



Body mass index and all-cause mortality: A systematic review and nonlinear dose-response meta-analysis of 230 prospective studies with 3.74 million deaths among 30.3 million participants

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Body mass index and all-cause mortality: A systematic review
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participants

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Abstract

OBJECTIVE

To conduct a systematic review and meta-analysis of cohort studies of body mass index (BMI) and the risk of all-cause mortality, and to clarify the shape and the nadir of the dose-response curve, and the influence of confounding from smoking, disease-associated weight loss and preclinical disease on the results.

DATA SOURCES

PubMed and Embase databases were searched up to September 23rd 2015.

STUDY SELECTION

Prospective studies that reported adjusted risk estimates for ≥ 3 categories of BMI in relation to all-cause mortality were included.

DATA SYNTHESIS

Summary relative risks (RRs) were calculated using random effects models. Nonlinear associations were explored using fractional polynomial models.

RESULTS

A total of 230 cohort studies (207 publications) were included. Fifty-three cohort studies (44 risk estimates) with >738,144 deaths and >9,976,077 participants were included in the analysis of never smokers and 228 cohort studies (198 risk estimates) with >3,744,722 deaths among 30,233,329 participants were included in the analysis of all participants. The summary RR for a 5 unit increment in BMI was 1.18 (95% confidence interval: 1.15 to 1.21, $I^2=95.4\%$, $n=44$) among never smokers, 1.21 (95% CI: 1.18 to 1.25, $I^2=92.8\%$, $n=25$) among healthy never smokers, 1.27 (95% CI: 1.21 to 1.33, $I^2=88.9\%$, $n=11$) among healthy never smokers with exclusion of early follow-up, and 1.05 (95% CI: 1.04 to 1.07, $I^2=97.1\%$, $n=198$) among all participants. There was a J-shaped dose-response relationship in never smokers ($p_{\text{nonlinearity}} < 0.0001$), and the lowest risk was observed at a BMI of 23-24 in never smokers, at a BMI of 22-23 in healthy never smokers, and at a BMI of 20-22 in studies of never smokers with ≥ 20 years follow-up. In contrast there was a U-shaped association between BMI and mortality in analyses with a greater potential for bias including all participants, current, former or ever smokers, and in studies with a short duration of follow-up (<5 years or <10 years), or with moderate study quality scores.

CONCLUSION

Overweight and obesity is associated with increased risk of all-cause mortality and the nadir of the curve was observed with a BMI of 23-24 among never smokers, 22-23 among healthy never smokers, and 20-22 with longer durations of follow-up. The increased mortality risk observed in underweight subjects may at least partly be due to residual confounding from pre-diagnostic disease. Lack of exclusion of ever smokers, persons with prevalent and pre-clinical disease and early follow-up may bias the results towards a more U-shaped association.

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Key words: Body mass index, mortality, systematic review, meta-analysis, cohort studies.

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What is already known on this topic

A high BMI is associated with increased risk of all-cause mortality, however, a recent meta-analysis found a reduced risk with overweight and that only obesity grade 2 (BMI ≥ 35) increased mortality risk, but the results may have been confounded by smoking, prevalent and pre-clinical disease, and been biased because of exclusion of many large cohort studies.

What this study adds

In never smokers and healthy never smokers, there was a J-shaped association between BMI and mortality and the lowest risk was observed at a BMI of 23-24 and 22-23, respectively, but when restricting the analysis to studies with a longer duration of follow-up (to reduce confounding by pre-diagnostic weight loss) the lowest risk was observed with a BMI of 20-22.

Lack of exclusion of ever smokers, persons with prevalent and pre-clinical disease or early follow-up may bias the associations between BMI and mortality towards a more U-shaped association

Introduction

The prevalence of overweight and obesity has increased rapidly over the last decades in all areas of the world.[1] This has raised serious public health concerns due to the association between overweight and obesity and increased risk of a wide range of chronic diseases, including cardiovascular diseases,[2] type 2 diabetes,[3] several types of cancer,[4-8] gallbladder disease,[9] gout,[10] osteoarthritis,[11], and several other conditions,[12, 13] as well as all-cause mortality.[2, 14]

A large number of studies have shown increased risk of all-cause mortality with greater adiposity as measured by body mass index (kg/m²),[15-24] however, questions remain about the shape of the dose-response relationship between BMI and all-cause mortality. Several large-scale prospective studies [15-24] and pooled analyses (each with 900,000 to 1.46 million participants)[2, 14, 25] have reported increased risk of all-cause mortality with greater BMI, and most of these found the lowest risk among participants with BMI in the range of 20 or 22.5 to 24.9. However, a recent large meta-analysis of 97 cohort studies with 2.88 million participants and 270 000 deaths which used the WHO cut-off points for overweight and obesity found summary hazard ratios of 0.94 (95% CI: 0.90-0.97), 0.97 (95% CI: 0.90-1.04), and 1.34 (95% CI: 1.21-1.47) for a BMI of 25-<30, 30-<35, and ≥35, respectively, suggesting a protective effect of overweight on mortality and that only severely obese persons are at increased risk of mortality.[26] However, that review had a number of limitations, for example: several very large and some smaller studies including >5.4 million participants and >1.1 million deaths that used more refined categorizations of BMI than the WHO categorizations were excluded.[15, 16, 18-20, 24, 27-54] Thus a larger number of deaths and participants were excluded than included in the analysis and questions have been raised with regard to the validity of the findings.[55] In addition, a large number of additional

cohorts were either missed by the search or excluded from the analysis,[56-65] and at least 53 additional studies have since been published including >2.3 million deaths and >21.6 million participants,[23, 24, 65-115] thus an updated analysis is warranted. It is well known that smoking strongly increases risk of mortality and many specific causes of death,[116, 117] and there is therefore a great potential for residual confounding by smoking as smoking typically also is associated with lower weight.[118] Indeed, a large number of studies have reported a very different shape of the dose-response relationship between BMI and mortality when restricting the analysis to never smokers or when comparing smokers and never smokers,[2, 14-22, 24, 77] but this was not adequately addressed in the previous meta-analysis.[26] Further, confounding by prevalent or undiagnosed illness may also have biased the results. It is well known that many chronic diseases (which increase the risk of death) lead to weight loss.[119] Weight loss may precede the diagnosis of disease by many years and because of such preclinical weight loss associations between low BMI and increased mortality may at least partly be due to confounding by preclinical disease.[120] Such bias can at least partly be avoided by excluding subjects with prevalent disease at baseline, by excluding the early follow-up of the studies and by stratifying studies by duration of follow-up, but the most recent meta-analysis did not conduct such subgroup or sensitivity analyses.[26] For these reasons we conducted a systematic review and dose-response meta-analysis of published cohort studies to clarify the strength and the shape of the dose-response relationship between BMI and all-cause mortality, the potential confounding effects of smoking, and whether prevalent disease, exclusion of early follow-up, or stratification by duration of follow-up, or the quality of the studies influenced the association between BMI and all-cause mortality. We used fractional polynomial models to assess the association between BMI and mortality and this allowed for inclusion of all relevant studies reporting results for 3 or more categories of BMI, and not only those reporting results using the WHO criteria for categorization of BMI.

Methods

Search strategy and inclusion criteria

We searched the PubMed and Embase database up to 23rd of September 2015 for eligible studies (DA, AS). We used wide search terms for the searches which are described in detail in the Supplementary Text. We followed standard criteria for conducting and reporting meta-analyses [121]. In addition, we searched the reference lists of a previous meta-analysis [26] for further studies. Study quality was assessed using the Newcastle-Ottawa scale.[122]

Patient involvement

No patients were involved in setting the research question or the outcome measures, nor were they involved in developing plans for design, or implementation of the study. No patients were asked to advise on interpretation or writing up of results. There are no plans to disseminate the results of the research to study participants or the relevant patient community.

Study selection

Cohort studies of the association between BMI and risk of all-cause mortality published in English language were included. Abstract only publications and grey literature was not included. Relative risk estimates (hazard ratios or risk ratios) for three or more BMI categories had to be available with the 95% confidence intervals (CIs) or the information to calculate the CIs in the publication and for the dose-response analysis, a quantitative measure of the exposure (BMI) had to be available in the publication. Studies from free-living

populations were included, while studies including only patients (e.g. diabetes, stroke, heart disease, and cancer), nursing home residents, and disabled subjects were excluded. When multiple publications were published from the same study we used in general the publication with the largest number of deaths, however, exceptions to this rule were made when publications with smaller number of deaths provided more detailed analyses with restriction to never smokers, healthy subjects and/or exclusion of early follow-up than the publications with larger number of deaths. In the analysis of never smokers, the definition of never smokers was strict so data from studies combining never smokers and former smokers who had quit for a long duration were not included in the analysis of never smokers. When more detailed analyses (restricted to never smokers or other subgroups) were published in an overlapping publication, but not in the publication used for the main analysis we used the information from the overlapping publication in the specific analysis, but each study was only included once in each analysis. Studies that only reported a continuous linear risk estimate were excluded as there is evidence that the association between BMI and mortality is nonlinear. A list of the excluded studies and exclusion reasons are provided in Supplementary Table 1.

Data extraction

We extracted the following data from each study: The first author's last name, publication year, country or region where the study was conducted, study period, sample size, number of deaths/participants, whether exclusions were made for prevalent disease, whether exclusions were made for early follow-up, BMI and any subgroup, exposure level, relative risks and 95% confidence intervals for categories of BMI, and variables adjusted for in the analysis. Data extractions were done by one author (DA) and checked by another author (MP)

for accuracy. For one study [16] we contacted the authors for clarification of which studies were included in the analysis.

Statistical methods

We calculated summary RRs and 95% CIs for a 5 unit increment in BMI by using a random effects model.[123] For the primary analysis we used the model from each study that had the greatest degree of control for potential confounding, with the exception of studies that also adjusted mutually between BMI and waist circumference and waist-to-hip ratio or which adjusted for potentially intermediate variables such as diabetes, hypertension, and serum cholesterol, for which we used the multivariate model without such adjustment if available. If the alternative model was only age-adjusted and the multivariate model included other confounders as well, the multivariate model with intermediates was chosen. The average of the natural logarithm of the RRs was estimated and the RR from each study was weighted according to the method of DerSimonian and Laird.[123] A two-tailed $p<0.05$ was considered statistically significant. If studies reported results separately for men and women or other subgroups we combined the subgroup-specific estimates using a fixed-effects model to generate an estimate for both subgroups combined so that each study was only represented once in the analyses.

The method described by Greenland and Longnecker[124] was used for the linear dose-response analysis of BMI and mortality and we calculated study-specific slopes (linear trends) and 95% CIs from the natural logs of the reported RRs and CIs across categories of BMI. When the reference category was not the lowest category (e.g. due to power issues) we excluded the categories below the reference category for the linear dose-response analysis to model the association between higher BMI and mortality. The mean or median BMI level in

each category was assigned to the corresponding relative risk for each study and for studies that reported the exposures in ranges we used the midpoint of the upper and the lower cut-off point. When upper and lower categories were open-ended or had extreme upper or lower values we used the width of the adjacent category to calculate an upper or lower bound. When studies reported analyses by the WHO categories of overweight and obesity we used a BMI of 15 as a lower bound for the underweight category (<18.5) and 18.5 as the lower bound for the normal weight category (<25). A potential nonlinear dose-response relationship between BMI in relation to total mortality was examined by using fractional polynomial models.[125] We determined the best fitting second order fractional polynomial regression model, defined as the one with the lowest deviance. A likelihood ratio test was used to assess the difference between the nonlinear and linear models to test for nonlinearity.[125] For the nonlinear dose-response analysis all categories of BMI were included (even the underweight categories) to model the association between BMI and mortality across the full BMI range and the method by Hamling et al was used to convert risk estimates when the lowest category was not the reference category,[126] but the analyses were re-scaled so the reference category was a BMI of 23, which appeared to be the nadir of the curve among never smokers, so there was no loss of statistical power due to these re-calculations. The fractional polynomial method estimated a dose-response curve for each study across the BMI values observed in the whole dataset (which was extrapolated to across the full BMI range for studies with a limited BMI range), so all studies contributed to the pooled risk estimates across the full BMI range. The dose-response curves for each of the individual studies were then pooled into an overall dose-response curve which are the curves showed in the nonlinear figures. The relative risk estimates in the tables were based on the nonlinear figures, but show risk estimates for selected BMI values.

Subgroup and meta-regression analyses were conducted to investigate potential sources of heterogeneity and heterogeneity between studies was quantitatively assessed by the Q test and I^2 . [127] Small study effects, such as publication bias, were assessed by inspecting the funnel plots for asymmetry and with Egger's test [128] and Begg's test [129] with the results considered to indicate small study effects when $p < 0.10$. To avoid potential confounding by smoking we present results on BMI and mortality in never smokers as the primary analysis, and conducted further restrictions to healthy never smokers, and healthy never smokers with exclusion of the early follow-up in supplementary analyses (here and throughout the manuscript healthy never smokers refers to never smokers who were healthy at baseline). We also report results among all participants (not excluding smokers) for comparison with the most recent meta-analysis, [26] and in smokers in secondary analyses. Further subgroup analyses were also conducted by gender, method of assessment of weight and height, duration of follow-up, geographic location, number of deaths, study quality and adjustment for confounders, adjustment for mediators, and restricted to studies with appropriate adjustment for age, smoking, alcohol, and physical activity, but without adjustment for prevalent disease or intermediate factors. Because we did not have access to the original data and because not every study excluded early follow-up we also conducted analyses stratified by duration of follow-up to investigate the influence of undiagnosed disease on the results. As the number of deaths increases with increasing duration of follow-up, the early follow-up (when participants with undiagnosed disease most likely would have died) will account for a smaller and smaller proportion of the total deaths the longer the duration of follow-up is. Since pre-clinical weight loss can precede the diagnosis of disease by many years stratification by duration of follow-up can allow for assessments of the longer-term impact of confounding by undiagnosed disease. Stata, version 12.0 (Stata Corp, College Station, TX, USA) was used for the statistical analyses.

Results

From a total of 112,173 records identified by the search 207 publications[16-24, 27-54, 56-115, 130-239] with 230 prospective studies including >3,748,549 deaths among 30,361,918 participants were included in the meta-analysis of BMI and all-cause mortality risk (Supplementary Table 2, Figure 1). Table 1 summarizes the main characteristics (number of studies, cases, and participants, geographic location, study size, and mean or median duration of follow-up) of the studies included in the analysis of never smokers and among all participants. Some publications reported on or included data from more than one study (which were analyzed as one combined dataset); one publication included data from 9 studies,[138] and another publication included 8 cohort studies which were combined in one analysis,[16] one publication reported results from 6 studies which were combined,[95] five publications reported results from 3 studies which were combined,[74, 140, 142, 150, 178] four publications reported results from two studies,[163, 170, 189, 191] which were included in the analysis. Four publications reported on men and women separately from the same two studies.[30, 31, 131, 132] Two duplicate publications were only included in subgroup analyses by sex[229, 235] as the main article only provided results for both sexes combined,[140] or because the duplicate publication had a longer follow-up,[235] however, it was not used for the main analysis as it only reported on women, while the main publication reported on both men and women,[166] and one publication was only included in the analysis of African Americans [237] as the main publication reported results from the full population.[17]

Ninety six studies were from Europe, 71 studies were from the North America, 3 studies were from Latin- or South-America, 49 studies were from Asia, 10 studies were from Australia and New Zealand and 1 study was from the Pacific region (Supplementary Table 2).

Of the 198 risk estimates included in the nonlinear dose-response analysis of BMI and all-cause mortality among all participants 38 (19.2%) had 3 categories of BMI, 61 (30.8%) had 4 categories, 47 (23.7%) had 5 categories, 17 (8.6%) had 6 categories, 15 (7.6%) had 7 categories, 4 (2%) had 8 categories, 10 (5.1%) had 9 categories, and 6 (3%) had 10 or more categories. Of the 44 risk estimates included in the nonlinear dose-response analysis of BMI and all-cause mortality among never smokers 5 (11.4%) had 3 categories of BMI, 5 had 4 categories (11.4%), 13 (29.6%) had 5 categories, 4 (9%) had 6 categories, 3 (6.8%) had 7 categories, 4 (9%) had 8 categories, 5 (11.4%) had 9 categories, and 5 (11.4%) had 10 or more categories.

Body mass index and mortality among never smokers and healthy never smokers

Fifty three prospective studies (43 publications, 44 risk estimates) [16-22, 24, 27, 30, 31, 33, 36, 38, 48, 49, 51, 62, 77, 94, 96, 107, 131, 132, 140, 159, 166, 178-180, 183, 185, 187, 188, 201, 221, 228, 230, 231, 234, 236, 238, 239] with >738,144 deaths and >9,976,077 participants were included in the analysis of never smokers. The summary RR for a 5 unit increase in BMI was 1.18 (95% CI: 1.15 to 1.21, $I^2=95.4\%$, $p_{\text{heterogeneity}} < 0.0001$) (Supplementary Figure 1). There was no evidence of publication bias with Egger's test, $p=0.67$ or with Begg's test, $p=0.66$ (Supplementary Figure 2). There was evidence of nonlinearity, $p_{\text{nonlinearity}} < 0.0001$, and there was a J-shaped association between BMI and mortality in never smokers with the lowest mortality observed with a BMI of 23 to 24 (Figure 2a). Relative risk estimates from the nonlinear dose-response analysis are provided in Table 2 for selected BMI values and these are derived from the nonlinear figures. The association was similar in men and in women (Supplementary Table 3, Supplementary Table 4). In an analysis of 5 studies of African American never smokers,[22, 24, 94, 96, 237] the summary RR was

1.13 (95% CI: 1.10 to 1.17) for a 5 unit increase in BMI (Supplementary Figure 3), and there was evidence of a J-shaped association, $p_{\text{nonlinearity}} < 0.0001$ (Supplementary Figure 4).

Twenty six prospective studies (25 publications, 25 risk estimates) [18-22, 24, 27, 30, 38, 48, 51, 77, 94, 131, 132, 140, 159, 178, 180, 183, 185, 188, 228, 236, 238] with >74,464 deaths among 727,687 participants were included in the analysis of healthy never smokers (which in general excluded persons with prevalent cancer, cardiovascular disease, and in some cases diabetes, and/or persons with recent weight loss). The summary RR for a 5 unit increment in BMI was 1.21 (95% CI: 1.18 to 1.25, $I^2=92.8\%$, $p_{\text{heterogeneity}} < 0.0001$) (Supplementary Figure 5, Table 2). There was evidence of nonlinearity, $p_{\text{nonlinearity}} < 0.0001$, and there was a J-shaped association between BMI and mortality in healthy never smokers with the lowest mortality observed with a BMI of 22 to 23 (Figure 2b). Further restricting the analysis to 11 studies [18, 19, 21, 24, 27, 30, 51, 185, 228, 229, 238] among healthy never smokers (88,860 deaths, 1,192,443 participants) which also excluded early follow-up (from first year up to 6 years of follow-up) gave a summary RR of 1.27 (95% CI: 1.21 to 1.33, $I^2=88.9\%$, $p_{\text{heterogeneity}} < 0.0001$) (Supplementary Figure 6).

Body mass index and all-cause mortality (all participants)

Two-hundred and twenty eight prospective studies (191 publications, 198 risk estimates)[16-24, 27-29, 32-54, 56-76, 78-115, 130-227] were included in the analysis of BMI and all-cause mortality risk and included a total of >3,744,722 deaths among 30,233,329 participants. The summary RR for a 5 unit increase in BMI was 1.05 (95% CI: 1.04 to 1.07, $I^2=97.1\%$, $p_{\text{heterogeneity}} < 0.0001$) (Supplementary Figure 7). There was indication of publication bias with Egger's test, $p=0.002$, but not with Begg's test, $p=0.82$, however, the funnel plot indicated missing positive studies (Supplementary Figure 8).

There was strong evidence of nonlinearity, $p_{\text{nonlinearity}} < 0.0001$, with a U-shaped dose-response curve and the lowest mortality was observed with a BMI of 25 (Figure 2c, Table 2).

Body mass index and mortality, current, former and ever smokers

Twenty-two studies (21 publications)[17, 20, 22, 27, 33, 38, 49, 51, 77, 107, 131, 132, 149, 159, 166, 180, 183, 188, 230, 231, 233] (>270,620 deaths, 3,911,812 participants), seventeen studies (18 publications)[17, 20, 22, 27, 38, 49, 51, 77, 131, 132, 149, 159, 180, 183, 230, 231] (>126,786 deaths, >1,523,435 participants), and twenty four studies (25 publications)[17-20, 22, 27, 33, 36, 38, 49, 51, 77, 94, 107, 131, 132, 159, 180, 183, 201, 221, 230-232, 239] (>696134 deaths, 6,616140 participants) studies were included in the analyses of current, former and ever smokers, respectively. There was strong evidence of nonlinearity in all analyses, $p_{\text{nonlinearity}} < 0.0001$ for all, and there was a U-shaped curve for the association between BMI and mortality among current, former and ever smokers (Figure 2d-f, Table 2).

Subgroup and sensitivity analyses

In the analysis of never smokers there was indication of heterogeneity ($p=0.02$) when studies were stratified by median or mean duration of follow-up (Supplementary Table 3), and the summary RRs for a 5 unit increment in BMI was 1.21 (95% CI: 1.14 to 1.28, $n=1$), 1.11 (95% CI: 0.94 to 1.30, $n=11$), 1.18 (95% CI: 1.14 to 1.22, $n=18$), 1.24 (95% CI: 1.09 to 1.40, $n=4$), 1.30 (95% CI: 1.19 to 1.42, $n=2$), and 1.25 (95% CI: 1.20 to 1.30, $n=7$) for <5, 5-<10, 10-<15, 15-<20, 20-<25 and ≥ 25 years of follow-up, respectively. In the nonlinear dose-response analysis restricted to studies with ≥ 20 or ≥ 25 years of follow-up, there was no increased risk at the low BMI range down to a BMI of 20, while risk increased slightly even

within the high normal range (BMI of 24-<25), but was more pronounced in the overweight, obese and severely obese BMI ranges (Supplementary Table 5, Figure 3a-d). In the analysis of all participants there was also significant heterogeneity ($p<0.0001$) when studies were stratified by median or mean duration of follow-up (Supplementary Table 6), and the summary RRs for a 5 unit increment in BMI were 0.90 (95% CI: 0.83 to 0.97, $n=15$), 1.00 (95% CI: 0.96 to 1.04, $n=53$), 1.07 (95% CI: 1.05 to 1.08, $n=66$), 1.09 (95% CI: 1.05 to 1.13, $n=27$), 1.12 (95% CI: 1.08 to 1.17, $n=15$), and 1.15 (95% CI: 1.11 to 1.19, $n=22$) for <5, 5-<10, 10-<15, 15-<20, 20-<25 and ≥ 25 years of follow-up, respectively. In the nonlinear dose-response analysis, the shape of the dose-response curve changed gradually from a U-shape to a J-shape with increasing durations of follow-up (Supplementary Table 7, Figure 4a-f).

There was no heterogeneity in the analyses among never smokers when stratified by sex, and although there was heterogeneity when analyses of all participants were stratified by sex, this appeared to be due to no association among the studies of men and women combined, and when restricted to studies in either men or women there was no heterogeneity (Supplementary Table 3, 4, and 6, Supplementary Figure 9a-f). Although there was evidence of heterogeneity by geographic location in the linear dose-response analysis of all participants ($p=0.04$), with a significant positive association observed only for Europe and North America (Supplementary Table 6), there was no heterogeneity by geographic location in never smokers ($p=0.91$) and positive associations were observed in European, North American, Australian and Asian studies (Supplementary Table 3), although slight variations in the risk estimates were observed in the nonlinear dose-response analysis (Supplementary Table 8, Supplementary Figure 10). There was evidence of heterogeneity between studies when stratified by study quality scores in the analysis of all participants, $p_{\text{heterogeneity}}=0.03$, with a significant association among studies with high study quality scores, but not among the studies with medium study quality scores (Supplementary Table 6). The nonlinearity was also

more pronounced among the studies with medium study quality compared to the studies of high study quality (Supplementary Table 9, Supplementary Figure 11, 12). However, there was no heterogeneity by study quality scores in the subgroup analyses of never smokers (Supplementary Table 6, Supplementary Figure 13, 14). There was evidence of heterogeneity when studies were stratified by the number of deaths in the analysis of all participants, $p_{\text{heterogeneity}} < 0.0001$, with a stronger association among studies with a larger number of deaths compared to studies with a smaller number of deaths (Supplementary Table 6), but this was not observed in never smokers (Supplementary Table 3).

The positive association between BMI and all-cause mortality among never smokers persisted in subgroup analyses defined by sex, assessment of anthropometric measures, geographic location, number of deaths and adjustment for confounding factors including age, education, alcohol, physical activity, height, dietary pattern, intake of fat and fruit and vegetables, and there was little evidence of heterogeneity between any of these subgroups with meta-regression analyses (Supplementary Table 3). No association was observed among the few studies which adjusted for potential intermediate factors (diabetes, hypertension, cholesterol). In general, heterogeneity was very high in most of the subgroup analyses.

In the analysis of all participants there was no evidence of heterogeneity when studies were stratified by adjustment for age, education, socio-economic status, alcohol, smoking status, pack-years, years since quitting, physical activity, height, dietary pattern, fat intake, or fruit and vegetable intake. There was heterogeneity among studies when stratified by adjustment for number of cigarettes smoked per day, $p_{\text{heterogeneity}} < 0.0001$, with a stronger association among studies with such adjustment compared to studies without such adjustment (Supplementary Table 6). There was also indication of a stronger association among studies with adjustment for years since quitting compared to studies without such adjustment, however, the test for heterogeneity between subgroups was not significant.

When studies were stratified by potential intermediates, there was heterogeneity by whether studies adjusted for diabetes, with no association among studies with such adjustment (Supplementary Table 6). Although the test for heterogeneity was not significant, there was also no association among studies with adjustment for systolic blood pressure and hypertension. There was also heterogeneity by adjustment for prevalent coronary heart disease, $p_{\text{heterogeneity}}=0.003$, stroke, $p_{\text{heterogeneity}}=0.07$, and prevalent cancer, $p_{\text{heterogeneity}}=0.03$, with no association among studies with such adjustment (Supplementary Table 6). Although the test for heterogeneity between subgroups was not significant, the association between BMI and mortality was stronger among studies which had adjusted for the most important confounding factors (age, smoking, alcohol, physical activity), but which did not adjust for intermediate factors or prevalent disease, and these associations were further strengthened among studies with longer duration of follow-up (Supplementary Table 3, 6).

In a further subgroup analysis among never smokers the association between BMI and all-cause mortality was considerably stronger among subjects <65 years age, summary $RRs=1.27$ (95% CI: 1.22-1.34, $I^2=91.2\%$, $p_{\text{heterogeneity}}<0.0001$, $n=14$) than among subjects aged ≥ 65 years, summary $RRs=1.04$ (95% CI: 1.01-1.07, $I^2=71.5\%$, $p_{\text{heterogeneity}}=0.004$, $n=6$) with significant heterogeneity between subgroups, $p_{\text{heterogeneity}}<0.0001$ (Supplementary Figure 15). The association was also considerably stronger among younger subjects in the nonlinear dose-response analysis (Supplementary Figure 16 and 17, Supplementary Table 10).

In sensitivity analyses excluding one study at a time there was minimal variation in the summary RR for never smokers (Supplementary Table 11) and all participants (Supplementary Table 12). In a further sensitivity analysis excluding studies where the BMI in the reference category was below 18.5 or 20.0 gave summary RRs of 1.19 (95% CI: 1.17-1.22, $I^2=92\%$, $p_{\text{heterogeneity}}<0.0001$, $n=43$) and 1.19 (95% CI: 1.16-1.22, $I^2=92\%$, $p_{\text{heterogeneity}}<0.0001$, $n=41$), respectively, per 5 BMI units among never smokers, and 1.07

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(95% CI: 1.06-1.08, $I^2=96\%$, $p_{\text{heterogeneity}} < 0.0001$, $n=178$) and 1.07 (95% CI: 1.06-1.08, $I^2=96\%$, $p_{\text{heterogeneity}} < 0.0001$, $n=172$), respectively, among all participants.

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Discussion

This meta-analysis of 230 prospective studies with >3.74 million deaths among >30.3 million participants provide further evidence that adiposity as measured by BMI increases the risk of premature mortality. Some increase in risk is also observed in the underweight subjects, but this may at least partly be a non-causal association. In the analysis of all participants the lowest mortality was observed with a BMI of around 25, however, the lowest mortality was observed in the BMI range 23-24 among never smokers, in the BMI range 22-23 among healthy never smokers, and in the BMI range 20-22 among studies of never smokers with longer durations of follow-up (≥ 20 and ≥ 25 years).

The analysis of all participants needs to be interpreted carefully as there is a greater possibility of confounding by smoking and confounding due to pre-diagnostic disease-associated weight loss, and some studies may have over-adjusted the analysis by including some intermediate factors such as diabetes, blood pressure, hypertension, and serum cholesterol or prevalent disease in the multivariate models. In addition, there was heterogeneity by study quality scores with more evidence of a U-shaped association among moderate-quality than among high-quality studies. There was some evidence of small study bias, such as publication bias, in the analysis of all participants, although this was not observed in the analysis of never smokers. However, if anything the funnel plot indicated missing positive studies, suggesting a possible underestimation of the association in the analysis of all participants.

The shape of the dose-response curve differed greatly when including all subjects (no exclusions), and when restricting the analysis to never smokers and healthy never smokers as there was more of a U-shaped dose-response relationship in the analysis of all participants and a J-shaped dose-response relationship among never smokers. This is consistent with a pooled

analysis from the National Cancer Institute (NCI) Cohort Consortium[14], and partly consistent with the results of the Prospective Studies Collaboration,[2] in which the increased risk in participants with a BMI below 20 was much more pronounced in current smokers than in never smokers. In this analysis of all subjects, former, current and ever smokers there was a slight inverse association towards the overweight range compared to a BMI of 23 and weaker relative risks in the overweight and obese range than among never smokers. The relative risks were also more similar to that observed in the meta-analysis by Flegal et al [26] in the unrestricted analysis, in studies with a shorter duration of follow-up, and among smokers, subgroups that may be particularly prone to confounding by smoking and confounding due to existing illness. When we restricted the analysis to never smokers there was evidence of increased mortality in the overweight range with more substantial increases in risk in the obese and morbidly obese range. Furthermore, when the analysis was restricted to studies with a longer duration of follow-up, which would be less influenced by confounding by pre-diagnostic weight loss, the increased risk among subjects with a BMI of 20 disappeared and was substantially attenuated in the underweight never smokers, while in all participants the inverse association in the overweight range was reversed and in the direction of increased risk. Thus, the increased risk observed with a BMI of 20 in the analysis of all participants and never smokers and the lower risk in overweight subjects in the analysis of all participants is likely to be due to confounding by smoking and pre-diagnostic weight loss. We also found significant heterogeneity when studies were stratified by study quality scores in the analysis of all participants, with no significant association among studies with moderate scores compared to a stronger association in studies with higher scores in the linear dose-response analysis. In the nonlinear dose-response analysis, the lowest risk was observed in the overweight range at a BMI of 27.5 in the studies with medium quality scores, while the lowest risk was observed at a BMI of 24-25 in the studies with the highest quality scores. This

finding provides further support that issues related to the study quality may have contributed to the slight inverse association at the high end of the normal weight category and in the overweight category in the analysis of all participants. At last we also found significant heterogeneity when studies among never smokers were stratified by baseline age, with a much stronger association among subjects <65 years age, than among subjects of age ≥ 65 years, and this is at least partly consistent with the data from the NCI Cohort Consortium.[14]

Results in context

The results of the analysis of never smokers and healthy never smokers in the present study are in line with the results from the NCI Cohort Consortium, which reported HRs of 1.09, 1.19, 1.44, 1.88 and 2.51 in the BMI ranges 25-27.4, 27.5-29.9, 30.0-34.9, 35.0-39.9, and 40-49.9 for women and 1.06, 1.21, 1.44, 2.06 and 2.93 for men in the respective BMI categories compared to 22.5-24.9,[14] while we found summary RRs of 1.11, 1.24, 1.42, 1.98 and 3.54 for BMI values of 27.5, 30, 32.5, 37.5 and 45 compared to a BMI of 23. The somewhat weaker association in the linear dose-response analysis in the current analysis (summary RR of 1.18, 95% CI: 1.15 to 1.22 per 5 BMI units increase for never smokers, 1.21 (95% CI: 1.18 to 1.25 for healthy never smokers, and 1.27 (95% CI: 1.21 to 1.34 for healthy never smokers with exclusion of early follow-up) compared to the NCI Cohort Consortium (HR=1.31, 95% CI: 1.29 to 1.33 for healthy never smokers with exclusion of the first year of follow-up in the BMI range between 25 and 49.9)[14] and the Prospective Studies Collaboration (HR=1.32, 95% CI: 1.28 to 1.36 for never smokers)[2] may be due to differences in the number of studies and subjects included, but may also be because these pooled analyses had access to the original data from each study and restricted the linear dose-response analysis in two ranges, between 15-25 and between 25 and 50, while in the current

linear dose-response analysis we used the reference category as reported in each publication which meant the BMI range would go lower as most of the studies had midpoints for the reference category between BMI 20 and 22, the part of the curve where the dose-response relationship was less steep.

Limitations of the study

Our meta-analysis has some limitations that need to be mentioned. As a meta-analysis of observational studies, confounding by unmeasured or imperfectly measured risk factors could have influenced the results. Smoking is a strong risk factor for premature mortality and several specific causes of death.[116, 117] A recent comprehensive analysis in the Million Women’s Study reported increased risk from 23 specific causes of death among current smokers compared to never smokers,[116] while a pooled analysis of 5 American cohort studies with >1 million participants reported increased risk of 35 and 41 specific causes of death in men and women, respectively.[117] At the same time smoking is associated with reduced body weight, leading to a lower BMI.[118, 240] The adverse effects of smoking are so strong that conventional multivariate adjustment is not sufficient to remove the confounding effects of smoking on the relationship between BMI and several cancers (mouth, esophagus, larynx, lung, and possibly pancreas, gallbladder, and liver) [5, 241-243] and several specific causes of death (most notably chronic obstructive pulmonary disease and pneumonia),[12, 244] and this is also likely to be the case for all-cause mortality. Further in support of this argument is the observation that the conditions most strongly associated with smoking (cancer of the lung, upper aerodigestive tract, and other respiratory diseases)[116, 117] also are the conditions for which the BMI-disease association shows the largest difference in risk estimates when analyses are restricted to never smokers.[8, 241, 243]

Therefore it is necessary to restrict the analysis to never smokers to obtain valid results. The differences in the shape of the dose-response relationship between BMI and mortality between smokers and never smokers as well as the stronger risk estimates among studies with more comprehensive adjustment for smoking (smoking status, cigarettes per day, time since quitting) observed in this analysis provide further support that smoking is a powerful confounder of the relationship between adiposity and mortality. Other confounding factors may also have influenced the results, however, in the analysis of never smokers the results persisted among studies that adjusted for age, education, alcohol, physical activity, height, dietary pattern, fat intake and fruit and vegetables, although few studies adjusted for dietary factors, suggesting that at least these confounders do not explain the association between BMI and mortality. In addition, it is possible that the increased risk observed in the underweight BMI range may be attenuated by physical activity or a generally healthy lifestyle,[14, 159] but we were not able to investigate potential interactions between BMI and physical activity or dietary factors in relation to all-cause mortality as few studies reported such results. Although BMI is an imperfect measure of body fatness as it does not distinguish between lean mass and fat mass, it is highly correlated with measures of body fat in most subjects[245, 246] and has been shown to be predictive of a number of chronic diseases.[8, 12, 247] BMI may be a less reliable marker of adiposity in the elderly as the prevalence of chronic disease (and associated weight loss) increases with age, and because of loss of muscle mass due to the aging process.[248] This might explain the weaker association observed between BMI and mortality in older compared to younger subjects and these findings are consistent with several previous studies as well,[14, 17, 94, 107] however, because of higher death rates absolute risks are much greater in older subjects.[249] A pooled analysis [250] and a meta-analysis [251] and the European Prospective Investigation into Cancer and Nutrition study [20] reported linear increases in risk of mortality with greater waist circumference and waist-to-hip ratio, even

among older subjects[20] and within the normal BMI range,[20, 250] thus incorporating waist measures may have additional clinical relevance for risk assessment.

The results were slightly stronger when the analysis was restricted to healthy never smokers (without prevalent disease at baseline), but the increased risk in the subjects with a low BMI persisted in these analyses. Nevertheless, residual confounding is still possible as an explanation for the increased risk with a low BMI because most studies excluded only participants with prevalent cardiovascular disease and cancer, and only 5 of the 26 studies additionally excluded subjects with respiratory disease. In the NCI Cohort Consortium the effect of exclusion of participants with prevalent disease on the BMI and mortality association was more pronounced in men and for heart disease rather than cancer, stroke or respiratory disease.[14] However, confounding by undiagnosed disease is still a possibility as weight loss may precede the diagnosis of some neurological and respiratory diseases by as much as 10-15 years,[2, 34, 252, 253] and because most of the studies only excluded the first 1, 2 or 3 years of follow-up. In a further subgroup analysis stratified by duration of follow-up we found that the increased risk among subjects with a BMI of 20 disappeared and in underweight subjects was substantially attenuated and the increased risk in overweight and obese subjects was strengthened among studies with ≥ 20 or ≥ 25 years of follow-up. This is in line with the results from the NCI Cohort Consortium where the increased risk among subjects with a BMI between 18.5-19.9 disappeared and that of the underweight subjects was greatly reduced in the subgroup with 15 or more years of follow-up,[14] while the positive association with higher BMI was strengthened with a longer duration of follow-up. This suggests that weight loss due to pre-diagnostic disease may explain the elevated risk we observed in the low-normal weight and underweight BMI ranges. However, another potential explanation might be if the subjects gained weight over time, as some underweight subjects might become normal weight and the obese even more obese over the follow-up period. It has been shown

that disease-associated weight loss prior to baseline is associated with increased mortality risk[254] and that in subjects with stable BMI there was a linear increase in risk of mortality, while in subjects that previously experienced weight loss (likely because of chronic illness) there was a more U-shaped association between BMI and mortality.[255] Any further large-scale cohort studies or pooled analyses should investigate these issues further by incorporating repeated anthropometric assessments during follow-up.

Another limitation is that the number of studies which conducted analyses stratified by smoking status was small compared to the total number of studies (53 out of 228 studies). However, many of the studies which provided results for never smokers were very large, and accounted for 68% of the total participants and 63% of the total deaths in this meta-analysis (2,372,930 deaths and 20,542,502 participants out of a total of >3,744,722 deaths among 30,233,329 participants), thus most likely the results for never smokers would not have been dramatically different if all studies had reported such data. The analyses of healthy never smokers and healthy never smokers with exclusion of early follow-up had a more limited number of studies included (26 and 11, respectively) and may therefore be less representative of all the studies included, but still included a larger number of deaths and participants among healthy never smokers than previous pooled analyses.[2, 14]

Measurement errors in the assessment of height and weight may have influenced the results. Most validation studies have found high correlations between self-reported and measured height and weight,[256-258] although some under-reporting of weight and over-reporting of height may occur. When studies were stratified by whether weight and height was measured or self-reported the summary RR was slightly weaker among studies using measured compared to studies using self-reported data, however, there was no significant heterogeneity between these subgroups. Height, weight, smoking status, and other covariates were measured only at baseline and changes in these factors may have occurred during

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3 follow-up, but we were not able to take such changes into account because most studies
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8 One final limitation is that we because of resource-constraints only included English-
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10 language publications. However, we assume that most of the large-scale and well-conducted
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12 cohort studies of importance will have been published in English-language journals. Given the
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14 large number of studies included in the present analysis any additional studies published in
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16 non-English journals would have to be very large and/or have a substantially different result
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18 than the present cohort studies to change any of the results meaningfully, but we consider this
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28 Strengths of the study
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31 Our meta-analysis has several strengths. Since we used fractional polynomial models
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35 of deaths and participants than previously with >3.74 million deaths among >30.2 million
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37 participants in 228 studies which is almost 14 times the number of deaths and >10 times the
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39 number of participants and more than twice the number of studies as compared to the meta-
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41 analysis by Flegal et al[26]. In the analysis of never smokers, there were >738000 deaths
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43 among >9.97 million participants, among healthy never smokers there were >74,464 deaths
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45 among 727,687 participants, and among healthy never smokers with exclusion of early
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47 follow-up there were 88,860 deaths among 1,192,443 participants, which compares
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49 favourably with the 35369 deaths and 687,590 healthy never smokers (first <1 year of follow-
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51 up excluded) in the NCI Cohort Consortium.[14] The fractional polynomial method has the
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53 advantage that studies are not required to use the exact same cut-off points when analyzing
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55 BMI, thus we were able to include important studies that were previously excluded.[26] We
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conducted analyses stratified by smoking status, prevalent disease and exclusion of early follow-up to investigate the potential impact of residual confounding from smoking, prevalent and undiagnosed disease. Important differences were observed between studies among never smokers and those among former, current and ever smokers with a more J-shaped curve for never smokers, while there was a U-shaped curve among smokers, suggesting that smoking may have influenced previous results that showed inverse associations in the overweight range. In addition, we stratified the analyses by duration of follow-up to clarify the potential influence of confounding by illness due to pre-diagnostic weight loss and found large differences in the shape of the dose-response relationship with different durations of follow-up, with more U-shaped associations with shorter follow-up and J-shaped associations with longer follow-up. We conducted a number of subgroup analyses by study characteristics, study quality scores and adjustment for confounding and mediating factors and the findings persisted in sensitivity analyses excluding one study at a time, suggesting that no individual study explained the results.

Mechanisms

Several potential mechanisms could explain an association between body mass index and premature mortality risk. Adiposity is an established risk factor for cardiovascular disease (coronary heart disease, stroke) and increases risk through increased cholesterol and triglyceride concentrations, elevated blood pressure, low-grade inflammation, and insulin resistance.[2] Overweight and obesity is the strongest established risk factor for type 2 diabetes,[3] which is associated with a 2-3 fold increase in mortality risk.[259] Adiposity is an established risk factor for at least ten different cancers, including cancers of the esophagus (adenocarcinoma), liver, gallbladder, colorectum, pancreas, kidney, prostate (advanced cancer

only), breast (post-menopausal), endometrium, and ovaries,[4, 6-8] and there is some evidence to suggest an association with several other cancers, including thyroid cancer, leukemia, multiple myeloma and lymphomas [8] as well as with a worse survival after cancer diagnosis.[260, 261] A wide range of mechanisms may explain the association with these cancers, including hormonal effects of adipose tissue, insulin resistance, inflammation, effects on predisposing conditions such as gastro-esophageal reflux disease [262], Barrett’s esophagus [263], gallbladder disease,[9] and colorectal adenomas,[264] and through effects on the immune system.[265] There is also evidence for an association between adiposity and a wide range of other chronic disease outcomes, which also may lead to complications and death.[10-13] On the other hand there is some indication that underweight may increase the risk of chronic pulmonary disease and other respiratory diseases[2, 18, 20, 266], however, reverse causality and confounding might at least partly explain these findings as weight loss may be an indicator of progressive chronic obstructive pulmonary disease and because smoking is so strongly related to these conditions.[267] For several outcomes, including coronary heart disease, hypertension, hypercholesterolemia, type 2 diabetes, gallstones, gout, colon, and endometrial cancer there is evidence of increased risk even within the high end of the normal BMI range[7, 9, 10, 247], and this might explain the slightly increased all-cause mortality risk observed among never smokers even at a BMI of 24-25 in the current meta-analysis, when restricted to studies with ≥ 20 or ≥ 25 years follow-up.

Policy implications and future research

The current analysis provide strong evidence that overweight and obesity increases the risk of all-cause mortality and therefore reinforces previous concerns regarding the adverse health effects of excess weight. Previous recommendations regarding body weight for

prevention of chronic diseases such as cancer and cardiovascular disease have recommended a BMI within the normal BMI range 18.5-24.9 as defined by the World Health Organisation.[120] Some recommendations stated that it would be best to stay as lean as possible within the normal range, as there is evidence of increased risk of cardiovascular disease, cancer, diabetes, and some other diseases even within the high normal BMI range (BMI of 22-24.9).[4, 9, 10, 247] The current results support these recommendations, but suggest that the lowest mortality is observed with a BMI of 22-24 (depending on whether prevalent disease is excluded or not), although we cannot entirely rule out the possibility that this might be a slight overestimate if the increased risk observed among subjects with a BMI of 20 is non-causal, as indicated by the studies with longer durations of follow-up. Any further studies should investigate in more detail the association between BMI and other adiposity measures and specific causes of death, including less common diseases contributing to all-cause mortality, and take into account the important methodological issues that have been highlighted in the current meta-analysis.

Conclusions

In conclusion, both overweight and obesity increases the risk of all-cause mortality with a J-shaped dose-response relationship, and the nadir of the dose-response curve appears to be in the BMI range of 23 to 24 among never smokers, 22-23 among healthy never smokers, but with longer duration of follow-up the nadir of the dose-response curve is in the BMI range of 20 to 22. There is some evidence of increased mortality in underweight subjects, but we cannot exclude the possibility that this partly could be due to residual confounding from pre-diagnostic disease. Lack of exclusion of ever smokers, persons with

prevalent disease and early follow-up and inclusion of studies with lower study quality may bias the associations between BMI and mortality towards a more U-shaped association.

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Data sharing: no additional data available.

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Data sharing: No additional data available.

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Table 1: Key characteristics of the studies, analysis of never smokers and all participants

	Never smokers	All participants
Number of studies (risk estimates)	53 (44)	228 (198)
Number of deaths	>738,144	>3,744,722
Number of participants	>9,981,558	30,233,329
Geographic location, n studies (n, risk estimates)		
North America	22 (20)	70 (67)
South America	0 (0)	3 (3)
Europe	18 (11)	96 (69)
Australia	2 (2)	9 (9)
Asia	11 (11)	49 (49)
Pacific	0 (0)	1 (1)
Study size, n studies (n, risk estimates)		
<1000	2 (2)	15 (12)
1000-<10000	13 (13)	92 (90)
10000-<100000	20 (18)	89 (71)
100000-<1000000	14 (7)	20 (20)
≥1000000	1 (1)	12 (5)
Missing	3 (3)	0 (0)
Minimum, maximum	441, 7436748	162, 12832637
Mean, median	243453, 20346	152694, 8876
Duration of follow-up		
Minimum, maximum (years)	3.9, 35	2, 42
Mean, median (years)	14.2, 12	13.8, 12

Table 2: Body mass index and mortality, never smokers, healthy never smokers, all participants, and in smokers, relative risk estimates are from the nonlinear dose-response analysis

	Never smokers	Healthy never smokers	All participants	Current smokers	Former smokers	Ever smokers
N	44	26	198	18	15	24
BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
15	2.01 (1.80 to 2.24)	1.48 (1.32 to 1.65)	2.24 (2.15 to 2.34)	2.61 (2.27 to 2.99)	(16.25)	(16.25)
16	1.66 (1.51 to 1.83)	1.31 (1.19 to 1.44)	1.83 (1.77 to 1.91)	2.08 (1.84 to 2.34)	2.15 (1.91 to 2.42)	1.81 (1.66 to 1.97)
17.5	1.35 (1.25 to 1.45)	1.15 (1.07 to 1.24)	1.47 (1.43 to 1.51)	1.61 (1.46 to 1.76)	1.68 (1.53 to 1.84)	1.50 (1.40 to 1.60)
20	1.10 (1.05 to 1.14)	1.03 (0.99 to 1.07)	1.15 (1.13 to 1.17)	1.19 (1.13 to 1.25)	1.20 (1.14 to 1.26)	1.16 (1.12 to 1.20)
22	1.01 (1.00 to 1.03)	1.00 (0.99 to 1.01)	1.03 (1.02 to 1.04)	1.04 (1.02 to 1.06)	1.04 (1.03 to 1.06)	1.04 (1.02 to 1.05)
23	1.00	1.00	1.00	1.00	1.00	1.00
24	1.00 (0.98 to 1.01)	1.01 (1.00 to 1.02)	0.98 (0.97 to 0.99)	0.97 (0.96 to 0.99)	0.98 (0.96 to 0.99)	0.98 (0.97 to 0.99)
25	1.01 (0.98 to 1.03)	1.03 (1.00 to 1.06)	0.97 (0.96 to 0.98)	0.96 (0.93 to 1.00)	0.97 (0.94 to 1.00)	0.97 (0.94 to 0.99)
27.5	1.07 (1.01 to 1.14)	1.11 (1.05 to 1.18)	0.98 (0.96 to 1.01)	0.99 (0.92 to 1.06)	1.00 (0.93 to 1.08)	0.98 (0.93 to 1.04)

30	1.20 (1.09 to 1.32)	1.24 (1.14 to 1.36)	1.04 (1.00 to 1.08)	1.08 (0.96 to 1.21)	1.11 (0.99 to 1.24)	1.05 (0.96 to 1.14)
32.5	1.39 (1.22 to 1.58)	1.42 (1.26 to 1.60)	1.14 (1.09 to 1.20)	1.24 (1.06 to 1.45)	1.28 (1.10 to 1.49)	1.15 (1.02 to 1.30)
35	1.65 (1.40 to 1.94)	1.66 (1.43 to 1.94)	1.29 (1.21 to 1.37)	1.48 (1.21 to 1.80)	1.54 (1.27 to 1.87)	1.31 (1.13 to 1.52)
37.5	2.02 (1.66 to 2.46)	1.98 (1.64 to 2.38)	1.49 (1.37 to 1.61)	1.82 (1.43 to 2.32)	1.91 (1.51 to 2.41)	1.51 (1.27 to 1.81)
40	2.50 (1.98 to 3.15)	2.37 (1.91 to 2.95)	1.74 (1.59 to 1.91)	2.32 (1.74 to 3.08)	2.44 (1.85 to 3.20)	1.79 (1.45 to 2.21)
42.5	3.16 (2.42 to 4.12)	2.88 (2.24 to 3.69)	2.07 (1.86 to 2.30)	3.03 (2.18 to 4.20)	3.15 (2.30 to 4.32)	2.14 (1.68 to 2.73)
45	4.02 (2.98 to 5.43)	3.54 (2.67 to 4.69)	2.49 (2.22 to 2.81)	4.01 (2.77 to 5.81)	4.18 (2.92 to 5.97)	2.61 (1.99 to 3.43)

Figure legends

Figure 1. Flow-chart of study selection

Figure 2. BMI and total mortality, never smokers, healthy never smokers, all participants, current, former and ever smokers, nonlinear dose-response analysis

Figure 3. BMI and total mortality, never smokers, stratified by duration of follow-up, nonlinear dose-response analysis

Figure 4. BMI and total mortality, all participants, stratified by duration of follow-up, nonlinear dose-response analysis

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Print abstract

Study question: To conduct a systematic review and meta-analysis of cohort studies of body mass index (BMI) and the risk of all-cause mortality.

Methods: PubMed and Embase databases were searched up to September 23rd 2015. Prospective studies that reported adjusted risk estimates of mortality by ≥ 3 categories of BMI were included. Nonlinear associations were explored using fractional polynomial models. A total of 230 cohort studies (207 publications) were included, with >738,144 deaths and >9,976,077 participants among never smokers (53 studies) and >3,744,722 deaths and 30,233,329 participants among all participants (228 studies).

Study answer and limitations: A J-shaped dose-response relationship was observed between BMI and mortality in never smokers ($p_{\text{nonlinearity}} < 0.0001$), and the nadir of the curve was observed at a BMI of 23-24 in never smokers, 22-23 in healthy never smokers, and at 20-22 in studies of never smokers with ≥ 20 years follow-up. In contrast there was a U-shaped association between BMI and mortality in analyses with a greater potential for bias including all participants, smokers, and in studies with a short duration of follow-up (<5 or <10 years). The main limitation of the study is that the results for never smokers accounted for approximately 2/3 of the available data.

What this study adds: In never smokers and healthy never smokers the lowest risk is observed at a BMI of 23-24 and 22-23, respectively, but when restricting the analysis to studies with a longer duration of follow-up the lowest risk is observed with a BMI of 20-22.

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Competing interests: All authors declare no conflicts of interest.

Data sharing: No additional data are available.

Figure to accompany the abstract in print issue: Please include Figure 2 with the data in never smokers and healthy never smokers in the print issue abstract.

