

Supplementary Online Content

Flegal KM, Kit BK, Orpana H, Graubard BI. Association of all-cause mortality with overweight and obesity using standard body mass index categories: a systematic review and meta-analysis. *JAMA*. doi:10.1001/jama.2012.113905

eTable 1. Search strategies

eTable 2. Included studies

eTable 3. Adjustment factors, exclusions, and our evaluation for included studies

eTable 4. Summary hazard ratios for all-cause mortality relative to normal weight for BMI 25-<30 by age, sex, region, and measurement type

eTable 5. Summary hazard ratios for all-cause mortality relative to normal weight for BMI \geq 30 by age, sex, region and measurement type

eTable 6. Summary hazard ratios for all-cause mortality relative to normal weight for BMI 30-<35 by age, sex, region and measurement type

eTable 7. Summary hazard ratios for all-cause mortality relative to normal weight for BMI \geq 35 by age, sex, region and measurement type

eTable 8. Summary hazard ratios all-cause mortality relative to normal weight by BMI category, adjustment and measurement type

eTable 9. Approximate hazard ratio estimates for overweight and obesity relative to normal weight constructed from selected recent large studies that used finer body mass index categories

eFigure. Study selection flow diagram

eReferences

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

eTable 1. Search strategies

Search 1: PubMed, search through September 30, 2012

("anthropometry"[MeSH Terms] OR "body mass index"[MeSH Terms] OR "body weight"[MeSH Terms] OR "overweight"[MeSH Terms] OR "obesity"[MeSH Terms] OR "risk factors"[MeSH Major Topic] OR "life style"[MeSH Major Topic] OR "adiposity"[MeSH Terms]) AND ("mortality"[MeSH Major Topic] OR "survival rate"[MeSH Terms] OR "cause of death"[MeSH Terms] OR "obesity/mortality"[MeSH Terms] OR "overweight/mortality"[MeSH Terms] OR "heart diseases/mortality"[MeSH Major Topic] OR "cardiovascular diseases/mortality"[MeSH Major Topic] OR "metabolic syndrome X/mortality"[MeSH Major Topic]) NOT ("case reports"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] OR "letter"[Publication Type] OR "review"[Publication Type]) NOT ("perinatal"[Title/abstract] OR "neonatal"[Title/abstract] OR "infant"[Title/abstract] OR "infants"[Title/abstract]) AND "humans"[MeSH Terms]

Search 2: PubMed, search through September 30, 2012

(((((obesity) AND mortality) NOT laparoscopic) NOT editorial[Publication Type]) NOT review[Publication Type]) NOT letter[Publication Type].. Filters: 10 years, Humans

Search 3: EMBASE, search through September 30, 2012 'obesity' OR 'obesity'/exp OR obesity AND ('mortality' OR 'mortality'/exp OR mortality) AND ('human'/exp OR 'human') AND ('article'/it OR 'book'/it) AND [1995-2012]/py

eTable 2. Included studies

First author, year	Sample size	Number of deaths	Sex	Baseline age in years: (Range/mean/median)	Years of follow-up (Max/mean/median)	Weight and height	Reference BMI category	Outcome BMI categories	Country or region: Sample
Al-Snih 2007 ¹	12 725	3 122	M, F	65+//	7//	Self-report	18.5-<25	25<30, 30-<35,	US: EPESE
Arndt 2007 ²	19 513	802	M	25-64//	10//	Measured	<25	25<30, 30-<35, ≥35	Germany: construction workers
Arnlov 2009 ³	1 758	788	M	50 (all)//	33//30	Measured	<25	25-30, >30	Sweden: Uppsala population
Atlantis 2010 ⁴	1 000	409	M, F	65+//	12//	Measured	18.5-<25	25-<30, ≥30	Australia: MELSHA
Baldinger 2006 ⁵	22 927	588	M	/39/	25/8.2//	Measured	18.5-<25	25-<30, ≥30	Switzerland: Insured men
Batty 2006 ⁶	14 400	8 886	M	40-64/51.2/	35//	Measured	18.5-<25	25-<30, ≥30	UK: Whitehall
Bellocco 2010 ⁷	40 729	1 811	M, F	7-94/50.3/	9.7//	Self-report	<25	25-<30, ≥30	Sweden: National March cohort
Bessonova 2011 ⁸	115 433	10 594	F	22-83/53.1/	13//	Self-report	18.5-<25	25-<30, ≥30	US: California Teachers Cohort
Bevilacqua 2011 ⁹	1 581	154	M, F	30+/55.6/	14//	Measured	18.5-<25	25-<30, ≥30	Brazil: Japanese-Brazilian Diabetes Study Group
Blain 2010 ¹⁰	1 300	410	F	75+//79.6	8//	Measured	18-<25	25-<30, ≥30	France: Osteoporosis study
Boggs 2011 ¹¹	33 916	706	F	30-69//	13//	Self-report	20-<25	25<30, 30-<35, ≥35	US: Black Women's Health Study
Cabrera 2005 ¹²	575	88	F	60+/72.5/	5//	Measured	18.5-<25	25-<30, ≥30	Brazil: outpatient cohort
Carlsson 2011 ¹³	44 258	14 217	M, F	16-86//	35/25.7/	Self-report	18.5-<25	25-<30, ≥30	Sweden: Twin Registry
Cesari 2009 ¹⁴	576	121	M, F	65+/74.5/	6/5.1/	Measured	<25	25-<30, ≥30	Italy: InCHIANTI study
Cohen 2012 ¹⁵	76 614	5 280	M, F	40-79/53.1/	8.9/5.2/	Self-report	20-<25	25<30, 30-<35, 35-<40	US: Southern Community Cohort Study
Corrada 2006 ¹⁶	13 451	11 203	M, F	44-101/73/	23//	Self-report	18.5-<25	25-<30, ≥30	US: Leisure World Cohort Study
Crespo 2002 ¹⁷	9 136	1 445	M	35-79//	12//	Measured	18.5-<25	25-<30, ≥30	US (Puerto Rico): Puerto Rico Heart Health Study
Faeh 2011 ¹⁸	9 853	1 526	M, F	25-74/47.2/	25/18.6	Measured	18.5-<25	25-<30, ≥30	Switzerland: MONICA
Fang 2011 ¹⁹	2 086	N/A†	M, F	55+//	5//	Measured	18.5-<25	25-<30	China: Beijing population sample
Farrell 2002 ²⁰	9 925	195	F	20-79/42.9/	26/11.4	Measured	18.5-<25	25-<30, ≥30	US: ACLS
Ferrie 2009 ²¹	1 916	1 219	M, F	35-70/48.0/	40//	Measured	18.5-<25	25-<30, ≥30	UK: General Post Office study
Flegal 2007 ²²	52 590	8 418	M, F	≥25//	20//	Measured	18.5-<25	25<30, 30-<35, ≥35	US:NHANES

First author, year	Sample size	Number of deaths	Sex	Baseline age in years: (Range/mean/median)	Years of follow-up (Max/mean/median)	Weight and height	Reference BMI category	Outcome BMI categories	Country or region: Sample
Flicker 2010 ²³	9 240	2 308	M, F	70-75/72.0/	10//	Self-report	18.5-<25	25-<30, ≥30	Australia: Subsamples of the Australian Health in Men Study and Longitudinal Study of Women's Health
Fontaine 2012 ²⁴	2 758	923	M, F	25-64/43.5/	14//	Measured	18.5-<25	25<30, 30-<35, ≥35	US: San Antonio Heart Study
Fontaine 2012 ²⁴	1 625	419	M, F	60+/70.4/	9//	Measured	18.5-<25	25<30, 30-<35, ≥35	US: Sacramento Area Latino Study on Aging
Ford 2008 ²⁵	12 422	2 321	F	70-75//	9//	Self-report	18.5-<25	25-<30, ≥30	Australia: Longitudinal Study on Women's Health
Freedman 2006 ²⁶	43 357	1 402	M, F	22-92//	19//	Self-report	18.5-<25	25<30, 30-<35, ≥35	US: Radiologic Technologists Study
Fujino 2007 ²⁷	109 778	15 507	M, F	40-79//	15/12.7/	Self-report	18.5-<25	25-<30, ≥30	Japan: Japan Collaborative Cohort Study
Gale 2007 ²⁸	348	315	M, F	≥65/74.6/	24//	Measured	18.5-<25	25-<30, ≥30	UK: population samples from 8 regions
Gelber 2007 ²⁹	97 567	4 803	M	40-80/55.9/	6.6//5.7	Self-report	<25	25<30, 30-<35, ≥35	US: Physicians Health Study
Gray 2010 ³⁰	1 503	255	M, F	16-35/27.9/	42//39.6	Self-report	<25	25-<30, ≥30	UK (Scotland): Two Midspan studies (Main and Collaborative)
Greenberg 2007 ³¹	12 457	606	M, F	51-70//	5.3//	Measured	18.5-<25	25<30, 30-<35, ≥35	US: ARIC
Gu 2006 ³²	154 736	17 687	M, F	≥40/55/	/8.3/	Measured	18.5-<25	25-<30, ≥30	China: national sample
Haapenen-Niemi 2000 ³³	2 212	295	M, F	35-63//	16//	Self-report	20-<25	25-<30, ≥30	Finland: Regionally representative cohort
Hanson 1995 ³⁴	1 814.	249	M, F	≥20/30.5/	25.1//7.7	Measured	<25	25<30, 30-<35, 35-<40	US: Pima Indian study
Heir 2011 ³⁵	1 086	309	M	40-59/49.6/	27//	Measured	<25		Norway: healthy employees
Hjartaker 2005 ³⁶	102 446	1 071	F	30-50/40.5/	10/9.1	Self-report	18.5-<25	25-<30, ≥30	Norway-Sweden: Norwegian-Swedish Women's Lifestyle and Health Cohort Study
Hotchkiss 2010 ³⁷	20 117	1 280	M, F	18-86/45.6/	12//	Measured	18.5-<25	25-<30, ≥30	UK (Scotland): Scottish Health Surveys
Hu 2005 ³⁸	47 212	7 394	M, F	25-64/43.4/	/17.7/	Measured	18.5-<25	25-<30, ≥30	Finland: Various population surveys

