

# ABSENCE OF EXCESS BODY FATNESS

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### 2.2.14 Cancer of the prostate

Cancer of the prostate is the fourth most commonly diagnosed cancer worldwide, and one of the most frequent causes of cancer-related mortality in developed countries.

The relationship between body weight and prostate cancer risk is complex, for several reasons. First, prostate cancer-specific mortality (death attributed to the underlying cancer) is a proxy for incidence in some studies, whereas it is a primary end-point in other studies, along with different types of prostate cancer incidence defined by tumour characteristics. However, prostate cancer-specific mortality may be over-represented in patients who die *with* but not *of* the disease. This is a particular concern if, for example, obese patients with prostate cancer have other comorbid disease and more regular contact with the health-care system; the cancer may be more prominent in their management and may be recorded on the death certificate, even if heart disease is the underlying cause of death. Second, detection bias could also be a concern in studies of prostate cancer incidence; because obese men have lower levels of prostate-specific antigen (PSA), their tumours are more difficult to detect, and they are less likely to undergo a biopsy ([Allot et al., 2013](#)). However, potential biological mechanisms have also been proposed to explain a lower risk of early-stage prostate cancer in men who are overweight or obese (see Section 4.3.1d).

In 2001, the Working Group of the *IARC Handbook on weight control and physical activity* ([IARC, 2002](#)) concluded that the evidence of an association between avoidance of weight gain and prostate cancer was *inadequate*. Since then, numerous prospective studies with at least 100 cases ([Table 2.2.14a](#)) and case-control studies ([Table 2.2.14b](#)) have been published, as well as several meta-analyses of observational studies addressing different measures of body fatness ([Table 2.2.14c](#)).

#### (a) Cohort studies

The *IARC Handbook on weight control and physical activity* ([IARC, 2002](#)), in the evaluation of prostate cancer risk and measures of body fatness, included 13 prospective cohort studies with at least 100 cases (not shown in [Table 2.2.14a](#)). Of those, four found a positive association and nine found no association. Notably, across all prospective studies, the highest category of BMI was overweight (25–29.9 kg/m<sup>2</sup>) but not obese ( $\geq 30$  kg/m<sup>2</sup>).

Since 2000, associations of body fatness assessed at baseline with total prostate cancer incidence have been examined in numerous individual prospective studies with at least 100 cases and in at least two meta-analyses. In most studies, neither BMI nor weight was associated with risk ([Habel et al., 2000](#); [Schuurman et al., 2000](#); [Lee et al., 2001](#); [Jonsson et al., 2003](#); [Rapp et al., 2005](#); [Gong et al., 2006](#); [Lukanova et al., 2006](#); [Tande et al., 2006](#); [Fujino et al., 2007](#); [Giovannucci et al., 2007](#); [Littman et al., 2007](#); [Máchová et al., 2007](#); [Rodriguez et al., 2007](#); [Pischon et al., 2008](#); [Wallström et al., 2009](#); [Andreotti et al., 2010](#); [Stocks et al., 2010](#); [Bassett et al., 2012](#)). However, in some studies statistically significant positive associations (or trends) between BMI at baseline and prostate cancer incidence were found ([Engeland et al., 2003](#); [Samanic et al., 2004, 2006](#); [Jee et al., 2008](#); [Barrington et al., 2015](#)), and four prospective studies found lower risk of prostate cancer with increasing BMI ([Wright et al., 2007](#); [Bhaskaran et al., 2014](#); [Møller et al., 2015](#)). In a meta-analysis of 27 prospective studies, there was a statistically significant positive association with prostate cancer incidence (RR per 5 kg/m<sup>2</sup> increase in BMI, 1.03; 95% CI, 1.00–1.07) ([Renehan et al., 2008](#)).

Associations of body fatness at baseline with stage of the disease were examined in several studies. Regarding the incidence of localized, low-grade, or non-aggressive disease, although five studies found no association ([Schuurman et](#)

al., 2000; Giovannucci et al., 2007; Pischon et al., 2008; Wallström et al., 2009; Bassett et al., 2012), at least seven other studies found an inverse association of BMI and/or weight with the incidence of non-aggressive (Littman et al., 2007; Stocks et al., 2010), non-metastatic low- to moderate-grade (Gong et al., 2006; Rodriguez et al., 2007; Møller et al., 2016 for BMI at age 21 years), or localized (Wright et al., 2007; Discacciati et al., 2011; Hernandez et al., 2009 for BMI at age 21 years) prostate cancer. In the Selenium and Vitamin E Cancer Prevention Trial (SELECT), there was evidence of a significant inverse trend between BMI and the incidence of low-grade prostate cancer in non-Hispanic White men, and a statistically significant positive association in African American men (Barrington et al., 2015).

Nine prospective studies found no associations of BMI and/or weight with the incidence of regional or distant prostate cancer (Habel et al., 2000), advanced, high-grade, or moderately to poorly differentiated prostate cancer (Schuurman et al., 2000; Pischon et al., 2008; Discacciati et al., 2011; Møller et al., 2015), aggressive prostate cancer (Littman et al., 2007; Wallström et al., 2009; Stocks et al., 2010), or extraprostatic prostate cancer (Wright et al., 2007). However, five other studies found positive associations or trends of BMI and/or weight with the incidence of high-grade or advanced prostate cancer (Gong et al., 2006; Giovannucci et al., 2007; Rodriguez et al., 2007; Hernandez et al., 2009 for BMI at age 21 years; Bassett et al., 2012; Barrington et al., 2015). A meta-analysis combining data from 24 prospective studies found a statistically significant positive association between BMI and risk of advanced, high-grade, or fatal prostate cancer (RR per 5 kg/m<sup>2</sup> increase in BMI, 1.08; 95% CI, 1.04–1.12) (WCRF/AICR, 2014).

There is considerable evidence of a positive association of BMI with prostate cancer mortality, based on findings from both individual prospective studies (Rodriguez et al., 2001; Calle et al., 2003; Giovannucci et al., 2007; Wright et al.,

2007; Stocks et al., 2010; Bassett et al., 2012) and a large pooled analysis of 57 prospective studies from Europe, Japan, and the USA, reporting a relative risk of mortality per 5 kg/m<sup>2</sup> increase in BMI of 1.13 (95% CI, 1.02–1.24) across the BMI range of 15–50 kg/m<sup>2</sup> (Whitlock et al., 2009). However, at least six other individual prospective studies found no association between BMI at baseline and death from prostate cancer (Batty et al., 2005; Fujino et al., 2007; Burton et al., 2010 for BMI at age < 30 years; Discacciati et al., 2011; Meyer et al., 2015; Møller et al., 2015). Similarly, BMI was not associated with prostate cancer mortality in a pooled analysis from the Asia Cohort Consortium (Fowke et al., 2015). [The Working Group noted that in this analysis, the reference group was men with a BMI of 22.5–24.9 kg/m<sup>2</sup>, compared with men with a BMI of 25–50 kg/m<sup>2</sup>. A possible effect of obesity (BMI > 30 kg/m<sup>2</sup>) on prostate cancer mortality might have been missed in this study.]

At least six prospective studies found no associations between BMI or weight at younger ages of adulthood and risk of prostate cancer (total, localized, advanced, or fatal) (Giovannucci et al., 1997; Jonsson et al., 2003; Fujino et al., 2007; Hernandez et al., 2009; Burton et al., 2010; Discacciati et al., 2011; Bassett et al., 2012), whereas in two other studies higher BMI (Schuurman et al., 2000) or weight (Littman et al., 2007) in young adulthood was significantly associated with increased total prostate cancer incidence. In the NIH-AARP cohort, both BMI and weight at age 18 years were not associated with the incidence of total prostate cancer or extraprostatic prostate cancer, whereas inverse associations with localized prostate cancer were reported ( $P_{\text{trend}} = 0.04$ ) (Wright et al., 2007). Similarly, in the Multiethnic Cohort Study and the Health Professionals Follow-up Study, BMI at age 21 years was inversely associated with the incidence of total, localized, and low- and moderate-grade prostate cancer and was not associated with the incidence of high-grade or fatal prostate cancer (Hernandez et al.,



2009; Møller et al., 2016). Similarly, in the study by Littman et al. (2007), the positive association with weight in young adulthood (ages 18, 30, or 45 years) was restricted to the aggressive type. In a meta-analysis of nine prospective studies, Robinson et al. (2008) found a positive association between BMI in early life (i.e. < 29 years) and prostate cancer incidence or mortality (RR per 5 kg/m<sup>2</sup> increase in BMI, 1.08).

In at least four individual prospective studies, change in neither BMI nor weight during adulthood was associated with prostate cancer incidence (Jonsson et al., 2003; Samanic et al., 2006; Rodriguez et al., 2007; Rapp et al., 2008). Similarly, a meta-analysis of four prospective studies also found no associations of adult weight gain [after adjustment for age and baseline BMI or weight in all studies] with total, localized, or advanced prostate cancer incidence (Keum et al., 2015). However, in the Netherlands Cohort Study, there was suggestive evidence of an inverse trend between increase in BMI from age 20 years to baseline ( $\geq 6$  kg/m<sup>2</sup>) and total prostate cancer incidence ( $P_{\text{trend}} = 0.07$ ), and this association was statistically significant for poorly differentiated or undifferentiated prostate tumours (Schoorman et al., 2000). In the Vitamins and Lifestyle (VITAL) cohort, both weight loss and weight gain were associated with a lower risk of non-aggressive prostate cancer, but there was no association with aggressive prostate cancer (Littman et al., 2007). In the NIH-AARP cohort, weight gain from age 18 years to baseline was not associated with prostate cancer incidence (total, localized, or extraprostatic), but was associated with prostate cancer mortality ( $P_{\text{trend}} = 0.009$ ) (Wright et al., 2007).

The association between waist circumference and total prostate cancer incidence was examined in at least eight individual prospective studies, and no study found evidence of statistically significant associations with total prostate cancer incidence (Giovannucci et al., 1997; Lee et al., 2001; MacInnis et al., 2003; Gong et al.,

2006; Tande et al., 2006; Pischon et al., 2008; Wallström et al., 2009; Møller et al., 2015). On the basis of four prospective studies, the WCRF Continuous Update Project summary (WCRF/AICR, 2014) found no dose–response association between waist circumference and risk of total or non-advanced prostate cancer, but a statistically significant positive association with risk of advanced or fatal prostate cancer (RR per 10 cm increase, 1.12; 95% CI, 1.04–1.21).

#### (b) Case–control studies

Case–control studies of BMI and other adiposity indices in relation to prostate cancer risk are presented in Table 2.2.14b. In the IARC Handbook on weight control and physical activity (IARC, 2002), 15 case–control studies of BMI and prostate cancer were reviewed (not shown here). Since then, at least 35 case–control studies and 5 meta-analyses including case–control study designs, focused on the association between weight, BMI, or waist circumference and prostate cancer, have been conducted in Asia (China, India, Japan, and Pakistan), the Caribbean (Barbados and Jamaica), Europe, the Islamic Republic of Iran, Nigeria, North America, and Oceania (Australia and New Zealand). In all of these studies, BMI was assessed on the basis of self-reported height and body weight, or body weight and height verified at the time of a hospital consultation.

Positive associations between high BMI and total prostate cancer incidence were reported in six of the case–control studies. Bashir et al. (2014), in a hospital-based case–control study in Pakistan with 140 cases and 280 controls, found a significant increase in the risk of prostate cancer for men with BMI > 25 kg/m<sup>2</sup> (OR, 5.78; 95% CI, 2.67–12.6). In a multicentre hospital-based case–control study in Italy, Dal Maso et al. (2004) identified a dose–response relationship between BMI at age 30 years and prostate cancer risk, based on 1257 cases ( $P_{\text{trend}} = 0.004$ ). Ganesh et al. (2011) reported a 2-fold greater risk of prostate cancer

in Indian men with BMI  $\geq 25$  kg/m<sup>2</sup> (OR, 2.1; 95% CI, 1.1–4.4). A hospital-based case–control study in France found a positive association between BMI  $> 29$  kg/m<sup>2</sup> and risk of prostate cancer (OR, 2.47; 95% CI, 1.41–4.34) ([Irani et al., 2003](#)). Similarly, a study in Canada reported a significant 27% increase in risk of prostate cancer in men with BMI  $\geq 30$  kg/m<sup>2</sup> compared with those with BMI  $< 25$  kg/m<sup>2</sup> ([Pan et al., 2004](#)).

An inverse association between BMI and prostate cancer has also been reported in several studies. [Beebe-Dimmer et al. \(2009\)](#), in a hospital-based case–control study in the USA, found an inverse relationship between high BMI ( $\geq 30$  kg/m<sup>2</sup>) and prostate cancer risk in Caucasian men, based on 494 cases (OR, 0.51; 95% CI, 0.33–0.80), but not in African American men. Similarly, a study in Canada found a statistically significant inverse relationship between BMI  $\geq 30$  kg/m<sup>2</sup> and prostate cancer risk (OR, 0.72; 95% CI, 0.60–0.87), but no associations with waist circumference or waist-to-hip ratio were found ([Boehm et al., 2015](#)). A population-based case–control study in the Islamic Republic of Iran ([Hosseini et al., 2010](#)), with 137 cases and 137 controls, also found a significant inverse relationship between high BMI ( $\geq 25$  kg/m<sup>2</sup>) and prostate cancer risk (OR, 0.4; 95% CI, 0.2–0.8). Finally, [Agalliu et al. \(2015\)](#) conducted a small hospital-based case–control study in Nigeria, with 50 cases and 50 controls. Inverse associations were reported for weight (OR per kg increase, 0.97; 95% CI, 0.94–1.00) and waist circumference (OR per cm increase, 0.91; 95% CI, 0.87–0.96).

One additional case–control study found an increased risk of total prostate cancer in men with an increased waist circumference ([Beebe-Dimmer et al., 2007](#)).

Three meta-analyses that included case–control studies suggested a small increase in risk of prostate cancer associated with higher BMI ([Bergström et al., 2001](#); [MacInnis & English, 2006](#); [Robinson et al., 2008](#)). In one additional meta-analysis, a significant positive association

with adult weight was observed for high-risk (RR, 1.13; 95% CI, 1.00–1.28) and fatal (RR, 1.58; 95% CI, 1.01–2.47) prostate cancer subtypes ([Chen et al., 2016](#)).