Figure 1. Flow-chart of study selection

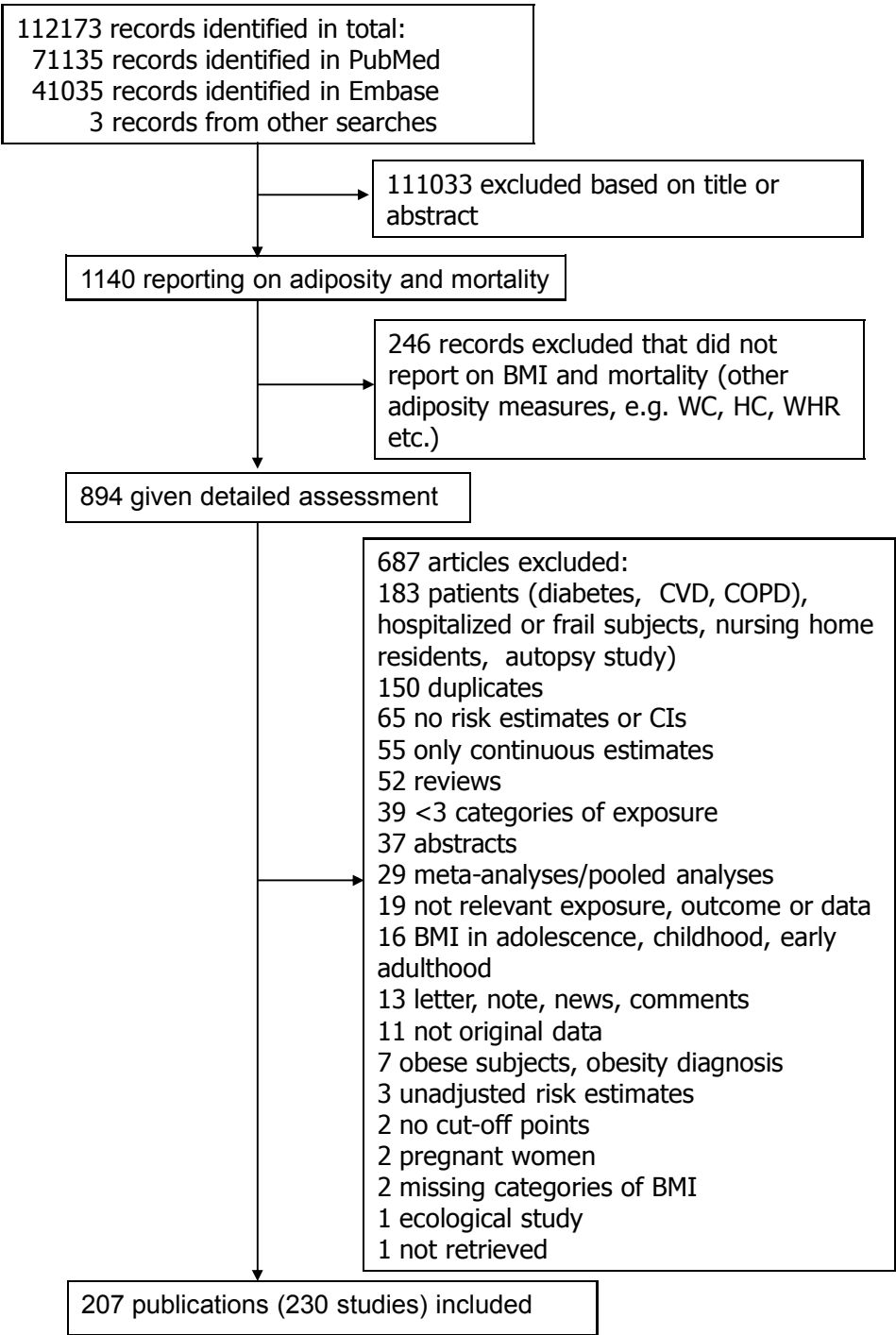


Figure 2. BMI and total mortality, never smokers, healthy never smokers, all participants, and current, former and ever smokers, nonlinear dose-response analysis

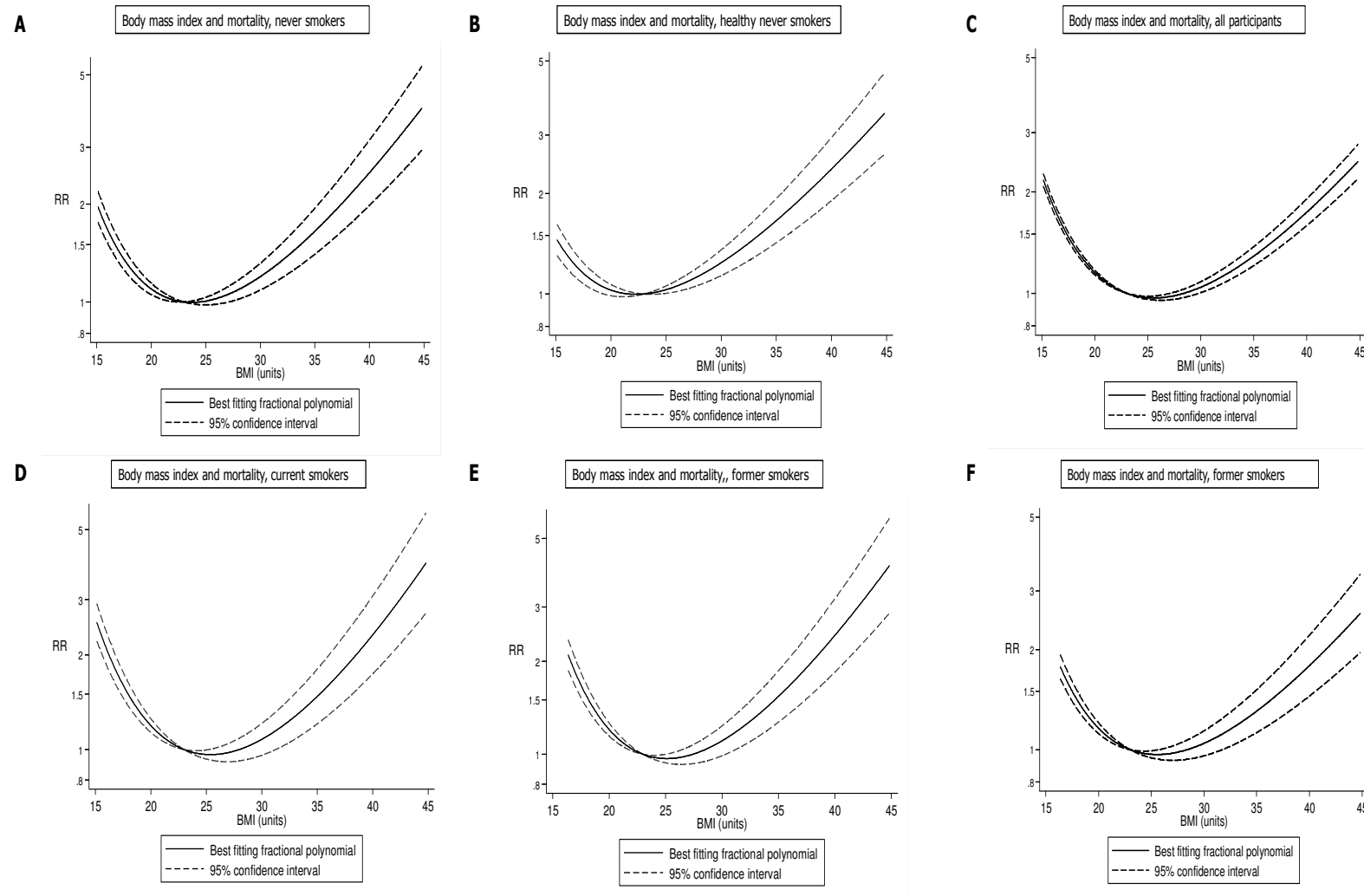


Figure 3. BMI and total mortality, never smokers, nonlinear dose-response analysis stratified by duration of follow-up

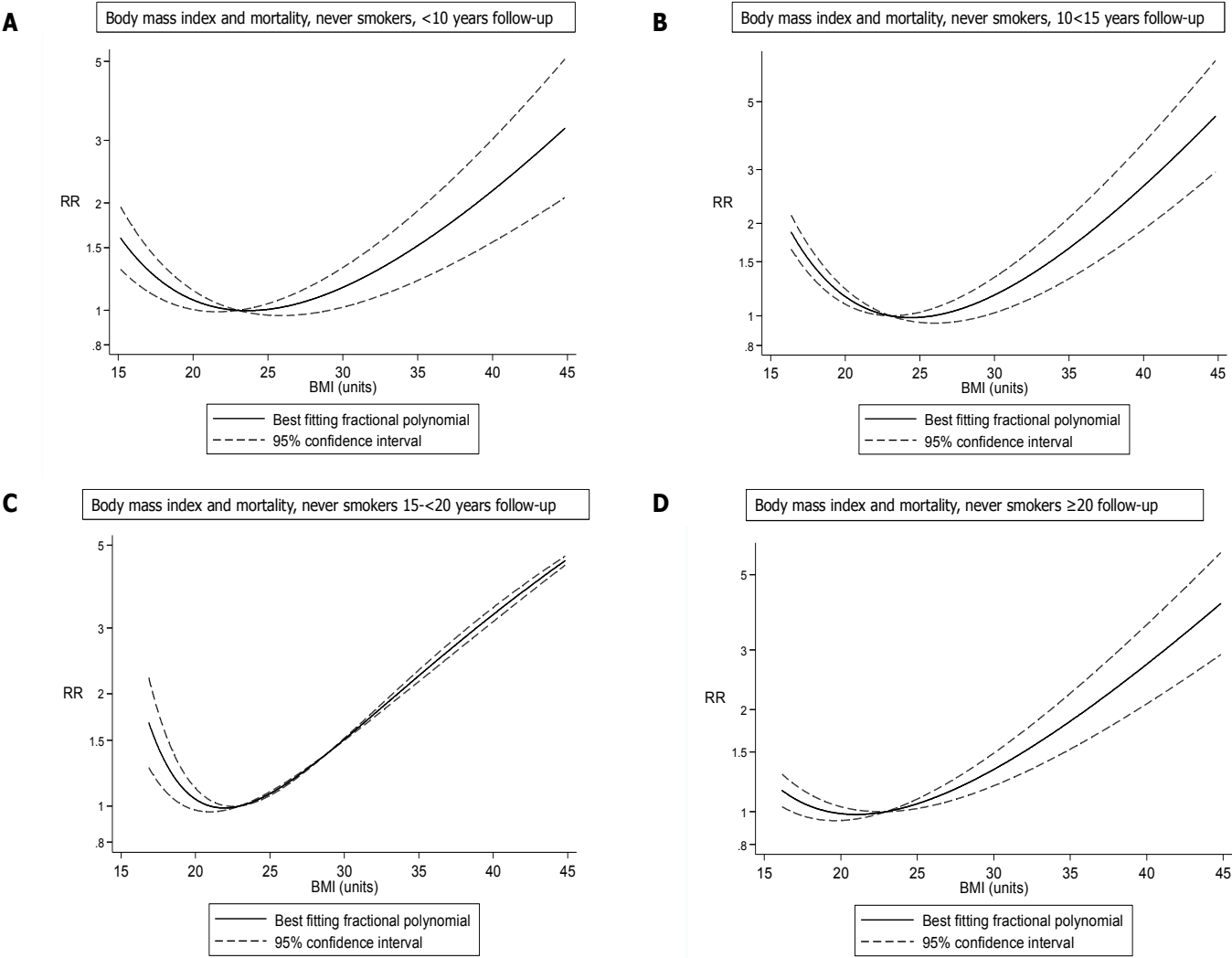
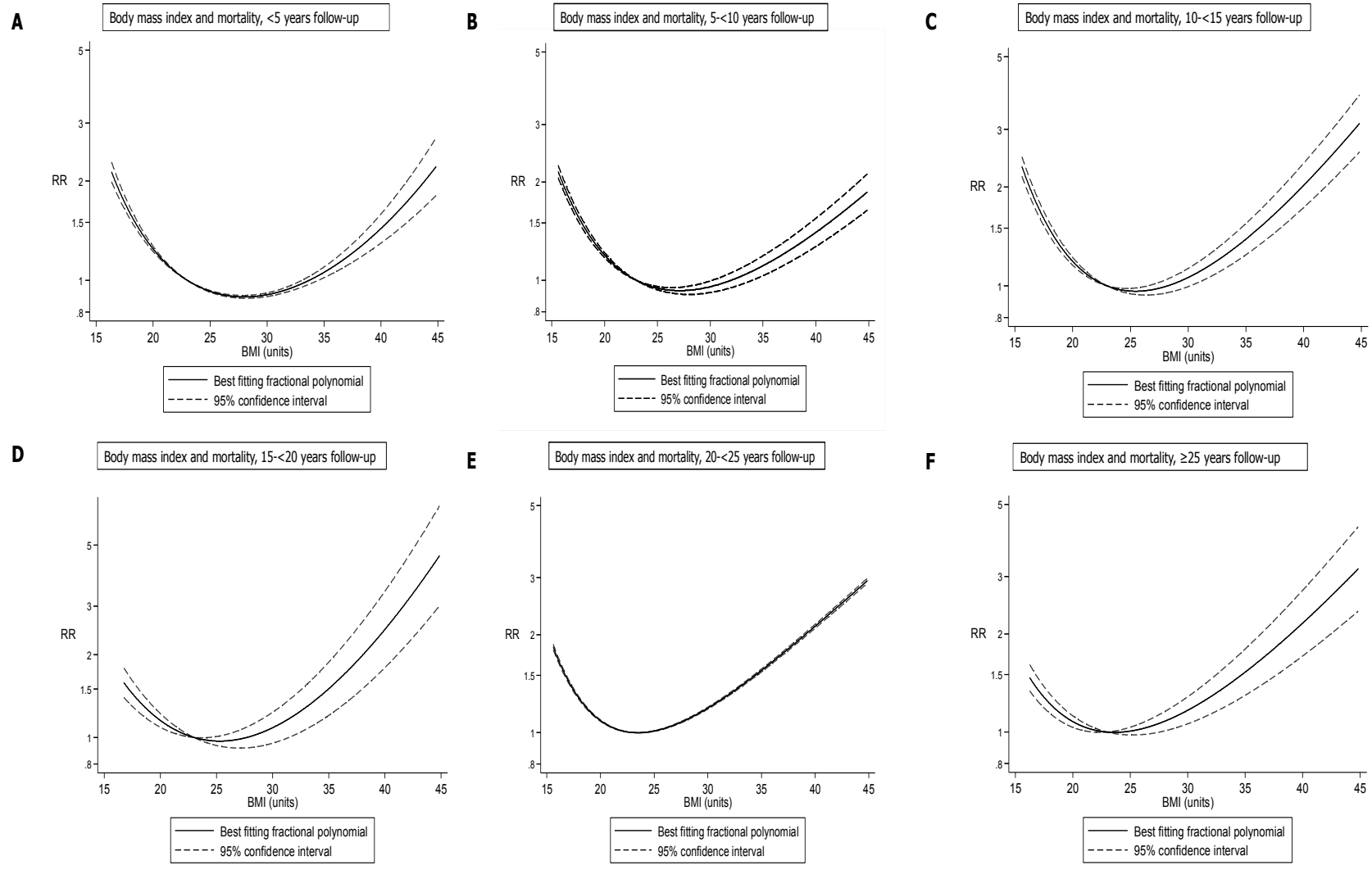


Figure 4. BMI and total mortality, all participants, nonlinear dose-response analysis stratified by duration of follow-up



Supplementary Table 1. List of excluded studies and exclusion reason

Exclusion reason	Reference
Abstract	1-37
BMI in childhood, adolescence, early adulthood	38-53
Comment	54,55
Duplicate	56-204
Ecological study	205
Interaction analysis	206,207
Less than 3 categories of BMI	208-247
Letter	248-253
Meta-analysis	254-271
Missing categories	272,273
News	274-276
No confidence intervals	277-282
No cut-off points for BMI	283,284
No risk estimates	285-343
Not original data	344-354
Not relevant data	355-369
Not relevant outcome	370,371
Not retrieved	372
Notes	373,374
Obese subjects, obesity diagnosis	375-381
Only continuous estimates	382-436
Patients	437-619

Pooled analysis	620-630
Pregnant women	631,632
Review	633-684
Unadjusted risk estimates	685-687

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Supplementary Table 2: Prospective studies of body mass index and all-cause mortality risk

Author, publication year, country/region	Study name	Recruitment and follow-up period	Study size, gender, age, number of deaths	Assessment of weight and height	Excluded baseline diseases	Excluded early follow-up	Exposure by subgroup	Description of quantiles of categories	RR (95% CI)	Adjustment for confounders
Multiple Risk Factor Intervention Trial Research Group, 1986, USA	Multiple Risk Factor Intervention Trial	NA-NA, 6 years follow-up	12866 men (6428 intervention/ 6438 usual care), mean age 46 years: 525 deaths	NA	No	No	BMI, special intervention group BMI, usual care group	≤24.9 25.0-26.6 26.7-28.2 28.3-30.5 ≥30.6 ≤24.9 25.0-26.6 26.7-28.2 28.3-30.5 ≥30.6	1.00 0.95 0.82 0.98 1.18 1.00 0.85 0.77 1.19 1.09	Age, diastolic blood pressure, cigarettes per day, serum cholesterol
Johnsen H et al, 1987, Canada	Nutrition Canada Survey Cohort	1970-72 – 1981, 10 years follow-up	3624 men and 4470 women, age 35-79 years: 532/330 deaths	NA	No	No	BMI, men BMI, women	<19.5 19.5-<25.0 25.0-<30.0 30.0-<32.0 ≥32.0 <19.5 19.5-<25.0 25.0-<30.0 30.0-<32.0 ≥32.0	1.26 (0.89-1.79) 1.00 0.92 (0.75-1.12) 0.84 (0.57-1.24) 1.28 (0.86-1.90) 1.15 (0.64-2.07) 1.00 1.05 (0.79-1.40) 1.11 (0.79-1.58) 1.39 (0.98-1.98)	Smoking status and pack-years
Rissanen A et al, 1989, Finland	Finnish Mobile Clinic Health Examination Survey	1966-1972 – 1981, 12 years follow-up	22995 men, age ≥25 years: 4073 deaths NA never smokers: 751 deaths NA former smokers: 916 deaths NA current smokers: 2406 deaths	Measured	Prevalent cancer, heart disease or diabetes were excluded	First 2 years of follow-up excluded in sensitivity analyses	BMI, all BMI, never smokers BMI, former smokers	<19.0 19.0-21.9 22.0-24.9 25.0-27.9 28.0-30.9 31.0-33.9 ≥34.0 <19.0 19.0-21.9 22.0-24.9 25.0-27.9 28.0-30.9 31.0-33.9 ≥34.0 <19.0 19.0-21.9 22.0-24.9	1.5 (1.28-1.75) 1.1 (1.01-1.19) 1.0 1.0 (0.93-1.08) 1.0 (0.92-1.09) 1.2 (1.10-1.31) 1.4 (1.15-1.71) 1.8 (0.92-3.52) 1.2 (0.95-1.52) 1.0 1.0 (0.84-1.19) 1.0 (0.82-1.22) 1.3 (1.00-1.70) 1.4 (0.91-2.16) 1.8 (1.02-3.17) 1.5 (1.20-1.88) 1.2 (1.01-1.43)	Age, region, smoking status and cigarettes per day Age

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							BMI, current smokers ≥15 cigarettes per day	25.0-27.9 28.0-30.9 31.0-33.9 ≥34.0 <19.0 19.0-21.9 22.0-24.9 25.0-27.9 28.0-30.9 31.0-33.9 ≥34.0	1.2 (1.01-1.42) 1.2 (1.00-1.44) 1.5 (1.18-1.90) 1.7 (1.15-2.51) 2.3 (1.76-3.01) 2.0 (1.70-2.36) 1.7 (1.45-1.99) 1.5 (1.26-1.78) 1.8 (1.47-2.21) 1.8 (1.32-2.46) 3.2 (2.17-4.72)	
							BMI, current smokers, >15 cigarettes per day	<19.0 19.0-21.9 22.0-24.9 25.0-27.9 28.0-30.9 31.0-33.9 ≥34.0	3.6 (2.74-4.73) 2.0 (1.68-2.38) 2.1 (1.80-2.45) 1.9 (1.61-2.24) 2.6 (2.16-3.13) 2.6 (1.97-3.43) 2.0 (1.28-3.13)	
Ussanen A et al, 1991, Finland	Finnish Mobile Clinic Health Examination Survey	1966-1972 - 1981, 12 years follow-up	17519 women, age 25-79 years: 898 deaths 14011 never smokers: 746 deaths 719 former smokers: 24 deaths 2765 current smokers: 128 deaths	Measured	Prevalent heart disease or cancer excluded	Stratified analyses by <7 and ≥7 years of follow-up	BMI, all BMI, never smokers BMI, former smokers BMI, current smokers	1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5	1.4 (1.1-1.7) 1.0 1.2 (1.0-1.5) 1.3 (1.1-1.7) 1.5 (1.2-1.8) 1.5 (1.2-1.9) 1.0 1.3 (1.0-1.6) 1.4 (1.1-1.8) 1.6 (1.2-2.0) 1.9 (0.3-11.6) 1.0 3.5 (0.7-16.8) 4.0 (0.9-19.1) 2.5 (0.4-13.6) 0.9 (0.6-1.4) 1.0 0.9 (0.5-1.6) 0.9 (0.5-1.6) 1.1 (0.6-2.0)	Age, region, smoking status Age, region
Ho SC et al, 1991, Hong Kong	Shatin New Town	1985 - 1987, 2 years follow-up	1054 men and women, age ≥70 years: 89 deaths	Measured	No	No	BMI	<20 20-24 >25	1.6 (1.0-2.5) 1.0 0.8 (0.3-1.7)	Age, sex, residence, marital status, smoking status, difficulties of daily living, health compared to others

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5 Lee IM et al, 6 1993, USA	Harvard Alumni Health Study	1962-66 – 1988, 27 years follow-up	19297 men, mean age 46.6 years: 4370 deaths 3965 never smokers: 578 deaths 6199 former smokers: 1398 deaths 9133 current smokers: 2394 deaths	Self- reported	Excluded prevalent coronary heart disease, stroke and cancer	Stratified by follow-up period and first 5 years excluded in sensitivity analyses	BMI, all BMI, never smokers, excluding first 5 years of follow-up BMI, never smokers BMI, former smokers BMI, current smokers	<22.5 22.5-<23.5 23.5-<24.5 24.5-<26.0 ≥26.0 <22.5 22.5-<23.5 23.5-<24.5 24.5-<26.0 ≥26.0 <22.5 22.5-<23.5 23.5-<24.5 24.5-<26.0 ≥26.0 <22.5 22.5-<23.5 23.5-<24.5 24.5-<26.0 ≥26.0 <22.5 22.5-<23.5 23.5-<24.5 24.5-<26.0 ≥26.0 <22.5 22.5-<23.5 23.5-<24.5 24.5-<26.0 ≥26.0	1.00 0.99 (0.89-1.20) 0.95 (0.87-1.05) 1.01 (0.91-1.10) 1.18 (1.08-1.28) 1.00 1.23 1.06 1.27 1.67 (1.29-2.17) 1.00 1.20 1.05 1.21 1.57 (1.23-2.00) 1.00 1.08 1.10 1.05 1.25 (1.06-1.47) 1.00 0.91 0.87 (0.77-0.98) 0.96 1.06 (0.94-1.19)	Age, smoking status, physical activity
26 Cornitzer M 27 et al, 1993, 28 Belgium	Belgian Bank Study	1964-1965 -NA, 25 years follow-up	1227 men, age 40-59 years: 453 deaths	Measured	Subjects with coronary heart disease were excluded	No	BMI	<23.4 23.4-26.0 ≥26.0	1.00 0.86 (0.79-1.02) 1.02 (0.88-1.23)	Age
29 Sorkin JD et 30 al, 1994, USA	Adventist Mortality Study	1960 – 1985, 15 years follow-up	8828 men, age 30-89 years: 3444 deaths	Self- reported	No	No	BMI	≤22.3 22.4-24.2 24.3-25.7 25.8-27.5 ≥27.5	0.86 (0.78-0.95) 0.86 (0.77-0.95) 0.88 (0.79-0.98) 0.88 (0.80-0.98) 1.00	Age
31 Norrish A et 32 al, 1995, New 33 Zealand	The Auckland Risk Factor Study	1982-1991, 9 years follow-up	1029 men, age 35-64 years: 96 deaths	Measured	No	No	BMI	<22.9 22.9-25.6 ≥25.6	1.00 1.14 (0.66-1.95) 1.59 (0.94-2.66)	Age, smoking status, alcohol, SES
34 Manson RL et 35 al, 1995, USA	Gila River Indian Community	1965-1990, 8.1 years follow-up	814 diabetic and 1814 nondiabetic participants, age >20 years: 570 deaths	Measured	No	No	BMI, no diabetes BMI, with diabetes	<25 25-30 30-35 35-40 ≥40 <25	1.5 (1.0-2.2) 1.0 (0.7-1.5) 1.0 1.2 (0.8-1.9) 1.9 (1.2-3.1) 1.4 (1.0-2.1)	Age, sex, smoking status

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Seidell JC et al, 1996, Netherlands	The Consultation Bureau Project on Cardiovascular Diseases	1974-80 – 1993, 12 years follow-up	48287 men and women, age 30-54 years: 1319 deaths	Measured	No	First 5 years of follow-up excluded in sensitivity analyses (partly reported results)	BMI, men BMI, women	<18.5 18.5-24.99 25.0-26.99 27.0-29.99 ≥30.0 <18.5 18.5-24.99 25.0-26.99 27.0-29.99 ≥30.0	2.60 (1.75-3.86) 1.00 0.89 (0.74-1.07) 1.12 (0.92-1.36) 1.47 (1.09-1.98) 1.13 (0.68-1.87) 1.00 0.81 (0.61-1.06) 1.12 (0.84-1.47) 1.08 (0.74-1.45)	Age
Hodge AM et al, 1996, Nauru, Fiji	Nauru, Fiji	1980/1982 - 1991/1992, 10/11 years follow-up	1400 Micronesian Nauruans 1279 Melanesian Fijians And 1182 Indian Fijians, age ≥20 years: 209 deaths 173 deaths 129 deaths	Measured	No	No	BMI, Nauru, men BMI, Melanesian Fijians, men BMI, Indian Fijians, men BMI, Nauru, women BMI, Melanesian Fijians, women BMI, Indian Fijians, women	<29.0 29.0-32.5 32.6-36.3 ≥36.4 <23.3 23.3-25.2 25.3-27.8 ≥27.9 <19.7 19.7-22.2 22.3-25.2 ≥25.3 <29.5 29.5-34.4 34.5-39.4 ≥39.5 <23.7 23.7-27.0 27.1-30.8 ≥30.9 <19.6 19.6-23.1 23.1-27.2 ≥27.2	1.4 (0.8-2.5) 1.2 (0.7-2.0) 1.2 (0.7-2.2) 1.0 1.1 (0.6-1.8) 0.8 (0.4-1.4) 1.0 (0.6-1.6) 1.0 1.3 (0.7-2.4) 0.9 (0.4-1.9) 1.1 (0.6-1.9) 1.0 0.8 (0.4-1.6) 0.8 (0.4-1.6) 0.8 (0.4-1.6) 1.0 2.7 (1.4-5.4) 0.8 (0.3-1.8) 1.4 (0.7-2.8) 1.0 1.6 (0.7-3.9) 2.0 (1.0-4.2) 0.7 (0.3-1.6) 1.0	Age, diabetes, smoking status
Chyou PH et al, 1997, USA	Honolulu Heart Program	1965-1968 – 1991, 22 years follow-up	8006 Japanese American man, age 45-68 years: 2667 deaths	Measured	No	No	BMI	<21.21 21.21-23.00 23.01-24.60 24.61-26.30 ≥26.31	1.13 (1.03-1.24) 0.98 (0.88-1.09) 1.00 1.01 (0.91-1.12) 1.29 (1.17-1.42)	Age, alcohol, smoking – pack years

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5 Lindsted KD 6 et al, 1997, 7 USA	Adventist Mortality Study	1960 – 1985, 26 years follow-up	12576 white never smoking women, age 30-74 years: 3280 deaths	Self- reported	Prevalent heart disease, stroke, and cancer, unstable weight, and severe physical complaints (chest pain, shortness of breath, fatigue, loss of appetite, blood in stool, blood in urine, lump or thickening in breast, unusual discharge from breast, unusual bleeding from vagina) excluded in sensitivity analyses	No	BMI, year 1-8, age 30-54 years	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.79 (0.44-1.40) 0.56 (0.30-1.06) 0.87 (0.48-1.58) 1.14 (0.64-2.03)	Age, alcohol, education, marital status, dietary pattern
8							BMI, year 9-14	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.84 (0.42-1.68) 0.86 (0.43-1.72) 1.23 (0.63-2.38) 1.81 (0.96-3.41)	
9							BMI, year, 15-26	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.69 (0.48-0.99) 0.87 (0.62-1.23) 0.98 (0.69-1.39) 1.64 (1.19-2.26)	
10							BMI, year 1-8, age 55-74 years	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.81 (0.59-1.12) 0.50 (0.36-0.70) 0.66 (0.49-0.89) 1.07 (0.82-1.40^)	
11							BMI, year 9-14	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.93 (0.69-1.27) 0.84 (0.63-1.12) 1.02 (0.78-1.33) 1.34 (1.04-1.74)	
12							BMI, year, 15-26	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 1.11 (0.91-1.36) 1.13 (0.93-1.36) 1.12 (0.93-1.33) 1.29 (1.08-1.54)	
13			No major chronic disease or sever physical complaints at baseline and stable weight				BMI, year 1-8, age 30-54 years	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.79 (0.33-1.90) 0.81 (0.33-1.98) 1.13 (0.47-2.72) 1.37 (0.57-3.31)	
14							BMI, year 9-14	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 1.10 (0.39-3.22) 1.23 (0.42-3.59) 2.81 (1.07-7.38) 4.02 (1.54-10.5)	
15							BMI, year, 15-26	<21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	1.00 0.67 (0.42-1.07) 0.90 (0.58-1.41)	
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							BMI, year 1-8, age 55-74 years	24.9-27.4 >27.4 <21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4 <21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4 <21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4 <21.3 21.3-22.9 23.0-24.8 24.9-27.4 >27.4	0.95 (0.60-1.50) 1.62 (1.06-2.49) 1.00 0.84 (0.49-1.46) 0.47 (0.27-0.84) 0.86 (0.53-1.41) 1.18 (0.74-1.88) 1.00 0.99 (0.65-1.52) 0.87 (0.58-1.30) 1.22 (0.83-1.77) 1.24 (0.85-1.82) 1.00 1.14 (0.88-1.47) 1.16 (0.91-1.47) 1.11 (0.88-1.41) 1.35 (1.16-1.71)	
Lindstedt KD et al, 1998, 21SA	Adventist Mortality Study	1960-1985, 26 years follow-up	5062 never- smoking men, age 30-74 years: 1034 deaths	Self- reported	No	Analyses stratified by duration of follow-up	BMI, age 30-54 years, years 1-8 BMI, age 55-74 years BMI, age 30-54 years, years 9-14 BMI, age 55-74 years BMI, age 30-54 years, years 15-26 BMI, age 55-74 years	14.3-22.5 22.6-27.4 27.5-43.9 14.3-22.5 22.6-27.4 27.5-43.9 14.3-22.5 22.6-27.4 27.5-43.9 14.3-22.5 22.6-27.4 27.5-43.9 14.3-22.5 22.6-27.4 27.5-43.9 14.3-22.5 22.6-27.4 27.5-43.9	0.72 (0.30-1.72) 1.00 0.50 (0.21-1.20) 1.03 (0.74-1.43) 1.00 0.78 (0.54-1.14) 1.60 (0.85-3.00) 1.00 1.36 (0.75-2.47) 0.71 (0.51-1.00) 1.00 1.23 (0.93-1.65) 0.86 (0.57-1.29) 1.00 1.67 (1.24-2.25) 0.77 (0.61-0.98) 1.00 1.10 (0.89-1.36)	Age
Maskarinec G et al, 1998, 36SA	Hawaii Household Survey	1975-1980 – 1994, ~16.5 years follow-up	27678 men and women, age >30 years: 5011 deaths	Self- reported	Prevalent cancers excluded	No	BMI, men BMI, women	<19.6 19.6-21.3 21.4-24.8 24.9-29.2 29.3-32.5 ≥32.6 <18.5 18.5-19.9	1.33 (1.15-1.53) 1.11 (0.99-1.26) 1.00 1.08 (0.99-1.18) 1.45 (1.23-1.72) 1.63 (1.32-2.02) 1.42 (1.22-1.66) 1.00	Age, ethnicity, years of schooling, alcohol, smoking status and packs per day

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Yuan JM et al, 1998, China	Shanghai Cohort Study	1986-1989 – 1995, 6.7 years follow-up	18244 men, age 45-64 years: 1198 deaths 7803 never smokers: 389 deaths 10441 ever smokers: 809 deaths NA current smokers: 678 deaths	Self-reported	Excluded prevalent cancer	Sensitivity analyses stratified by <4 and ≥4 years follow-up	BMI BMI, never smokers BMI, ever smokers BMI, current smokers BMI, never smokers, <4 years follow-up BMI, never smokers, ≥4 years follow-up	<18.5 18.5-<21.0 21.0-<23.5 23.5-<26.0 ≥26.0 <18.5 18.5-<21.0 21.0-<23.5 23.5-<26.0 ≥26.0 <18.5 18.5-<21.0 21.0-<23.5 23.5-<26.0 ≥26.0 <18.5 18.5-<21.0 21.0-<23.5 23.5-<26.0 ≥26.0 <18.5 18.5-<21.0 21.0-<23.5 23.5-<26.0 ≥26.0 <18.5 18.5-<21.0 21.0-<23.5 23.5-<26.0 ≥26.0	1.16 (0.95-1.42) 1.06 (0.91-1.22) 1.00 1.02 (0.87-1.20) 1.04 (0.85-1.28) 1.73 (1.23-2.42) 1.09 (0.82-1.44) 1.00 1.11 (0.84-1.48) 1.48 (1.08-2.03) 0.96 (0.75-1.22) 1.03 (0.87-1.23) 1.00 0.98 (0.80-1.20) 0.83 (0.63-1.09) 0.89 (0.68-1.17) 1.01 (0.84-1.22) 1.00 0.98 (0.78-1.23) 0.78 (0.56-1.08) 1.86 (1.18-2.93) 1.04 (0.70-1.55) 1.00 1.03 (0.69-1.54) 1.18 (0.73-1.89) 1.58 (0.96-2.62) 1.13 (0.76-1.69) 1.00 1.20 (0.80-1.80) 1.81 (1.18-2.79)	Age, education, alcohol, smoking status, cigarettes per day, age at starting smoking
Seccarecchia F et al, 1998, Italy	The Italian Risk Factor and Life Expectancy Pooling Project	1978-1987-NA, 6 years follow-up	32741 men and 30305 women, age 20-69 years: 1373 deaths	Measured	No	Two first years of follow-up were excluded in sensitivity analyses	BMI, men, age 20-44 years, all subjects BMI, men, age 45-69 years	<20 20-24 25-29 30-34 ≥35 <20 20-24 25-29 30-34	1.00 0.80 (0.24-2.60) 0.69 (0.21-2.28) 0.33 (0.07-1.54) 0.64 (0.06-6.40) 1.62 (1.10-2.38) 1.12 (0.97-1.30) 1.00 1.04 (0.86-1.24)	Age, SBP, serum cholesterol, cigarette smoking

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							BMI, women, age 20-44 years	≥35 <20 20-24 25-29 30-34	1.30 (0.84-1.99) 1.83 (0.52-6.39) 1.32 (0.56-3.12) 1.00 1.18 (0.31-4.49)	
							BMI, women, age 45-69 years	≥35 <20 20-24 25-29 30-34	4.42 (1.28-15.28) 2.47 (1.39-4.37) 1.50 (1.05-2.14) 1.30 (0.93-1.81) 1.00	
							BMI, men, age 20-44 years, smokers excluded	≥35 <20 20-24 25-29 30-34	1.40 (0.88-2.22) Model did not converge	
							BMI, men, age 45-69 years	≥35 <20 20-24 25-29 30-34	1.00 0.39 (0.20-0.74) 0.37 (0.20-0.70) 0.42 (0.22-0.81) 0.47 (0.20-1.09)	
							BMI, women, age 20-44 years	≥35 <20 20-24 25-29 30-34	4.03 (0.84-19.26) 1.97 (0.61-6.40) 1.00 1.43 (0.26-7.89) 6.18 (1.32-29.04)	
							BMI, women, age 45-69 years	≥35 <20 20-24 25-29 30-34	2.19 (1.05-4.55) 1.56 (1.04-2.35) 1.39 (0.96-2.02) 1.00 1.61 (0.98-2.66)	
							BMI, men, age 20-44 years, early deaths excluded	≥35 <20 20-24 25-29 30-34	1.00 0.42 (0.13-1.47) 0.48 (0.14-1.65) 0.38 (0.08-1.64) 0.73 (0.07-7.34)	
							BMI, men, age 45-69 years	≥35 <20 20-24 25-29 30-34	1.00 0.73 (0.44-1.22) 0.69 (0.42-1.15) 0.78 (0.46-1.32) 0.95 (0.47-1.94)	
							BMI, women, age 20-44 years	≥35 <20 20-24	1.97 (0.44-8.85) 1.47 (0.50-4.27)	

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							BMI, women, age 45-69 years	25-29 30-34 ≥35	1.00 1.20 (0.23-6.24) 4.70 (1.06-20.97)	
							BMI, men, age 20-44 years, smokers and early deaths excluded	<20 20-24 25-29 30-34 ≥35	2.50 (1.26-4.98) 1.46 (0.95-2.24) 1.37 (0.92-2.03) 1.00 1.37 (0.78-2.39)	
							BMI, men, age 45-69 years	<20 20-24 25-29 30-34 ≥35	Model did not converge 1.00 0.31 (0.14-0.67) 0.33 (0.15-0.70) 0.41 (0.19-0.91) 0.32 (0.10-0.95)	
							BMI, women, age 20-44 years	<20 20-24 25-29 30-34 ≥35	7.34 (1.19-48.11) 2.73 (0.55-13.43) 1.00 1.34 (0.12-14.90) 10.14 (1.56-65.91)	
							BMI, women, age 45-69 years	<20 20-24 25-29 30-34 ≥35	1.92 (0.73-5.04) 1.63 (0.99-2.68) 1.55 (0.99-2.44) 1.00 1.75 (0.96-3.19)	
28 Rosengren A 29 et al, 1999, 30 Sweden	The Multifactor Primary Prevention Trial	1970-1973 – 1993, 19.7 years follow-up	6874 men, age 47-55 years: 493 deaths	Measured	Excluded prevalent MI	No	BMI	<20 20-22.5 22.5-25.0 25.0-27.5 27.5-30.0 >30.0	1.66 (1.31-2.12) 1.00 0.95 (0.82-1.10) 1.01 (0.87-1.17) 1.18 (1.01-1.39) 1.55 (1.29-1.85)	Age, smoking, physical activity
33 Allison DB et 34 al, 1999, USA	Framingham Heart Study	1948-1980, ~42 years follow-up	5166 men and women, age 28-62 years: 1964 deaths	Measured	No	No	BMI, all	<23 23-<25 25-<26 26-<27 27-<28 28-<29 29-<30 30-35 >35	1.12 (0.90-1.30) 1.00 0.96 (0.80-1.10) 1.11 (0.90-1.30) 1.04 (0.90-1.20) 1.08 (0.90-1.30) 1.41 (1.10-1.70) 1.60 (1.40-1.80) 1.94 (1.50-2.50)	Age, sex, smoking status

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							BMI, nonsmokers	<23 23-<25 25-<26 26-<27 27-<28 28-<29 29-<30 30-35 >35	1.26 (0.90-1.60) 1.00 1.09 (0.80-1.50) 1.08 (0.80-1.50) 1.16 (0.90-1.60) 1.35 (0.90-1.80) 1.65 (1.20-2.30) 1.52 (1.20-1.90) 1.96 (1.40-2.70)	
Allison DB et al, 1999, USA	Tecumseh Community Health Study	1959-1960 - 1985, ~25.5 years follow-up	3905 men and women, age 35-69 years: 708 deaths	Measured	No	No	BMI, all	<23 23-<25 25-<26 26-<27 27-<28 28-<29 29-<30 30-35 >35	1.20 (0.90-1.50) 1.00 1.18 (0.90-1.60) 0.89 (0.70-1.20) 1.12 (0.80-1.50) 0.92 (0.60-1.30) 0.94 (0.60-1.40) 1.45 (1.10-1.90) 1.87 (1.30-2.70)	Age, sex, smoking status
							BMI, nonsmokers	<23 23-<25 25-<26 26-<27 27-<28 28-<29 29-<30 30-35 >35	1.05 (0.70-1.50) 1.00 1.17 (0.70-1.80) 1.14 (0.70-1.90) 0.83 (0.50-1.40) 0.81 (0.50-1.40) 1.32 (0.70-2.60) 1.60 (1.10-2.40) 1.52 (0.90-2.60)	
Allison DB et al, 1999, USA	Cancer Prevention Study 1	1959-1960-1973, ~13.5 years follow-up	829636 men and women, age ≥30 years: 124229 deaths 314135 never smokers: NA	Self-reported	Prevalent poor health, myocardial infarction, stroke, or cancer	No	BMI, all	<23 23-<25 25-<26 26-<27 27-<28 28-<29 29-<30 30-35 >35	1.07 (1.00-1.10) 1.00 1.02 (1.00-1.04) 1.06 (1.00-1.10) 1.08 (1.00-1.10) 1.14 (1.10-1.20) 1.21 (1.20-1.30) 1.35 (1.30-1.40) 1.72 (1.60-1.80)	Age, sex, smoking status
							BMI, healthy never smokers	<23 23-<25 25-<26 26-<27 27-<28 28-<29 29-<30	1.05 (1.00-1.10) 1.00 1.04 (1.00-1.10) 1.08 (1.00-1.10) 1.10 (1.08-1.20) 1.16 (1.10-1.20) 1.20 (1.10-1.30)	

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5								30-35	1.36 (1.30-1.40)		
6								>35	1.76 (1.70-1.80)		
7	Ostbye T et	Canadian Study	1991 –	9995 men and	NA	No	No	BMI, women	<20	1.0	Age, marital status, residence, cognitive impairment, activities of daily living, vision, hearing impairment, Hachinski score, heart disease, respiratory disease, diabetes, smoking status
8	al, 1999,	of Health and	1996, 5	women, age				20-24.9	0.6 (0.3-1.2)		
9	Canada	Aging	years	≥65 years:				25.0-26.9	0.4 (0.2-1.0)		
10			follow-up	2975 deaths				≥27.0	0.3 (0.2-0.7)		
11								BMI, men	<20	1.0	
12								20-24.9	0.5 (0.1-1.9)		
13								25.0-26.9	0.4 (0.1-1.7)		
14								≥27.0	0.3 (0.1-1.2)		
15	Singh PN et	Adventist Health	1976-1988,	20346 never	Self-	Prevalent	Analyses	BMI, women, age 25-54	13.9-20.6	1.2 (0.6-2.6)	Age
16	al, 1999, USA	Study	12 years	smoking men	reported	coronary heart	stratified by	years, follow-up 1-6 years	20.7-27.4	1.0	
17			follow-up	and women,		disease, stroke	duration of	BMI, women, age 25-54	27.5-55.0	2.0 (1.0-3.7)	
18				age 25-84		or cancer	follow-up	years, follow-up 7-12 years	13.9-20.6	0.6 (0.2-1.2)	
19				years: 2364		excluded			20.7-27.4	1.0	
20				deaths				BMI, men, age 25-54 years,	27.5-55.0	1.9 (1.2-3.0)	
21								follow-up 1-6 years	15.0-22.3	2.0 (0.9-4.2)	
22									22.4-27.3	1.0	
23								BMI, men, age 25-54 years,	27.4-51.7	1.6 (0.7-3.6)	
24								follow-up 7-12 years	15.0-22.3	0.9 (0.5-1.9)	
25									22.4-27.3	1.0	
26								BMI, women, age 55-84	27.4-51.7	1.5 (0.8-2.6)	
27								years, follow-up 1-6 years	13.4-20.6	1.6 (1.2-2.1)	
28									20.7-22.4	1.4 (1.1-1.9)	
29								BMI, women, age 55-84	22.5-24.2	1.0	
30								years, follow-up 7-12 years	24.3-27.4	1.1 (0.9-1.5)	
31									27.5-65.6	1.6 (1.2-2.1)	
32								BMI, men, age 55-84	13.4-20.6	1.3 (1.1-1.6)	
33								years, follow-up 1-6 years	20.7-22.4	0.9 (0.7-1.2)	
34									22.5-24.2	1.0	
35								BMI, men, age 55-84 years,	24.3-27.4	1.1 (0.9-1.3)	
36								follow-up 1-6 years	27.5-65.6	1.5 (1.2-1.8)	
37									13.5-22.3	0.9 (0.6-1.4)	
38								BMI, men, age 55-84 years,	22.4-23.7	1.2 (0.8-1.7)	
39								follow-up 7-12 years	23.8-25.3	1.0	
									25.4-27.3	1.0 (0.6-1.4)	
									27.4-40.5	1.2 (0.8-1.8)	
								BMI, men, age 55-84 years,	13.5-22.3	1.3 (1.0-1.9)	
								follow-up 7-12 years	22.4-23.7	1.5 (1.1-2.0)	
									23.8-25.3	1.0	
									25.4-27.3	1.2 (0.9-1.7)	
									27.4-40.5	1.8 (1.3-2.5)	

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Stevens J et al, 2000, USA	Cancer Prevention Study-1	1959-1960 – 1971-1972, 11 years follow-up	57073 men and 240158 women, never smokers, age 30-70 years: 9498/24700 deaths (no of deaths from NEJM 1998;338:1-7)	Self-reported	Participants with heart disease, stroke or cancer were excluded	No	BMI, women BMI, men	18.5-24.9 25.0-29.9 >30.0 18.5-24.9 25.0-29.9 >30.0	1.00 1.19 (1.17-1.21) 1.58 (1.51-1.65) 1.00 1.19 (1.13-1.25) 1.58 (1.48-1.72)	Age, education, physical activity
Andersen LB et al, 2000, Denmark	The Copenhagen City Cohort Study, The Glostrup Population studies and the Copenhagen Male Study	1976-83 – 1994, 13.8 years follow-up	13375 women and 17265 men, age 20-93 years: 2881 /5668 deaths	Measured	No	No	BMI, women BMI, men	<20 20-25 25.01-27 27.01-30 >30 <20 20-25 25.01-27 27.01-30 >30	1.65 (1.46-1.87) 1.00 0.98 (0.59-1.11) 1.10 (0.98-1.23) 1.43 (1.28-1.59) 1.69 (1.48-1.73) 1.00 0.93 (0.87-1.00) 1.06 (0.98-1.13) 1.21 (1.11-1.32)	Age, SBP, serum cholesterol, TG, smoking status, education
Paik I et al, 2000, USA	Health Professionals Follow-up Study	1986-1996, 10 years follow-up	39756 men, age 40-75 years: 1972 deaths	Self-reported	Participants with prevalent myocardial infarction, angina, coronary artery bypass grafting or angioplasty, stroke, transient cerebral ischemia, peripheral venous thrombosis, intermittent claudication, pulmonary embolus, paroxysmal atrial tachycardia	Sensitivity analyses excluding first 4 years of follow-up	BMI, all BMI, subjects without weight loss of ≥10 pounds in the past 5 years, 1986-1996 BMI, subjects without weight loss of ≥10 pounds in the past 5 years, 1990-1996 BMI, subjects without weight loss of ≥10 pounds in the past 5 years, age <65 years	<21 21.0-22.9 23-24.9 25-26.9 27-29.9 ≥30 <21 21.0-22.9 23-24.9 25-26.9 27-29.9 ≥30 <21 21.0-22.9 23-24.9 25-26.9 27-29.9 ≥30 <23.0 23-24.9 25-26.9 27-29.9 ≥30	1.47 (1.18-1.83) 1.06 (0.91-1.23) 1.00 1.07 (0.94-1.21) 1.17 (1.02-1.34) 1.50 (1.27-1.77) 1.35 (1.06-1.73) 1.07 (0.91-1.26) 1.00 1.06 (0.93-1.22) 1.15 (0.99-1.34) 1.53 (1.26-1.82) 1.28 (0.88-1.85) 0.99 (0.76-1.28) 1.00 1.03 (0.83-1.26) 1.16 (0.92-1.45) 1.49 (1.13-1.96) 1.00 1.21 (0.88-1.65) 1.19 (0.87-1.63) 1.39 (1.00-1.93) 1.97 (1.36-2.84)	Age, smoking status, cigarettes per day, FH – MI or colon cancer before age 60 years, profession, marital status, height, alcohol, vitamin A, vitamin E, dietary fiber

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5 6 7 8 9 10 11 12					and other heart-rhythm disturbances, cancer, chronic renal failure, and chronic pulmonary disease		BMI, subjects without weight loss of ≥ 10 pounds in the past 5 years, age ≥ 65 years	<23.0 23-24.9 25-26.9 27-29.9 ≥ 30	1.00 0.69 (0.48-0.99) 0.75 (0.53-1.08) 0.83 (0.56-1.23) 0.85 (0.49-1.46)		
13 14 15 16 17 18 19	Iolsom AR et al, 2000, USA	Iowa Women's Health Study	1986 - 1997, 11-12 years	31702 women, age 55-69 years: 2476 deaths	Self-reported	Excluded prevalent cancer, heart disease, and diabetes	No	BMI	<22.80 22.80-24.86 24.87-27.05 27.06-30.20 ≥ 30.21	1.00 0.76 (0.7-0.9) 0.74 (0.7-0.8) 0.71 (0.6-0.8) 0.91 (0.8-1.0)	Age, education, physical activity, alcohol, smoking status, age at 1st live birth, estrogen use, vitamin use, energy, whole grain, fruit and vegetables, fish, red meat, Keys score, high blood pressure
20 21 22	Portes C et al, 2000, Italy	Elderly in Rome	1993-1998, 5 years follow-up	162 men and women, age ≥ 65 years: 53 deaths	Measured	Excluded subjects with severe disability	No	BMI	21.0 21.1-30.0 > 30	1.00 0.62 (0.30-1.31) 0.57 (0.35-1.42)	Age, sex, education, smoking status, cognitive function, chronic diseases
23 24 25 26 27 28 29	Jaapanen-Niemi N et al, 2000, Finland	Three Northeastern Municipalities in Finland	1980-1996, 16 years follow-up	1090 men and 1122 women, age 35-63 years: 208/87 deaths	Self-reported	Subjects with BMI <20, or disease and symptoms that prevented participation in physical activity	No	BMI, men BMI, women	20.0-24.9 25.0-29.9 ≥ 30.0 20.0-24.9 25.0-29.9 ≥ 30.0	1.00 0.87 (0.64-1.19) 1.06 (0.67-1.69) 1.00 0.87 (0.52-1.46) 1.35 (0.76-2.41)	Age, employment status, marital status, perceived health status, smoking status, alcohol
30 31 32 33 34 35	Hara M et al, 2000, Japan	Saga Prefecture Japan	1983-1997, 14 years follow-up	2121 men, age 40-69 years: 309 deaths	Self-reported	No	No	BMI, men BMI, women	<20 20-<22 22-<24 ≥ 24 <20 20-<22 22-<24 ≥ 24	1.00 0.82 (0.51-1.32) 0.80 (0.41-1.59) 0.54 (0.19-1.54) 1.00 0.56 (0.25-1.25) 0.86 (0.32-2.32) 0.73 (0.16-3.24)	Age, health status, smoking status, physical activity, balance of daily food intake
36 37 38 39 40	Lawbridge J et al, 2000, USA	Alameda County Study	1965-1994, 31 years follow-up	6253 men and women, age 21-75 years: 1295 deaths	Self-reported	No	First year of follow-up excluded	BMI, all BMI, men	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥ 35.0 <18.5	1.84 (1.41-2.39) 1.00 0.82 (0.72-0.92) 0.80 (0.63-1.01) 1.36 (0.93-2.00) 1.40 (0.78-2.50)	Age, sex, race/ethnicity, education, chronic bronchitis, cancer, cigarette smoking, physical activity

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							BMI, women	18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0 <18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.00 0.77 (0.65-0.91) 1.09 (0.80-1.50) 1.85 (0.87-3.93) 2.03 (1.51-2.74) 1.00 0.89 (0.74-1.09) 0.58 (0.41-0.83) 1.19 (0.75-1.87)	
Visser TL et al, 2000, Europe	Seven Countries Study	1960-75 1970-85 15 years follow-up	7985 men, age 40-59 years: 3777 deaths 1870 never smokers: 222 deaths 1153 former smokers: 189 deaths 4550 current smokers: 936 deaths	Measured	No	First 5 years of follow-up excluded	BMI, 1960-75, never smokers BMI, ex-smokers BMI, current smokers BMI, 1970-85, never smokers BMI, ex-smokers BMI, current smokers	<18.5 18.5-25 25-30 ≥30 <18.5 18.5-25 25-30 ≥30 <18.5 18.5-25 25-30 ≥30 <18.5 18.5-25 25-30 ≥30 <18.5 18.5-25 25-30 ≥30	2.1 (0.8-5.7) 1.0 1.3 (0.9-1.7) 1.8 (1.2-2.8) 2.0 (0.5-8.2) 1.0 1.0 (0.7-1.3) 1.3 (0.8-2.1) 2.1 (1.5-2.8) 1.0 0.9 (0.8-1.1) 1.0 (0.7-1.4) 2.3 (1.0-5.3) 1.0 1.0 (0.8-1.2) 1.4 (1.0-1.9) 2.5 (1.3-4.8) 1.0 1.1 (0.9-1.4) 1.4 (1.0-1.8) 1.5 (1.1-2.1) 1.0 1.0 (0.9-1.1) 1.0 (0.8-1.3)	Age, study center
Visser TL et al, 2001, Netherlands	Rotterdam study	1990-93 – 1998, 5.4 years follow-up	6296 men and women, age 55-102 years: 479 deaths 2414 never smokers: 372 deaths 2573 former	Measured	No	No	BMI, men, never smokers BMI, ex smokers	<23.1 23.1-24.5 24.6-26.1 26.2-27.8 ≥27.9 <23.1 23.1-24.5 24.6-26.1 26.2-27.8 ≥27.9	1.0 (0.5-1.9) 1.0 1.0 (0.5-1.9) 0.9 (0.5-1.8) 0.9 (0.4-1.8) 1.1 (0.8-1.6) 1.0 0.7 (0.5-1.1) 0.9 (0.6-1.4) 0.8 (0.6-1.2)	Age

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			smokers: 374 deaths 1309 current smokers: 210 deaths				BMI, current smokers	<23.1 23.1-24.5 24.6-26.1 26.2-27.8 ≥27.9	1.3 (0.8-2.1) 1.0 0.8 (0.4-1.3) 0.9 (0.5-1.6) 0.6 (0.3-1.1)	
							BMI, women, never smokers	<23.6 23.6-<25.5 25.5-<27.5 27.5-<30.0 ≥30.0	1.0 (0.7-1.5) 1.0 0.8 (0.5-1.2) 0.8 (0.6-1.2) 0.8 (0.5-1.1)	
							BMI, ex smokers	<23.6 23.6-<25.5 25.5-<27.5 27.5-<30.0 ≥30.0	1.3 (0.7-2.3) 1.0 1.2 (0.6-2.2) 1.3 (0.7-2.3) 1.0 (0.5-1.9)	
							BMI, current smokers	<23.6 23.6-<25.5 25.5-<27.5 27.5-<30.0 ≥30.0	1.7 (0.8-3.7) 1.0 1.4 (0.6-3.0) 1.0 (0.5-2.4) 0.9 (0.4-2.1)	
Grabowski et al, 2001, USA	Longitudinal Study of Aging	1984-1991, 8 years follow-up	7048 men and women, age ≥70 years: 2870 deaths	Self- reported	Prevalent cancer, diabetes, heart disease excluded in sensitivity analyses	Excluding first 2 years of follow-up in sensitivity analyses	BMI	17.8 23.8 31.8	1.46 (1.30-1.64) 1.00 0.86 (0.77-0.97)	Age, number of doctor visits, number of hospital bed days, number of short-stay hospital episodes, number of functional limitations, residential stability, urbanization, gender, race, private health insurance, region of the country, ever in a nursing home, education, self-rated health, lives alone, need for proxy, married, Medicaid
							BMI, excluding first 2 years	17.8 23.8 31.8	1.38 (1.20-1.57) 1.00 0.93 (0.82-1.06)	
							BMI, excluding prevalent cancer, diabetes or heart disease	17.8 23.8 31.8	1.40 (1.13-1.74) 1.00 0.67 (0.51-0.88)	
Katzmarzyk et al, 2001, Canada	Canada Fitness Survey	1981-1993, 12.4 years follow-up	10725 men and women, age 20-69 years: 593 deaths	Measured	No	Sensitivity analysis excluding first 2 years of follow-up (not reported)	BMI	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.63 (0.93-2.85) 1.00 1.16 (0.96-1.39) 1.25 (0.96-1.65) 2.96 (1.39-6.29)	Age, smoking status, alcohol
							BMI, men	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	2.29 (1.06-4.93) 1.00 1.08 (0.86-1.36) 1.00 (0.68-1.47) 2.52 (0.80-7.99)	

