SUPPLEMENTAL MATERIAL

Mediterranean and DASH diet scores and mortality in women with heart failure: the Women's Health Initiative

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Supplemental Methods

The modified Block food-frequency questionnaire (FFQ) contained 122 questions about frequency of consumption of foods and beverages over the previous 3 months, 19 adjustment items primarily related to fat intake, and 4 summary questions.[1] The frequency questions included predefined responses that ranged from "never or less than once per month" to "2+ times per day" for foods and "6+ times per day" for beverages. Small, medium, or large portion sizes were assessed as compared to specified medium size portions. Pictures were provided to help with portion size estimation.

Nutrient intake was calculated by multiplying the frequency of consumption of each item reported on the food-frequency questionnaire (FFQ) by the nutrient content for the specified portion size and summing over items and was adjusted for energy using the residuals method.[2] Total energy intake was calculated using calibration equations based on energy intake determined using doubly-labeled water.[3] The food groups fruits, vegetables, legumes, nuts, whole grains, fish, and red and processed meats were created using the MyPyramid Equivalents Database to include contributions from mixed dishes.[4] The food groups low-fat dairy and sweetened beverages, which are not defined in the MyPyramid Equivalents Database, were created from the FFQ line items. Milk drinking was assessed as frequency and usual type of milk. Milk servings counted toward the low-fat dairy group if the usual type was 2% milk, 1% milk or butter milk, or non-fat or skim milk. The line items low fat cottage cheese, non-fat cheeses, part-skim or reduced fat cheeses, and non-fat yogurt also counted towards the low-fat dairy group. The line items Tang, Kool-Aid, other fruit drinks and regular soft drinks (not diet) counted towards the sweetened beverages group.

For the Mediterranean diet score, we ranked participants on intake of 1. fruits, 2. vegetables, 3. nuts, 4. legumes, 5. whole grains, 6. fish, 7. ratio of monounsaturated to saturated fat, 8. red and processed meats, and 9. alcohol, as previously described.[5] Participants whose intake was above the median for fruits, vegetables, nuts, legumes, whole grains, fish, or ratio of monounsaturated to saturated fat received one point for each category. Consumption of red and processed meat below the median was awarded 1 point, and alcohol intake between 5 and 15 g/d was awarded 1 point. The total score could range from 0 to 9.

For the DASH diet score, we ranked participants on intake of 1. fruits, 2. vegetables, 3. nuts and legumes, 4. low-fat dairy, 5. whole grains, 6. sodium, 7. sweetened beverages, and 8. red and processed meats, as previously described.[6] For fruits, vegetables, nuts and legumes, low-fat dairy, and whole grains, participants in the highest quintile received a score of 5, those in the second highest quintile received a score of 4, and so on. For sodium, sweetened beverages, red and processed meats, the scoring was reversed with participants in the highest quintile receiving a score of 1 and participants in the lowest quintile receiving a score of 5. The score for each component was summed to get the overall score which could range from 8 to 40.

Supplemental Table 1. Characteristics of Women's Health Initiative participants with heart failure hospitalization by whether they were included or excluded*