First author, year	Sample size	Number of deaths	Sex	Baseline age in years: (Range/mean/median)	Years of follow-up (Max/mean/median)	Weight and height	Reference BMI category	Outcome BMI categories	Country or region: Sample
Ioachimescu 2010 ³⁹	5 904	275	M, F	/55/	11//5.3	Measured	18.5-<25	25-<30, ≥30	US: Cleveland Clinic
Iribarren 2005 ⁴⁰	5 115	127	M, F	18-30//	16//	Measured	18.5-<25	25-<30, ≥30	US: CARDIA
Iversen 2010 ⁴¹	10 059	877	F	/56.1/	12//11.8	Self-report	18.5-<25	25-<30, ≥30	UK: subsample of the RCGP Oral Contraception Study
Janssen 2007 ⁴²	4 968	1 464	M, F	≥65//	9//	Measured	20-<25	25-<30, ≥30	US: Cardiovascular Health Study
Janssen 2008 ⁴³	3 288	1 845	M, F	≥70/71/	//10.6	Measured	20-<25	25-<30, ≥30	US: Framingham Heart Study
Jerant 2012 ⁴⁴	50 994	1 683	M, F	18-90//	6//	Self-report	20-<25	25<30, 30-<35, ≥35	US: Medical Care Expenditure Panel Survey
Jonsson 2002 ⁴⁵	22 025	2 674	M	27-61/43.7/	23//	Measured	20-<25	25-<30, ≥30	Sweden: Malmo Preventive Project
Katzmarzyk 2001 ⁴⁶	10 725	593	M, F	20-69//	13/12.4/	Measured	18.5-<25	25<30, 30-<35, ≥35	Canada: Canada Fitness Survey
Katzmarzyk 2012 ⁴⁷	10 522	1 148	M, F	18-74/43.5/	19.1/13.9	Measured	18.5-<25	25<30, 30-<35, ≥35	Canada: Canadian Heart Health Surveys
Keller 2005 ⁴⁸	539	207	M, F	≥65//	10//	Measured	18.5-<25	25-<30, ≥30	Canada: Canadian Study of Health and Aging
Kreuger 2004 ⁴⁹	45 162	11 964	M, F	≥60//	10/	Self-report	18.5-<25	25<30, 30-<35, 35-<40	US: National Health Interview Survey
Lahmann 2002 ⁵⁰	27 716	958	M, F	46-73/58.1/	/5.7	Measured	<25	25-<30, ≥30	Sweden: Malmo Diet and Cancer Study
Lakoski 2011 ⁵¹	16 486	927	M, F	≥45/64/	6//	Measured	20-<25	25<30, 30-<35, ≥35	US: REGARDS study.
Lang 2008 ⁵²	3 793	393	M, F	≥65/72.8/	5//	Measured	20-<25	25<30, 30-<35, ≥35	UK: ELSA
Lantz 2010 ⁵³	3 617	1 409	M, F	≥25//	19/	Self-report	18.5-<25	25-<30, ≥30	US: Americans' Changing Lives study
Lawlor 2006 ⁵⁴	15 344	10 261	M, F	45-64/54.3	//29	Measured	18.5-<25	25-<30, ≥30	UK (Scotland): Renfrew-Paisley (Midspan study)
Lawlor 2006 ⁵⁴	4 016	2 957	M	45-64/51.7	//32	Measured	18.5-<25	25-<30, ≥30	UK (Scotland): Collaborative (Midspan study)
Leitzmann 2011 ⁵⁵	185 412	15 563	M, F	51-71/62.9/	9//	Self-report	18.5-<25	25<30, 30-<35, ≥35	US: NIH-AARP Diet and Health Study
Lisko 2011 ⁵⁶	257	133	M, F	89-91//	4//	Measured	18.5-<25	25-<30, ≥30	Finland: Vitality 90+

First author, year	Sample size	Number of deaths	Sex	Baseline age in years: (Range/mean/median)	Years of follow-up (Max/mean/median)	Weight and height	Reference BMI category	Outcome BMI categories	Country or region: Sample
Locher 2007 ⁵⁷	983	147	M, F	≥65/75.3/	3//	Measured	18.5-<25	25<30, 30-<35, ≥35	US: UAB Study of Aging
Lubin 2003 ⁵⁸	632	151	M, F	41-70/55.2/	18//	Measured	<25	25-<30, ≥30	Israel: cohort subsample
Luchsinger 2008 ⁵⁹	1 372	479	M, F	≥65/78.3/77	9/7.0	Measured	18.5-<25	25-<30, ≥30	US: New York City cohort
Ma 2011 ⁶⁰	112 328	3 178	M, F	18-39/29.3/	20/16/16.1	Self-report	18.5-<25	25<30, 30-<35, ≥35	US: National Health Interview Survey
Majer 2011 ⁶¹	66 331	950	M, F	15-90/46.9/	4/2.6/	Self-report	18.5-<25	25-30, >30	Europe: ECHP (non disabled)
McAuley 2010 ⁶²	12 417	2 801	M	40-70/57/	22.9/7.7/	Measured	18.5-<25	25<30, 30-<35, ≥35	US: Veterans
McTigue 2006 ⁶³	83 691	4 302	F	50-79//	9.9/7/	Measured	18.5-<25	25<30, 30-<35, 35-<40	US: WHI Observational Study
Mehta 2009 ⁶⁴	6 453	1 301	M, F	50-61/55.5/	12//	Self-report	18.5-<25	25<30, 30-<35, ≥35	US: Health and Retirement Study
Miller 2002 ⁶⁵	1 396	579	M, F	≥70/77.9/	8//	Measured	20-<25	25-30, >30	Australia: Australian Longitudinal Study of Ageing
Monteverde 2010 ⁶⁶	7 880	465	M, F	≥59//	3//	Self-report	18.5-<25	25<30, 30-<35, ≥35	Mexico: Mexican Health and Aging Study
Nagai 2012 ⁶⁷	43 972	5 707	M, F	40-79/58.8/	13//	Self-report	18.5-<25	25-<30, ≥30	Japan: Ohsaki Cohort Study
Nechuta 2010 ⁶⁸	71 243	2 860	F	40-70//	/9	Measured	18.5-<25	25-<30, ≥30	China: Shanghai women .
Niedhammer 2011 ⁶⁹	4 118	291	M, F	<70//	12.5//	Self-report	18.5-<25	25-30, >30	France: Lorhandicap cohort
Orpana 2009 ⁷⁰	11 326	1 929	M, F	≥25//	12//	Self-report	18.5-<25	25<30, 30-<35, ≥35	Canada: 1994/1995 National Population Health Survey
Osler 2001 ⁷¹	5 610	586	M, F	30-70//	16//15	Measured	20-<25	25-<30, ≥30	Denmark: MONICA
Pednekar 2008 ⁷²	147 097	13 001	M, F	≥35//	12//	Measured	18.5-<25	25-<30, ≥30	India: Mumbai population study
Petursson 2011 ⁷³	62 223	5 169	M, F	20-79/47.1/	12.5/12/	Measured	18.5-<25	25<30, 30-<35, ≥35	Norway: HUNT-2
Ringback Weitoft 2008 ⁷⁴	23 580	2 306	M, F	16-74//	12//	Self-report	18.5-<25	25-<30, ≥30	Sweden: Swedish Survey of Living Conditions
Seccariccia 1998 ⁷⁵	63 036	1 373	M, F	20-69//	6//	Measured	20-<25	25<30, 30-<35, ≥35	Italy: RIFLE pooling project
Seidell 1996 ⁷⁶	48 287	1 319	M, F	30-54//	20/12	Measured	18.5-<25	≥30	Netherlands: Prospective cohort study in 5 towns

First author, year	Sample size	Number of deaths	Sex	Baseline age in years: (Range/mean/median)	Years of follow-up (Max/mean/median)	Weight and height	Reference BMI category	Outcome BMI categories	Country or region: Sample
Simpson 2007 ⁷⁷	31 313	2 822	M, F	27-75//	//11	Measured	18.5-<25	25-<30, ≥30	Australia: Melbourne Collaborative Cohort Study
Sonestedt 2011 ⁷⁸	22 799	3 452	M, F	44-74//	12//	Measured	18.5-<25	30-35, ≥35	Sweden: Malmo Diet and Cancer Study
Stessmann 2009 ⁷⁹	2 408	733	M, F	70 (all)//	18//	Measured	18.5-<25	25-<30, ≥30	Israel: Jerusalem Longitudinal Study
Stevens 2000 ⁸⁰	297 231	N/A†	M, F	≥30//	11//	Self-report	18.5-<25	25-<30, ≥30	US: CPS I
Strawbridge 2000 ⁸¹	6 253	1 295	M, F	21-75//	31//	Self-report	18.5-<25	25-<30, 30-<35, ≥35	US: Alameda Co. Study
Suadcani 2009 ⁸²	2 982	1 184	M	53-75/63/	16//	Measured	20-<25	≥30	Denmark: Copenhagen Male Study
Sui 2007 ⁸³	2 603	450	M, F	≥60/64.4/	24/12	Measured	18.5-<25	25-<30, 30-<35, ≥35	US: ACLS
Takata 2007 ⁸⁴	697	107	M, F	80(all)//	4//	Measured	18.5-<25	25-<30	Japan: Community cohort
Taylor 2001 ⁸⁵	4 208	N/A†	M, F	≥65//	1//	Self-report	18.5-<25	25-<30, 30-<35, ≥35	US: community sample
Tice 2006 ⁸⁶	17 748	1886	F	55-80/68/	9//	Measured	18.5-<25	25-<30, 30-<35, ≥35	US: Post-menopausal women screened for intervention trial
Tsai 2006 ⁸⁷	7 139	970	M, F	30-69//42	20//	Measured	18.5-<25	25-<30, ≥30	US: Shell Oil employees
Tsai 2008 ⁸⁸	33 259	2 095	M, F	≥40/50.9/	//15	Measured	18.5-<25	25-<30, ≥30	Taiwan: Sample of civil servants and teachers
Uretsky 2010 ⁸⁹	3 673	496	M, F	/60/	/7.5/	Measured	18.5-<25	25-<30, ≥30	US: Patients referred for testing who had normal results
Van Dam 2008 ⁹⁰	77 782	8 882	F	34-59//	24//	Self-report	18.5-<25	25-<30, ≥30	US: Nurses' Health Study
Visscher 2000 ⁹¹	1 565	396	M	50-69//	15	Measured	18.5-<25	25-<30, ≥30	Europe: Seven Countries Study
Visscher 2004 ⁹²	10 318	1 184	M, F	20-92/45/	15//	Measured	18.5-<25	25-<30, ≥30	Finland:12 municipalities
Walter 2009 ⁹³	5 980	2 388	M, F	≥55/68.9/	15//	Measured	18.5-<25	25-<30, 30-<35, ≥35	Netherlands:The Rotterdam Study
Wandell 2009 ⁹⁴	2 422	562	M, F	18-64//	26//	Measured	20-<25	25-<30, ≥30	Sweden: Stockholm population sample
Wannamethee 2007 ⁹⁵	4 107	713	M	60-79//	7/6	Measured	18.5-<25	≥30	UK: British Regional Heart Study
Yates 2008 ⁹⁶	2 357	1 387	M	66-84/72/	//14.3	Self-report	<25	25-<30, ≥30	US: Physicians' Health Study