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							BMI, women	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.24 (0.54-2.83) 1.00 1.24 (0.93-1.67) 1.59 (1.08-2.34) 3.13 (1.15-8.52)	
Nivert M et al, 2001, USA	Life Insurance Applicants	1975-1998 – 1999, 4.7 years follow-up	356926 men and women, age 18-≥60 years: 4105 deaths	NA	No	No	BMI, all	<19 19-21 22-24 25-27 28-30 31-33 ≥34	1.21 1.09 1.10 1.00 1.13 1.22 1.19	Age, sex, smoking status, duration of follow-up
							BMI, smokers	19-21 22-24 25-27 28-30 ≥31	1.16 1.22 1.00 1.11 1.32	
							BMI, non-smokers	<22 22-24 25-27 28-30 31-33 ≥34	1.16 1.00 1.08 1.01 1.45 1.48	
Hey DK et al, 2001, Sweden	Geriatric Medicine Department, Gothenburg	1971-1981 – NA, 15 years follow-up	2628 men and women, age 70 years: 781/552 deaths	Measured	Prevalent cancers were excluded	Excluding first 5 years in sensitivity analyses	BMI, men	14.0-22.6 22.7-24.6 24.7-26.4 26.5-28.5 28.6-39.2	1.20 (0.96-1.51) 1.07 (0.85-1.34) 1.00 1.01 (0.81-1.26) 1.19 (0.95-1.49)	Birth cohort, smoking
							BMI, women	14.1-22.5 22.6-24.5 24.6-26.5 26.6-29.2 29.3-39.8	1.49 (1.14-1.96) 1.16 (0.88-1.53) 1.00 1.16 (0.88-1.52) 1.25 (0.95-1.64)	
							BMI, men, excluding first 5 years	14.0-22.6 22.7-24.6 24.7-26.4 26.5-28.5 28.6-39.2	1.06 (0.79-1.42) 1.09 (0.82-1.45) 1.00 1.07 (0.81-1.42) 1.22 (0.92-1.60)	
							BMI, women, excluding first 5 years	14.1-22.5 22.6-24.5 24.6-26.5 26.6-29.2 29.3-39.8	1.52 (1.06-2.98) 1.35 (0.94-1.93) 1.00 1.29 (0.90-1.85) 1.48 (1.03-2.12)	

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							BMI, men, non-smokers	14.0-22.6 22.7-24.6 24.7-26.4 26.5-28.5 28.6-39.2	1.15 (0.71-1.86) 1.09 (0.70-1.71) 1.00 0.96 (0.63-1.47) 1.30 (0.87-1.95)	
							BMI, women, non-smokers	14.1-22.5 22.6-24.5 24.6-26.5 26.6-29.2 29.3-39.8	1.58 (1.15-2.16) 1.04 (0.75-1.44) 1.00 1.12 (0.82-1.53) 1.22 (0.90-1.65)	
							BMI, men, non-smokers, excluding first 5 years	14.0-22.6 22.7-24.6 24.7-26.4 26.5-28.5 28.6-39.2	0.91 (0.53-1.58) 0.80 (0.47-1.35) 1.00 0.72 (0.45-1.18) 1.11 (0.71-1.74)	
							BMI, women, non-smokers, excluding first 5 years	14.1-22.5 22.6-24.5 24.6-26.5 26.6-29.2 29.3-39.8	1.50 (1.03-2.17) 1.14 (0.79-1.65) 1.00 1.24 (0.87-1.77) 1.42 (1.00-2.00)	
Wannamethee SG et al, 2001, United Kingdom	British Regional Heart Study	1978-1980 – 1997, 13.8 years follow-up	7065 men, age 40-59 years: 1457 deaths 1709 non-smokers: 620 deaths 722 recent ex-smokers: 199 deaths 2242 current smokers: 648 deaths	Measured	Subjects who had lost weight were excluded in sensitivity analyses	No	BMI, non-smokers (includes long-term ex-smokers)	<22 22-<24 24-<26 26-<28 ≥28	1.00 1.04 (0.71-1.53) 1.25 (0.87-1.79) 1.02 (0.71-1.48) 1.31 (0.91-1.88)	Age, social class, alcohol intake, physical activity, FEV1, former smoking/number of cigarettes among smokers
							BMI, recent ex-smokers	<22 22-<24 24-<26 26-<28 ≥28	1.00 0.66 (0.36-1.21) 0.63 (0.34-1.16) 0.52 (0.28-0.95) 0.65 (0.36-1.17)	
							BMI, current smokers	<22 22-<24 24-<26 26-<28 ≥28	1.00 0.85 (0.65-1.10) 0.92 (0.71-1.18) 0.96 (0.74-1.26) 0.97 (0.74-1.27)	
							BMI, non-smokers, excluding men who lost weight	<22 22-<24 24-<26 26-<28 ≥28	1.00 1.30 (0.80-2.13) 1.56 (0.98-2.48) 1.35 (0.85-2.16) 1.61 (1.01-2.56)	
							BMI, recent ex-smokers	<22 22-<24 24-<26	1.00 0.55 (0.28-1.08) 0.56 (0.29-1.09)	

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							BMI, current smokers	26-<28 ≥28 <22 22-<24 24-<26 26-<28 ≥28	0.52 (0.27-0.99) 0.63 (0.34-1.19) 1.00 0.90 (0.66-1.22) 0.99 (0.74-1.32) 1.08 (0.79-1.46) 1.02 (0.75-1.38)	
Osler M et al, 2001, Denmark	Danish MONICA 1-3 surveys	1982-1998, 15 years follow-up	2855 men and 2755 women, age 30-70 years: 376/210 deaths	Measured	No	No	BMI, men BMI, women	<20 20-24.9 25-29.9 >30 <20 20-24.9 25-29.9 >30	1.67 (1.04-2.67) 1.00 0.91 (0.72-1.14) 1.14 (0.83-1.57) 1.40 (0.90-2.17) 1.00 1.07 (0.76-1.50) 1.52 (1.01-2.26)	Age, prudent diet score, self-rated health, physical activity, smoking status, vocational education
Barbagallo M et al, 2001, Italy	The 'Ventimiglia di Sicilia' project	1989-1997, 8 years follow-up	835 men and women, age 20-69 years: 37 deaths	Measured	No	No	BMI	<27 27-29.99 ≥30.0	1.00 1.64 (0.65-4.15) 2.45 (1.03-5.87)	Age, sex
Harrell SW et al, 2002, USA	Aerobics Center Longitudinal Study	1970-1996, 11.4 years follow-up	9925 women, mean age 42.9 years: 195 deaths	Measured	No	No	BMI	18.5-24.99 25.0-29.99 ≥30.0	1.00 0.84 (0.56-1.26) 1.21 (0.71-2.05)	Age, smoking, baseline health status, cardiorespiratory fitness
Stevens J et al, 2002, USA	Lipid Research Clinics Study	1972-76 – 1998, ~24 years follow-up	2506 women, and 2860 men, mean age 46.6/45.1 years: 484/682 deaths	Measured	Prevalent coronary heart disease, stroke	Excluded first year of follow-up	BMI, women BMI, men	18.7-21.0 21.1-22.6 22.7-24.4 24.5-27.6 27.7-42.6 19.5-23.6 23.7-25.2 25.3-26.7 26.8-28.6 28.7-39.4	1.00 1.06 (0.74-1.51) 0.99 (0.71-1.38) 0.94 (0.68-1.30) 1.21 (0.87-1.67) 1.00 1.00 (0.78-1.29) 1.00 (0.77-1.31) 0.97 (0.75-1.26) 1.12 (0.88-1.44)	Age, education, smoking status, cigarettes per day, alcohol, Keys score, fitness
Sugane S et al, 2002, Japan	Japan Public Health-Center-based Prospective Study 1	1990-1999, 10 years follow-up	19500 men and 21315 women, age 40-59 years: 943/483 deaths 8655 and 19749 never smokers: 592	Self-reported and measured	Excluded prevalent cancer, cerebro-vascular disease, myocardial infarction, chronic liver disease	Sensitivity analyses excluding first 5 years of follow-up	BMI, men BMI, excluding first 5 years	14.0-18.9 19.0-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 30.0-39.9 14.0-18.9 19.0-20.9 21.0-22.9	2.26 (1.66-3.08) 1.57 (1.25-1.98) 1.33 (1.09-1.63) 1.00 1.14 (0.90-1.45) 1.38 (1.03-1.83) 1.97 (1.27-3.06) 2.35 (1.58-3.49) 1.66 (1.24-2.22) 1.30 (1.01-1.69)	Age, cigarette smoking status and pack-years, study area, alcohol, education, sports and physical exercise at leisure-time, weight change since 20 years old

deaths						23.0-24.9	1.00
6686 former smokers (men): 175 deaths						25.0-26.9	1.19 (0.90-1.61)
						27.0-29.9	1.19 (0.81-1.73)
						30.0-39.9	1.51 (0.81-2.82)
					BMI, excluding subjects reporting weight loss of ≥ 10 kg since 20 years old	14.0-18.9	2.41 (1.63-3.55)
						19.0-20.9	1.52 (1.18-1.96)
						21.0-22.9	1.26 (1.01-1.56)
10400 current smokers (men): 592 deaths						23.0-24.9	1.00
						25.0-26.9	1.08 (0.84-1.38)
						27.0-29.9	1.34 (1.00-1.80)
						30.0-39.9	1.80 (1.14-2.85)
					BMI, women	14.0-18.9	1.94 (1.30-2.89)
						19.0-20.9	0.98 (0.69-1.40)
						21.0-22.9	0.99 (0.74-1.32)
						23.0-24.9	1.00
						25.0-26.9	1.30 (0.96-1.76)
						27.0-29.9	1.33 (0.94-1.88)
						30.0-39.9	1.91 (1.22-2.99)
					BMI, excluding first 5 years	14.0-18.9	1.46 (0.87-2.46)
						19.0-20.9	0.91 (0.59-1.39)
						21.0-22.9	0.82 (0.57-1.17)
						23.0-24.9	1.00
						25.0-26.9	1.13 (0.78-1.64)
						27.0-29.9	0.90 (0.57-1.44)
						30.0-39.9	1.72 (0.99-2.98)
					BMI, excluding subjects reporting weight loss of ≥ 10 kg since 20 years old	14.0-18.9	1.60 (0.89-2.88)
						19.0-20.9	1.00 (0.66-1.50)
						21.0-22.9	0.94 (0.68-1.31)
						23.0-24.9	1.00
						25.0-26.9	1.34 (0.98-1.84)
						27.0-29.9	1.35 (0.95-1.92)
						30.0-39.9	1.91 (1.21-3.03)
					BMI, men, never smokers	14.0-18.9	2.82 (1.33-5.95)
						19.0-20.9	1.17 (0.63-2.18)
						21.0-22.9	1.62 (1.01-2.58)
						23.0-24.9	1.00
						25.0-26.9	1.17 (0.69-1.99)
						27.0-29.9	1.63 (0.92-2.91)
						30.0-39.9	1.47 (0.51-4.21)
					BMI, men, past smokers	14.0-18.9	2.00 (0.80-5.01)
						19.0-20.9	2.93 (1.75-4.92)
						21.0-22.9	1.60 (0.99-2.58)
						23.0-24.9	1.00

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							BMI, men, current smokers	25.0-26.9 27.0-29.9 30.0-39.9 14.0-18.9 19.0-20.9 21.0-22.9 23.0-24.9	1.09 (0.63-1.89) 1.57 (0.86-2.86) 1.50 (0.52-4.27) 2.11 (1.46-3.04) 1.37 (1.04-1.81) 1.20 (0.94-1.55) 1.00	
							BMI, women, never smokers	25.0-26.9 27.0-29.9 30.0-39.9 14.0-18.9 19.0-20.9 21.0-22.9 23.0-24.9	1.14 (0.84-1.54) 1.19 (0.80-1.78) 2.31 (1.34-3.99) 2.11 (1.37-3.23) 0.99 (0.68-1.45) 1.02 (0.75-1.39) 1.00	
								25.0-26.9 27.0-29.9 30.0-39.9	1.33 (0.97-1.82) 1.23 (0.84-1.79) 1.79 (1.08-2.96)	
Miyazaki M et al, 2002, Japan	Four towns, western Japan	1987-1990 – 1995- 1998, ~8 years follow-up	7301 men and 8825 women, age 40-69 years: 502 / 287 deaths 1604 and 7711 never smokers: 293 deaths 5697 and 1114 ever smokers: 496 deaths	Self- reported	No	First two years of follow-up excluded in sensitivity analyses (risk estimates not reported)	BMI, men	<20 20-<22 22-<24 24-<26 ≥26	1.78 (1.38-2.29) 1.35 (1.06-1.73) 1.00 0.91 (0.67-1.22) 1.11 (0.79-1.56)	Age, smoking
							BMI, men, never smokers	<20 20-<22 22-<24 24-<26 ≥26	3.30 (1.65-6.60) 2.10 (1.05-4.20) 1.00 0.96 (0.41-2.25) 1.37 (0.57-3.31)	
							BMI, women	<20 20-<22 22-<24 24-<26 ≥26	1.92 (1.35-2.72) 1.22 (0.85-1.76) 1.00 1.26 (0.86-1.84) 1.56 (1.05-2.31)	
							BMI, women, never smokers	<20 20-<22 22-<24 24-<26 ≥26	2.33 (1.57-3.45) 1.27 (0.81-1.84) 1.00 1.27 (0.82-1.96) 1.57 (0.99-2.50)	
							BMI, men, ever smokers	<20 20-<22 22-<24 24-<26 ≥26	1.61 (1.23-2.11) 1.27 (0.97-1.65) 1.00 0.91 (0.66-1.25) 1.09 (0.75-1.55)	
							BMI, women, ever smokers	<20	0.93 (0.42-2.04)	

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								20-<22 22-<24 24-<26 ≥26	1.25 (0.59-2.62) 1.00 1.22 (0.56-2.67) 1.46 (0.68-3.11)	
Wang Z et al, 2002, Australia	Aboriginal renal disease screening program	1992-1995 - 2001, 7.4 years follow-up	744 aboriginal adults, age 20- 77 years: 87 deaths	Measured	No	Excluded first 4 years of follow-up	BMI BMI, smoker and drinker BMI, non-smoker and non- drinkers BMI, either smoker or drinker BMI, excluding 1 st 4 years of follow-up	18.1 21.7 24.7 30.1 18.1 21.7 24.7 30.1 18.1 21.7 24.7 30.1 18.1 21.7 24.7 30.1 18.1 21.7 24.7 30.1	1.00 0.92 (0.54-1.59) 0.71 (0.40-1.26) 0.38 (0.19-0.75) 1.00 1.08 (0.53-2.20) 0.80 (0.36-1.74) 0.42 (0.14-1.27) 1.00 0.41 (0.08-2.02) 0.12 (0.02-0.86) 0.08 (0.01-0.52) 1.00 0.74 (0.25-2.20) 0.90 (0.33-2.43) 0.48 (0.16-1.45) 1.00 1.13 (0.53-2.40) 0.93 (0.42-2.07) 0.55 (0.22-1.37)	Age, sex, smoking status, drinking
Miller MD et 2002, Australia	The Australian Longitudinal Study of Ageing	1992-2000, 8 years follow-up	1396 men and women, age ≥70 years: 579 deaths	Measured	No	No	BMI	<20 20-25 >25-30 >30	1.36 (0.94-1.99) 1.00 0.99 (0.82-1.21) 1.13 (0.86-1.49)	Age, sex, marital status, self- rated health, smoking status, comorbid conditions, presence of depression, cognitive performance, assistance required with ADL, corrected arm muscle area
James GW et 2002, USA	Systolic Hypertension in the Elderly Program	1984-1990, 4.5 years follow-up	4485 men and women, age ≥60 years: 351 deaths	Measured	No	First 2 years of follow-up excluded in sensitivity analyses	BMI	<23.6 23.6-<28.0 28.0-<31.0 ≥31.0	1.35 (1.00-1.82) 1.00 1.02 (0.72-1.45) 1.15 (0.76-1.76)	Age, gender, current smoking status, presence of myocardial infarction, diabetes, stroke
Engeland A et 2003, Norway	Norwegian Tuberculosis Screening Program and Norwegian Health Surveys (Nord-	1963-2000 - 2001, 22.1 years follow-up	1977953 men and women, age 20-74 years: 722606 deaths 111846	Measured	No	Sensitivity analysis excluding first 4 years of follow-up (results did not change)	BMI, men	<17.50 17.50-18.49 18.50-19.49 19.50-20.49 20.50-21.49 21.50-22.49 22.50-23.49	1.74 (1.62-1.87) 1.43 (1.37-1.49) 1.29 (1.25-1.32) 1.18 (1.15-1.20) 1.09 (1.07-1.10) 1.02 (1.01-1.04) 1.00	Age, birth cohort, height

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Trøndelag Health Study - HUNT-1 & 2, Hordaland Health Study - HUSK, The Norwegian Counties Study - Finmark, Sogn og Fjordane, Oppland, the Study of 40-year Olds, Oslo Study 1 and 2)	(estimated) never smokers: 3776/ 4783 deaths (m/w)							23.50-24.99 25.00-27.49 27.50-29.99 30.00-32.49 32.50-34.99 35.00-37.49 37.50-39.99 ≥40 BMI, women <17.50 17.50-18.49 18.50-19.49 19.50-20.49 20.50-21.49 21.50-22.49 22.50-23.49 23.50-24.99 25.00-27.49 27.50-29.99 30.00-32.49 32.50-34.99 35.00-37.49 37.50-39.99 ≥40 BMI, men, never smokers <17.50 17.50-18.49 18.50-19.49 19.50-20.49 20.50-21.49 21.50-22.49 22.50-23.49 23.50-24.99 25.00-27.49 27.50-29.99 30.00-32.49 32.50-34.99 35.00-37.49 37.50-39.99 ≥40 BMI, women, never smokers <17.50 17.50-18.49 18.50-19.49 19.50-20.49 20.50-21.49	1.00 (0.99-1.01) 1.04 (1.02-1.05) 1.13 (1.12-1.15) 1.29 (1.27-1.31) 1.47 (1.43-1.51) 1.74 (1.66-1.83) 1.90 (1.74-2.08) 2.53 (2.24-2.85) 1.96 (1.87-2.06) 1.53 (1.47-1.59) 1.32 (1.29-1.36) 1.17 (1.14-1.20) 1.08 (1.06-1.11) 1.03 (1.01-1.05) 1.00 0.98 (0.97-1.00) 1.01 (0.99-1.02) 1.08 (1.06-1.09) 1.16 (1.14-1.18) 1.28 (1.25-1.30) 1.40 (1.37-1.43) 1.62 (1.57-1.67) 1.93 (1.86-2.00) 2.06 (0.91-4.63) 1.23 (0.71-2.15) 1.21 (0.85-1.73) 0.96 (0.73-1.27) 1.04 (0.86-1.26) 0.90 (0.77-1.07) 1.00 1.03 (0.91-1.17) 1.11 (0.98-1.25) 1.34 (1.18-1.53) 1.58 (1.35-1.85) 2.29 (1.85-2.83) 1.47 (1.01-2.15) 3.45 (2.09-5.69) 3.30 (1.93-5.64) 2.39 (1.65-3.45) 1.57 (1.13-2.18) 1.28 (1.02-1.62) 0.98 (0.81-1.18) 1.00 (0.86-1.18)	
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6								22.50-23.49	1.00		
7								23.50-24.99	0.91 (0.80-1.03)		
8								25.00-27.49	0.97 (0.86-1.09)		
9								27.50-29.99	1.06 (0.94-1.20)		
10								30.00-32.49	1.19 (1.04-1.36)		
11								32.50-34.99	1.23 (1.05-1.44)		
12								35.00-37.49	1.45 (1.21-1.75)		
13								37.50-39.99	1.61 (1.26-2.05)		
14								≥40	2.47 (1.96-3.11)		
15	Rubin F et al, 2003, Israel	Israeli Population Registry	1982-2000, 18 years follow-up	632 men and women, age 41-70 years: 151 deaths	Measured	Excluded participant with diabetes or other chronic disease	No	BMI	<25 25-29.9 ≥30.0	1.00 0.76 (0.53-1.08) 1.02 (0.61-1.68)	Age, ethnicity, sex, smoking, SBP, physical activity, fatty acids, E% from fat, cholesterol, dietary fiber
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18	Thorogood M et al, 2003, United Kingdom	Oxford Vegetarian Study	1980-1984 – 2000, 18 years follow-up	10858 men and women, age 16-89 years: 1134 deaths	Self-reported	Prevalent cancers excluded	First 5 years of follow-up excluded in sensitivity analyses (results not altered, but risk estimates not reported)	BMI	<18 18-<20 20-<22 22-<24 24-<26 26-<28 ≥28	2.07 (1.58-2.70) 1.24 (1.02-1.50) 1.00 1.12 (0.94-1.33) 1.29 (1.07-1.56) 1.15 (0.90-1.47) 1.28 (0.97-1.70)	Age, sex, smoking status and cigarettes per day, pre-existing cardiovascular disease or diabetes
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26	Rosegood V et al, 2003, Bangladesh	Determinants of Natural Fertility Study	1975-79 - 1993, 19 years follow-up	1888 women, mean age 27.9 years: 102 deaths	Measured	No	No	BMI	<17.3 17.3-18.41 18.42-19.61 ≥19.62	1.00 0.82 (0.50-1.37) 0.46 (0.25-0.87) 0.89 (0.52-1.52)	Age, education
27											
28											
29	Kuriyama S et al, 2004, Japan	Miyagi Cohort Study	1990-2001, 10.4 years follow-up	39610 men and women, age 40-64 years: 1688 deaths	Self-reported	Prevalent cancers, stroke, myocardial infarction, kidney disease, and liver disease excluded	Excluded first 3 years of follow-up in sensitivity analyses	BMI, men	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0	2.05 (1.53-2.74) 1.10 (0.92-1.31) 0.97 (0.83-1.15) 1.00 0.92 (0.76-1.12) 1.01 (0.80-1.29) 1.00 (0.62-1.60)	Age, weight loss of 5 kg or more since age 20 years old, marital status, cigarette smoking status and cigarettes per day, alcohol, walking time
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35								BMI, women	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0	1.76 (1.16-2.67) 0.88 (0.66-1.17) 0.92 (0.72-1.17) 1.00 0.91 (0.70-1.17) 0.95 (0.70-1.27) 1.65 (1.13-2.40)	
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							BMI, men, first 3 years of follow-up excluded	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0	2.06 (1.49-2.84) 1.12 (0.92-1.36) 0.98 (0.82-1.17) 1.00 0.96 (0.77-1.18) 1.05 (0.81-1.36) 0.85 (0.49-1.49)	
							BMI, women, first 3 years of follow-up excluded	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0	1.83 (1.17-2.88) 0.82 (0.60-1.14) 0.92 (0.70-1.19) 1.00 1.02 (0.78-1.34) 0.93 (0.67-1.28) 1.64 (1.09-2.49)	
Stevens J et al, 2004, Russia	Lipid Research Clinics Study - Russia	1972-77 – 1995, ~20.5 years follow-up	1359 Russian men, age 40-59 years: 211 deaths	Measured	Subjects with coronary heart disease, stroke, and BMI <18.5 were excluded	First year of follow-up was excluded	BMI	18.6-22.8 22.9-24.8 24.9-26.5 26.6-28.5 28.6-37.4	1.00 0.90 (0.56-1.44) 1.19 (0.74-1.92) 0.88 (0.53-1.44) 0.88 (0.55-1.41)	Age, smoking status and cigarettes per day, education, alcohol, Keys score
Sundquist K et al, 2004, Sweden	Swedish Annual Level-of-Living Survey	1988-89 – 2000, 12 years follow-up	3206 men and women, age 65-≥96 years: 881/925 deaths	Self-reported	No	No	BMI	≤18.5 18.6-25.0 25.0-30.0 30.0	1.45 (1.16-1.81) 1.00 0.87 (0.78-0.96) 1.09 (0.91-1.30)	Age, sex, smoking status, physical activity, education
Baru S et al, 2004, Netherlands	Diagnostisch Onderzoek Mamma-carcinoom	1974-1977 – 1996, 17 years follow-up	8100 women, age 50-66 years: 1269 deaths	Measured	Prevalent medication use for hypertension, cardiovascular disease, or diabetes, or being on a salt-free or diabetic diet	No	BMI	21.6 24.4 26.5 30.5	1.0 0.9 (0.8-1.1) 1.1 (0.9-1.2) 1.4 (1.2-1.6)	Age, smoking status and cigarettes per day, weight change status within a year
Hu FB et al, 2004, USA	Nurses' Health Study	1976 – 2000, 24 years follow-up	116564 women, age 30-55 years: 10282 deaths 51080 never smokers: 3262	Self-reported (validated)	Prevalent cardiovascular disease and cancer excluded	No	BMI, all women	<21.0 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 30.0-32.9 33.0-34.9 35.0-39.9	1.00 0.91 (0.86-0.97) 0.92 (0.87-0.98) 0.99 (0.93-1.07) 1.26 (1.18-1.36) 1.57 (1.44-1.71) 1.73 (1.52-1.97) 2.02 (1.79-2.29)	Age, smoking status and cigarettes per day, PH – CHD, menopausal status and hormone use, alcohol, physical activity

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			deaths				BMI, women who never smoked	≥ 40.0 < 21.0 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 30.0-32.9 33.0-34.9 35.0-39.9 ≥ 40.0 < 21.0 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 30.0-32.9 33.0-34.9 35.0-39.9 ≥ 40.0 < 21.0 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 30.0-32.9 33.0-34.9 35.0-39.9 ≥ 40.0 < 21.0 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 30.0-32.9 33.0-34.9 35.0-39.9 ≥ 40.0 < 25.0 25.0-29.9 ≥ 30.0 < 25.0 25.0-29.9 ≥ 30.0	2.89 (2.47-3.38) 1.00 1.02 (0.91-1.15) 1.09 (0.97-1.23) 1.23 (1.07-1.40) 1.61 (1.42-1.83) 1.96 (1.69-2.26) 2.10 (1.70-2.59) 2.29 (1.87-2.80) 3.71 (2.91-4.72) 1.00 0.94 (0.81-1.09) 1.05 (0.91-1.22) 1.01 (0.85-1.21) 1.27 (1.07-1.51) 1.68 (1.38-2.04) 1.83 (1.39-2.04) 2.44 (1.92-3.11) 3.52 (2.59-4.80) 1.00 0.86 (0.80-0.93) 0.83 (0.76-0.90) 0.90 (0.82-1.00) 1.13 (1.02-1.25) 1.34 (1.18-1.53) 1.60 (1.29-1.98) 1.79 (1.45-2.21) 2.07 (1.53-2.80) 1.00 1.13 (1.06-1.20) 1.69 (1.57-1.82) 1.00 1.36 (1.22-1.51) 1.99 (1.76-2.25)	
			27194 former smokers: 1885 deaths				BMI, former smokers			
			37596 current smokers: 5056 deaths				BMI, current smokers			
							BMI, all women			
							BMI, women who never smoked			
Hu G et al, 2005, Finland	Finnish MONICA study	1972-1997, 17.7 years follow-up	22528 men and 24684 women, age 25-64 years: 7394 deaths	Measured	Subjects with coronary heart disease, stroke, heart failure, cancer	First 2 years of follow-up were excluded in sensitivity analyses, but results were not altered (data not shown)	BMI, men	< 18.5 18.5-24.9 25.0-29.9 ≥ 30.0	2.79 (1.85-4.22) 1.00 0.93 (0.87-1.00) 1.17 (1.07-1.28)	Age, study year, SBP, smoking status, cholesterol, diabetes, physical activity
							BMI, women	< 18.5 18.5-24.9 25.0-29.9 ≥ 30.0	1.69 (1.15-2.48) 1.00 1.00 (0.91-1.10) 1.15 (1.04-1.27)	

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Nyholm M et al, 2005, Sweden	Skaraborg Hypertension and Diabetes Project	1993-1994 – 1999, 5.5 years follow-up	1109 men and women, age ≥40 years: 125 deaths	Measured	Subjects with prevalent CVD excluded in sensitivity analyses	No	BMI, men, all	<24.2 24.2-<26.3 26.3-<28.4 ≥28.4	1.0 0.8 (0.61-1.1) 1.0 (0.7-1.3) 0.6 (0.4-0.9)	Age, smoking status, leisure-time physical activity
							BMI, men without previous CVD	<24.2 24.2-<26.3 26.3-<28.4 ≥28.4	1.0 0.7 (0.4-1.2) 1.2 (0.8-1.8) 0.9 (0.5-1.5)	
							BMI, men with previous CVD	<24.2 24.2-<26.3 26.3-<28.4 ≥28.4	1.0 0.7 (0.5-1.1) 0.6 (0.4-0.9) 0.4 (0.2-0.7)	
							BMI, women, all	<24.2 24.2-<26.3 26.3-<28.4 ≥28.4	1.0 0.7 (0.5-1.1) 0.6 (0.4-1.0) 0.8 (0.6-1.2)	
							BMI, women without previous CVD	<24.2 24.2-<26.3 26.3-<28.4 ≥28.4	1.0 0.8 (0.5-1.3) 0.5 (0.2-1.0) 0.9 (0.6-1.5)	
							BMI, women with previous CVD	<24.2 24.2-<26.3 26.3-<28.4 ≥28.4	1.0 0.7 (0.4-1.4) 0.8 (0.4-1.3) 0.7 (0.4-1.3)	
Jak A et al, 2005, Poland	POL-MONICA cohort study	1983-1994 - 1998, 10.7 years follow-up	5281 men and 5691 women, age 35-64 years: 914/430 deaths	Measured	No	No	BMI, men	18.4-20.0 20.0-21.9 22.0-23.9 24.0-25.9 26.0-27.9 28.0-29.9 30.0-31.9 32.0-34.9 35.0-47.8	2.27 (1.71-3.01) 1.28 (0.99-1.66) 1.00 1.05 (0.83-1.33) 1.02 (0.81-1.29) 0.98 (0.76-1.27) 1.09 (0.82-1.46) 1.41 (1.04-1.92) 1.73 (1.19-2.51)	Age, self-assessment of health, hypercholesterolemia, cigarette smoking, arterial hypertension, place of residence
							BMI, women	18.4-20.0 20.0-21.9 22.0-23.9 24.0-25.9 26.0-27.9 28.0-29.9 30.0-31.9 32.0-34.9 35.0-47.8	1.66 (1.01-2.72) 0.94 (0.60-1.47) 1.00 0.78 (0.54-1.14) 0.71 (0.48-1.05) 0.81 (0.55-1.19) 0.84 (0.55-1.26) 0.85 (0.56-1.28) 1.10 (0.75-1.62)	

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5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Sribarren C et al, 2005, USA	The CARDIA Study	1985-1986 – 2000, 13 years follow-up	5115 men and women, age 18-30 years: 127 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.53 (1.22-5.24) 1.00 0.77 (0.50-1.19) 0.62 (0.36-1.08)	Age, sex, race, DM, liver disease, thyroid disease, smoking status, physical activity, hostility, social support, marital status
	Jain MG et al, 2005, Canada	Canadian National Breast Screening Study Cohort	1980-1985 – 1998-2000, 16.5 years follow-up	49165 women, age 40-59 years: 2566 deaths	Measured	No	No	BMI	<18.5 18.5-21.9 22.0-24.9 25.0-27.9 28.0-29.9 30.0-34.9 ≥35.0	1.12 (0.99-1.25) 1.00 1.15 (1.11-1.18) 1.28 (1.24-1.32) 1.34 (1.29-1.39) 1.30 (1.25-1.35) 1.40 (1.33-1.47)	Age, number of pregnancies, menopausal status, smoking status, cigarette years, university education, mammography allocation, alcohol, energy intake
	Hayashi R et al, 2005, Japan	Komochi Village and Isesaki City	1993 - 2000, 6.4 years follow-up	5554 men and 5827 women, age 40-69 years: 329/147 deaths	Self-reported	No	Exclusion of first 3 years of follow-up in sensitivity analyses	BMI, men BMI, women BMI, men, excluding first 3 years of follow-up BMI, women, excluding first 3 years of follow-up	<18.5 18.5-21.9 22.0-24.9 25.0-27.9 ≥28.0 <18.5 18.5-21.9 22.0-24.9 25.0-27.9 ≥28.0 <18.5 18.5-21.9 22.0-24.9 25.0-27.9 ≥28.0 <18.5 18.5-21.9 22.0-24.9 25.0-27.9 ≥28.0	2.59 (1.74-3.85) 1.25 (0.94-1.66) 1.00 1.06 (0.74-1.53) 1.63 (0.93-2.87) 2.93 (1.62-5.30) 1.49 (0.94-2.35) 1.00 1.34 (0.78-2.31) 2.71 (1.51-4.88) 2.66 (1.59-4.46) 1.33 (0.93-1.91) 1.00 1.21 (0.78-1.90) 1.18 (0.51-2.74) 3.14 (1.38-7.13) 1.98 (1.07-3.65) 1.00 1.92 (0.96-3.84) 3.25 (1.48-7.15)	Age, physical activity, smoking status and cigarettes per day, alcohol, sleep, snacking, skipping breakfast, weight in 30's perceived health status, chronic diseases, health examination, occupation, marital status, education
	Jartåker A et al, 2005, Norway, Sweden	Women's Lifestyle and Health Cohort Study	1991-1992 – 2000, 9.1 years follow-up	93295 women, age 30-50 years: 1071 deaths	Self-reported	Prevalent cancers excluded in sensitivity analyses	First 1, 2, and 3 years follow-up excluded in sensitivity analyses	BMI, premenopausal women BMI, postmenopausal women BMI, premenopausal women, 1 st year of follow-up excluded	<18.5 18.5-24.9 25.0-29.9 ≥30.0 <18.5 18.5-24.9 25.0-29.9 ≥30.0 <18.5 18.5-24.9 25.0-29.9	1.26 (0.82-1.94) 1.00 1.24 (1.01-1.52) 2.24 (1.70-2.97) 1.52 (0.93-2.48) 1.00 0.86 (0.68-1.08) 1.27 (0.92-1.75) 1.21 (0.76-1.92) 1.00 1.30 (1.05-1.61)	Age, smoking status, years of education, physical activity

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							BMI, postmenopausal women	≥30.0 <18.5 18.5-24.9 25.0-29.9	2.16 (1.60-2.92) 1.56 (0.96-2.55) 1.00 0.85 (0.67-1.07)	
							BMI, premenopausal women, prevalent cancer cases excluded	≥30.0 <18.5 18.5-24.9 25.0-29.9	1.28 (0.92-1.77) 1.39 (0.88-2.19) 1.00 1.22 (0.97-1.53)	
							BMI, postmenopausal women	≥30.0 <18.5 18.5-24.9 25.0-29.9	2.54 (1.88-3.42) 1.39 (0.78-2.49) 1.00 0.83 (0.64-1.07)	
								≥30.0 <18.5 18.5-24.9 25.0-29.9	1.35 (0.95-1.91) 1.00 1.12 (0.82-1.51) 1.12 (0.82-1.51)	
Chang-Claude J et al, 2005, Germany	The German Vegetarian Study	1978-1999, 21 years follow-up	1904 men and women, age <34-≥75 years: 456 deaths	Self-reported	No	No	BMI	<18.5 18.5-25.0 >25.0	1.13 (0.85-1.51) 1.00 1.12 (0.82-1.51)	Age, sex, smoking status, alcohol consumption, physical activity, education, vegetarian status
Freeze E et al, 2006, United Kingdom	Whitehall Study	1997-1998 – 2002, 5.4 years follow-up	3411 ever smoking men, age 40-69 years: 822 deaths	Measured	Prevalent CVD, MI, stroke, angina, diabetes, cancer, COPD, claudication excluded in sensitivity analyses	No	BMI, ever smokers BMI, never smokers	<22.7 22.7-<24.4 24.4-<26.1 ≥26.1 <22.7 22.7-<24.4 24.4-<26.1 ≥26.1	1.20 (1.00-1.50) 1.00 0.93 (0.70-1.20) 1.00 (0.80-1.20) 1.26 (0.90-1.80) 1.00 0.78 (0.50-1.20) 1.39 (1.00-2.00)	Age, marital status, employment grade, alcohol, unable to do at least one activity of daily living, poor physical performance
Yu D et al, 2006, China	China National Hypertension Survey	1991 – 1999-2000, 8.3 years follow-up	154736 men and women, age ≥40 years: 17687 deaths	Measured	Stratified analyses among high-risk participants (prevalent cardiovascular disease, stroke, cancer, end-stage renal disease, chronic obstructive pulmonary syndrome,	Sensitivity analyses excluding first 3 years of follow-up were reported	BMI, all BMI, men	<18.5 18.5-19.9 20.0-20.9 21.0-21.9 22.0-22.9 23.0-23.9 24.0-24.9 25.0-26.9 27.0-29.9 ≥30.0 <18.5 18.5-19.9 20.0-20.9 21.0-21.9 22.0-22.9	1.65 (1.54-1.77) 1.31 (1.22-1.41) 1.20 (1.11-1.29) 1.12 (1.04-1.21) 1.11 (1.03-1.20) 1.09 (1.01-1.19) 1.00 1.00 (0.92-1.08) 1.15 (1.06-1.24) 1.29 (1.16-1.42) 1.64 (1.49-1.80) 1.32 (1.20-1.45) 1.17 (1.06-1.30) 1.10 (0.99-1.22) 1.10 (0.99-1.22)	Age, sex, smoking status, alcohol, physical activity, education, geographic region, urbanization

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					BMI, former smokers	<18.5	2.17 (1.82-2.59)	
						18.5-20.9	1.79 (1.64-1.95)	
						21.0-23.4	1.19 (1.13-1.26)	
						23.5-24.9	1.00	
						25.0-26.4	0.98 (0.93-1.03)	
						26.5-27.9	0.96 (0.91-1.01)	
						28.0-29.9	1.00 (0.95-1.05)	
						30.0-34.9	1.07 (1.02-1.12)	
						35.0-39.9	1.30 (1.22-1.39)	
						≥40.0	1.74 (1.58-1.92)	
					BMI, never smokers	<18.5	1.67 (1.24-2.24)	
						18.5-20.9	1.29 (1.12-1.49)	
						21.0-23.4	1.09 (1.00-1.19)	
						23.5-24.9	1.00	
						25.0-26.4	0.97 (0.89-1.05)	
						26.5-27.9	1.09 (1.00-1.18)	
						28.0-29.9	1.20 (1.10-1.30)	
						30.0-34.9	1.39 (1.28-1.51)	
						35.0-39.9	1.91 (1.70-2.15)	
						≥40.0	2.59 (2.20-3.06)	
					BMI, preexisting chronic disease	<18.5	1.91 (1.66-2.20)	
						18.5-20.9	1.60 (1.48-1.73)	
						21.0-23.4	1.20 (1.13-1.26)	
						23.5-24.9	1.00	
						25.0-26.4	0.94 (0.90-0.99)	
						26.5-27.9	0.91 (0.86-0.96)	
						28.0-29.9	0.94 (0.89-0.99)	
						30.0-34.9	0.98 (0.93-1.03)	
						35.0-39.9	1.10 (1.02-1.18)	
						≥40.0	1.41 (1.26-1.57)	
					BMI, no preexisting chronic disease	<18.5	1.70 (1.42-2.04)	
						18.5-20.9	1.35 (1.24-1.47)	
						21.0-23.4	1.08 (1.02-1.13)	
						23.5-24.9	1.00	
						25.0-26.4	0.96 (0.91-1.01)	
						26.5-27.9	0.99 (0.94-1.04)	
						28.0-29.9	1.06 (1.00-1.11)	
						30.0-34.9	1.19 (1.14-1.25)	
						35.0-39.9	1.57 (1.57-1.69)	
						≥40.0	2.24 (2.02-2.49)	

BMI, all women	<18.5	2.03 (1.84-2.25)
	18.5-20.9	1.30 (1.22-1.38)
	21.0-23.4	1.07 (1.01-1.13)
	23.5-24.9	1.00
	25.0-26.4	1.00 (0.94-1.07)
	26.5-27.9	1.06 (0.99-1.12)
	28.0-29.9	1.07 (1.01-1.14)
	30.0-34.9	1.18 (1.12-1.25)
	35.0-39.9	1.49 (1.39-1.60)
	≥40.0	1.94 (1.79-2.09)
BMI, current smokers	<18.5	1.87 (1.62-2.17)
	18.5-20.9	1.24 (1.12-1.37)
	21.0-23.4	1.01 (0.92-1.11)
	23.5-24.9	1.00
	25.0-26.4	0.96 (0.86-1.07)
	26.5-27.9	0.88 (0.78-0.99)
	28.0-29.9	0.94 (0.83-1.05)
	30.0-34.9	1.10 (0.99-1.22)
	35.0-39.9	1.28 (1.10-1.49)
	≥40.0	1.61 (1.33-1.93)
BMI, former smokers	<18.5	2.45 (2.03-2.96)
	18.5-20.9	1.41 (1.27-1.57)
	21.0-23.4	1.13 (1.04-1.24)
	23.5-24.9	1.00
	25.0-26.4	1.00 (0.91-1.11)
	26.5-27.9	1.10 (0.99-1.21)
	28.0-29.9	1.09 (0.99-1.20)
	30.0-34.9	1.13 (1.04-1.24)
	35.0-39.9	1.39 (1.25-1.54)
	≥40.0	1.75 (1.56-1.97)
BMI, never smokers	<18.5	1.70 (1.35-2.15)
	18.5-20.9	1.21 (1.06-1.37)
	21.0-23.4	1.06 (0.96-1.18)
	23.5-24.9	1.00
	25.0-26.4	1.09 (0.97-1.22)
	26.5-27.9	1.21 (1.08-1.36)
	28.0-29.9	1.27 (1.13-1.42)
	30.0-34.9	1.38 (1.25-1.53)
	35.0-39.9	1.82 (1.62-2.06)
	≥40.0	2.52 (2.20-2.88)

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							BMI, preexisting chronic disease	<18.5 18.5-20.9 21.0-23.4 23.5-24.9 25.0-26.4 26.5-27.9 28.0-29.9 30.0-34.9 35.0-39.9 ≥40.0	2.02 (1.75-2.32) 1.32 (1.21-1.45) 1.01 (0.93-1.09) 1.00 0.94 (0.85-1.03) 0.98 (0.89-1.07) 0.94 (0.86-1.03) 0.95 (0.87-1.03) 1.21 (1.10-1.34) 1.29 (1.15-1.45)	
							BMI, no preexisting chronic disease	<18.5 18.5-20.9 21.0-23.4 23.5-24.9 25.0-26.4 26.5-27.9 28.0-29.9 30.0-34.9 35.0-39.9 ≥40.0	1.86 (1.61-2.14) 1.26 (1.16-1.37) 1.12 (1.04-1.20) 1.00 1.05 (0.97-1.14) 1.11 (1.02-1.21) 1.15 (1.06-1.25) 1.34 (1.24-1.44) 1.61 (1.47-1.77) 2.42 (2.18-2.68)	
Psai SP et al, 2006, USA	Shell Oil Company	1983-2003, 20 years follow-up	7139 men and women, age ≥30 years: 970 deaths	NA	No	No	BMI	18.5-24.9 25.0-29.9 ≥30.0	1.00 0.94 (0.80-1.09) 1.25 (1.03-1.51)	Age, sex, smoking status
Van Dam RM et al, 2006, USA	Nurses' Health Study 2	1989 – 2001, 12 years follow-up	102400 women, age 24-44 years: 710 deaths	Self-reported	Prevalent cancers or pregnancy at study initiation were excluded	No	BMI	<18.5 18.5-21.9 22.0-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.67 (1.15-2.42) 1.00 1.16 (0.96-1.41) 1.29 (1.04-1.59) 1.35 (1.01-1.80) 2.14 (1.61-2.85)	Age, smoking status and cigarettes per day, physical activity, alcohol, HRT, OC use
							BMI, excluding subjects who lost weight	<18.5 18.5-21.9 22.0-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.33 (0.84-2.11) 1.00 1.16 (0.94-1.42) 1.29 (1.03-1.62) 1.39 (1.03-1.86) 2.24 (1.63-3.00)	
Lee SH et al, 2006, Korea	Korea National Health Insurance Corporation Study	1992-1995 – 2004, 12 years follow-up	1213829 men and women, age 30-95 years: 82372 deaths 160276/	Measured	Athero-sclerotic CVD, cancer, liver disease, diabetes, respiratory	First two years of follow-up excluded in main analyses	BMI, men	<18.5 18.5-19.9 20.0-21.4 21.5-22.9 23.0-24.9 25.0-26.4 26.5-27.9	1.35 (1.30-1.41) 1.19 (1.15-1.23) 1.16 (1.13-1.20) 1.09 (1.06-1.12) 1.00 0.97 (0.94-1.00) 0.99 (0.95-1.03)	Age, cigarette smoking status and number of cigarettes per day, alcohol, exercise

415790 never
smokers: 9657
/18558 deaths

610280 ever
smokers
(men): 48655

disease

BMI, women

BMI, men, never smokers

BMI, men, ever smokers

BMI, women, never smokers

28.0-29.9	1.06 (1.00-1.12)
30.0-31.9	1.20 (1.08-1.34)
≥32.0	2.11 (1.78-2.50)
<18.5	1.16 (1.09-1.23)
18.5-19.9	1.11 (1.05-1.17)
20.0-21.4	0.99 (0.95-1.04)
21.5-22.9	1.00 (0.95-1.04)
23.0-24.9	1.00
25.0-26.4	0.98 (0.94-1.03)
26.5-27.9	1.02 (0.97-1.08)
28.0-29.9	1.09 (1.02-1.16)
30.0-31.9	1.16 (1.06-1.28)
≥32.0	1.22 (1.08-1.38)
<18.5	1.3 (1.2-1.4)
18.5-19.9	1.1 (1.0-1.2)
20.0-21.4	1.0 (1.0-1.1)
21.5-22.9	1.0 (0.9-1.1)
23.0-24.9	1.0
25.0-26.4	1.0 (0.9-1.1)
26.5-27.9	1.1 (1.0-1.2)
28.0-29.9	1.1 (1.0-1.3)
30.0-31.9	1.5 (1.3-1.9)
≥32.0	2.5 (1.8-3.5)
<18.5	1.4 (1.3-1.4)
18.5-19.9	1.2 (1.1-1.2)
20.0-21.4	1.2 (1.1-1.2)
21.5-22.9	1.1 (1.1-1.1)
23.0-24.9	1.0
25.0-26.4	1.0 (0.9-1.0)
26.5-27.9	1.0 (0.9-1.0)
28.0-29.9	1.0 (1.0-1.1)
30.0-31.9	1.1 (1.0-1.3)
≥32.0	2.1 (1.7-2.5)
<18.5	1.2 (1.1-1.3)
18.5-19.9	1.1 (1.0-1.1)
20.0-21.4	1.0 (1.0-1.0)
21.5-22.9	1.0 (1.0-1.1)
23.0-24.9	1.0
25.0-26.4	1.0 (0.9-1.0)
26.5-27.9	1.0 (1.0-1.1)
28.0-29.9	1.1 (1.1-1.2)
30.0-31.9	1.2 (1.1-1.3)
≥32.0	1.2 (1.1-1.4)

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5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	Lawlor DA et al, 2006, Scotland	Renfrew/Paisley study	1972-1976 – 2004, 28 years follow-up	8327 women and 7017 men, age 45-64 years: 5242/5019 deaths (m/w)	Measured	No	Sensitivity analyses excluding first 5 years of follow-up	BMI, men	<18.5 18.5-<25 25-<30 ≥30	1.34 (1.00-1.81) 1.00 0.90 (0.85-0.95) 1.08 (0.99-1.19)	Age	
11 12 13 14 15 16 17 18 19 20 21 22				1112/3652 never smokers: 666/1986 deaths				BMI, women	<18.5 18.5-<25 25-<30 ≥30	1.80 (1.52-2.14) 1.00 0.97 (0.91-1.03) 1.28 (1.18-1.38)		
11 12 13 14 15 16 17 18 19 20 21 22				7242 current smokers 5158 deaths				BMI, men, never smokers, excl. first 5 years	18.5-<25 25-<30 ≥30	1.00 1.38 (1.16-1.66) 2.10 (1.66-2.66)		
11 12 13 14 15 16 17 18 19 20 21 22								BMI, women, never smokers, excl. first 5 years	18.5-<25 25-<30 ≥30	1.00 1.12 (1.01-1.23) 1.56 (1.39-1.76)		
11 12 13 14 15 16 17 18 19 20 21 22								BMI, men, current smokers, excl. first 5 years	<18.5 18.5-<25 25-<30 ≥30	1.09 (0.76-1.57) 1.00 0.95 (0.88-1.02) 1.08 (0.94-1.24)		
11 12 13 14 15 16 17 18 19 20 21 22								BMI, women, current smokers, excl. first 5 years	<18.5 18.5-<25 25-<30 ≥30	1.57 (1.28-1.93) 1.00 0.99 (0.90-1.08) 1.24 (1.09-1.40)		
23 24 25 26 27 28 29 30 31 32	Lawlor DA et al, 2006, Scotland	Collaborative Study	1970-1973 – 2004, 34 years follow-up	4016 men, age 45-64 years: 2957 deaths	Measured	No	Sensitivity analyses excluding first 5 years of follow-up	BMI	<18.5 18.5-<25 25-<30 ≥30	1.36 (0.94-1.98) 1.00 1.01 (0.94-1.09) 1.28 (1.11-1.49)		Age
23 24 25 26 27 28 29 30 31 32				573 never smokers: 302 deaths				BMI, never smokers, excl. first 5 years	18.5-<25 25-<30 ≥30	1.00 1.23 (0.96-1.58) 1.96 (1.35-2.84)		
23 24 25 26 27 28 29 30 31 32				2116 current smokers 1609 deaths				BMI, men, current smokers, excl. first 5 years	<18.5 18.5-<25 25-<30 ≥30	1.25 (0.82-1.90) 1.00 1.10 (1.00-1.22) 1.22 (0.97-1.54)		
33 34 35 36 37 38 39 40	Price GM et al, 2006, United Kingdom	The MRC Trial of Assessment and Management of Older People in the Community	NA – 2002, 5.9 years follow-up	14833 men and women, age >75 years: 6649 deaths	Measured	Prevalent cancer, MI, stroke, diabetes, Parkinson’s disease, hip fracture, angina, weight loss, pneumonia,	First 1 and 2 years excluded in sensitivity analyses	BMI, nonsmoking men (not current smoking)	15.9-23.0 >23.0-25.0 >25.0-26.7 >26.7-29.0 >29.0-40.4	1.00 0.84 (0.71-0.98) 0.77 (0.67-0.88) 0.73 (0.63-0.85) 0.78 (0.68-0.90)	Age, height, serious illness in loved one in the past year, depression, cognitive impairment, unexplained recent weight loss >3.2 kg, housing type, UK quintiles of Carstairs area deprivation score, former smoking (in nonsmokers only), alcohol	
33 34 35 36 37 38 39 40								BMI, nonsmoking women	14.7-22.3 >22.3-24.6 >24.6-26.8 >26.8-29.7 >29.7-45.2	1.00 0.92 (0.83-1.02) 0.73 (0.65-0.83) 0.76 (0.67-0.87) 0.82 (0.71-0.93)		

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					leg ulcer, cognitively impaired, not able to carry out 1 or more ADLs, ≥ 2 falls in previous 6 months, no physical activity excluded in sensitivity analyses		BMI, smoking men	15.9-23.0 >23.0-25.0 >25.0-26.7 >26.7-29.0 >29.0-40.4	1.00 0.65 (0.50-0.86) 0.51 (0.38-0.70) 0.75 (0.61-1.11) 0.73 (0.49-1.10)	
							BMI, smoking women	14.7-22.3 >22.3-24.6 >24.6-26.8 >26.8-29.7 >29.7-45.2	1.00 0.76 (0.55-1.04) 0.60 (0.41-0.88) 0.51 (0.34-0.78) 0.43 (0.27-0.67)	
Schooling CM et al, 2006, China	Hong Kong Elderly	1998-2003, 4.1 years follow-up	56167 men and women, age ≥ 65 years: 3819 deaths	Unclear (recorded)	Stratified analyses by number of co- morbidities	No	BMI	<18.5 18.5-<23 23-<25 ≥ 25	1.78 (1.61-1.97) 1.00 0.84 (0.77-0.92) 0.75 (0.70-0.82)	Age, sex, education, ever drinking alcohol, ever smoking, monthly personal expenditure, housing, physical activity
							BMI, excluding 1 st 2 years of follow-up	<18.5 18.5-<23 23-<25 ≥ 25	1.72 (1.51-1.97) 1.00 0.87 (0.78-0.97) 0.83 (0.75-0.92)	
							BMI, 0 comorbidities	<18.5 18.5-<23 23-<25 ≥ 25	1.76 (1.00-3.08) 1.00 0.96 (0.58-1.59) 1.54 (1.02-2.33)	
							BMI, 1 comorbidity	<18.5 18.5-<23 23-<25 ≥ 25	1.41 (1.01-1.97) 1.00 1.04 (0.81-1.33) 0.98 (0.78-1.239)	
							BMI, 2 comorbidities	<18.5 18.5-<23 23-<25 ≥ 25	2.22 (1.81-2.73) 1.00 0.82 (0.68-0.99) 0.72 (0.61-0.85)	
							BMI, 3 comorbidities	<18.5 18.5-<23 23-<25 ≥ 25	1.81 (1.45-2.26) 1.00 0.70 (0.58-0.84) 0.64 (0.55-0.75)	
							BMI, 4-12 comorbidities	<18.5 18.5-<23 23-<25 ≥ 25	1.76 (1.51-2.07) 1.00 0.72 (0.63-0.83) 0.55 (0.49-0.63)	

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5								21.0-22.9	1.00		
6								23.0-24.9	1.01 (0.73-1.41)		
7								25.0-26.9	0.71 (0.49-1.02)		
8								27.0-29.9	0.84 (0.58-1.22)		
9								30.0-34.9	1.42 (0.94-2.15)		
10								≥35.0	2.82 (1.58-5.04)		
11							BMI, women who never	<18.5	0.62 (0.15-2.62)		
12							smoked and excluding 1st 5	18.5-20.9	1.13 (0.62-2.05)		
13							years of follow-up	21.0-22.9	1.00		
14								23.0-24.9	1.01 (0.69-1.50)		
15								25.0-26.9	0.80 (0.53-1.20)		
16								27.0-29.9	0.87 (0.57-1.32)		
17								30.0-34.9	1.70 (1.08-2.67)		
18								≥35.0	3.46 (1.86-6.43)		
17	Freedman	The US	1983-89 –	64120 women	Self-reported	Cancer and	No	BMI, women, age <65 years,	18.5-24.9	1.00	Birth cohort, race/ethnicity, education, alcohol, year first worked as a radiologic technologist by decade
18	DM et al,	Radiologic	2002, 16.3	and 18760		myocardial		never smokers	25.0-29.9	1.38 (1.10-1.72)	
19	2006, USA	Technologists	years	men, age 22-		infarction			30.0-34.9	0.96 (0.65-1.43)	
20		study	follow-up	92 years:					≥35.0	1.87 (1.19-2.95)	
21				2721/1758			BMI, women, age ≥65 years,	18.5-24.9	1.00		
22				deaths			never smokers	25.0-29.9	1.09 (0.89-1.33)		
23								30.0-34.9	1.44 (1.08-1.92)		
24				NA never				≥35.0	2.57 (1.68-3.95)		
25				smokers:			BMI, women, age <65 years,	18.5-24.9	1.10 (0.91-1.33)		
26				980/422			former smokers	25.0-29.9	1.79 (1.40-2.29)		
27				deaths				30.0-34.9	1.57 (1.02-2.40)		
28								≥35.0	1.88 (1.10-3.22)		
29				NA former			BMI, women, age ≥65 years,	18.5-24.9	1.30 (1.09-1.55)		
30				smokers:			former smokers	25.0-29.9	1.64 (1.32-2.04)		
31				693/700				30.0-34.9	1.29 (0.88-1.89)		
32				deaths				≥35.0	2.45 (1.48-4.06)		
33							BMI, women, age <65 years,	18.5-24.9	2.22 (1.90-2.60)		
34				NA current			current smokers	25.0-29.9	2.46 (1.96-3.10)		
35				smokers:				30.0-34.9	3.82 (2.74-5.32)		
36				889/618				≥35.0	5.20 (3.30-8.20)		
37				deaths			BMI, women, age ≥65 years,	18.5-24.9	2.20 (1.86-2.62)		
38							current smokers	25.0-29.9	2.55 (1.99-3.25)		
39								30.0-34.9	2.66 (1.63-4.36)		
40								≥35.0	3.55 (1.57-8.02)		
							BMI, men, age <65 years,	18.5-24.9	1.00		
							never smokers	25.0-29.9	0.89 (0.67-1.20)		
								30.0-34.9	1.35 (0.87-2.08)		
								≥35.0	1.95 (1.02-3.74)		
							BMI, men, age ≥65 years,	18.5-24.9	1.00		