	Included (n = 3,215)	Excluded (n = 828)	P
Age at heart failure hospitalization (y)	72.7 (7.0)	72.8 (7.5)	0.77
Race/ethnicity (%)			<0.001
American Indian/Alaskan Native	0.5	0.5	
Asian/Pacific Islander	1.0	1.0	
Black	10.5	17.3	
Hispanic	1.7	4.3	
White not of Hispanic origin	85.4	75.1	
Not one of above	1.0	1.8	
Education (%)			<0.001
Less than high school	8.2	15.8	
High school graduate/some college	61.4	60.0	
College graduate	8.2	6.9	
Graduate school	22.2	17.3	
Income (%)			<0.001
<$20,000	31.6	45.1	
$20,000-34,999	30.5	27.3	
$35,000-49,999	17.7	12.2	
≥$50,000	20.2	15.5	
Married (%)	51.6	50.3	0.50
Current cigarette smoking (%)	8.9	10.1	0.25
Body mass index (kg/m^2)	30.5 (7.4)	30.3 (7.1)	0.73
Physical activity (MET-hr/wk)	8.8 (11.3)	9.5 (12.1)	0.07
Rand-36 Physical function score	59.5 (26.7)	56.4 (27.4)	0.002
Systolic blood pressure (mm Hg)	134 (20)	136 (22)	0.40
Diastolic blood pressure (mm Hg)	72 (11)	73 (12)	0.004
History of high cholesterol (%)	22.5	19.1	0.03
History of hypertension (%)	58.4	55.3	0.10
History of diabetes (%)	27.9	30.8	0.10
History of myocardial infarction (%)	17.6	18.4	0.63
History of revascularization (%)	17.2	16.2	0.49
History of atrial fibrillation (%)	14.7	15.2	0.70
Off-study postmenopausal hormone use (%)	26.0	20.2	<0.001
Use of diuretics (%)	41.8	37.6	0.03
Use of β-blockers (%)	23.4	22.6	0.62
Use of ACE inhibitor or ARB (%)	32.0	31.0	0.59
WHI hormone arm (%)			0.10
Estrogen alone intervention	5.1	5.2	
Estrogen alone control	5.2	5.6	
Estrogen plus progestin intervention	4.6	3.6	
Estrogen plus progestin control	4.7	6.9	
WHI diet modification arm (%)			0.45
Diet modification intervention	11.8	11.5	
Diet modification control	17.5	15.8	
WHI calcium/vitamin D arm (%)			0.67
Calcium/vitamin D intervention	10.4	9.3	
Calcium/vitamin D control	10.4	10.4	

*Numbers are mean (standard deviation) or percent. For excluded participants, many of whom were excluded for missing data, numbers are calculated for those with available data.

Supplemental Table 2. Causes of death among Women's Health Initiative participants with heart failure

Cause of death	Frequency	Percent*
Breast cancer	23	1.66
Ovarian cancer	8	0.58
Endometrial cancer	3	0.22
Colon cancer	19	1.37
Rectosigmoid cancer	1	0.07
Rectum cancer	2	0.14
Other cancer	143	10.32
Unknown cancer site	5	0.36
Definite CHD	289	20.87
Cerebrovascular	90	6.5
Pulmonary embolism	7	0.51
Possible CHD	110	7.94
Other cardiovascular	194	14.01
Unknown cardiovascular	11	0.79
Accident	26	1.88
Suicide	1	0.07
Other injury	1	0.07
Other known cause	320	23.1
Unknown cause	33	2.38
Not adjudicated	99	7.15

CHD: coronary heart disease
* Percent of participants who died

Supplemental Table 3. Mediterranean and DASH diet scores and food and nutrient intake

	Mediterranean diet score					DASH diet score				
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	P-trend	Quartile 1	Quartile 2	Quartile 3	Quartile 4	P-trend
Food intake[*]										
Fruit, cup/d[†, ‡]	0.9	1.5	1.9	2.4	<0.001	0.8	1.3	1.8	2.5	<0.001
Vegetables, cup/d[†, ‡]	0.6	1.0	1.3	1.6	<0.001	0.7	0.9	1.2	1.6	<0.001
Nuts, oz/d[†, ‡]	0.2	0.3	0.4	0.6	<0.001	0.2	0.3	0.4	0.6	<0.001
Legumes, oz/d[†, ‡]	0.1	0.3	0.4	0.6	<0.001	0.2	0.3	0.4	0.6	<0.001
Whole grains, oz/d[†, ‡]	0.6	1.0	1.3	1.6	<0.001	0.6	0.9	1.2	1.7	<0.001
Low-fat dairy, servings/d[‡]	0.9	1.0	1.2	1.4	<0.001	0.5	0.8	1.2	1.9	<0.001
Fish, oz/d[†]	0.3	0.5	0.7	0.9	<0.001	0.5	0.5	0.6	0.7	<0.001
Red and processed meats, oz/d[†, ‡]	2.2	2.1	2.1	1.9	0.002	2.5	2.2	2.0	1.6	<0.001
Sweetened beverages, servings/d[‡]	0.3	0.2	0.2	0.2	0.001	0.4	0.2	0.2	0.1	<0.001
Nutrient intake[*]										
Total energy intake, kcal/d[§]	2,138	2,153	2,174	2,146	0.45	2,171	2,161	2,155	2,124	<0.001
Saturated fat, g/d[†, ‖]	23.6	20.0	17.6	15.7	<0.001	22.7	20.5	18.4	15.6	<0.001
Monounsaturated fat, g/d[†, ‖]	24.1	22.6	20.8	19.3	<0.001	25.8	23.0	20.7	17.9	<0.001
Polyunsaturated fat, g/d[‖]	11.9	12.0	11.7	11.3	<0.001	13.2	12.3	11.4	10.4	<0.001
Protein, g/d[‖]	65.5	66.3	67.4	67.2	0.008	66.0	65.7	66.7	67.7	0.004
Carbohydrate, g/d[‖]	175	189	199	210	<0.001	170	184	199	217	<0.001
Sodium, mg/d[‡, ‖]	2,516	2,632	2,725	2,941	<0.001	2,717	2,653	2,636	2,612	<0.001
Potassium, mg/d[‖]	2,240	2,517	2,738	2,941	<0.001	2,084	2,442	2,726	3,120	<0.001
Calcium, mg/d[‖]	800	795	813	830	0.03	629	756	853	973	<0.001
Magnesium, mg/d[‖]	209	239	261	283	<0.001	199	234	259	296	<0.001
Fiber, g/d[‖]	11.2	14.7	17.3	19.7	<0.001	11.4	14.2	16.6	20.2	<0.001
Alcohol, g/d[†]	3.6	3.1	4.0	4.2	0.05	3.0	3.9	3.7	3.8	0.13