Six case–control studies differentiated prostate cancer by grade, stage, or aggressiveness, and generally reported positive associations of BMI, waist circumference, or waist-to-hip ratio with prostate cancers with higher Gleason scores. [Fowke et al. \(2012\)](#) analysed 809 hospital-based cases and 1057 controls in the USA by Gleason score. On the basis of 135 cases, BMI and waist circumference were marginally associated with increased risk of high-grade prostate cancer (OR per 1 kg/m<sup>2</sup> increase in BMI, 1.04; 95% CI, 1.00–1.08 and OR per 1 cm increase in waist circumference, 1.01; 95% CI, 0.99–1.03). [Jackson et al. \(2010\)](#) separated patients with high-grade prostate cancer in their hospital-based case–control study (243 cases and 275 controls) in Jamaica. Waist circumference and waist-to-hip ratio were positively associated with high-grade prostate cancer after adjustment for BMI. A dose–response relationship was also observed for waist circumference, and no association was found with BMI. A case–control study in Italy observed significant positive associations of BMI and prostate cancer of Gleason score 7–10 only ( $P_{\text{trend}} < 0.01$ ) ([Dal Maso et al., 2004](#)). [Liu et al. \(2005\)](#) conducted a population-based sibling case–control study in the USA with 439 cases and 479 controls and found no association of aggressive prostate cancer (defined as Gleason score  $\geq 7$  or tumour stage T2C or greater) with increased BMI, whereas an inverse association was observed for lean body mass ( $P_{\text{trend}} = 0.02$ ). [Nemesure et al. \(2012\)](#) conducted a population-based case–control study in Barbados with 963 cases and 941 controls and reported a positive association of waist circumference with all prostate cancers (OR for highest versus lowest quartiles, 1.84; 95% CI, 1.19–2.85), which did not hold when stratifying by disease grade. [Robinson et al. \(2005\)](#) in the USA reported an inverse association between

BMI > 30 kg/m<sup>2</sup> at age 20–29 years and advanced prostate cancer [based on 12 cases].

Several studies assessed BMI and body weight at different ages, and BMI/weight change. In a population-based case–control study in Sweden, [Gerdtsen et al. \(2015\)](#) investigated several anthropometric measures, including BMI and weight, at multiple time points in life. Weight increase in adolescence (age 16–22 years) was associated with increased risk of prostate cancer (OR per 5 kg increase in weight, 1.05; 95% CI, 1.01–1.09), and increase in BMI and weight in middle age (age 44–50 years) was associated with increased mortality from prostate cancer, and with increased metastasis. Weight gain of 10.0–14.9 kg in adulthood was significantly associated with a 3–4-fold greater risk of prostate cancer in a population-based case–control study in Japan ([Mori et al., 2011](#)). In the same study, BMI of 23.0–24.9 kg/m<sup>2</sup> at age 20 years was associated with a reduced risk of prostate cancer (OR, 0.47; 95% CI, 0.22–0.98) ([Mori et al., 2011](#)) [based on 11 cases only]. In contrast, a total of 16 case–control studies conducted in Australia, Canada, the Czech Republic, Italy, Japan, New Zealand, Spain, Sweden, Switzerland, the United Kingdom, and the USA reported no associations between risk of total prostate cancer and BMI or other adiposity indices at different ages ([Putnam et al., 2000](#); [Sharpe & Siemiatycki, 2001](#); [Giles et al., 2003](#); [Friedenreich et al., 2004](#); [Porter & Stanford, 2005](#); [Robinson et al., 2005](#); [Wuermli et al., 2005](#); [Cox et al., 2006](#); [Gallus et al., 2007](#); [Máková et al., 2007](#); [Nagata et al., 2007](#); [Magura et al., 2008](#); [Dimitropoulou et al., 2011](#); [Pelucchi et al., 2011](#); [Möller et al., 2013](#); [Alvarez-Cubero et al., 2015](#); [Zhang et al., 2015](#)) or BMI change or weight gain from early adulthood ([Putnam et al., 2000](#); [Giles et al., 2003](#); [Friedenreich et al., 2004](#)).

### (c) Mendelian randomization studies

Three Mendelian randomization studies have been conducted in this context ([Table 2.2.14d](#)).

[Lewis et al. \(2010\)](#) showed that each additional A allele of the *FTO* rs9939609 SNP was associated with an increase of 0.56 kg/m<sup>2</sup> ( $P = 0.007$ ) in BMI across all groups (cases and controls). Estimates obtained from Mendelian randomization analyses provided odds ratios of 0.77 (95% CI, 0.52–1.15;  $P = 0.20$ ) for prostate cancer and 1.35 (95% CI, 0.90–2.03;  $P = 0.14$ ) for high-grade versus low-grade cancer with each 1 kg/m<sup>2</sup> increase in BMI.

[Davies et al. \(2015\)](#) extended this work by using a genetic risk score based on 32 SNPs associated with BMI ([Speliotes et al., 2010](#)) as an instrument for BMI within a much larger sample size. Each increase of 1 standard deviation in genetically predicted BMI was associated on average with a nonsignificant 2% reduction in risk (95% CI, 0.96–1.00;  $P = 0.07$ ) in any prostate cancer diagnosis.

In Mendelian randomization analyses that used genetic risk scores based on 77 SNPs for adult BMI ([Locke et al., 2015](#)) and 15 SNPs for childhood BMI ([Felix et al., 2016](#)), [Gao et al. \(2016\)](#) found no strong evidence for associations of childhood or adult BMI with either total or aggressive prostate cancer risk.

[Although results from [Lewis et al. \(2010\)](#) and [Davies et al. \(2015\)](#) point towards an inverse association between BMI and prostate cancer risk, this association was not significant and was not consistently found in all three studies.]

**Table 2.2.14a Cohort studies of measures of body fatness and cancer of the prostate**

| Reference<br>Cohort<br>Location<br>Follow-up period   | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code) | Exposure<br>categories        | Exposed<br>cases | Relative risk<br>(95% CI) | Covariates   | Comments  |   |
|---|--|---|-------------------------------|------------------|---------------------------|--|---|---|
| <a href="#">Giovannucci et al. (1997)</a><br>Health<br>Professionals<br>Follow-up Study<br>USA<br>1986–1994 | 47 781<br>Incidence                                    | Prostate,<br>advanced                         | BMI at age 21 yr<br>< 20      | 81               | 1.00                      | Age, height  |   |   |
|   |  |   | 20–21.9                       | 117              | 0.91 (0.69–1.22)          |  |   |   |
|   |  |   | 22–22.9                       | 59               | 0.88 (0.62–1.24)          |  |   |   |
|   |  |   | 23–23.9                       | 56               | 0.77 (0.54–1.10)          |  |   |   |
|   |  |   | 24–25.9                       | 60               | 0.71 (0.50–1.02)          |  |   |   |
|   |  |   | ≥ 26                          | 26               | 0.53 (0.33–0.86)          |  |   |   |
|   |  | [ <i>P</i> <sub>trend</sub> ]                 |                               | [< 0.006]        |                           |  |   |   |
|   |  | Prostate, all                                 | BMI at age 21 yr<br>< 20      | 229              | 1.00                      |  |   | WC also not associated<br>with increased risk |
|   |  |   | 20–21.9                       | 353              | 0.98 (0.83–1.16)          |  |   |   |
|   |  |   | 22–22.9                       | 188              | 1.00 (0.82–1.22)          |  |   |   |
|   |  |   | 23–23.9                       | 200              | 1.03 (0.84–1.26)          |  |   |   |
|   |  |   | 24–25.9                       | 223              | 1.00 (0.82–1.22)          |  |   |   |
| ≥ 26  | 104  |   | 0.87 (0.67–1.12)              |                  |                           |  |   |   |
| [ <i>P</i> <sub>trend</sub> ]   |  | [0.60]  |                               |                  |                           |  |   |   |
| <a href="#">Habel et al. (2000)</a><br>Kaiser<br>Permanente<br>USA<br>1964–1973 to 1996                     | 70 712<br>Incidence                                    | Prostate                                      | BMI<br>< 22.7                 | 2079 total       | 1.00                      | Age, race, year of birth   | Weight also not<br>associated with increased<br>risk<br>No associations were<br>observed in results<br>stratified by race |   |
|   |  |   | 22.7–24.3                     |                  | 1.09 (0.93–1.27)          |  |   |   |
|   |  |   | 24.4–25.9                     |                  | 1.04 (0.89–1.21)          |  |   |   |
|   |  |   | 26–27.9                       |                  | 1.04 (0.90–1.21)          |  |   |   |
|   |  |   | > 27.9                        |                  | 0.99 (0.85–1.15)          |  |   |   |
|   |  |   | [ <i>P</i> <sub>trend</sub> ] |                  |                           |  |   |   |
|   |  | Prostate,<br>regional/distant                 | BMI<br>< 22.7                 | 578 total        | 1.00                      |  |   |   |
|   |  |   | 22.7–24.3                     |                  | 0.84 (0.62–1.13)          |  |   |   |
|   |  |   | 24.4–25.9                     |                  | 1.05 (0.80–1.39)          |  |   |   |
|   |  |   | 26–27.9                       |                  | 1.04 (0.79–1.37)          |  |   |   |
|   |  |   | > 27.9                        |                  | 0.91 (0.69–1.20)          |  |   |   |
|   |  |   | [ <i>P</i> <sub>trend</sub> ] |                  |                           |  |   |   |
| <a href="#">Schuurman et al. (2000)</a><br>Netherlands<br>Cohort Study<br>The Netherlands<br>1986–1982      | 58 279<br>Incidence                                    | Prostate                                      | BMI at baseline<br>< 22       | 63               | 1.00                      | Age, family history of<br>prostate cancer, SES;<br>BMI change results<br>also adjusted for BMI<br>at age 20 yr |   |   |
|   |  |   | 22–23                         | 164              | 1.20 (0.84–1.73)          |  |   |   |
|   |  |   | 24–25                         | 236              | 1.35 (0.95–1.90)          |  |   |   |
|   |  |   | 26–27                         | 150              | 1.26 (0.87–1.83)          |  |   |   |
|   |  |   | ≥ 28                          | 62               | 0.89 (0.58–1.37)          |  |   |   |
|   |  |   | [ <i>P</i> <sub>trend</sub> ] |                  | [0.73]                    |  |   |   |
|   |  |   | per 2 kg/m <sup>2</sup>       |                  | 1.00 (0.92–1.07)          |  |   |   |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code) | Exposure<br>categories        | Exposed<br>cases | Relative risk<br>(95% CI) | Covariates | Comments |
|---|--|---|-------------------------------|------------------|---------------------------|------------|----------|
| <a href="#">Schuurman et al. (2000)</a><br>(cont.)  | 58 279<br>Incidence                                    |   | BMI at age 20 yr              |                  |                           |            |          |
|   |  |   | < 19                          | 57               | 1.00                      |            |          |
|   |  |   | 19–20.9                       | 122              | 1.06 (0.72–1.56)          |            |          |
|   |  |   | 21–22.9                       | 176              | 1.09 (0.76–1.58)          |            |          |
|   |  |   | 23–24.9                       | 119              | 1.39 (0.93–2.06)          |            |          |
|   |  |   | ≥ 25                          | 44               | 1.33 (0.81–2.19)          |            |          |
|   |  |   | [ <i>P</i> <sub>trend</sub> ] |                  | [0.02]                    |            |          |
|   |  |   | per 2 kg/m <sup>2</sup>       |                  | 1.08 (0.99–1.18)          |            |          |
|   |  |   | BMI change                    |                  |                           |            |          |
|   |  |   | –9.2 to < 0                   | 47               | 1.19 (0.74–1.90)          |            |          |
|   |  |   | 0–1.9                         | 120              | 1.00                      |            |          |
|   |  |   | 2–3.9                         | 176              | 1.32 (0.98–1.79)          |            |          |
|   |  |   | 4–5.9                         | 113              | 1.04 (0.74–1.47)          |            |          |
|   |  |   | 6–7.9                         | 43               | 0.83 (0.52–1.31)          |            |          |
|   |  |   | ≥ 8                           | 19               | 0.67 (0.36–1.23)          |            |          |
|   |  |   | [ <i>P</i> <sub>trend</sub> ] |                  | [0.07]                    |            |          |
|   |  |   | per 2 kg/m <sup>2</sup>       |                  | 0.93 (0.84–1.03)          |            |          |
| Prostate,<br>localized<br>TNM: T0–2, M0             |  |   | BMI, per 2 kg/m <sup>2</sup>  | 239 total        |                           |            |          |
|   |  |   | BMI at baseline               |                  | 0.96 (0.86–1.06)          |            |          |
|   |  |   | BMI at age 20 yr              |                  | 1.18 (1.04–1.35)          |            |          |
|   |  |   | BMI change                    |                  | 0.87 (0.74–1.02)          |            |          |
| Prostate,<br>advanced<br>TNM: T3–4,<br>M0; T0–4, M1 |  |   | BMI, per 2 kg/m <sup>2</sup>  | 226 total        |                           |            |          |
|   |  |   | BMI at baseline               |                  | 1.01 (0.90–1.13)          |            |          |
|   |  |   | BMI at age 20 yr              |                  | 1.03 (0.91–1.18)          |            |          |
|   |  |   | BMI change                    |                  | 0.93 (0.80–1.08)          |            |          |



Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period  | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)       | Exposure<br>categories   | Exposed<br>cases          | Relative risk<br>(95% CI)   | Covariates   | Comments  |
|--|--|---|--|---------------------------|---|--|---|
| <a href="#">Schuurman et al. (2000)</a><br>(cont.)   |  | Prostate, well-differentiated                       | BMI, per 2 kg/m <sup>2</sup><br>BMI at baseline<br>BMI at age 20 yr<br>BMI change            | 194 total                 | 0.92 (0.82–1.04)<br>1.09 (0.94–1.26)<br>0.77 (0.65–0.92)                      |  |   |
|  |  | Prostate, moderately differentiated                 | BMI, per 2 kg/m <sup>2</sup><br>BMI at baseline<br>BMI at age 20 yr<br>BMI change            | 247 total                 | 1.02 (0.93–1.13)<br>1.15 (1.01–1.31)<br>0.97 (0.83–1.13)                      |  |   |
|  |  | Prostate, poorly differentiated or undifferentiated | BMI, per 2 kg/m <sup>2</sup><br>BMI at baseline<br>BMI at age 20 yr<br>BMI change            | 174 total                 | 1.01 (0.89–1.14)<br>0.97 (0.83–1.13)<br>0.68 (0.58–0.81)                      |  |   |
| <a href="#">Lee et al. (2001)</a><br>Harvard Alumni Health Study<br>USA<br>1988–1993             | 8922<br>Incidence                                      | Prostate  | BMI at baseline<br>< 22.5<br>22.5–24.9<br>25.0–27.4<br>27.5<br>[ <i>P</i> <sub>trend</sub> ] | 87<br>172<br>134<br>46    | 1.00<br>1.27 (0.94–1.71)<br>1.26 (0.92–1.72)<br>1.02 (0.68–1.53)<br>[0.71]    | Age, smoking, alcohol consumption, paternal history of prostate cancer   | WC also not associated with increased risk<br>BMI at age 18 yr (available for 92% of the men) also not associated with increased risk |
| <a href="#">Rodriguez et al. (2001)</a><br>Cancer Prevention Study I (CPS I)<br>USA<br>1959–1972 | 381 638<br>Mortality                                   | Prostate<br>ICD-7: 177                              | BMI<br>< 25<br>25–29.99<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]                             | 782<br>698<br>110         | 1.00<br>1.02 (0.92–1.14)<br>1.27 (1.04–1.56)<br>[0.06]                        | Age, race, height, education level, exercise, smoking status, family history of prostate cancer  |   |
| <a href="#">Calle et al. (2003)</a><br>Cancer Prevention Study II (CPS II)<br>USA<br>1982–1998   | 404 576<br>Mortality                                   | Prostate  | BMI<br>18.5–24.9<br>25–29.9<br>30–34.9<br>≥ 35<br>[ <i>P</i> <sub>trend</sub> ]              | 1681<br>1971<br>311<br>41 | 1.00<br>1.08 (1.01–1.15)<br>1.20 (1.06–1.36)<br>1.34 (0.98–1.83)<br>[< 0.001] | Age, education level, smoking, physical activity, alcohol consumption, marital status, race, aspirin use, fat consumption, vegetable consumption |   |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period  | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code) | Exposure<br>categories  | Exposed<br>cases   | Relative risk<br>(95% CI)  | Covariates   | Comments  |
|--|--|---|---|--|--|--|---|
| <a href="#">Engeland et al. (2003)</a><br>Norwegian<br>clinical<br>population<br>Norway<br>1963–1999 to 2001 | 951 466<br>Incidence                                   | Prostate<br>ICD-7: 177                        | BMI<br>< 18.5<br>18.5–24.9<br>25–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]  | 147<br>16 720<br>14 524<br>1923  | 0.92 (0.78–1.08)<br>1.00<br>1.07 (1.05–1.09)<br>1.09 (1.04–1.15)<br>[0.001]  | Age at BMI<br>measurement, birth<br>cohort                                   | In stratified analyses by<br>age at BMI measurement,<br>no differences in risk by<br>age strata were observed |
| <a href="#">Jonsson et al. (2003)</a><br>Swedish Twin<br>Registry<br>Sweden<br>1969–2003                     | 8998<br>Incidence                                      | Prostate<br>ICD-7: 177                        | BMI at baseline<br>< 18.5<br>18.5–24.9<br>25.0–29.9<br>≥ 30<br><br>BMI at age 25 yr<br>< 18.5<br>18.5–24.9<br>≥ 25<br><br>BMI at age 40 yr<br>< 18.5<br>18.5–24.9<br>25.0–29.9<br>≥ 30<br><br>Adult weight change (kg)<br>< 0<br>0–5<br>6–10<br>11–20<br>≥ 21 | 6<br>355<br>248<br>22<br><br>4<br>436<br>64<br><br>6<br>368<br>155<br>13<br><br>96<br>178<br>114<br>95<br>21 | 1.4 (0.6–3.1)<br>1.0<br>1.0 (0.8–1.2)<br>1.0 (0.6–1.5)<br><br>0.5 (0.2–1.5)<br>1.0<br>1.0 (0.7–1.3)<br><br>2.5 (1.1–5.5)<br>1.0<br>0.9 (0.7–1.1)<br>0.9 (0.5–1.6)<br><br>0.9 (0.7–1.2)<br>1.0<br>1.0 (0.8–1.3)<br>0.9 (0.7–1.2)<br>1.1 (0.8–1.8) | Age; BMI at age<br>25 yr and 40 yr also<br>controlled for BMI at<br>baseline | No associations were<br>observed in stratified<br>analyses by age at<br>diagnosis (≥ 70 yr vs<br>< 70 yr)     |
| <a href="#">Samanic et al. (2004)</a><br>United States<br>Veterans cohort<br>USA<br>1969–1996                | 4 500 700<br>Incidence                                 | Prostate<br>ICD-9: 185                        | Obesity<br><br>Non-obese<br>Obese<br><br>Non-obese<br>Obese   | Black men:<br>15 272<br>815<br><br>White men:<br>45 901<br>3206  | 1.00<br>1.12 (1.04–1.20)<br><br>1.00<br>1.19 (1.15–1.24)   | Age, calendar year   | Obesity defined as<br>discharge diagnosis of<br>obesity: ICD-8: 277;<br>ICD-9: 278.0                          |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period  | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)                           | Exposure<br>categories   | Exposed<br>cases                              | Relative risk<br>(95% CI)  | Covariates   | Comments  |
|--|--|---|--|---|--|--|---|
| <a href="#">Batty et al. (2005)</a><br>Whitehall Study<br>United Kingdom<br>1967–2002                  | 18 403<br>Mortality                                    | Prostate  | BMI<br>18.5–24.9<br>25.0–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]   | 243<br>175<br>13                              | 1.00<br>0.92 (0.75–1.13)<br>0.91 (0.51–1.63)<br>[0.45]   | Age, employment<br>grade, physical activity,<br>smoking, marital<br>status, prevalent<br>disease, past-year<br>weight loss, BP<br>medication, height,<br>skinfold thickness,<br>systolic BP, plasma<br>cholesterol, glucose<br>intolerance, diabetes |   |
| <a href="#">Rapp et al. (2005)</a><br>Vorarlberg<br>VHM&PP<br>Austria<br>1985–2001                     | 67 447<br>Incidence                                    | Prostate<br>ICD-9: 185  | BMI<br>18.5–24.9<br>25–29.9<br>30–34.9<br>≥ 35<br>[ <i>P</i> <sub>trend</sub> ]  | 446<br>583<br>99<br>10                        | 1.00<br>1.03 (0.91–1.17)<br>0.82 (0.66–1.03)<br>0.73 (0.39–1.37)<br>[0.16]   | Age, smoking status,<br>occupation   |   |
| <a href="#">Gong et al. (2006)</a><br>Prostate Cancer<br>Prevention Trial<br>(PCPT)<br>USA<br>N/A–2003 | 10 258<br>Incidence                                    | Prostate<br><br>Prostate, low-<br>grade<br><br>Prostate, high-<br>grade | BMI<br>< 25<br>25–26.9<br>27–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]<br>BMI<br>< 25<br>25–26.9<br>27–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]<br>BMI<br>< 25<br>25–26.9<br>27–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ] | 1936 total<br><br>1300 total<br><br>521 total | 1.00<br>0.91 (0.79–1.05)<br>0.96 (0.83–1.10)<br>0.96 (0.83–1.10)<br>[0.67]<br>1.00<br>0.88 (0.74–1.04)<br>0.88 (0.75–1.04)<br>0.82 (0.69–0.98)<br>[0.03]<br>1.00<br>0.97 (0.75–1.27)<br>1.09 (0.85–1.40)<br>1.29 (1.01–1.67)<br>[0.04] | Age, race, treatment,<br>diabetes, family history<br>of prostate cancer  | Analyses of the<br>association of WC with<br>total prostate, and low-<br>grade and high-grade<br>subtypes also reported |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period   | Total number<br>of subjects<br>Incidence/<br>mortality                          | Organ site or<br>cancer subtype<br>(ICD code) | Exposure<br>categories   | Exposed<br>cases                                   | Relative risk<br>(95% CI)   | Covariates                              | Comments   |
|---|---|---|--|--|---|---|--|
| <a href="#">Lukanova et al. (2006)</a><br>Northern Sweden<br>Health and<br>Disease Cohort<br>(NSHDC)<br>1985–2003                   | 33 424<br>Incidence/<br>mortality   | Prostate                                      | BMI<br>18.5–23.4<br>23.5–25.3<br>25.4–27.6<br>≥ 27.1<br>[ <i>P</i> <sub>trend</sub> ]  | 93<br>114<br>129<br>125                            | 1.00<br>1.00 (0.76–1.32)<br>0.96 (0.74–1.26)<br>0.89 (0.68–1.16)<br>[0.31]  | Age, calendar year,<br>smoking          |  |
| <a href="#">Samanic et al. (2006)</a><br>Swedish<br>Construction<br>Worker Cohort<br>Sweden<br>1958–1999                            | 362 552<br>Incidence<br><br>107 815 (in<br>BMI change<br>analysis)<br>Incidence | Prostate<br>ICD-7: 177                        | BMI<br>18.5–24.9<br>25–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]<br>6-yr BMI change<br>–4% to 4.9%<br>5–9.9%<br>10–14.9%<br>≥ 15%<br>[ <i>P</i> <sub>trend</sub> ] | 3003<br>3160<br>528<br><br>1281<br>417<br>97<br>22 | 1.00<br>1.06 (1.01–1.12)<br>1.09 (0.99–1.19)<br>[< 0.05]<br>1.00<br>1.09 (0.98–1.22)<br>0.93 (0.75–1.14)<br>0.75 (0.49–1.15)<br>[> 0.5] | Attained age, calendar<br>year, smoking |  |
| <a href="#">Tande et al. (2006)</a><br>Atherosclerosis<br>Risk in<br>Communities<br>(ARIC) Study<br>USA<br>1987–2000                | 6332<br>Incidence   | Prostate                                      | BMI<br>< 24.7<br>24.7–26.9<br>27.0–29.7<br>≥ 29.8  | 94<br>99<br>91<br>101                              | 1.00<br>1.17 (0.88–1.55)<br>0.97 (0.72–1.29)<br>1.14 (0.86–1.50)  | Age, race                               | WC also not associated<br>with increased risk<br>Men with metabolic<br>syndrome were 27% less<br>likely to develop prostate<br>cancer  |
| <a href="#">Fujino et al. (2007)</a><br>Japan<br>Collaborative<br>Cohort Study<br>for Evaluation of<br>Cancer (JACC)<br>Japan<br>NR | NR<br>Mortality   | Prostate                                      | BMI<br>< 18.5<br>18.5–24<br>25–29<br>≥ 30  | 17<br>107<br>31<br>1                               | 1.39 (0.83–2.34)<br>1.00<br>1.56 (1.04–2.34)<br>0.87 (0.12–6.29)  | Age, area of study                      | [No information<br>reported on follow-up<br>period or total number of<br>participants included in<br>the study]<br>Weight at baseline and<br>at age 20 yr also not<br>associated with increased<br>mortality |



**Table 2.2.14a (continued)**

| Reference<br>Cohort<br>Location<br>Follow-up period  | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)        | Exposure<br>categories | Exposed<br>cases | Relative risk<br>(95% CI) | Covariates   | Comments   |                        |        |
|--|--|--|------------------------|------------------|---------------------------|--|--|------------------------|--------|
| <a href="#">Giovannucci et al. (2007)</a><br>Health Professionals<br>Follow-up Study<br>USA<br>1986–2002<br>Updated<br>follow-up from<br><a href="#">Giovannucci et al. (1997)</a> | 47 750<br>Incidence                                    | Prostate   | BMI                    | 3544 total       |                           | Age, time period,<br>BMI at age 21 yr,<br>height, pack-years<br>of smoking, physical<br>activity, family<br>history of prostate<br>cancer, diabetes, race,<br>energy intake, intake<br>of processed meat,<br>fish, $\alpha$ -linolenic acid,<br>tomato sauce, vitamin<br>E supplements | [CI provided only for the<br>last BMI category]<br>No association was<br>observed with BMI for<br>low-grade or high-grade<br>prostate cancer (based on<br>Gleason score) |                        |        |
|  |  |  | < 21                   |                  | 1.00                      |  |  |                        |        |
|  |  |  | 21–22.9                |                  | 1.21                      |  |  |                        |        |
|  |  |  | 23–24.9                |                  | 1.36                      |  |  |                        |        |
|  |  |  | 25–27.4                |                  | 1.24                      |  |  |                        |        |
|  | 47 750<br>Mortality                                    | Prostate   | 27.5–29.9              |                  | 1.24                      |  |  |                        |        |
|  |  |  | $\geq 30$              |                  | 1.13 (0.91–1.41)          |  |  |                        |        |
|  |  |  | [ $P_{\text{trend}}$ ] | 523 total        | [0.84]                    |  |  |                        |        |
|  |  |  | BMI                    |                  | 1.00                      |  |  |                        |        |
|  |  |  | < 21                   |                  | 1.34 (0.79–2.26)          |  |  |                        |        |
| <a href="#">Littman et al. (2007)</a><br>Vitamins and<br>Lifestyle (VITAL)<br>cohort<br>USA<br>2000–2004   | 34 754<br>Incidence                                    | Prostate   | BMI at baseline        |                  |                           | Age, family history of<br>prostate cancer, race,<br>baseline BMI, recent<br>PSA screening  | BMI at ages 18 yr, 30 yr,<br>and 45 yr also not<br>associated with increased<br>risk   |                        |        |
|  |  |  | < 25                   | 218              | 1.0                       |  |  |                        |        |
|  |  |  | 25–29.9                | 435              | 1.1 (0.97–1.4)            |  |  |                        |        |
|  | Prostate, non-<br>aggressive<br>Gleason score<br>< 7   | Prostate, non-<br>aggressive<br>Gleason score<br>< 7 | $\geq 30$              | 155              | 0.87 (0.71–1.1)           |  |  | [ $P_{\text{trend}}$ ] | [0.13] |
|  |  |  | BMI at baseline        |                  |                           |  |  |                        |        |
|  |  |  | < 25                   | 129              | 1.0                       |  |  |                        |        |
|  | Prostate, aggressive<br>Gleason score<br>7–10          | Prostate, aggressive<br>Gleason score<br>7–10        | 25–29.9                | 222              | 0.99 (0.79–1.2)           |  |  | [ $P_{\text{trend}}$ ] | [0.01] |
|  |  |  | $\geq 30$              | 73               | 0.69 (0.52–0.93)          |  |  |                        |        |
|  |  |  | BMI at baseline        |                  |                           |  |  |                        |        |
|  |  |  | < 25                   | 85               | 1.0                       |  |  |                        |        |
| 7–10   | 7–10   | 25–29.9  | 209                    | 1.4 (1.1–1.8)    | [ $P_{\text{trend}}$ ]    | [0.69]   |  |                        |        |
|  |  | $\geq 30$  | 179                    | 1.1 (0.83–1.6)   |                           |  |  |                        |        |

Absence of excess body fatness

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period       | Total number of subjects Incidence/mortality | Organ site or cancer subtype (ICD code) | Exposure categories           | Exposed cases  | Relative risk (95% CI) | Covariates   | Comments  |
|--|--|---|-------------------------------|----------------|------------------------|--|---|
| <a href="#">Littman et al. (2007)</a><br>(cont.) | 34 754<br>Incidence                          | Prostate                                | Weight (lb) at age 18 yr      |                |                        | Age, family history of prostate cancer, race, baseline BMI, recent PSA screening | For non-aggressive prostate cancer, weight at age 18 yr and 30 yr was not associated with an increased risk |
|  |  |   | < 139                         | 166            | 1.0                    |  |   |
|  |  |   | 139–154                       | 203            | 1.2 (0.96–1.5)         |  |   |
|  |  |   | 155–170                       | 198            | 1.1 (0.93–1.4)         |  |   |
|  |  |   | ≥ 171                         | 231            | 1.2 (1.0–1.5)          |  |   |
|  |  |   | [ <i>P</i> <sub>trend</sub> ] |                | [0.08]                 |  |   |
|  |  |   | Weight (lb) at age 30 yr      |                |                        |  |   |
|  |  |   | < 154                         | 174            | 1.0                    |  |   |
|  |  |   | 154–169                       | 192            | 1.2 (0.95–1.4)         |  |   |
|  |  |   | 170–184                       | 188            | 1.1 (0.93–1.4)         |  |   |
|  |  |   | ≥ 185                         | 241            | 1.3 (1.0–1.6)          |  |   |
|  |  |   | [ <i>P</i> <sub>trend</sub> ] |                | [0.03]                 |  |   |
|  |  | Weight (lb) at age 45 yr                |                               |                |                        |  |   |
|  |  | < 165                                   | 194                           | 1.0            |                        |  |   |
|  |  | 165–179                                 | 182                           | 1.0 (0.82–1.2) |                        |  |   |
|  |  | 180–199                                 | 224                           | 1.1 (0.91–1.3) |                        |  |   |
|  |  | ≥ 200                                   | 200                           | 1.1 (0.87–1.3) |                        |  |   |
|  |  | [ <i>P</i> <sub>trend</sub> ]           |                               | [0.46]         |                        |  |   |
|  |  | Weight (lb) at baseline                 |                               |                |                        |  |   |
|  |  | < 173                                   | 211                           | 1.0            |                        |  |   |
| 174–189  | 181  | 1.0 (0.83–1.2)                          |                               |                |                        |  |   |
| 190–214  | 233  | 0.99 (0.82–1.2)                         |                               |                |                        |  |   |
| ≥ 215  | 192  | 0.92 (0.75–1.1)                         |                               |                |                        |  |   |
| [ <i>P</i> <sub>trend</sub> ]                    |  | [0.35]                                  |                               |                |                        |  |   |
| Prostate, non-aggressive<br>Gleason score < 7    |  |   |                               |                |                        |  |   |
| Weight (lb) at baseline                          |  |   |                               |                |                        |  |   |
| < 173  | 130  | 1.00                                    |                               |                |                        |  |   |
| 174–189  | 90   | 0.82 (0.62–1.1)                         |                               |                |                        |  |   |
| 190–214  | 116  | 0.81 (0.63–1.1)                         |                               |                |                        |  |   |
| ≥ 215  | 92   | 0.71 (0.54–0.93)                        |                               |                |                        |  |   |
| [ <i>P</i> <sub>trend</sub> ]                    |  | [0.02]                                  |                               |                |                        |  |   |
| Prostate, aggressive<br>Gleason score 7–10       |  |   |                               |                |                        |  |   |
| Weight (lb) at age 18 yr                         |  |   |                               |                |                        |  |   |
| < 139  | 71   | 1.00                                    |                               |                |                        |  |   |
| 139–154  | 94   | 1.3 (0.92–1.7)                          |                               |                |                        |  |   |
| 155–170  | 89   | 1.2 (0.86–1.6)                          |                               |                |                        |  |   |
| ≥ 171  | 117  | 1.4 (1.0–1.9)                           |                               |                |                        |  |   |
| [ <i>P</i> <sub>trend</sub> ]                    |  | [0.04]                                  |                               |                |                        |  |   |

