 0.4)	0.316	-0.2 (-1.1, 0.7)	0.683
LDL (per SD= 36.41)	0.7 (-0.3, 1.7)	0.152	0.4 (-0.6, 1.3)	0.472	0.8 (0, 1.6)	0.058	0.6 (-0.2, 1.4)	0.135
NT-proBNP (per 2-fold increase)	-1.6 (-2.3, -1)	<0.001	-1.4 (-2.1, -0.7)	<0.001	-1.4 (-2, -0.8)	<0.001	-1 (-1.6, -0.3)	0.004
hsTNT (per 2-fold increase)	-2 (-3, -0.9)	<0.001	-1.4 (-2.5, -0.3)	0.014	-4.4 (-5.5, -3.2)	<0.001	-3.5 (-4.7, -2.2)	<0.001
PIIINP (per SD =1.79)	-1.9 (-3.2, -0.5)	0.008	-1.4 (-2.8, -0.09)	0.037	-3.2 (-4.6, -1.8)	<0.001	-2.2 (-3.6, -0.84)	0.002

Model 1 adjusted for age, race, BMI, and BMI². Model 2 additionally adjusted for smoking, arthritis, cancer, diabetes ADA status, eGFR, antihypertensive medication use, systolic blood pressure, congestive heart failure, stroke, and coronary heart disease (myocardial infarction, angina, coronary artery bypass grafting, or angioplasty). hsCRP, high sensitivity C-Reactive Protein; IQR, Inter-Quartile Range; LDL, Low Density Lipoprotein cholesterol; NT-proBNP, N-Terminal pro-Brain Natriuretic Peptide; hsTNT, high sensitivity Troponin-T; PIIINP, Procollagen III N-terminal Propeptide.

Table S3. Linear regression results of adjusted cardiovascular imaging risk factors for YAL, YOL, and percentage of YOL spent in an able state for all participants in CHS (n=4,902).

Cardiovascular Imaging Variables	Years of Able Life				Years of Life				% Years of Life Without ADL Difficulty			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Percent (95% CI)	P value	Percent (95% CI)	P value
Abnormal LVEF (<55%)	-2.43 (-2.93, -1.94)	<0.001	-1.4 (-1.89, -0.91)	<0.001	-2.72 (-3.19, -2.24)	<0.001	-1.66 (-2.13, -1.19)	<0.001	-3.7 (-6, -1.5)	0.001	-1.6 (-3.9, 0.7)	0.173
LA Dimension (per SD= 0.67)	-0.43 (-0.58, -0.28)	<0.001	-0.23 (-0.37, -0.08)	0.002	-0.41 (-0.55, -0.27)	<0.001	-0.2 (-0.33, -0.06)	0.005	-0.9 (-1.5, -0.2)	0.013	-0.5 (-1.2, 0.2)	0.156
Peak E velocity (per SD= 0.19)	-0.23 (-0.37, -0.09)	0.001	-0.09 (-0.22, 0.05)	0.197	-0.25 (-0.38, -0.11)	<0.001	-0.1 (-0.23, 0.02)	0.115	-0.5 (-1.2, 0.1)	0.098	-0.2 (-0.9, 0.4)	0.433
Peak A velocity (per SD= 0.23)	-0.37 (-0.52, -0.23)	<0.001	-0.23 (-0.37, -0.09)	0.001	-0.38 (-0.52, -0.25)	<0.001	-0.26 (-0.39, -0.12)	<0.001	-0.6 (-1.2, 0.1)	0.074	-0.2 (-0.9, 0.4)	0.453
E/A ratio		<0.001		<0.001		<0.001		<0.001		0.132		0.882
<0.7	-1.39 (-1.75, -1.03)	<0.001	-0.91 (-1.26, -0.57)	<0.001	-1.63 (-1.97, -1.28)	<0.001	-1.16 (-1.49, -0.84)	<0.001	-1.4 (-3.1, 0.2)	0.084	-0.4 (-2, 1.2)	0.635
0.7, <1.5	Ref	--	Ref	--	Ref	--	Ref	--	Ref	--	Ref	--
≥1.5	-1.38 (-1.96, -0.8)	<0.001	-0.72 (-1.27, -0.17)	0.01	-1.8 (-2.35, -1.25)	<0.001	-1.13 (-1.65, -0.6)	<0.001	-1.7 (-4.3, 1)	0.215	-0.3 (-2.9, 2.3)	0.827
LV Mass (per SD=51.17)	-0.96 (-1.15, -0.77)	<0.001	-0.57 (-0.75, -0.38)	<0.001	-1.10 (-1.27, -0.92)	<0.001	-0.74 (-0.92, -0.57)	<0.001	-1 (-1.9, -0.2)	0.017	0 (-0.9, 0.8)	0.964
LV RWT (per SD=0.08)	-0.22 (-0.39, -0.05)	0.013	-0.16 (-0.32, 0)	0.052	-0.23 (-0.4, -0.07)	0.004	-0.18 (-0.34, -0.03)	0.019	-0.3 (-1, 0.5)	0.492	-0.2 (-0.9, 0.6)	0.67
Carotid intima thickness (per SD= 0.34)	-1.08 (-1.23, -0.94)	<0.001	-0.65 (-0.8, -0.51)	<0.001	-1.12 (-1.26, -0.98)	<0.001	-0.71 (-0.84, -0.57)	<0.001	-2.2 (-2.9, -1.5)	<0.001	-1.3 (-2, -0.6)	<0.001