[*]Values presented are means.
[†]Component of Mediterranean diet score
[‡]Component of DASH diet score
[§] Energy calibrated to doubly labeled water
[‖]Adjusted for energy using the residuals method

Supplemental Table 4. Hazard ratios* (95% confidence intervals) for the association of Mediterranean and DASH diet scores and mortality among women with heart failure: sensitivity analyses in subgroups of participants with heart failure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend
Mediterranean diet score					
No self-reported heart failure at baseline	1	1.10 (0.94-1.29)	1.02 (0.84-1.23)	0.87 (0.72-1.06)	0.17
No history of cancer	1	1.08 (0.91-1.28)	1.02 (0.83-1.25)	0.90 (0.73-1.10)	0.31
Physician diagnosis of heart failure at index hospitalization	1	1.03 (0.89-1.21)	0.93 (0.78-1.13)	0.83 (0.69-1.00)	0.04
Not in diet modification or calcium/vitamin D trials	1	1.05 (0.87-1.26)	0.96 (0.77-1.21)	0.85 (0.68-1.05)	0.10
DASH diet score					
No self-reported heart failure at baseline	1	1.05 (0.89-1.24)	0.86 (0.74-1.02)	0.83 (0.69-0.99)	0.01
No history of cancer	1	1.07 (0.89-1.27)	0.83 (0.70-0.99)	0.85 (0.70-1.02)	0.02
Physician diagnosis of heart failure at index hospitalization	1	1.01 (0.86-1.18)	0.79 (0.67-0.92)	0.82 (0.69-0.97)	0.004
Not in diet modification or calcium/vitamin D trials	1	1.08 (0.89-1.31)	0.88 (0.73-1.06)	0.89 (0.73-1.09)	0.11

* Adjusted for age at heart failure hospitalization, total energy intake, race/ethnicity, education, income, married, current smoking, total exercise, physical function, use of off-study postmenopausal hormone therapy, WHI study arm systolic blood pressure, diastolic blood pressure, use of diuretics, beta-blockers, and angiotensin converting enzyme inhibitors or angiotensin receptor blockers, body mass index, and history of high cholesterol, high blood pressure, diabetes, myocardial infarction, coronary revascularization, and atrial fibrillation.

Supplemental Table 5. Mediterranean and DASH diet scores and cardiovascular disease mortality among women with heart failure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend
Mediterranean diet score					
N	572	1,305	589	749	
Median (Range)	2 (0-2)	4 (3-4)	5 (5-5)	6 (6-9)	
Cardiovascular deaths	117	309	126	142	
Person-years	2,582	5,772	2,741	3,639	
Model 1 HR (95% CI)[*]	1	1.17 (0.94-1.47)	1.00 (0.77-1.30)	0.82 (0.64-1.05)	0.05
Model 2 HR (95% CI)[†]	1	1.24 (0.99-1.56)	1.13 (0.86-1.49)	0.95 (0.74-1.23)	0.67
Model 3 HR (95% CI)[‡]	1	1.20 (0.95-1.52)	1.09 (0.82-1.43)	0.88 (0.68-1.15)	0.33
DASH diet score					
N	768	704	956	787	
Median (Range)	19 (9-21)	23 (22-24)	26 (25-28)	31 (29-40)	
Cardiovascular deaths	179	152	191	172	
Person-years	3,440	3,120	4,477	3,698	
Model 1 HR (95% CI)[*]	1	0.88 (0.70-1.10)	0.73 (0.59-0.92)	0.76 (0.61-0.95)	0.009
Model 2 HR (95% CI)[†]	1	0.92 (0.74-1.16)	0.80 (0.63-1.02)	0.87 (0.69-1.10)	0.20
Model 3 HR (95% CI)[‡]	1	0.90 (0.71-1.13)	0.76 (0.60-0.97)	0.82 (0.65-1.05)	0.09