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							never smokers	25.0-29.9 30.0-34.9 ≥35.0	0.77 (0.57-1.03) 1.15 (0.70-1.89) 3.16 (1.27-7.84)	
							BMI, men, age <65 years, former smokers	18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.19 (0.90-1.58) 1.04 (0.79-1.37) 1.90 (1.33-2.72) 2.05 (1.07-3.95)	
							BMI, men, age ≥65 years, former smokers	18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.15 (0.90-1.48) 1.11 (0.86-1.42) 1.79 (1.26-2.55) 1.40 (0.59-3.30)	
							BMI, men, age <65 years, current smokers	18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	2.45 (1.91-3.15) 2.14 (1.64-2.79) 2.26 (1.49-3.44) 4.19 (2.38-7.37)	
							BMI, men, age ≥65 years, current smokers	18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	2.36 (1.81-3.09) 2.28 (1.69-3.08) 2.80 (1.52-5.16) 4.29 (1.73-10.64)	
Rice JA et al, 2006, USA	The Breast and Bone Follow-up of the Fracture Intervention Trial (B-FIT)	1990-1992 – 2001, 9 years follow-up	17748 postmenopausal women, age 55-80 years: 1886 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35	1.9 (1.4-2.5) 1.0 0.8 (0.7-0.9) 0.7 (0.6-0.8) 0.7 (0.6-0.9)	Age, hypertension, DM, heart disease, stroke, breast cancer, HRT, weight loss, self-reported health status, smoking status and pack-years, alcohol, physical function scale, WHR, SBP, heart rate, timed up and go test, grip strength
Corrada MM et al, 2006, USA	Leisure World Cohort Study	1981-2004, 23 years follow-up	13451 men and women, mean age 73 years: 11203 deaths	Self-reported	No	Excluding first 5 years of follow-up in sensitivity analyses	BMI	17.6 22.4 26.5 31.6	1.50 (1.37-1.64) 1.00 0.99 (0.95-1.03) 1.18 (1.07-1.31)	Age, sex, smoking status, activity
							BMI, excluding first 5 years of follow-up	17.6 22.4 26.5 31.6	1.38 (1.24-1.54) 1.00 1.02 (0.98-1.08) 1.22 (1.10-1.37)	
Gale CR et al, 2007, UK	UK Department of Health and Social Security Survey	1973-1974 - NA, 24 years follow-up	800 men and women, age ≥65 years: 756 deaths	Measured	No	Sensitivity analyses excluding first 5 years of follow-up	BMI	<18.5 18.5-24.9 25-29.9 ≥30	1.41 (0.90-2.38) 1.00 1.00 (0.74-1.34) 1.14 (0.76-1.71)	Age, height, social class, smoking status, reported change in weight, calories, physical activity, diagnosed disease at baseline
							BMI, excluding first 5 years of follow-up	<18.5 18.5-24.9 25-29.9	2.03 (1.15-3.59) 1.00 1.05 (0.76-1.45)	

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5								≥30	1.41 (1.05-2.07)		
6	Smith TC et al, 2007, USA	Rancho Bernardo Study	1984-1986 – 1996, 10 years follow-up	1627 men and women, age 50-90 years: 538 deaths	Measured	No	No	BMI	<18.5 18.5-25.0 25.0-29.9 ≥30.0	1.52 (0.90-2.59) 1.00 0.86 (0.71-1.04) 1.02 (0.72-1.43)	Age, sex, smoking status, alcohol, exercise, hypertension, triglycerides, HDL-cholesterol, history of CHD
7											
8											
9											
10	Vanhsen I, 2007, USA	Cardiovascular Health Study	1989-1990 - NA, 9 years follow-up	4968 men and women, age ≥65 years: 1464 deaths	Measured	No	No	BMI, all	20-24.9 25-29.9 ≥30	1.00 0.92 (0.82 to 1.03) 0.94 (0.80 to 1.09)	Age, sex, race, SES, smoking, status and pack-years, physical activity
11								BMI, men	20-24.9 25-29.9 ≥30	1.00 0.93 (0.80 to 1.08) 0.88 (0.71 to 1.10)	
12								BMI, women	20-24.9 25-29.9 ≥30	1.00 0.90 (0.75 to 1.07) 0.98 (0.79 to 1.22)	
13								BMI, age 65-74 years	20-24.9 25-29.9 ≥30	1.00 1.01 (0.85 to 1.22) 1.02 (0.82 to 1.27)	
14								BMI, age ≥75 years	20-24.9 25-29.9 ≥30	1.00 0.88 (0.76 to 1.02) 0.80 (0.64 to 1.01)	
15								BMI, none to passive smoke exposure	20-24.9 25-29.9 ≥30	1.00 0.82 (0.69 to 0.98) 0.86 (0.68 to 1.08)	
16								BMI, light to high smoking exposure	20-24.9 25-29.9 ≥30	1.00 0.99 (0.85 to 1.16) 1.02 (0.83 to 1.26)	
17								BMI, all	20-24.9 25-29.9 ≥30	1.00 0.89 (0.80 to 0.99) 0.83 (0.71 to 0.97)	+ prevalent disease
18								BMI, men	20-24.9 25-29.9 ≥30	1.00 0.91 (0.78 to 1.06) 0.77 (0.61 to 0.97)	
19								BMI, women	20-24.9 25-29.9 ≥30	1.00 0.85 (0.71 to 1.01) 0.88 (0.71 to 1.10)	
20								BMI, age 65-74 years	20-24.9 25-29.9 ≥30	1.00 0.91 (0.76 to 1.09) 0.83 (0.66 to 1.04)	
21								BMI, age ≥75 years	20-24.9 25-29.9 ≥30	1.00 0.89 (0.76 to 1.03) 0.73 (0.58 to 0.92)	
22								BMI, none to passive smoke	20-24.9	1.00	

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							exposure	25-29.9 ≥30	0.79 (0.67 to 0.94) 0.79 (0.62 to 0.99)	
							BMI, light to high smoking exposure	20-24.9 25-29.9 ≥30	1.00 0.96 (0.82 to 1.12) 0.88 (0.71 to 1.09)	
Sai XY et al, 2007, China	Xi'an male veterans	1987 – 2005, 18 years follow-up	1268 retired military men, age ≥55 years: 491 deaths	Measured	No	No	BMI	<18.5 18.5-23.9 24-27.9 ≥28	2.03 (1.33-3.11) 1.00 1.03 (0.85-1.25) 1.20 (0.90-1.62)	Age, SBP, cigarettes per day, duration of smoking, age of starting smoking total cholesterol, TG, alcohol, exercise, prevalent cancer, stroke, diabetes, CHD, hypertension, COPD, cerebral arteriosclerosis
Greenberg JA et al, 2007, USA	Atherosclerosis Risk in Communities Study	1993-1995 – 1996-1998, 5.3 years follow-up	12457 men and women, age 51-70 years: 606 deaths	Measured	Exclusion of subjects ever smokers, MI, HF, stroke, DM, cancer, chronic lung disease	No	BMI, no correction for regression dilution BMI, correction for regression dilution BMI, correction for regression dilution and reverse causation	18.5-<25 25-<30 30-<35 ≥35 18.5-<25 25-<30 30-<35 ≥35 18.5-<25 25-<30 30-<35 ≥35	1.00 0.88 (0.72-1.08) 1.14 (0.91-1.44) 1.24 (0.93-1.66) 1.00 1.00 (0.82-1.23) 1.31 (1.04-1.66) 1.54 (1.14-2.08) 1.00 2.07 (1.01-4.24) 2.71 (1.25-5.89) 4.02 (1.72-9.43)	Age, sex, race, smoking status, alcohol
Snih et al, 2007, USA	Established Populations for Epidemiologic Studies of the Elderly	1982-1993 – NA, 7 years follow-up	12725 men and women, age ≥65 years: 3122 deaths	Measured	Subjects with limitation in activities of daily living	No	BMI	<18.5 18.5-<25.0 25.0-<30.0 30.0-<35.0 35.0-<40.0 ≥40.0	1.53 (1.31-1.80) 1.00 0.78 (0.72-0.85) 0.80 (0.72-0.90) 1.02 (0.84-1.24) 1.13 (0.79-1.60)	Age, sex
Legal KM et al, 2007, USA	National Health and Nutrition Examination Survey 1, 2 and 3	NHANES 1: 1971-1975 – 1992, ~19 years follow-up NHANES 2: 1976-1980 – 1992, ~14 years follow-up	52590 men and women, age ≥25 years: 8418 deaths 19547 never smokers: 2412 deaths	Measured	Prevalent cancers and CVD excluded in sensitivity analyses	First 3 years of follow-up excluded in sensitivity analyses	BMI, age 25-59 years BMI, age 25-59 years, excluded cancer and CVD BMI, age 25-59 years, excluded cancer and CVD	<18.5 18.5-<25 25.0-<30.0 30.0-<35.0 ≥35.0 18.5-<25 18.5-<25 25.0-<30.0 30.0-<35.0 ≥35.0 18.5-<25 18.5-<25	1.38 (0.82-2.32) 1.00 0.83 (0.65-1.06) 1.20 (0.84-1.72) 1.83 (1.27-2.62) 1.64 (0.94-2.88) 1.00 0.89 (0.69-1.16) 1.06 (0.73-1.53) 2.05 (1.39-3.02) 1.54 (0.33-7.06) 1.00	Sex, smoking status, racial/ethnic group, alcohol

NHANES
3: 1988-
1994 –
2000, ~9
years
follow-up

and ever smokers

25.0-<30.0	0.73 (0.40-1.35)
30.0-<35.0	0.86 (0.49-1.50)
≥35.0	1.39 (0.81-2.41)
<18.5	0.77 (0.22-2.66)
18.5-<25	1.00
25.0-<30.0	0.83 (0.42-1.65)
30.0-<35.0	0.80 (0.44-1.43)
≥35.0	1.62 (0.90-2.90)
<18.5	2.30 (1.70-3.13)
18.5-<25	1.00
25.0-<30.0	0.95 (0.80-1.13)
30.0-<35.0	1.13 (0.89-1.42)
≥35.0	1.63 (1.16-2.30)
<18.5	2.28 (1.52-3.43)
18.5-<25	1.00
25.0-<30.0	0.95 (0.77-1.15)
30.0-<35.0	1.15 (0.90-1.48)
≥35.0	1.80 (1.16-2.81)
<18.5	3.34 (1.26-8.80)
18.5-<25	1.00
25.0-<30.0	0.67 (0.45-1.00)
30.0-<35.0	1.29 (0.85-1.96)
≥35.0	2.18 (1.24-3.82)
<18.5	1.85 (0.70-4.89)
18.5-<25	1.00
25.0-<30.0	0.71 (0.46-1.11)
30.0-<35.0	1.36 (0.84-2.19)
≥35.0	2.47 (1.37-4.45)
<18.5	1.69 (1.38-2.07)
18.5-<25	1.00
25.0-<30.0	0.91 (0.83-1.01)
30.0-<35.0	1.03 (0.91-1.17)
≥35.0	1.17 (0.94-1.47)
<18.5	1.73 (1.38-2.16)
18.5-<25	1.00
25.0-<30.0	0.86 (0.77-0.97)
30.0-<35.0	1.05 (0.91-1.21)
≥35.0	1.16 (0.91-1.48)
<18.5	1.68 (1.19-2.37)
18.5-<25	1.00
25.0-<30.0	0.83 (0.70-0.99)
30.0-<35.0	1.14 (0.93-1.41)
≥35.0	1.07 (0.81-1.42)

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							BMI, age ≥70 years, excluded cancer and CVD, ever smokers and first 3 years of follow-up	<18.5 18.5-<25 25.0-<30.0 30.0-<35.0 ≥35.0	1.85 (1.28-2.68) 1.00 0.84 (0.71-1.00) 1.16 (0.96-1.42) 1.16 (0.85-1.56)	
Mazza A et al, 2007, Italy	The Experience of Cardiovascular Study in the Elderly (CASTEL)	NA-NA, 12 years follow-up	3282 men and women, age 65-96 years: 1599 deaths 441 never smokers: 224 deaths	Measured	No	First two years of follow-up excluded in sensitivity analyses	BMI, men, all BMI, excluding early deaths BMI, excluding current smokers BMI, excluding ex-smokers	<22.7 22.7-24.9 25.0-26.5 26.6-29.0 >29.0 <22.7 22.7-24.9 25.0-26.5 26.6-29.0 >29.0 <22.7 22.7-24.9 25.0-26.5 26.6-29.0 >29.0 <22.7 22.7-24.9 25.0-26.5 26.6-29.0 >29.0	1.63 (1.23-2.71) 1.28 (0.92-1.73) 1.20 (0.85-1.67) 1.16 (0.82-1.32) 1.00 1.54 (1.15-2.18) 1.17 (0.94-1.78) 1.24 (0.96-1.44) 1.21 (0.78-1.31) 1.00 1.52 (1.10-2.00) 1.20 (0.84-1.42) 1.10 (0.92-1.54) 1.10 (0.88-1.61) 1.00 1.33 (1.16-2.2) 1.20 (0.92-1.55) 1.20 (0.78-1.34) 1.10 (0.79-1.36) 1.00	Age, COPD, cigarette smoking status, duration of smoking, alcohol, serum total cholesterol, history of CVD, arterial hypertension, diabetes, serum creatinine
Simpson JA et al, 2007, Australia	Melbourne Collaborative Cohort Study	1990-1994 – 2003, 11 years follow-up	16969 men and 24344 women, age 27-75 years: 2822 deaths 23485 never smokers: NA 13135 former smokers: NA 4676 current smokers: NA	Measured	Excluded subjects with history of angina, heart attack, diabetes, stroke, cancer in sensitivity analyses (results were unchanged , but not reported)	Excluded first 2 years of follow-up in sensitivity analyses (results were unchanged , but not reported)	BMI, men BMI, women BMI, men, all BMI, women, all	<23 23-24.9 25-27.4 27.5-29.9 ≥30 <23 23-24.9 25-27.4 27.5-29.9 ≥30 <23 23-24.9 25-27.4 27.5-29.9 ≥30 <17.4 kg 17.4-21.2 21.3-24.8	1.2 (1.0, 1.4) 1.0 1.0 (0.9, 1.2) 1.0 (0.9, 1.2) 1.2 (1.0, 1.4) 1.2 (1.0, 1.5) 1.0 0.9 (0.7, 1.1) 0.9 (0.8, 1.1) 1.1 (0.9, 1.3) 1.3 (1.1-1.6) 1.0 0.9 (0.8-1.1) 1.0 (0.8-1.1) 1.1 (1.0-1.3) 1.2 (1.0-1.5) 1.0 0.8 (0.7-1.0)	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

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							BMI, men, never smokers	24.9-29.3 ≥29.4 <23 23-24.9 25-27.4 27.5-29.9 30	0.9 (0.8-1.2) 1.1 (0.9-1.3) 0.9 (0.6-1.3) 1.0 1.1 (0.8-1.4) 0.9 (0.7-1.2) 1.2 (0.9-1.6)	
							BMI, women, never smoker	<23 23-24.9 25-27.4 27.5-29.9 ≥30	1.1 (0.9-1.4) 1.0 0.8 (0.6-1.1) 1.0 (0.8-1.3) 1.2 (0.9-1.5)	
							BMI, men, former smokers	<23 23-24.9 25-27.4 27.5-29.9 ≥30	1.3 (1.0-1.7) 1.0 0.9 (0.8-1.2) 1.0 (0.8-1.2) 1.1 (0.9-1.4)	
							BMI, women, former smokers	<23 23-24.9 25-27.4 27.5-29.9 ≥30	1.3 (0.9-1.9) 1.0 0.8 (0.6-1.2) 0.9 (0.6-1.4)	
							BMI, men, current smokers	<23 23-24.9 25-27.4 27.5-29.9 ≥30	1.1 (0.7-1.5) 1.8 (1.2-2.6) 1.0 0.7 (0.5-1.0) 1.1 (0.7-1.5)	
							BMI, women, current smokers	<23 23-24.9 25-27.4 27.5-29.9 ≥30	1.4 (0.9-2.1) 1.0 0.8 (0.5-1.3) 0.7 (0.4-1.2) 0.7 (0.4-1.1)	
32 33 34 35	2 3 4 5	6 7 8 9 10	11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	32 33 34 35	36 37 38 39 40	41 42 43 44 45 46 47 48 49	BMI	<18.5 18.2-25.0 25-30 30-35 >35	2.18 (1.02-4.66) 1.00 1.25 (0.83-1.87) 0.83 (0.49-1.42) 0.92 (0.47-1.80)	Age, sex, race, smoking status, comorbidities
36 37 38 39 40	41 42 43 44 45	46 47 48 49	50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 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								25-29	1.05 (0.98-1.12)	
								≥30	1.50 (1.29-1.74)	
Gelber RP et al, 2007, USA	Physicians' Health Study	1982-1983 – 1988, 5.7 years follow-up	99253 men, age 40-84 years: 5438 deaths	Self-reported	Prevalent myocardial infarction, stroke, cancer, liver disease excluded in sensitivity analyses	First 2 years of follow-up excluded in sensitivity analyses	BMI, all	<20	1.68 (1.45-1.93)	Age, alcohol intake, physical activity
								20.0-22.4	1.13 (1.05-1.23)	
								22.5-24.9	1.00	
								25.0-27.4	1.01 (0.94-1.08)	
								27.5-29.9	1.12 (1.01-1.23)	
			44276 never smokers: 1659 deaths				BMI, never smokers	≥30.0	1.35 (1.21-1.52)	
								<20	1.08 (0.79-1.47)	
								20.0-22.4	1.04 (0.90-1.21)	
								22.5-24.9	1.00	
			42270 former smokers: 2702 deaths					25.0-27.4	1.03 (0.91-1.17)	
								27.5-29.9	1.14 (0.95-1.36)	
							BMI, former smokers	≥30.0	1.39 (1.13-1.71)	
								<20	1.56 (1.25-1.95)	
			12048 current smokers: 986 deaths					20.0-22.4	1.17 (1.05-1.31)	
								22.5-24.9	1.00	
								25.0-27.4	0.96 (0.87-1.06)	
								27.5-29.9	1.14 (1.00-1.31)	
							BMI, current smokers	≥30.0	1.30 (1.11-1.52)	
								<20	2.42 (1.87-3.13)	
								20.0-22.4	1.15 (0.95-1.38)	
								22.5-24.9	1.00	
								25.0-27.4	1.07 (0.90-1.26)	
								27.5-29.9	0.99 (0.77-1.27)	
							BMI, without prior disease	≥30.0	1.43 (1.09-1.87)	
								<20	1.63 (1.31-2.02)	
								20.0-22.4	1.09 (0.98-1.22)	
								22.5-24.9	1.00	
								25.0-27.4	1.10 (1.00-1.21)	
								27.5-29.9	1.20 (1.05-1.37)	
							BMI, with prior disease	≥30.0	1.57 (1.36-1.82)	
								<20	1.62 (1.33-1.96)	
								20.0-22.4	1.15 (1.03-1.29)	
								22.5-24.9	1.00	
								25.0-27.4	0.89 (0.80-0.99)	
								27.5-29.9	0.99 (0.85-1.14)	
							BMI, with prior disease, ever smokers, ≤2 years follow-up	≥30.0	1.08 (0.90-1.29)	
								<20	1.68 (1.45-1.95)	
								20.0-22.4	1.15 (1.06-1.25)	
								22.5-24.9	1.00	
								25.0-27.4	0.97 (0.90-1.04)	
								27.5-29.9	1.03 (0.92-1.14)	

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							BMI, without prior disease, never smokers, excluding first 2 years of follow-up	≥ 30.0 < 20 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 ≥ 30.0	1.27 (1.13-1.44) 0.88 (0.56-1.40) 0.99 (0.81-1.21) 1.00 1.16 (0.98-1.36) 1.30 (1.03-1.63) 1.47 (1.13-1.93)	
Polan CM et al, 2007, USA	Study of Osteoporotic Fractures	1989-1991 – 1997, 8 years follow-up	8029 women, age ≥ 65 years: 945 deaths 4864 never smokers: 457 deaths	Measured	No	No	BMI, all BMI, never smokers	≤ 22.38 $> 22.38-24.56$ $> 24.56-26.73$ $> 26.73-29.82$ > 29.82 ≤ 22.38 $> 22.38-24.56$ $> 24.56-26.73$ $> 26.73-29.82$ > 29.82	1.00 0.80 (0.65-0.96) 0.70 (0.57-0.87) 0.72 (0.58-0.89) 0.89 (0.72-1.10) 1.00 0.94 (0.71-1.24) 0.83 (0.62-1.11) 0.81 (0.60-1.09) 1.20 (0.90-1.60)	Age, smoking status (all), self-reported health, grip strength, nonthiazide diuretic use, femoral neck bone mineral density
Pischon T et al, 2008, Europe	European Prospective Investigation into Cancer and Nutrition	1992-2000 - NA, 9.7 years follow-up	359387 men and women, age 25-70 years: 14273 deaths	Measured	Excluded participants with prevalent cancer, heart disease, or stroke	Analyses were stratified by > 5 years or shorter follow-up	BMI, men BMI, women BMI, men, never smokers	< 18.5 18.5-21.0 21.0- < 23.5 23.5- < 25 25- < 26.5 26.5- < 28.0 28.0- < 30.0 30.0- < 35.0 ≥ 35.0 < 18.5 18.5-21.0 21.0- < 23.5 23.5- < 25 25- < 26.5 26.5- < 28.0 28.0- < 30.0 30.0- < 35.0 ≥ 35.0 < 18.5 18.5-21.0 21.0- < 23.5 23.5- < 25 25- < 26.5 26.5- < 28.0 28.0- < 30.0 30.0- < 35.0	2.30 (1.84-2.86) 1.39 (1.24-1.57) 1.03 (0.94-1.12) 1.00 0.91 (0.84-0.99) 0.96 (0.88-1.04) 1.08 (1.00-1.17) 1.24 (1.14-1.35) 1.94 (1.71-2.20) 1.71 (1.44-2.01) 1.22 (1.10-1.34) 1.00 (0.92-1.09) 1.00 1.02 (0.92-1.11) 1.07 (0.97-1.18) 1.11 (1.00-1.22) 1.17 (1.07-1.29) 1.65 (1.46-1.85) 1.19 (0.54-2.62) 1.25 (0.93-1.67) 0.97 (0.80-1.07) 1.00 0.89 (0.73-1.07) 1.05 (0.86-1.27) 1.21 (1.01-1.47) 1.48 (1.22-1.79)	Age, smoking status, education, alcohol, activity, height

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							BMI, women, never smokers	≥35.0 <18.5 18.5-21.0 21.0-<23.5 23.5-<25 25-<26.5 26.5-<28.0 28.0-<30.0 30.0-<35.0 ≥35.0	2.78 (2.09-3.71) 1.44 (1.08-1.92) 1.09 (0.93-1.27) 1.00 (0.88-1.13) 1.00 1.00 (0.87-1.15) 1.12 (0.98-1.30) 1.12 (0.97-1.29) 1.25 (1.09-1.43) 1.80 (1.53-2.12)	
							BMI, men, former smokers	<18.5 18.5-21.0 21.0-<23.5 23.5-<25 25-<26.5 26.5-<28.0 28.0-<30.0 30.0-<35.0 ≥35.0	2.18 (1.39-3.41) 1.69 (1.34-2.13) 1.05 (0.90-1.22) 1.00 0.95 (0.83-1.09) 1.01 (0.88-1.15) 1.16 (1.01-1.32) 1.39 (1.21-1.59) 2.10 (1.71-2.58)	
							BMI, women, former smokers	<18.5 18.5-21.0 21.0-<23.5 23.5-<25 25-<26.5 26.5-<28.0 28.0-<30.0 30.0-<35.0 ≥35.0	1.47 (0.98-2.20) 1.01 (0.82-1.25) 0.85 (0.72-1.00) 1.00 0.94 (0.79-1.12) 0.91 (0.75-1.11) 0.94 (0.77-1.14) 0.95 (0.79-1.16) 1.49 (1.16-1.91)	
							BMI, men, current smokers	<18.5 18.5-21.0 21.0-<23.5 23.5-<25 25-<26.5 26.5-<28.0 28.0-<30.0 30.0-<35.0 ≥35.0	2.75 (2.09-3.63) 1.39 (1.19-1.63) 1.03 (0.91-1.17) 1.00 0.86 (0.76-0.98) 0.91 (0.80-1.03) 0.99 (0.87-1.13) 1.11 (0.98-1.26) 1.66 (1.34-2.05)	
							BMI, women, current smokers	<18.5 18.5-21.0 21.0-<23.5 23.5-<25 25-<26.5 26.5-<28.0	2.29 (1.79-2.95) 1.53 (1.29-1.81) 1.14 (0.98-1.33) 1.00 1.07 (0.90-1.28) 1.21 (1.00-1.46)	

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								28.0-<30.0 30.0-<35.0 ≥35.0	1.30 (1.07-1.58) 1.38 (1.14-1.67) 1.60 (1.20-2.13)	
Hozawa A et al, 2008, Japan	NIPPON DATA80	1980 – 1999, 19 years follow-up	8924 men and women, age 30-92 years: 1718 deaths 3712 never smokers: 329 deaths	Measured	Prevalent CVD excluded	First 5 years of follow-up excluded in sensitivity analysis	BMI, all BMI, never smokers, healthy subjects	<18.5 18.5-21 21-23 23-25 25-27 ≥27 <18.5 18.5-21 21-23 23-25 25-27 ≥27	1.39 (1.19-1.62) 1.17 (1.03-1.33) 1.07 (0.94-1.22) 1.00 1.06 (0.90-1.26) 1.19 (1.00-1.42) 2.01 (1.32-3.05) 1.26 (0.92-1.72) 1.07 (0.79-1.44) 1.00 1.46 (1.05-2.04) 1.61 (1.16-2.24)	Age, sex, smoking status and cigarettes per day, alcohol
Luchsinger JA et al, 2008, USA	Northern Manhattan	1992-1994 – 2003, 6.9 years follow-up	1372 men and women, age ≥65 years: 479 deaths	Measured	No	First 2 years excluded in sensitivity analyses, results only partly reported	BMI	<23 23-26.1 26.2-29.4 >29.4	1.5 (1.1-2.9) 1.0 1.2 (0.9-1.6) 1.2 (0.9-1.5)	Age, sex, education, ethnic group, cancer, current smoking status, dementia
Orsini N et al, 2008, Sweden	Cohort of Swedish Men	1997-1998 – 2007, 9.7 years follow-up	37633 men, age 45-79 years: 4086 deaths	Self-reported	Prevalent cancer, cardiovascular disease, diabetes were excluded	No	BMI, high physical activity BMI, medium physical activity BMI, low physical activity	<25.0 25.0-29.9 ≥30.0 <25.0 25.0-29.9 ≥30.0 <25.0 25.0-29.9 ≥30.0	1.00 1.08 (0.95-1.22) 1.43 (1.13-1.80) 1.18 (1.04-1.34) 1.08 (0.95-1.22) 1.47 (1.17-1.87) 1.53 (1.36-1.72) 1.32 (1.17-1.48) 1.73 (1.44-2.06)	Age, smoking status, pack-years of smoking, alcohol, education, parental history of CHD and cancer
Wivimaki M et al, 2008, United Kingdom	Whitehall Study	1967-1970 - 2005, 35 years follow-up	18860 men, age 40-69 years: 13498 deaths 7865 healthy never smokers: 4766 deaths	Measured	Prevalent cardiovascular disease, hypertension, heart disease, ischemia, intermittent claudication, dyspnea, bronchitis,	First 5 years of follow-up excluded in sensitivity analyses	BMI, all	<18.5 18.5-18.9 19.0-19.9 20.0-20.9 21.0-21.9 22.0-22.9 23.0-23.9 24.0-24.9 25.0-25.9 26.0-26.9 27.0-27.9 28.0-28.9	1.54 (1.33-1.79) 1.25 (1.03-1.52) 1.13 (1.01-1.26) 1.13 (1.04-1.24) 1.09 (1.01-1.19) 0.95 (0.89-1.03) 1.00 0.98 (0.92-1.05) 1.04 (0.98-1.11) 1.04 (0.98-1.12) 1.12 (1.04-1.21) 1.22 (1.11-1.33)	Age

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					diabetes, unexplained weight loss		BMI, healthy never smokers	29.0-29.9 30.0-30.9 31.0-31.9 32.0-32.9 ≥33.0 <18.5 18.5-18.9 19.0-19.9 20.0-20.9 21.0-21.9 22.0-22.9 23.0-23.9 24.0-24.9 25.0-25.9 26.0-26.9 27.0-27.9 28.0-28.9 29.0-29.9 30.0-30.9 31.0-31.9 32.0-32.9 ≥33.0	1.18 (1.06-1.30) 1.28 (1.12-1.46) 1.47 (1.25-1.71) 1.73 (1.40-2.14) 1.85 (1.57-2.18) 1.26 (0.89-1.79) 1.47 (0.98-2.21) 1.06 (0.86-1.31) 0.95 (0.81-1.13) 1.02 (0.88-1.17) 0.96 (0.85-1.08) 1.00 1.06 (0.95-1.18) 1.13 (1.01-1.25) 1.10 (0.98-1.23) 1.20 (1.06-1.36) 1.40 (1.21-1.62) 1.21 (1.02-1.44) 1.54 (1.23-1.91) 1.59 (1.22-2.06) 1.90 (1.31-2.75) 2.32 (1.73-3.10)	
Pednekar MS et al, 2008, India	Mumbai City	1991-97 – 2003, 5.2 years follow-up	148173 men and women, age ≥35 years: 13261 deaths Never smokers or smokeless tobacco users: 3255 deaths	Measured	No	First 2 years of follow-up was excluded in a sensitivity analysis	BMI, men, never user of tobacco BMI, smokeless tobacco user BMI, men, smoker BMI, women, never user of tobacco	<16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5	2.68 (2.26-3.19) 1.50 (1.21-1.86) 1.37 (1.16-1.62) 1.10 (0.98-1.23) 1.00 1.34 (1.05-1.71) 2.75 (2.38-3.19) 1.71 (1.44-2.03) 1.53 (1.33-1.77) 1.18 (1.06-1.32) 1.02 (0.86-1.17) 1.17 (0.90-1.51) 3.36 (2.93-3.85) 2.38 (2.04-2.78) 2.02 (1.76-2.31) 1.61 (1.44-1.80) 1.38 (1.20-1.59) 1.56 (1.21-2.01) 2.70 (2.12-3.45) 1.80 (1.29-2.53) 1.37 (1.04-1.80)	Age, education, religion, mother tongue

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							BMI, women, smokeless tobacco user	18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0	1.07 (0.90-1.26) 1.00 1.09 (0.84-1.42) 2.22 (1.86-2.64) 1.55 (1.25-1.91) 1.48 (1.23-1.77) 1.20 (1.03-1.40) 1.04 (0.87-1.24) 1.14 (0.89-1.46)	
Bednekar MS et al, 2008, India	Mumbai City	1991-97 – 2003, 5.2 years follow-up	148173 men and women, age ≥35 years: 13261 deaths	Measured	No	First 2 years of follow-up was excluded in a sensitivity analysis	BMI, women BMI, men BMI, women, excluding first 2 years of follow-up BMI, men, excluding first 2 years of follow-up	<16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0 <16.0 16.0-<17.0 17.0-<18.5 18.5-<25.0 25.0-<30.0 ≥30.0	1.94 (1.75-2.15) 1.38 (1.19-1.60) 1.24 (1.11-1.39) 1.00 0.89 (0.81-0.98) 0.97 (0.83-1.14) 2.24 (2.09-2.39) 1.45 (1.33-1.58) 1.27 (1.19-1.36) 1.00 0.87 (0.82-0.93) 1.05 (0.92-1.21) 1.83 (1.62-2.06) 1.36 (1.15-1.61) 1.15 (1.01-1.31) 1.00 0.89 (0.80-0.99) 0.90 (0.75-1.08) 1.92 (1.77-2.09) 1.38 (1.25-1.53) 1.26 (1.16-1.36) 1.00 0.90 (0.84-0.97) 1.13 (0.97-1.32)	Age, education, religion, mother tongue, tobacco
Matsuo T et al, 2008, Japan	Ibaraki Prefecture	1993-2003, 9.7/9.9 years follow-up	32060 men and 61916 women, age 40-79 years: 3930/3164 deaths	Measured	No	First 3 years of follow-up excluded in main analysis	BMI, men, age 40-59 years BMI, men, age 60-79 years	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0 <18.5 18.5-20.9 21.0-22.9	2.05 (1.25-3.35) 1.16 (0.85-1.58) 1.00 1.09 (0.83-1.43) 1.02 (0.76-1.38) 1.08 (0.77-1.52) 1.54 (0.88-2.70) 1.58 (1.39-1.79) 1.17 (1.06-1.29) 1.00	Age, alcohol, smoking status

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							BMI, women, age 40-59 years	23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0 <18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0	0.97 (0.88-1.07) 0.93 (0.83-1.05) 0.93 (0.80-1.08) 1.43 (1.08-1.89) 1.77 (1.09-2.88) 1.13 (0.82-1.55) 1.00 1.18 (0.89-1.56) 1.23 (0.90-1.68) 1.46 (1.04-2.05) 2.23 (1.46-3.42)	
							BMI, women, age 60-79 years	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-26.9 27.0-29.9 ≥30.0	1.70 (1.46-1.99) 1.17 (1.04-1.33) 1.00 0.97 (0.87-1.10) 1.03 (0.91-1.17) 1.17 (1.02-1.33) 1.39 (1.14-1.69)	
Shang X et al, 2008, China	Shanghai Women's Health Study	1996-2000 – 2007, 7.4 years follow-up	74896 women, age 40-70 years: 2389 deaths 26055 women, age 51-70 years: 1187 deaths 19883 healthy, never smoking women without previous CVD, cancer, substantial weight loss, excluding first 3 years of follow-up: 486 deaths	Measured	Participants with previous CVD, cancer, substantial weight loss, and first 3 years of follow-up were excluded in a sensitivity analysis	First 3 years of follow-up was excluded in a sensitivity analysis	BMI, baseline, all age 51-70 years BMI, baseline, healthy never smokers, excl. first 3 years of follow-up	<22.2 22.2-24.3 24.4-26.6 ≥26.7 <22.2 22.2-24.3 24.4-26.6 ≥26.7	1.00 0.84 (0.71-0.99) 1.01 (0.86-1.18) 1.11 (0.95-1.30) 1.00 1.13 (0.85-1.50) 1.40 (1.17-1.84) 1.61 (1.23-2.10)	Age Age, education, occupation, annual family income, menopausal status, HRT, exercise, alcohol, SFA, vegetables and fruits

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12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 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784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000	Trivandrum Oral Cancer Study	1995-2004, 8 years follow-up	75868 men and women, age ≥35 years: 4684 deaths 59024 never smokers: 879/2098 deaths 1301 former smokers: NA 17334 current smokers: 1400 deaths	Measured	Prevalent cancer, tuberculosis, stroke, cardio- vascular disease, asthma were excluded	First 3 years of follow-up excluded in sensitivity analyses	BMI, men BMI, women BMI, men, non-smokers (never) BMI, women, non-smokers (never) BMI, men, current smokers BMI, men	<16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4 ≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4 ≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4 ≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4 ≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4 ≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4 ≥27.5	1.35 (1.15-1.58) 1.19 (1.07-1.31) 1.00 0.92 (0.81-1.05) 0.88 (0.75-1.04) 0.78 (0.59-1.02) 1.29 (1.10-1.51) 1.17 (1.04-1.31) 1.00 0.90 (0.78-1.04) 1.01 (0.87-1.17) 0.87 (0.72-1.04) 1.95 (1.46-2.60) 1.33 (1.11-1.59) 1.00 1.01 (0.83-1.23) 0.82 (0.64-1.05) 0.75 (0.51-1.10) 1.27 (1.07-1.50) 1.15 (1.03-1.29) 1.00 0.90 (0.78-1.04) 1.00 (0.86-1.17) 0.87 (0.72-1.04) 1.17 (0.95-1.44) 1.11 (0.98-1.26) 1.00 0.86 (0.70-1.07) 1.02 (0.79-1.31) 0.96 (0.62-1.47) 1.26 (1.03-1.55) 1.16 (1.03-1.32) 1.00 0.95 (0.81-1.12) 0.85 (0.69-1.05)	Age, education, occupation, smoking status, pack-years, SES, study group, tobacco chewing, alcohol, religion

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							BMI, women	≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4	0.89 (0.65-1.21) 1.20 (0.99-1.47) 1.12 (0.98-1.28) 1.00 0.87 (0.73-1.04) 1.11 (0.93-1.33)	
							BMI, men, non-smokers	≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4	0.93 (0.75-1.15) 1.79 (1.22-2.63) 1.27 (1.01-1.60) 1.00 1.16 (0.92-1.46) 0.80 (0.59-1.09)	
							BMI, women, non-smokers	≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4	0.97 (0.64-1.48) 1.21 (0.98-1.48) 1.11 (0.97-1.28) 1.00 0.87 (0.73-1.04) 1.11 (0.92-1.32)	
							BMI, men, current smokers	≥27.5 <16 16-18.4 18.5-22.9 23.0-24.9 25.0-27.4	0.93 (0.75-1.15) 1.12 (0.87-1.44) 1.06 (0.91-1.25) 1.00 0.79 (0.60-1.02) 0.98 (0.72-1.34)	
Engback Weitöft GR et al, 2008, Sweden	Swedish Surveys of Living Conditions (ULF)	1980-1981 – 1988- 1989, 12 years follow-up	23580 men and women, age 16-74 years: 2306 deaths	Self-reported	No	Excluding first 3 years of follow-up in sensitivity analyses	BMI, men	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.4 (1.6-3.6) 1.0 1.0 (0.9-1.1) 1.5 (1.2-1.8)	Age, smoking status, longstanding illness, education
							BMI, women	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.0 (1.5-2.7) 1.0 1.1 (1.0-1.3) 1.4 (1.1-1.7)	
							BMI, men, excluding first 3 years	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.3 (1.4-3.7) 1.0 1.1 (0.9-1.2) 1.4 (1.1-1.7)	
							BMI, women, excluding first 3 years	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.0 (1.4-2.8) 1.0 1.1 (0.9-1.3) 1.4 (1.1-1.7)	

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5 Moore SC et al, 2008, USA	Breast Cancer Detection Demonstration Project	1987-1989 – 1997, 10 years follow-up	50186 women, age 40-93 years: 5201 deaths 25103 never smokers: 2715 deaths 16321 former smokers: 1567 deaths 6203 current smokers: 791 deaths	Measured	Prevalent coronary heart disease, diabetes or cancer excluded in sensitivity analyses	No	BMI, all	15.0-18.4 18.5-20.9 21.0-23.4 23.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	1.43 (1.19-1.72) 1.07 (0.98-1.17) 1.00 1.10 (1.00-1.20) 1.20 (1.11-1.31) 1.23 (1.11-1.37) 1.60 (1.44-1.77) 1.92 (1.64-2.24)	Age, menopausal status, annual household income, education, race/ethnicity, smoking status and cigarettes per day, physical activity
6							BMI, any chronic disease history	15.0-18.4 18.5-20.9 21.0-23.4 23.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	1.10 (0.74-1.65) 1.21 (1.01-1.45) 1.00 1.29 (1.08-1.54) 1.21 (1.02-1.42) 1.34 (1.09-1.64) 1.58 (1.29-1.92) 1.68 (1.25-2.26)	
7							BMI, no chronic disease history	15.0-18.4 18.5-20.9 21.0-23.4 23.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	1.53 (1.25-1.88) 1.04 (0.94-1.15) 1.00 1.04 (0.94-1.16) 1.19 (1.08-1.31) 1.17 (1.03-1.32) 1.57 (1.38-1.77) 1.93 (1.61-2.33)	
8							BMI, never smokers	15.0-18.4 18.5-20.9 21.0-23.4 23.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	1.32 (0.99-1.75) 1.07 (0.94-1.21) 1.00 1.09 (0.97-1.24) 1.18 (1.05-1.32) 1.28 (1.11-1.47) 1.58 (1.38-1.82) 1.94 (1.58-2.40)	
9							BMI, former smokers	15.0-18.4 18.5-20.9 21.0-23.4 23.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	1.50 (1.07-2.09) 1.05 (0.90-1.23) 1.00 1.13 (0.97-1.32) 1.19 (1.02-1.38) 1.13 (0.92-1.38) 1.70 (1.40-2.06) 1.65 (1.22-2.22)	
10							BMI, current smokers	15.0-18.4 18.5-20.9 21.0-23.4	1.72 (1.22-2.43) 1.19 (0.97-1.45) 1.00	

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5								23.5-24.9	1.11 (0.88-1.40)	
6								25.0-27.4	1.26 (1.02-1.57)	
7								27.5-29.9	1.09 (0.80-1.50)	
8								30.0-34.9	1.33 (0.96-1.82)	
9								≥35.0	2.21 (1.40-3.47)	
10	Kulminski	National Long	1994-NA,	4791 men and	Self-reported	No,	BMI, all	<18.5	1.86 (1.62-2.14)	Age, sex
11	M et al,	Term Care	9 years	women, age	No,	sensitivity		18.5-21.9	1.27 (1.14-1.41)	
12	2008, USA	Survey	follow-up	≥65 years:	analyses	excluding		22.0-24.9	1.00	
13				2956 deaths	subjects	with		25-29.9	0.82 (0.74-0.91)	
14					disability		BMI, men	30-34.9	0.78 (0.68-0.91)	
15								≥35	1.05 (0.87-1.26)	
16								<18.5	2.24 (1.74-2.88)	
17								18.5-21.9	1.51 (1.26-1.80)	
18								22.0-24.9	1.00	
19								25-29.9	0.80 (0.68-0.93)	
20							BMI, women	30-34.9	0.85 (0.66-1.08)	
21								≥35	1.15 (0.79-1.67)	
22								<18.5	1.70 (1.44-2.02)	
23								18.5-21.9	1.15 (1.00-1.31)	
24								22.0-24.9	1.00	
25								25-29.9	0.84 (0.73-0.95)	
26								30-34.9	0.75 (0.62-0.89)	
27							BMI, all	≥35	0.99 (0.80-1.23)	
28								<18.5	1.96 (1.68-2.29)	
29								18.5-21.9	1.30 (1.16-1.47)	
30								22.0-24.9	1.00	
31								25-29.9	0.81 (0.73-0.91)	
32								30-34.9	0.76 (0.65-0.89)	
33							BMI, disabled	≥35	1.08 (0.89-1.32)	
34								<18.5	1.31 (0.86-2.01)	
35								18.5-21.9	1.10 (0.85-1.42)	
36								22.0-24.9	1.00	
37								25-29.9	0.73 (0.58-0.91)	
38								30-34.9	0.67 (0.47-0.94)	
39							BMI, nondisabled	≥35	1.29 (0.81-2.01)	
40								<18.5	2.01 (1.70-2.38)	
41								18.5-21.9	1.38 (1.20-1.58)	
42								22.0-24.9	1.00	
43								25-29.9	0.85 (0.74-0.96)	
44								30-34.9	0.75 (0.62-0.89)	
45								≥35	0.88 (0.71-1.09)	

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5Guallar- 6Castillon P et 7al, 2009, 8Spain	Spanish Elderly	2000-2001 – 2007, 5.7 years follow-up	3536 men and women, age ≥60 years: 659 deaths	Measured	No	No	BMI	<25.6/<26.1 <28.0/<29.0 <30.7/<32.4 ≥30.7/≥32.4	1.00 0.82 (0.64-1.04) 0.72 (0.58-0.90) 0.85 (0.66-1.08)	Age, sex, education, smoking status, alcohol, leisure-time physical activity, chronic obstructive lung disease, cancer, untreated cataracts, depression requiring treatment, dementia, SF-36 mental summary component
9							BMI, no mobility limitation	<25.6/<26.1 <28.0/<29.0 <30.7/<32.4 ≥30.7/≥32.4	1.00 1.04 (0.67-1.61) 1.03 (0.65-1.64) 0.92 (0.53-1.62)	
10							BMI, mobility limitation	<25.6/<26.1 <28.0/<29.0 <30.7/<32.4 ≥30.7/≥32.4	1.00 0.65 (0.47-0.89) 0.47 (0.34-0.65) 0.52 (0.35-0.78)	
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15Walter S et al, 162009, 17Netherlands	Rotterdam Study	1990-1993 – 2006, 15 years follow-up	5980 men and women, age : 2388 deaths	Measured	Excluded participant with unintentiona l weight loss of >3.5 kg in 18 months before baseline	No	BMI, non-disabled	18.5-25 25-30 30-35 ≥35	1.00 0.96 (0.86-1.07) 1.06 (0.89-1.25) 1.31 (0.86-1.99)	Age, sex, smoking status, pack-years of cigarettes, alcohol consumption, alcohol in g/d, education, income, living situation
18							BMI, disabled	18.5-25 25-30 30-35 ≥35	1.00 0.82 (0.70-0.96) 0.73 (0.60-0.90) 1.12 (0.80-1.57)	
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24Klenk J et al, 252009, Austria	The Vorarlberg Health Monitoring & Promotion Program	1985-2003 – 2006, 15.1 years follow-up	184697 men and women, mean age 41.7 years: 15557 deaths	Measured	No	First 1-3 years follow-up excluded in sensitivity analyses, but not reported	BMI, men	<18.5 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	2.57 (2.17-3.05) 1.44 (1.25-1.65) 1.24 (1.15-1.34) 1.00 1.01 (0.95-1.08) 1.13 (1.05-1.21) 1.25 (1.15-1.35) 2.13 (1.82-2.48)	Age, smoking status
26							BMI, women	<18.5 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0	1.40 (1.21-1.62) 1.11 (0.99-1.26) 1.06 (0.98-1.14) 1.00 1.05 (0.98-1.13) 1.10 (1.02-1.19) 1.29 (1.20-1.40) 1.60 (1.42-1.81)	
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37Wandell PE 38et al, 2009, 39Sweden	Stockholm County Study	1969-1996, 26 years follow-up	1020 men and women, age 18-64 years: 562 deaths	Measured	No	No	BMI, men	<20 20-<25 25-30 >30	1.21 (0.49-3.00) 1.00 0.95 (0.64-1.39) 2.76 (1.43-5.33)	Age, need of care, heart rate, hypertension, low fasting blood glucose, diabetes, alcohol, smoking status
40							BMI, women	<20	0.36 (0.15-0.91)	

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5								20-<25	1.00		
6								25-30	0.88 (0.52-1.50)		
7								>30	1.59 (0.77-3.30)		
8	Gulsvik AK et al, 2009, Norway	Bergen Clinical Blood Pressure Study	1965-2007, 42 years follow-up	5653 men and women, age 22-75 years: 4520 deaths	Measured	No	No	BMI, age 20-44 years	<22 22-24.9 25.0-27.9 ≥28.0	0.85 (0.65-1.12) 1.00 1.23 (0.91-1.66) 1.65 (1.09-2.50)	Sex, hypertension, cholesterol, smoking status and cigarettes per day, SES, diabetes, cardiovascular disease, chronic obstructive pulmonary disease, physical inactivity, physical appearance
10							BMI, age 45-64 years	<22 22-24.9 25.0-27.9 ≥28.0	1.06 (0.87-1.29) 1.00 1.00 (0.84-1.19) 1.29 (1.07-1.56)		
12							BMI, ≥65 years	<22 22-24.9 25.0-27.9 ≥28.0	1.58 (1.11-2.25) 1.00 0.86 (0.64-1.16) 1.10 (0.83-1.46)		
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18	Stessman J et al, 2009, Israel	Jersualem Longitudinal Study	1990, 1998, 2005 – 2008, 18/10/3 years follow-up	447/870/1086 men and women, age 70, 78, and 85 years: NA	NA	No	Yes, excluding the first 1, 3.5 and 6 years of follow-up	BMI, women, 1990-2008	<25 25-29.9 ≥30	1.00 0.55 (0.33-0.92) 0.45 (0.25-0.83)	Perceived economic hardship, self-rated health, physical activity, pack-years of smoking, activity of daily living dependency, hypertension, DM, IHD, cancer
20							BMI, women, 1996-2008	<25 25-29.9 ≥30	1.00 0.55 (0.31-0.97) 0.39 (0.20-0.79)		
22							BMI, women, 1998-2008	<25 25-29.9 ≥30	1.00 0.66 (0.41-1.05) 0.41 (0.25-0.68)		
24							BMI, women, 2001-2008	<25 25-29.9 ≥30	1.00 0.45 (0.26-0.76) 0.28 (0.16-0.49)		
26							BMI, women, 2005-2008	<25 25-29.9 ≥30	1.00 0.30 (0.15-0.62) 0.38 (0.19-0.78)		
28							BMI, women, 2006-2008	<25 25-29.9 ≥30	1.00 0.22 (0.09-0.51) 0.18 (0.07-0.47)		
30							BMI, men, 1990-2008	<25 25-29.9 ≥30	1.00 0.93 (0.63-1.70) 1.03 (0.59-1.79)		
32							BMI, men, 1996-2008	<25 25-29.9 ≥30	1.00 0.88 (0.55-1.40) 1.17 (0.61-2.26)		
34							BMI, men, 1998-2008	<25 25-29.9 ≥30	1.00 0.77 (0.54-1.09) 0.78 (0.48-1.28)		
36							BMI, men, 2001-2008	<25	1.00		
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							BMI, men, 2005-2008	25-29.9 ≥30 <25	0.94 (0.61-1.46) 0.53 (0.27-1.07) 1.00	
							BMI, men, 2006-2008	25-29.9 ≥30 <25	1.06 (0.52-2.10) 0.36 (0.10-1.30) 1.00	
								25-29.9 ≥30	1.04 (0.47-2.30) 0.28 (0.06-1.33)	
Gesari M et al, 2009, Italy	The InCHIANTI Study	1998-2000 – 2006, 5.1 years follow-up	934 men and women, age ≥65 years: 263 deaths	NA	No	No	BMI, no sarcopenia	<25 25-29.9 ≥30	1.00 1.17 (0.65-2.09) 0.99 (0.53-1.84)	Age, sex, site, education, mini-mental state examination score, center for epidemiological studies depression scale score, physical activity, CHF, CAD, hypertension, PAD, respiratory disease, osteoarthritis, stroke, IL-6, CRP, TNF-alpha
							BMI, sarcopenia	<25 25-29.9 ≥30	1.25 (0.69-2.25) 1.24 (0.65-2.37) 1.18 (0.46-3.02)	
Leovius M et al, 2009, Sweden	Swedish Military Conscripts	1969-1970 – 2007, 38 years follow-up	45920 men, mean age 18.7 years: 2878 deaths	Measured	No	No	BMI, all	<18.5 18.5-24.9 25.0-29.9 ≥30.0	0.97 (0.86-1.08) 1.00 1.33 (1.15-1.53) 2.14 (1.61-2.85)	
							BMI, non-smokers	<18.5 18.5-24.9 25.0-29.9 ≥30.0	0.94 (0.75-1.18) 1.00 1.37 (1.05-1.79) 2.16 (1.24-3.76)	
							BMI, smokers	<18.5 18.5-24.9 25.0-29.9 ≥30.0	0.97 (0.85-1.11) 1.00 1.35 (1.14-1.60) 2.23 (1.60-3.12)	Age, muscular strength, SES, smoking status, cigarettes per day
							BMI, 1-10 cig/d	<18.5 18.5-24.9 25.0-29.9 ≥30.0	0.91 (0.75-1.10) 1.00 1.44 (1.11-1.86) 1.83 (0.98-3.42)	
							BMI, >10 cig/d	<18.5 18.5-24.9 25.0-29.9 ≥30.0	1.05 (0.88-1.25) 1.00 1.23 (0.98-1.54) 2.27 (1.53-3.38)	
Grana HM et al, 2010, Canada	National Population Health Survey	1994-1995 - 2005, 12 years follow-up	11326 men and women, age ≥25 years: 1929 deaths	Self-reported	No	First 4 years excluded in sensitivity analyses (Results were	BMI, all	<18.5 18.5-25.0 25.0-30.0 30.0-35.0 ≥35.0	1.73 (1.25-2.39) 1.00 0.83 (0.72-0.96) 0.95 (0.77-1.18) 1.36 (1.00-1.85)	Age, sex, smoking status, physical activity, alcohol

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5			4213 never smokers: 37 deaths			similar, but not reported)	BMI, corrected	<18.5	1.51 (0.99-2.30)	
6								18.5-<25.0	1.00	
7								25.0-<30.0	0.75 (0.65-0.86)	
8								30.0-<35.0	0.84 (0.67-1.05)	
9								≥35.0	1.09 (0.86-1.39)	
10							BMI, age 25-59 years	<18.5	0.87 (0.20-3.85)	
11								18.5-<25.0	1.00	
12								25.0-<30.0	0.91 (0.66-1.25)	
13								30.0-<35.0	0.89 (0.49-1.60)	
14								≥35.0	1.53 (0.91-2.58)	
15							BMI, age ≥60 years	<18.5	1.88 (1.32-2.68)	
16								18.5-<25.0	1.00	
17								25.0-<30.0	0.81 (0.68-0.97)	
18								30.0-<35.0	0.96 (0.76-1.21)	
19								≥35.0	1.25 (0.83-1.90)	
20							BMI, men	<18.5	2.54 (1.47-4.37)	
21								18.5-<25.0	1.00	
22								25.0-<30.0	0.86 (0.71-1.03)	
23								30.0-<35.0	1.10 (0.81-1.49)	
24								≥35.0	1.72 (1.13-2.63)	
25							BMI, women	<18.5	1.50 (1.01-2.22)	
26								18.5-<25.0	1.00	
27								25.0-<30.0	0.77 (0.63-0.95)	
28								30.0-<35.0	0.81 (0.62-1.08)	
29								≥35.0	1.09 (0.69-1.74)	
30							BMI, ever smokers	<18.5	1.69 (1.10-2.60)	
31								18.5-<25.0	1.00	
32								25.0-<30.0	0.82 (0.69-0.96)	
33								30.0-<35.0	0.94 (0.73-1.21)	
34								≥35.0	1.21 (0.85-1.74)	
35							BMI, never smokers	<18.5	2.05 (1.32-3.18)	
36								18.5-<25.0	1.00	
37								25.0-<30.0	0.76 (0.58-0.99)	
38								30.0-<35.0	0.83 (0.55-1.26)	
39								≥35.0	1.68 (0.93-3.05)	
40							BMI	<18.5	1.89 (1.36-2.64)	
								18.5-<20.0	1.23 (0.86-1.76)	
								20.0-<22.5	1.18 (0.98-1.44)	
								22.5-<25.0	1.00	
								25.0-<27.5	0.93 (0.77-1.12)	
								27.5-<30.0	0.87 (0.69-1.10)	
								30.0-<32.5	1.08 (0.80-1.45)	
								32.5-<35.0	0.92 (0.67-1.26)	

