

Supplementary Online Content

Xu H, Cupples LA, Stokes A, Liu C-T. Association of obesity with mortality over 24 years of weight history: findings from the Framingham Heart Study. *JAMA Netw Open*. 2018;1(7):e184587. doi:10.1001/jamanetworkopen.2018.4587

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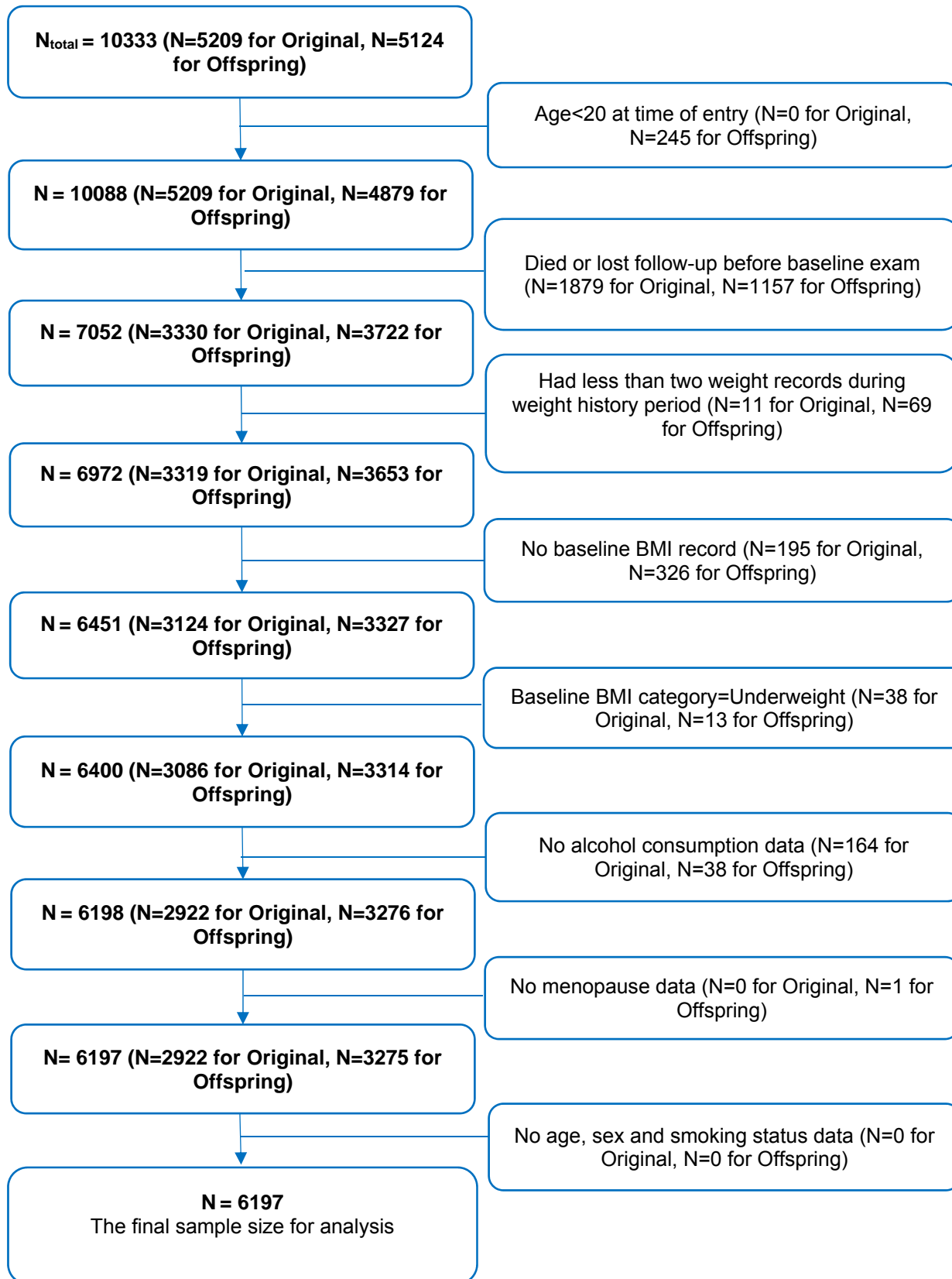