[*] Adjusted for age at heart failure hospitalization and total energy intake

[†] Adjusted for variables in Model 1 and race/ethnicity, education, income, married, current smoking, total exercise, physical function, use of off-study postmenopausal hormone therapy, and WHI study arm

[‡] Adjusted for variables in Model 2 and systolic blood pressure, diastolic blood pressure, use of diuretics, beta-blockers, and angiotensin converting enzyme inhibitors or angiotensin receptor blockers, body mass index, and history of high cholesterol, high blood pressure, diabetes, myocardial infarction, coronary revascularization, and atrial fibrillation.

Supplemental Table 6. Mediterranean and DASH diet scores and mortality among selected subgroups of women with heart failure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend	p-interaction
Mediterranean diet score						
Body mass index <25 kg/m^2						0.60
Deaths	69	145	60	100		
Person-years	531	1,143	618	1,027		
HR (95% CI) *	1	1.21 (0.89-1.65)	1.06 (0.73-1.53)	0.88 (0.62-1.23)	0.31	
Body mass index 25-29.9 kg/m^2						
Deaths	75	170	68	82		
Person-years	683	1,636	841	1,174		
HR (95% CI) *	1	0.96 (0.72-1.28)	0.81 (0.57-1.15)	0.73 (0.51-1.03)	0.05	
Body mass index 30-34.9 kg/m^2						
Deaths	61	129	58	57		
Person-years	709	1,277	683	695		
HR (95% CI) *	1	1.25 (0.91-1.73)	1.07 (0.72-1.57)	1.02 (0.68-1.53)	0.94	
Body mass index ≥35 kg/m^2						
Deaths	55	143	62	51		
Person-years	659	1,717	600	743		
HR (95% CI) *	1	0.93 (0.67-1.28)	1.02 (0.70-1.50)	0.76 (0.51-1.15)	0.33	
History of diabetes						0.78
Deaths	87	180	83	91		
Person-years	624	1,512	698	808		
HR (95% CI) *	1	0.85 (0.65-1.12)	0.90 (0.66-1.24)	0.83 (0.60-1.14)	0.30	
No history of diabetes						
Deaths	173	407	165	199		
Person-years	1,958	4,260	2,043	2,831		
HR (95% CI) *	1	1.18 (0.99-1.42)	1.04 (0.83-1.30)	0.88 (0.70-1.09)	0.20	

Supplemental Table 6 cont. Mediterranean and DASH diet scores and mortality among selected subgroups of women with heart failure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend	p-interaction
Mediterranean diet score						
History of myocardial infarction or revascularization						0.52
Deaths	82	169	63	92		
Person-years	720	1,289	563	886		
HR (95% CI) *	1	1.08 (0.81-1.42)	1.01 (0.72-1.43)	0.92 (0.66-1.28)	0.60	
No history of myocardial infarction or revascularization						
Deaths	178	418	185	198		
Person-years	1,862	4,483	2,178	2,753		
HR (95% CI) *	1	1.03 (0.86-1.23)	0.98 (0.79-1.21)	0.82 (0.66-1.02)	0.08	
Income <$20,000/year						0.89
Deaths	108	240	82	68		
Person-years	907	1,897	774	727		
HR (95% CI) *	1	1.10 (0.87-1.40)	0.92 (0.68-1.25)	0.80 (0.58-1.11)	0.21	
Income ≥$20,000/year						
Deaths	152	347	166	222		
Person-years	1,675	3,875	1,967	2,912		
HR (95% CI) *	1	1.00 (0.82-1.21)	0.97 (0.77-1.22)	0.83 (0.67-1.04)	0.10	
Current cigarette smoking						0.81
Deaths	47	68	17	20		
Person-years	344	576	146	197		
HR (95% CI) *	1	0.92 (0.58-1.47)	0.70 (0.37-1.35)	0.90 (0.48-1.66)	0.49	
No current cigarette smoking						
Deaths	213	519	231	270		
Person-years	2,238	5,196	2,595	3,442		
HR (95% CI) *	1	1.05 (0.89-1.24)	1.01 (0.83-1.22)	0.84 (0.70-1.02)	0.08	