First author, year	Sample size	Number of deaths	Sex	Baseline age in years: (Range/mean/median)	Years of follow-up (Max/mean/median)	Weight and height	Reference BMI category	Outcome BMI categories	Country or region: Sample
Zunzunegui 2012 ⁹⁷	1 008	672	M, F	65+//74.6	16//11.6	Self-report	18.5-<25	25<30, 30-<35, ≥35	Spain: Aging in Leganes cohort

† N/A=not available

Abbreviations: Aerobics Center Longitudinal Study (ACLS); Cancer Prevention Study (CPS); Coronary Artery Risk Development in Young Adults (CARDIA); English Longitudinal Study of Ageing (ELSA), Established Populations for Epidemiologic Studies of the Elderly (EPESE); European Community Household Panel (ECHP); Invecchiare in Chianti (InCHIANTI) study; Melbourne Longitudinal Studies on Healthy Ageing (MELSHA) ; Multinational Monitoring of trends and determinants in Cardiovascular disease (MONICA); National Health and Nutrition Examination Survey (NHANES); Nord-Trøndelag Health Study (HUNT 2); Reasons for Geographic and Racial Differences in Stroke study (REGARDS); Risk Factors and Life Expectancy (RIFLE); Royal College of General Practitioners (RCGP); University of Alabama at Birmingham (UAB); United States (US); United Kingdom (UK) Women's Health Initiative (WHI)

eTable 3. Adjustment factors, exclusions, and our evaluation for studies in **eTable 2**

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Al-Snih 2007 ¹	Age, sex, smoking status, race/ethnicity, marital status, level of formal education, comorbidity (cancer, hypertension, diabetes mellitus, or a hip fracture, or had ever had a heart attack or stroke) and EPESE site	Those with any limitations in ADL at baseline were excluded	2. Possible over-adjustment.
Arndt 2007 ²	Age, smoking status, nationality, and alcohol consumption	Men only. First 3 yrs of mortality excluded	1. Adequately adjusted
Arnlov 2009 ³	Age, smoking status and LDL cholesterol	Included men only. Men with diabetes or history of cardiovascular hospitalization excluded at baseline [We used only findings for men without metabolic syndrome]	2. Possible over-adjustment
Atlantis 2010 ⁴	Age, sex, smoking, instrumental activities of daily living, social activity, cognitive impairment and cardiovascular disease	Limited to community dwellers	2. Possible over-adjustment
Baldinger 2006 ⁵	Age, calendar year, blood pressure level, smoking, impaired glucose metabolism, history of other disease	Men only. Limited to men who underwent a thorough medical examination for high-sum assured life insurance coverage	2. Possible over-adjustment.
Batty 2006 ⁶	Age, sex, age, employment grade, physical activity, smoking habit, marital status, disease at entry, and weight loss in the previous year, BP lowering medication, height adjusted FEV1, systolic BP, diastolic BP, plasma cholesterol, blood glucose (in normoglycaemic patients), glucose intolerance, and diabetes status.	Male British civil servants only. Results stratified by presence of absence of CHD at baseline. [We selected the results only for men without existing CHD at baseline]	2. Possible over-adjustment.
Bellocco 2010 ⁷	Age at enrollment, sex, physical activity, cigarette smoking status, alcohol drinking, use of vitamins and minerals, and educational level in men; further adjusted for contraceptive pill use and hormone therapy replacement in women	History of cancer or CVD at baseline	1 Adequately adjusted,
Bessonova 2011 ⁸	Age, sex, race, hormone therapy, physical activity, diabetes, co-morbidities (including hypertension, heart attack, stroke and any cancer), smoking status, alcohol consumption, percent daily calories from fat, weight change (in kg) from age 18 to baseline	Women only. Excluded 1 year of follow-up	2. Possible-over-adjustment.
Bevilacqua 2011 ⁹	Unadjusted	None mentioned	3. Possible under-adjustment

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Blain 2010 ¹⁰	Age	Women only. Community-dwelling sample “ study included only high-functioning women aged 75 years or older, able to walk independently without a cane and in excellent physical and cognitive health” First year of mortality excluded	3. Possible under-adjustment.
Boggs 2011 ¹¹	Education, marital status, physical activity and alcohol consumption	Women only. Excluded women with a history of cancer or cardiovascular disease. Primary analyses limited to never smokers.	1. Adequately adjusted.
Cabrera 2005 ¹²	Unadjusted	Women only. Excluded women with cancer other than basal cell skin cancer and excluded the first 6 months of mortality	3 Possible under-adjustment
Carlsson 2011 ¹³	Age as timeline, sex-specific, adjusted for smoking	Excluded first 2 years of mortality	1. Adequately adjusted
Cesari 2009 ¹⁴	age, sex, site, smoking, education, Mini-Mental State Examination score, Center for Epidemiological Studies-Depression scale score, physical activity, congestive heart failure, coronary artery disease, hypertension, peripheral artery disease, respiratory disease, osteoarthritis, stroke, interleukin-6 , C-reactive protein, and tumor necrosis factor- alpha .	None mentioned [We excluded the group with sarcopenia]	2. Possible over-adjustment
Cohen 2012 ¹⁵	Age, sex, education; income, source (community health center vs.general population); cigarette smoking, alcohol consumption	Excluded first year of mortality. Restricted to those not under cancer treatment in the preceding year	1. Adequately adjusted
Corrada 2006 ¹⁶	Age at entry, sex, smoking, “active” activities (seven categories) and history of hypertension, angina, myocardial infarction, stroke, diabetes, arthritis, and cancer	Excluded first 5 years of mortality	2. Possible over-adjustment
Crespo 2002 ¹⁷	Age, sex, physical activity smoking, education; urban residence (rural or urban); hypertension and high blood cholesterol	Restricted to men free of coronary disease at Exam 1 who survived for at least 3 years after baseline	2. Possible over-adjustment
Faeh 2011 ¹⁸	age, sex , survey wave, diet, physical activity, smoking and educational level	None mentioned	1. Adequately adjusted
Fang 2011 ¹⁹	age, sex, region, blood pressure history	None mentioned	2 Possible over-adjustment

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Farrell 2002 ²⁰	age, sex, smoking status, baseline health status (reported myocardial infarction, stroke, hypertension, diabetes, cancer) at the time of their baseline examination or had an abnormal resting or exercise electrocardiogram), cardiorespiratory fitness	None mentioned	2 Possible over-adjustment
Ferrie 2009 ²¹	Age and sex	Limited to employees	3. Possible under-adjustment.
Flegal 2007 ²²	Age, sex, smoking status, race/ethnicity, and alcohol consumption	Restricted to civilian non-institutionalized population	1. Adequately adjusted
Flicker 2010 ²³	Age (narrow age range), sex. No adjustment mentioned for main analysis. Subsequent analyses stratified by both smoking and sedentary behavior and showed results almost identical to main analysis.	Included only women residing in metropolitan/urban areas, in order to correspond to male sample	1. Adequately adjusted
Fontaine 2012 ²⁴	Age, sex and smoking	None mentioned	1. Adequately adjusted
Ford 2008 ²⁵	Age, sex, smoking, self-rated health, physical activity, comorbidity score, marital status	Overrepresentation of women in rural and remote areas	2. Possible over-adjustment
Freedman 2006 ²⁶	race/ethnicity, education, alcohol behavior, and year first worked as a radiologic technologist by decade	Restricted to those with no history of myocardial infarction or cancer. [We used analyses for never-smokers only]	1. Adequately adjusted
Fujino 2007 ²⁷	Age, sex and area of study	Excluded those with a history of cancer	3 Possible under-adjustment.
Gale 2007 ²⁸	Age, height, social class, smoking, reported change in weight, daily calorie intake, physical activity, diagnosed disease (unspecified) at baseline, grip strength .	Included only those living at home. [We used analyses for results after deleting first 5 years of mortality]	1. Adequately adjusted
Gelber 2007 ²⁹	Age, sex, smoking, pre-existing disease self-reported history of myocardial infarction, stroke, cancer or liver disease and their interactions with BMI, in addition to age, alcohol consumption and physical activity ("optimal model")	First 2 years of deaths.	2. Possible over-adjustment
Gray 2010 ³⁰	Age, sex, smoking, bronchitis, social class, regular driving, height, systolic and diastolic blood pressure, forced expiratory volume, forced vital capacity, cardiothoracic ratio, alcohol	None mentioned	2. Possible over-adjustment
Greenberg 2007 ³¹	age in years, sex, race, smoking and alcohol consumption	None mentioned	1. Adequately adjusted

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Gu 2006 ³²	Age, sex, cigarette smoking, alcohol consumption, physical activity, education, geographic region (north vs. south), and urbanization (urban vs. rural)	None mentioned	1. Adequately adjusted
Haapenen-Niemi 2000 ³³	age, employment status, marital status, perceived health status, smoking status and alcohol consumption	Excluded those with BMI<20 or who were unable for health reasons to participate in leisure time physical activity	1. Adequately adjusted
Hanson 1995 ³⁴	age, sex, smoking, the time between the initial and baseline examinations and year of baseline examination, weight loss	[We selected results for non-diabetic persons only]	1. Adequately adjusted
Heir 2011 ³⁵	Age, sex, fitness, blood pressure, cholesterol	Employees screened for being in good health at baseline. [We selected data for never smokers only]	2. Possible over-adjustment
Hjartaker 2005 ³⁶	Age, smoking status, years of education, current level of physical activity	None mentioned	1. Adequately adjusted
Hotchkiss 2010 ³⁷	Age, sex, smoking status, alcohol consumption and year of survey	None mentioned	1. Adequately adjusted
Hu 2005 ³⁸	Age, sex, study year, education, smoking status, physical activity, systolic blood pressure, cholesterol and diabetes at baseline	Excluded those with a history of heart disease, stroke, heart failure, or cancer	2. Possible over-adjustment
Ioachimescu 2010 ³⁹	Age, sex, smoking status, history of diabetes mellitus, systolic and diastolic blood pressure, and fasting LDL-C and HDL-C.	Patients referred to the Preventive Cardiology Section for primary or secondary prevention of CVD	2. Possible over-adjustment
Iribarren 2005 ⁴⁰	Age, sex, smoking, race, physical activity, diabetes, liver disease, thyroid disease, hostility, social support, marital status	None mentioned	2. Possible over-adjustment
Iversen 2010 ⁴¹	Age, sex, social class, parity, history of serious illness (ischaemic heart disease, hypertension, stroke, venous thromboembolism, malignancy, diabetes mellitus, asthma, or bronchitis) pack-years of smoking, weekly alcohol intake, and hours of physical activity/week	None mentioned	2. Possible over-adjustment
Janssen 2007 ⁴²	age, sex, race, socioeconomic status, smoking, physical activity and prevalent disease (diabetes, coronary heart disease, congestive heart failure, stroke, cancer).	Those with a history of cancer in the previous 5 years were excluded from the CHS sample	2. Possible over-adjustment
Janssen 2008 ⁴³	sex, age, smoking, alcohol, and the exam year at which the BMI measure was obtained	None mentioned	1. Adequately adjusted
Jerant 2012 ⁴⁴	Age, sex, race, education, income, health insurance, urban/rural, census region, smoking	Restricted to civilian non-institutionalized population	1. Adequately adjusted