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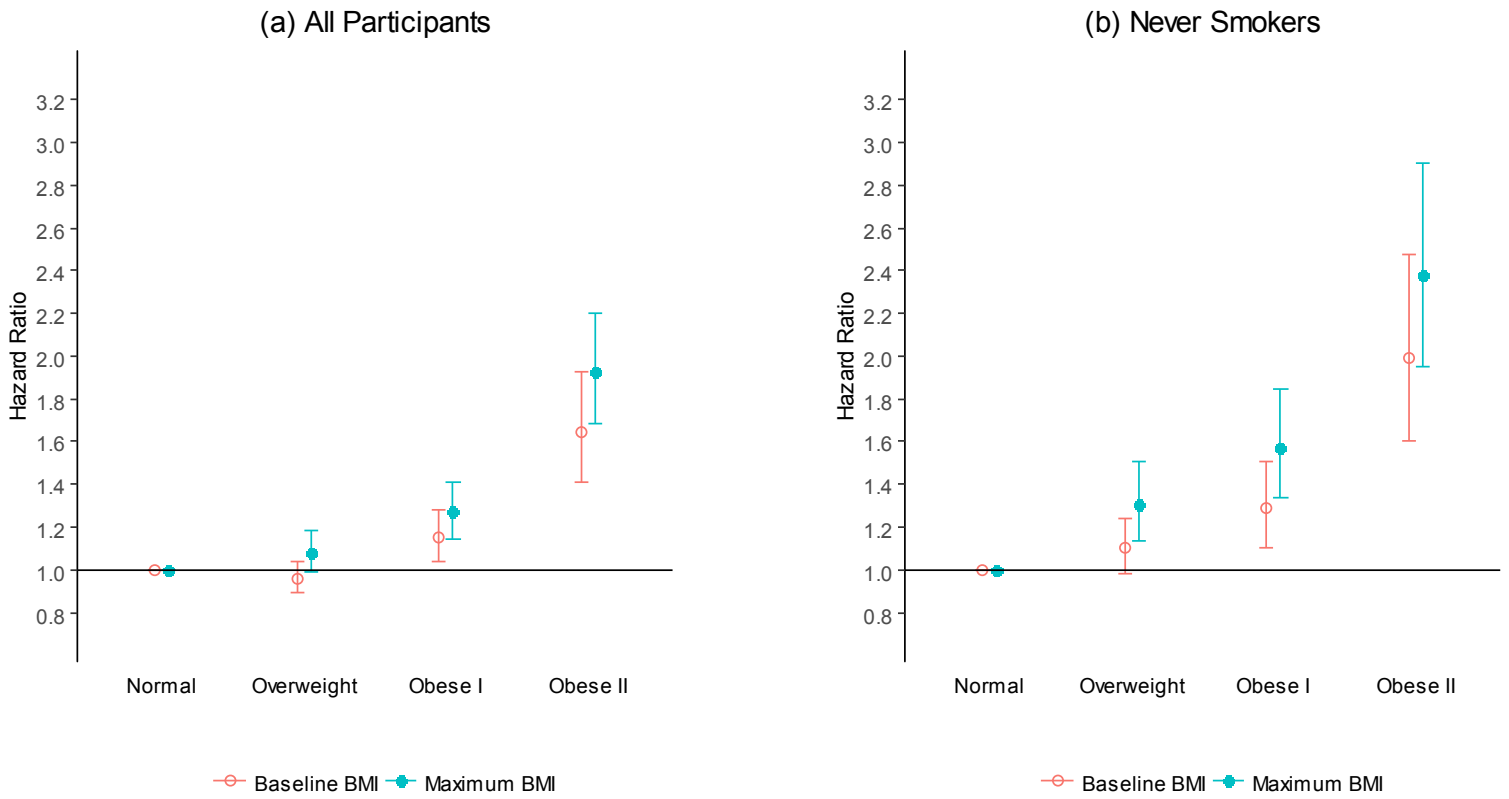
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This supplementary material has been provided by the authors to give readers additional information about their work.