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								≥35.0	1.48 (1.06-2.06)	
Royal College of General Practitioners' Oral Contraceptive Study	1994-1995 – 2006, 11.8 years follow-up	10073 women, mean age 56.1 years: 896 deaths	Self-reported	No	No	BMI		<18.50 18.50-24.99 25.00-29.99 ≥30.00	1.66 (1.03-2.68) 1.00 0.98 (0.84-1.14) 1.03 (0.85-1.24)	Age, social class, parity, history of serious illness (IHD, hypertension, stroke, venous thromboembolism, malignancy, diabetes, asthma, bronchitis), pack-years, alcohol, physical activity
Health Effects of Arsenic Longitudinal Study (HEALS)	2000-2002 – 2009, 6.4 years follow-up	11445 men and women, age 18-75 years: 393 deaths	Measured	No	First 2 years excluded in sensitivity analysis (risk estimates not reported, only shown in figure)	BMI, men BMI, women		<16.0 16.0-16.9 17.0-18.4 18.5-22.9 ≥23.0 <16.0 16.0-16.9 17.0-18.4 18.5-22.9 ≥23.0	2.31 (1.34-3.25) 1.62 (1.13-2.33) 1.14 (0.82-1.57) 1.00 1.49 (1.00-2.23) 1.58 (0.92-2.69) 0.89 (0.45-1.77) 0.84 (0.49-1.40) 1.00 0.54 (0.27-1.12)	Age, sex, smoking status, education, BMI-related symptoms experienced in the 6 months prior to baseline (weight loss and weakness)
Uppsala Longitudinal Study of Adult Men (ULSAM)	1970-1973 –NA, 30 years follow-up	1758 men, age ≥50 years: 788 deaths	NA	CVD hospital-ization, diabetes	No	BMI		<25, no metsyn <25, metsyn 25-29.9, no mets 25-29.9, mets ≥30, no metsyn ≥30, metsyn	1.00 1.28 (0.90-1.82) 1.21 (1.03-1.40) 1.53 (1.19-1.96) 1.65 (1.03-2.66) 2.43 (1.81-3.27)	Age, smoking status, LDL cholesterol
Singapore Chinese Health Study	1993-1998 – 2008, 12.4 years follow-up	51251 men and women, age 45-74 years: 8356 deaths 9777 current smokers: 2762 deaths 5708 former smokers: 1423 deaths 35766 never smokers: 4171 deaths	Self-reported	Prevalent cardio-vascular disease, diabetes, respiratory disease excluded in sensitivity analyses	First 5 years of follow-up ecluded in sensitivity analyses	BMI, current smokers including prevalent disease BMI, former smokers including prevalent disease BMI, never smokers, including prevalent disease		<18.5 18.5-19.9 20.0-21.4 21.5-22.9 23.0-24.4 24.5-25.9 26.0-27.4 ≥27.5 <18.5 18.5-19.9 20.0-21.4 21.5-22.9 23.0-24.4 24.5-25.9 26.0-27.4 ≥27.5 <18.5 18.5-19.9	1.18 (0.97-1.43) 1.14 (0.94-1.38) 1.03 (0.86-1.25) 0.99 (0.82-1.20) 1.00 (0.83-1.21) 1.09 (0.89-1.33) 1.00 1.25 (1.01-1.55) 1.48 (1.20-1.82) 1.25 (1.02-1.55) 1.12 (0.93-1.36) 1.04 (0.86-1.26) 1.00 1.17 (0.96-1.43) 1.27 (1.02-1.59) 1.36 (1.11-1.68) 1.19 (1.03-1.39) 1.00	Age, sex, year of enrollment, dialect, education, dietary pattern score, physical activity, intensity and duration of smoking among smokers, and durations since quit in former smokers

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5								20.0-21.4	0.93 (0.82-1.06)	
6								21.5-22.9	1.02 (0.90-1.15)	
7								23.0-24.4	1.00 (0.88-1.13)	
8								24.5-25.9	1.02 (0.89-1.16)	
9								26.0-27.4	1.16 (1.00-1.34)	
10								≥27.5	1.27 (1.12-1.45)	
11							BMI, current smokers	<18.5	1.40 (1.11-1.77)	
12							excluding prevalent disease	18.5-19.9	1.32 (1.05-1.67)	
13								20.0-21.4	1.17 (0.93-1.47)	
14								21.5-22.9	1.19 (0.94-1.51)	
15								23.0-24.4	1.13 (0.89-1.43)	
16								24.5-25.9	1.23 (0.96-1.58)	
17								26.0-27.4	1.00	
18								≥27.5	1.44 (1.10-1.87)	
19							BMI, former smokers	<18.5	1.69 (1.29-2.21)	
20							excluding prevalent disease	18.5-19.9	1.26 (0.96-1.67)	
21								20.0-21.4	1.23 (0.95-1.58)	
22								21.5-22.9	1.10 (0.85-1.42)	
23								23.0-24.4	1.00	
24								24.5-25.9	1.16 (0.89-1.52)	
25								26.0-27.4	1.48 (1.10-1.98)	
26								≥27.5	1.51 (1.15-1.98)	
27							BMI, never smokers,	<18.5	1.27 (1.06-1.52)	
28							excluding prevalent disease	18.5-19.9	1.00	
29								20.0-21.4	0.99 (0.85-1.15)	
30								21.5-22.9	1.06 (0.91-1.23)	
31								23.0-24.4	1.01 (0.87-1.18)	
32								24.5-25.9	1.04 (0.89-1.22)	
33								26.0-27.4	1.19 (1.01-1.42)	
34								≥27.5	1.25 (1.07-1.47)	
35							BMI, current smokers	<18.5	1.52 (1.14-2.02)	
36							excluding prevalent disease,	18.5-19.9	1.50 (1.13-1.99)	
37							excluding first 5 years of	20.0-21.4	1.34 (1.01-1.77)	
38							follow-up	21.5-22.9	1.38 (1.04-1.83)	
39								23.0-24.4	1.27 (0.95-1.69)	
40								24.5-25.9	1.35 (1.00-1.83)	
								26.0-27.4	1.00	
								≥27.5	1.65 (1.20-2.26)	
							BMI, former smokers	<18.5	1.66 (1.20-2.28)	
							excluding prevalent disease,	18.5-19.9	1.21 (0.87-1.68)	
							excluding first 5 years of	20.0-21.4	1.13 (0.84-1.52)	
							follow-up	21.5-22.9	1.15 (0.86-1.54)	
								23.0-24.4	1.00	

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5								24.5-25.9	1.16 (0.85-1.57)		
6								26.0-27.4	1.43 (1.01-2.01)		
7								≥27.5	1.56 (1.14-2.13)		
8							BMI, never smokers, excluding prevalent disease, excluding first 5 years of follow-up	<18.5	1.32 (1.07-1.62)		
9								18.5-19.9	1.00		
10								20.0-21.4	1.06 (0.88-1.26)		
11								21.5-22.9	1.15 (0.96-1.36)		
12								23.0-24.4	1.07 (0.89-1.27)		
13								24.5-25.9	1.09 (0.91-1.31)		
14								26.0-27.4	1.25 (1.02-1.53)		
15								≥27.5	1.40 (1.16-1.68)		
16	Wapattanawo	National Health	2004-2007, 3.8 years follow-up	15997 men and women, age ≥15 years: 1575 deaths	Measured	No	No	BMI, men	<18.5	1.71 (1.37-2.11)	Age, marital status, urban/rural status, education, living arrangement, diabetes, hypertension, smoking status, physical activity
17	et al, 2010, Thailand	Examination Survey 111							18.5-22.9	1.00	
18									23.0-24.9	0.78 (0.61-0.99)	
19									25.0-27.5	0.79 (0.61-1.03)	
20									27.5-29.9	0.63 (0.43-0.94)	
21									30.0-34.9	0.61 (0.34-1.09)	
22							BMI, women	≥35.0	2.02 (0.74-5.52)		
23								<18.5	1.33 (1.06-1.67)		
24								18.5-22.9	1.00		
25								23.0-24.9	0.71 (0.55-0.91)		
26								25.0-27.5	0.80 (0.62-1.02)		
27								27.5-29.9	0.58 (0.41-0.82)		
28								30.0-34.9	0.60 (0.40-0.90)		
29								≥35.0	0.71 (0.22-1.51)		
30	Bellocchio R et	Swedish	1997 – 2007, 10 years follow-up	14585 men and 26144 women, age 20-94 years: 1054/757 deaths	Self-reported	Cancer, cardio- vascular disease	First 2 years of follow-up excluded in sensitivity analyses (partly reported for men)	BMI, men	<25	1.00	Age, physical activity, cigarette smoking status, alcohol, use of vitamins and minerals, education (men), OC use and HRT (women)
31	al, 2010, Sweden	National March Cohort Study							25-29.9	1.12 (0.97-1.30)	
32									≥30	1.62 (1.21-2.17)	
33									<25	1.00	
34									25-29.9	1.02 (0.85-1.22)	
35									≥30	1.35 (1.02-1.78)	
36	Leantz PM et	Americans’ Changing Lives study	1986-2005, 19 years follow-up	3617 men and women, age ≥25 years: 1409 deaths	Self-reported	No	No	BMI, age <55 years	<18.5	2.33 (0.60-9.04)	Age, sex, race, residence, education, inflation-adjusted income, smoking status, alcohol, physical activity
37	al, 2010, USA								18.5-24.9	1.00	
38									25.0-29.9	1.15 (0.71-1.84)	
39									≥30.0	1.50 (0.89-2.54)	
40									<18.5	2.21 (1.68-2.89)	
41									18.5-24.9	1.00	
42									25.0-29.9	0.81 (0.69-0.96)	
43									≥30.0	0.73 (0.59-0.90)	

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5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49	Vessey M et al, 2010, UK	The Oxford-Family Planning Association Contraceptive Study	1968-1974 – 2009, ~ 35.4 years follow-up	17032 women, age 25-39 years: 1715 deaths	Self-reported	No exclusions reported	No exclusions reported	BMI	<20 20-21 22-23 24-25 26-27 ≥28	1.00 0.86 (0.74-1.01) 0.96 (0.83-1.13) 1.00 (0.84-1.20) 1.18 (0.95-1.46) 1.33 (1.07-1.64)	Age, parity, social class, smoking status and cigarettes per day, OC use, total OC use months, interval since last OC use
	Berraho M et al, 2010, France	PAQUID Cohort Study	NA-NA, 13 years follow-up	3646 men and women, age ≥65 years: 1973 deaths	Self-reported	No	No	BMI BMI, disabled BMI, nondisabled	<18.5 18.5-21.9 22.0-24.9 25.0-29.9 ≥30.0 <18.5 18.5-21.9 22.0-24.9 25.0-29.9 ≥30.0 <18.5 18.5-21.9 22.0-24.9 25.0-29.9 ≥30.0	1.45 (1.17-1.78) 1.27 (1.12-1.43) 1.00 0.98 (0.88-1.10) 1.06 (0.89-1.27) 1.43 (1.15-1.77) 1.30 (1.14-1.49) 1.00 0.95 (0.84-1.08) 1.06 (0.87-1.28) 0.88 (0.32-2.42) 0.95 (0.67-1.35) 1.00 1.12 (0.86-1.46) 0.87 (0.51-1.48)	Age, physical activity, smoking status, comorbidity (diabetes, dyspnea, hypertension, ischemic heart disease antecedent, stroke antecedent, number of medications used)
	Atlantis E et al, 2010, Australia	The Melbourne Longitudinal Studies on Healthy Aging (MELSHA)	1994-2006, 12 years follow-up	1000 men and women, age ≥65 years: 509 deaths	Measured	No exclusions	No exclusions	BMI	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.15 (1.15-4.02) 1.00 0.96 (0.77-1.20) 1.04 (0.76-1.42)	Age, sex, smoking status, activities of daily living, timed get up and go, social activity, cognitive impairment, CVD
	Yagai M et al, 2010, Japan	The Ohsaki Cohort Study	1994-2006, 12 years follow-up	43972 men and women, age 40-79 years: 5707 deaths	Self-reported	Prevalent cancer, myocardial infarction, stroke excluded	First 2 years of follow-up excluded in sensitivity analyses	BMI, men BMI, excluded first 2 years BMI, women	<18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-27.4 27.5-29.9 ≥30.0 <18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-27.4 27.5-29.9 ≥30.0 <18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-27.4 27.5-29.9 ≥30.0	1.42 (1.23-1.65) 1.10 (0.99-1.22) 1.04 (0.95-1.14) 1.00 1.01 (0.90-1.13) 1.10 (0.92-1.31) 1.44 (1.11-1.87) 1.35 (1.15-1.59) 1.06 (0.95-1.19) 1.01 (0.92-1.12) 1.00 0.99 (0.88-1.12) 1.05 (0.87-1.26) 1.42 (1.07-1.88) 1.49 (1.24-1.80) 1.15 (0.99-1.33) 0.99 (0.87-1.14)	Age, weight change since age 20 years, education, marital status, cigarette smoking status and cigarettes per day, alcohol, time spent walking, sports and physical exercise, history of kidney disease, history of liver disease Models with exclusion of first 2 year were also adjusted for hypertension and diabetes

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							BMI, excluded first 2 years	23.0-24.9 25.0-27.4 27.5-29.9 ≥30.0 <18.5 18.5-20.9 21.0-22.9 23.0-24.9 25.0-27.4 27.5-29.9 ≥30.0	1.00 1.03 (0.89-1.19) 1.07 (0.89-1.30) 1.33 (1.05-1.69) 1.78 (1.13-2.81) 1.36 (1.00-1.86) 1.21 (0.92-1.59) 1.00 1.02 (0.76-1.36) 0.99 (0.68-1.45) 1.32 (0.82-2.15)	
Byun W et al, 2010, USA	Aerobics Center Longitudinal Study	1974-2002 – 2003, 16.1 years follow-up	38110 men, age 20-84 years: 2642 deaths	Measured	Prevalent cardio- vascular disease or cancer excluded	No	BMI	18.5-24.9 25.0-29.9 ≥30.0	1.00 0.97 (0.89-1.05) 1.31 (1.16-1.48)	Age, examination year, hypertension, diabetes, hypercholesterolemia, smoking status, alcohol, physical activity, cardiorespiratory fitness
Hart CL et al, 2011, United Kingdom	Renfrew and Paisley Study	1972-1976 - NA, 22.7 years follow-up	3613 never smoking women, age 45-64 years: 1796 deaths	Measured	No	No	BMI	18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.00 1.10 (0.99-1.23) 1.35 (1.17-1.56) 2.01 (1.67-2.42)	Age, occupational class
Carlsson S et al, 2011, Sweden	Swedish Twin Registry	1969-1970, 1972 – 2004, 25.7 years follow-up	44258 men and women, age 16-86 years: 14217 deaths	Self-reported	No	First 2 years of follow-up excluded	BMI, men BMI, women	<18.5 18.5-<25 25-<29.9 ≥30 <18.5 18.5-<25 25-<29.9 ≥30	1.18 (0.93-1.50) 1.00 1.22 (1.15-1.30) 1.64 (1.42-1.88) 1.24 (1.07-1.43) 1.00 1.30 (1.23-1.38) 1.66 (1.49-1.84)	Age, smoking status
Deeg B et al, 2011, Netherlands	Dutch Permanent Survey of the Living Situation (POLS)	1997-1999 – 2006, ~8 years follow-up	6217 men and women, age ≥55 years: 1614 deaths	Self-reported	No	No	BMI	18.5-24.9 25.0-29.9 30.0	1.00 0.97 (0.87-1.07) 1.15 (0.98-1.36)	Age, sex, marital status
Hwang LC et al, 2011, Taiwan	Six-Community Hypertension Intervention Project	1982-1983 – 2006, 24 years follow-up	6603 men and women, age 20-65 years: 1896 deaths	Measured	No	No	BMI BMI, men	<23 23-24.9 25-26.9 ≥27 <23 23-24.9 25-26.9 ≥27	1.00 1.06 (0.94-1.19) 1.28 (1.12-1.47) 1.46 (1.27-1.68) 1.00 1.05 (0.90-1.23) 1.20 (1.09-1.32) 1.49 (1.20-1.85)	Age, sex, alcohol, smoking status, education, exercise

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							BMI, women	<23 23-24.9 25-26.9 ≥27	1.00 1.08 (0.89-1.32) 1.42 (1.14-1.76) 1.43 (1.18-1.74)	
Lin WY et al, 2011, China	National Health Screening Centres in Taiwan	1998-1999 - 2008, 10 years follow-up	58738 men and 65718 women, age 20 years: 3947 deaths	Measured	No	Three first years of follow-up excluded in sensitivity analyses	BMI, men	<18.5 18.5-19.9 20.0-21.9 22.0-23.9 24.0-25.9 26.0-27.9 28.0-29.9 30.0-34.9 ≥35.0	1.65 (1.34-2.04) 1.32 (1.09-1.60) 1.15 (0.99-1.33) 1.14 (0.99-1.30) 1.00 1.01 (0.86-1.18) 1.12 (0.91-1.38) 1.27 (0.95-1.70) 2.37 (1.22-4.60)	Age, smoking status, alcohol, betel-nut chewing, physical activity, income level, education
							BMI, women	<18.5 18.5-19.9 20.0-21.9 22.0-23.9 24.0-25.9 26.0-27.9 28.0-29.9 30.0-34.9 ≥35.0	1.52 (1.17-1.99) 1.34 (1.06-1.70) 1.18 (0.97-1.42) 1.05 (0.80-1.26) 1.00 1.03 (0.84-1.26) 1.08 (0.83-1.39) 1.39 (1.07-1.80) 1.65 (0.92-2.95)	
							BMI, men, excluding first 3 years of follow-up	<18.5 18.5-19.9 20.0-21.9 22.0-23.9 24.0-25.9 26.0-27.9 28.0-29.9 30.0-34.9 ≥35.0	1.65 (1.29-2.10) 1.36 (1.10-1.69) 1.10 (0.92-1.30) 1.09 (0.94-1.27) 1.00 1.00 (0.84-1.20) 1.19 (0.95-1.50) 1.09 (0.76-1.55) 2.08 (0.92-4.67)	
							BMI, women, excluding first 3 years of follow-up	<18.5 18.5-19.9 20.0-21.9 22.0-23.9 24.0-25.9 26.0-27.9 28.0-29.9 30.0-34.9 ≥35.0	1.60 (1.19-2.15) 1.22 (0.93-1.61) 1.22 (0.99-1.51) 1.03 (0.84-1.26) 1.00 1.07 (0.85-1.34) 1.03 (0.77-1.38) 1.44 (1.08-1.93) 1.76 (0.93-3.34)	
Boggs DA et al, 2011, USA	Black Women's Cohort Study	1995-2008, ~12.4 years	51695 black women, age 21-69 years:	Self-reported	Cardio- vascular disease,	First 6 years excluded in sensitivity	BMI, never smokers	15.0-18.4 18.5-19.9 20.0-22.4	1.89 (1.03-3.44) 1.36 (0.87-2.14) 1.02 (0.76-1.39)	Age, questionnaire cycle, educational level, marital status, vigorous physical

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		follow-up	1773 deaths 33916 healthy (no CVD/cancer) never smoking women: 770 deaths NA current smokers: 547 deaths NA former smokers: 456 deaths		cancer	analyses, partly reported	BMI, former smokers	22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 40.0-49.9 15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 40.0-49.9 15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 40.0-49.9	1.00 1.12 (0.87-1.44) 1.31 (1.01-1.72) 1.27 (0.99-1.64) 1.51 (1.13-2.02) 2.19 (1.62-2.95) 1.86 (0.67-5.21) 2.29 (1.22-4.31) 1.41 (0.94-2.12) 1.00 1.06 (0.76-1.48) 1.15 (0.81-1.63) 1.04 (0.75-1.45) 1.43 (0.98-2.09) 2.04 (1.37-3.04) 1.51 (0.85-2.71) 1.06 (0.68-1.65) 0.90 (0.66-1.23) 1.00 0.68 (0.52-0.89) 0.67 (0.49-0.91) 0.85 (0.65-1.12) 0.73 (0.49-1.08) 1.48 (1.01-2.15)	activity, alcohol
Sisko I et al, 2011, Finland	Vitality 90+ Study	2000-2004, 4 years follow-up	192 women and 65 men, age ≥90 years: 89/44 deaths	Measured	No	First 2 years of follow-up excluded in sensitivity analyses	BMI, women BMI, men	<18.5 18.5-24.9 25.0-29.9 ≥30.0 18.5-24.9 25.0-29.9 ≥30.0	1.09 (0.14-8.79) 1.29 (0.79-2.08) 1.00 1.07 (0.45-2.52) 3.09 (1.35-7.06) 1.00 1.63 (0.31-8.62)	Chronic conditions (cardiovascular disease, cancer, diabetes, respiratory disease, infectious disease), MMSE score, functional status, smoking status, alcohol
Wee CC et al, 2011, USA	Medicare Current Beneficiary Surveys	1994-2000 – 2008, 14 years follow-up	20975 men and women, age ≥65 years: 11093 deaths	Self-reported	No	First 1 year of follow-up excluded	BMI, men BMI, women	<18.5 18.5-21.9 22.0-24.9 25.0-27.4 27.5-29.9 30.0-34.9 ≥35.0 <18.5 18.5-21.9 22.0-24.9 25.0-27.4 27.5-29.9	2.17 (1.74-2.71) 1.21 (1.09-1.33) 1.00 0.84 (0.78-0.92) 0.81 (0.73-0.90) 0.89 (0.81-0.99) 1.49 (1.20-1.85) 1.67 (1.45-1.92) 1.14 (1.04-1.25) 1.00 0.90 (0.81-0.99) 0.82 (0.74-0.92)	Age, smoking status, education, proxy response, chronic health conditions (COPD, rheumatoid arthritis, dementia, mental retardation, Alzheimer, Parkinson disease), and cancer

								30.0-34.9 ≥35.0	0.98 (0.88-1.08) 1.21 (1.06-1.39)	
Puddu PE et al, 2011, Europe	Seven Countries Study	1960-2000, 25-40 years follow-up	6554 men, age 40-59 years: 5590 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 ≥30.0	1.00 0.88 (0.73-1.08) 1.02 (0.83-1.26) 1.16 (0.92-1.48)	Age, location, father status, mother status, SES, physical activity, cigarettes per day, arm circumference, mean blood pressure, heart rate, serum cholesterol, FEV1, ECG abnormalities
Cohen-Mansfield J et al, 2011, Israel	Cross-Sectional and Longitudinal Aging Study (CALAS)	1989-1992 - NA, 20 years follow-up	1369 men and women, age 75-94 years: 1310 deaths	Measured	No	No	BMI	<22 22-30 >30	1.41 (1.20-1.67) 1.00 1.12 (0.93-1.34)	Age, sex, origin, education, additional income, had children
Niedhammer J et al, 2011, France	Lorhandicap Study	1996-2008, 12.5 years follow-up	4118 men and women, age 15-<70 years: 165 deaths	NA	No	No	BMI, all BMI, men BMI, women	<25 25-30 ≥30 <25 25-30 ≥30 <25 25-30 ≥30	1.00 0.91 (0.63-1.31) 0.91 (0.60-1.40) 1.00 0.92 (0.60-1.40) 0.86 (0.50-1.47) 1.00 0.86 (0.41-1.80) 0.99 (0.49-2.02)	Age, sex, SES, smoking status, alcohol, biomechanical exposure, physical exposure, temporary contract, social support
Hotchkiss JW et al, 2011, Scotland	Scottish Health Surveys	1995, 1998, 2003 - 2007, ~9.2 years follow-up	20117 (BMI) men and women, age 18-86 years: 1280 deaths 8204 never smokers: 214 deaths 7995 never smokers, excluding first 2 years: 185 deaths	Measured	Prevalent cancers and CVD excluded in sensitivity analyses	First 2 years excluded in sensitivity analyses	BMI, all BMI, excluding prevalent cancer and CVD BMI, excluding prevalent cancer and CVD and ever smokers BMI, excluding prevalent cancer and CVD, ever smokers and first 2 years of follow-up	<18.5 18.5-<25 25.0-<30 ≥30.0 <18.5 18.5-<25 25.0-<30 ≥30.0 <18.5 18.5-<25 25.0-<30 ≥30.0 <18.5 18.5-<25 25.0-<30 ≥30.0	1.63 (1.95-3.55) 1.00 0.80 (0.70-0.91) 0.93 (0.80-1.07) 2.54 (1.82-3.55) 1.00 0.75 (0.65-0.87) 0.87 (0.74-1.03) 2.71 (0.84-8.70) 1.00 0.68 (0.49-0.95) 0.94 (0.67-1.32) 4.52 (1.06-19.18) 1.00 1.02 (0.66-1.59) 1.09 (0.67-1.78)	Age, sex, smoking status, alcohol, survey year

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Mehta NK et al, 2011, USA	Framingham Heart Study Offspring Cohort	1985-1992 – 2003, 14.8 years follow-up	2744 men and women, mean age 55.4 years: 470 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	2.77 (1.28-6.00) 1.00 0.87 (0.70-1.09) 0.98 (0.74-1.29) 1.85 (1.27-2.69)	Sex, cigarette smoking status and packs per day, education
Heir T et al, 2011, Norway	Norwegian White and Blue collar workers	1972-1975 - 1999, 25-27 years follow-up	2014 healthy men, age 40-59 years: 746 deaths	NA	Coronary or other heart diseases, advanced pulmonary diseases, diabetes mellitus, hypertension treated with drugs, advanced renal disease, liver disease, cancer and miscellaneous other diseases including neurological, muscular or joint diseases	First 5 years excluded in sensitivity analyses (results not altered, but not reported)	BMI, non-smokers (former and never), CVD mortality BMI, non-smokers, non-CVD mortality BMI, smokers, CVD mortality BMI, non-smokers, non-CVD mortality	<25 25-29.9 ≥30 <25 25-29.9 ≥30 <25 25-29.9 ≥30	1.00 1.63 (1.19-2.23) 3.67 (2.02-6.64) 1.00 0.89 (0.64-1.24) 2.28 (1.18-4.39) 1.00 1.10 (0.82-1.48) 2.06 (1.14-3.73) 1.00 0.85 (0.63-1.16) 0.94 (0.42-2.16)	Age
Chen AC et al, 2011, Taiwan	Survey of Health and Living Status of the Elderly in Taiwan	1999-2003, 4 years follow-up	4191 men and women, age ≥53 years: 566 deaths	Self-reported	No	No	BMI, age 53-64 years BMI, age 65-74 years BMI, age ≥75 years	<21 21-27 ≥27 <21 21-27 ≥27 <21 21-27 ≥27	2.79 (1.58-4.95) 1.00 1.45 (0.70-2.98) 1.54 (1.12-2.13) 1.00 0.58 (0.31-1.08) 1.38 (1.10-1.74) 1.00 0.78 (0.50-1.21)	Age, sex, exercise, smoking status
Pignon G et al, 2011,	Gerontological and Geriatric	1971-2000 – 2009,	1037 men and women, age	NA			BMI	<20 20-<30	1.32 (0.90-1.96) 1.00	Male gender, waist circumference, low physical

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Sweden	Population Studies in Gothenburg	~23 years follow-up	70 years: 630 deaths					>30	0.94 (0.72-1.24)	activity, marital status, smoking status, education, birth cohort
Bessonova L et al, 2011, USA	California Teachers Study	1995-1996 – 2007, ~11.5 years follow-up	115433 women, mean age 53.1 years: 10574 deaths 75582 never smokers: 5962 deaths	Self-reported	No	First year of follow-up excluded	BMI, all BMI, never smokers BMI, ever smokers	<18.5 18.5-24.9 25-29.9 ≥30 <18.5 18.5-24.9 25-29.9 ≥30 <18.5 18.5-24.9 25-29.9 ≥30	1.33 (1.20-1.47) 1.00 1.04 (0.98-1.10) 1.27 (1.19-1.37) 1.35 (1.18-1.55) 1.00 1.07 (1.00-1.15) 1.34 (1.22-1.47) 1.39 (1.19-1.63) 1.00 1.00 (0.92-1.09) 1.17 (1.05-1.31)	Age, race/ ethnicity, HRT, physical activity, diabetes, hypertension, heart attack, stroke, any cancer, alcohol, smoking status, fat, weight change from age 18 to baseline
Strand BH et al, 2012, United Kingdom	The British 1946 birth cohort	1972 – 2006, 40 years follow-up	1471 men and 1476 women, age 20 years: 332 deaths	Self-reported	No	No	BMI (age 20), men BMI (age 20), women	17.7 20.1 22.6 25.1 27.6 16.1 18.9 21.8 24.8 28.0	7.00 (1.94-25.2) 1.00 (0.43-2.31) 1.00 1.11 (0.45-2.70) 1.00 (0.37-2.71) 0.43 (0.06-3.22) 0.55 (0.21-1.43) 1.00 0.56 (0.23-1.37) 1.01 (0.37-2.79)	Father's occupation, education, smoking status
Lin WH et al, 2012, Taiwan	MJ Health Examination Cohort	1994-1996 – 2007, 11.7 years follow-up	111949 men and women, age ≥20 years: 5345 deaths	Measured	No	First 5 years of follow-up excluded in the main analysis	BMI, men, age 20-39 years BMI, men, age 40-59 years BMI, men age ≥60 years BMI, women, age 20-39 years BMI, women, age 40-59 years	<18.5 18.5-23.9 24.0-26.9 ≥27.0 <18.5 18.5-23.9 24.0-26.9 ≥27.0 <18.5 18.5-23.9 24.0-26.9 ≥27.0 <18.5 18.5-23.9 24.0-26.9 ≥27.0 <18.5 18.5-23.9	1.00 0.77 (0.45-1.32) 0.86 (0.49-1.51) 1.18 (0.66-2.11) 1.00 0.73 (0.49-1.10) 0.76 (0.51-1.15) 0.91 (0.60-1.38) 1.00 0.81 (0.67-0.97) 0.78 (0.64-0.94) 0.83 (0.67-1.02) 1.00 0.76 (0.47-1.23) 1.32 (0.74-2.36) 1.44 (0.73-2.83) 1.00 0.65 (0.40-1.06)	Age, age squared, smoking status

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5	Park SY et al,	Multiethnic	1993-1996	183211 men	Self-reported	Cancer, heart	Exclusion of	BMI, men, all	<18.5	1.98 (1.75-2.23)	Age, ethnicity, alcohol, smoking status, average number of cigarettes, squared average number of cigarettes, number of years smoked, number of years since quitting, interactions between ethnicity and smoking status, average number of cigarettes, squared average number of cigarettes and number of years smoked
6	2012, USA	Cohort Study	- 2007,	and women,		disease	first 3 years		18.5-22.9	1.25 (1.20-1.31)	
7			12.5 years	age 45-75			in sensitivity		23-24.9	1.00	
8			follow-up	years: 35664			analyses		25-27.4	0.97 (0.93-1.01)	
9				deaths					27.5-29.9	1.02 (0.97-1.07)	
10									30-34.9	1.23 (1.17-1.29)	
11				21893 and					≥35	1.60 (1.48-1.72)	
12				48108 never				BMI, excluding baseline	<18.5	1.97 (1.70-2.30)	
13				smokers:				cancer and heart disease	18.5-22.9	1.24 (1.17-1.31)	
14				2972/ 5152					23-24.9	1.00	
15				deaths					25-27.4	0.99 (0.94-1.04)	
16									27.5-29.9	1.05 (0.99-1.12)	
17				21540 and					30-34.9	1.28 (1.20-1.36)	
18				47601 never				BMI, further excluding ever	≥35	1.80 (1.64-1.97)	
19				smokers,				smokers	<18.5	1.42 (0.98-2.07)	
20				excluding first					18.5-22.9	1.06 (0.94-1.19)	
21				3 years:					23-24.9	1.00	
22				2619/4645					25-27.4	0.94 (0.84-1.05)	
23				deaths					27.5-29.9	1.14 (1.01-1.29)	
24								BMI, further excluding deaths	30-34.9	1.45 (1.27-1.65)	
25								within 3 years	≥35	2.37 (1.99-2.82)	
26									<18.5	1.25 (0.81-1.91)	
27									18.5-22.9	1.06 (0.93-1.20)	
28									23-24.9	1.00	
29									25-27.4	0.97 (0.86-1.09)	
30									27.5-29.9	1.20 (1.05-1.37)	
31									30-34.9	1.56 (1.36-1.79)	
32									≥35	2.71 (2.26-3.26)	

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							BMI, women, all	<18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	1.88 (1.72-2.04) 1.13 (1.07-1.19) 1.00 1.04 (0.98-1.10) 1.12 (1.06-1.19) 1.25 (1.18-1.33) 1.63 (1.53-1.74)	
							BMI, excluding baseline cancer and heart disease	<18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	1.84 (1.66-2.04) 1.12 (1.05-1.19) 1.00 1.03 (0.97-1.11) 1.13 (1.05-1.22) 1.28 (1.19-1.37) 1.73 (1.59-1.87)	
							BMI, further excluding ever smokers	<18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	1.71 (1.47-1.99) 1.07 (0.98-1.17) 1.00 1.09 (0.99-1.20) 1.20 (1.08-1.33) 1.39 (1.26-1.54) 1.94 (1.73-2.19)	
							BMI, further excluding deaths within 3 years	<18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	1.66 (1.42-1.95) 1.07 (0.97-1.18) 1.00 1.10 (0.99-1.21) 1.21 (1.08-1.35) 1.40 (1.26-1.55) 1.97 (1.74-2.23)	
							BMI, men, healthy never smokers (excluding first 3 years), African Americans	<18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	1.51 (0.20-11.17) 1.34 (0.92-1.96) 1.00 1.08 (0.78-1.48) 1.64 (1.18-2.28) 1.87 (1.36-2.58) 2.72 (1.81-4.08)	
							BMI, men, healthy never smokers (excluding first 3 years), Native Hawaiians	<18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	0.70 (0.09-5.40) 1.27 (0.64-2.51) 1.00 1.16 (0.65-2.07) 1.18 (0.66-2.12) 1.67 (0.94-2.97) 3.05 (1.69-5.54)	
							BMI, men, healthy never	<18.5	1.31 (0.74-2.31)	

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5						smokers (excluding first 3 years), Japanese Americans	18.5-22.9	1.08 (0.89-1.31)	
6							23-24.9	1.00	
7							25-27.4	1.01 (0.82-1.24)	
8							27.5-29.9	1.30 (0.99-1.71)	
9							30-34.9	1.89 (1.35-2.65)	
10							≥35	3.97 (2.08-7.58)	
11						BMI, men, healthy never smokers (excluding first 3 years), Latinos	<18.5	0.93 (0.29-2.95)	
12							18.5-22.9	0.90 (0.66-1.22)	
13							23-24.9	1.00	
14							25-27.4	0.82 (0.65-1.03)	
15							27.5-29.9	0.98 (0.77-1.25)	
16							30-34.9	1.18 (0.91-1.52)	
17							≥35	1.82 (1.27-2.62)	
18						BMI, men, healthy never smokers (excluding first 3 years), Whites	<18.5	1.57 (0.57-4.30)	
19							18.5-22.9	1.05 (0.79-1.39)	
20							23-24.9	1.00	
21							25-27.4	1.01 (0.78-1.30)	
22							27.5-29.9	1.08 (0.79-1.46)	
23							30-34.9	1.61 (1.18-2.18)	
24							≥35	3.31 (2.26-4.85)	
25						BMI, women, healthy never smokers (excluding first 3 years), African Americans	<18.5	1.88 (1.09-3.24)	
26							18.5-22.9	1.22 (0.94-1.58)	
27							23-24.9	1.00	
28							25-27.4	1.06 (0.84-1.34)	
29							27.5-29.9	1.23 (0.97-1.54)	
30							30-34.9	1.45 (1.16-1.80)	
31							≥35	1.74 (1.37-2.20)	
32						BMI, women, healthy never smokers (excluding first 3 years), Native Hawaiians	<18.5	1.52 (0.53-4.34)	
33							18.5-22.9	0.98 (0.63-1.52)	
34							23-24.9	1.00	
35							25-27.4	0.91 (0.59-1.41)	
36							27.5-29.9	1.24 (0.79-1.93)	
37							30-34.9	1.34 (0.89-2.01)	
38							≥35	2.10 (1.36-3.24)	
39						BMI, women, healthy never smokers (excluding first 3 years), Japanese Americans	<18.5	1.59 (1.30-1.94)	
40							18.5-22.9	1.01 (0.88-1.17)	
							23-24.9	1.00	
							25-27.4	1.05 (0.87-1.25)	
							27.5-29.9	1.16 (0.92-1.47)	
							30-34.9	1.35 (1.02-1.79)	
							≥35	1.77 (0.96-3.24)	
						BMI, women, healthy never smokers (excluding first 3 years), Latinos	<18.5	1.05 (0.49-2.25)	
							18.5-22.9	1.34 (1.07-1.68)	

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5 6 7 8 9 10 11 12 13 14							BMI, women, healthy never smokers (excluding first 3 years), Whites	23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35 <18.5 18.5-22.9 23-24.9 25-27.4 27.5-29.9 30-34.9 ≥35	1.00 1.32 (1.07-1.62) 1.34 (1.08-1.67) 1.53 (1.23-1.89) 2.27 (1.77-2.91) 1.84 (1.22-2.78) 0.93 (0.74-1.17) 1.00 1.06 (0.84-1.34) 1.16 (0.89-1.51) 1.29 (1.00-1.66) 2.26 (1.68-3.05)		
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	Gatzmarzyk et al, 2012, Canada	Canadian Heart Health Surveys	1986-1995 – 2004, 13.9 years follow-up	10522 men and women, age 18-74 years: 1149 deaths	Measured	No	First 6 months of follow-up excluded	BMI, men BMI, women	<18.0 18.0-24.9 25.0-29.9 30-34.9 ≥35 <18.0 18.0-24.9 25.0-29.9 30-34.9 ≥35	0.84 (0.41-1.72) 1.00 0.99 (0.83-1.18) 1.16 (0.94-1.45) 1.41 (0.97-2.05) 1.80 (1.07-3.03) 1.00 1.16 (0.92-1.46) 1.47 (1.12-1.93) 1.85 (1.33-2.56)	Age, exam year, smoking status, alcohol, education
	Park Y et al, 2012, USA	NIH-AARP Diet and Health Study	1995-1996 - 2009, 13 years follow-up	16471 non-Hispanic black men and women, age 50-71 years: 2609 deaths	Self-reported	Prevalent cancer or heart disease	No	BMI, all, never smokers BMI, men BMI, women	15-<20 20-<25 25-<30 30-<35 35-<40 40-50 15-<20 20-<25 25-<30 30-<35 35-<40 40-50 15-<20 20-<25 25-<30 30-<35 35-<40 40-50	1.97 (1.24-3.13) 1.00 0.97 (0.78-1.20) 1.31 (1.04-1.65) 1.67 (1.27-2.21) 2.23 (1.61-3.07) 2.12 (1.00-4.52) 1.00 1.27 (0.91-1.78) 1.56 (1.07-2.28) 2.48 (1.53-4.05) 2.80 (1.46-5.39) 1.85 (1.03-3.33) 1.00 0.78 (0.59-1.04) 1.17 (0.88-1.57) 1.35 (0.96-1.90) 1.93 (1.33-2.81)	Age, sex, education, marital status, smoking status, cigarettes per day, physical activity, alcohol, menopausal hormone therapy
	Montaine KR et al, 2012, Puerto Rico	Puerto Rico Heart Health Program	1965-1980, 12 years follow-up	5187 hispanic men, mean age 54.4 years	NA	Prevalent coronary heart disease	No	BMI, age 18-<60	<18.5 18.5-<25 25-<30	1.52 (1.07-2.17) 1.00 0.97 (0.84-1.12)	Age

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5			(35-79): 2619 deaths		excluded		BMI, age 60-<70	30-<35 ≥35 <18.5 18.5-<25 25-<30 30-<35 ≥35 <18.5 18.5-<25 25-<30 30-<35 ≥35	1.09 (0.88-1.34) 1.32 (0.70-2.48) 1.38 (1.04-1.83) 1.00 1.09 (0.96-1.25) 1.19 (0.98-1.44) 1.64 (0.94-2.85) 1.60 (1.08-2.37) 1.00 1.01 (0.81-1.26) 1.24 (0.88-1.73) 1.38 (0.44-4.35)	
6	Fontaine KR et al, 2012, USA	San Antonio Heart Study	1979 - 2000, 14 years follow-up	2758 men and women, mean age 43.5 years: 923 deaths	NA	No	No	BMI, age 18-<60 		

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De Hollander et al, 2012, Netherlands	Survey in Europe on Nutrition and the Elderly (SENECA)	1988-1989 - 1999, 10 years follow-up	1980 men and women, age 70-75 years: 751 deaths	Measured	Chronic diseases at baseline excluded in sensitivity analyses	First 2 years of follow-up excluded in sensitivity analyses	BMI	<20 20-25 25-30 ≥30	1.06 (0.73-1.55) 1.00 0.92 (0.78-1.09) 1.05 (0.89-1.29)	Age, sex, smoking status, education
Chen Z et al, 2012, China	45 Areas of China	1990-1991 – 2006, 15 years follow-up	142214 men, age 45-79 years: 17800 deaths	Measured	Chronic obstructive pulmonary disease, asthma, heart disease, stroke, cancer, peptic ulcer, cirrhosis, kidney disease, hepatitis, tuberculosis	Excluded first 5 years of follow-up	BMI	15.0-<18.5 18.5-<20.0 20.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0	1.16 (1.10-1.22) 1.07 (1.02-1.12) 1.03 (0.99-1.07) 1.00 1.09 (1.02-1.16) 1.21 (1.09-1.34) 1.43 (1.21-1.68)	Age, area, smoking status, alcohol, education
Laessle H et al, 2012, Germany	German Construction Workers Cohort	1986-1992 – 2007- 2008, 17.24 years follow-up	19476 men, age 26-65 years: 2211 deaths	Measured	No	No	BMI	<25.0 25.0-29.9 30.0	1.00 0.83 (0.76-0.92) 0.99 (0.88-1.12)	Age, nationality, alcohol, smoking status
Choe CW et al, 2012, Korea	Seoul Male Cohort Study	1993-2008, 15 years follow-up	14533 men, age 40-59 years: 990 deaths	Self-reported	No	No	BMI	<18.5 18.5-22.9 23.0-24.9 ≥25.0	0.98 (0.82-1.18) 1.00 1.00 (0.85-1.19) 1.63 (0.97-2.74)	Age, smoking status, alcohol, regular exercise, sleep hours, education, hypertension, diabetes
John SS et al, 2012, USA	Southern Community Cohort Study	2002-2009 - 2011, 8.9 years follow-up	22014 black and 9343 white men 30810 black and 14447 white women, age 40-79 years: 5427 deaths	Self- reported, measured in 25% of participants	Exclusion of participant with cancer, heart disease and stroke in sensitivity analyses	Excluding first 12 months of follow-up	BMI, black men, total mortality BMI, white men BMI, black women	<20 20-24.9 25-29.9 30-34.9 35-39.9 ≥40 <20 20-24.9 25-29.9 30-34.9 35-39.9 ≥40 <20 20-24.9 25-29.9	1.47 (1.24-1.74) 1.00 0.80 (0.72-0.90) 0.70 (0.61-0.80) 0.90 (0.74-1.08) 1.13 (0.89-1.43) 0.96 (0.67-1.39) 1.00 0.72 (0.60-0.85) 0.75 (0.60-0.93) 1.12 (0.87-1.45) 1.37 (1.02-1.84) 1.71 (1.35-2.17) 1.00 0.80 (0.69-0.94)	Age, education, income, source, cigarette smoking status and packs per day, alcohol

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5									30-34.9	0.66 (0.56-0.78)	
6									35-39.9	0.72 (0.60-0.86)	
7									≥40	0.87 (0.72-1.04)	
8							BMI, white women	<20	1.40 (1.04-1.89)		
9								20-24.9	1.00		
10								25-29.9	0.96 (0.77-1.18)		
11								30-34.9	1.07 (0.86-1.34)		
12								35-39.9	1.03 (0.79-1.34)		
13							BMI, black men and women, non-current smokers	≥40	1.47 (1.15-1.89)		
14								<20	2.06 (1.53-2.79)		
15								20-24.9	1.00		
16								25-29.9	0.72 (0.61-0.86)		
17								30-34.9	0.66 (0.54-0.80)		
18								35-39.9	0.72 (0.58-0.89)		
19							BMI, white men and women, non-current smokers	≥40	1.09 (0.89-1.35)		
20								<20	0.81 (0.35-1.87)		
21								20-24.9	1.00		
22								25-29.9	0.84 (0.62-1.13)		
23	Robson A et al, 2012, Australia	Australian Longitudinal Study on Women's Health	1996 – NA, 10 years follow-up	7438 women, age 71-79 years: 1734 deaths	Self-reported	No	No	BMI, women	30-34.9	0.85 (0.62-1.17)	Age, smoking status, alcohol, physical activity
24								35-39.9	1.12 (0.79-1.59)		
25								≥40	1.74 (1.24-2.41)		
26	Robson A et al, 2012, Australia	Health in Men Study	1996 – NA, 10 years follow-up	6053 men, age 71-79 years: 2290 deaths	Self-reported	No	No	BMI, men	18.5-<25.0	1.00	Age, smoking status, alcohol, physical activity
27									25.0-<30.0	0.87 (0.77-0.99)	
28									≥30.0	0.98 (0.83-1.15)	
29	Hotchkiss JW et al, 2013, Scotland	Scottish Health Survey Cohort	1995, 1998, 2003 – 2008, 10.1 years follow-up	19329 men and women, age 18-86 years: 1495 deaths	Measured	Subjects with prior CHD or stroke hospital admissions	First 3-5 years excluded in sensitivity analyses, results not reported	BMI, men	<18.5	2.53 (1.58-4.06)	Age, smoking status, alcohol, year of survey
30									18.5-<25	1.00	
31									25-<30	0.64 (0.54-0.77)	
32									≥30	0.82 (0.67-1.01)	
33								BMI, women	<18.5	2.69 (1.80-4.03)	
34									18.5-<25	1.00	
35									25-<30	0.98 (0.81-1.18)	
36	Choi KM et al, 2013, Korea	South-West Seoul Study	1999 – 2009, 10.3 years follow-up	2317 men and women, age 60-92 years: 393 deaths	Measured	No	No	BMI, no MetS	≥30	0.93 (0.75-1.15)	Age, sex, smoking status
37									18.5-<23	1.39 (1.00-1.94)	
38									23-<25	1.00	
39									≥25	1.25 (0.88-1.76)	
40								BMI, MetS	18.5-<23	2.49 (1.61-3.83)	
									23-<25	1.77 (1.16-2.69)	
									≥25	1.49 (1.04-2.14)	

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Schmidt M et al, 2013, Denmark	Danish Military Conscripts	1977 – 2010, 31 years follow-up	6502 men, age 22 years: 507 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 ≥30.0	1.0 (0.7-1.5) 1.0 0.9 (0.7-1.2) 2.1 (1.3-3.5)	Cognitive test score, education
Yano Y et al, 2013, Japan	Jichi Medical School Cohort Study	1992-1993 – 2002, 10.2 years follow-up	3641 men and women, mean age 53.7 years: 240 deaths	Measured	No	No	BMI	19.5 22.7 27.0	1.70 (1.24-2.33) 1.00 1.24 (0.91-1.70)	Age, sex, current smoking, SBP, diabetes
Masters RK et al, 2013, USA	National Health Interview Survey	1986-2004 – 2006, ~12.4 years follow-up	373185 men and 416908 women, age 25-84.9 years: 64443/ 58937 deaths	Self-reported	No	No	BMI, men BMI, women	18.5-29.9 30-34.9 35-39.9 ≥40 18.5-29.9 30-34.9 35-39.9 ≥40	1.00 1.11 (1.09-1.14) 1.42 (1.36-1.49) 2.14 (1.97-2.33) 1.00 1.11 (1.08-1.14) 1.37 (1.32-1.43) 1.90 (1.80-2.00)	Age, education, income, marital status, region of residence, race/ ethnicity
Ma J et al, 2013, USA	National Health Interview Survey	1987-1995 – 2006, 16 years follow-up	210818 men and women, age 18-99 years: 34239 deaths 106964 never smokers: 14763 deaths 48261 former smokers: 10516 deaths 55593 current smokers: 8960 deaths	Self-reported	Prevalent fair or bad health excluded	First 5 years of follow-up excluded in sensitivity analyses	BMI, never smokers, age 18-44 years, men BMI, former smokers BMI, current smokers BMI, never smokers, age 45-64 years, men BMI, former smokers BMI, current smokers	15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0 15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0 15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0 15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0 15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0 15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	0.85 (0.31-2.32) 1.00 0.94 (0.77-1.15) 1.22 (0.95-1.56) 3.18 (2.37-4.27) 0.57 (0.08-4.06) 0.92 (0.74-1.16) 0.87 (0.70-1.07) 1.33 (0.96-1.85) 2.15 (1.32-3.49) 3.17 (1.87-5.38) 2.29 (1.96-2.68) 1.96 (1.65-2.34) 2.71 (2.16-3.39) 4.03 (2.92-5.56) 0.38 (0.05-2.87) 1.00 1.10 (0.92-1.31) 1.62 (1.28-2.04) 2.40 (1.70-3.38) 3.96 (1.85-8.49) 1.44 (1.22-1.70) 1.43 (1.22-1.68) 1.94 (1.60-2.35) 2.50 (1.90-3.30) 6.47 (4.42-9.46)	Age, education, race

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5								18.5-24.9	3.37 (2.85-3.99)	
6								25.0-29.9	2.74 (2.31-3.25)	
7								30.0-34.9	3.25 (2.61-4.05)	
8								≥35.0	4.15 (2.88-5.99)	
9							BMI, never smokers, age 65-99 years, men	15.0-18.4	1.42 (0.96-2.10)	
10								18.5-24.9	1.00	
11								25.0-29.9	1.00 (0.91-1.09)	
12								30.0-34.9	1.22 (1.04-1.43)	
13								≥35.0	1.55 (1.15-2.08)	
14							BMI, former smokers	15.0-18.4	2.02 (1.31-3.12)	
15								18.5-24.9	1.25 (1.16-1.35)	
16								25.0-29.9	1.22 (1.12-1.32)	
17								30.0-34.9	1.37 (1.21-1.54)	
18								≥35.0	1.79 (1.40-2.30)	
19							BMI, current smokers	15.0-18.4	2.90 (2.02-4.17)	
20								18.5-24.9	1.93 (1.71-2.18)	
21								25.0-29.9	1.84 (1.64-2.07)	
22								30.0-34.9	2.72 (2.20-3.37)	
23								≥35.0	2.77 (1.11-6.96)	
24							BMI, never smokers, age 18-44 years, women	15.0-18.4	0.76 (0.43-1.34)	
25								18.5-24.9	1.00	
26								25.0-29.9	1.46 (1.21-1.76)	
27								30.0-34.9	1.45 (1.09-1.92)	
28								≥35.0	2.04 (1.45-2.87)	
29							BMI, former smokers	15.0-18.4	1.86 (0.97-3.56)	
30								18.5-24.9	1.10 (0.86-1.42)	
31								25.0-29.9	1.33 (0.97-1.83)	
32								30.0-34.9	1.51 (0.93-2.43)	
33								≥35.0	1.08 (0.58-2.01)	
34							BMI, current smokers	15.0-18.4	3.15 (2.34-4.23)	
35								18.5-24.9	2.73 (2.34-3.19)	
36								25.0-29.9	2.51 (2.07-3.04)	
37								30.0-34.9	1.94 (1.46-2.59)	
38								≥35.0	2.81 (1.92-4.10)	
39							BMI, never smokers, age 45-64 years, women	15.0-18.4	1.79 (1.23-2.58)	
40								18.5-24.9	1.00	
								25.0-29.9	1.16 (1.01-1.34)	
								30.0-34.9	1.68 (1.41-2.01)	
								≥35.0	2.24 (1.82-2.75)	
							BMI, former smokers	15.0-18.4	2.19 (1.25-3.85)	
								18.5-24.9	1.40 (1.22-1.60)	
								25.0-29.9	1.67 (1.41-1.99)	
								30.0-34.9	1.98 (1.61-2.43)	

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						BMI, current smokers	≥35.0	3.66 (2.95-4.55)	
							15.0-18.4	5.02 (3.98-6.33)	
							18.5-24.9	3.09 (2.73-3.50)	
							25.0-29.9	3.42 (3.01-3.90)	
							30.0-34.9	3.95 (3.26-4.79)	
							≥35.0	4.74 (3.51-6.41)	
						BMI, never smokers, age 65-99 years, women	15.0-18.4	1.31 (1.15-1.50)	
							18.5-24.9	1.00	
							25.0-29.9	0.97 (0.92-1.02)	
							30.0-34.9	1.10 (1.01-1.19)	
							≥35.0	1.21 (1.04-1.40)	
						BMI, former smokers	15.0-18.4	1.73 (1.41-2.12)	
							18.5-24.9	1.28 (1.21-1.36)	
							25.0-29.9	1.20 (1.11-1.30)	
							30.0-34.9	1.49 (1.33-1.67)	
							≥35.0	1.72 (1.44-2.05)	
						BMI, current smokers	15.0-18.4	3.12 (2.58-3.77)	
							18.5-24.9	2.05 (1.90-2.22)	
							25.0-29.9	1.73 (1.53-1.96)	
							30.0-34.9	2.35 (1.90-2.93)	
							≥35.0	2.19 (1.63-2.96)	
						BMI, never smokers, age 18-44 years, excluding first 5 years of follow-up	15.0-18.4	0.90 (0.54-1.50)	
							18.5-24.9	1.00	
							25.0-29.9	1.23 (1.04-1.45)	
							30.0-34.9	1.53 (1.25-1.87)	
							≥35.0	3.01 (2.33-3.88)	
						BMI, former smokers	15.0-18.4	1.72 (0.90-3.27)	
							18.5-24.9	1.00 (0.81-1.23)	
							25.0-29.9	1.06 (0.88-1.28)	
							30.0-34.9	1.53 (1.11-2.09)	
							≥35.0	2.16 (1.39-3.37)	
						BMI, current smokers	15.0-18.4	3.43 (2.59-4.53)	
							18.5-24.9	2.72 (2.40-3.08)	
							25.0-29.9	2.52 (2.17-2.91)	
							30.0-34.9	2.90 (2.36-3.56)	
							≥35.0	4.12 (3.13-5.43)	
						BMI, never smokers, age 45-64 years, excluding first 5 years of follow-up	15.0-18.4	1.50 (0.99-2.27)	
							18.5-24.9	1.00	
							25.0-29.9	1.12 (0.99-1.27)	
							30.0-34.9	1.68 (1.44-1.96)	
							≥35.0	2.28 (1.87-2.78)	
						BMI, former smokers	15.0-18.4	2.67 (1.59-4.47)	
							18.5-24.9	1.42 (1.27-1.59)	