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Jonsson 2002 ⁴⁵	Age, sex, heart rate, hypertension, diabetes mellitus, hyperlipidaemia, smoking habits, self-reported health, sedentary leisure-time physical activity, history of cancer, history of angina pectoris, single status, socio-economic position and history of problematic drinking behavior	Exclusions for history of MI or stroke	2. Possible over-adjustment
Katzmarzyk 2001 ⁴⁶	Age, sex, smoking status, and alcohol consumption	None mentioned	1. Adequately adjusted
Katzmarzyk 2012 ⁴⁷	Age, sex, exam year, smoking status, alcohol consumption and education	Excluded the first six months of follow-up	1. Adequately adjusted
Keller 2005 ⁴⁸	Age, sex, smoking, weight loss, education, marital status, cognitive impairment	Excluded the first 5 years of mortality and also those who developed dementia after the first 5 yrs	1. Adequately adjusted
Krueger 2004 ⁴⁹	Age, sex, race/ethnicity, marital status, socioeconomic factors and smoking	None mentioned	1. Adequately adjusted
Lahmann 2002 ⁵⁰	Age, height, smoking status, leisure physical activity	None mentioned	1. Adequately adjusted
Lakoski 2011 ⁵¹	Age, sex, race	None mentioned	3. Possible under-adjustment.
Lang 2008 ⁵²	age, sex, level of education, wealth, income, smoking status, number of comorbidities, alcohol consumption	None mentioned	1. Adequately adjusted
Lantz 2010 ⁵³	Age, sex, race, residence, education, income, smoking, alcohol use, physical activity, physical impairment, self-reported health	Non-institutionalized only	1. Adequately adjusted
Lawlor 2006 ⁵⁴	Age (stratified by sex and cohort)	None mentioned	3. Possible under-adjustment
Leitzmann 2011 ⁵⁵	age sex, race/ethnicity, smoking status, alcohol intake	None mentioned	1. Adequately adjusted
Lisko 2011 ⁵⁶	chronic conditions (cardiovascular disease, cancer, diabetes, respiratory disease, infectious disease, and MMSE score of 0–22), functional status, smoking, and alcohol intake	None mentioned	2. Possible over-adjustment
Locher 2007 ⁵⁷	age, sex, race, smoking status, and comorbidities (based on Charlson Co-morbidity Index)	Community dwelling	2. Possible over-adjustment
Lubin 2003 ⁵⁸	Age, sex, smoking, ethnic origin, systolic blood pressure, physical activity, mean energy intake, fatty acid intake, percent energy from fat, fiber intake, serum cholesterol	Free of diabetes or major chronic disease	2. Possible over-adjustment

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Luchsinger 2008 ⁵⁹	Age, sex, education, ethnic group, cancer, current smoking, and dementia	None mentioned	1. Adequately adjusted
Ma 2011 ⁶⁰	sex, age, education, race/ ethnicity, and smoking status	Excluded those reporting BMI < 15 or BMI >99	1. Adequately adjusted
Majer 2011 ⁶¹	Age, sex, smoking, disability	Results for never-smokers only	1. Adequately adjusted
McAuley 2010 ⁶²	age, ethnicity, examination year, test site, cardiovascular disease, (CVD), hypertension, dyslipidemia, diabetes mellitus, current smoking, and CVD medications	Excluded patients with a history of implanted pacemaker, those who developed left bundle branch block during the test, and those who were clinically unstable or required emergent intervention	2. Possible over-adjustment
McTigue 2006 ⁶³	Age, sex, tobacco use, educational achievement, US region, and physical activity	Women only	1. Adequately adjusted
Mehta 2009 ⁶⁴	Age, sex, race/ethnicity, marital status, SES (education, income, and wealth), behaviors (smoking status and physical activity).	None mentioned	1. Adequately adjusted
Miller 2002 ⁶⁵	Age, sex, marital status, smoking, self-rated health, activities of daily living, comorbidities (any cancer, arthritis, heart attack, heart condition, hypertension, ulcers, diabetes mellitus, respiratory disease, hernia, stroke), depression, cognitive performance	Community sample	2. Possible over-adjustment
Monteverde 2010 ⁶⁶	Age, sex, education and smoking	None mentioned	1 Adequately adjusted
Nagai 2012 ⁶⁷	Age, sex, smoking status, alcohol drinking, sports and physical exercise, time spent walking and education	Excluded participants with a history of cancer, myocardial infarction, stroke or kidney disease. Excluded the first year of follow-up	1 Adequately adjusted
Nechuta 2010 ⁶⁸	Age, education, occupation, and income	Women who reported ever drinking or ever smoking were excluded	1 Adequately adjusted
Niedhammer 2011 ⁶⁹	Age, sex, smoking, SES, alcohol, biomechanical and physical exposures, temporary contract, low social support	None mentioned	1 Adequately adjusted
Orpana 2009 ⁷⁰	Age, sex, self-reported smoking status, physical activity frequency, and alcohol consumption	Limited to members of private households	1. Adequately adjusted
Osler 2001 ⁷¹	Age, sex, prudent diet score, self rated health, physical activity, smoking, and vocational education	None mentioned	1. Adequately adjusted
Pednekar 2008 ⁷²	Age, sex, education, religion, mother tongue and tobacco use.	Very sick or bedridden	1. Adequately adjusted

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Petursson 2011 ⁷³	Age, smoking and physical activity per week	None mentioned	1. Adequately adjusted
Ringback Weitoft 2008 ⁷⁴	Age, smoking, longstanding illness (not specified) and education	None mentioned	1. Adequately adjusted
Seccariccia 1998 ⁷⁵	Age, systolic blood pressure, serum cholesterol, and cigarette smoking	None mentioned	2. Possible over-adjustment
Seidell 1996 ⁷⁶	Age	None mentioned	3. Possible under-adjustment
Simpson 2007 ⁷⁷	Adjusted for sex, age at attendance, country of birth, physical activity, alcohol intake, education, smoking status, living alone (men only), and family history of heart attack (men only); and stratified by "previous history of heart attack, angina, diabetes, stroke, and cancer."	None mentioned	1. Adequately adjusted
Sonestedt 2011 ⁷⁸	Age and sex	Excluded those with a history of diabetes, cancer or cardiovascular disease	3. Possible under-adjustment
Stessmann 2009 ⁷⁹	perceived economic hardship; subjective self-rated health; physical activity; smoking; activity of daily living dependency; and diagnoses of hypertension, diabetes mellitus, ischemic heart disease, and cancer	None mentioned	2. Possible over-adjustment
Stevens 2000 ⁸⁰	Age, education and physical activity	Limited to white never smokers with no history of cancer or heart disease, no 10lb or more weight loss in past 2 years and who did not report being ill at baseline or feeling poorly in the previous month; first year of mortality also excluded	1. Adequately adjusted
Strawbridge 2000 ⁸¹	Age, sex, race/ethnicity, education, chronic bronchitis, cancer, cigarette smoking, and physical activity	First year of follow-up excluded	1. Adequately adjusted
Suadicani 2009 ⁸²	LTPA, cumulative tobacco consumption (cigarette equivalents), alcohol intake, and social class	Included only men without overt cardiovascular disease	1. Adequately adjusted
Sui 2007 ⁸³	Age, sex, examination year, smoking, abnormal EKG, cardiovascular disease, diabetes, hypertension, hypercholesterolemia, fitness	Excluded those who did not reach 85% of predicted maximal heart rate (220-age)	2. Possible over-adjustment.
Takata 2007 ⁸⁴	Age, sex, current outpatient status, smoking, drinking, weight loss, systolic blood pressure, physical activity, functional status, marital status, preexisting diseases, place of residence, and levels of total serum cholesterol and glucose	None mentioned	2. Possible over-adjustment.

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Taylor 2001 ⁸⁵	Age, sex, smoking, weight change, self-reported sickness, exercise level, drinking, education, cognition, proxy reporting	None mentioned	1. Adequately adjusted.
Tice 2006 ⁸⁶	Age, sex, hypertension, diabetes mellitus, heart disease, stroke, breast cancer, no use of postmenopausal hormone therapy, recent weight loss, worse self-reported health status, current smoking, pack years of smoking, higher WHR, higher systolic blood pressure, higher heart rate, longer Up and Go Test times, and weaker grip strength	Postmenopausal women only	2. Possible over-adjustment
Tsai 2006 ⁸⁷	Age, sex, smoking status and other potential risk factors (ie, cholesterol, blood pressure, and fasting glucose).	Employed at beginning of follow-up	2. Possible over-adjustment
Tsai 2008 ⁸⁸	Age, sex, smoking status	None mentioned	1. Adequately adjusted
Uretsky 2010 ⁸⁹	Age, sex, smoking, hypertension, diabetes, hypercholesterolemia, family history, race, history of chest pain, pharmacologic stress	No history of heart disease; ischemia ruled out by single photon emission computed tomography (SPECT)	2 possible over-adjustment
Van Dam 2008 ⁹⁰	age (5 year categories), time period (12 periods), smoking, physical activity, alcohol consumption, healthy diet score	Excluded women with a history of CVD or cancer and non-drinkers who had previously had high alcohol consumption	1. Adequately adjusted
Visscher 2000 ⁹¹	Age, sex, study center	First 5 yrs of follow-up excluded. [We only tabulated results for never smokers]	1. Adequately adjusted
Visscher 2004 ⁹²	Age, sex, smoking, geographical location, alcohol use	Included only never smokers	1 Adequately adjusted
Walter 2009 ⁹³	Age, sex, smoking status, pack years of cigarettes smoked in the past, alcohol consumption, education, income and living situation.	Patients who reported unintentional wt loss of 3.5 kg or more in previous 18 months	1 Adequately adjusted
Wandell 2009 ⁹⁴	Age, sex, care need level	None mentioned	3. Possible under-adjustment
Wannamethee 2007 ⁹⁵	Age, social class, physical activity, cigarette smoking, alcohol intake, lung function, albumin, stroke, and cancer.	Included men ages 60-79 y without diagnosed heart failure [We selected results that excluded current smokers and recent exsmokers]	1 Adequately adjusted
Yates 2008 ⁹⁶	age, smoking status, alcohol intake, exercise frequency, hypertension, diabetes, hypercholesterolemia, angina, and treatment assignment	Excluded those with a history of cancer (excluding non-melanoma skin cancer), myocardial infarction, transient cerebral ischemia or stroke, or other serious diseases	2. Possible over-adjustment