Model 1 adjusted for age, race, sex, and BMI. Model 2 additionally adjusted for smoking, arthritis, cancer, diabetes ADA status, eGFR, antihypertensive medication use, systolic blood pressure, congestive heart failure, stroke, and coronary heart disease (myocardial infarction, angina, coronary artery bypass grafting, or angioplasty). LVEF, Left ventricular Ejection Fraction; LA, Left Atrium; SD, Standard Deviation; E, Early Filling; A, Atrial Filling; RWT, Relative Wall Thickness; IMT, Carotid Intima-Media Thickness.

Table S4. Linear regression results of adjusted biomarkers risk factors for YAL, YOL, and percentage of YOL spent in an able state for all participants in CHS (n=4,902).

Biomarkers	Years of Able Life				Years of Life				% Years of Life Without ADL Difficulty			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Percent (95% CI)	P value	Percent (95% CI)	P value
hsCRP (per 2-fold increase)	-0.56 (-0.66, -0.46)	<0.001	-0.33 (-0.42, -0.23)	<0.001	-0.55 (-0.64, -0.45)	<0.001	-0.32 (-0.41, -0.23)	<0.001	-1.2 (-1.6, -0.7)	<0.001	-0.7 (-1.1, -0.2)	0.003
Fibrinogen (per SD= 65.80)	-0.46 (-0.6, -0.32)	<0.001	-0.25 (-0.38, -0.12)	<0.001	-0.47 (-0.61, -0.34)	<0.001	-0.26 (-0.39, -0.13)	<0.001	-0.9 (-1.6, -0.3)	0.003	-0.5 (-1.2, 0.1)	0.091
LDL (per SD= 36.41)	0.27 (0.13, 0.41)	<0.001	0.2 (0.07, 0.34)	0.003	0.16 (0.03, 0.3)	0.018	0.12 (-0.01, 0.24)	0.073	0.8 (0.1, 1.4)	0.018	0.5 (-0.1, 1.1)	0.12
NT-proBNP (per 2-fold increase)	-0.82 (-0.92, -0.72)	<0.001	-0.63 (-0.73, -0.53)	<0.001	-0.84 (-0.93, -0.75)	<0.001	-0.65 (-0.74, -0.55)	<0.001	-1.5 (-1.9, -1)	<0.001	-1.1 (-1.6, -0.6)	<0.001
hsTNT (per 2-fold increase)	-1.3 (-1.47, -1.13)	<0.001	-0.9 (-1.07, -0.72)	<0.001	-1.34 (-1.5, -1.18)	<0.001	-0.94 (-1.1, -0.78)	<0.001	-3.1 (-3.8, -2.3)	<0.001	-2.3 (-3.1, -1.4)	<0.001
PIIINP (per SD =1.79)	-0.37 (-0.50, -0.24)	<0.001	-0.29 (-0.41, -0.17)	<0.001	-0.31 (-0.42, -0.20)	<0.001	-0.25 (-0.36, -0.15)	<0.001	-2.6 (-3.6, -1.6)	<0.001	-2.1 (-3.0, -1.1)	<0.001

Model 1 adjusted for age, race, sex, BMI, and BMI². Model 2 additionally adjusted for smoking, arthritis, cancer, diabetes ADA status, eGFR, antihypertensive medication use, systolic blood pressure, congestive heart failure, stroke, and coronary heart disease (myocardial infarction, angina, coronary artery bypass grafting, or angioplasty). hsCRP, high sensitivity C-Reactive Protein; IQR, Inter-Quartile Range; LDL, Low Density Lipoprotein; NT-proBNP, N-Terminal pro-Brain Natriuretic Peptide; hsTNT, high sensitivity Troponin-T; PIIINP, Procollagen III N-terminal Propeptide.

Table S5. Cox proportional hazards regression results of cardiovascular imaging and biomarkers risk factors on time to first ADL difficulty amongst participants in CHS (n=4902).