Supplemental Table 6 cont. Mediterranean and DASH diet scores and mortality among selected subgroups of women with heart failure

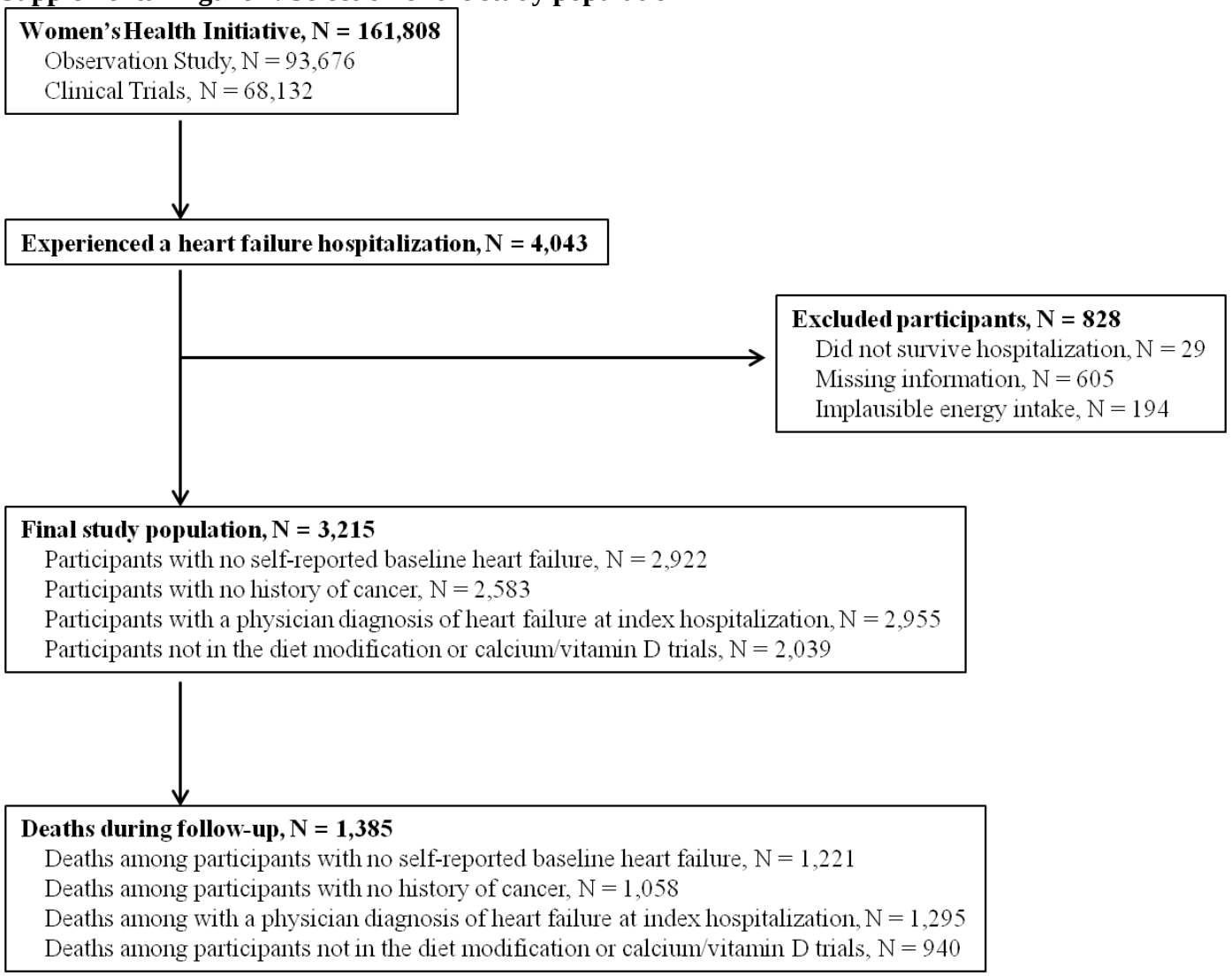
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend	p-interaction
DASH diet score						
Body mass index <25 kg/m^2						0.57
Deaths	71	73	111	119		
Person-years	607	535	958	1,217		
HR (95% CI) *	1	1.09 (0.77-1.54)	1.02 (0.74-1.41)	0.86 (0.62-1.21)	0.24	
Body mass index 25-29.9 kg/m^2						
Deaths	98	98	107	92		
Person-years	811	924	1,447	1,153		
HR (95% CI) *	1	0.89 (0.67-1.19)	0.60 (0.44-0.80)	0.72 (0.52-0.99)	0.01	
Body mass index 30-34.9 kg/m^2						
Deaths	84	81	81	59		
Person-years	899	800	986	679		
HR (95% CI) *	1	1.23 (0.89-1.69)	0.92 (0.65-1.28)	0.84 (0.58-1.21)	0.23	
Body mass index ≥35 kg/m^2						
Deaths	92	77	87	55		
Person-years	1,123	861	1,085	649		
HR (95% CI) *	1	1.00 (0.73-1.38)	0.89 (0.65-1.22)	0.90 (0.63-1.30)	0.47	
History of diabetes						0.11
Deaths	114	107	118	102		
Person-years	985	823	1,089	743		
HR (95% CI) *	1	1.00 (0.76-1.33)	0.80 (0.61-1.06)	1.03 (0.76-1.40)	0.88	
No history of diabetes						
Deaths	231	222	268	223		
Person-years	2,455	2,296	3,387	2,954		
HR (95% CI) *	1	1.04 (0.86-1.26)	0.85 (0.70-1.02)	0.76 (0.62-0.93)	0.002	