Study	Adjusted for	Inclusions/exclusions (other than missing data)	Evaluation
Zunzunegui 2012 ⁹⁷	Age, sex, smoking, education, chronic conditions, activities of daily living, physical activity	Excluded first year of follow-up	1 Adequately adjusted

eTable 4. Summary hazard ratios for all-cause mortality relative to normal weight for BMI 25-<30 by age, sex, region, and measurement type

BMI category	Baseline age category	Self-reported or measured height and weight			Measured height and weight			Self-reported height and weight		
		Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)
Both men and women†										
	All ages	52	0.89 (0.86-0.93)*	78.6	35	0.91 (0.86-0.97)*	78.6	17	0.86 (0.82-0.91)*	78.2
	Mixed ages	35	0.89 (0.85-0.94)*	81.7	23	0.91 (0.84-0.99)*	83.3	12	0.87 (0.81-0.92)*	76.5
	≥ 65 only	17	0.89 (0.83-0.94)*	65.2	12	0.91 (0.84-0.98)	44.9	5	0.86 (0.76-0.96)*	84.6
Men										
	All ages	42	0.94 (0.90-0.99)*	84.8	28	0.92 (0.88-0.97)*	71.4	14	0.97 (0.88-1.06)*	90.0
	Mixed ages	35	0.95 (0.90-1.00)*	86.8	24	0.93 (0.88-0.97)*	73.9	11	0.99 (0.89-1.09)*	91.0
	≥ 65 only	7	0.90 (0.82-0.99)	29.8	4	0.81 (0.59-1.12)	47.0	3	0.92 (0.85-1.00)	17.5
Women										
	All ages	46	0.99 (0.94-1.03)*	82.9	26	0.92 (0.87-0.98)*	71.0	20	1.05 (0.99-1.12)*	83.5
	Mixed ages	37	1.00 (0.95-1.05)*	84.4	20	0.93 (0.87-0.99)*	75.4	17	1.08 (1.01-1.14)*	81.6
	≥ 65 only	9	0.92 (0.84-1.00)	26.8	6	0.88 (0.79-1.00)	0.0	3	0.95 (0.83-1.09)	65.4
US and Canada										
	All ages	58	0.92 (0.88-0.96)*	88.3	30	0.90 (0.85-0.95)*	66.3	28	0.95 (0.89-1.00)*	92.2
	Mixed ages	44	0.93 (0.89-0.98)*	89.5	22	0.90 (0.83-0.97)*	70.4	22	0.96 (0.90-1.03)*	92.7
	≥ 65 only	14	0.89 (0.84-0.96)*	70.9	8	0.89 (0.82-0.98)	53.2	6	0.89 (0.79-1.00)*	82.4
Europe										
	All ages	58	0.96 (0.92-1.00)*	79.5	43	0.94 (0.90-0.98)*	68.9	15	1.02 (0.92-1.12)*	83.2
	Mixed ages	49	0.97 (0.93-1.01)*	81.9	34	0.94 (0.91-0.98)*	73.5	15	1.02 (0.92-1.12)*	83.2
	≥ 65 only	9	0.90 (0.81-1.00)	0.0	9	0.90 (0.81-1.00)	0.0	0		
Other regions										
	All ages	9	0.89 (0.85-0.93)	13.1	4	0.87 (0.79-0.97)	34.8	5	0.90 (0.85-0.94)	1.4
	Mixed ages	2	0.83 (0.75-0.91)	5.1	2	0.83 (0.75-0.91)	5.1	0		
	≥ 65 only	7	0.90 (0.86-0.94)	0.0	2	0.98 (0.84-1.13)	0.0	5	0.90 (0.85-0.94)	1.4

* Significant heterogeneity (p<.05)

† Based only on hazard ratios from the studies that did not report results separately for men and women

eTable 5. Summary hazard ratios for all-cause mortality relative to normal weight for BMI \geq 30 by age, sex, region and measurement type

BMI category	Baseline age category	Self-reported or measured height and weight			Measured height and weight			Self-reported height and weight		
		Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)
Both men and women†										
	All ages	24	1.01 (0.91-1.11)*	81.9	17	1.00 (0.87-1.15)*	85.0	7	1.00 (0.87-1.16)*	68.2
	Mixed ages	15	1.02 (0.87-1.19)*	85.9	10	1.02 (0.84-1.24)*	88.7	5	1.00 (0.79-1.27)*	67.6
	≥ 65 only	9	0.99 (0.88-1.12)*	70.0	7	0.97 (0.80-1.16)*	74.1	2	1.05 (0.92-1.20)	61.9
Men										
	All ages	30	1.27 (1.18-1.37)*	74.4	22	1.21 (1.13-1.30)*	58.6	8	1.41 (1.26-1.59)*	62.8
	Mixed ages	25	1.27 (1.18-1.38)*	78.2	19	1.21 (1.12-1.30)*	63.1	6	1.45 (1.28-1.65)*	65.5
	≥ 65 only	5	1.27 (1.08-1.49)	0.0	3	1.25 (0.93-1.68)	0.0	2	1.28 (1.02-1.61)	29.2
Women										
	All ages	30	1.25 (1.15-1.36)*	87.4	17	1.13 (1.04-1.24)*	56.7	13	1.38 (1.24-1.54)*	89.3
	Mixed ages	23	1.32 (1.22-1.44)*	86.9	12	1.17 (1.08-1.28)*	53.0	11	1.47 (1.34-1.61)*	83.8
	≥ 65 only	7	0.97 (0.81-1.18)*	59.6	5	0.93 (0.70-1.23)	55.5	2	1.02 (0.73-1.44)	82.9
US and Canada										
	All ages	17	1.08 (0.95-1.24)*	94.6	10	0.90 (0.73-1.11)*	86.4	7	1.33 (1.17-1.53)*	94.3
	Mixed ages	11	1.13 (0.97-1.32)*	94.7	6	0.90 (0.64-1.27)*	88.5	5	1.37 (1.19-1.58)*	94.5
	≥ 65 only	6	1.02 (0.85-1.23)*	83.5	4	0.90 (0.67-1.21)*	86.6	2	1.23 (0.97-1.56)	64.2
Europe										
	All ages	47	1.27 (1.20-1.35)*	71.5	32	1.22 (1.16-1.29)*	54.1	15	1.36 (1.19-1.55)*	79.0
	Mixed ages	40	1.30 (1.22-1.38)*	74.2	25	1.24 (1.17-1.32)*	59.9	15	1.36 (1.19-1.55)*	79.0
	≥ 65 only	7	1.08 (0.94-1.25)	0.0	7	1.08 (0.94-1.25)	0.0	0		
Other regions										
	All ages	8	1.01 (0.94-1.08)	12.3	4	1.02 (0.93-1.12)	0.0	4	1.02 (0.88-1.17)	57.2
	Mixed ages	2	1.00 (0.90-1.11)	0.0	2	1.00 (0.90-1.11)	0.0	0		
	≥ 65 only	6	1.03 (0.92-1.14)	36.2	2	1.09 (0.89-1.34)	0.0	4	1.02 (0.88-1.17)	57.2

* Significant heterogeneity (p<.05)

† Based only on hazard ratios from the studies that did not report results separately for men and women

eTable 6. Summary hazard ratios for all-cause mortality relative to normal weight for BMI 30-<35 by age, sex, region and measurement type

BMI category	Baseline age category	Self-reported or measured height and weight			Measured height and weight			Self-reported height and weight		
		Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)
Both men and women†										
	All ages	27	0.95 (0.88-1.03)*	84.8	17	0.98 (0.89-1.09)*	64.6	10	0.91 (0.79-1.04)*	92.5
	Mixed ages	20	1.02 (0.94-1.11)*	80.2	13	1.03 (0.92-1.14)*	60.7	7	1.01 (0.89-1.15)*	90.3
	≥ 65 only	7	0.75 (0.61-0.92)*	78.0	4	0.82 (0.61-1.11)*	71.1	3	0.63 (0.42-0.96)*	81.0
Men										
	All ages	12	0.92 (0.77-1.09)*	86.6	6	0.84 (0.64-1.10)*	90.0	6	1.00 (0.77-1.30)*	84.1
	Mixed ages	10	0.90 (0.74-1.09)*	88.8	5	0.81 (0.60-1.10)*	91.9	5	0.98 (0.74-1.31)*	86.7
	≥ 65 only	2	1.07 (0.75-1.51)	0.0	1	0.99 (0.61-1.61)	0.0	1	1.15 (0.70-1.89)	0.0
Women										
	All ages	14	0.98 (0.85-1.14)*	79.5	7	0.96 (0.80-1.15)*	74.7	7	1.01 (0.77-1.32)*	84.4
	Mixed ages	12	0.94 (0.81-1.10)*	80.2	6	0.94 (0.77-1.14)*	78.4	6	0.95 (0.72-1.25)*	82.6
	≥ 65 only	2	1.39 (1.08-1.78)	0.0	1	1.23 (0.73-2.06)	0.0	1	1.44 (1.08-1.92)	0.0
US and Canada										
	All ages	39	0.96 (0.88-1.05)*	89.1	18	0.95 (0.83-1.09)*	84.4	21	0.97 (0.87-1.08)*	90.6
	Mixed ages	31	0.99 (0.90-1.08)*	89.6	14	0.98 (0.83-1.16)*	86.8	17	0.99 (0.88-1.11)*	90.1
	≥ 65 only	8	0.84 (0.67-1.05)*	82.5	4	0.82 (0.61-1.11)*	71.1	4	0.83 (0.52-1.34)*	89.2
Europe										
	All ages	12	0.94 (0.83-1.06)*	69.8	12	0.94 (0.83-1.06)*	69.8	0		
	Mixed ages	10	0.92 (0.81-1.05)*	74.8	10	0.92 (0.81-1.05)*	74.8	0		
	≥ 65 only	2	1.10 (0.77-1.56)	0.0	2	1.10 (0.77-1.56)	0.0	0		
Other regions										
	All ages	1	0.79 (0.56-1.11)	0.0	0			1	0.79 (0.56-1.11)	0.0
	Mixed ages	0			0			0		
	≥ 65 only	1	0.79 (0.56-1.11)	0.0	0			1	0.79 (0.56-1.11)	0.0