							25.0-29.9	1.47 (1.31-1.64)	
							30.0-34.9	2.08 (1.83-2.37)	
							≥35.0	3.17 (2.63-3.82)	
						BMI, current smokers	15.0-18.4	5.40 (4.36-6.69)	
							18.5-24.9	3.28 (2.94-3.66)	
							25.0-29.9	2.97 (2.67-3.30)	
							30.0-34.9	3.71 (3.16-4.36)	
							≥35.0	4.50 (3.53-5.74)	
						BMI, never smokers, age 65-99 years, excluding first 5 years of follow-up	15.0-18.4	1.19 (1.03-1.38)	
							18.5-24.9	1.00	
							25.0-29.9	0.99 (0.93-1.04)	
							30.0-34.9	1.11 (1.02-1.21)	
							≥35.0	1.22 (1.06-1.41)	
						BMI, former smokers	15.0-18.4	1.51 (1.22-1.88)	
							18.5-24.9	1.23 (1.17-1.30)	
							25.0-29.9	1.20 (1.13-1.27)	
							30.0-34.9	1.45 (1.33-1.59)	
							≥35.0	1.71 (1.44-2.04)	
						BMI, current smokers	15.0-18.4	2.58 (2.12-3.14)	
							18.5-24.9	1.91 (1.77-2.06)	
							25.0-29.9	1.77 (1.61-1.94)	
							30.0-34.9	2.42 (1.99-2.94)	
							≥35.0	2.12 (1.52-2.97)	
						BMI, never smokers, age 18-44 years, all subjects (including poor and fair health at baseline)	15.0-18.4	1.13 (0.74-1.73)	
							18.5-24.9	1.00	
							25.0-29.9	1.23 (1.05-1.44)	
							30.0-34.9	1.60 (1.32-1.94)	
							≥35.0	2.78 (2.20-3.50)	
						BMI, former smokers	15.0-18.4	1.62 (0.88-3.01)	
							18.5-24.9	1.08 (0.89-1.30)	
							25.0-29.9	1.08 (0.90-1.29)	
							30.0-34.9	1.62 (1.22-2.15)	
							≥35.0	2.36 (1.62-3.42)	
						BMI, current smokers	15.0-18.4	3.68 (2.91-4.64)	
							18.5-24.9	2.81 (2.50-3.15)	
							25.0-29.9	2.48 (2.16-2.85)	
							30.0-34.9	3.32 (2.78-3.96)	
							≥35.0	4.87 (3.90-6.08)	
						BMI, never smokers, age 45-64 years, all subjects (including poor and fair health at baseline)	15.0-18.4	1.75 (1.25-2.44)	
							18.5-24.9	1.00	
							25.0-29.9	1.16 (1.06-1.28)	
							30.0-34.9	1.67 (1.48-1.89)	
							≥35.0	2.47 (2.12-2.88)	

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							BMI, former smokers	15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	2.98 (2.09-4.25) 1.44 (1.30-1.60) 1.50 (1.36-1.66) 2.11 (1.91-2.34) 3.28 (2.87-3.76)	
							BMI, current smokers	15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	5.63 (4.75-6.67) 3.22 (2.94-3.53) 3.02 (2.75-3.30) 3.59 (3.15-4.10) 5.10 (4.29-6.08)	
							BMI, never smokers, age 65-99 years, all subjects (including poor and fair health at baseline)	15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.17 (1.04-1.32) 1.00 0.99 (0.94-1.04) 1.11 (1.04-1.19) 1.34 (1.20-1.51)	
							BMI, former smokers	15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.83 (1.54-2.18) 1.25 (1.19-1.31) 1.21 (1.15-1.27) 1.47 (1.36-1.59) 1.82 (1.60-2.08)	
							BMI, current smokers	15.0-18.4 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	2.13 (1.75-2.58) 1.87 (1.75-1.99) 1.73 (1.60-1.86) 2.21 (1.92-2.55) 2.41 (1.91-3.04)	
Winnouho M et al, 2013, United Kingdom	Whitehall Study 2	1985-1988 – 2010, 17.7 years follow-up	5269 men and women, age 39-62 years: 413 deaths	Measured	No	First 5 years excluded in sensitivity analysis	BMI	18.5-24.9 25-29.9 ≥30	1.00 1.01 (0.82-1.26) 1.68 (1.27-2.22)	Age, sex, occupational position, physical activity, smoking status, alcohol, fruit and vegetable consumption, marital status, ethnicity
Yakata Y et al, 2013, Japan	Fukuoka Prefecture	1998 – 2010, 12 years follow-up	675 men and women, age 80 years: 397 deaths	Measured	No	No	BMI	<19.5 19.5-<21.1 21.1-<22.5 22.5-<23.8 23.8-<26.0 ≥26.0	1.00 0.78 (0.55-1.12) 0.75 (0.52-1.08) 0.47 (0.32-0.70) 0.55 (0.38-0.79) 0.61 (0.42-0.89)	Gender, smoking status, alcohol, current outpatient, SBP, serum glucose, total cholesterol
Ahl AK et al, 2013, Sweden	OCTO-Twin, Gender, and NONA studies	NA-NA, 18 years follow-up	882 men and women, age 70-95 years: 667 deaths	Measured	No	No	BMI	<25.0 25.0-29.9 30.0	1.00 0.80 (0.67-0.95) 0.93 (0.71-1.22)	Age, sex, education, multimorbidity, BMI change, age X BMI change interaction
Stenholm S et al, 2014,	Mini-Finland Health	1978-1980 – 2011,	3594 men and women, age	Measured	Prevalent cardiovascular	First 5 years of	BMI, age 50-69 years	18.5-24.9 25.0-29.9	1.00 0.99 (0.89-1.09)	Age, sex, education, smoking status, alcohol use, physical

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Finland	Examination Survey	17.9 years follow-up	50-91 years: 3043 deaths		disease and cancer excluded in sensitivity analyses (not reported)	follow-up excluded in sensitivity analyses (results not reported)	BMI, age ≥ 70 years	≥ 30.0 18.5-24.9 25.0-29.9 ≥ 30.0	1.24 (1.10-1.40) 1.00 0.84 (0.72-0.97) 0.81 (0.67-0.98)	activity, handgrip strength
Singh PN et al, 2014, USA	Adventist Health Study 2	2002/2007 – 2009, 5.7 years follow-up	22884 black men and women, age 58-108 years: 879 deaths 5131 and 13640 never smokers:	Self-reported, validated	No	No	BMI, women BMI, men BMI, women, never smokers BMI, men, never smokers	<23.7 23.7-<26.6 26.6-<29.6 29.6-33.8 >33.8 <23.6 23.6-<25.8 25.8-<27.8 27.8-30.8 >30.8 <18.5 18.5-24.9 25-29.9 ≥ 30 <18.5 18.5-24.9 25-29.9 ≥ 30	1.40 (1.05-1.86) 1.08 (0.80-1.44) 1.00 1.23 (0.92-1.63) 1.42 (1.06-1.88) 1.44 (0.95-2.16) 1.19 (0.79-1.79) 1.00 1.35 (0.88-2.04) 1.66 (1.10-2.49) 1.24 (0.66-2.33) 1.00 0.95 (0.73-1.24) 1.43 (1.11-1.84) 4.42 (2.14-9.13) 1.00 0.85 (0.58-1.25) 1.59 (1.02-2.49)	Age, smoking status, vegetarian diet, vigorous physical activity
Pharmaralani H et al, 2014, Australia	Blue Mountains Eye Study	1992-1994 – 1997-1999 - 2007, 14.7 years follow-up	2216 men and women, age ≥ 49 years: 599 deaths	Measured	No	No	BMI, age 70 years BMI, age >70 years	<18.5 18.5-<25 25-<30 ≥ 30 <18.5 18.5-<25 25-<30 ≥ 30	1.82 (0.80-4.15) 1.00 1.07 (0.82-1.41) 1.44 (1.05-1.98) 1.20 (0.53-2.72) 1.00 0.98 (0.77-1.25) 0.94 (0.67-1.32)	Age, sex, smoking status, pre-existing disease (hypertension, diabetes, angina, acute myocardial infarction, stroke, cancer)
Xiao Q et al, 2014, USA	Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial	1993-2001 – 2009, 13 years follow-up the	7446 non-Hispanic black and 130598 white men and women, age 49-78 years: 1495/ 18236 deaths	Self-reported	Prevalent cancer, heart attack or stroke excluded in sensitivity analyses	No	BMI, non-hispanic black, all men BMI, non-hispanic black, healthy men who never	15.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0 15.0-<22.5 22.5-<25.0	1.32 (1.04-1.67) 1.00 0.95 (0.77-1.19) 0.88 (0.70-1.10) 1.15 (0.93-1.43) 1.25 (0.93-1.67) 1.87 (1.25-2.79) 1.33 (0.84-2.12) 1.00	Age, education, marital status, smoking status, pack-years, years since quitting smoking Healthy men and women who never smoked or quit ≥ 5 years

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smoked or quit 5 years before baseline	25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	0.90 (0.62-1.31) 0.92 (0.63-1.35) 1.03 (0.71-1.49) 1.34 (0.84-2.16) 2.57 (1.48-4.54)	ago: age, education marital status, remote former smoking, previous-pack-years, years since quitting smoking
BMI, non-hispanic white, all men	15.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	1.29 (1.19-1.40) 1.00 0.95 (0.90-1.01) 0.99 (0.94-1.06) 1.17 (1.10-1.24) 1.60 (1.47-1.75) 2.06 (1.80-2.37)	
BMI, non-hispanic white, healthy men who never smoked or quit 5 years before baseline	15.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	1.26 (1.11-1.44) 1.00 0.99 (0.91-1.08) 1.10 (1.01-1.19) 1.23 (1.13-1.34) 1.73 (1.53-1.96) 2.33 (1.93-2.82)	
BMI, non-hispanic black, all women	15.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	1.55 (1.07-2.24) 1.00 0.80 (0.58-1.10) 0.84 (0.61-1.14) 0.89 (0.67-1.19) 1.04 (0.75-1.44) 1.50 (1.06-2.14)	
BMI, non-hispanic black, healthy women who never smoked or quit 5 years before baseline	15.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	1.51 (0.81-2.79) 1.00 0.89 (0.55-1.44) 0.94 (0.59-1.48) 0.90 (0.58-1.40) 1.00 (0.61-1.63) 1.67 (1.00-2.14)	
BMI, non-hispanic white, all women	15.0-<22.5 22.5-<25.0 25.0-<27.5 27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	1.29 (1.19-1.40) 1.00 0.97 (0.90-1.05) 1.07 (0.98-1.16) 1.22 (1.13-1.33) 1.41 (1.27-1.57) 2.20 (1.95-2.49)	
BMI, non-hispanic white, healthy women who never smoked or quit 5 years before	15.0-<22.5 22.5-<25.0 25.0-<27.5	1.27 (1.14-1.43) 1.00 1.05 (0.94-1.16)	

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							baseline	27.5-<30.0 30.0-<35.0 35.0-<40.0 40.0-<50.0	1.11 (0.99-1.24) 1.34 (1.21-1.49) 1.56 (1.36-1.79) 2.46 (2.10-2.88)	
McTigue KM et al, 2014, USA	Women's Health Initiative	1993-1998 - 2005, 7.82 years follow-up	156775 women, age 50-79 years: NA	Measured	No	No	BMI, all	18.5-24.9 25-29.9 30-34.9 35-39.9 ≥40	1.00 0.97 (0.92-1.02) 1.16 (1.09-1.23) 1.53 (1.41-1.65) 1.88 (1.71-2.07)	Age, smoking status, education, participant's cohort of the WHI
							BMI, white women	18.5-24.9 25-29.9 30-34.9 35-39.9 ≥40	1.00 0.97 (0.92-1.03) 1.15 (1.07-1.22) 1.51 (1.39-1.65) 1.97 (1.77-2.20)	
							BMI, African American women	18.5-24.9 25-29.9 30-34.9 35-39.9 ≥40	1.00 1.07 (0.88-1.31) 1.28 (1.04-1.57) 1.58 (1.26-1.98) 1.55 (1.20-2.00)	
							BMI, hispanic women	18.5-24.9 25-29.9 30-34.9 35-39.9 ≥40	1.00 0.88 (0.61-1.26) 1.37 (0.95-1.99) 2.15 (1.39-3.31) 2.59 (1.55-4.31)	
Reys DR et al, 2014, USA	University of Alabama at Birmingham Study of Aging	1999-2001 - NA, 8.5 years follow-up	1000 men and women, age ≥65 years: 382 deaths	Measured and self-reported	No	No	BMI	18.5 >18.5-25 >25-30 >30-35 ≥35	1.57 (0.88-2.82) 1.00 0.94 (0.73-1.21) 0.80 (0.58-1.09) 0.73 (0.49-1.09)	Age, life-space, marital status, social support, comorbidity score, rural versus urban residence, race, gender, education
Ford DW et al, 2014, USA	Geisinger Rural Health Study	2009-2013, 3.1 years follow-up	2995 men and women, age ≥74 years: 360 deaths	Self-reported	No	No	BMI	<18.5 18.5-24.9 25-29.9 30-34.9 ≥35	1.85 (1.09-3.14) 1.00 0.71 (0.55-0.91) 0.82 (0.60-1.11) 0.89 (0.62-1.51)	
Joshy G et al, 2014, Australia	The 45 and Up Study	2006-2008 - 2012, 3.9 years follow-up	246314 men and women, age ≥45 years: 11127 deaths 41754 healthy men and 66489 healthy women, never smokers:	Self-reported, validated	CVD, cancer	First 2 years of follow-up	BMI, men, never smokers	15-18.49 18.5-19.99 20-22.49 22.50-24.99 25.00-27.49 27.50-29.99 30-34.99 35-50	1.85 (1.04-3.27) 1.84 (1.20-2.81) 1.49 (1.18-1.88) 1.00 0.99 (0.80-1.23) 1.08 (0.84-1.38) 1.45 (1.12-1.88) 2.61 (1.81-3.78)	Age, region of residence, household income, education, alcohol intake, health insurance
							BMI, women, never smokers	15-18.49	1.93 (1.35-2.76)	

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			1463 deaths					18.5-19.99 20-22.49 22.50-24.99 25.00-27.49 27.50-29.99 30-34.99 35-50	1.74 (1.29-2.35) 1.45 (1.16-1.82) 1.00 1.01 (0.80-1.28) 1.06 (0.81-1.38) 1.21 (0.93-1.57) 1.66 (1.18-2.33)	
Patel AV et al, 2014, USA	Cancer Prevention Study 2	1982 – 2010, 28 years follow-up	891572 white and 38119 black men and women, age ≥30 years: 434400/18702 deaths 115673 white men and 4279 black men, 318798 white women, and 15083 black women, never smokers: 20123/36179 deaths 806/1390 deaths 56005/81028 deaths 2907/3833 deaths	Self-reported	Analyses were stratified by prevalent disease (cancer, heart disease, stroke, emphysema, chronic bronchitis, asthma)	No	BMI, white smokers with prevalent disease, men BMI, white smokers without prevalent disease BMI, white never smoker with prevalent disease BMI, white never smoker without prevalent disease	15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 ≥40.0 15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 ≥40.0 15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 ≥40.0 15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 ≥40.0	1.66 (1.55-1.76) 1.47 (1.39-1.55) 1.18 (1.15-1.22) 1.00 0.96 (0.94-0.98) 1.02 (1.00-1.05) 1.15 (1.12-1.19) 1.28 (1.19-1.37) 1.52 (1.22-1.89) 1.29 (1.18-1.42) 1.34 (1.27-1.42) 1.15 (1.12-1.18) 1.00 0.99 (0.97-1.01) 1.06 (1.04-1.08) 1.24 (1.21-1.28) 1.50 (1.40-1.60) 2.00 (1.63-2.45) 1.34 (1.16-1.54) 1.38 (1.25-1.53) 1.11 (1.05-1.16) 1.00 1.06 (1.02-1.10) 1.14 (1.09-1.19) 1.42 (1.35-1.50) 1.75 (1.55-1.97) 1.18 (0.75-1.86) 1.25 (1.08-1.45) 1.06 (0.96-1.17) 1.01 (0.97-1.05) 1.00 1.07 (1.04-1.10) 1.28 (1.24-1.32) 1.50 (1.44-1.56) 2.17 (1.98-2.39) 2.52 (1.92-3.30)	Age, race, education, physical activity, alcohol, marital status, aspirin use, fat consumption, vegetable consumption, and among ever smokers: smoking status, cigarettes per day, years since quitting + analyses with prevalent disease further adjusted for cancer, heart disease, stroke, emphysema, chronic bronchitis, asthma

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5							BMI, black smokers with prevalent disease, men	15.0-18.4	1.35 (0.95-1.93)	
6								18.5-19.9	1.36 (1.04-1.77)	
7								20.0-22.4	1.10 (0.94-1.29)	
8								22.5-24.9	1.00	
9								25.0-27.4	0.97 (0.86-1.11)	
10								27.5-29.9	0.95 (0.83-1.10)	
11								30.0-34.9	1.06 (0.90-1.23)	
12								≥35.0	1.14 (0.86-1.52)	
13							BMI, black smokers without prevalent disease	15.0-18.4	0.99 (0.66-1.50)	
14								18.5-19.9	1.57 (1.24-2.00)	
15								20.0-22.4	1.14 (1.00-1.29)	
16								22.5-24.9	1.00	
17								25.0-27.4	1.03 (0.94-1.14)	
18								27.5-29.9	1.00 (0.89-1.12)	
19								30.0-34.9	1.11 (0.97-1.28)	
20								≥35.0	1.15 (0.88-1.51)	
21							BMI, black never smoker with prevalent disease	15.0-18.4	1.76 (0.98-3.17)	
22								18.5-19.9	2.00 (1.17-3.45)	
23								20.0-22.4	1.36 (0.99-1.86)	
24								22.5-24.9	1.00	
25								25.0-27.4	0.76 (0.60-0.95)	
26								27.5-29.9	0.88 (0.70-1.12)	
27								30.0-34.9	1.00 (0.79-1.27)	
28								≥35.0	0.91 (0.57-1.46)	
29								15.0-18.4	0.78 (0.29-2.13)	
30								18.5-19.9	1.60 (0.94-2.72)	
31								20.0-22.4	1.05 (0.83-1.34)	
32							BMI, black never smoker without prevalent disease	22.5-24.9	1.00	
33								25.0-27.4	1.18 (1.01-1.38)	
34								27.5-29.9	1.24 (1.05-1.47)	
35								30.0-34.9	1.53 (1.28-1.83)	
36								≥35.0	1.97 (1.41-2.76)	
37								15.0-18.4	1.69 (1.61-1.77)	
38								18.5-19.9	1.21 (1.16-1.26)	
39								20.0-22.4	1.05 (1.03-1.08)	
40								22.5-24.9	1.00	
							BMI, white smokers with prevalent disease, women	25.0-27.4	1.04 (1.01-1.08)	
								27.5-29.9	1.12 (1.08-1.17)	
								30.0-34.9	1.20 (1.16-1.25)	
								35.0-39.9	1.32 (1.24-1.40)	
								≥40.0	1.58 (1.43-1.74)	
								15.0-18.4	1.56 (1.49-1.63)	
								18.5-19.9	1.14 (1.10-1.18)	

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							BMI, white smokers without prevalent disease	20.0-22.4	1.02 (1.00-1.05)	
								22.5-24.9	1.00	
								25.0-27.4	1.06 (1.03-1.08)	
								27.5-29.9	1.13 (1.09-1.17)	
								30.0-34.9	1.26 (1.21-1.31)	
								35.0-39.9	1.53 (1.43-1.64)	
								≥40.0	1.92 (1.70-2.16)	
								15.0-18.4	1.44 (1.37-1.52)	
								18.5-19.9	1.10 (1.06-1.14)	
							BMI, white never smoker with prevalent disease	20.0-22.4	1.01 (0.98-1.03)	
								22.5-24.9	1.00	
								25.0-27.4	1.05 (1.02-1.07)	
								27.5-29.9	1.13 (1.10-1.17)	
								30.0-34.9	1.25 (1.21-1.28)	
								35.0-39.9	1.51 (1.44-1.59)	
								≥40.0	1.82 (1.67-1.98)	
								15.0-18.4	1.20 (1.14-1.26)	
								18.5-19.9	1.04 (1.01-1.07)	
							BMI, white never smoker without prevalent disease	20.0-22.4	0.97 (0.95-0.99)	
								22.5-24.9	1.00	
								25.0-27.4	1.09 (1.07-1.11)	
								27.5-29.9	1.21 (1.18-1.24)	
								30.0-34.9	1.39 (1.35-1.43)	
								35.0-39.9	1.79 (1.70-1.88)	
								≥40.0	2.45 (2.25-2.67)	
								15.0-18.4	1.40 (1.06-1.84)	
								18.5-19.9	1.52 (1.17-1.98)	
							BMI, black smokers with prevalent disease, women	20.0-22.4	1.17 (1.00-1.38)	
								22.5-24.9	1.00	
								25.0-27.4	0.99 (0.86-1.13)	
								27.5-29.9	1.10 (0.94-1.29)	
								30.0-34.9	1.12 (0.97-1.30)	
								35.0-39.9	1.14 (0.93-1.40)	
								≥40.0	1.43 (1.10-1.86)	
								15.0-18.4	2.11 (1.59-2.80)	
								18.5-19.9	1.42 (1.15-1.76)	
							BMI, black smokers without prevalent disease	20.0-22.4	1.12 (0.98-1.28)	
								22.5-24.9	1.00	
								25.0-27.4	1.13 (1.00-1.28)	
								27.5-29.9	1.18 (1.02-1.36)	
								30.0-34.9	1.36 (1.19-1.55)	
								35.0-39.9	1.52 (1.23-1.88)	
								≥40.0	1.42 (0.98-2.07)	

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5							BMI, black never smoker with prevalent disease	15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 ≥40.0	1.11 (0.79-1.55) 1.06 (0.81-1.38) 1.14 (0.98-1.34) 1.00 1.15 (1.01-1.30) 1.14 (0.99-1.30) 1.19 (1.05-1.34) 1.45 (1.23-1.70) 2.06 (1.67-2.56)		
6							BMI, black never smoker without prevalent disease	15.0-18.4 18.5-19.9 20.0-22.4 22.5-24.9 25.0-27.4 27.5-29.9 30.0-34.9 35.0-39.9 ≥40.0	1.38 (1.03-1.85) 1.04 (0.82-1.30) 0.97 (0.85-1.10) 1.00 1.08 (0.97-1.19) 1.27 (1.14-1.42) 1.32 (1.19-1.46) 1.64 (1.40-1.91) 1.78 (1.43-2.21)		
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20	Gao S et al, 2014, China	Rural Elderly Chinese (Sichuan and Shandong)	2003-2005 – NA, 7 years follow-up	2000 men and women, age ≥65 years: 473 deaths	Measured	No	Excluded 1 st year of follow-up in sensitivity analysis	BMI	<18.5 18.5-24.9 25.0-29.9 ≥30.0	1.64 (1.30-2.06) 1.00 1.09 (0.82-1.46) 0.39 (0.15-1.06)	Age, sex, diabetes, stroke, cognitive decline score
21											
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25	Yu Y et al, 2014, China	Kailuan Study	2006-2007 – 2010, 4.02 years follow-up	95429 men and women, age 18-98 years: 1843 deaths	Measured	No	No	BMI	<25 25-<30 ≥30	1.00 (0.84-1.19) 0.86 (0.72-1.02) 1.00	Age, sex, average income, education, alcohol, history of MI, stroke, cancer
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30	Roh L et al, 2014, Switzerland	Swiss MONICA study, National Research Program 1A, the SOMIOPS study, and the Swiss Health Survey	1977-1993 – 2008, 19.2 years follow-up	31578 men and women, age 25-74 years: 5694 deaths	Measured and self-reported	No	Exclusion of first 1-5 years in sensitivity analyses	BMI, all	<18.5 18.5-<25 25-<30 ≥30.0	1.37 (1.14-1.65) 1.00 1.02 (0.97-1.09) 1.32 (1.22-1.43)	Age, age squared, study waves, smoking status, sports frequency, healthy eating, education
31								BMI, measured BMI	<18.5 18.5-<25 25-<30 ≥30.0	1.16 (0.88-1.53) 1.00 1.01 (0.94-1.09) 1.31 (1.18-1.44)	
32								BMI, self-reported BMI	<18.5 18.5-<25 25-<30 ≥30.0	1.56 (1.24-2.05) 1.00 1.04 (0.95-1.15) 1.32 (1.14-1.53)	
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40	Clark DO et al, 2014, USA	Indianapolis-Ibadan	1992-2001 – 2011, 10	1197 Yoruba Nigerian and	Measured	No	First year of follow-	BMI, Yoruba Nigerians	<18.5 18.5-24.9	1.35 (1.12-1.63) 1.00	Age, sex, alcohol, smoking

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	Dementia Project	years follow-up	1269 African American men and women, age ≥70 years: 563/553 deaths			up excluded in sensitivity analyses (partly reported)	BMI, African Americans	25.0-29.9 ≥30.0 <18.5 18.5-24.9 25.0-29.9 ≥30.0	0.88 (0.67-1.16) 0.92 (0.61-1.39) 2.49 (1.40-4.43) 1.00 0.90 (0.72-1.14) 1.06 (0.85-1.33)	
Wu CY et al, 2014, China	Taipei Geriatric Health Examination Database	2006-2010, 3.3 years follow-up	77541 men and women, age ≥65 years: 3842 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 30.0-34.9 ≥35.0	1.92 (1.71-2.15) 1.00 0.82 (0.76-0.88) 0.82 (0.69-0.98) 1.59 (1.06-2.38)	Age, sex, marital status, education, smoking status, alcohol, exercise
Lehtinen NK et al, 2014, Finland	Health 2000 Survey	2000-2001 – 2011, ~10.5 years follow-up	2505 men and women, age 50-74 years: 335 deaths	Measured	No	No	BMI	<25.0 25.0-29.9 ≥30.0	1.00 1.08 (0.82-1.43) 1.22 (0.91-1.65)	Age, sex, education, cigarette smoking status
Lee Y et al, 2014, Korea	Living Profiles of Older People Survey	2008 – 2011, 3 years follow-up	11844 men and women, age ≥60 years: 832 deaths	Measured	No	No	BMI	<18.5 18.5-24.9 25.0-29.9 ≥30.0	2.04 (1.55-2.70) 1.00 0.74 (0.57-0.96) 1.01 (0.57-1.79)	Age, sex, marital status, education, household income, comorbidity, cognitive impairment, smoking status, alcohol, nutritional risk
He Y et al, 2014, China	Machinery Factory Employees in Xi'an	1976-1994 – 2011, 30.4 years follow-up	1696 men and women, age 36-65 years: 655 deaths	Measured	Prevalent cancers and CVD cases excluded	No	BMI, 1976 BMI, 1994	<18.5 18.5-22.9 23.0-24.9 ≥25.0 <18.5 18.5-22.9 23.0-24.9 ≥25.0	0.93 (0.67-1.30) 1.00 0.69 (0.57-0.84) 0.75 (0.60-1.00) 1.43 (1.00-2.04) 1.00 1.14 (0.90-1.43) 1.27 (1.02-1.59)	Age, sex, marital status, occupation, education, alcohol drinking, smoking status
Rokkino P et al, 2014, USA	Veterans Affairs Medical Centers	1986-2011 - 2012, 10.8 years follow-up	18033 men, mean age 58.4 years: 5070 deaths	Measured	Implanted pacemakers, left bundle branch block, unable to complete exercise test, COPD, exercise capacity <2 METs	No	BMI BMI, excluding first 2 years of follow-up	18.5-20.0 20.1-23.9 24.0-27.9 28.0-31.9 ≥32.0 18.5-20.0 20.1-23.9 24.0-27.9 28.0-31.9 ≥32.0	1.56 (1.37-1.77) 1.21 (1.12-1.30) 1.00 0.95 (0.88-1.02) 0.97 (0.89-1.06) 1.55 (1.35-1.79) 1.21 (1.12-1.32) 1.00 0.96 (0.89-1.04) 0.99 (0.90-1.09)	Age, METs achieved, blood pressure, race, cardiovascular disease including heart failure, hypertension, type 2 diabetes, dyslipidemia, smoking status, muscle-wasting diseases, alcohol, drug abuse, beta-blockers, calcium-channel blockers, diuretics, angiotensin-converting enzyme inhibitors, angiotensin 2 receptor blockers, aspirin, lipid-

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5										lowering agents, hypoglycemic agents, year of entry into the study	
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8	Hirani V et al,	Concord Health	2005-2007	1705 men, age	Measured	No	No	BMI	<20	2.10 (1.17-3.79)	Age, smoking status, alcohol
9	2014,	and Ageing in	- 2013, 6.7	70-97 years:					20.0-24.9	1.00	consumption, myocardial
10	Australia	Men Project	years	461 deaths					25.0-29.9	0.69 (0.54-0.89)	infarction, congestive heart
11			follow-up						≥30	0.61 (0.45-0.82)	failure, cancer, depressive
12											symptoms, IADL disability,
13											ADL disability, chair stands,
14											white blood cell count,
15											haemoglobin albumin
16	Phengprugsas	Thai Cohort	2005-2010,	87151 men	Self-reported	Metabolic,	No	BMI, age <35 years	<18.5	1.15 (0.79-1.68)	Age, sex, monthly income,
17	van V et al,	Study	5 years	and women,		cardiovascular			18.5-<20.75	1.00	paid work hours, rural-urban
18	2014,		follow-up	age 15-87		disorders			20.75-<23.0	0.98 (0.70-1.36)	residence, self-assessed health
19	Thailand			years: 583		including			23.0-<25.0	1.08 (0.72-1.62)	at baseline, smoking status,
20				deaths		diabetes and			25.0-<30.0	1.11 (0.71-1.73)	alcohol drinking status,
21						hypertension		BMI, age 35-65 years	≥30.0	0.63 (0.20-1.20)	physical activity
22									<18.5	1.82 (0.81-4.08)	
23									18.5-<20.75	1.00	
24									20.75-<23.0	1.61 (0.93-2.81)	
25									23.0-<25.0	0.79 (0.41-1.51)	
26									25.0-<30.0	1.28 (0.69-2.35)	
27									≥30.0	2.37 (1.01-5.70)	
28	Chong ES et	Korean	2005-2006	1000 men and	Measured	No	No	BMI	13.9-21.8	1.00	Age, sex, alcohol, smoking
29	al, 2015,	Longitudinal	- 2011, 6	women, age					21.8-23.9	0.76 (0.53-1.10)	status, exercise
30	Korea	Study on Health	years	≥65 years: 222					23.9-26.0	0.63 (0.41-0.96)	
31		and Aging	follow-up	deaths					26.0-35.8	0.54 (0.34-0.86)	
32	Chong G et al,	Allied Dunbar	1990 -	1796 men and	Measured	No	No	BMI	14.9-24.9	1.00	Age, sex
33	2015, United	National Fitness	2014, 22.9	2122 women,					25.0-29.9	1.10 (0.93-1.31)	
34	Kingdom	Survey	years	age 16-96					30.0-49.9	1.36 (1.08-1.72)	
35			follow-up	years: 1175							
36				deaths							
37	Siemoto CK	The Health,	2000-2006	1527 men and	Measured	Prevalent	No	BMI	18.5-<20.0	1.51 (1.08-2.10)	Age, sex, marital status, years
38	al, 2015,	Well-Being and	- 2010, 6.5	women, age		cancers			20.0-<25.0	1.00	of education, childhood SES,
39	Brazil	Ageing (SABE)	years	≥75 years: 621		excluded			25.0-<30.0	0.84 (0.70-1.02)	occupation, income, diabetes,
40		study	follow-up	deaths					≥30.0	0.82 (0.64-1.06)	heart disease, lung disease,
											stroke, arthritis, depressive
											symptoms, alcohol, smoking
											status, physical activity,
											cognitive function, activities
											of daily living, frailty,
											nutritional status, year of
											entry into the study

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6								21.0-21.9	1.28 (1.22-1.34)	
7								22.0-22.9	1.14 (1.08-1.19)	
8								23.0-23.9	1.03 (0.99-1.08)	
9								24.0-24.9	1.00 (0.95-1.04)	
10								25.0-25.9	0.97 (0.93-1.02)	
11								26.0-26.9	1.00	
12								27.0-27.9	1.07 (1.02-1.13)	
13								28.0-28.9	1.07 (1.01-1.14)	
14								29.0-29.9	1.28 (1.19-1.37)	
15								30.0-31.4	1.31 (1.21-1.42)	
16								31.5-32.9	1.39 (1.23-1.57)	
17								33.0-34.9	1.61 (1.36-1.90)	
18								35.0-50.0	2.02 (1.63-2.52)	
19							BMI, men, age 45-54 years	<16	5.63 (4.90-6.48)	
20								16-17.4	3.36 (3.12-3.61)	
21								17.5-18.9	2.39 (2.28-2.50)	
22								19.0-19.9	1.92 (1.85-2.01)	
23								20.0-20.9	1.68 (1.62-1.74)	
24								21.0-21.9	1.42 (1.37-1.48)	
25								22.0-22.9	1.24 (1.20-1.28)	
26								23.0-23.9	1.12 (1.08-1.16)	
27								24.0-24.9	1.05 (1.02-1.09)	
28								25.0-25.9	1.01 (0.98-1.05)	
29								26.0-26.9	1.00	
30								27.0-27.9	1.06 (1.01-1.10)	
31								28.0-28.9	1.09 (1.04-1.15)	
32								29.0-29.9	1.17 (1.11-1.24)	
33								30.0-31.4	1.27 (1.18-1.35)	
34								31.5-32.9	1.34 (1.21-1.48)	
35								33.0-34.9	1.48 (1.26-1.73)	
36								35.0-50.0	1.60 (1.27-2.02)	
37							BMI, men, age 55-64 years	<16	4.97 (4.59-5.38)	
38								16-17.4	3.15 (3.00-3.29)	
39								17.5-18.9	2.21 (2.14-2.28)	
40								19.0-19.9	1.81 (1.76-1.87)	
								20.0-20.9	1.61 (1.56-1.66)	
								21.0-21.9	1.39 (1.36-1.43)	
								22.0-22.9	1.25 (1.22-1.29)	
								23.0-23.9	1.13 (1.10-1.16)	
								24.0-24.9	1.05 (1.02-1.08)	
								25.0-25.9	1.02 (0.99-1.05)	
								26.0-26.9	1.00	

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								27.0-27.9	1.00 (0.96-1.03)	
								28.0-28.9	1.03 (0.99-1.07)	
								29.0-29.9	1.08 (1.03-1.14)	
								30.0-31.4	1.11 (1.05-1.18)	
								31.5-32.9	1.22 (1.11-1.33)	
								33.0-34.9	1.31 (1.13-1.51)	
								35.0-50.0	1.47 (1.21-1.80)	
						BMI, men, age 65-74 years	<16	3.52 (3.33-3.72)		
							16-17.4	2.47 (2.39-2.56)		
							17.5-18.9	1.87 (1.82-1.92)		
							19.0-19.9	1.60 (1.56-1.65)		
							20.0-20.9	1.41 (1.37-1.45)		
							21.0-21.9	1.31 (1.27-1.34)		
							22.0-22.9	1.20 (1.17-1.24)		
							23.0-23.9	1.11 (1.08-1.14)		
							24.0-24.9	1.04 (1.01-1.06)		
							25.0-25.9	0.99 (0.96-1.02)		
							26.0-26.9	1.00		
							27.0-27.9	0.96 (0.93-1.00)		
							28.0-28.9	1.00 (0.96-1.04)		
							29.0-29.9	1.07 (1.01-1.13)		
							30.0-31.4	1.07 (1.00-1.14)		
							31.5-32.9	1.17 (1.05-1.30)		
							33.0-34.9	1.31 (1.12-1.52)		
							35.0-50.0	1.37 (1.09-1.71)		
						BMI, men, age 75-99 years	<16	2.71 (2.54-2.90)		
							16-17.4	1.98 (1.89-2.08)		
							17.5-18.9	1.62 (1.55-1.69)		
							19.0-19.9	1.44 (1.38-1.50)		
							20.0-20.9	1.34 (1.29-1.40)		
							21.0-21.9	1.23 (1.18-1.29)		
							22.0-22.9	1.15 (1.11-1.20)		
							23.0-23.9	1.10 (1.05-1.15)		
							24.0-24.9	1.03 (0.99-1.08)		
							25.0-25.9	1.00 (0.96-1.05)		
							26.0-26.9	1.00		
							27.0-27.9	0.98 (0.92-1.04)		
							28.0-28.9	0.97 (0.90-1.04)		
							29.0-29.9	0.89 (0.81-0.98)		
							30.0-31.4	0.98 (0.88-1.10)		
							31.5-32.9	1.00 (0.84-1.18)		
							33.0-34.9	1.09 (0.79-1.50)		
							35.0-50.0	1.33 (0.94-1.89)		

BMI, women, age 18-34 years	<16	1.02 (0.69-1.52)
	16-17.4	1.02 (0.85-1.23)
	17.5-18.9	1.00 (0.86-1.17)
	19.0-19.9	1.03 (0.88-1.21)
	20.0-20.9	0.98 (0.84-1.15)
	21.0-21.9	1.03 (0.88-1.21)
	22.0-22.9	0.99 (0.83-1.17)
	23.0-23.9	0.97 (0.81-1.16)
	24.0-24.9	1.00
	25.0-25.9	1.11 (0.89-1.39)
	26.0-26.9	1.50 (1.19-1.88)
	27.0-27.9	1.32 (1.01-1.74)
	28.0-28.9	1.29 (0.93-1.78)
	29.0-29.9	1.42 (0.98-2.06)
	30.0-31.4	1.24 (0.84-1.85)
	31.5-32.9	1.06 (0.62-1.83)
	33.0-34.9	1.88 (1.13-3.13)
	35.0-50.0	2.36 (1.42-3.92)
BMI, women, age 35-44 years	<16	4.87 (3.68-6.45)
	16-17.4	1.56 (1.32-1.85)
	17.5-18.9	1.07 (0.97-1.19)
	19.0-19.9	0.93 (0.85-1.02)
	20.0-20.9	0.92 (0.85-1.00)
	21.0-21.9	0.94 (0.87-1.02)
	22.0-22.9	0.94 (0.87-1.02)
	23.0-23.9	0.92 (0.85-1.00)
	24.0-24.9	1.00
	25.0-25.9	1.02 (0.93-1.12)
	26.0-26.9	1.09 (0.99-1.21)
	27.0-27.9	1.13 (1.01-1.26)
	28.0-28.9	1.18 (1.04-1.34)
	29.0-29.9	1.28 (1.10-1.48)
	30.0-31.4	1.40 (1.19-1.64)
	31.5-32.9	1.36 (1.10-1.67)
	33.0-34.9	1.42 (1.08-1.88)
	35.0-50.0	1.66 (1.21-2.28)
BMI, women, age 45-54 years	<16	4.85 (3.79-6.20)
	16-17.4	2.20 (1.90-2.54)
	17.5-18.9	1.55 (1.42-1.68)
	19.0-19.9	1.18 (1.10-1.28)
	20.0-20.9	1.14 (1.07-1.21)
	21.0-21.9	1.02 (0.97-1.08)
	22.0-22.9	0.97 (0.92-1.03)

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								23.0-23.9	1.00 (0.95-1.05)	
								24.0-24.9	1.00	
								25.0-25.9	1.01 (0.96-1.07)	
								26.0-26.9	1.01 (0.95-1.07)	
								27.0-27.9	1.08 (1.01-1.15)	
								28.0-28.9	1.13 (1.05-1.22)	
								29.0-29.9	1.22 (1.12-1.33)	
								30.0-31.4	1.26 (1.15-1.38)	
								31.5-32.9	1.37 (1.22-1.54)	
								33.0-34.9	1.43 (1.22-1.69)	
								35.0-50.0	1.73 (1.43-2.09)	
						BMI, women, age 55-64 years	<16		3.89 (3.38-4.49)	
							16-17.4		2.33 (2.14-2.54)	
							17.5-18.9		1.81 (1.71-1.91)	
							19.0-19.9		1.44 (1.37-1.52)	
							20.0-20.9		1.26 (1.20-1.32)	
							21.0-21.9		1.16 (1.11-1.20)	
							22.0-22.9		1.07 (1.03-1.11)	
							23.0-23.9		1.01 (0.97-1.05)	
							24.0-24.9		1.00	
							25.0-25.9		0.99 (0.95-1.03)	
							26.0-26.9		1.00 (0.96-1.04)	
							27.0-27.9		1.00 (0.96-1.05)	
							28.0-28.9		1.08 (1.03-1.13)	
							29.0-29.9		1.07 (1.01-1.13)	
							30.0-31.4		1.20 (1.13-1.28)	
							31.5-32.9		1.37 (1.27-1.47)	
							33.0-34.9		1.33 (1.19-1.48)	
							35.0-50.0		1.72 (1.52-1.95)	
						BMI, women, age 65-74 years	<16		2.53 (2.35-2.72)	
							16-17.4		1.87 (1.78-1.96)	
							17.5-18.9		1.58 (1.53-1.64)	
							19.0-19.9		1.39 (1.34-1.44)	
							20.0-20.9		1.25 (1.21-1.29)	
							21.0-21.9		1.17 (1.14-1.21)	
							22.0-22.9		1.06 (1.03-1.09)	
							23.0-23.9		1.04 (1.01-1.07)	
							24.0-24.9		1.00	
							25.0-25.9		0.99 (0.96-1.02)	
							26.0-26.9		0.98 (0.95-1.01)	
							27.0-27.9		0.99 (0.96-1.03)	
							28.0-28.9		1.01 (0.98-1.05)	
							29.0-29.9		1.07 (1.02-1.11)	

BMI, women, age 75-99 years	30.0-31.4	1.08 (1.03-1.13)
	31.5-32.9	1.14 (1.07-1.21)
	33.0-34.9	1.19 (1.09-1.30)
	35.0-50.0	1.35 (1.20-1.52)
	<16	1.92 (1.80-2.04)
	16-17.4	1.70 (1.63-1.78)
	17.5-18.9	1.46 (1.41-1.51)
	19.0-19.9	1.35 (1.31-1.40)
	20.0-20.9	1.23 (1.19-1.27)
	21.0-21.9	1.17 (1.13-1.21)
	22.0-22.9	1.10 (1.07-1.14)
	23.0-23.9	1.07 (1.04-1.11)
	24.0-24.9	1.00
	25.0-25.9	0.99 (0.96-1.03)
	26.0-26.9	1.00 (0.96-1.03)
	27.0-27.9	1.00 (0.96-1.04)
BMI, men, age 18-44 years, never smokers	28.0-28.9	1.00 (0.96-1.04)
	29.0-29.9	1.02 (0.97-1.07)
	30.0-31.4	0.99 (0.93-1.05)
	31.5-32.9	1.06 (0.99-1.14)
	33.0-34.9	1.04 (0.94-1.14)
	35.0-50.0	1.12 (0.97-1.29)
	<17.5	2.86 (2.45-3.33)
	17.5-18.9	1.61 (1.46-1.79)
	19.0-20.4	1.34 (1.25-1.45)
	20.5-21.9	1.16 (1.09-1.24)
BMI, men, age 45-64 years, never smokers	22.0-23.4	1.07 (1.01-1.14)
	23.5-24.9	0.99 (0.93-1.05)
	25.0-26.4	1.00
	26.5-27.9	1.08 (1.00-1.16)
	28.0-29.4	1.24 (1.14-1.35)
	29.5-30.9	1.28 (1.13-1.45)
	31.0-50.0	1.68 (1.48-1.90)
	<17.5	3.82 (3.59-4.07)
	17.5-18.9	2.20 (2.10-2.31)
	19.0-20.4	1.73 (1.67-1.79)
	20.5-21.9	1.40 (1.36-1.44)
	22.0-23.4	1.18 (1.15-1.21)
	23.5-24.9	1.05 (1.02-1.07)
	25.0-26.4	1.00
	26.5-27.9	1.01 (0.98-1.05)
	28.0-29.4	1.11 (1.07-1.15)
	29.5-30.9	1.16 (1.09-1.23)

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							BMI, men, age 65-99 years, never smokers	31.0-50.0 <17.5 17.5-18.9 19.0-20.4 20.5-21.9 22.0-23.4 23.5-24.9 25.0-26.4 26.5-27.9 28.0-29.4 29.5-30.9 31.0-50.0	1.43 (1.33-1.53) 2.69 (2.60-2.78) 1.89 (1.83-1.94) 1.54 (1.50-1.58) 1.34 (1.31-1.37) 1.18 (1.15-1.20) 1.06 (1.04-1.09) 1.00 0.96 (0.93-0.99) 1.01 (0.97-1.05) 1.00 (0.94-1.07) 1.10 (1.01-1.19)	
							BMI, men, age 18-44 years, former smokers	<17.5 17.5-18.9 19.0-20.4 20.5-21.9 22.0-23.4 23.5-24.9 25.0-26.4 26.5-27.9 28.0-29.4 29.5-30.9 31.0-50.0	3.57 (2.76-4.63) 2.00 (1.71-2.35) 1.40 (1.25-1.57) 1.10 (1.00-1.22) 1.02 (0.93-1.11) 0.97 (0.88-1.06) 1.00 0.94 (0.84-1.04) 1.05 (0.92-1.20) 1.29 (1.07-1.54) 1.52 (1.25-1.86)	
							BMI, men, age 45-64 years, former smokers	<17.5 17.5-18.9 19.0-20.4 20.5-21.9 22.0-23.4 23.5-24.9 25.0-26.4 26.5-27.9 28.0-29.4 29.5-30.9 31.0-50.0	4.42 (3.98-4.91) 2.61 (2.42-2.80) 1.82 (1.72-1.92) 1.49 (1.43-1.57) 1.22 (1.16-1.27) 1.11 (1.06-1.16) 1.00 1.01 (0.96-1.06) 1.11 (1.04-1.19) 1.16 (1.04-1.28) 1.21 (1.06-1.37)	
							BMI, men, age 65-99 years, former smokers	<17.5 17.5-18.9 19.0-20.4 20.5-21.9 22.0-23.4 23.5-24.9 25.0-26.4 26.5-27.9 28.0-29.4	2.61 (2.46-2.77) 1.91 (1.82-2.01) 1.61 (1.55-1.69) 1.35 (1.29-1.40) 1.18 (1.13-1.23) 1.05 (1.00-1.09) 1.00 1.01 (0.96-1.07) 0.98 (0.91-1.06)	

							29.5-30.9	1.08 (0.96-1.22)	
							31.0-50.0	1.21 (1.05-1.41)	
						BMI, men, age 18-44 years, current smokers	<17.5	2.32 (2.10-2.55)	
							17.5-18.9	1.86 (1.76-1.96)	
							19.0-20.4	1.55 (1.48-1.62)	
							20.5-21.9	1.35 (1.30-1.41)	
							22.0-23.4	1.16 (1.11-1.20)	
							23.5-24.9	1.04 (1.00-1.08)	
							25.0-26.4	1.00	
							26.5-27.9	1.09 (1.04-1.15)	
							28.0-29.4	1.15 (1.09-1.21)	
							29.5-30.9	1.37 (1.27-1.48)	
							31.0-50.0	1.55 (1.43-1.68)	
						BMI, men, age 45-64 years, current smokers	<17.5	3.21 (3.07-3.35)	
							17.5-18.9	2.20 (2.13-2.27)	
							19.0-20.4	1.77 (1.72-1.81)	
							20.5-21.9	1.45 (1.42-1.49)	
							22.0-23.4	1.20 (1.18-1.23)	
							23.5-24.9	1.05 (1.02-1.07)	
							25.0-26.4	1.00	
							26.5-27.9	1.00 (0.97-1.03)	
							28.0-29.4	0.99 (0.95-1.03)	
							29.5-30.9	1.12 (1.06-1.19)	
							31.0-50.0	1.19 (1.10-1.28)	
						BMI, men, age 65-99 years, current smokers	<17.5	2.13 (2.05-2.21)	
							17.5-18.9	1.63 (1.57-1.68)	
							19.0-20.4	1.41 (1.37-1.46)	
							20.5-21.9	1.24 (1.21-1.28)	
							22.0-23.4	1.14 (1.11-1.18)	
							23.5-24.9	1.06 (1.02-1.09)	
							25.0-26.4	1.00	
							26.5-27.9	0.99 (0.95-1.04)	
							28.0-29.4	1.00 (0.94-1.07)	
							29.5-30.9	1.11 (1.01-1.22)	
							31.0-50.0	1.21 (1.07-1.37)	
						BMI, women, age 18-44 years, never smokers	<18.5	1.15 (1.06-1.24)	
							18.5-21.0	0.98 (0.93-1.03)	
							21.0-23.0	0.99 (0.94-1.05)	
							23.0-25.0	1.00	
							25.0-27.5	1.15 (1.08-1.22)	
							27.5-30.0	1.30 (1.19-1.41)	
							30.0-50.0	1.56 (1.40-1.74)	
						BMI, women, age 45-64	<18.5	2.13 (2.03-2.23)	

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							years, never smokers	18.5-21.0	1.30 (1.26-1.34)	
								21.0-23.0	1.07 (1.04-1.10)	
								23.0-25.0	1.00	
								25.0-27.5	1.00 (0.98-1.03)	
								27.5-30.0	1.10 (1.07-1.13)	
								30.0-50.0	1.32 (1.27-1.37)	
						BMI, women, age 65-99	<18.5		1.70 (1.66-1.74)	
						years, never smokers	18.5-21.0		1.28 (1.26-1.31)	
							21.0-23.0		1.10 (1.08-1.12)	
							23.0-25.0		1.00	
							25.0-27.5		0.96 (0.94-0.98)	
							27.5-30.0		1.00 (0.97-1.02)	
							30.0-50.0		1.07 (1.04-1.11)	
						BMI, women, age 18-44	<18.5		0.94 (0.62-1.43)	
						years, former smokers	18.5-21.0		0.75 (0.55-1.02)	
							21.0-23.0		0.69 (0.50-0.95)	
							23.0-25.0		1.00	
							25.0-27.5		0.74 (0.49-1.11)	
							27.5-30.0		0.59 (0.31-1.15)	
							30.0-50.0		0.99 (0.51-1.93)	
						BMI, women, age 45-64	<18.5		1.70 (1.13-2.55)	
						years, former smokers	18.5-21.0		1.41 (1.12-1.77)	
							21.0-23.0		0.90 (0.73-1.11)	
							23.0-25.0		1.00	
							25.0-27.5		1.05 (0.86-1.27)	
							27.5-30.0		0.86 (0.66-1.11)	
							30.0-50.0		1.21 (0.88-1.67)	
						BMI, women, age 65-99	<18.5		1.66 (1.45-1.89)	
						years, former smokers	18.5-21.0		1.37 (1.24-1.53)	
							21.0-23.0		1.03 (0.92-1.14)	
							23.0-25.0		1.00	
							25.0-27.5		0.99 (0.89-1.11)	
							27.5-30.0		0.97 (0.84-1.13)	
							30.0-50.0		1.18 (0.97-1.44)	
						BMI, women, age 18-44	<18.5		1.32 (1.00-1.75)	
						years, current smokers	18.5-21.0		1.12 (0.91-1.39)	
							21.0-23.0		1.21 (0.98-1.49)	
							23.0-25.0		1.00	
							25.0-27.5		1.12 (0.86-1.45)	
							27.5-30.0		1.55 (1.14-2.10)	
							30.0-50.0		1.19 (0.79-1.80)	
						BMI, women, age 45-64	<18.5		1.97 (1.71-2.28)	
						years, current smokers	18.5-21.0		1.26 (1.13-1.40)	

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5								21.0-23.0	1.05 (0.95-1.16)		
6								23.0-25.0	1.00		
7								25.0-27.5	0.89 (0.80-0.98)		
8								27.5-30.0	0.89 (0.78-1.01)		
9							BMI, women, age 65-99	30.0-50.0	1.13 (0.97-1.32)		
10							years, current smokers	<18.5	1.48 (1.39-1.56)		
11								18.5-21.0	1.18 (1.12-1.24)		
12								21.0-23.0	1.03 (0.98-1.09)		
13								23.0-25.0	1.00		
14								25.0-27.5	0.94 (0.88-1.00)		
15								27.5-30.0	0.98 (0.90-1.07)		
16								30.0-50.0	0.88 (0.77-1.01)		
17	JL et al,	Racial and	2004-2006	3376187 men	Measured	No	No	BMI, age <40 years	<20	1.00	Sex, Index eGFR, race, marital status, income, Charlson Comorbidity Index, cerebrovascular disease, congestive heart failure, peripheral artery disease, malignancies, liver disease, rheumatoid disease, lung disease, Aids, depression, cardiovascular disease, statin use, angiotensin converting enzyme inhibitor, anti-hypertensive use
18	15, USA	Cardiovascular	– 2013, 6.8	and women,					20-<25	0.50 (0.43-0.58)	
19		Risk Anomalies	years	mean age 60					25-<30	0.39 (0.34-0.46)	
20		in Chronic	follow-up	years: 672341					30-<35	0.38 (0.33-0.45)	
21		Kidney Disease		deaths					35-<40	0.36 (0.30-0.42)	
22		study							≥40	0.52 (0.43-0.62)	
23								BMI, age 40-<50 years	<20	4.09 (3.53-4.74)	
24									20-<25	1.92 (1.67-2.21)	
25									25-<30	1.31 (1.13-1.50)	
26									30-<35	1.10 (0.95-1.27)	
27									35-<40	1.16 (1.01-1.35)	
28									≥40	1.46 (1.26-1.69)	
29								BMI, age 50-<60 years	<20	7.10 (6.17-8.18)	
30									20-<25	3.72 (3.23-4.28)	
31									25-<30	2.31 (2.01-2.66)	
32									30-<35	1.98 (1.72-2.27)	
33									35-<40	2.02 (1.75-2.32)	
34									≥40	2.44 (2.12-2.81)	
35								BMI, age 60-<70 years	<20	11.27 (9.78-12.98)	
36									20-<25	5.96 (5.18-6.86)	
37									25-<30	3.63 (3.15-4.18)	
38									30-<35	3.21 (2.79-3.69)	
39									35-<40	3.42 (2.97-3.93)	
40									≥40	4.11 (3.56-4.74)	
								BMI, age 70-<80 years	<20	17.19 (14.93-19.79)	
									20-<25	9.97 (8.66-11.47)	
									25-<30	7.06 (6.13-8.12)	
									30-<35	6.39 (5.55-7.36)	
									35-<40	6.76 (5.87-7.79)	
									≥40	8.08 (6.99-9.33)	
								BMI, age ≥80 years	<20	26.34 (22.87-30.33)	