Supplemental Table 6 cont. Mediterranean and DASH diet scores and mortality among selected subgroups of women with heart failure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	p-trend	p-interaction
DASH diet score						
History of myocardial infarction or revascularization						0.89
Deaths	107	92	117	90		
Person-years	899	665	1,088	805		
HR (95% CI) *	1	1.00 (0.74-1.34)	0.80 (0.61-1.06)	0.86 (0.64-1.17)	0.23	
No history of myocardial infarction or revascularization						
Deaths	238	237	269	235		
Person-years	2,541	2,455	3,388	2,892		
HR (95% CI) *	1	1.05 (0.88-1.27)	0.85 (0.71-1.02)	0.84 (0.69-1.03)	0.03	
Income <$20,000/year						0.17
Deaths	152	122	126	98		
Person-years	1,406	910	1,180	808		
HR (95% CI) *	1	1.18 (0.92-1.51)	0.92 (0.72-1.18)	1.06 (0.80-1.40)	0.99	
Income ≥$20,000/year						
Deaths	193	207	260	227		
Person-years	2,034	2,210	3,296	2,890		
HR (95% CI) *	1	0.93 (0.76-1.14)	0.76 (0.62-0.92)	0.72 (0.59-0.90)	0.001	
Current cigarette smoking						0.87
Deaths	68	36	29	19		
Person-years	491	340	251	180		
HR (95% CI) *	1	0.73 (0.46-1.18)	0.76 (0.47-1.25)	0.73 (0.39-1.35)	0.23	
No current cigarette smoking						
Deaths	277	293	357	306		
Person-years	2,949	2,780	4,225	3,517		
HR (95% CI) *	1	1.08 (0.91-1.28)	0.85 (0.72-1.00)	0.85 (0.72-1.02)	0.02	

* HR: hazard ratio, CI: confidence interval. Adjusted for age at heart failure hospitalization, total energy intake, race/ethnicity, education, income, married, current smoking, total exercise, physical function, use of off-study postmenopausal hormone therapy, WHI study arm systolic blood pressure, diastolic blood pressure, use of diuretics, beta-blockers, and angiotensin converting enzyme inhibitors or angiotensin receptor blockers, body mass index, and history of high cholesterol, high blood pressure, diabetes, myocardial infarction, coronary revascularization, and atrial fibrillation. All p values for interaction across strata were > 0.05.

Supplemental Figure 1. Selection of the study population



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