* Significant heterogeneity (p<.05)

† Based only on hazard ratios from the studies that did not report results separately for men and women

eTable 7. Summary hazard ratios for all-cause mortality relative to normal weight for BMI ≥ 35 by age, sex, region and measurement type

BMI category	Baseline age category	Self-reported or measured height and weight			Measured height and weight			Self-reported height and weight		
		Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)
Both men and women†										
	All ages	27	1.29 (1.16-1.44)*	77.2	17	1.29 (1.14-1.47)*	51.2	10	1.29 (1.07-1.54)*	88.0
	Mixed ages	20	1.43 (1.28-1.58)*	70.4	13	1.40 (1.24-1.59)	36.4	7	1.45 (1.22-1.73)*	86.1
	≥ 65 only	7	0.99 (0.86-1.15)	22.2	4	1.04 (0.88-1.22)	0.0	3	0.88 (0.60-1.30)	62.2
Men										
	All ages	12	1.26 (1.05-1.50)*	64.4	6	1.13 (0.92-1.40)	42.4	6	1.41 (1.04-1.91)*	76.7
	Mixed ages	10	1.18 (1.01-1.39)*	60.3	5	1.08 (0.91-1.28)	25.4	5	1.31 (0.98-1.74)*	76.0
	≥ 65 only	2	2.84 (1.48-5.46)	0.0	1	2.54 (0.99-6.49)	0.0	1	3.16 (1.27-7.85)	0.0
Women										
	All ages	14	1.34 (1.09-1.66)*	86.5	7	1.26 (0.96-1.64)*	82.2	7	1.43 (0.99-2.06)*	90.3
	Mixed ages	12	1.26 (1.02-1.57)*	86.9	6	1.23 (0.92-1.64)*	84.9	6	1.30 (0.90-1.88)*	89.5
	≥ 65 only	2	2.28 (1.54-3.38)	5.7	1	1.63 (0.77-3.46)	0.0	1	2.57 (1.67-3.95)	0.0
US and Canada										
	All ages	39	1.30 (1.17-1.45)*	85.9	18	1.23 (1.07-1.43)*	74.5	21	1.36 (1.17-1.58)*	89.3
	Mixed ages	31	1.34 (1.19-1.50)*	86.7	14	1.31 (1.10-1.56)*	78.6	17	1.36 (1.16-1.59)*	89.6
	≥ 65 only	8	1.14 (0.86-1.50)*	76.6	4	1.04 (0.88-1.22)	0.0	4	1.36 (0.68-2.74)*	88.9
Europe										
	All ages	12	1.32 (1.17-1.48)	21.4	12	1.32 (1.17-1.48)	21.4	0		
	Mixed ages	10	1.30 (1.15-1.46)	24.3	10	1.30 (1.15-1.46)	24.3	0		
	≥ 65 only	2	1.94 (1.08-3.49)	0.0	2	1.94 (1.08-3.49)	0.0	0		
Other regions										
	All ages	1	1.09 (0.69-1.71)	0.0	0			1	1.09 (0.69-1.71)	0.0
	Mixed ages	0			0			0		
	≥ 65 only	1	1.09 (0.69-1.71)	0.0	0			1	1.09 (0.69-1.71)	0.0

* Significant heterogeneity (p<.05)

† Based only on hazard ratios from the studies that did not report results separately for men and women

eTable 8. Summary hazard ratios for all-cause mortality relative to normal weight for possibly over-adjusted studies, by BMI category, age and measurement type

BMI category	Baseline age category	Self-reported or measured height and weight			Measured height and weight			Self-reported height and weight		
		Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)	Number of hazard ratios	Summary hazard ratio	I ² (%)
BMI 25-<30										
	All ages	40	0.93 (0.88-0.97)*	81.4	32	0.91 (0.86-0.97)*	80.8	8	0.97 (0.89-1.05)*	84.6
	Mixed ages	26	0.94 (0.89-1.00)*	82.9	22	0.92 (0.86-0.98)*	84.8	4	1.07 (0.98-1.16)	35.6
	≥ 65 only	14	0.89 (0.82-0.97)*	68.3	10	0.88 (0.75-1.02)	48.4	4	0.89 (0.79-1.00)*	87.1
BMI ≥ 30										
	All ages	28	1.10 (1.01-1.21)*	80.9	22	1.08 (0.96-1.21)*	81.7	6	1.15 (1.00-1.34)*	80.7
	Mixed ages	17	1.17 (1.05-1.31)*	82.9	14	1.15 (1.01-1.32)*	84.7	3	1.24 (0.99-1.54)	71.2
	≥ 65 only	11	0.99 (0.86-1.14)*	63.9	8	0.92 (0.78-1.08)	31.8	3	1.10 (0.87-1.38)*	83.0
BMI 30-<35										
	All ages	10	0.82 (0.69-0.96)*	75.6	8	0.72 (0.64-0.81)	22.6	2	1.07 (0.59-1.92)*	93.8
	Mixed ages	8	0.82 (0.65-1.04)*	80.3	7	0.72 (0.64-0.82)	30.5	1	1.46 (1.12-1.91)	0.0
	≥ 65 only	2	0.80 (0.71-0.90)	0.0	1	0.83 (0.49-1.42)	0.0	1	0.80 (0.71-0.90)	0.0
BMI ≥ 35										
	All ages	10	1.02 (0.86-1.21)	48.4	8	0.92 (0.78-1.09)	22.2	2	1.25 (0.80-1.96)	78.5
	Mixed ages	8	1.04 (0.82-1.33)*	59.3	7	0.93 (0.76-1.13)	33.3	1	1.62 (1.12-2.35)	0.0
	≥ 65 only	2	1.01 (0.84-1.22)	0.0	1	0.92 (0.47-1.80)	0.0	1	1.02 (0.84-1.24)	0.0

* Significant heterogeneity (p<.05)

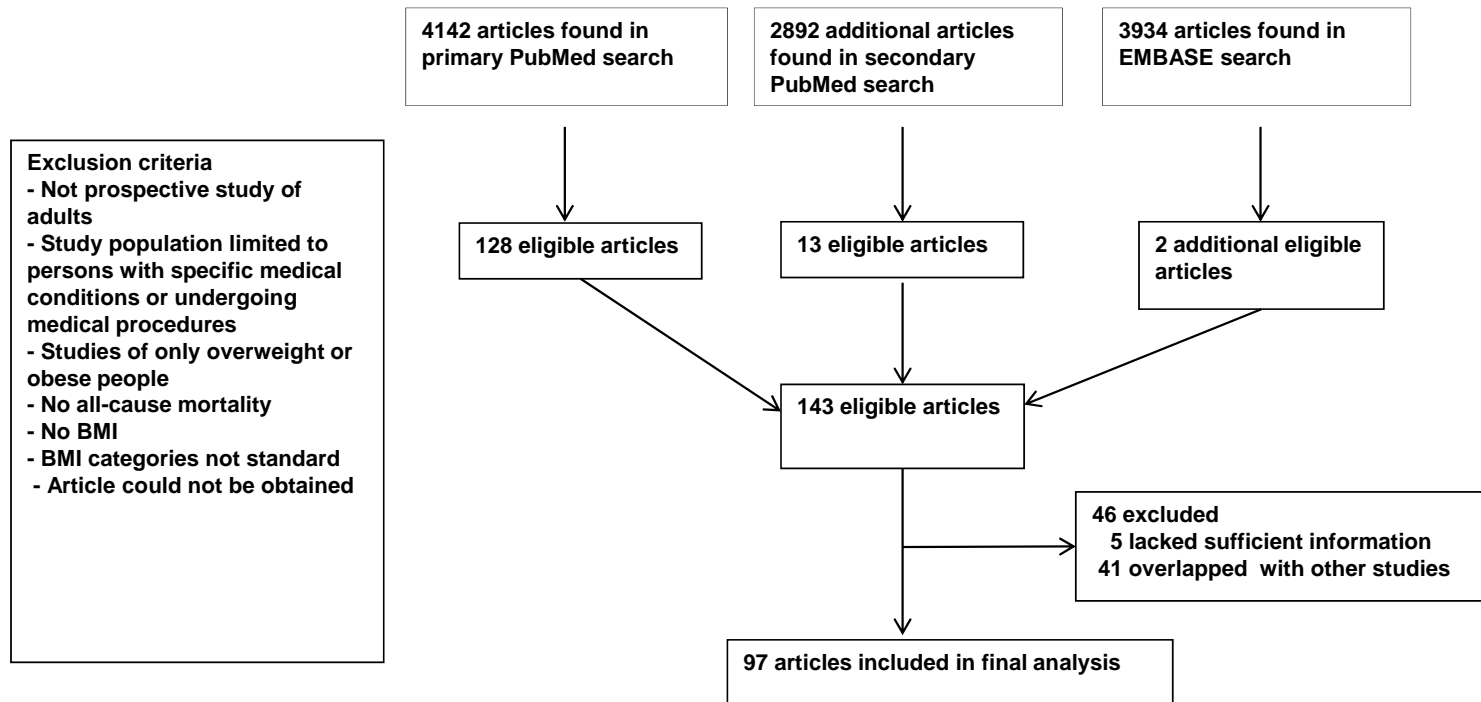
eTable 9. Approximate hazard ratio estimates for overweight and obesity relative to normal weight constructed from selected recent large studies that used finer body mass index categories

Source	Study	Weight and height	Sample size	BMI			
				Men		Women	
				25-<30	>30	25-<30	>30
Jacobs, ⁹ 2010	Cancer Prevention Study II (US)	Self-reported	104 843	0.91	1.10	0.96	1.26
Jee, ¹⁰ 2006	Korean Cancer Prevention Study	Measured	1 213 829	1.03	1.75	1.01	1.18
Klenk, ¹¹ 2009	Vorarlberg Health Monitoring and Promotion Program (Austria)	Measured	184 697	0.95	1.25	1.04	1.32
Pischon, ¹² 2008	European Prospective Investigation into Cancer and Nutrition	Measured	147 857	0.92	1.29	1.01	1.25
Whitlock, ¹³ 2009	Prospective Studies Collaboration (mostly Western Europe and North America)	Primarily measured, some self-reported	894 576	1.06*	1.46*	1.06*	1.45*
Zheng, ¹⁴ 2011	Asia Cohort Consortium BMI Project (East Asians)	Some measured, some self-reported	479 492	0.93†	1.23†	1.01†	1.26†
Zheng, ¹⁴ 2011	Asia Cohort Consortium BMI Project (Indians and Bangladeshis)	Measured	209 596	0.93†	1.17†	0.91†	0.90†

* Reference category is 20-<25.