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period  | Total number of subjects Incidence/mortality | Organ site or cancer subtype (ICD code) | Exposure categories      | Exposed cases | Relative risk (95% CI) | Covariates  | Comments                           |
|---|--|---|--------------------------|---------------|------------------------|---|------------------------------------|
| <a href="#">Littman et al. (2007)</a><br>(cont.)  | 34 754<br>Incidence                          |   | Weight (lb) at age 30 yr |               |                        |   |                                    |
|   |  |   | < 154                    | 72            | 1.0                    |   |                                    |
|   |  |   | 154–169                  | 84            | 1.2 (0.90–1.7)         |   |                                    |
|   |  |   | 170–184                  | 93            | 1.4 (0.99–1.9)         |   |                                    |
|   |  |   | ≥ 185                    | 119           | 1.5 (1.1–2.0)          |   |                                    |
|   |  |   | $[P_{\text{trend}}]$     |               | [0.01]                 |   |                                    |
|   |  |   | Weight (lb) at age 45 yr |               |                        |   |                                    |
|   |  |   | < 165                    | 72            | 1.0                    |   |                                    |
|   |  |   | 165–179                  | 86            | 1.3 (0.93–1.8)         |   |                                    |
|   |  |   | 180–199                  | 111           | 1.5 (1.1–2.0)          |   |                                    |
|   |  |   | ≥ 200                    | 102           | 1.4 (1.1–2.0)          |   |                                    |
|   |  |   | $[P_{\text{trend}}]$     |               | [0.032]                |   |                                    |
| Weight (lb) at baseline   |  |   |                          |               |                        | Weight gain since age 18 yr not associated with risk of incidence |                                    |
| < 173   | 78   | 1.0                                     |                          |               |                        |   |                                    |
| 174–189   | 87   | 1.3 (0.96–1.8)                          |                          |               |                        |   |                                    |
| 190–214   | 115  | 1.3 (0.97–1.7)                          |                          |               |                        |   |                                    |
| ≥ 215   | 98   | 1.3 (0.93–1.7)                          |                          |               |                        |   |                                    |
| $[P_{\text{trend}}]$  |  | [0.23]                                  |                          |               |                        |   |                                    |
| <a href="#">Máchová et al. (2007)</a><br>National Cancer Registry<br>Nested case–control study in the population of the Šumperk District<br>Czech Republic<br>1987–2002 | 17 334<br>Incidence                          | Prostate<br>ICD-10: C61                 | BMI                      |               | 338 total              |   | Age, smoking, hypertension, height |
|   |  |   | 18.5–24.9                |               | 1.00                   |   |                                    |
|   |  |   | 25–29.9                  |               | 1.05 (0.72–1.39)       |   |                                    |
|   |  |   | ≥ 30                     |               | 0.97 (0.66–1.41)       |   |                                    |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period                   | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)                                  | Exposure<br>categories  | Exposed<br>cases                               | Relative risk<br>(95% CI)  | Covariates  | Comments   |
|---|--|--|---|--|--|---|--|
| <a href="#">Rodriguez et al. (2007)</a>                               | 69 991<br>Incidence                                    | Prostate   | BMI<br>< 25<br>25–27.4<br>27.5–29.9<br>30–34.9<br>≥ 35<br>[ <i>P</i> <sub>trend</sub> ]   | 1935<br>1742<br>920<br>556<br>99               | 1.00<br>1.02 (0.96–1.09)<br>0.98 (0.90–1.06)<br>0.94 (0.85–1.04)<br>0.91 (0.75–1.12)<br>[0.14]                               | Age, race, education level, family history of prostate cancer, energy intake, smoking status, PSA testing, diabetes, physical activity; | When stratifying by subtype, weight change also not associated with increased risk for any subtype |
| Cancer Prevention Study II (CPS II) Nutrition Cohort USA<br>1992–2003 |  |  | Weight change (lb), 1982–1992<br>≥ 21 loss<br>11–20 loss<br>6–19 loss<br>5 loss to 5 gain<br>6–10 gain<br>11–20 gain<br>≥ 21 gain | 113<br>349<br>541<br>2450<br>751<br>687<br>322 | 0.84 (0.69–1.02)<br>0.84 (0.75–0.95)<br>0.98 (0.89–1.08)<br>1.00<br>0.98 (0.90–1.06)<br>0.97 (0.89–1.05)<br>0.89 (0.79–1.00) | Weight change also adjusted for BMI in 1982 and height  |  |
|   |  | Prostate, non-metastatic, low-grade<br>TNM: T1–3, N0, M0<br>Gleason score ≤ 8  | BMI<br>< 25<br>25–27.4<br>27.5–29.9<br>30–34.9<br>≥ 35<br>[ <i>P</i> <sub>trend</sub> ]   | 1544<br>1409<br>700<br>412<br>73               | 1.00<br>1.03 (0.96–1.10)<br>0.92 (0.84–1.01)<br>0.86 (0.77–0.97)<br>0.84 (0.66–1.06)<br>[0.002]                              |   |  |
|   |  | Prostate, non-metastatic high-grade<br>TNM: T1–3, N0, M0<br>Gleason score > 8  | BMI<br>< 25<br>25–27.4<br>27.5–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]  | 239<br>180<br>140<br>103                       | 1.00<br>0.87 (0.72–1.06)<br>1.23 (1.00–1.53)<br>1.22 (0.96–1.55)<br>[0.03]   |   |  |
|   | 69 991<br>Incidence or mortality                       | Prostate, metastatic or fatal<br>TNM: T4, Nx, Mx or Tx, N1–2, Mx or Tx, Nx, M1 | BMI<br>< 25<br>25–27.4<br>27.5–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]  | 92<br>104<br>46<br>46                          | 1.00<br>1.41 (1.06–1.87)<br>1.14 (0.79–1.63)<br>1.54 (1.06–2.23)<br>[0.05]   |   |  |



Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period                                  | Total number of subjects Incidence/mortality | Organ site or cancer subtype (ICD code) | Exposure categories   | Exposed cases | Relative risk (95% CI) | Covariates | Comments  |
|---|--|---|---|---------------|------------------------|------------|---|
| <a href="#">Wright et al. (2007)</a><br>NIH-AARP cohort<br>USA<br>1995–2000 | 172 961<br>Incidence                         | Prostate<br>ICD-9: 185<br>ICD-10: C61   | BMI   |               |                        |            | Age, race, smoking status, education level, diabetes, family history of prostate cancer<br>For BMI at age 18 yr, also BMI at baseline, height |
|   |  |   | < 25  | 3076          | 1.00                   |            |   |
|   |  |   | 25–29.9   | 5054          | 1.00 (0.95–1.04)       |            |   |
|   |  |   | 30–34.9   | 1532          | 0.97 (0.91–1.03)       |            |   |
|   |  |   | 35–39.9   | 269           | 0.84 (0.74–0.95)       |            |   |
|   |  |   | ≥ 40  | 55            | 0.65 (0.50–0.85)       |            |   |
|   |  |   | [ <i>P</i> <sub>trend</sub> ]   |               | [0.0008]               |            |   |
|   |  |   | BMI at age 18 yr  |               |                        |            |   |
|   |  |   | < 18.5  | 723           | 0.95 (0.87–1.04)       |            |   |
|   |  |   | 18.5–20.9   | 1787          | 1.00                   |            |   |
|   |  |   | 21–22.9   | 1510          | 1.01 (0.95–1.09)       |            |   |
|   |  |   | 23–24.9   | 775           | 0.90 (0.83–0.98)       |            |   |
|   |  |   | ≥ 25  | 641           | 0.93 (0.84–1.02)       |            |   |
|   |  |   | [ <i>P</i> <sub>trend</sub> ]   |               | [0.17]                 |            |   |
|   |  |   | Weight (kg) at age 18 yr, quintiles   |               |                        |            |   |
|   |  |   | < 58.6  | 1004          | 1.0                    |            |   |
|   |  |   | 58.7–64.5   | 1338          | 1.01 (0.93–1.10)       |            |   |
| 64.6–69.9   | 1043   | 0.99 (0.91–1.09)                        |   |               |                        |            |   |
| 70–76.7   | 1138   | 0.99 (0.91–1.09)                        |   |               |                        |            |   |
| > 76.7  | 1071   | 0.92 (0.84–1.02)                        |   |               |                        |            |   |
| [ <i>P</i> <sub>trend</sub> ]   |  | [0.08]                                  |   |               |                        |            |   |
| Weight (kg) at baseline, quintiles  |  |   |   |               |                        |            |   |
| < 74.5  | 1126   | 1.0                                     |   |               |                        |            |   |
| 74.6–81.3   | 1224   | 1.02 (0.93–1.11)                        |   |               |                        |            |   |
| 81.4–87.2   | 1204   | 1.01 (0.92–1.10)                        |   |               |                        |            |   |
| 87.3–97.2   | 1157   | 1.00 (0.91–1.09)                        |   |               |                        |            |   |
| > 97.2  | 1014   | 0.91 (0.82–1.00)                        |   |               |                        |            |   |
| [ <i>P</i> <sub>trend</sub> ]   |  | [0.99]                                  |   |               |                        |            |   |
|   |  |   | Weight at baseline also not associated with increased risk for localized and with metastatic prostate cancer subtypes |               |                        |            |   |

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period      | Total number of subjects Incidence/mortality | Organ site or cancer subtype (ICD code)        | Exposure categories                       | Exposed cases | Relative risk (95% CI) | Covariates   | Comments  |   |  |   |
|---|--|--|---|---------------|------------------------|--|---|---|--|---|
| <a href="#">Wright et al. (2007)</a><br>(cont.) | 172 961<br>Incidence                         | Prostate, localized<br>TNM: T1a to T2b, N0, M0 | Weight change (kg), age 18 yr to baseline |               |                        |  |   | Weight change also not associated with increased risk for localized and for extraprostatic prostate cancer subtypes |  |   |
|   |  |  | < -4                                      | 161           | 1.00 (0.83–1.19)       |  |   |   |  |   |
|   |  |  | -4 to 3.9                                 | 430           | 1.0                    |  |   |   |  |   |
|   |  |  | 4–9.9                                     | 936           | 1.04 (0.93–1.17)       |  |   |   |  |   |
|   |  |  | 10–19.9                                   | 1896          | 1.12 (1.00–1.24)       |  |   |   |  |   |
|   |  |  | 20–29.9                                   | 1425          | 1.12 (1.00–1.26)       |  |   |   |  |   |
|   |  |  | 30–39.9                                   | 469           | 0.99 (0.87–1.14)       |  |   |   |  |   |
|   |  |  | ≥ 40                                      | 277           | 1.03 (0.88–1.20)       |  |   |   |  |   |
|   |  |  | [ <i>P</i> <sub>trend</sub> ]             |               | [0.81]                 |  |   |   |  |   |
|   |  |  | BMI                                       |               |                        |  |   |   |  | Age, race, smoking status, education level, diabetes, family history of prostate cancer<br>For BMI at age 18 yr, also BMI at baseline, height |
|   |  |  | < 25                                      | 2652          | 1.00                   |  |   |   |  |   |
|   |  |  | 25–29.9                                   | 4328          | 0.99 (0.94–1.04)       |  |   |   |  |   |
|   |  |  | 30–34.9                                   | 1277          | 0.94 (0.88–1.01)       |  |   |   |  |   |
|   |  |  | 35–39.9                                   | 236           | 0.86 (0.75–0.98)       |  |   |   |  |   |
|   |  |  | ≥ 40                                      | 48            | 0.67 (0.50–0.89)       |  |   |   |  |   |
|   |  |  | [ <i>P</i> <sub>trend</sub> ]             |               | [0.0006]               |  |   |   |  |   |
|   |  |  | BMI at age 18 yr                          |               |                        |  |   |   |  |   |
|   |  |  | < 18.5                                    | 633           | 0.95 (0.86–1.04)       |  |   |   |  |   |
|   |  |  | 18.5–20.9                                 | 1570          | 1.0                    |  |   |   |  |   |
|   |  |  | 21–22.9                                   | 1317          | 1.01 (0.94–1.09)       |  |   |   |  |   |
|   |  |  | 23–24.9                                   | 653           | 0.87 (0.80–0.96)       |  |   |   |  |   |
|   |  |  | ≥ 25                                      | 535           | 0.89 (0.80–0.99)       |  |   |   |  |   |
|   |  |  | [ <i>P</i> <sub>trend</sub> ]             |               | [0.04]                 |  |   |   |  |   |
| Weight (kg) at age 18 yr, quintiles             |  |  |   |               |                        | Age, race, smoking status, education level, diabetes, family history of prostate cancer, BMI, height |   |   |  |   |
| < 58.6  | 881  | 0.95 (0.86–1.04)                               |   |               |                        |  |   |   |  |   |
| 58.7–64.5                                       | 1185   | 1.00   |   |               |                        |  |   |   |  |   |
| 64.6–69.9                                       | 903  | 1.01 (0.94–1.09)                               |   |               |                        |  |   |   |  |   |
| 70–76.7   | 988  | 0.87 (0.80–0.96)                               |   |               |                        |  |   |   |  |   |
| > 76.7  | 891  | 0.89 (0.80–0.99)                               |   |               |                        |  |   |   |  |   |
| [ <i>P</i> <sub>trend</sub> ]                   |  | [0.04]   |   |               |                        |  |   |   |  |   |
| BMI   |  |  |   |               |                        |  | Age, race, smoking status, education level, diabetes, family history of prostate cancer<br>For BMI at age 18 yr, also BMI, height |   |  |   |
| < 25  | 424  | 1.0  |   |               |                        |  |   |   |  |   |
| 25–29.9   | 726  | 1.03 (0.91–1.16)                               |   |               |                        |  |   |   |  |   |
| 30–34.9   | 255  | 1.14 (0.97–1.33)                               |   |               |                        |  |   |   |  |   |
| ≥ 35  | 40   | 0.68 (0.49–0.94)                               |   |               |                        |  |   |   |  |   |
| [ <i>P</i> <sub>trend</sub> ]                   |  | [0.64]   |   |               |                        |  |   |   |  |   |