	All				Males				Females			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value
Abnormal LVEF (<55%)	1.2 (1.08, 1.34)	0.001	1.22 (1.09, 1.36)	<0.001	1.23 (1.08, 1.41)	0.002	1.28 (1.12, 1.48)	<0.001	1.14 (0.95, 1.37)	0.16	1.11 (0.92, 1.34)	0.297
LA Dimension (per SD=0.67)	1.04 (1, 1.07)	0.024	1.03 (1, 1.07)	0.05	1.04 (0.99, 1.09)	0.131	1.03 (0.98, 1.08)	0.221	1.04 (0.99, 1.09)	0.09	1.03 (0.99, 1.08)	0.144
Peak E velocity (per SD=0.19)	1.03 (1, 1.06)	0.064	1.03 (0.99, 1.06)	0.118	1.03 (0.98, 1.08)	0.292	1.03 (0.98, 1.08)	0.306	1.04 (0.99, 1.08)	0.09	1.03 (0.99, 1.08)	0.104
Peak A velocity (per SD=0.23)	1.05 (1.01, 1.08)	0.006	1.03 (1, 1.07)	0.071	1.06 (1.01, 1.12)	0.018	1.04 (0.98, 1.09)	0.171	1.04 (1, 1.09)	0.06	1.03 (0.99, 1.08)	0.135
E/A ratio												
	1.13 (1.04, 1.22)	0.002	1.08 (1, 1.17)	0.055	1.19 (1.06, 1.35)	0.004	1.12 (0.99, 1.26)	0.078	1.08 (0.98, 1.2)	0.12	1.05 (0.95, 1.17)	0.342
<0.7												
0.7, <1.5												
>=1.5	1.06 (0.93, 1.21)	0.351	1.05 (0.92, 1.2)	0.484	1.08 (0.9, 1.29)	0.391	1.08 (0.9, 1.3)	0.391	1.04 (0.86, 1.26)	0.69	1.01 (0.83, 1.22)	0.932
LV Mass (per SD=51.17)	1.09 (1.04, 1.14)	<0.001	1.07 (1.02, 1.12)	0.003	1.12 (1.06, 1.19)	<0.001	1.1 (1.04, 1.17)	0.001	1.06 (0.99, 1.13)	0.08	1.03 (0.96, 1.09)	0.447
LV RWT (per SD=0.08)	1.05 (1.01, 1.09)	0.015	1.04 (1, 1.08)	0.07	1.05 (0.99, 1.12)	0.107	1.04 (0.98, 1.11)	0.233	1.05 (1, 1.1)	0.04	1.04 (0.99, 1.09)	0.149
Carotid intima thickness (per SD=0.34)	1.13 (1.1, 1.17)	<0.001	1.1 (1.06, 1.13)	<0.001	1.19 (1.14, 1.24)	<0.001	1.14 (1.09, 1.19)	<0.001	1.09 (1.04, 1.14)	<0.001	1.06 (1.01, 1.11)	0.014
hsCRP (per 2-fold increase)	1.07 (1.05, 1.1)	<0.001	1.05 (1.03, 1.07)	<0.001	1.11 (1.07, 1.15)	<0.001	1.08 (1.04, 1.11)	<0.001	1.05 (1.02, 1.08)	0.001	1.03 (1, 1.06)	0.038
Fibrinogen (per SD=65.80)	1.05 (1.02, 1.08)	0.002	1.03 (1, 1.07)	0.03	1.1 (1.05, 1.15)	<0.001	1.07 (1.03, 1.12)	0.002	1.01 (0.96, 1.05)	0.82	1 (0.96, 1.04)	0.986
LDL (per SD=36.41)	0.93 (0.9, 0.95)	<0.001	0.94 (0.91, 0.97)	<0.001	0.91 (0.87, 0.96)	<0.001	0.94 (0.89, 0.98)	0.01	0.93 (0.9, 0.97)	<0.001	0.95 (0.91, 0.98)	0.005
NT-proBNP (per 2-fold increase)	1.1 (1.07, 1.12)	<0.001	1.09 (1.07, 1.12)	<0.001	1.12 (1.08, 1.15)	<0.001	1.12 (1.08, 1.16)	<0.001	1.08 (1.05, 1.11)	<0.001	1.07 (1.04, 1.11)	<0.001
hsTNT (per 2-fold increase)	1.19 (1.15, 1.23)	<0.001	1.15 (1.11, 1.2)	<0.001	1.17 (1.11, 1.23)	<0.001	1.13 (1.07, 1.2)	<0.001	1.21 (1.15, 1.28)	<0.001	1.18 (1.11, 1.24)	<0.001
PIIINP (per SD=1.79)	1.11 (1.05, 1.17)	<0.001	1.1 (1.05, 1.16)	<0.001	1.11 (1.03, 1.18)	0.004	1.1 (1.03, 1.18)	0.006	1.11 (1.02, 1.21)	0.01	1.1 (1.01, 1.2)	0.028

Model 1 adjusted for age, race, sex, and BMI. Model 2 additionally adjusted for smoking, arthritis, cancer, diabetes ADA status, eGFR, antihypertensive medication use, systolic blood pressure, congestive heart failure (CHF), stroke, and coronary heart disease (CHD), in addition to incident CHF, stroke and myocardial infarction. HR, Hazard Ratio; LVEF, Left ventricular Ejection Fraction; LA, Left Atrium; SD, Standard Deviation; E, Early Filling; A, Atrial Filling; RWT, Relative Wall Thickness; IMT, Carotid Intima-Media Thickness. hsCRP, high sensitivity C-Reactive Protein; IQR, Inter-Quartile Range; LDL, Low Density Lipoprotein; NT-proBNP, N-Terminal pro-Brain Natriuretic Peptide; hsTNT, high sensitivity Troponin-T; PIIINP, Procollagen III N-terminal Propeptide.