eFigure 1. Flowchart of Sample Exclusion



eFigure 2. Hazard Ratios for Categories of Maximum BMI With 24 Years of Weight History and Baseline BMI Among Both All Individuals and Never Smokers



eTable 1. Characteristics of Prior Conditions Among BMI Categories

Maximum / Baseline BMI categories		All		Prior CVD				Prior cancer			
				No		Yes		No		Yes	
		N	%	N	%	N	%	N	%	N	%
All		6197	100	5765	93.0	432	7.0	5763	93.0	434	7.0
Maximum BMI	Baseline BMI										
Normal	Normal	1404	100.0	1339	95.4	65	4.6	1309	93.2	95	6.8
Overweight	Normal	642	100.0	579	90.2	63	9.8	576	89.7	66	10.3
Overweight	Overweight	2266	100.0	2130	94.0	136	6.0	2107	93.0	159	7.0
Obese	Normal	33	100.0	28	84.9	5	15.2	32	97.0	1	3.0
Obese	Overweight	423	100.0	371	87.7	52	12.3	388	91.7	35	8.3
Obese	Obese	1429	100.0	1318	92.2	111	7.8	1351	94.5	78	5.5

BMI categories: Normal (18.5-24.9 kg/m²), Overweight (25.0-29.9 kg/m²), Obese (≥30.0 kg/m²)

eTable 2. Analysis of Trends in the Mortality Risks Between FHS Original and Offspring Cohorts for Overweight and Obesity Categories of Maximum BMI

Strata	Overweight	Obese I	Obese II
All Individuals			
Original	1 (Reference)	1 (Reference)	1 (Reference)
Offspring ^a	0.81 (0.66,0.99)	0.72 (0.57,0.91)	0.89 (0.67,1.18)
Male			
Original	1 (Reference)	1 (Reference)	1 (Reference)
Offspring	0.70 (0.50,0.97)	0.55 (0.39,0.79)	0.72 (0.45,1.15)
Female			
Original	1 (Reference)	1 (Reference)	1 (Reference)
Offspring	0.82 (0.62,1.09)	0.86 (0.62,1.18)	0.92 (0.64,1.32)
Never Smokers			
Original	1 (Reference)	1 (Reference)	1 (Reference)
Offspring	0.81 (0.59,1.11)	0.77 (0.54,1.09)	0.97 (0.64,1.46)
Male			
Original	1 (Reference)	1 (Reference)	1 (Reference)
Offspring	0.64 (0.31,1.12)	0.56 (0.30,1.04)	0.73 (0.34,1.57)
Female			
Original	1 (Reference)	1 (Reference)	1 (Reference)
Offspring	0.80 (0.53,1.21)	0.84 (0.53,1.33)	0.95 (0.57,1.58)
^a : Multivariable model- including maximum BMI category, cohort, interaction term of maximum BMI category and cohort, together with other covariates (age at baseline, sex (if appropriate), smoking status (if appropriate), alcohol intake, menopause status (if appropriate), duration between exam of reaching maximum BMI and baseline exam) in the model BMI categories: Normal (18.5-24.9 kg/m ²), Overweight (25.0-29.9 kg/m ²), Obese I(30.0-34.9 kg/m ²), Obese II(≥35 kg/m ²)			

eTable 3. Hazard Ratios for All-Cause Mortality in the FHS Original and Offspring Cohorts for Maximum BMI Categories With 24 Years of Weight History, Stratified by Smoking Status, Sex, and Cohort

Strata	Original Cohort				Offspring Cohort			
	Normal	Overweight	Obese I	Obese II	Normal	Overweight	Obese I	Obese II
All Individuals								
Event (n)	532	1316	542	186	178	376	221	127
Multivariable HR (95% CI) ^a	1 (Reference)	1.14 (1.03,1.26)	1.37 (1.21,1.54)	1.91 (1.61,2.26)	1 (Reference)	0.91 (0.75,1.09)	0.98 (0.80,1.20)	1.80 (1.43,2.28)
Male								
Event (n)	151	671	280	56	63	252	138	60
Multivariable HR (95% CI)	1 (Reference)	1.25 (1.05,1.50)	1.58 (1.30,1.94)	2.43 (1.78,3.32)	1 (Reference)	0.89 (0.68,1.18)	0.91 (0.67,1.24)	2.00 (1.39,2.88)
Female								
Event (n)	381	645	262	130	115	124	83	67
Multivariable HR (95% CI)	1 (Reference)	1.10 (0.97,1.25)	1.28 (1.09,1.50)	1.78 (1.46,2.18)	1 (Reference)	0.90 (0.69,1.16)	1.08 (0.81,1.44)	1.64 (1.21,2.23)
Never Smokers								
Event (n)	179	548	249	96	79	209	106	68
Multivariable HR (95% CI)	1 (Reference)	1.39 (1.17,1.65)	1.69 (1.40,2.06)	2.30 (1.79,2.96)	1 (Reference)	1.12 (0.86,1.46)	1.33 (0.98,1.80)	2.45 (1.76,3.41)
Male								
Event (n)	33	217	88	21	24	142	65	32
Multivariable HR (95% CI)	1 (Reference)	2.05 (1.42,2.97)	2.59 (1.72,3.88)	3.83 (2.19,6.71)	1 (Reference)	1.35 (0.87,2.09)	1.55 (0.96,2.50)	3.34 (1.94,5.74)
Female								
Event (n)	146	331	161	75	55	67	41	36
Multivariable HR (95% CI)	1 (Reference)	1.24 (1.02,1.50)	1.50 (1.20,1.88)	2.01 (1.52,2.67)	1 (Reference)	0.98 (0.68,1.42)	1.25 (0.83,1.89)	1.97 (1.28,3.05)
^a : Multivariable model- including maximum BMI category and other covariates (age at baseline, sex (if appropriate), smoking status (if appropriate), alcohol intake, menopause status (if appropriate), duration between exam of reaching maxbmi and baseline exam) in the model BMI categories: Normal (18.5-24.9 kg/m ²), Overweight (25.0-29.9 kg/m ²), Obese I(30.0-34.9 kg/m ²), Obese II(≥35 kg/m ²) Abbreviations: HR=Hazard Ratio, p-yrs=person-years, CI= Confidence Interval								