**Table 2.2.14a (continued)**

| Reference Cohort Location Follow-up period                                  | Total number of subjects Incidence/ mortality | Organ site or cancer subtype (ICD code) | Exposure categories                       | Exposed cases | Relative risk (95% CI) | Covariates | Comments   |
|---|---|---|---|---------------|------------------------|------------|--|
| <a href="#">Wright et al. (2007)</a><br>(cont.)                             | 172 961 Incidence                             |   | BMI at age 18 yr                          |               |                        |            |  |
|   |   |   | < 18.5                                    | 90            | 0.98 (0.77–1.26)       |            |  |
|   |   |   | 18.5–20.9                                 | 217           | 1.00                   |            |  |
|   |   |   | 21–22.9                                   | 193           | 1.04 (0.86–1.27)       |            |  |
|   |   |   | 23–24.9                                   | 122           | 1.11 (0.88–1.39)       |            |  |
|   |   |   | ≥ 25                                      | 106           | 1.15 (0.90–1.47)       |            |  |
|   |   |   | [ <i>P</i> <sub>trend</sub> ]             |               | [0.18]                 |            |  |
|   |   |   | Weight (kg) at age 18 yr, quintiles       |               |                        |            | Age, race, smoking status, education level, diabetes, family history of prostate cancer, BMI, height |
|   |   |   | < 58.6                                    | 123           | 1.0                    |            |  |
|   |   |   | 58.7–64.5                                 | 153           | 0.95 (0.74–1.20)       |            |  |
|   |   |   | 64.6–69.9                                 | 140           | 1.08 (0.84–1.38)       |            |  |
|   |   |   | 70–76.7                                   | 150           | 1.03 (0.80–1.33)       |            |  |
|   |   |   | > 76.7                                    | 180           | 1.18 (0.91–1.54)       |            |  |
|   |   |   | [ <i>P</i> <sub>trend</sub> ]             |               | [0.13]                 |            |  |
| <a href="#">Wright et al. (2007)</a><br>NIH-AARP cohort<br>USA<br>1995–2000 | Mortality                                     | Prostate<br>ICD-9: 185<br>ICD-10: C61   | BMI                                       |               |                        |            |  |
|   |   |   | < 25                                      | 44            | 1.0                    |            |  |
|   |   |   | 25–29.9                                   | 87            | 1.25 (0.87–1.80)       |            |  |
|   |   |   | 30–34.9                                   | 31            | 1.46 (0.92–2.33)       |            |  |
|   |   |   | ≥ 35                                      | 11            | 2.12 (1.08–4.15)       |            |  |
|   |   |   | [ <i>P</i> <sub>trend</sub> ]             |               | [0.02]                 |            |  |
|   |   |   | BMI at age 18 yr                          |               |                        |            |  |
|   |   |   | < 18.5                                    | 13            | 1.67 (0.82–3.42)       |            |  |
|   |   |   | 18.5–20.9                                 | 18            | 1.0                    |            |  |
|   |   |   | 21–22.9                                   | 25            | 1.65 (0.90–3.02)       |            |  |
|   |   |   | 23–24.9                                   | 16            | 1.71 (0.86–3.39)       |            |  |
|   |   |   | ≥ 25                                      | 11            | 1.35 (0.62–2.95)       |            |  |
|   |   |   | [ <i>P</i> <sub>trend</sub> ]             |               | [0.73]                 |            |  |
|   |   |   | Weight change (kg), age 18 yr to baseline |               |                        |            | Age, race, smoking status, education level, diabetes, family history of prostate cancer, BMI, height |
|   |   |   | < -4                                      | 3             | 1.18 (0.29–4.74)       |            |  |
|   |   |   | -4 to 3.9                                 | 6             | 1.0                    |            |  |
|   |   |   | 4–9.9                                     | 12            | 1.06 (0.40–2.83)       |            |  |
|   |   |   | 10–19.9                                   | 23            | 1.17 (0.47–2.92)       |            |  |
| 20–29.9   | 24  | 1.74 (0.69–4.40)                        |   |               |                        |            |  |
| 30–39.9   | 10  | 2.05 (0.72–5.90)                        |   |               |                        |            |  |
| 40  | 8   | 2.98 (0.99–9.04)                        |   |               |                        |            |  |
| [ <i>P</i> <sub>trend</sub> ]   |   | [0.009]                                 |   |               |                        |            |  |

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period   | Total number of subjects Incidence/mortality | Organ site or cancer subtype (ICD code)                 | Exposure categories   | Exposed cases                  | Relative risk (95% CI)   | Covariates   | Comments   |
|--|--|---|---|--------------------------------|--|--|--|
| <a href="#">Jee et al. (2008)</a><br>National Health Insurance Corporation (NHIC) medical evaluation Republic of Korea 1992–2006 | 770 556<br>Incidence                         | Prostate  | BMI<br>< 20.0<br>20.0–22.9<br>23.0–24.9<br>25.0–29.9<br>≥ 30.0<br>[ <i>P</i> <sub>trend</sub> ]                                     | 265<br>896<br>747<br>638<br>23 | 0.67 (0.56–0.80)<br>0.87 (0.77–0.98)<br>1.00<br>0.95 (0.83–1.08)<br>1.39 (0.90–2.17)<br>[< 0.0001]                 | Age, smoking   |  |
| <a href="#">Pischon et al. (2008)</a><br>EPIC cohort 8 European countries, 1992–2000 (8.5 yr follow-up on average)               | 129 502<br>Incidence                         | Prostate<br>ICD-10: C61                                 | BMI, quintiles<br>< 23.6<br>23.6–25.3<br>25.4–27<br>27.1–29.3<br>≥ 29.4<br>[ <i>P</i> <sub>trend</sub> ]<br>per 5 kg/m <sup>2</sup> | 2446 total                     | 1.00<br>1.06 (0.93–1.20)<br>1.08 (0.95–1.23)<br>0.95 (0.83–1.09)<br>0.99 (0.86–1.13)<br>[0.37]<br>0.96 (0.90–1.02) | Study centre, age, smoking status, education level, alcohol consumption, physical activity, height | Also examined hip circumference and waist-to-hip ratio<br>WC also not associated with increased risk |
|  |  | Prostate, localized<br>TNM: T0–T2 and N0/Nx, M0         | BMI, quintiles<br>< 23.6<br>23.6–25.3<br>25.4–27<br>27.1–29.3<br>≥ 29.4<br>[ <i>P</i> <sub>trend</sub> ]<br>continuous              | 991 total                      | 1.00<br>1.09 (0.89–1.34)<br>1.02 (0.83–1.25)<br>0.88 (0.71–1.10)<br>0.95 (0.77–1.18)<br>[0.22]<br>0.92 (0.84–1.01) | Study centre, age, smoking status, education level, alcohol consumption, physical activity, height | WC also not associated with increased risk   |
|  |  | Prostate, advanced<br>TNM: T3–T4 and/or N1–N3 and/or M1 | BMI<br>< 23.6<br>23.6–25.3<br>25.4–27<br>27.1–29.3<br>≥ 29.4<br>[ <i>P</i> <sub>trend</sub> ]<br>continuous                         | 499 total                      | 1.00<br>1.05 (0.78–1.40)<br>1.25 (0.94–1.66)<br>1.08 (0.81–1.46)<br>1.17 (0.86–1.58)<br>[0.34]<br>1.09 (0.96–1.24) | Study centre, age, smoking status, education level, alcohol consumption, physical activity, height | WC also not associated with increased risk   |



Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period  | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)    | Exposure<br>categories        | Exposed<br>cases | Relative risk<br>(95% CI) | Covariates   | Comments   |
|--|--|--|-------------------------------|------------------|---------------------------|--|--|
| <a href="#">Pischon et al. (2008)</a><br>(cont.)   | 129 502<br>Incidence                                   | Prostate, low-<br>grade<br>Gleason score<br>< 7  | BMI                           | 841 total        | 1.00                      | Study centre, age,<br>smoking status,<br>education level, alcohol<br>consumption, physical<br>activity, height | WC also not associated<br>with increased risk  |
|  |  |  | < 23.6                        |                  | 0.97 (0.78–1.21)          |  |  |
|  |  |  | 23.6–25.3                     |                  | 0.95 (0.77–1.19)          |  |  |
|  |  |  | 25.4–27                       |                  | 0.83 (0.66–1.04)          |  |  |
|  |  |  | 27.1–29.3                     |                  | 0.84 (0.66–1.06)          |  |  |
|  |  |  | ≥ 29.4                        |                  | [0.06]                    |  |  |
|  |  |  | [ <i>P</i> <sub>trend</sub> ] |                  | 0.88 (0.79–0.98)          |  |  |
|  |  | Prostate, high-<br>grade<br>Gleason score<br>≥ 7 | BMI                           | 580 total        | 1.00                      | Study centre, age,<br>smoking status,<br>education level, alcohol<br>consumption, physical<br>activity, height | WC also not associated<br>with increased risk  |
|  |  |  | < 23.6                        |                  | 1.26 (0.96–1.65)          |  |  |
|  |  |  | 23.6–25.3                     |                  | 1.34 (1.02–1.76)          |  |  |
|  |  |  | 25.4–27                       |                  | 1.16 (0.87–1.54)          |  |  |
|  |  |  | 27.1–29.3                     |                  | 1.23 (0.92–1.65)          |  |  |
|  |  |  | ≥ 29.4                        |                  | [0.37]                    |  |  |
|  |  |  | [ <i>P</i> <sub>trend</sub> ] |                  | 1.04 (0.92–1.18)          |  |  |
| <a href="#">Rapp et al. (2008)</a><br>VHM&PP<br>Austria<br>1985–2002                               | 28 711<br>Incidence                                    | Prostate<br>ICD-10: C61                          | BMI change, annual            |                  |                           | Age, smoking status,<br>blood glucose,<br>occupational group,<br>BMI at baseline                               |  |
|  |  |  | < –0.1                        | 164              | 0.96 (0.79–1.16)          |  |  |
|  |  |  | –0.1– < 0.1                   | 317              | 1.00                      |  |  |
|  |  |  | 0.1– < 0.3                    | 231              | 1.00 (0.85–1.19)          |  |  |
|  |  |  | 0.3– < 0.5                    | 72               | 1.01 (0.78–1.31)          |  |  |
|  |  |  | ≥ 0.5                         | 12               | 0.43 (0.24–0.76)          |  |  |
|  |  |  | [ <i>P</i> <sub>trend</sub> ] |                  | [0.06]                    |  |  |
| <a href="#">Hernandez et al. (2009)</a><br>Multiethnic<br>Cohort<br>USA<br>1993/1996–<br>2002/2005 | 83 879<br>Incidence                                    | Prostate,<br>advanced                            | BMI at age 21 yr              |                  |                           |  | No associations were<br>observed with high grade<br>either                             |
|  |  |  | < 18.5                        | 41               | 0.96 (0.69–1.35)          |  | Inverse associations were<br>observed with localized<br>and with low-grade<br>subtypes |
|  |  |  | 18.5–24.9                     | 475              | 1.00                      |  |  |
|  |  |  | ≥ 25.0                        | 86               | 1.09 (0.85–1.40)          |  |  |
|  |  |  | [ <i>P</i> <sub>trend</sub> ] |                  | [0.46]                    |  |  |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period  | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)  | Exposure<br>categories  | Exposed<br>cases       | Relative risk<br>(95% CI)  | Covariates   | Comments                                      |
|--|--|--|---|------------------------|--|--|---|
| <a href="#">Wallström et al. (2009)</a><br>Malmö Diet and<br>Cancer Study<br>Sweden<br>1991–2005   | 11 063<br>Incidence                                    | Prostate<br>ICD-9: 185   | BMI<br>< 18.5<br>18.5–24.9<br>25–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]  | 8<br>287<br>417<br>105 | 2.29 (1.13–4.63)<br>1.00<br>1.02 (0.88–1.19)<br>1.06 (0.84–1.33)<br>[0.15] | Age, height,<br>cohabitation<br>status, SES, alcohol<br>consumption,<br>smoking, prevalent<br>diabetes, physical<br>activity, country of<br>birth, total intake of<br>eicosapentaenoic acid,<br>docosahexaenoic acid,<br>red meat, calcium | WC also not associated<br>with increased risk |
|  |  | Prostate,<br>aggressive<br>TNM: T3–T4,<br>or N1 or M1, or<br>Gleason score<br>≥ 8, or PSA<br>> 50 ng/mL            | BMI<br>< 18.5<br>18.5–24.9<br>25–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]  | 4<br>102<br>140<br>35  | 3.15 (1.15–8.62)<br>1.00<br>0.99 (0.76–1.29)<br>1.02 (0.69–1.52)<br>[0.16] |  | WC also not associated<br>with increased risk |
|  |  | Prostate, non-<br>aggressive<br>Not stage T3–<br>T4, or N1 or M1,<br>or Gleason score<br>≥ 8, or PSA<br>> 50 ng/mL | BMI<br>< 18.5<br>18.5–24.9<br>25–29.9<br>≥ 30<br>[ <i>P</i> <sub>trend</sub> ]  | 4<br>183<br>274<br>69  | 0.84 (0.63–1.11)<br>1.00<br>1.16 (0.89–1.50)<br>1.11 (0.85–1.44)<br>[0.65] |  | WC also not associated<br>with increased risk |
| <a href="#">Whitlock et al. (2009)</a><br>Prospective<br>Studies<br>Collaboration<br>(pooled analysis<br>of 57 cohorts from<br>Europe, Japan,<br>and the USA)<br>Follow-up varied<br>by cohort | 894 576<br>Mortality                                   | Prostate<br>ICD-9: 185   | BMI, per 5 kg/m <sup>2</sup><br>For BMI 15–25<br>For BMI 25–50<br>For BMI 15–50 | 578<br>665             | 1.00 (0.75–1.32)<br>1.09 (0.91–1.31)<br>1.13 (1.02–1.24)                   | Study, sex, age,<br>smoking  |   |