† Lifelong non-smokers only Reference category is 20.1-25, Overweight is 25.1-30, obesity is 30.1 or above.

eFigure. Study selection flow diagram



eReferences

- (1) Al Snih S, Ottenbacher KJ, Markides KS, Kuo YF, Eschbach K, Goodwin JS. The effect of obesity on disability vs mortality in older Americans. *Arch Intern Med* 2007;167:774-780.
- (2) Arndt V, Rothenbacher D, Zschenderlein B, Schubert S, Brenner H. Body Mass Index and Premature Mortality in Physically Heavily Working Men-A Ten-Year Follow-Up of 20,000 Construction Workers. *J Occup Environ Med* 2007;49:913-921.
- (3) Arnlov J, Ingelsson E, Sundstrom J, Lind L. Impact of body mass index and the metabolic syndrome on the risk of cardiovascular disease and death in middle-aged men. *Circulation* 2010;121:230-236.
- (4) Atlantis E, Browning C, Kendig H. Body mass index and unintentional weight change associated with all-cause mortality in older Australians: the Melbourne Longitudinal Studies on Healthy Ageing (MELSHA). *Age Ageing* 2010;39:643-646.
- (5) Baldinger B, Schwarz C, Jaggy C. Cardiovascular risk factors, BMI and mortality in a cohort of Swiss males (1976-2001) with high-sum-assured life insurance cover. *J Insur Med* 2006;38:44-53.
- (6) Batty GD, Shipley MJ, Jarrett RJ, Breeze E, Marmot MG, Davey Smith G. Obesity and overweight in relation to disease-specific mortality in men with and without existing coronary heart disease in London: the original Whitehall study. *Heart* 2006;92:886-892.
- (7) Belloc R, Jia C, Ye W, Lagerros YT. Effects of physical activity, body mass index, waist-to-hip ratio and waist circumference on total mortality risk in the Swedish National March Cohort. *Eur J Epidemiol* 2010;25:777-788.
- (8) Bessonova L, Marshall SF, Ziogas A et al. The association of body mass index with mortality in the California Teachers Study. *Int J Cancer* 2011;129:2492-2501.
- (9) Bevilacqua MR, Gimeno SG. Abdominal obesity in Japanese-Brazilians: which measure is best for predicting all-cause and cardiovascular mortality? *Cad Saude Publica* 2011;27:1986-1996.
- (10) Blain H, Carriere I, Sourial N et al. Balance and walking speed predict subsequent 8-year mortality independently of current and intermediate events in well-functioning women aged 75 years and older. *J Nutr Health Aging* 2010;14:595-600.

- (11) Boggs DA, Rosenberg L, Cozier YC et al. General and abdominal obesity and risk of death among black women. *N Engl J Med* 2011;365:901-908.
- (12) Cabrera MA, Wajngarten M, Gebara OC, Diament J. [Relationship between body mass index, waist circumference, and waist-to-hip ratio and mortality in elderly women: a 5-year follow-up study]. *Cad Saude Publica* 2005;21:767-775.
- (13) Carlsson S, Andersson T, de Faire U, Lichtenstein P, Michaelsson K, Ahlbom A. Body mass index and mortality: is the association explained by genetic factors? *Epidemiology* 2011;22:98-103.
- (14) Cesari M, Pahor M, Lauretani F et al. Skeletal muscle and mortality results from the InCHIANTI Study. *J Gerontol A Biol Sci Med Sci* 2009;64:377-384.
- (15) Cohen SS, Signorello LB, Cope EL et al. Obesity and all-cause mortality among black adults and white adults. *Am J Epidemiol* 2012;176:431-442.
- (16) Corrada MM, Kawas CH, Mozaffar F, Paganini-Hill A. Association of body mass index and weight change with all-cause mortality in the elderly. *Am J Epidemiol* 2006;163:938-949.
- (17) Crespo CJ, Palmieri MR, Perdomo RP et al. The relationship of physical activity and body weight with all-cause mortality: results from the Puerto Rico Heart Health Program. *Ann Epidemiol* 2002;12:543-552.
- (18) Faeh D, Braun J, Tarnutzer S, Bopp M. Obesity but not overweight is associated with increased mortality risk. *Eur J Epidemiol* 2011;26:647-655.
- (19) Fang X, Tang Z, Xiang M et al. [The relationship between body mass index, hypertension and all-cause mortality in the populaton over 55 year old in Beijing]. *Zhonghua Liu Xing Bing Xue Za Zhi* 2002;23:28-31.
- (20) Farrell SW, Braun L, Barlow CE, Cheng YJ, Blair SN. The relation of body mass index, cardiorespiratory fitness, and all-cause mortality in women. *Obes Res* 2002;10:417-423.
- (21) Ferrie JE, Singh-Manoux A, Kivimaki M et al. Cardiorespiratory risk factors as predictors of 40-year mortality in women and men. *Heart* 2009;95:1250-1257.
- (22) Flegal KM, Graubard BI, Williamson DF, Gail MH. Impact of smoking and preexisting illness on estimates of the fractions of deaths associated with underweight, overweight, and obesity in the US population. *Am J Epidemiol* 2007;166:975-982.
- (23) Flicker L, McCaul KA, Hankey GJ et al. Body mass index and survival in men and women aged 70 to 75. *J Am Geriatr Soc* 2010;58:234-241.

- (24) Fontaine KR, McCubrey R, Mehta T et al. Body mass index and mortality rate among Hispanic adults: a pooled analysis of multiple epidemiologic data sets. *Int J Obes (Lond)* 2012;36:1121-1126.
- (25) Ford J, Spallek M, Dobson A. Self-rated health and a healthy lifestyle are the most important predictors of survival in elderly women. *Age Ageing* 2008;37:194-200.
- (26) Freedman DM, Sigurdson AJ, Rajaraman P, Doody MM, Linet MS, Ron E. The mortality risk of smoking and obesity combined. *Am J Prev Med* 2006;31:355-362.
- (27) Fujino Y. Anthropometry, development history and mortality in the Japan Collaborative Cohort Study for Evaluation of Cancer (JACC). *Asian Pac J Cancer Prev* 2007;8 Suppl:105-112.
- (28) Gale CR, Martyn CN, Cooper C, Sayer AA. Grip strength, body composition, and mortality. *Int J Epidemiol* 2007;36:228-235.
- (29) Gelber RP, Kurth T, Manson JE, Buring JE, Gaziano JM. Body mass index and mortality in men: evaluating the shape of the association. *Int J Obes (Lond)* 2007;31:1240-1247.
- (30) Gray L, Hart CL, Davey Smith GD, Batty GD. What is the predictive value of established risk factors for total and cardiovascular disease mortality when measured before middle age? Pooled analyses of two prospective cohort studies from Scotland. *Eur J Cardiovasc Prev Rehabil* 2010;17:106-112.
- (31) Greenberg JA, Fontaine K, Allison DB. Putative biases in estimating mortality attributable to obesity in the US population. *Int J Obes (Lond)* 2007;31:1449-1455.
- (32) Gu D, He J, Duan X et al. Body weight and mortality among men and women in China. *JAMA* 2006;295:776-783.
- (33) Haapanen-Niemi N, Miilunpalo S, Pasanen M, Vuori I, Oja P, Malmberg J. Body mass index, physical inactivity and low level of physical fitness as determinants of all-cause and cardiovascular disease mortality--16 y follow-up of middle-aged and elderly men and women. *Int J Obes Relat Metab Disord* 2000;24:1465-1474.
- (34) Hanson RL, McCance DR, Jacobsson LT et al. The U-shaped association between body mass index and mortality: relationship with weight gain in a Native American population. *J Clin Epidemiol* 1995;48:903-916.
- (35) Heir T, Erikssen J, Sandvik L. Overweight as predictor of long-term mortality among healthy, middle-aged men: A prospective cohort study. *Prev Med* 2011;52:223-226.

- (36) Hjartaker A, Adami HO, Lund E, Weiderpass E. Body mass index and mortality in a prospectively studied cohort of Scandinavian women: the women's lifestyle and health cohort study. *Eur J Epidemiol* 2005;20:747-754.
- (37) Hotchkiss JW, Leyland AH. The relationship between body size and mortality in the linked Scottish Health Surveys: cross-sectional surveys with follow-up. *Int J Obes (Lond)* 2011;35:838-851.
- (38) Hu G, Tuomilehto J, Silventoinen K, Barengo NC, Peltonen M, Jousilahti P. The effects of physical activity and body mass index on cardiovascular, cancer and all-cause mortality among 47 212 middle-aged Finnish men and women. *Int J Obes (Lond)* 2005;29:894-902.
- (39) Ioachimescu AG, Brennan DM, Hoar BM, Hoogwerf BJ. The lipid accumulation product and all-cause mortality in patients at high cardiovascular risk: a PreCIS database study. *Obesity (Silver Spring)* 2010;18:1836-1844.
- (40) Iribarren C, Jacobs DR, Kiefe CI et al. Causes and demographic, medical, lifestyle and psychosocial predictors of premature mortality: the CARDIA study. *Soc Sci Med* 2005;60:471-482.
- (41) Iversen L, Hannaford PC, Lee AJ, Elliott AM, Fielding S. Impact of lifestyle in middle-aged women on mortality: evidence from the Royal College of General Practitioners' Oral Contraception Study. *Br J Gen Pract* 2010;60:563-569.
- (42) Janssen I. Morbidity and mortality risk associated with an overweight BMI in older men and women. *Obesity (Silver Spring)* 2007;15:1827-1840.
- (43) Janssen I, Bacon E. Effect of Current and Midlife Obesity Status on Mortality Risk in the Elderly. *Obesity (Silver Spring)* 2008;16:2504-2509.
- (44) Jerant A, Franks P. Body mass index, diabetes, hypertension, and short-term mortality: a population-based observational study, 2000-2006. *J Am Board Fam Med* 2012;25:422-431.
- (45) Jonsson S, Hedblad B, Engstrom G, Nilsson P, Berglund G, Janzon L. Influence of obesity on cardiovascular risk. Twenty-three-year follow-up of 22,025 men from an urban Swedish population. *Int J Obes Relat Metab Disord* 2002;26:1046-1053.
- (46) Katzmarzyk PT, Craig CL, Bouchard C. Original article underweight, overweight and obesity: relationships with mortality in the 13-year follow-up of the Canada Fitness Survey. *J Clin Epidemiol* 2001;54:916-920.
- (47) Katzmarzyk PT, Reeder BA, Elliott S et al. Body mass index and risk of cardiovascular disease, cancer and all-cause mortality. *Can J Public Health* 2012;103:147-151.