eTable 4. Hazard Ratios for All-Cause Mortality in the FHS Original and Offspring Cohorts for Maximum BMI Categories With 24 Years of Weight History and BMI Categories at Baseline Exam, Stratified by Age of 70 at Baseline

Strata	Maximum BMI Category				Baseline BMI Category			
	Normal	Overweight	Obese I	Obese II	Normal	Overweight	Obese I	Obese II
All Individuals								
Age < 70 years								
Event (n)	519	1088	492	219	796	1004	372	146
Multivariable HR (95% CI)	1 (Reference)	1.00 (0.90,1.11)	1.20 (1.06,1.37)	1.92 (1.63,2.25)	1 (Reference)	0.96 (0.88,1.06)	1.23 (1.08,1.40)	1.95 (1.62,2.34)
Age ≥ 70 years								
Event (n)	191	604	271	94	414	527	174	45
Multivariable HR (95% CI)	1 (Reference)	1.32 (1.12,1.56)	1.48 (1.22,1.78)	2.06 (1.60,2.65)	1 (Reference)	1.10 (0.96,1.25)	1.19 (0.99,1.44)	1.51 (1.10,2.07)
Never Smokers								
Age < 70 years								
Event (n)	158	403	203	101	252	390	148	75
Multivariable HR (95% CI)	1 (Reference)	1.22 (1.01,1.47)	1.59 (1.29,1.96)	2.48 (1.93,3.20)	1 (Reference)	1.21 (1.03,1.42)	1.48 (1.20,1.82)	2.47 (1.89,3.23)
Age ≥ 70 years								
Event (n)	100	354	152	63	239	300	101	29
Multivariable HR (95% CI)	1 (Reference)	1.43 (1.14,1.80)	1.54 (1.19,1.99)	2.27 (1.65,3.12)	1 (Reference)	1.08 (0.91,1.29)	1.13 (0.89,1.44)	1.70 (1.14,2.53)
^a : Multivariable model- including maximum BMI category (or Baseline BMI category) and other covariates (age at baseline, sex (if appropriate), smoking status (if appropriate), alcohol intake, menopause status (if appropriate), duration between exam of reaching maxbmi and baseline exam) in the model BMI categories: Normal (18.5-24.9 kg/m ²), Overweight (25.0-29.9 kg/m ²), Obese I(30.0-34.9 kg/m ²), Obese II(≥35 kg/m ²) Abbreviations: HR=Hazard Ratio, CI= Confidence Interval								

eTable 5. Hazard Ratios for All-Cause Mortality in the FHS Original and Offspring Cohorts for Maximum BMI Categories With 24 Years of Weight History, Stratified by Smoking Status and Sex, Further Adjusting for BMI at Baseline Exam as Sensitivity Analyses