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period   | Total number of subjects Incidence/ mortality | Organ site or cancer subtype (ICD code) | Exposure categories            | Exposed cases    | Relative risk (95% CI)  | Covariates  | Comments   |  |
|--|---|---|--------------------------------|------------------|-------------------------|---|--|--|
| <a href="#">Andreotti et al. (2010)</a><br>Agricultural Health Study USA<br>1993–2005                | 39 628<br>Incidence                           | Prostate                                | BMI                            |                  |                         | Race, smoking status, exercise, family history of prostate cancer |  |  |
|  |   |   | < 18.5                         | 0                | –                       |   |  |  |
|  |   |   | 18.5–24.9                      | 308              | 1.00                    |   |  |  |
|  |   |   | 25–29.9                        | 696              | 1.06 (0.89–1.27)        |   |  |  |
|  |   |   | 30–34.9                        | 226              | 0.89 (0.71–1.13)        |   |  |  |
| ≥ 35   | 44  | 0.94 (0.61–1.44)                        |                                |                  |                         |   |  |  |
|  |   |   |                                |                  | [0.56]                  |   |  |  |
| <a href="#">Burton et al. (2010)</a><br>Glasgow Alumni Cohort<br>United Kingdom<br>1948–1968 to 2009 | 9549<br>Incidence                             | Prostate<br>ICD-9: 185<br>ICD-10: C61   | BMI, young adult (age < 30 yr) |                  |                         | Smoking, SES, height  |  |  |
|  |   |   | < 19                           | 25               | 1.30 (0.84–1.99)        |   |  |  |
|  |   |   | 19–22.9                        | 125              | 1.00                    |   |  |  |
|  |   |   | 23–24.9                        | 33               | 1.14 (0.78–1.68)        |   |  |  |
|  |   |   | ≥ 25                           | 14               | 1.18 (0.68–2.06)        |   |  |  |
|  |   |   |                                |                  |                         | per 1 kg/m <sup>2</sup>   | 1.00 (0.93–1.06)   |  |
|  |   |   |                                |                  |                         | [P <sub>trend</sub> ]   | [0.89]   |  |
|  | 9549<br>Mortality                             | Prostate<br>ICD-9: 185<br>ICD-10: C61   | BMI, young adult (age < 30 yr) |                  |                         |   |  |  |
|  |   |   | < 19                           | 14               | 1.58 (0.88–2.83)        |   |  |  |
|  |   |   | 19–22.9                        | 59               | 1.00                    |   |  |  |
| 23–24.9  |   |   | 21                             | 1.52 (0.92–2.50) |                         |   |  |  |
| ≥ 25   |   |   | 8                              | 1.43 (0.68–3.00) |                         |   |  |  |
|  |   |   |                                |                  | per 1 kg/m <sup>2</sup> | 1.02 (0.93–1.11)  |  |  |
|  |   |   |                                |                  | [P <sub>trend</sub> ]   | [0.74]  |  |  |
| <a href="#">Stocks et al. (2010)</a><br>Swedish Construction Worker Cohort<br>Sweden<br>1971–2004    | 336 159<br>Mortality                          | Prostate<br>ICD-7: 177                  | BMI                            |                  |                         | Birth cohort, smoking   | No association of BMI with incidence of prostate (total), or aggressive prostate cancer subtypes. Significant negative association observed between BMI and incidence for non-aggressive prostate cancer subtype |  |
|  |   |   | < 21.9                         | 230              | 1.00                    |   |  |  |
|  |   |   | 21.9– < 23.5                   | 383              | 1.17 (1.00–1.39)        |   |  |  |
|  |   |   | 23.5– < 25                     | 476              | 1.09 (0.93–1.27)        |   |  |  |
|  |   |   | 25– < 27                       | 702              | 1.26 (1.08–1.46)        |   |  |  |
|  |   |   | ≥ 27                           | 810              | 1.28 (1.11–1.49)        |   |  |  |
|  |   |   |                                |                  | [P <sub>trend</sub> ]   | [0.0004]  |  |  |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period              | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)   | Exposure<br>categories | Exposed<br>cases | Relative risk<br>(95% CI) | Covariates  | Comments  |
|--|--|---|------------------------|------------------|---------------------------|---|---|
| <a href="#">Discacciati et al. (2011)</a><br>Sweden<br>1998–2008 | Incidence  | Prostate,<br>localized<br>TNM: T1–2<br>and NX–0 and<br>MX–0 or PSA<br>< 20 ng/mL or<br>Gleason score<br>< 7 | BMI at baseline        |                  |                           |   | BMI at age 30 yr, age,<br>energy intake, physical<br>activity, education<br>level, smoking, family<br>history of prostate<br>cancer, diabetes |
|  |  |   | < 21                   | 62               | 0.78 (0.54–1.13)          |   |   |
|  |  |   | 21–22.9                | 245              | 1.00                      |   |   |
|  |  |   | 23–24.9                | 401              | 1.00 (0.94–1.06)          |   |   |
|  |  |   | 25–27.4                | 467              | 0.95 (0.86–1.05)          |   |   |
|  |  |   | 27.5–29.9              | 204              | 0.88 (0.76–1.02)          |   |   |
|  |  |   | ≥ 30                   | 124              | 0.71 (0.53–0.94)          |   |   |
|  |  |   | BMI at age 30 yr       |                  |                           |   |   |
|  |  | < 21  | 287                    | 1.01 (0.91–1.12) |                           |   |   |
|  |  | 21–22.9   | 539                    | 1.00             |                           |   |   |
|  |  | 23–24.9   | 467                    | 0.99 (0.94–1.05) |                           |   |   |
|  |  | 25–27.4   | 154                    | 0.99 (0.89–1.10) |                           |   |   |
|  |  | 27.5–29.9   | 41                     | 0.98 (0.82–1.16) |                           |   |   |
|  |  | ≥ 30  | 15                     | 0.96 (0.69–1.34) |                           |   |   |
|  |  | per 5 kg/m <sup>2</sup>   |                        | 0.98 (0.87–1.12) |                           |   |   |
|  |  | Prostate,<br>advanced<br>TNM: T3–4<br>and NX–1 and<br>MX–1 or PSA<br>> 100 ng/mL or<br>Gleason score<br>> 7 | BMI at baseline        |                  |                           | BMI at age 30 yr, age,<br>energy intake, physical<br>activity, education<br>level, smoking, family<br>history of prostate<br>cancer, diabetes |   |
| < 21   | 27   |   | 0.97 (0.85–1.10)       |                  |                           |   |   |
| 21–22.9  | 72   |   | 1.00                   |                  |                           |   |   |
| 23–24.9  | 163  |   | 1.02 (0.95–1.08)       |                  |                           |   |   |
| 25–27.4  | 150  |   | 1.03 (0.90–1.18)       |                  |                           |   |   |
| 27.5–29.9  | 79   |   | 1.05 (0.85–1.31)       |                  |                           |   |   |
| ≥ 30   | 47   |   | 1.11 (0.73–1.68)       |                  |                           |   |   |
| per 5 kg/m <sup>2</sup>  |  |   | 1.04 (0.88–1.22)       |                  |                           |   |   |
| BMI at age 30 yr   |  |   |                        |                  |                           |   |   |
| < 21   | 108  |   | 1.09 (0.92–1.29)       |                  |                           |   |   |
| 21–22.9  | 185  |   | 1.00                   |                  |                           |   |   |
| 23–24.9  | 164  |   | 0.96 (0.88–1.04)       |                  |                           |   |   |
| 25–27.4  | 69   |   | 0.91 (0.77–1.09)       |                  |                           |   |   |
| 27.5–29.9  | 8  |   | 0.87 (0.65–1.15)       |                  |                           |   |   |
| ≥ 30   | 4  |   | 0.76 (0.44–1.30)       |                  |                           |   |   |
| per 5 kg/m <sup>2</sup>  |  |   | 0.90 (0.73–1.11)       |                  |                           |   |   |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period   | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)   | Exposure<br>categories  | Exposed<br>cases                 | Relative risk<br>(95% CI)  | Covariates   | Comments  |
|---|--|---|---|----------------------------------|--|--|---|
| <a href="#">Discacciati et al. (2011)</a><br>(cont.)  | 36 959<br>Mortality                                    | Prostate  | BMI at baseline<br>< 21<br>21–22.9<br>23–24.9<br>25–27.4<br>27.5–29.9<br>≥ 30<br>per 5 kg/m <sup>2</sup>      | 11<br>35<br>62<br>59<br>29<br>23 | 0.91 (0.75–1.11)<br>1.00<br>1.05 (0.95–1.16)<br>1.11 (0.89–1.36)<br>1.16 (0.83–1.63)<br>1.34 (0.70–2.55)<br>1.12 (0.87–1.43) | BMI at age 30 yr, age, energy intake, physical activity, education level, smoking, family history of prostate cancer, diabetes | BMI at age 30 yr also not associated with increased risk  |
| <a href="#">Bassett et al. (2012)</a><br>Melbourne<br>Collaborative<br>Cohort Study<br>(MCCS)<br>Australia<br>1990–2004<br>Same cohort as<br><a href="#">MacInnis et al. (2003)</a> | 16 525<br>Incidence                                    | Prostate<br>ICD-9: 185<br>ICD-10: C61   | BMI at baseline<br>< 18.5<br>18.5–22.9<br>23–24.9<br>≥ 25<br>per 5 kg/m <sup>2</sup><br>[P <sub>trend</sub> ] | 111<br>259<br>757<br>247         | 0.73 (0.59–0.91)<br>1.00<br>0.98 (0.85–1.12)<br>0.96 (0.80–1.15)<br>1.06 (0.97–1.17)<br>[0.19]                               | Country of birth, education level  | No associations were observed between weight at baseline, BMI or weight (kg) at age 18 yr, or WC, and prostate cancer risk (incidence)                |
|   |  | Prostate, non-aggressive<br>Not Gleason score > 7, stage 4, or death from prostate cancer | BMI at baseline<br>< 18.5<br>18.5–22.9<br>23–24.9<br>≥ 25<br>per 5 kg/m <sup>2</sup><br>[P <sub>trend</sub> ] | 83<br>194<br>527<br>160          | 0.73 (0.56–0.94)<br>1.00<br>0.91 (0.77–1.08)<br>0.83 (0.67–1.03)<br>0.99 (0.89–1.10)<br>[0.83]                               | Country of birth, education level  | No associations were observed between weight at baseline, BMI or weight (kg) at age 18 yr, or WC, and non-aggressive prostate cancer risk (incidence) |
|   |  | Prostate, aggressive<br>Gleason score > 7, stage 4, or death from prostate cancer         | BMI at baseline<br>< 18.5<br>18.5–22.9<br>23–24.9<br>≥ 25<br>per 5 kg/m <sup>2</sup><br>[P <sub>trend</sub> ] | 28<br>65<br>230<br>87            | 0.74 (0.47–1.15)<br>1.00<br>1.17 (0.89–1.54)<br>1.33 (0.96–1.84)<br>1.27 (1.08–1.49)<br>[0.004]                              | Country of birth, education level  | No associations were observed between weight at baseline, BMI or weight (kg) at age 18 yr, or WC, and aggressive prostate cancer risk (incidence)     |
|   | 16 525<br>Mortality                                    | Prostate<br>ICD-9: 185<br>ICD-10: C61   | BMI at baseline<br>< 18.5<br>18.5–22.9<br>23–24.9<br>≥ 25<br>per 5 kg/m <sup>2</sup><br>[P <sub>trend</sub> ] | 7<br>23<br>71<br>38              | 0.53 (0.23–1.24)<br>1.00<br>0.95 (0.59–1.53)<br>1.52 (0.89–2.58)<br>1.49 (1.11–2.00)<br>[0.01]                               | Country of birth, education level  | Weight at baseline also associated with increased mortality<br>No association was observed with BMI or weight at age 18 yr and mortality              |

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period  | Total number of subjects Incidence/mortality | Organ site or cancer subtype (ICD code)  | Exposure categories  | Exposed cases  | Relative risk (95% CI)       | Covariates  | Comments  |
|---|--|--|--|--|------------------------------|---|---|
| <a href="#">Bhaskaran et al. (2014)</a><br>Clinical Practice Research Datalink<br>United Kingdom<br>1987–2012                               | 2 379 320<br>Incidence                       | Prostate<br>ICD-10: C61                  | BMI<br>per 5 kg/m <sup>2</sup><br>[P <sub>trend</sub> ]                              | 24 901 total   | 0.98 (0.95–1.00)<br>[0.0042] | Age, diabetes, smoking, alcohol consumption, SES, calendar year, sex                  | No differences were found in non-smokers only                                   |
| <a href="#">Barrington et al. (2015)</a><br>Participants in the Selenium and Vitamin E cancer Prevention Trial (SELECT)<br>USA<br>2001–2008 | 26 035<br>Incidence                          | Prostate                                 | BMI<br>< 25.0<br>25.0–27.5<br>27.5–29.9<br>30–34.9<br>35–50<br>[P <sub>trend</sub> ] | Non-Hispanic White:<br>289 1.00<br>438 1.12 (0.97–1.30)<br>333 1.04 (0.89–1.22)<br>299 0.96 (0.82–1.13)<br>94 0.94 (0.74–1.19)<br>[0.63]       |                              | Age, education level, diabetes, smoking, family history of prostate cancer, study arm | For African Americans, BMI < 25.0 in Non-Hispanic Whites was taken as reference |
|   | 26 035<br>Incidence                          | Prostate, low-grade<br>Gleason score 2–6 | BMI<br>< 25.0<br>25.0–27.5<br>27.5–29.9<br>30–34.9<br>35–50<br>[P <sub>trend</sub> ] | Non-Hispanic White:<br>182 1.00<br>293 1.18 (0.98–1.42)<br>202 1.00 (0.82–1.22)<br>170 0.86 (0.70–1.06)<br>51 0.80 (0.58–1.09)<br>[0.02]       |                              | Age, education level, diabetes, smoking, family history of prostate cancer, study arm |   |
|   |  |  | BMI<br>< 25.0<br>25.0–27.5<br>27.5–29.9<br>30–34.9<br>35–50<br>[P <sub>trend</sub> ] | African American:<br>39 1.28 (0.91–1.80)<br>63 1.67 (1.27–2.21)<br>57 1.64 (1.23–2.19)<br>74 1.68 (1.29–2.18)<br>37 1.90 (1.34–2.70)<br>[0.03] |                              |   |   |
|   |  |  |  | African American:<br>16 0.80 (0.48–1.43)<br>37 1.47 (1.03–2.10)<br>35 1.52 (1.05–2.20)<br>37 1.27 (0.83–1.82)<br>23 1.77 (1.14–2.76)<br>[0.05] |                              |   |   |

Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period  | Total number of subjects Incidence/ mortality | Organ site or cancer subtype (ICD code) | Exposure categories  | Exposed cases  | Relative risk (95% CI)   | Covariates   | Comments   |
|---|---|---|--|--|--|--|--|
| <a href="#">Barrington et al. (2015)</a> (cont.)  | 26 035 Incidence                              | Prostate, high-grade Gleason score 7–10 | BMI<br>< 25.0<br>25.0–27.5<br>27.5–29.9<br>30–34.9<br>35–50<br>[P <sub>trend</sub> ] | Non-Hispanic White:<br>84<br>115<br>101<br>104<br>37<br>[0.01] | 1.00<br>1.03 (0.78–1.37)<br>1.11 (0.83–1.49)<br>1.18 (0.88–1.58)<br>1.33 (0.90–1.97) | Age, education level, diabetes, smoking, family history of prostate cancer, study arm                                    |  |
| <a href="#">Fowke et al. (2015)</a><br>Pooled analysis in Asia Cohort Consortium (ACC)<br>Different Asian countries (1963–2001) to 2006 | 522 736 Mortality                             | Prostate                                | BMI<br>12–19.9<br>20–22.4<br>22.5–24.9<br>25–50<br>[P <sub>trend</sub> ]             | 142<br>188<br>184<br>120                                       | 0.98 (0.78–1.23)<br>0.92 (0.75–1.13)<br>1.00<br>1.08 (0.85–1.36)<br>[0.58]           | Age, education level, population density, marital status, history of severe cancer, heart disease, or stroke at baseline | Similar results were observed in stratified analyses by region                 |
| <a href="#">Meyer et al. (2015)</a><br>Population-based Swiss cohort study Switzerland 1977–2008  | 35 703 in cohort, number of men NR Mortality  | Prostate ICD-8: 185 ICD-10: C61         | BMI<br>< 25<br>25–29.9<br>≥ 30   | 170 total  | 1.00<br>1.45 (1.03–2.04)<br>1.54 (0.93–2.55)   | Age, survey, alcohol consumption, physical activity, civil status, years of education, nationality, diet                 | Those who were overweight and who also smoked (ever smoking) had a higher risk |