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								20-<25 25-<30 30-<35 35-<40 ≥40	17.21 (14.96-19.80) 13.68 (11.89-15.74) 12.74 (11.06-14.67) 13.30 (11.50-15.38) 15.33 (13.02-18.07)	
Chung WS et al, 2015, Korea	Taiwan Longitudinal Study on Aging (Health and Living Status of the Elderly in Taiwan)	1996-2007, 10.2 years follow-up	4145 men and women, age ≥50 years: 1123 deaths	Self-reported	No	3 first years of follow-up excluded	BMI	<18.5 18.5-<24.0 24.0-<27.0 27.0-28.0 28.0-29.0 ≥29.0	1.35 (1.11-1.64) 1.00 0.90 (0.77-1.04) 0.56 (0.39-0.80) 0.89 (0.61-1.30) 1.00 (0.75-1.33)	Age, sex, education, ethnicity, smoking status, spouse status, alcohol drinking status
Chong S et al, 2015, Korea	Kangwha Cohort Study	1985-2008, 23.8 years follow-up	6166 men and women, age ≥55 years: 2174/2372 deaths	Measured	Chronic diseases and cancers excluded in sensitivity analyses (risk estimates not reported)	First 4.8 years of follow-up excluded in sensitivity analyses	BMI, men BMI, women	<16.0 16.0-18.4 18.5-20.9 21.0-22.9 23.0-24.9 25.0-27.4 ≥27.5 <16.0 16.0-18.4 18.5-20.9 21.0-22.9 23.0-24.9 25.0-27.4 ≥27.5	2.35 (1.57-3.51) 1.77 (1.49-2.11) 1.26 (1.11-1.43) 1.01 (0.89-1.15) 1.00 1.06 (0.88-1.27) 1.47 (1.12-1.92) 2.12 (1.42-3.17) 1.38 (1.17-1.62) 1.14 (1.01-1.29) 1.04 (0.92-1.18) 1.00 0.89 (0.76-1.03) 1.14 (0.96-1.35)	Age, smoking status, alcohol intake, fruit and vegetables, occupation, education, health insurance status, known diseases, hypertension
Ponce-Garcia et al, 2015, Spain	Castilla-La Mancha	1992-1994 – 2006, 10.6 years follow-up	1248 men and women, age ≥18 years: 135 deaths	Measured	No	No	BMI	18.5-29.9 30.0-34.9 35.0-39.9	1.00 0.89 (0.57-1.39) 1.94 (1.11-3.42)	Age, sex, diabetes, hypertension, smoking status, personal history of CVD, hypercholesterolemia, HDL-cholesterol/triglycerides ratio
Nakade M et al, 2015, Japan	The Aichi Gerontological Evaluation (AGES) Cohort Study	2003 – 2008, 3.8 years follow-up	14931 men and women, age ≥65 years: 857 deaths	Self-reported	No	First year of follow-up excluded	BMI, men BMI, women	<18.5 18.5-22.9 23.0-24.9 ≥25.0 <18.5 18.5-22.9 23.0-24.9 ≥25.0	1.99 (1.49-2.67) 1.20 (0.96-1.49) 1.00 1.15 (0.88-1.51) 1.59 (1.07-2.35) 0.90 (0.65-1.23) 1.00 1.02 (0.71-1.47)	Age, marital status, self-rated health, present illness
Dankner R et al, 2015, Israel	Israel GOH Study	1969-1971 – 2012, 40 years follow-up	5710 men and women, age 28-59 years: 2932 deaths	Measured	No	No	BMI, all men	<20.0 20.0-24.9 25.0-26.9 27.0-29.9	1.22 (1.03-1.45) 1.00 0.95 (0.80-1.13) 1.01 (0.85-1.20)	Age, smoking status, blood pressure

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Cao B et al, 2015, USA	US Health and Retirement Study	1992/1998 – NA, NA	8678 men and women, age ≥50 years: NA	Self-reported	No	No	BMI, never smokers	<18.5 18.5-<25.0 25.0-<30.0 30.0-<35.0 ≥35.0	1.85 (1.08-3.03) 1.00 0.88 (0.76-1.02) 1.01 (0.89-1.15) 1.89 (1.54-2.34)	Age, sex, race/ethnicity, education, household income, physical activity, previous chronic diseases (diabetes, cancer, lung disease, heart problem, stroke), self-reported health
							BMI, ever smokers	<18.5 18.5-<25.0 25.0-<30.0 30.0-<35.0 ≥35.0	4.23 (2.02-8.55) 1.00 0.96 (0.76-1.21) 1.09 (0.89-1.34) 1.74 (1.29-2.35)	

ADL; activity of daily living, BMI; body mass index, CAD; coronary artery disease, CHD; coronary heart disease, CVD; cardiovascular disease, COPD; chronic obstructive pulmonary disease, CRP; C-reactive protein, DM; diabetes mellitus, ECG; electrocardiography, eGFR; estimated glomerular filtration rate, E%; energy percentage, FEV1; forced expiratory volume in 1 second, FH; family history, HDL; high-density lipoprotein, HRT; hormone replacement therapy, IADL; instrumental activities of daily living, IHD; ischemic heart disease, IL-6; interleukin-6, kg; kilogram, LDL; low-density lipoprotein, MET; metabolic equivalent tasks, MI; myocardial infarction, MMSE; mini-mental state examination, NA: not available, OC use; oral contraceptive use, PAD; peripheral artery disease, PH; parental history, SBP; systolic blood pressure, SES; socio-economic status, SFA; saturated fatty acids, TG; triglycerides, TNF-alpha; tumor necrosis factor alpha, WHI; Women’s Health Initiative, WHR; waist-to-hip ratio

Supplementary Table 3: Subgroup analyses of BMI and total mortality in never smokers, per 5 units increase in BMI

	BMI					
	<i>n</i>	RR (95% CI)	<i>I</i> ² (%)	<i>P</i> _h ¹	<i>P</i> _h ²	
All studies	44	1.18 (1.15 to 1.21)	95.5	<0.0001		
Sex						
Men	30	1.21 (1.16 to 1.27)	92.7	<0.0001	0.12/ 0.40	
Women	28	1.17 (1.14 to 1.21)	94.9	<0.0001		
Men and women	7	1.11 (1.03 to 1.20)	91.9	<0.0001		
Assessment of weight/height						
Measured	23	1.14 (1.07 to 1.20)	95.5	<0.0001	0.14	
Self-reported	20	1.22 (1.19 to 1.25)	91.4	<0.0001		
Measured and self-reported	1	1.32 (1.07 to 1.62)	NC	NC		
Unclear	0					
Duration of follow-up						
<5 years follow-up	1	1.21 (1.14 to 1.28)	NC	NC	0.02	
5-<10	11	1.11 (0.94 to 1.30)	96.6	<0.0001		
10-<15	18	1.18 (1.14 to 1.22)	94.7	<0.0001		
15-<20	4	1.24 (1.09 to 1.40)	86.6	<0.0001		
20-<25	2	1.30 (1.19 to 1.42)	92.8	<0.0001		
≥25	7	1.25 (1.20 to 1.30)	61.5	0.02		
Geographic location						
Europe	11	1.18 (1.11 to 1.25)	81.9	<0.0001	0.90	
North-America	20	1.21 (1.17 to 1.24)	92.3	<0.0001		
Australia	2	1.19 (1.11 to 1.27)	18.0	0.27		
Asia	11	1.17 (1.05 to 1.29)	96.8	<0.0001		
Number of deaths						
<500	11	1.14 (1.01 to 1.28)	77.7	<0.0001	0.70	
500-<1000	5	1.24 (1.13 to 1.36)	58.1	0.05		
1000-<5000	15	1.19 (1.08 to 1.31)	97.2	<0.0001		
5000-<10000	3	1.22 (1.13 to 1.33)	94.6	<0.0001		
≥10000	6	1.18 (1.13 to 1.22)	98.2	<0.0001		
Study quality						
0-3	0				0.73	
4-6	13	1.20 (1.14 to 1.26)	86.9	<0.0001		
7-9	31	1.17 (1.13 to 1.21)	96.3	<0.0001		
Adjustment for confounders						
Age	Yes	43	1.18 (1.15 to 1.21)	94.6	<0.0001	0.65
	No	1	1.11 (1.10 to 1.13)			
Education	Yes	16	1.16 (1.10 to 1.23)	97.1	<0.0001	0.62
	No	28	1.19 (1.15 to 1.23)	93.2	<0.0001	
Alcohol	Yes	22	1.17 (1.14 to 1.21)	91.0	<0.0001	0.70
	No	21	1.19 (1.13 to 1.25)	96.8	<0.0001	
Physical activity	Yes	16	1.21 (1.17 to 1.25)	88.3	<0.0001	0.30
	No	28	1.16 (1.11 to 1.21)	96.4	<0.0001	
Height	Yes	2	1.26 (1.22 to 1.31)	49.5	0.16	0.46
	No	42	1.17 (1.14 to 1.21)	95.4	<0.0001	
Waist circumference or waist-to-hip ratio	Yes	0				NC
	No	44	1.18 (1.15 to 1.21)	95.5	<0.0001	
Dietary pattern	Yes	3	1.17 (1.13 to 1.22)	0	0.84	0.93
	No	41	1.18 (1.15 to 1.21)	95.6	<0.0001	
Fat intake	Yes	3	1.19 (1.11 to 1.28)	87.4	<0.0001	0.66
	No	41	1.18 (1.14 to 1.22)	95.5	<0.0001	
Fruit, vegetables	Yes	2	1.29 (1.08 to 1.52)	72.4	0.06	0.39
	No	42	1.18 (1.14 to 1.22)	95.4	<0.0001	

Adjustment for potential intermediates							
Diabetes	Yes	2	0.99 (0.76 to 1.29)	89.6	0.002	0.10	
	No	42	1.19 (1.15 to 1.22)	95.4	<0.0001		
Hypertension	Yes	2	0.99 (0.76 to 1.29)	89.6	0.002	0.10	
	No	42	1.19 (1.15 to 1.22)	95.4	<0.0001		
Cholesterol	Yes	1	0.85 (0.72 to 1.01)	NC	NC	0.04	
	No	43	1.18 (1.15 to 1.22)	95.3	<0.0001		
Studies with adjustment for age, smoking, alcohol, and physical activity and without adjustment for prevalent disease or intermediate factors							
Adjustment for main confounders, but not for intermediates	Yes	9	1.23 (1.16 to 1.31)	90.2	<0.0001	0.35	
	No	35	1.16 (1.13 to 1.20)	95.7	<0.0001		
Studies with adjustment for main confounders, but not intermediates, stratified by duration of follow-up	<10 years	Yes	3	1.29 (1.20 to 1.38)	30.3	0.24	0.10
		No	9	1.05 (0.89 to 1.23)	95.5	<0.0001	
	10-15	Yes	5	1.17 (1.08 to 1.27)	91.5	<0.0001	0.93
		No	13	1.18 (1.13 to 1.23)	95.5	<0.0001	
	≥15	Yes	1	1.36 (1.13 to 1.41)	NC	NC	0.22
		No	12	1.24 (1.19 to 1.28)	87.6	<0.0001	

n does not always add up to the total because of missing information in some studies

Supplementary Table 4: Body mass index and mortality, all participants and never smokers, stratified by sex, nonlinear dose-response

	Never smokers, all studies	Never smokers, men	Never smokers, women	Never smokers, men and women	All participants, all studies	All participants, men	All participants, women	All participants, men and women
N	44	29	28	7	198	103	92	74
BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
15	2.01 (1.80 to 2.24)	2.65 (2.28 to 3.08)	1.72 (1.49 to 1.98)	(16.75)	2.24 (2.15 to 2.34)	2.50 (2.34 to 2.67)	2.05 (1.89 to 2.22)	(16.75)
16	1.66 (1.51 to 1.83)	2.05 (1.80 to 2.33)	1.48 (1.31 to 1.67)	1.40 (1.21 to 1.62)	1.83 (1.77 to 1.91)	1.98 (1.87 to 2.10)	1.71 (1.60 to 1.84)	1.59 (1.54 to 1.65)
17.5	1.35 (1.25 to 1.45)	1.54 (1.39 to 1.70)	1.25 (1.13 to 1.37)	1.30 (1.15 to 1.47)	1.47 (1.43 to 1.51)	1.54 (1.47 to 1.61)	1.41 (1.33 to 1.49)	1.45 (1.41 to 1.50)
18	1.10 (1.05 to 1.14)	1.15 (1.09 to 1.21)	1.06 (1.01 to 1.12)	1.09 (1.03 to 1.16)	1.15 (1.13 to 1.17)	1.17 (1.14 to 1.20)	1.13 (1.10 to 1.17)	1.16 (1.14 to 1.18)
19	1.01 (1.00 to 1.03)	1.02 (1.01 to 1.04)	1.01 (0.99 to 1.02)	1.02 (1.00 to 1.04)	1.03 (1.02 to 1.04)	1.03 (1.02 to 1.04)	1.03 (1.02 to 1.04)	1.04 (1.03 to 1.04)
20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	1.00 (0.98 to 1.01)	0.99 (0.97 to 1.01)	1.00 (0.99 to 1.02)	0.99 (0.97 to 1.01)	0.98 (0.97 to 0.99)	0.98 (0.97 to 0.99)	0.98 (0.97 to 0.99)	0.97 (0.96 to 0.98)
22	1.01 (0.98 to 1.03)	1.00 (0.96 to 1.03)	1.02 (0.98 to 1.05)	0.99 (0.96 to 1.03)	0.97 (0.96 to 0.98)	0.97 (0.96 to 0.99)	0.97 (0.95 to 0.99)	0.96 (0.95 to 0.97)
25	1.07 (1.01 to 1.14)	1.07 (0.99 to 1.16)	1.09 (1.01 to 1.18)	1.03 (0.95 to 1.12)	0.98 (0.96 to 1.01)	1.00 (0.96 to 1.03)	0.99 (0.94 to 1.03)	0.96 (0.93 to 0.98)
27	1.20 (1.09 to 1.32)	1.23 (1.08 to 1.39)	1.21 (1.07 to 1.37)	1.12 (0.98 to 1.27)	1.04 (1.00 to 1.08)	1.08 (1.02 to 1.14)	1.04 (0.97 to 1.12)	1.00 (0.97 to 1.04)
28	1.39 (1.22 to 1.58)	1.48 (1.24 to 1.75)	1.39 (1.18 to 1.64)	1.25 (1.05 to 1.49)	1.14 (1.09 to 1.20)	1.21 (1.12 to 1.31)	1.13 (1.03 to 1.25)	1.09 (1.04 to 1.15)
30	1.65 (1.40 to 1.94)	1.85 (1.49 to 2.30)	1.63 (1.32 to 2.01)	1.44 (1.15 to 1.80)	1.29 (1.21 to 1.37)	1.41 (1.28 to 1.55)	1.26 (1.12 to 1.42)	1.24 (1.16 to 1.31)
32.5	2.02 (1.66 to 2.46)	2.39 (1.84 to 3.11)	1.96 (1.52 to 2.53)	1.69 (1.29 to 2.22)	1.49 (1.37 to 1.61)	1.68 (1.49 to 1.89)	1.44 (1.24 to 1.66)	1.44 (1.34 to 1.55)
33	2.50 (1.98 to 3.15)	3.16 (2.32 to 4.30)	2.38 (1.77 to 3.21)	2.03 (1.47 to 2.80)	1.74 (1.59 to 1.91)	2.03 (1.77 to 2.34)	1.66 (1.40 to 1.97)	1.72 (1.58 to 1.88)
35	3.16 (2.42 to 4.12)	4.26 (2.99 to 6.07)	2.93 (2.09 to 4.12)	2.47 (1.70 to 3.59)	2.07 (1.86 to 2.30)	2.52 (2.15 to 2.95)	1.94 (1.59 to 2.35)	2.10 (1.90 to 2.32)
36	4.02 (2.98 to 5.43)	5.84 (3.92 to 8.71)	3.66 (2.49 to 5.39)	3.05 (1.99 to 4.68)	2.49 (2.22 to 2.81)	3.16 (2.64 to 3.78)	2.29 (1.84 to 2.85)	2.62 (2.34 to 2.93)

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Supplementary Table 5: Body mass index and mortality in never smokers, stratified by duration of follow-up, nonlinear dose-response

7	All	<10 years	10-<15 years	15-<20 years	20-<25 years	≥25 years	≥20 years
8N	44	9	15	4	2	8	10
9BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
10							
115	2.01 (1.80 to 2.24)	1.63 (1.32 to 2.01)					
12							
136	1.66 (1.51 to 1.83)	1.43 (1.21 to 1.70)	1.92 (1.68 to 2.19) (16.3)	1.73 (1.29 to 2.31) (16.7)	1.22 (0.77 to 1.95)	1.10 (0.99 to 1.23) (16.75)	1.16 (1.04 to 1.30)
147.5	1.35 (1.25 to 1.45)	1.24 (1.10 to 1.41)	1.54 (1.38 to 1.71)	1.44 (1.16 to 1.81)	1.09 (0.76 to 1.58)	1.06 (0.96 to 1.16)	1.06 (0.97 to 1.16)
15							
160	1.10 (1.05 to 1.14)	1.07 (1.00 to 1.14)	1.15 (1.09 to 1.22)	1.04 (0.97 to 1.11)	1.00 (0.82 to 1.21)	0.99 (0.94 to 1.04)	0.99 (0.94 to 1.03)
17							
172	1.01 (1.00 to 1.03)	1.01 (0.99 to 1.03)	1.03 (1.01 to 1.05)	0.99 (0.97 to 1.00)	0.99 (0.93 to 1.05)	0.99 (0.97 to 1.00)	0.99 (0.97 to 1.00)
18							
188	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20							
204	1.00 (0.98 to 1.01)	1.00 (0.98 to 1.02)	0.99 (0.97 to 1.01)	1.03 (1.02 to 1.04)	1.02 (0.96 to 1.10)	1.02 (1.01 to 1.04)	1.02 (1.01 to 1.04)
21							
225	1.01 (0.98 to 1.03)	1.01 (0.97 to 1.05)	0.99 (0.95 to 1.03)	1.08 (1.07 to 1.09)	1.06 (0.92 to 1.21)	1.06 (1.02 to 1.09)	1.06 (1.02 to 1.09)
23							
247.5	1.07 (1.01 to 1.14)	1.06 (0.98 to 1.15)	1.04 (0.96 to 1.14)	1.26 (1.25 to 1.27)	1.17 (0.87 to 1.58)	1.17 (1.08 to 1.26)	1.17 (1.09 to 1.26)
25							
250	1.20 (1.09 to 1.32)	1.16 (1.02 to 1.32)	1.17 (1.02 to 1.34)	1.51 (1.50 to 1.52)	1.35 (0.86 to 2.13)	1.33 (1.18 to 1.50)	1.33 (1.19 to 1.49)
26							
272.5	1.39 (1.22 to 1.58)	1.31 (1.10 to 1.56)	1.37 (1.14 to 1.64)	1.84 (1.80 to 1.88)	1.60 (0.86 to 2.96)	1.55 (1.32 to 1.83)	1.55 (1.34 to 1.81)
28							
285	1.65 (1.40 to 1.94)	1.52 (1.21 to 1.91)	1.66 (1.32 to 2.09)	2.23 (2.16 to 2.32)	1.93 (0.89 to 4.20)	1.85 (1.51 to 2.26)	1.85 (1.53 to 2.23)
29							
307.5	2.02 (1.66 to 2.46)	1.80 (1.36 to 2.38)	2.07 (1.57 to 2.74)	2.71 (2.59 to 2.82)	2.37 (0.92 to 6.06)	2.23 (1.74 to 2.84)	2.23 (1.77 to 2.80)
31							
310	2.50 (1.98 to 3.15)	2.17 (1.56 to 3.03)	2.66 (1.92 to 3.68)	3.26 (3.12 to 3.41)	2.96 (0.98 to 8.94)	2.71 (2.03 to 3.62)	2.73 (2.08 to 3.57)
33							
332.5	3.16 (2.42 to 4.12)	2.66 (1.80 to 3.93)	3.45 (2.38 to 5.01)	3.89 (3.74 to 4.04)	3.72 (1.05 to 13.12)	3.34 (2.40 to 4.64)	3.36 (2.47 to 4.58)
34							
355	4.02 (2.98 to 5.43)	3.30 (2.10 to 5.18)	4.58 (3.01 to 6.99)	4.60 (4.48 to 4.73)	4.73 (1.13 to 19.77)	4.16 (2.86 to 6.05)	4.18 (2.95 to 5.92)
36							

Because there was only one study with a duration <5 years the categories <5 and 5-<10 years were collapsed and the same was done for the categories of 20-<25 and ≥25 years of follow-up. N=number of risk estimates (doesn't add up to the total because some studies were excluded because the model did not converge, and one because the duration of follow-up was not reported).

Supplementary Table 6: Subgroup analyses of BMI and total mortality in all participants, per 5 units increase in BMI

		BMI				
		<i>n</i>	RR (95% CI)	<i>I</i> ² (%)	<i>P</i> _h ¹	<i>P</i> _h ²
All studies		198	1.05 (1.04 to 1.07)	97.1	<0.0001	
Sex						
Men		101	1.07 (1.05 to 1.09)	93.0	<0.0001	0.01/0.47
Women		91	1.09 (1.08 to 1.11)	92.2	<0.0001	
Men and women		76	1.00 (0.97 to 1.03)	96.1	<0.0001	
Assessment of weight/height						
Measured		115	1.05 (1.03 to 1.07)	96.4	<0.0001	0.09
Self-reported		60	1.08 (1.06 to 1.10)	94.0	<0.0001	
Measured and self-reported		4	1.07 (0.97 to 1.17)	93.2	<0.0001	
Unclear		19	0.97 (0.90 to 1.05)	95.3	<0.0001	
Duration of follow-up						
<5 years follow-up		15	0.90 (0.83 to 0.97)	90.1	<0.0001	<0.0001
5-<10		53	1.00 (0.96 to 1.04)	97.2	<0.0001	
10-<15		66	1.07 (1.05 to 1.08)	91.8	<0.0001	
15-<20		27	1.09 (1.05 to 1.13)	87.9	<0.0001	
20-<25		15	1.12 (1.08 to 1.17)	91.7	<0.0001	
≥25		22	1.15 (1.11 to 1.19)	90.0	<0.0001	
Geographic location						
Europe		69	1.07 (1.04 to 1.09)	97.2	<0.0001	0.04
North America		67	1.07 (1.05 to 1.10)	98.1	<0.0001	
South America		3	0.92 (0.88 to 0.97)	0	0.55	
Australia		9	0.99 (0.91 to 1.07)	74.9	<0.0001	
Asia		49	1.01 (0.97 to 1.05)	92.6	<0.0001	
Pacific		1	0.88 (0.79 to 1.00)			
Number of cases						
<500		41	0.95 (0.90 to 1.01)	74.3	<0.0001	<0.0001
500-<1000		39	1.04 (1.00 to 1.09)	84.3	<0.0001	
1000-<5000		74	1.05 (1.03 to 1.08)	92.6	<0.0001	
5000-<10000		16	1.08 (1.04 to 1.12)	94.1	<0.0001	
10000-<20000		15	1.13 (1.08 to 1.18)	97.1	<0.0001	
≥20000		10	1.11 (1.06 to 1.17)	99.8	<0.0001	
Study quality						
0-3		0				0.03
4-6		66	1.02 (0.99 to 1.04)	97.7	<0.0001	
7-9		132	1.07 (1.06 to 1.09)	94.1	<0.0001	
Adjustment for confounders						
Age	Yes	186	1.06 (1.04 to 1.07)	96.2	<0.0001	0.17
	No	12	0.98 (0.88 to 1.09)	95.1	<0.0001	
Education	Yes	74	1.05 (1.03 to 1.06)	94.7	<0.0001	0.51
	No	124	1.06 (1.04 to 1.08)	97.6	<0.0001	
Socio-economic status	Yes	14	1.05 (0.95 to 1.16)	96.4	<0.0001	0.99
	No	184	1.06 (1.04 to 1.07)	96.2	<0.0001	
Alcohol	Yes	78	1.05 (1.03 to 1.07)	94.7	<0.0001	0.95
	No	120	1.05 (1.03 to 1.07)	97.7	<0.0001	
Smoking status	Yes	150	1.06 (1.05 to 1.08)	93.5	<0.0001	0.40
	No	47	1.03 (1.00 to 1.06)	98.9	<0.0001	
Cigarettes per day	Yes	30	1.16 (1.13 to 1.19)	91.9	<0.0001	<0.0001
	No	168	1.03 (1.02 to 1.05)	97.2	<0.0001	
Pack-years	Yes	17	1.07 (1.04 to 1.11)	95.4	<0.0001	0.78
	No	181	1.05 (1.04 to 1.07)	97.2	<0.0001	
Years since quitting	Yes	4	1.17 (1.15 to 1.18)	77.4	0.004	0.15

	No	194	1.05 (1.03 to 1.06)	96.9	<0.0001		
Physical activity	Yes	63	1.06 (1.04 to 1.08)	93.5	<0.0001	0.82	
	No	135	1.05 (1.03 to 1.07)	97.6	<0.0001		
Height	Yes	5	1.10 (0.99 to 1.22)	97.8	<0.0001	0.48	
	No	193	1.05 (1.04 to 1.07)	96.6	<0.0001		
Waist circumference or waist-to-hip ratio	Yes	2	0.87 (0.83 to 0.91)	0	0.82	0.10	
	No	196	1.05 (1.04 to 1.07)	97.1	<0.0001		
Dietary pattern	Yes	4	1.12 (1.07 to 1.16)	48.1	0.12	0.38	
	No	194	1.05 (1.04 to 1.07)	97.2	<0.0001		
Fat intake	Yes	3	1.12 (1.06 to 1.18)	86.6	0.001	0.69	
	No	195	1.05 (1.04 to 1.07)	97.0	<0.0001		
Fruit, vegetables	Yes	4	1.10 (0.95 to 1.28)	96.4	<0.0001	0.49	
	No	194	1.05 (1.04 to 1.07)	97.0	<0.0001		
Adjustment for potential intermediates							
Diabetes	Yes	27	0.97 (0.93 to 1.02)	85.5	<0.0001	0.006	
	No	171	1.06 (1.05 to 1.08)	97.4	<0.0001		
Systolic blood pressure	Yes	12	1.01 (0.95 to 1.07)	92.3	<0.0001	0.28	
	No	186	1.06 (1.04 to 1.07)	97.2	<0.0001		
Diastolic blood pressure	Yes	4	1.08 (0.99 to 1.17)	84.1	<0.0001	0.67	
	No	194	1.05 (1.04 to 1.07)	97.2	<0.0001		
Hypertension	Yes	20	1.01 (0.94 to 1.08)	95.6	<0.0001	0.23	
	No	178	1.06 (1.05 to 1.07)	96.2	<0.0001		
Triglycerides	Yes	3	1.12 (1.09 to 1.16)	0	0.87	0.49	
	No	195	1.05 (1.04 to 1.07)	97.2	<0.0001		
Serum cholesterol	Yes	14	1.04 (0.99 to 1.09)	82.8	<0.0001	0.61	
	No	184	1.05 (1.04 to 1.07)	97.3	<0.0001		
Adjustment for medical history							
Prevalent coronary heart disease	Yes	26	0.96 (0.90 to 1.02)	99.0	<0.0001	0.003	
	No	172	1.07 (1.05 to 1.08)	96.0	<0.0001		
Prevalent stroke	Yes	22	0.99 (0.92 to 1.06)	98.6	<0.0001	0.07	
	No	176	1.06 (1.05 to 1.08)	96.2	<0.0001		
Prevalent cancer	Yes	19	0.98 (0.91 to 1.04)	99.3	<0.0001	0.03	
	No	179	1.06 (1.05 to 1.08)	95.9	<0.0001		
Family history of coronary heart disease	Yes	3	1.16 (1.04 to 1.30)	83.9	0.001	0.26	
	No	195	1.05 (1.04 to 1.07)	97.1	<0.0001		
Studies with adjustment for age, smoking, alcohol, and physical activity and without adjustment for prevalent disease or intermediate factors							
Adjustment for main confounders, but not for intermediates	Yes	25	1.09 (1.04 to 1.14)	94.8	<0.0001	0.16	
	No	173	1.05 (1.03 to 1.06)	97.1	<0.0001		
Studies with adjustment for main confounders, but not intermediates, stratified by duration of follow-up	<5 years	Yes	2	0.83 (0.70 to 0.98)	92.5	<0.0001	0.40
		No	13	0.92 (0.84 to 1.00)	87.2	<0.0001	
	5-<10	Yes	5	1.16 (1.03 to 1.29)	81.7	<0.0001	0.19
		No	48	0.99 (0.95 to 1.02)	97.1	<0.0001	
	10-<15	Yes	12	1.11 (1.06 to 1.16)	87.4	<0.0001	0.08
		No	54	1.06 (1.03 to 1.08)	92.3	<0.0001	
	15-<20	Yes	3	1.03 (0.90 to 1.18)	88.0	<0.0001	0.34
		No	24	1.10 (1.06 to 1.14)	87.2	<0.0001	
	≥20	Yes	3	1.22 (1.11 to 1.35)	74.4	0.02	0.38
		No	33	1.13 (1.10 to 1.16)	90.4	<0.0001	

Supplementary Table 7: Body mass index and mortality in all participants, stratified by duration of follow-up, nonlinear dose-response

	All	<5 years	5-<10 years	10-<15 years	15-<20 years	20-<25 years	≥25 years
N	198	12	41	66	28	15	23
BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
15	2.24 (2.15 to 2.34)		2.20 (2.10 to 2.30) ^(15.5)	2.37 (2.54 to 2.21) ^(15.5)		1.87 (1.84 to 1.91) ^(15.5)	
16	1.83 (1.77 to 1.91)	2.18 (2.03 to 2.34) ^(16.2)	1.99 (1.91 to 2.08)	2.10 (1.97 to 2.24)	1.60 (1.41 to 1.82) ^(16.6)	1.69 (1.67 to 1.73)	1.49 (1.35 to 1.63)
17.5	1.47 (1.43 to 1.51)	1.72 (1.64 to 1.80)	1.57 (1.52 to 1.62)	1.60 (1.52 to 1.68)	1.44 (1.29 to 1.60)	1.35 (1.34 to 1.37)	1.28 (1.18 to 1.38)
18	1.15 (1.13 to 1.17)	1.25 (1.22 to 1.27)	1.19 (1.17 to 1.21)	1.18 (1.15 to 1.22)	1.15 (1.09 to 1.22)	1.09 (1.08 to 1.09)	1.08 (1.03 to 1.12)
19	1.03 (1.02 to 1.04)	1.06 (1.05 to 1.06)	1.04 (1.03 to 1.05)	1.04 (1.03 to 1.05)	1.03 (1.01 to 1.05)	1.01 (1.01 to 1.01)	1.01 (1.00 to 1.03)
20	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	0.98 (0.97 to 0.99)	0.96 (0.95 to 0.96)	0.97 (0.96 to 0.97)	0.97 (0.96 to 0.98)	0.98 (0.96 to 1.00)	1.00 (0.99 to 1.00)	1.00 (0.98 to 1.01)
22	0.97 (0.96 to 0.98)	0.93 (0.92 to 0.93)	0.95 (0.93 to 0.96)	0.96 (0.95 to 0.98)	0.97 (0.93 to 1.01)	1.01 (1.00 to 1.01)	1.01 (0.98 to 1.04)
23	0.98 (0.96 to 1.01)	0.89 (0.88 to 0.90)	0.93 (0.91 to 0.95)	0.98 (0.94 to 1.02)	1.00 (0.92 to 1.08)	1.08 (1.07 to 1.08)	1.06 (1.00 to 1.13)
24.5	1.04 (1.00 to 1.08)	0.90 (0.89 to 0.92)	0.96 (0.92 to 1.00)	1.06 (0.99 to 1.13)	1.08 (0.95 to 1.23)	1.19 (1.18 to 1.20)	1.17 (1.06 to 1.29)
25	1.14 (1.09 to 1.20)	0.96 (0.94 to 0.98)	1.01 (0.96 to 1.07)	1.19 (1.09 to 1.30)	1.25 (1.05 to 1.49)	1.35 (1.34 to 1.36)	1.32 (1.16 to 1.50)
26	1.29 (1.21 to 1.37)	1.06 (1.02 to 1.10)	1.11 (1.03 to 1.19)	1.39 (1.24 to 1.55)	1.50 (1.20 to 1.88)	1.55 (1.53 to 1.57)	1.53 (1.30 to 1.80)
27.5	1.49 (1.37 to 1.61)	1.21 (1.13 to 1.29)	1.24 (1.14 to 1.35)	1.65 (1.45 to 1.89)	1.89 (1.44 to 2.49)	1.81 (1.79 to 1.83)	1.81 (1.48 to 2.20)
28	1.74 (1.59 to 1.91)	1.44 (1.30 to 1.59)	1.40 (1.27 to 1.55)	2.02 (1.73 to 2.36)	2.47 (1.79 to 3.40)	2.13 (2.10 to 2.16)	2.16 (1.71 to 2.72)
29	2.07 (1.86 to 2.30)	1.76 (1.52 to 2.05)	1.62 (1.44 to 1.81)	2.52 (2.11 to 3.01)	3.35 (2.31 to 4.85)	2.51 (2.47 to 2.55)	2.62 (2.01 to 3.42)
30	2.49 (2.22 to 2.81)	2.25 (1.83 to 2.76)	1.88 (1.65 to 2.14)	3.18 (2.60 to 3.90)	4.67 (3.06 to 7.11)	2.96 (2.90 to 3.01)	3.21 (2.38 to 4.34)

The number of risk estimates does not add up to the total because some studies had to be excluded for the model to converge.

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Supplementary Table 8: Body mass index and mortality in never smokers, stratified by geographic location

	All	Europe	North America	Australia	Asia
N	44	6	20	2	11
BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
15	2.01 (1.80 to 2.24)	-	-	-	2.26 (1.86 to 2.74)
16	1.66 (1.51 to 1.83)	1.66 (1.39 to 1.98)	1.23 (1.13 to 1.34) ^(16.75)	-	1.88 (1.59 to 2.23)
17.5	1.35 (1.25 to 1.45)	1.35 (1.18 to 1.53)	1.16 (1.08 to 1.26)	-	1.51 (1.32 to 1.72)
20	1.10 (1.05 to 1.14)	1.09 (1.03 to 1.17)	1.03 (0.99 to 1.07)	-	1.16 (1.08 to 1.25)
22	1.01 (1.00 to 1.03)	1.01 (0.99 to 1.03)	1.00 (0.99 to 1.01)	1.05 (0.97 to 1.12)	1.03 (1.01 to 1.06)
23	1.00	1.00	1.00	1.00	1.00
24	1.00 (0.98 to 1.01)	1.00 (0.98 to 1.02)	1.01 (1.00 to 1.02)	0.96 (0.90 to 1.03)	0.98 (0.96 to 1.01)
25	1.01 (0.98 to 1.03)	1.01 (0.97 to 1.05)	1.03 (1.00 to 1.05)	0.94 (0.85 to 1.06)	0.99 (0.94 to 1.03)
27.5	1.07 (1.01 to 1.14)	1.08 (1.00 to 1.18)	1.10 (1.04 to 1.17)	0.95 (0.80 to 1.13)	1.06 (0.95 to 1.18)
30	1.20 (1.09 to 1.32)	1.22 (1.07 to 1.38)	1.22 (1.11 to 1.34)	1.07 (0.91 to 1.27)	1.24 (1.04 to 1.46)
32.5	1.39 (1.22 to 1.58)	1.42 (1.20 to 1.68)	1.39 (1.22 to 1.57)	1.36 (1.07 to 1.73)	1.57 (1.25 to 1.98)
35	1.65 (1.40 to 1.94)	1.71 (1.38 to 2.12)	1.61 (1.37 to 1.89)	1.99 (1.13 to 3.49)	2.16 (1.62 to 2.88)
37.5	2.02 (1.66 to 2.46)	2.11 (1.62 to 2.74)	1.90 (1.56 to 2.30)	3.41 (1.12 to 10.40)	3.18 (2.24 to 4.50)
40	2.50 (1.98 to 3.15)	2.63 (1.93 to 3.59)	2.27 (1.81 to 2.85)	-	4.99 (3.31 to 7.53)
42.5	3.16 (2.42 to 4.12)	3.36 (2.34 to 4.82)	2.73 (2.10 to 3.55)	-	-
45	4.02 (2.98 to 5.43)	4.34 (2.87 to 6.57)	3.33 (2.48 to 4.48)	-	-

The number of risk estimates does not add up to the total because some studies had to be excluded for the model to converge.

Supplementary Table 9: Body mass index and mortality, all participants and never smokers, stratified by study quality, nonlinear dose-response

	All participants, all studies	All participants, study quality=4-6	All participants, study quality=7-9	Never smokers, all studies	Never smokers, study quality=4-6	Never smokers, study quality=7-9
N	198	63	128	44	13	31
BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
15	2.24 (2.15-2.34)	2.10 (2.00-2.20) ^{15.5}	2.17 (2.05-2.29)	2.01 (1.80-2.24)		2.03 (1.77-2.33)
16	1.83 (1.77-1.91)	1.91 (1.82-1.99)	1.78 (1.70-1.87)	1.66 (1.51-1.83)	1.50 (1.30-1.73) ^{16.75}	1.68 (1.49-1.89)
17.5	1.47 (1.43-1.51)	1.53 (1.48-1.59)	1.44 (1.38-1.49)	1.35 (1.25-1.45)	1.36 (1.20-1.54)	1.36 (1.24-1.49)
20	1.15 (1.13-1.17)	1.19 (1.17-1.21)	1.14 (1.11-1.16)	1.10 (1.05-1.14)	1.09 (1.03-1.17)	1.10 (1.05-1.16)
22	1.03 (1.02-1.04)	1.04 (1.03-1.05)	1.03 (1.02-1.04)	1.01 (1.00-1.03)	1.01 (0.99-1.03)	1.02 (1.00-1.03)
23	1.00	1.00	1.00	1.00	1.00	1.00
24	0.98 (0.97-0.99)	0.96 (0.95-0.97)	0.98 (0.97-0.99)	1.00 (0.98-1.01)	1.00 (0.98-1.02)	1.00 (0.98-1.01)
25	0.97 (0.96-0.98)	0.94 (0.93-0.96)	0.98 (0.96-0.99)	1.01 (0.98-1.03)	1.01 (0.97-1.06)	1.00 (0.97-1.04)
27.5	0.98 (0.96-1.01)	0.93 (0.90-0.96)	1.00 (0.97-1.03)	1.07 (1.01-1.14)	1.09 (0.99-1.20)	1.06 (0.99-1.15)
30	1.04 (1.00-1.08)	0.96 (0.92-1.01)	1.07 (1.02-1.12)	1.20 (1.09-1.32)	1.24 (1.07-1.44)	1.18 (1.05-1.33)
32.5	1.14 (1.09-1.20)	1.03 (0.97-1.09)	1.19 (1.11-1.27)	1.39 (1.22-1.58)	1.46 (1.19-1.79)	1.36 (1.16-1.60)
35	1.29 (1.21-1.37)	1.14 (1.06-1.23)	1.35 (1.24-1.47)	1.65 (1.40-1.94)	1.78 (1.37-2.30)	1.61 (1.32-1.97)
37.5	1.49 (1.37-1.61)	1.29 (1.18-1.42)	1.57 (1.42-1.74)	2.02 (1.66-2.46)	2.21 (1.62-3.02)	1.95 (1.53-2.48)
40	1.74 (1.59-1.91)	1.50 (1.34-1.67)	1.86 (1.65-2.09)	2.50 (1.98-3.15)	2.82 (1.96-4.05)	2.41 (1.81-3.20)
42.5	2.07 (1.86-2.30)	1.77 (1.56-2.00)	2.23 (1.95-2.55)	3.16 (2.42-4.12)	3.63 (2.38-5.52)	3.02 (2.18-4.20)
45	2.49 (2.22-2.81)	2.13 (1.85-2.45)	2.71 (2.33-3.16)	4.02 (2.98-5.43)	4.78 (2.96-7.69)	3.83 (2.64-5.54)

The number of studies included does not always add up to the total because some studies had to be excluded for the nonlinear model to converge.

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Supplementary Table 10: Body mass index and mortality, never smokers, stratified by age, nonlinear dose-response

	Never smokers, all studies	Never smokers, age <65 years	Never smokers, age ≥65 years
N	44	13	6
BMI	RR (95% CI)	RR (95% CI)	RR (95% CI)
15	2.01 (1.80-2.24)		
16	1.66 (1.51-1.83)	2.00 (1.92-2.09) ^{16.25}	1.73 (1.44-2.08) ^{16.25}
17.5	1.35 (1.25-1.45)	1.54 (1.49-1.59)	1.46 (1.26-1.69)
20	1.10 (1.05-1.14)	1.13 (1.11-1.15)	1.16 (1.07-1.25)
22	1.01 (1.00-1.03)	1.02 (1.01-1.03)	1.04 (1.01-1.07)
23	1.00	1.00	1.00
24	1.00 (0.98-1.01)	1.00 (0.99-1.01)	0.97 (0.95-1.00)
25	1.01 (0.98-1.03)	1.02 (1.01-1.03)	0.96 (0.91-1.01)
27.5	1.07 (1.01-1.14)	1.12 (1.11-1.14)	0.95 (0.85-1.08)
30	1.20 (1.09-1.32)	1.32 (1.29-1.36)	0.99 (0.82-1.19)
32.5	1.39 (1.22-1.58)	1.63 (1.57-1.69)	1.05 (0.82-1.36)
35	1.65 (1.40-1.94)	2.08 (1.99-2.17)	1.15 (0.83-1.59)
37.5	2.02 (1.66-2.46)	2.71 (2.57-2.86)	1.28 (0.87-1.90)
40	2.50 (1.98-3.15)	3.60 (3.38-3.83)	1.45 (0.92-2.29)
42.5	3.16 (2.42-4.12)	4.83 (4.50-5.19)	1.66 (0.98-2.81)
45	4.02 (2.98-5.43)	6.56 (6.05-7.11)	1.92 (1.06-3.48)

Supplementary Table 11. Influence analysis of BMI and all-cause mortality among never smokers

Study omitted	Estimate	[95% Conf. Interval]	
Rissanen, 1989	1.1801792	1.1488022	1.2124132
Rissanen, 1991	1.1760972	1.1449667	1.2080739
Lee, 1993	1.1756554	1.1446522	1.2074983
Lindsted, 1997	1.1783594	1.1468321	1.2107533
Lindsted, 1998	1.1773396	1.1461253	1.2094041
Yuan, 1998	1.1771479	1.1461149	1.2090211
Singh, 1999	1.1728579	1.1418855	1.2046703
Allison, 1999, CPS1	1.1775452	1.1427189	1.2134328
Visscher, 2000	1.1786907	1.1473466	1.2108909
Visscher, 2001	1.1821303	1.1510041	1.2140983
Tsugane, 2002	1.177052	1.1459383	1.2090106
Miyazaki, 2002	1.1774776	1.1465021	1.2092899
Engeland, 2003	1.1765411	1.1448325	1.2091278
Hu, 2004	1.1730058	1.1421667	1.2046776
Adams, 2006	1.1753507	1.1438026	1.2077689
Freedman, 2006	1.1772259	1.1458265	1.2094859
Lawlor, 2006, Renfrew-Paisley	1.1764736	1.1449702	1.2088438
Lawlor, 2006, Collaborative	1.1766042	1.1454438	1.2086122
Jee, 2006	1.1802418	1.1485417	1.2128168
Gelber, 2007	1.1781315	1.1468171	1.2103009
Mazza, 2007	1.1840056	1.1528548	1.2159982
Flegal, 2007	1.1821638	1.1507456	1.2144399
Simpson, 2007	1.179721	1.1483896	1.2119073
Dolan, 2007	1.1807076	1.1493915	1.2128769
Pischon, 2008	1.1751304	1.1437678	1.2073529
Hozawa, 2008	1.176594	1.1456565	1.208367
Kivimaki, 2008	1.1744596	1.1432441	1.2065275
Pednekar, 2008	1.1941104	1.1681112	1.2206882
Zhang, 2008	1.1755044	1.1444472	1.2074046
Tsai, 2008	1.1749504	1.1437142	1.2070396
Moore, 2008	1.1766896	1.1451812	1.2090648
Sauvaget, 2008	1.1859139	1.1548196	1.2178454
Orpana, 2010	1.1822603	1.1509815	1.214389
Odegaard, 2010	1.1791822	1.1476296	1.2116023
Bessonova, 2011	1.1804385	1.1488141	1.2129333
Boggs, 2011	1.1784773	1.1469526	1.2108684
Hotchkiss, 2011	1.1826183	1.1513882	1.2146953
Park, 2012	1.174419	1.143186	1.2065055
Ma, 2013	1.180945	1.1492094	1.213557
Singh, 2013	1.1784825	1.1471149	1.210708
Joshya, 2014	1.1776602	1.146153	1.2100335
Patel, 2014	1.1790823	1.1415523	1.217846
Yi, 2015	1.180904	1.1490226	1.2136701
Cao, 2015	1.1800684	1.1484958	1.2125089
Combined	1.1785422	1.1475681	1.2103523

Supplementary Table 12. Influence analysis of BMI and total mortality among all participants

Study omitted	Estimate	[95% Conf. Interval]	
Multiple Risk Factor Intervention Trial, 1986	1.0518801	1.0373954	1.0665672
Johansen, 1987	1.0523934	1.0378823	1.0671073
Rissanen, 1989	1.0522426	1.0377041	1.0669849
Rissanen, 1991	1.0513349	1.0368488	1.0660235
Ho, 1991	1.0527363	1.0382656	1.0674088
Lee, 1993	1.051461	1.0369658	1.0661589
Kornitzer, 1993	1.052516	1.0380242	1.06721
Sorkin, 1994	1.0515583	1.0370653	1.0662539
Norrish, 1995	1.0518863	1.0374252	1.0665489
Hanson, 1995	1.0513637	1.0368962	1.066033
Seidell, 1996	1.0520784	1.0375745	1.0667849
Hodge, 1996	1.05308	1.0385827	1.0677797
Chyou, 1997	1.0507386	1.0362805	1.0653985
Maskarinec, 1998	1.0513431	1.0368328	1.0660565
Yuan, 1998	1.0522366	1.0377532	1.0669221
Seccareccia, 1998	1.0529143	1.0384259	1.0676048
Rosengren, 1999	1.0511266	1.0366404	1.0658152
Allison, 1999, CPS1	1.0510976	1.0366157	1.0657817
Allison, 1999, FHS	1.0506448	1.0361809	1.0653105
Allison, 1999, TCHS	1.0513002	1.0368181	1.0659845
Ostbye, 1999	1.0536469	1.0391736	1.0683218
Andersen, 2000	1.0517125	1.0371847	1.0664438
Baik, 2000	1.0511166	1.0366368	1.0657986
Folsom, 2000	1.0532054	1.0387195	1.0678933
Fortes, 2000	1.0527692	1.038288	1.0674524
Haapanen-Niemi, 2000	1.0522742	1.037787	1.0669638
Hara, 2000	1.0523965	1.0379308	1.0670638
Strawbridge, 2000	1.0529985	1.0384966	1.067703
Grabowski, 2001	1.0540669	1.039625	1.0687094
Katzmarzyk, 2001	1.0517206	1.037227	1.0664167
Niverthi, 2001	1.0516554	1.0371573	1.0663561
Dey, 2001	1.0516729	1.0371978	1.06635
Wannamethee, 2001	1.0522776	1.0377772	1.0669805
Osler, 2001	1.0519544	1.0374618	1.0666496
Barbagallo, 2001	1.0519493	1.0374916	1.0666084
Farrell, 2002	1.0523038	1.0378219	1.0669878
Stevens, 2002	1.0521407	1.0376415	1.0668424
Tsugane, 2002	1.0510149	1.0365474	1.0656843
Miyazaki, 2002	1.0518377	1.0373714	1.0665057
Miller, 2002	1.0522125	1.0377189	1.0669085
Wang, 2002	1.0526546	1.0381947	1.0673159
Somes, 2002	1.052128	1.0376563	1.0668015
Engeland, 2003	1.0508018	1.0356785	1.0661458
Lubin, 2003	1.0524812	1.0379992	1.0671651
Thorogood, 2003	1.0516467	1.0371612	1.0663345
Hosegood, 2003	1.0523453	1.0378808	1.0670114
Kuriyama, 2004	1.0520171	1.0375296	1.0667069
Stevens, 2004	1.0524694	1.03799	1.0671507
Sundquist, 2004	1.0526925	1.0381866	1.0674012

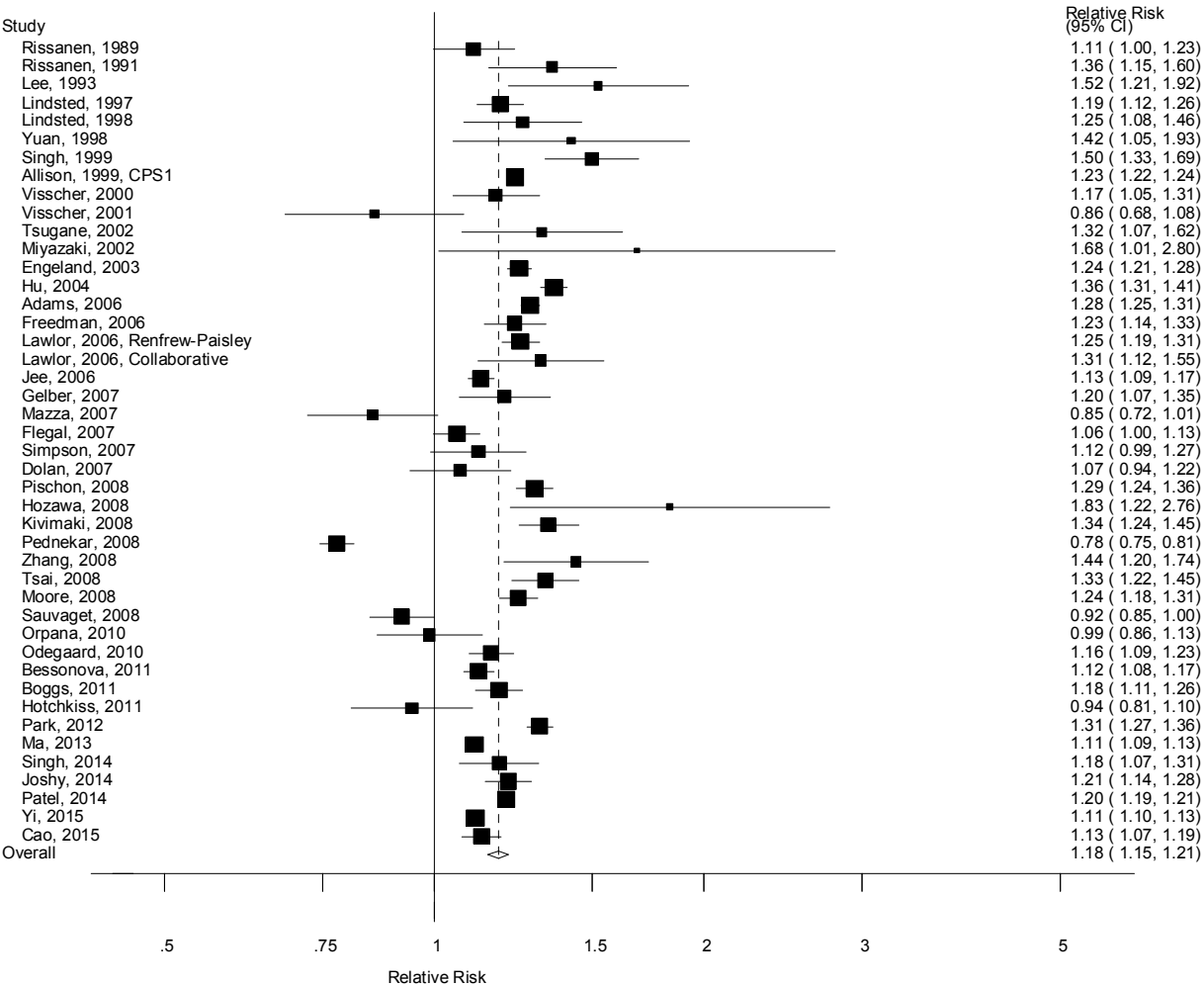
Maru, 2004		1.0511444	1.0366583	1.0658327
Hu, 2004		1.0509914	1.0365392	1.0656451
Hu, 2005		1.0522054	1.0376759	1.0669385
Nyholm, 2005		1.0529865	1.0385003	1.0676746
Pajak, 2005		1.051806	1.0373032	1.0665116
Iribarren, 2005		1.0529237	1.0384411	1.0676082
Jain, 2005		1.0516325	1.036911	1.0665629
Hayashi, 2005		1.0514543	1.0369974	1.0661128
Hjartåker, 2005		1.0513479	1.0368574	1.0660408
Chang-Claude, 2005		1.0524288	1.0379436	1.0671163
Gu, 2006		1.0512131	1.0367218	1.0659071
Adams, 2006		1.0512717	1.0366213	1.0661292
Tsai, 2006		1.0514542	1.03695	1.0661613
van Dam, 2006		1.0511907	1.0367008	1.065883
Jee, 2006		1.0518556	1.0373155	1.0665995
Lawlor, 2006, Renfrew/Paisley Study		1.0522847	1.0377535	1.0670195
Lawlor, 2006, Collaborative Study		1.0521495	1.0376351	1.0668671
Price, 2006		1.053936	1.0394962	1.0685763
Schooling, 2006		1.0543426	1.0398877	1.0689986
Baldinger, 2006		1.0514857	1.0369979	1.0661758
Ray, 2006		1.0523673	1.0378921	1.0670444
Freedman, 2006		1.0513655	1.0368627	1.066071
Tice, 2006		1.0536325	1.0391743	1.0682918
Corrada, 2006		1.0523286	1.03781	1.0670502
Gale, 2007		1.0522069	1.0377221	1.0668938
Smith, 2007		1.0527197	1.0382226	1.0674193
Janssen, 2007		1.0528154	1.0383105	1.0675229
Sai, 2007		1.0520865	1.0375975	1.0667776
Greenberg, 2007		1.0513816	1.03692	1.0660449
Al Snih, 2007		1.0530558	1.0385739	1.0677395
Flegal, 2007		1.0522	1.0376786	1.0669246
Mazza, 2007		1.0531702	1.0386821	1.0678605
Simpson, 2007		1.0520489	1.0375435	1.0667571
Locher, 2007		1.0525461	1.0380589	1.0672357
Fujino, 2007		1.0523944	1.0378755	1.0671164
Gelber, 2007		1.0514642	1.0369645	1.0661666
Dolan, 2007		1.0528574	1.0383554	1.0675619
Pischon, 2008		1.0511395	1.0366436	1.065838
Hozawa, 2008		1.0517567	1.0372831	1.0664325
Luchsinger, 2008		1.051949	1.037469	1.066631
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Pednekar, 2008		1.0530503	1.0385755	1.0677267
Matsuo, 2008		1.051748	1.0372375	1.0664614
Zhang, 2008		1.0511624	1.0366986	1.0658278
Tsai, 2008		1.0511882	1.0366976	1.0658815
Sauvaget, 2008		1.0531188	1.0386195	1.0678204
Ringback Weitoft, 2008		1.0518637	1.0373542	1.066576
Moore, 2008		1.0510457	1.036559	1.0657346
Kulminski, 2008		1.0528523	1.0383489	1.0675582
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Reuser, 2009		1.0516306	1.0371268	1.0663372
Ferrie, 2009		1.0521325	1.0376291	1.0668387
Guallar-Castillon, 2009		1.0529807	1.0384806	1.0676832
Walter, 2009		1.0526942	1.0381871	1.0674042