Strata	Maximum BMI Category			
	Normal (18.5-24.9 kg/m ²)	Overweight (25.0-29.9 kg/m ²)	Obese I (30.0-34.9 kg/m ²)	Obese II (≥35.0 kg/m ²)
All Individuals				
Event (n)	710	1692	763	313
1,000 p-yrs	25.42	49.63	21.88	8.28
Multivariable HR (95% CI) ^a	1 (Reference)	1.203 (1.08,1.34)	1.585 (1.345,1.867)	2.839 (2.195,3.671)
Male				
Event (n)	214	923	418	116
1,000 p-yrs	5.55	23.93	10.91	2.86
Multivariable HR (95% CI)	1 (Reference)	1.267 (1.061,1.514)	1.666 (1.282,2.165)	3.303 (2.186,4.989)
Female				
Event (n)	496	769	345	197
1,000 p-yrs	19.87	25.70	10.97	5.43
Multivariable HR (95% CI)	1 (Reference)	1.178 (1.025,1.353)	1.57 (1.265,1.948)	2.694 (1.931,3.758)
Never Smokers				
Event (n)	258	757	355	164
1,000 p-yrs	12.42	24.87	10.79	4.47
Multivariable HR (95% CI)	1 (Reference)	1.483 (1.252,1.756)	2.052 (1.598,2.634)	3.78 (2.575,5.549)
Male				
Event (n)	57	359	153	53
1,000 p-yrs	2.59	10.98	4.45	1.37
Multivariable HR (95% CI)	1 (Reference)	1.787 (1.302,2.454)	2.153 (1.382,3.354)	4.008 (2.063,7.785)
Female				
Event (n)	201	398	202	111
1,000 p-yrs	9.84	13.89	6.34	3.10
Multivariable HR (95% CI)	1 (Reference)	1.382 (1.125,1.697)	2.044 (1.498,2.789)	3.771 (2.343,6.068)
^a : Multivariable model- including maximum BMI category and other covariates (age at baseline, cohort, sex (if appropriate), smoking status (if appropriate), alcohol intake, menopause status (if appropriate), duration between exam of reaching maximum BMI and baseline exam and BMI at baseline exam) in the model Abbreviations: HR=Hazard Ratio, p-yrs=person-years, CI= Confidence Interval				

eTable 6. Sample Size and Hazard Ratios for All-Cause Mortality for FHS Original and Offspring Cohorts Stratified by Maximum BMI and Baseline BMI Among All Individuals. (Obese I and Obese II were combined as Obese in this specific analysis due to small event size)

Sample Size / Hazard Ratios (95% CI)		Maximum BMI		
		Normal	Overweight	Obese
Baseline BMI	Normal	1404 / 1 (Reference)	642 / 1.22 (1.09, 1.38)	33 / 1.80 (1.23, 2.64)
	Overweight		2266 / 1.04 (0.94, 1.14)	423 / 1.33 (1.16, 1.53)
	Obese			1429 / 1.32 (1.18, 1.48)

BMI categories: Normal (18.5-24.9 kg/m²), Overweight (25.0-29.9 kg/m²), Obese (≥30.0 kg/m²)

eTable 7. Hazard Ratios for Cause-Specific Mortality in the FHS Original and Offspring Cohorts for Maximum BMI Categories With 24 Years of Weight History

Strata	Normal	Overweight	Obese I	Obese II
All-Cause mortality				
Event (n) /1,000 p-yrs	710 / 25.42	1692 / 49.63	763 / 21.88	313 / 8.28
Multivariable HR (95% CI) ^a	1 (Reference)	1.08 (0.99,1.18)	1.27 (1.14,1.41)	1.93 (1.68,2.20)
CVD				
Event (n)	173	501	257	103
Multivariable HR (95% CI)	1 (Reference)	1.22 (1.02,1.45)	1.66 (1.36,2.02)	2.56 (2.00,3.28)
Cancer				
Event (n)	189	442	180	70
Multivariable HR (95% CI)	1 (Reference)	1.02 (0.85,1.21)	1.02 (0.82,1.25)	1.39 (1.06,1.84)
Other Causes				
Event (n)	348	749	326	140
Multivariable HR (95% CI)	1 (Reference)	1.05 (0.92,1.19)	1.21 (1.03,1.41)	1.93 (1.58,2.35)
^a : Multivariable model- including maximum BMI category and other covariates (age at baseline, cohort, sex (if appropriate), smoking status, alcohol intake, menopause status (if appropriate), duration between exam of reaching maximum BMI and baseline exam) in the model BMI categories: Normal (18.5-24.9 kg/m ²), Overweight (25.0-29.9 kg/m ²), Obese I(30.0-34.9 kg/m ²), Obese II(≥35 kg/m ²)				