Table 2.2.14a (continued)

| Reference Cohort Location Follow-up period  | Total number of subjects Incidence/ mortality | Organ site or cancer subtype (ICD code) | Exposure categories           | Exposed cases    | Relative risk (95% CI) | Covariates   | Comments  |
|---|---|---|-------------------------------|------------------|------------------------|--|---|
| <a href="#">Møller et al. (2015)</a><br>Diet, Cancer and Health Study<br>Denmark<br>1993–2011       | 26 044<br>Incidence                           | Prostate                                | BMI                           |                  |                        | NR   | WC showed no association with total prostate cancer incidence<br>Inverse associations were observed with the upper quartile of body fat percentage (15% decreased risk)<br>WC also no associated with advanced prostate cancer incidence<br>Positive associations were observed with the upper quartile of body fat percentage (31% increased risk) |
|   |   |   | 15.4–24.9                     | 649              | 1.00                   |  |   |
|   |   |   | 25–29.9                       | 920              | 0.94 (0.85–1.04)       |  |   |
|   | 26 044<br>Mortality                           | Prostate                                | 30–52.7                       | 244              | 0.86 (0.74–0.99)       | [0.03]   |   |
|   |   |   | [ <i>P</i> <sub>trend</sub> ] |                  |                        |  |   |
|   |   |   | Prostate Stage 3–4            | BMI              |                        |  |   |
| 15.4–24.9   | 208   | 1.00                                    |                               |                  |                        |  |   |
| 25–29.9   | 314   | 1.00 (0.84–1.19)                        |                               |                  |                        |  |   |
|   |   | 30–52.7                                 | 104                           | 1.14 (0.90–1.44) | [0.37]                 |  |   |
|   |   | [ <i>P</i> <sub>trend</sub> ]           |                               |                  |                        |  |   |
| <a href="#">Møller et al. (2016)</a><br>Health Professionals<br>Follow-up Study<br>USA<br>1986–2010 | 47 491<br>Incidence and mortality             | Prostate                                | BMI at age 21 yr              |                  |                        | Age, calendar time, ethnicity, physical activity, energy intake, smoking, diabetes, family history of prostate cancer, PSA testing | When analysing cumulative BMI average, the significant decrease in risk persisted only in those younger than 65 yr  |
|   |   |   | < 20                          | 825              | 0.99 (0.90–1.08)       |  |   |
|   |   |   | 20–21.9                       | 1546             | 1.00                   |  |   |
|   |   |   | 22–23.9                       | 1852             | 0.98 (0.91–1.05)       |  |   |
|   |   |   | 24–25.9                       | 1132             | 0.92 (0.85–1.00)       |  |   |
|   |   |   | ≥ 26                          | 588              | 0.89 (0.80–0.98)       |  |   |
| [ <i>P</i> <sub>trend</sub> ]   |   | [0.01]                                  |                               |                  |                        |  |   |
| per 5 kg/m <sup>2</sup>   |   | 0.94 (0.89–0.98)                        |                               |                  |                        |  |   |

Table 2.2.14a (continued)

| Reference<br>Cohort<br>Location<br>Follow-up period | Total number<br>of subjects<br>Incidence/<br>mortality | Organ site or<br>cancer subtype<br>(ICD code)   | Exposure<br>categories                            | Exposed<br>cases | Relative risk<br>(95% CI) | Covariates       | Comments  |  |  |
|---|--|---|---|------------------|---------------------------|------------------|---|--|--|
| <a href="#">Møller et al. (2016)</a><br>(cont.)     | 47 491<br>Incidence and<br>mortality                   | Prostate, fatal                                 | BMI at age 21 yr                                  |                  |                           |                  | BMI at age 21 yr also<br>not associated with<br>lethal subtypes (incident<br>cases and deaths due to<br>prostate cancer or distant<br>metastases at diagnosis<br>or during follow-up) |  |  |
|   |  |   | < 20  | 94               | 0.83 (0.64–1.07)          |                  |   |  |  |
|   |  |   | 20–21.9   | 181              | 1.00                      |                  |   |  |  |
|   |  |   | 22–23.9   | 177              | 0.92 (0.74–1.14)          |                  |   |  |  |
|   |  |   | 24–25.9   | 88               | 0.74 (0.57–0.97)          |                  |   |  |  |
|   |  |   | ≥ 26  | 51               | 0.77 (0.56–1.07)          |                  |   |  |  |
|   |  |   | [P <sub>trend</sub> ]                             |                  | [0.20]                    |                  |   |  |  |
|   |  |   | per 5 kg/m <sup>2</sup>                           |                  | 0.88 (0.75–1.02)          |                  |   |  |  |
|   |  |   | Prostate, high-<br>grade<br>Gleason score<br>8–10 | BMI at age 21 yr |                           |                  |   |  |  |
|   |  |   |   | < 20             | 85                        | 0.82 (0.63–1.07) |   |  |  |
|   |  | 20–21.9   |   | 181              | 1.00                      |                  |   |  |  |
|   |  | 22–23.9   |   | 204              | 0.93 (0.75–1.15)          |                  |   |  |  |
|   |  | 24–25.9   |   | 130              | 0.91 (0.72–1.16)          |                  |   |  |  |
|   |  | ≥ 26  |   | 79               | 1.10 (0.83–1.45)          |                  |   |  |  |
|   |  | [P <sub>trend</sub> ]                           |   |                  | [0.27]                    |                  |   |  |  |
|   |  | per 5 kg/m <sup>2</sup>                         |   |                  | 1.03 (0.90–1.19)          |                  |   |  |  |
|   |  | Prostate, moderate-<br>grade<br>Gleason score 7 |   | BMI at age 21 yr |                           |                  |   |  | Age, calendar time,<br>ethnicity, physical<br>activity, energy intake,<br>smoking, diabetes,<br>family history of<br>prostate cancer, PSA<br>testing |
|   |  |   |   | < 20             | 233                       | 0.98 (0.83–1.15) |   |  |  |
|   |  |   | 20–21.9   | 446              | 1.00                      |                  |   |  |  |
|   |  |   | 22–23.9   | 548              | 0.98 (0.86–1.11)          |                  |   |  |  |
| 24–25.9   | 333  |   | 0.90 (0.78–1.04)                                  |                  |                           |                  |   |  |  |
| ≥ 26  | 159  |   | 0.77 (0.64–0.93)                                  |                  |                           |                  |   |  |  |
| [P <sub>trend</sub> ]                               |  |   | [0.01]  |                  |                           |                  |   |  |  |
| per 5 kg/m <sup>2</sup>                             |  |   | 0.87 (0.80–0.95)                                  |                  |                           |                  |   |  |  |
| Prostate, low-<br>grade<br>Gleason score<br>2–6     | BMI at age 21 yr                                       |   |   |                  |                           |                  |   |  |  |
|   | < 20   |   | 333   | 1.01 (0.88–1.16) |                           |                  |   |  |  |
|   | 20–21.9  | 620   | 1.00  |                  |                           |                  |   |  |  |
|   | 22–23.9  | 735   | 0.94 (0.84–1.05)                                  |                  |                           |                  |   |  |  |
|   | 24–25.9  | 465   | 0.90 (0.79–1.02)                                  |                  |                           |                  |   |  |  |
|   | ≥ 26   | 236   | 0.88 (0.75–1.03)                                  |                  |                           |                  |   |  |  |
| [P <sub>trend</sub> ]                               |  | [0.03]  |   |                  |                           |                  |   |  |  |
| per 5 kg/m <sup>2</sup>                             |  | 0.93 (0.87–1.01)                                |   |                  |                           |                  |   |  |  |

BMI, body mass index (in kg/m<sup>2</sup>); BP, blood pressure; CI, confidence interval; EPIC, European Prospective Investigation into Cancer and Nutrition; ICD, International Classification of Diseases; N/A, not applicable; NIH-AARP, National Institutes of Health–AARP Diet and Health Study; NR, not reported; PSA, prostate-specific antigen; SD, standard deviation; SES, socioeconomic status; TNM, tumour–node–metastasis; VHM&PP, Voralberg Health Monitoring and Prevention Program; WC, waist circumference; yr, year or years

**Table 2.2.14b Case-control studies of measures of body fatness and cancer of the prostate**

| Reference<br>Study location<br>Period                                  | Total number<br>of cases<br>Source of<br>controls | Exposure categories   | Exposed cases   | Relative risk<br>(95% CI)  | Adjustment for<br>confounding  | Comments  |
|--|---|---|---|--|--|---|
| <a href="#">Putnam et al. (2000)</a><br>USA<br>1986–1989               | 101<br>Population                                 | BMI<br>< 24.1<br>24.1–26.6<br>> 26.6<br>BMI change (%) from age 20 yr<br>> 5% loss<br>5% loss to 5% gain<br>5.1–10.0% gain<br>10.1–15.0% gain<br>> 15.0% gain<br>Weight (kg)<br>< 74.8<br>74.8–83.9<br>> 83.9 | 27<br>31<br>38<br><br>1<br>12<br>15<br>14<br>51<br><br>22<br>41<br>33 | 1.0<br>1.0 (0.6–1.7)<br>1.3 (0.8–2.2)<br><br>0.2 (0.02–1.5)<br>1.0<br>1.3 (0.6–2.7)<br>1.0 (0.5–1.9)<br>1.3 (0.8–2.2)<br><br>1.0<br>1.4 (0.8–2.3)<br>1.2 (0.7–2.1) | Age  |   |
| <a href="#">Sharpe &amp; Siemiatycki (2001)</a><br>Canada<br>1979–1985 | 399<br>Population                                 | BMI<br>< 24.05<br>24.05–26.66<br>> 26.66  | 127<br>128<br>141   | 0.87 (0.6–1.22)<br>1.00<br>1.14 (0.81–1.61)  | Age, ethnicity,<br>respondent status,<br>family income, alcohol<br>consumption                 |   |
| <a href="#">Giles et al. (2003)</a><br>Australia<br>1994–1998          | 1476<br>Population                                | BMI at age 21 yr<br>< 20.5<br>20.5–22.1<br>22.2–23.9<br>> 23.9  | 353<br>372<br>337<br>332  | 1.00<br>0.99 (0.79–1.23)<br>0.96 (0.76–1.20)<br>1.10 (0.88–1.39)   | Age, country of birth,<br>family history of prostate<br>cancer, study centre,<br>calendar year | No associations were<br>observed for weight or<br>WC at age 21 yr |
| <a href="#">Irani et al. (2003)</a><br>France<br>1993–1999             | 194<br>Hospital                                   | BMI<br>< 29<br>> 29   | NR<br><br>1   | NR<br><br>1.00<br>2.47 (1.41–4.34)   | Age  |   |

Table 2.2.14b (continued)

| Reference<br>Study location<br>Period                             | Total number<br>of cases<br>Source of<br>controls | Exposure categories              | Exposed cases | Relative risk<br>(95% CI) | Adjustment for<br>confounding | Comments   |   |
|---|---|----------------------------------|---------------|---------------------------|-------------------------------|--|---|
| <a href="#">Dal Maso et al. (2004)</a><br>Italy<br>1991–2002      | 1294<br>Hospital                                  | BMI at baseline                  |               |                           |                               | Age, study centre, education level, physical activity, family history of prostate cancer   | No associations were observed between weight (kg), waist-to-hip ratio, or lean body mass and prostate cancer. When stratified by grade, associations of BMI at diagnosis were only significant with prostate cancer of Gleason score 7–10 (384 cases, $P_{\text{trend}} < 0.01$ ) |
|   |   | < 24.22                          | 301           | 1.00                      |                               |  |   |
|   |   | 24.22–26.18                      | 346           | 1.18 (0.95–1.47)          |                               |  |   |
|   |   | 26.18–28.41                      | 324           | 1.12 (0.89–1.40)          |                               |  |   |
|   |   | ≥ 28.41                          | 319           | 1.18 (0.94–1.47)          |                               |  |   |
|   |   | [ $P_{\text{trend}}$ ]           |               | [0.23]                    |                               |  |   |
|   |   | BMI at age 30 yr                 |               |                           |                               |  |   |
|   |   | < 22.65                          | 406           | 1.00                      |                               |  |   |
| 22.65–24.69   | 437   | 1.33 (1.09–1.62)                 |               |                           |                               |  |   |
| ≥ 24.69   | 414   | 1.22 (1.01–1.48)                 |               |                           |                               |  |   |
| [ $P_{\text{trend}}$ ]  |   | [0.004]                          |               |                           |                               |  |   |
| <a href="#">Friedenreich et al. (2004)</a><br>Canada<br>1997–2000 | 988<br>Population                                 | BMI, quartiles                   |               |                           |                               | Age, region, education level, average lifetime total alcohol intake, first-degree family history of prostate cancer, number of times had PSA test done, number of digital rectal exams, total lifetime physical activity |   |
|   |   | Q1                               | 252           | 1.00                      |                               |  |   |
|   |   | Q2                               | 236           | 0.95 (0.74–1.23)          |                               |  |   |
|   |   | Q3                               | 245           | 0.98 (0.76–1.26)          |                               |  |   |
|   |   | Q4                               | 254           | 1.07 (0.83–1.38)          |                               |  |   |
|   |   | [ $P_{\text{trend}}$ ]           |               | [0.57]                    |                               |  |   |
|   |   | Weight, quartiles                |               |                           |                               |  |   |
|   |   | Q1                               | 268           | 1.00                      |                               |  |   |
|   |   | Q2                               | 233           | 0.93 (0.72–1.21)          |                               |  |   |
|   |   | Q3                               | 262           | 1.00 (0.78–1.28)          |                               |  |   |
|   |   | Q4                               | 224           | 0.91 (0.70–1.18)          |                               |  |   |
|   |   | [ $P_{\text{trend}}$ ]           |               | [0.18]                    |                               |  |   |
|   |   | Weight gain (kg) since age 20 yr |               |                           |                               |  |   |
| < 4.54  | 241   | 1.00                             |               |                           |                               |  |   |
| 4.54–13.6   | 286   | 1.14 (0.89–1.47)                 |               |                           |                               |  |   |
| 13.6–20.4   | 238   | 1.05 (0.82–1.36)                 |               |                           |                               |  |   |
| ≥ 20.4  | 215   | 0.91 (0.70–1.19)                 |               |                           |                               |  |   |
| [ $P_{\text{trend}}$ ]  |   | [0.26]                           |               |                           |                               |  |   |