- (48) Keller HH, Ostbye T. Body Mass Index (BMI), BMI change and mortality in community-dwelling seniors without dementia. *J Nutr Health Aging* 2005;9:316-320.
- (49) Kreuger PM, Rogers RG, Hummer RA, Boardman JD. Body mass index, smoking, and overall and cause-specific mortality among older U.S. adults. *Research on Aging* 2004;26:82-107.
- (50) Lahmann PH, Lissner L, Gullberg B, Berglund G. A prospective study of adiposity and all-cause mortality: the Malmo Diet and Cancer Study. *Obes Res* 2002;10:361-369.
- (51) Lakoski SG, Le AH, Muntner P et al. Adiposity, inflammation, and risk for death in black and white men and women in the United States: the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. *J Clin Endocrinol Metab* 2011;96:1805-1814.
- (52) Lang IA, Llewellyn DJ, Alexander K, Melzer D. Obesity, physical function, and mortality in older adults. *J Am Geriatr Soc* 2008;56:1474-1478.
- (53) Lantz PM, Golberstein E, House JS, Morenoff J. Socioeconomic and behavioral risk factors for mortality in a national 19-year prospective study of U.S. adults. *Soc Sci Med* 2010;70:1558-1566.
- (54) Lawlor DA, Hart CL, Hole DJ, Davey SG. Reverse causality and confounding and the associations of overweight and obesity with mortality. *Obesity (Silver Spring)* 2006;14:2294-2304.
- (55) Leitzmann MF, Moore SC, Koster A et al. Waist circumference as compared with body-mass index in predicting mortality from specific causes. *PLoS ONE* 2011;6:e18582.
- (56) Lisko I, Tiainen K, Stenholm S, Luukkaala T, Hervonen A, Jylha M. Body mass index, waist circumference, and waist-to-hip ratio as predictors of mortality in nonagenarians: the Vitality 90+ Study. *J Gerontol A Biol Sci Med Sci* 2011;66:1244-1250.
- (57) Locher JL, Roth DL, Ritchie CS et al. Body mass index, weight loss, and mortality in community-dwelling older adults. *J Gerontol A Biol Sci Med Sci* 2007;62:1389-1392.
- (58) Lubin F, Lusky A, Chetrit A, Dankner R. Lifestyle and ethnicity play a role in all-cause mortality. *J Nutr* 2003;133:1180-1185.
- (59) Luchsinger JA, Patel B, Tang MX, Schupf N, Mayeux R. Body mass index, dementia, and mortality in the elderly. *J Nutr Health Aging* 2008;12:127-131.

- (60) Ma J, Flanders WD, Ward EM, Jemal A. Body mass index in young adulthood and premature death: analyses of the US National Health Interview Survey linked mortality files. *Am J Epidemiol* 2011;174:934-944.
- (61) Majer IM, Nusselder WJ, Mackenbach JP, Kunst AE. Life expectancy and life expectancy with disability of normal weight, overweight, and obese smokers and nonsmokers in Europe. *Obesity (Silver Spring)* 2011;19:1451-1459.
- (62) McAuley PA, Kokkinos PF, Oliveira RB, Emerson BT, Myers JN. Obesity paradox and cardiorespiratory fitness in 12,417 male veterans aged 40 to 70 years. *Mayo Clin Proc* 2010;85:115-121.
- (63) McTigue K, Larson JC, Valoski A et al. Mortality and cardiac and vascular outcomes in extremely obese women. *JAMA* 2006;296:79-86.
- (64) Mehta NK, Chang VW. Mortality attributable to obesity among middle-aged adults in the United States. *Demography* 2009;46:851-872.
- (65) Miller MD, Crotty M, Giles LC et al. Corrected arm muscle area: an independent predictor of long-term mortality in community-dwelling older adults? *J Am Geriatr Soc* 2002;50:1272-1277.
- (66) Monteverde M, Noronha K, Palloni A, Novak B. Obesity and excess mortality among the elderly in the United States and Mexico. *Demography* 2010;47:79-96.
- (67) Nagai M, Kuriyama S, Kakizaki M et al. Impact of obesity, overweight and underweight on life expectancy and lifetime medical expenditures: the Ohsaki Cohort Study. *BMJ Open* 2012;2.
- (68) Nechuta SJ, Shu XO, Li HL et al. Combined impact of lifestyle-related factors on total and cause-specific mortality among Chinese women: prospective cohort study. *PLoS Med* 2010;7.
- (69) Niedhammer I, Bourgkard E, Chau N. Occupational and behavioural factors in the explanation of social inequalities in premature and total mortality: a 12.5-year follow-up in the Lorhandicap study. *Eur J Epidemiol* 2011;26:1-12.
- (70) Orpana HM, Berthelot JM, Kaplan MS, Feeny DH, McFarland B, Ross NA. BMI and mortality: results from a national longitudinal study of Canadian adults. *Obesity (Silver Spring)* 2010;18:214-218.
- (71) Osler M, Heitmann BL, Hoidrup S, Jorgensen LM, Schroll M. Food intake patterns, self rated health and mortality in Danish men and women. A prospective observational study. *J Epidemiol Community Health* 2001;55:399-403.

- (72) Pednekar MS, Hakama M, Hebert JR, Gupta PC. Association of body mass index with all-cause and cause-specific mortality: findings from a prospective cohort study in Mumbai (Bombay), India. *Int J Epidemiol* 2008;37:524-535.
- (73) Petursson H, Sigurdsson JA, Bengtsson C, Nilsen TI, Getz L. Body configuration as a predictor of mortality: comparison of five anthropometric measures in a 12 year follow-up of the Norwegian HUNT 2 study. *PLoS ONE* 2011;6:e26621.
- (74) Ringback Weitoft G., Eliasson M, Rosen M. Underweight, overweight and obesity as risk factors for mortality and hospitalization. *Scand J Public Health* 2008;36:169-176.
- (75) Seccareccia F, Lanti M, Menotti A, Scanga M. Role of body mass index in the prediction of all cause mortality in over 62,000 men and women. The Italian RIFLE Pooling Project. Risk Factor and Life Expectancy. *J Epidemiol Community Health* 1998;52:20-26.
- (76) Seidell JC, Verschuren WM, van Leer EM, Kromhout D. Overweight, underweight, and mortality. A prospective study of 48,287 men and women. *Arch Intern Med* 1996;156:958-963.
- (77) Simpson JA, MacInnis RJ, Peeters A, Hopper JL, Giles GG, English DR. A comparison of adiposity measures as predictors of all-cause mortality: the Melbourne Collaborative Cohort Study. *Obesity (Silver Spring)* 2007;15:994-1003.
- (78) Sonestedt E, Gullberg B, Ericson U, Wirfalt E, Hedblad B, Orho-Melander M. Association between fat intake, physical activity and mortality depending on genetic variation in FTO. *Int J Obes (Lond)* 2011;35:1041-1049.
- (79) Stessman J, Jacobs JM, Ein-Mor E, Bursztyn M. Normal Body Mass Index Rather than Obesity Predicts Greater Mortality in Elderly People: The Jerusalem Longitudinal Study. *J Am Geriatr Soc* 2009.
- (80) Stevens J, Cai J, Juhaeri, Thun MJ, Wood JL. Evaluation of WHO and NHANES II standards for overweight using mortality rates. *J Am Diet Assoc* 2000;100:825-827.
- (81) Strawbridge WJ, Wallhagen MI, Shema SJ. New NHLBI clinical guidelines for obesity and overweight: will they promote health? *Am J Public Health* 2000;90:340-343.
- (82) Suadicani P, Hein HO, von Eyben FE, Gyntelberg F. Metabolic and lifestyle predictors of ischemic heart disease and all-cause mortality among normal weight, overweight, and obese men: a 16-year follow-up in the Copenhagen Male Study. *Metab Syndr Relat Disord* 2009;7:97-104.

- (83) Sui X, LaMonte MJ, Laditka JN et al. Cardiorespiratory fitness and adiposity as mortality predictors in older adults. *JAMA* 2007;298:2507-2516.
- (84) Takata Y, Ansai T, Soh I et al. Association between body mass index and mortality in an 80-year-old population. *J Am Geriatr Soc* 2007;55:913-917.
- (85) Taylor DH, Jr., Ostbye T. The effect of middle- and old-age body mass index on short-term mortality in older people. *J Am Geriatr Soc* 2001;49:1319-1326.
- (86) Tice JA, Kanaya A, Hue T et al. Risk factors for mortality in middle-aged women. *Arch Intern Med* 2006;166:2469-2477.
- (87) Tsai SP, Donnelly RP, Wendt JK. Obesity and mortality in a prospective study of a middle-aged industrial population. *J Occup Environ Med* 2006;48:22-27.
- (88) Tsai SP, Wen CP, Chan HT, Chiang PH, Tsai MK, Cheng TY. The effects of pre-disease risk factors within metabolic syndrome on all-cause and cardiovascular disease mortality. *Diabetes Res Clin Pract* 2008;82:148-156.
- (89) Uretsky S, Supariwala A, Singh P et al. Impact of weight on long-term survival among patients without known coronary artery disease and a normal stress SPECT MPI. *J Nucl Cardiol* 2010;17:390-397.
- (90) van Dam RM, Li T, Spiegelman D, Franco OH, Hu FB. Combined impact of lifestyle factors on mortality: prospective cohort study in US women. *BMJ* 2008;337:a1440.
- (91) Visscher TL, Seidell JC, Menotti A et al. Underweight and overweight in relation to mortality among men aged 40-59 and 50-69 years: the Seven Countries Study. *Am J Epidemiol* 2000;151:660-666.
- (92) Visscher TL, Rissanen A, Seidell JC et al. Obesity and unhealthy life-years in adult Finns: an empirical approach. *Arch Intern Med* 2004;164:1413-1420.
- (93) Walter S, Kunst A, Mackenbach J, Hofman A, Tiemeier H. Mortality and disability: the effect of overweight and obesity. *Int J Obes (Lond)* 2009;33:1410-1418.
- (94) Wandell PE, Carlsson AC, Theobald H. The association between BMI value and long-term mortality. *Int J Obes (Lond)* 2009;33:577-582.
- (95) Wannamethee SG, Shaper AG, Lennon L, Whincup PH. Decreased muscle mass and increased central adiposity are independently related to mortality in older men. *Am J Clin Nutr* 2007;86:1339-1346.
- (96) Yates LB, Djousse L, Kurth T, Buring JE, Gaziano JM. Exceptional longevity in men: modifiable factors associated with survival and function to age 90 years. *Arch Intern Med* 2008;168:284-290.

- (97) Zunzunegui MV, Sanchez MT, Garcia A, Casado JM, Otero A. Body mass index and long-term mortality in an elderly Mediterranean population. *J Aging Health* 2012;24:29-47.