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2					
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7	Cesari, 2009		1.0524118	1.0379318	1.0670936
8	Neovius, 2009		1.050784	1.0363144	1.0654558
9	Orpana, 2010		1.0524367	1.0379335	1.0671427
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12	Arnlov, 2010		1.0513183	1.0368338	1.0660051
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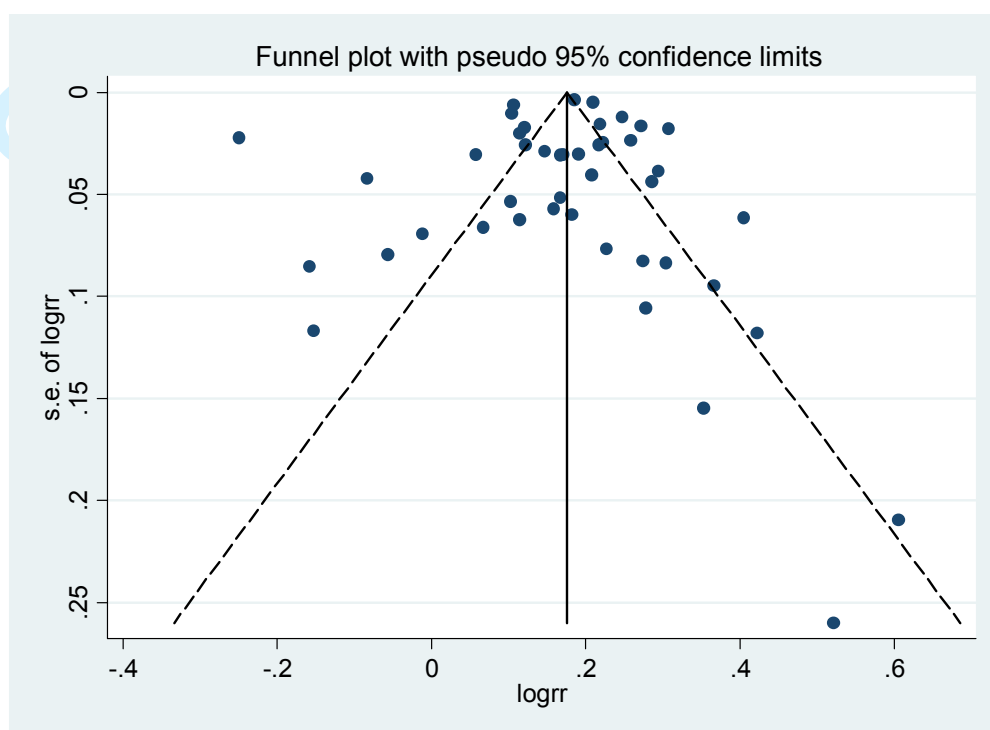
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Suemoto, 2015		1.0530163	1.038519	1.067716
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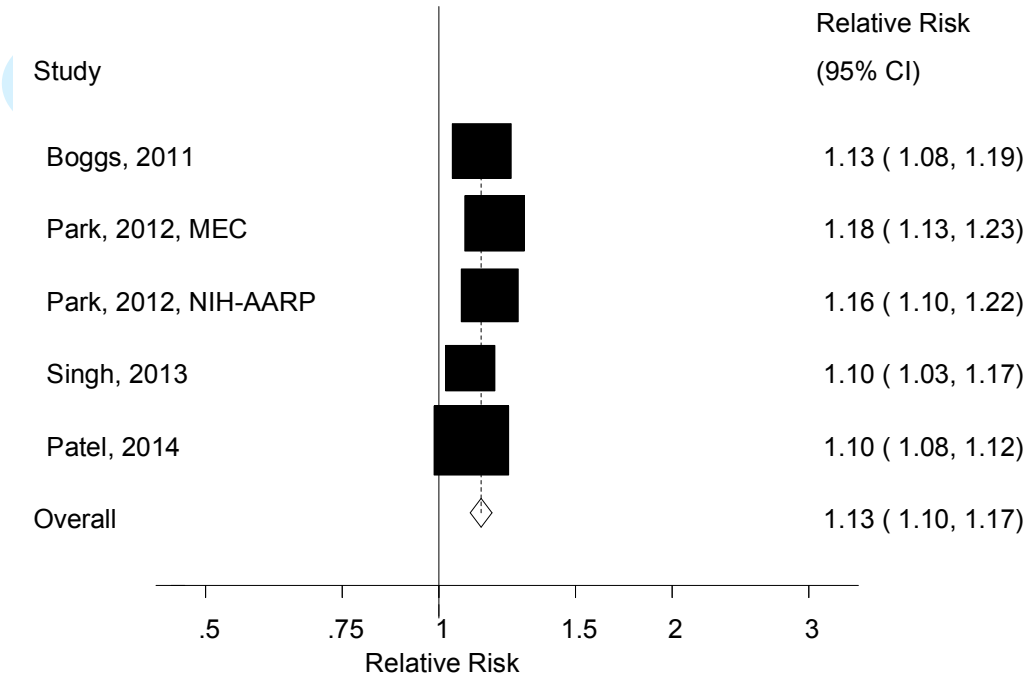
Supplementary Figure 1. BMI and total mortality, never smokers, linear dose-response analysis, per 5 units



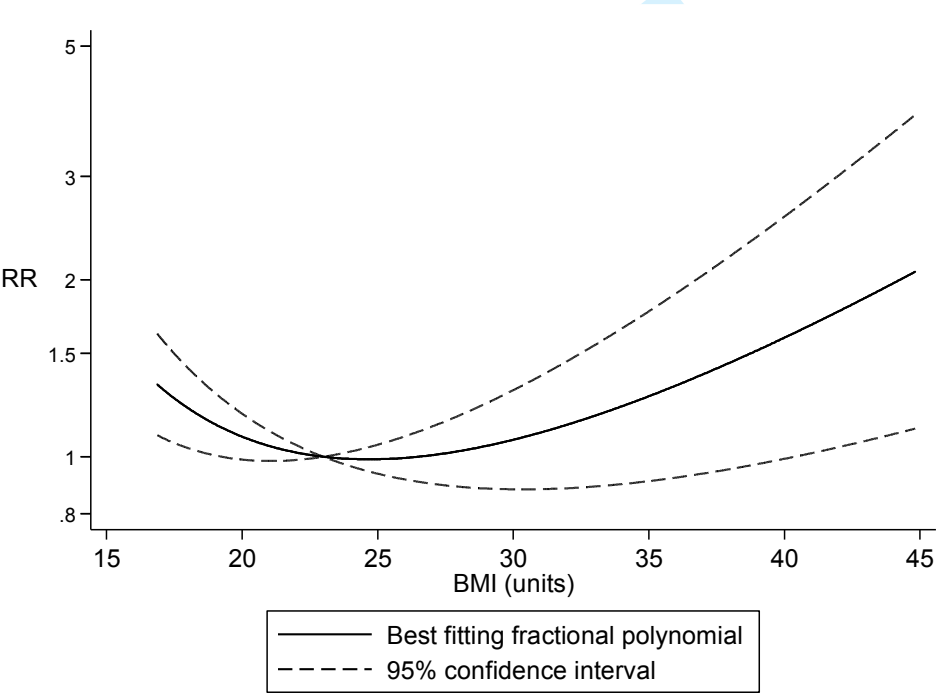
Supplementary Figure 2. Funnel plot of BMI and all-cause mortality (never smokers)



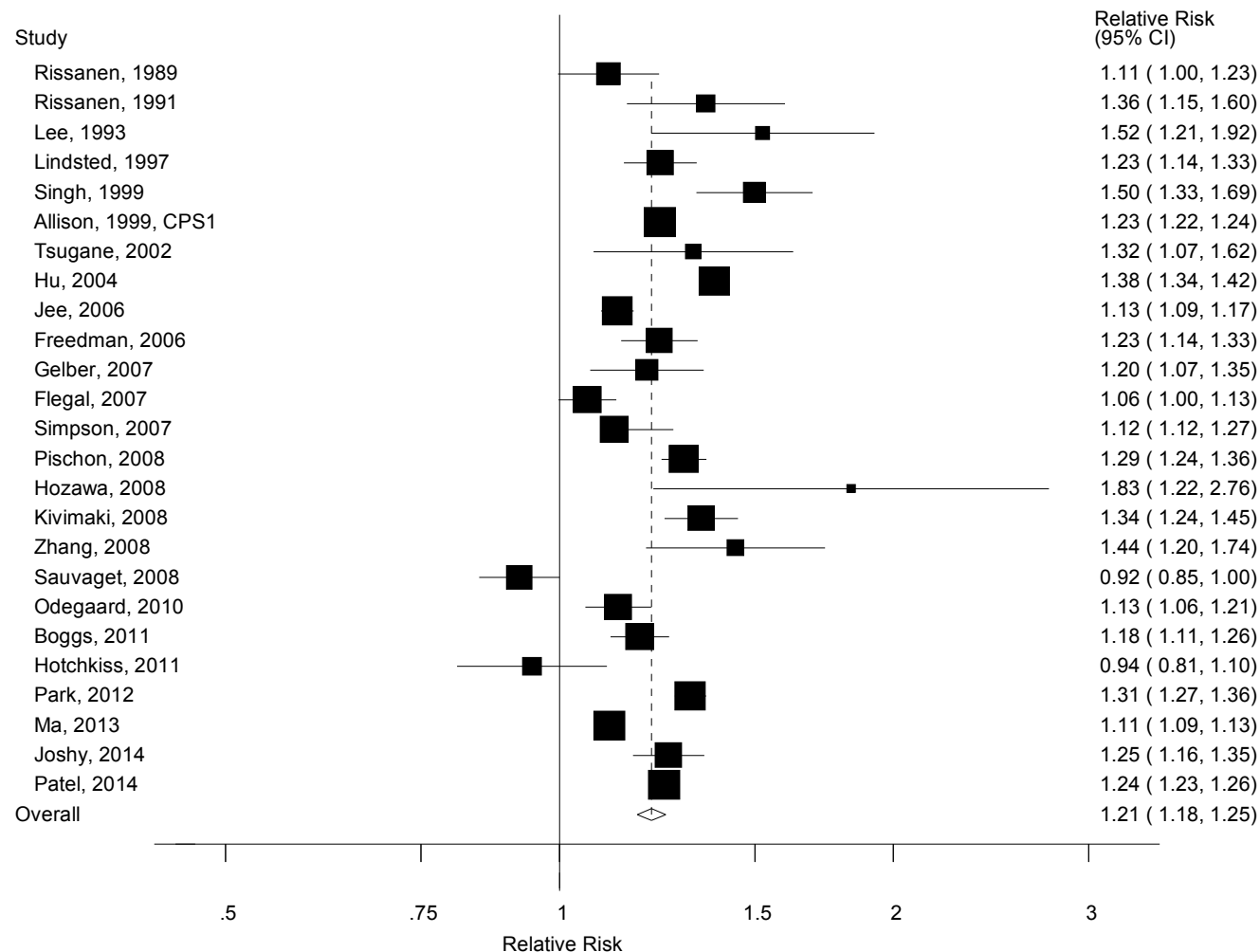
Supplementary Figure 3. BMI and total mortality, never smokers, African Americans, linear dose-response



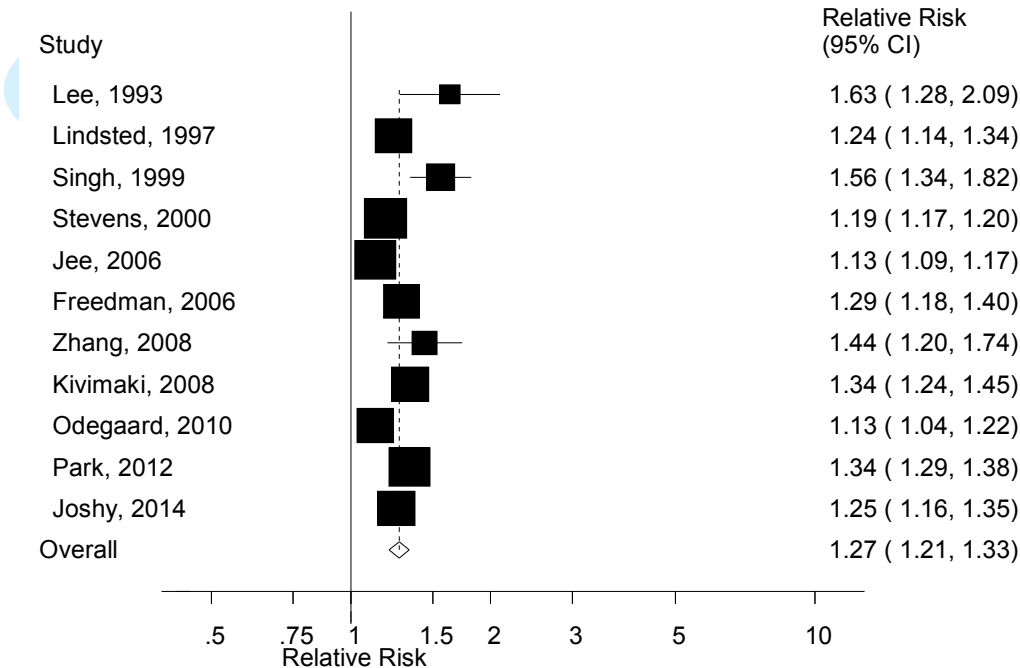
Supplementary Figure 4. BMI and total mortality, never smokers, African Americans, nonlinear dose-response



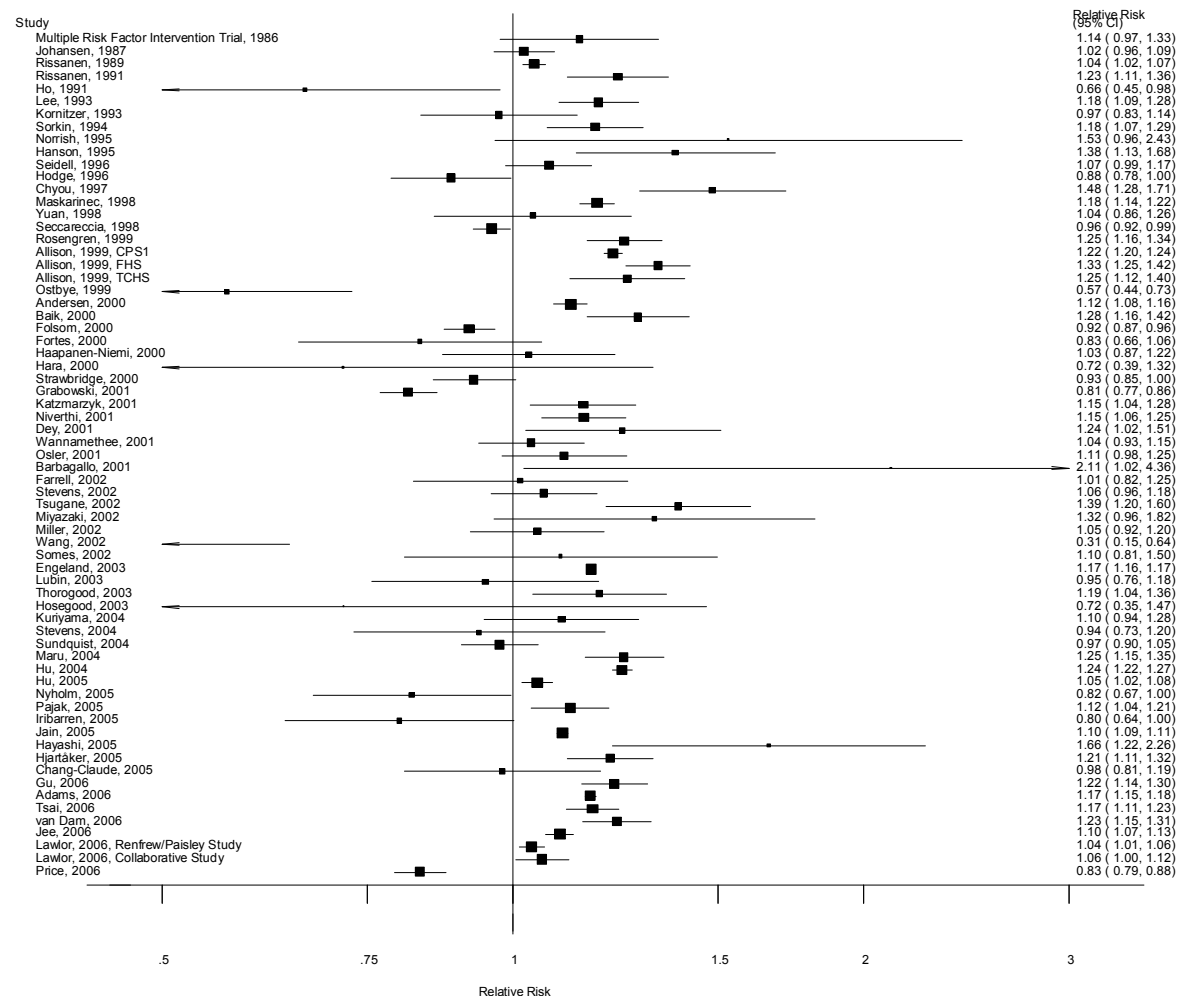
Supplementary Figure 5. BMI and total mortality, healthy never smokers, dose-response analysis, per 5 units



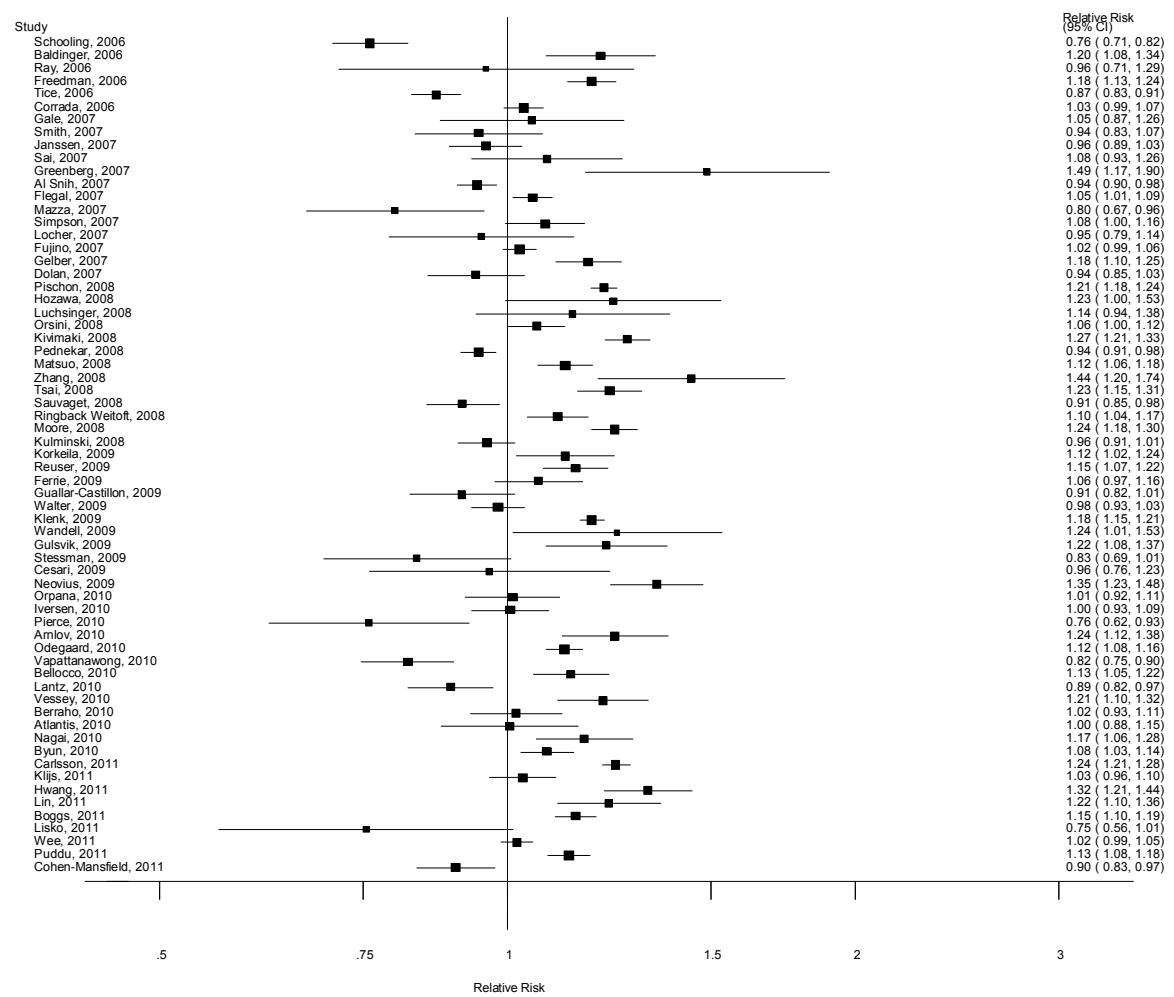
Supplementary Figure 6. BMI and total mortality, healthy never smokers, excluding early follow-up, dose-response analysis, per 5 units



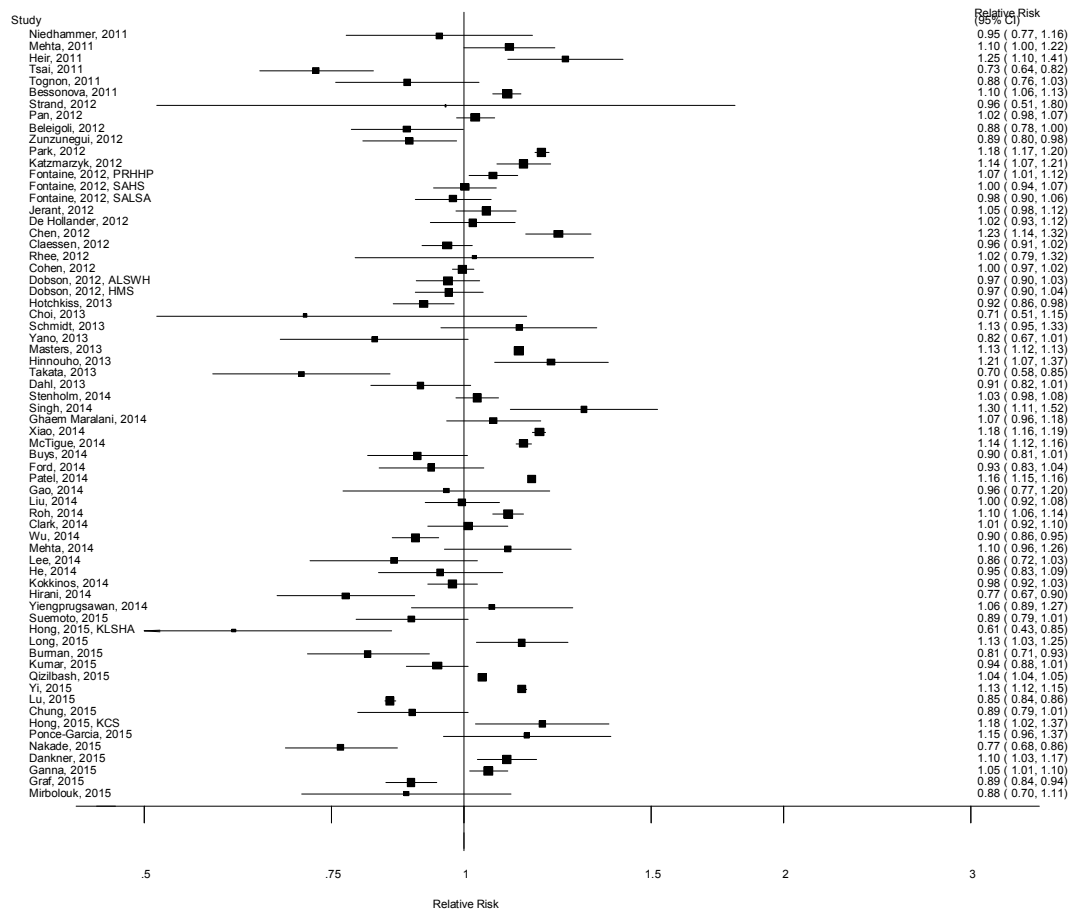
Supplementary Figure 7. BMI and total mortality, all participants, dose-response analysis, per 5 units*



Supplementary Figure 7. BMI and total mortality, all participants, dose-response analysis, per 5 units (continued)

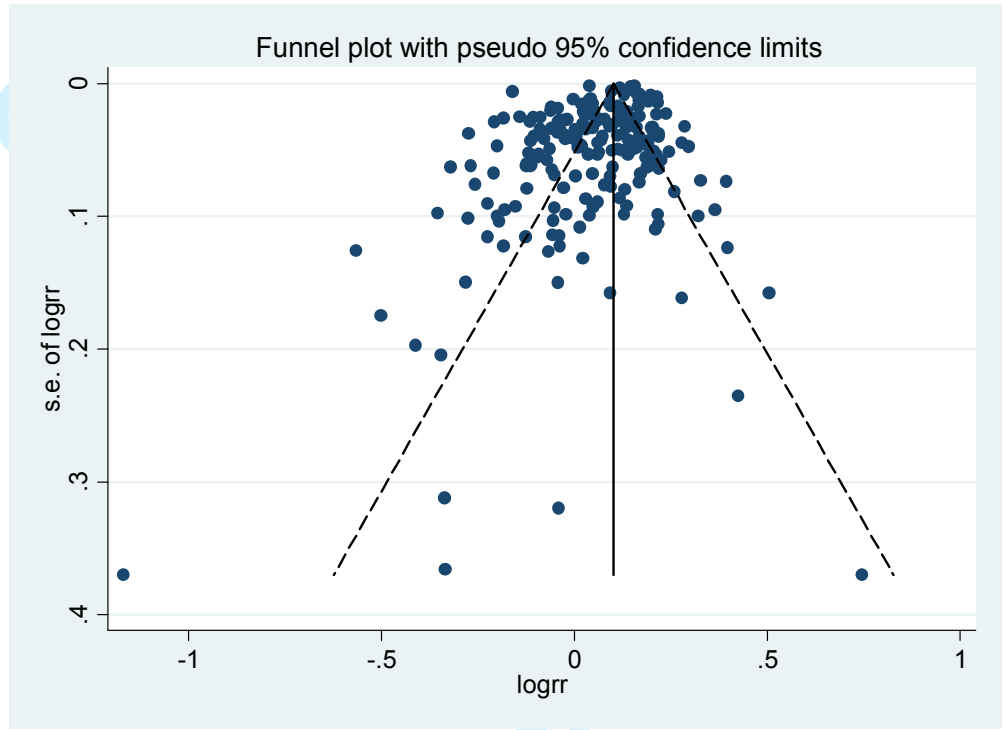


Supplementary Figure 7. BMI and total mortality, all participants, dose-response analysis, per 5 units (continued)

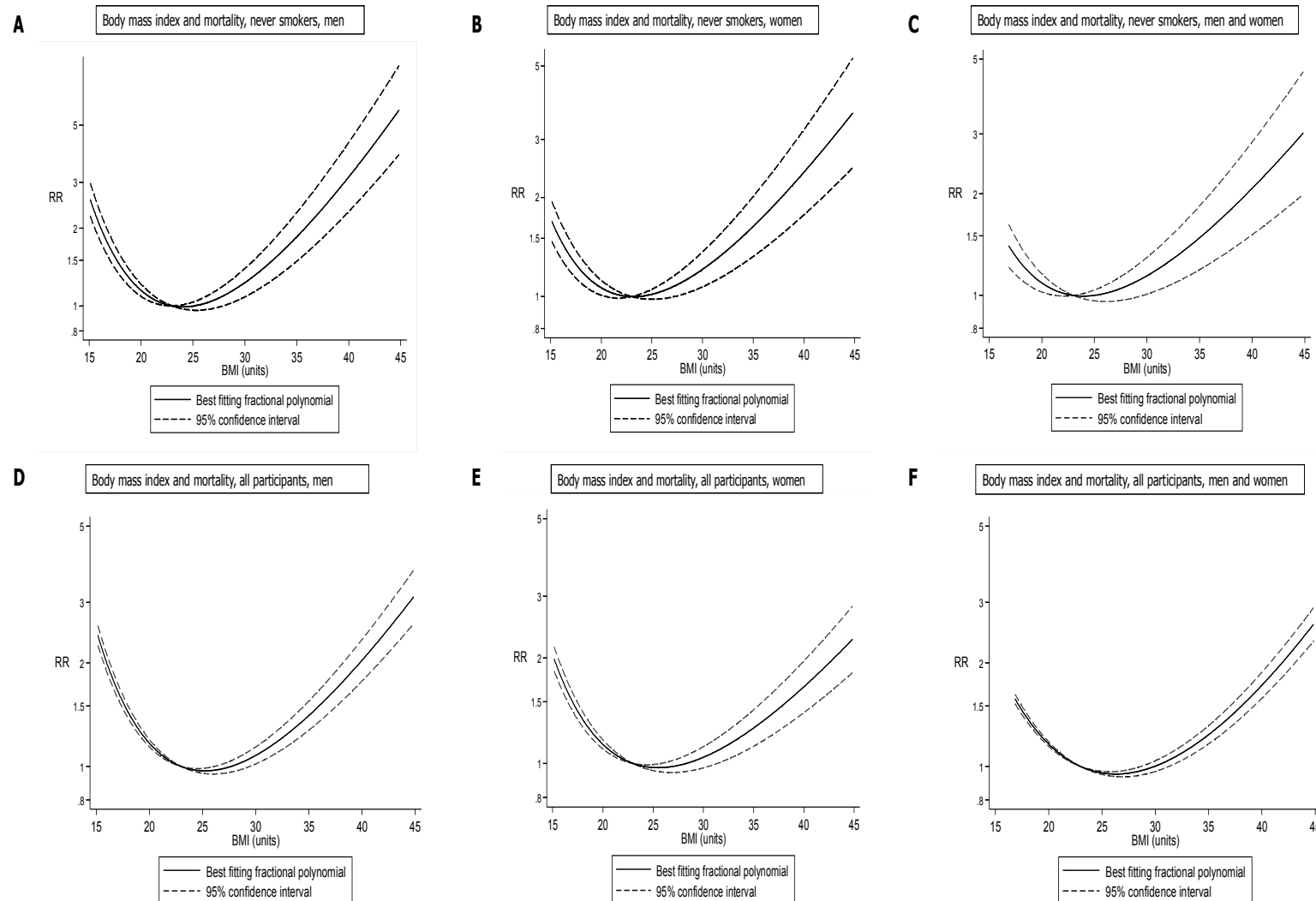


* Because of the large number of studies the figure had to be divided into three different parts and because of this it was not possible to show the summary RR at the bottom like in the other figures. Summary RR=1.05 (95% CI: 1.04-1.07, $I^2=97.1\%$, $p_{\text{heterogeneity}} < 0.0001$).

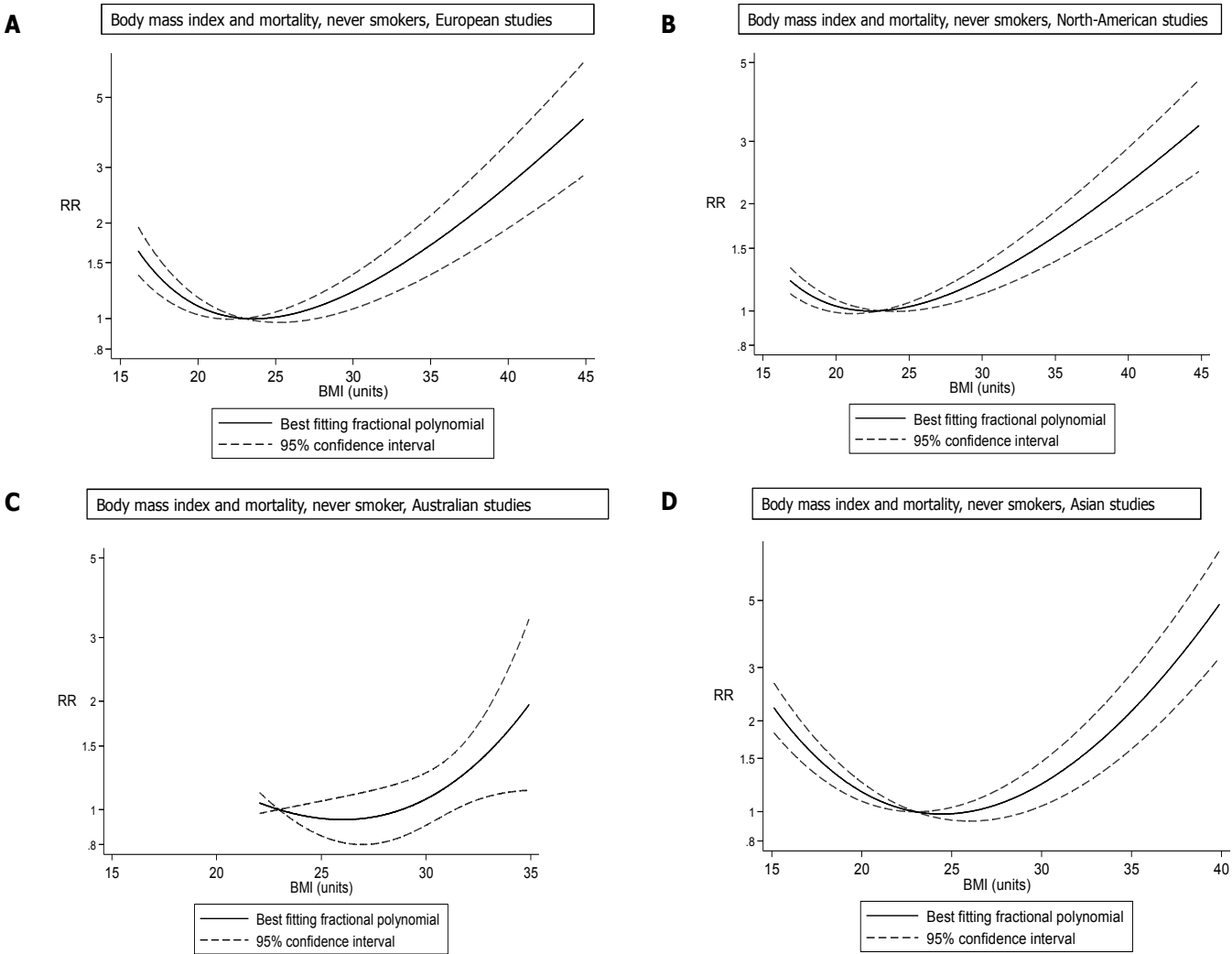
Supplementary Figure 8. Funnel plot of BMI and all-cause mortality (all participants)



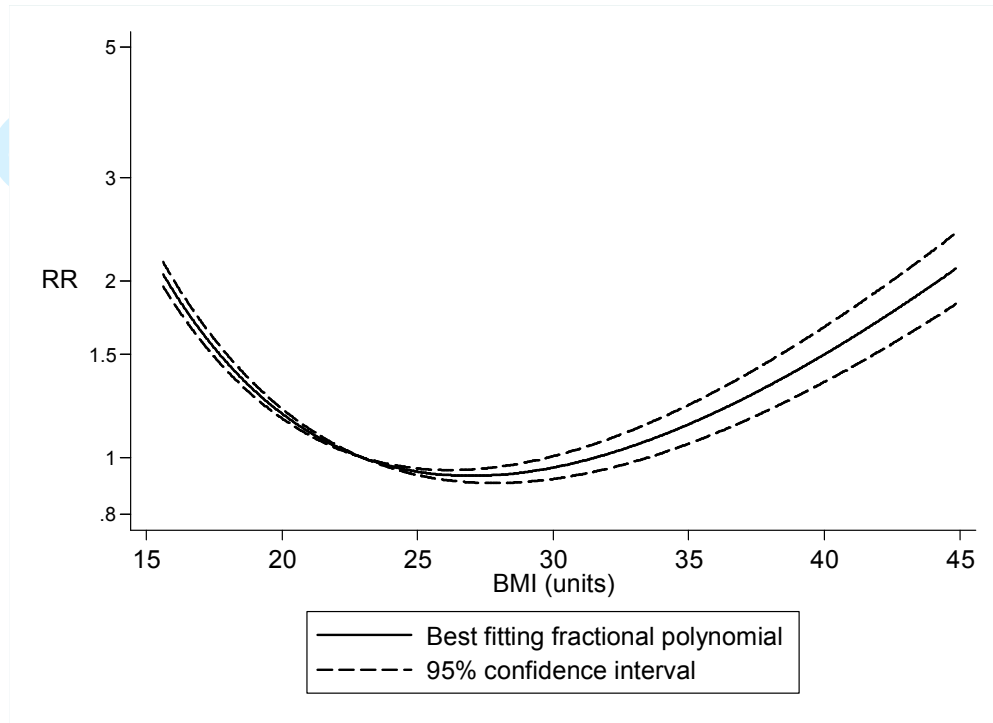
Supplementary Figure 9. BMI and mortality, never smokers, by sex



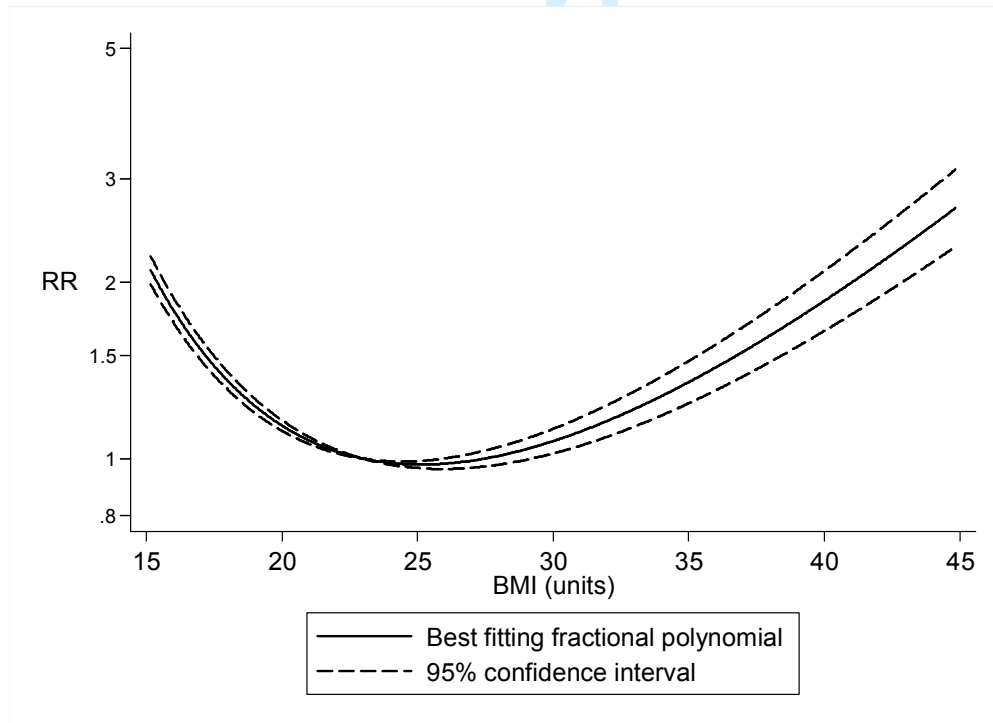
Supplementary Figure 10. BMI and mortality, never smokers, by geographic location



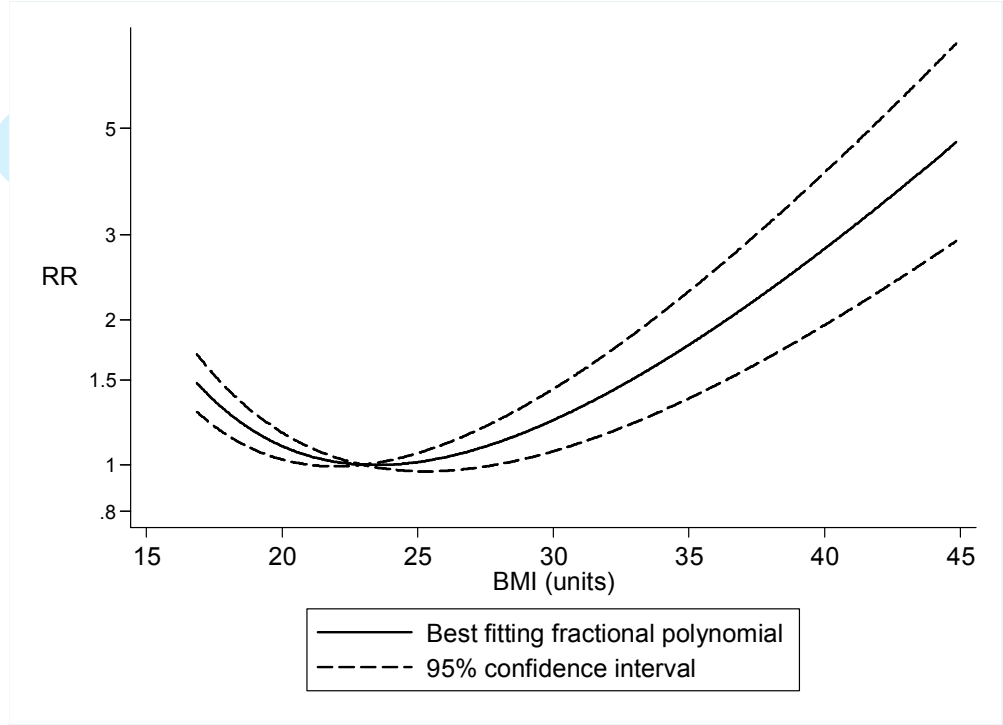
Supplementary Figure 11. BMI and mortality, all participants, study quality=4-6



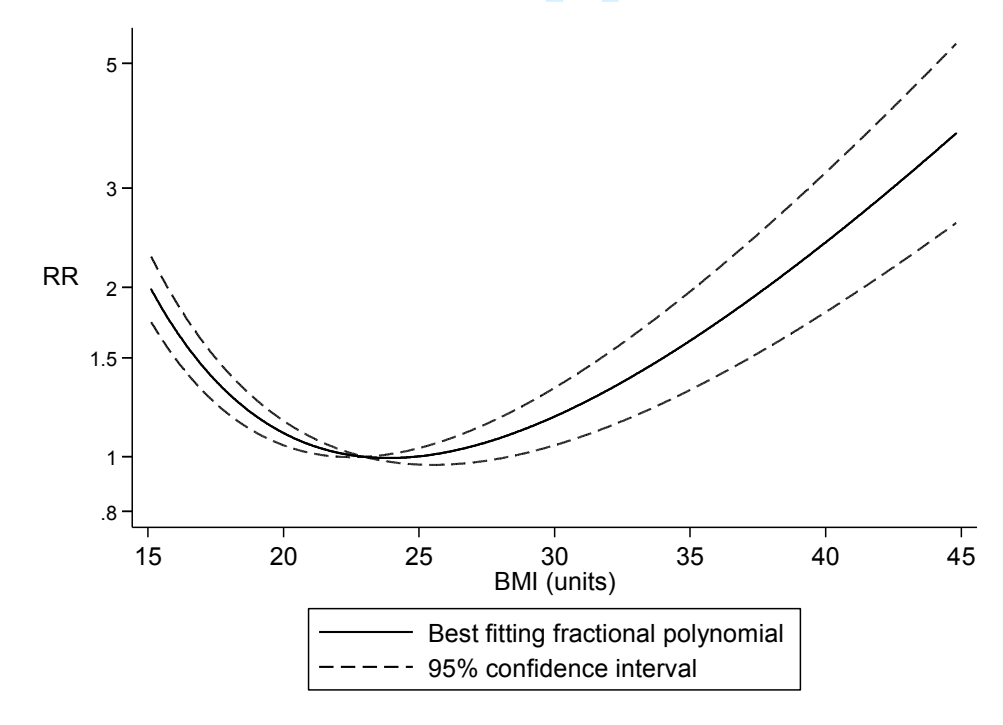
Supplementary Figure 12. BMI and mortality, all participants, study quality=7-9



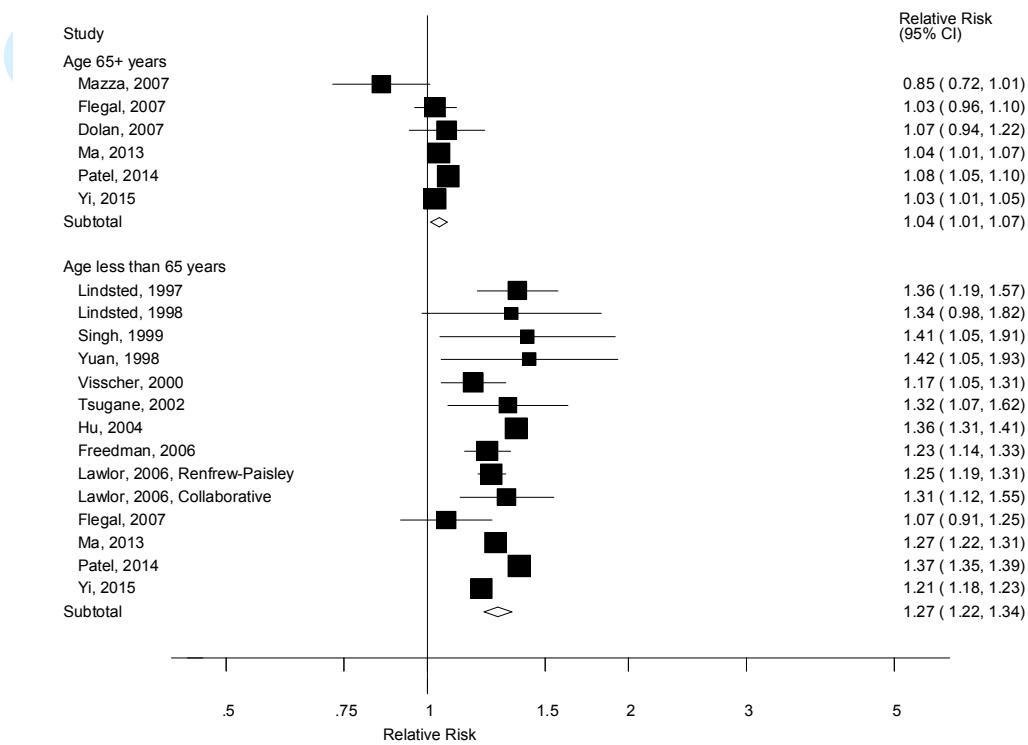
Supplementary Figure 13. BMI and mortality, never smokers, study quality = 4-6



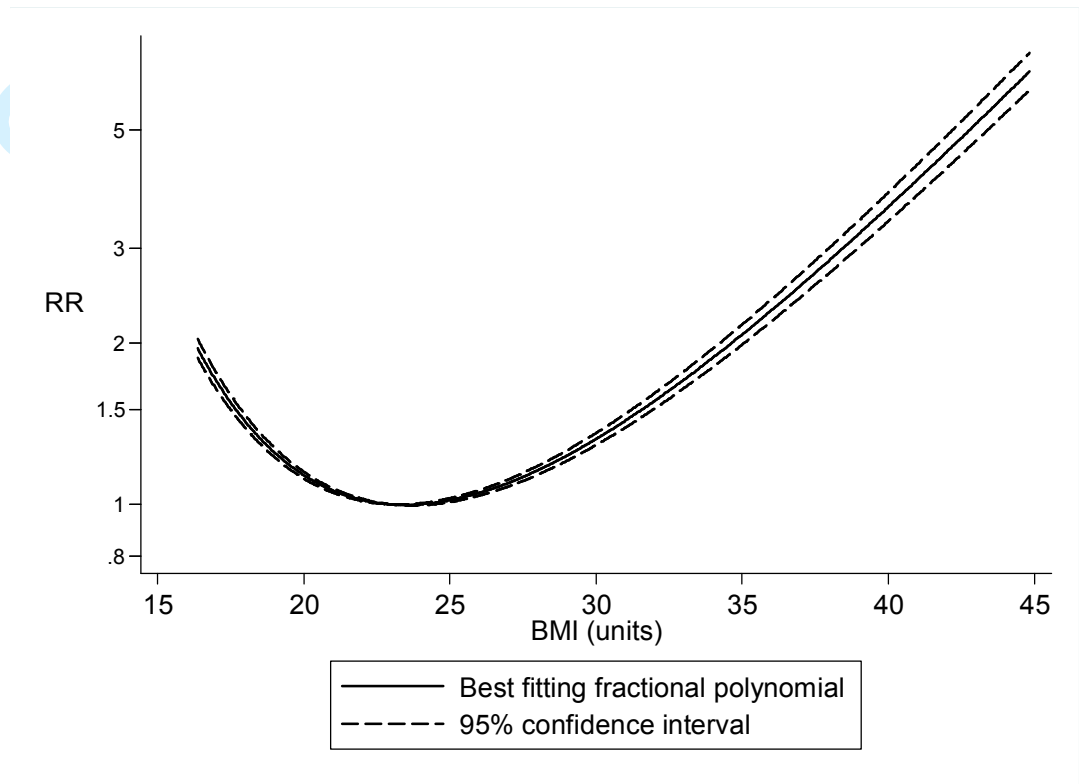
Supplementary Figure 14. BMI and mortality, never smokers, study quality = 7-9



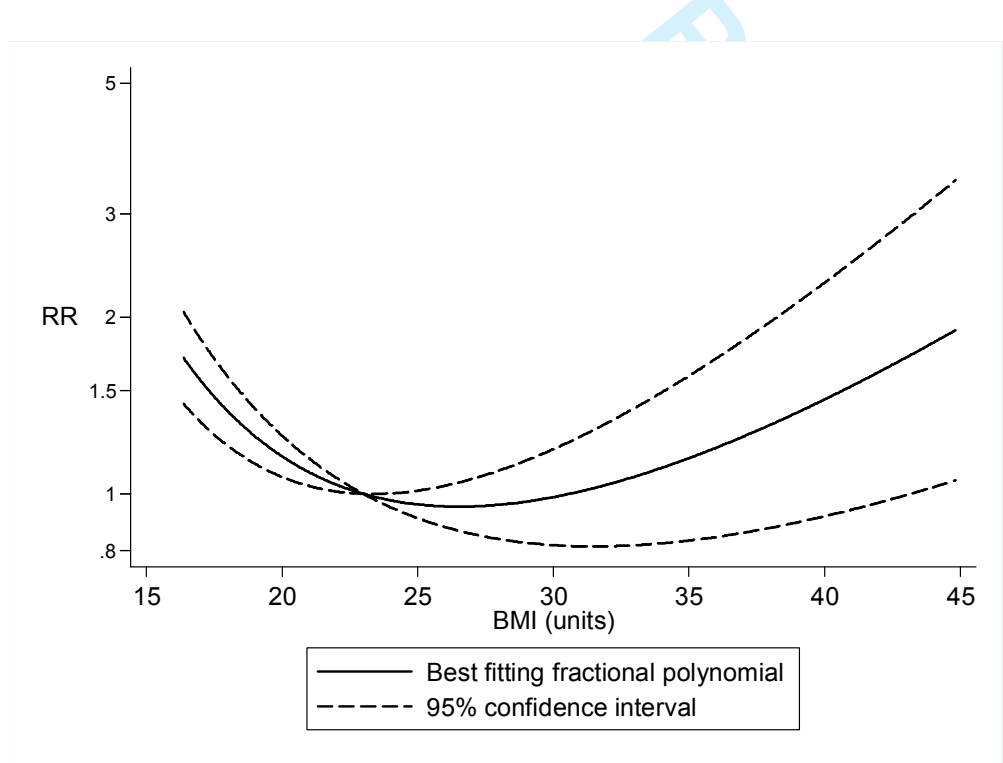
Supplementary Figure 15. BMI and mortality in never smokers, stratified by age (<65 years vs. ≥65 years), linear dose-response analysis



Supplementary Figure 16. BMI and mortality in never smokers, age <65 years, nonlinear dose-response analysis



Supplementary Figure 17. BMI and mortality in never smokers, age ≥65 years, nonlinear dose-response analysis



Supplementary Text. PubMed search

("body mass index" OR BMI OR overweight OR obesity OR anthropometry OR fatness OR "body fatness" OR "abdominal fatness" OR "abdominal obesity" OR "waist circumference" OR "waist-to-hip ratio" OR adiposity OR "weight gain" OR "weight change" OR "weight loss")

AND

("coronary heart disease" OR "heart disease" OR "ischemic heart disease" OR "ischaemic heart disease" OR "coronary artery disease" OR "myocardial infarction" OR "angina pectoris" OR "heart failure" OR stroke OR "ischemic stroke" OR "haemorrhagic stroke" OR "cerebrovascular disease" OR "cardiovascular disease" OR cancer OR "total cancer" OR neoplasm OR mortality OR "all-cause mortality" OR "total mortality" OR survival OR death)

AND

("case-control" OR cohort OR cohorts OR prospective OR longitudinal OR retrospective OR "follow-up" OR "cross-sectional" OR "hazard ratio" OR "hazard ratios" OR "relative risk" OR "relative risks" OR "incidence rate ratio" OR "incidence rate ratios" OR "odds ratios" OR "odds ratio" OR incidence)

NOT

(perinatal OR neonatal OR infant OR "case reports"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] OR "letter"[Publication Type] OR animal)

Supplementary Text. Embase search

(body mass index/ OR BMI/ OR overweight/ OR obesity/ OR anthropometry/ OR fatness/ OR body fatness/ OR abdominal fatness/ OR abdominal obesity/ OR waist circumference/ OR waist-to-hip ratio/ OR adiposity/ OR weight gain/ OR weight change/ OR weight loss/)

AND

(coronary heart disease/ OR heart disease/ OR ischemic heart disease/ OR ischaemic heart disease/ OR coronary artery disease/ OR myocardial infarction/ OR angina pectoris/ OR heart failure/ OR stroke/ OR ischemic stroke/ OR haemorrhagic stroke/ OR cerebrovascular disease/ OR cardiovascular disease/ OR cancer/ OR total cancer/ OR neoplasm/ OR mortality/ OR all-cause mortality/ OR total mortality/ OR survival/ OR death/)

AND

(case-control OR cohort OR cohorts OR prospective OR longitudinal OR retrospective OR follow-up OR cross-sectional OR hazard ratio OR hazard ratios OR relative risk OR relative risks OR incidence rate ratio OR incidence rate ratios OR odds ratios OR odds ratio OR incidence)