Table 2.2.14b (continued)

| Reference<br>Study location<br>Period                                | Total number<br>of cases<br>Source of<br>controls | Exposure categories  | Exposed cases | Relative risk<br>(95% CI)   | Adjustment for<br>confounding   | Comments  |
|--|---|--|---------------|---|---|---|
| <a href="#">Pan et al. (2004)</a><br>Canada<br>1994–1997             | 1801<br>Population                                | BMI<br>< 25<br>25–30<br>≥ 30<br>[P <sub>trend</sub> ]  |               | 1.00<br>1.16 (0.94–1.43)<br>1.27 (1.09–1.47)<br>[0.026]   | Age group, province of<br>residence, education level,<br>pack-years of smoking,<br>alcohol consumption,<br>total energy intake,<br>vegetable intake, dietary<br>fibre intake, recreational<br>physical activity |   |
| <a href="#">Liu et al. (2005)</a><br>USA<br>NR                       | 439<br>Population<br>(sibling-based)              | BMI, quartiles<br>Q1<br>Q2<br>Q3<br>Q4<br>[P <sub>trend</sub> ]<br>LBM, quartiles<br>Q1<br>Q2<br>Q3<br>Q4<br>[P <sub>trend</sub> ]                                 |               | 106 1.00<br>112 1.57 (0.85–2.89)<br>110 1.43 (0.78–2.61)<br>106 0.91 (0.49–1.70)<br>[0.73]<br>LBM > 66.3:<br>113 1.00<br>104 0.58 (0.31–1.08)<br>114 0.43 (0.22–0.81)<br>103 0.41 (0.20–0.84)<br>[0.02] | Age, education, calorie<br>intake   | Results are presented<br>for high-aggressiveness<br>prostate cancer (Gleason<br>score ≥ 7, or tumour<br>stage T2C or greater) |
| <a href="#">Porter &amp;<br/>Stanford (2005)</a><br>USA<br>1993–1996 | 753<br>Population                                 | BMI<br>18–24.4<br>24.4–26.5<br>26.5–29.1<br>29.1–55<br>[P <sub>trend</sub> ]<br>Weight (kg)<br>< 77.2<br>77.2–85.8<br>85.9–95.3<br>> 95.3<br>[P <sub>trend</sub> ] |               | 195 1.00<br>202 1.04 (0.78–1.39)<br>178 0.85 (0.64–1.14)<br>178 0.91 (0.66–1.21)<br>[0.04]<br>175 1.00<br>222 0.96 (0.70–1.30)<br>193 0.77 (0.56–1.06)<br>163 0.74 (0.53–1.03)<br>[0.03]                | Age, race, education<br>level, smoking, family<br>history of prostate cancer,<br>prostate cancer screening,<br>dietary fat, energy intake   |   |
| <a href="#">Robinson et al.<br/>(2005)</a><br>USA<br>1997–2000       | 568<br>Population                                 | BMI at age 20–29 yr<br>< 25.0<br>25.0–29.9<br>≥ 30.0   |               | 361 1.00<br>191 1.13 (0.87–1.47)<br>12 0.40 (0.20–0.81)   | Age, race, family history<br>of prostate cancer,<br>saturated fat intake  | This study evaluated<br>the association with<br>advanced prostate<br>cancer   |

Table 2.2.14b (continued)

| Reference<br>Study location<br>Period                               | Total number<br>of cases<br>Source of<br>controls | Exposure categories   | Exposed cases                 | Relative risk<br>(95% CI)   | Adjustment for<br>confounding  | Comments   |
|---|---|---|-------------------------------|---|--|--|
| <a href="#">Wuermli et al. (2005)</a><br>Switzerland<br>1997–2002   | 504<br>Hospital                                   | BMI<br>< 30<br>> 30   | NR                            | 1.00<br>0.97 (0.93–1.01)  | Age, BMI, diabetes, lipid-lowering drugs   |  |
| <a href="#">Cox et al. (2006)</a><br>New Zealand<br>1996–1998       | 550<br>Population                                 | BMI 5 yr before interview, quintiles<br>Q1<br>Q2<br>Q3<br>Q4<br>Q5                          | 50<br>40<br>105<br>122<br>233 | 1.0<br>0.9 (0.5–1.6)<br>0.8 (0.6–1.2)<br>0.9 (0.6–1.3)<br>0.9 (0.6–1.3) | Age  | No associations were observed between BMI or weight at age 20 yr and prostate cancer |
| <a href="#">Beebe-Dimmer et al. (2007)</a><br>USA<br>1996–2002      | 139<br>Population<br>(community-based)            | WC (cm)<br>≤ 102<br>> 102   | 59                            | 1.00<br>1.84 (1.17–2.91)  | Age, smoking history   |  |
| <a href="#">Gallus et al. (2007)</a><br>Italy<br>1991–2002          | 219<br>Hospital                                   | BMI<br>< 24.84<br>24.84–27.76<br>≥ 27.77<br>[ <i>P</i> <sub>trend</sub> ]                   | 69<br>80<br>70                | 1.0<br>1.3 (0.8–2.0)<br>1.2 (0.8–1.9)<br>[0.38]                         | Age, education level, study centre, occupational physical activity, family history of prostate cancer  |  |
| <a href="#">Máková et al. (2007)</a><br>Czech Republic<br>1987–2002 | 338<br>Population                                 | BMI<br>18.5–< 25<br>25–30<br>≥ 30   | NR                            | 1.00<br>1.05 (0.72–1.39)<br>0.97 (0.66–1.41)                            | Age, smoking, hypertension, height   |  |
| <a href="#">Nagata et al. (2007)</a><br>Japan<br>1996–2003          | 200<br>Hospital                                   | BMI 1 yr before diagnosis<br>< 23.0<br>23.0–24.9<br>> 25.0<br>[ <i>P</i> <sub>trend</sub> ] | 81<br>60<br>59                | 1.00<br>1.28 (0.87–1.87)<br>1.06 (0.72–1.55)<br>[0.65]                  | Smoking  | BMI at age 40–45 yr not associated with increased risk of prostate cancer            |
| <a href="#">Magura et al. (2008)</a><br>USA<br>2004–2006            | 312<br>Hospital                                   | BMI<br>< 25<br>≥ 25   | 30<br>282                     | 1.00<br>1.04 (0.58–1.85)  | Age, family history of prostate cancer, type 2 diabetes, smoking, use of multivitamins, use of statins |  |

Table 2.2.14b (continued)

| Reference<br>Study location<br>Period   | Total number<br>of cases<br>Source of<br>controls | Exposure categories  | Exposed cases     | Relative risk<br>(95% CI)  | Adjustment for<br>confounding  | Comments  |
|---|---|--|-------------------|--|--|---|
| <a href="#">Beebe-Dimmer et al. (2009)</a><br>USA<br>2001–2004                  | 637<br>Hospital                                   | BMI<br>< 30<br>≥ 30  | –<br>208          | 1.00<br>0.51 (0.33–0.80)   | Age, PSA screening history, hypertension, diabetes, low HDL, high triglycerides  | Inverse association was observed only in Caucasians ( <i>n</i> = 494). No association observed in African Americans ( <i>n</i> = 381) |
| <a href="#">Hosseini et al. (2010)</a><br>Islamic Republic of Iran<br>2005–2008 | 137<br>Population                                 | BMI<br>≤ 25<br>> 25  | 105<br>35         | 1.0<br>0.4 (0.2–0.8)   | Age, family history of prostate cancer, history of other cancers, history of prostatitis, alcohol consumption, smoking, physical activity  | [Discrepancy in the number of reported cases]   |
| <a href="#">Jackson et al. (2010)</a><br>Jamaica<br>2005–2007                   | 243<br>Hospital                                   | BMI, quartiles<br>Q4 vs Q1 (ref)<br>[ <i>P</i> <sub>trend</sub> ]<br>WC, tertiles<br>T3 vs T1 (ref)<br>[ <i>P</i> <sub>trend</sub> ]<br>Waist-to-hip ratio<br>< 0.95<br>≥ 0.95 | NR                | 0.90 (0.42–1.91)<br>[0.28]<br>5.57 (1.43–18.63)<br>[0.008]<br>1.00<br>2.94 (1.34–6.38) | BMI: age, education level, medical history, first-degree family history of prostate cancer, smoking, physical activity<br>WC and waist-to-hip ratio: age, height and BMI as continuous; education level, current smoker, physical activity | Results are presented for high-grade cancer (Gleason score ≥ 7)<br>12% of the cases were obese  |
| <a href="#">Dimitropoulou et al. (2011)</a><br>United Kingdom<br>2001–2008      | 960<br>Population                                 | BMI<br>< 25.0<br>25.0–29.9<br>> 30.0<br>[ <i>P</i> <sub>trend</sub> ]<br>WC, tertiles<br>T1<br>T2<br>T3<br>[ <i>P</i> <sub>trend</sub> ]                                       | 264<br>481<br>174 | 1.00<br>0.98 (0.82–1.16)<br>0.83 (0.67–1.03)<br>[0.097]                                | Age, family history of prostate cancer   |   |
| <a href="#">Ganesh et al. (2011)</a><br>India<br>1999–2001                      | 123<br>Hospital                                   | BMI<br>< 25<br>≥ 25  | 41<br>76          | 1.0<br>2.1 (1.1–4.4)   | Age, religion, education level, hypertension   |   |



Table 2.2.14b (continued)

| Reference<br>Study location<br>Period                        | Total number<br>of cases<br>Source of<br>controls | Exposure categories  | Exposed cases   | Relative risk<br>(95% CI)  | Adjustment for<br>confounding   | Comments  |
|--|---|--|---|--|---|---|
| <a href="#">Mori et al. (2011)</a><br>Japan<br>2007–2008     | 117<br>Population                                 | BMI<br>< 21.0<br>21.0–22.9<br>23.0–24.9<br>≥ 25.0<br>[P <sub>trend</sub> ]<br>Weight (kg)<br>< 55<br>55.0–64.9<br>65.0–74.9<br>≥ 75.0<br>Weight gain (kg) in adult life<br>< 5<br>5.0–9.9<br>10.0–14.9<br>≥ 15 | 14<br>29<br>41<br>33<br><br>7<br>52<br>45<br>13<br><br>18<br>24<br>43<br>32 | 1.00<br>1.05 (0.50–2.21)<br>1.63 (0.77–3.45)<br>1.39 (0.66–2.96)<br>[0.07]<br>1.00<br>1.49 (0.57–3.85)<br>1.74 (0.65–4.64)<br>1.64 (0.55–4.91)<br><br>1.00<br>1.22 (0.58–2.55)<br>3.55 (1.71–7.39)<br>1.73 (0.83–3.59) | Dietary intake, physical activity, smoking, alcohol consumption   | BMI of 23–25 at age 20 yr associated with a 53% reduced risk (based on 11 cases)<br>No associations between body weight at age 20 yr and prostate cancer risk |
| <a href="#">Pelucchi et al. (2011)</a><br>Italy<br>1991–2002 | 1294<br>Hospital                                  | BMI<br>< 28<br>≥ 28<br>WC (cm)<br>< 94<br>≥ 94<br>Abdominal obesity (combined WC, BMI)<br>No<br>Yes  | 909<br>381<br><br>242<br>730<br><br>470<br>820                              | 1.00<br>0.98 (0.83–1.17)<br><br>1.00<br>1.13 (0.91–1.40)<br><br>1.00<br>1.02 (0.86–1.21)   | Age, study centre, education level, smoking, alcohol consumption, physical activity, family history of prostate cancer, non-alcohol energy intake         |   |
| <a href="#">Fowke et al. (2012)</a><br>USA<br>NR             | 809<br>Hospital                                   | BMI<br>per 1 kg/m <sup>2</sup> increase<br>WC<br>per 1 cm increase   | 135<br><br>135  | 1.04 (1.00–1.08)<br><br>1.01 (0.99–1.03)   | Age, PSA, prostate volume, race, family history of prostate cancer, current treatment for diabetes, benign prostatic hyperplasia, CVD, or hyperlipidaemia | Results are presented for high-grade (Gleason score 8–10) prostate cancer   |

**Table 2.2.14b (continued)**

| Reference<br>Study location<br>Period                              | Total number<br>of cases<br>Source of<br>controls | Exposure categories   | Exposed cases            | Relative risk<br>(95% CI)  | Adjustment for<br>confounding   | Comments  |
|--|---|---|--------------------------|--|---|---|
| <a href="#">Nemesure et al. (2012)</a><br>Barbados<br>2002–2011    | 963<br>Population                                 | WC (cm), quartiles<br>Q1: < 84<br>Q2: 84–92<br>Q3: 92–99<br>Q4: ≥ 99  | NR                       | 1.00<br>1.36 (1.01–1.85)<br>1.67 (1.14–2.44)<br>1.84 (1.19–2.85)                               | Age, marital status,<br>religion, occupation,<br>smoking, family history<br>of prostate cancer, BMI | Study in African<br>Barbadian population.<br>When stratifying by<br>high-grade ( <i>n</i> = 434)<br>vs low-grade ( <i>n</i> = 480)<br>prostate cancer, the<br>associations were not<br>significant in either<br>group |
| <a href="#">Möller et al. (2013)</a><br>Sweden<br>2001–2002        | 1499<br>Population                                | BMI<br>< 22.5<br>22.5– < 25<br>25– < 27.5<br>≥ 27.5<br>per 5 kg/m <sup>2</sup><br>[ <i>P</i> <sub>trend</sub> ] | 382<br>655<br>295<br>120 | 1.00<br>0.94 (0.76–1.15)<br>0.90 (0.71–1.15)<br>0.96 (0.69–1.33)<br>0.98 (0.83–1.16)<br>[0.54] | Age, region of residence,<br>time span between first<br>and last recalled weight                    | No associations with<br>BMI when stratifying by<br>low- and intermediate-<br>grade vs high-grade<br>prostate cancer<br>No significant<br>associations with BMI at<br>age 20 yr  |
| <a href="#">Bashir et al. (2014)</a><br>Pakistan<br>2012–2013      | 140<br>Hospital                                   | BMI<br>≤ 25<br>> 25   | 66<br>74                 | 1.00<br>5.78 (2.67–12.6)   | Age, lifestyle (physical<br>activity), family history<br>of prostate cancer,<br>smoking, diet       |   |
| <a href="#">Agalliu et al. (2015)</a><br>Nigeria<br>2011–2012      | 50<br>Hospital                                    | BMI<br>< 25<br>25–29.9<br>≥ 30<br>Weight (kg)<br>per kg increase<br>WC (cm)<br>per cm increase                  | 21<br>21<br>8            | 1<br>1.39 (0.59–3.28)<br>1.35 (0.42–4.36)<br>0.97 (0.94–1.00)<br>0.91 (0.87–0.96)              | Age   |   |
| <a href="#">Alvarez-Cubero et al. (2015)</a><br>Spain<br>2011–2014 | 100<br>Hospital                                   | BMI<br>≥ 30 vs < 30   | 31                       | 1.65 (0.36–7.57)   | Age, residential area,<br>family history of prostate<br>cancer                                      |   |

**Table 2.2.14b (continued)**

| Reference<br>Study location<br>Period                         | Total number<br>of cases<br>Source of<br>controls | Exposure categories                      | Exposed cases | Relative risk<br>(95% CI)      | Adjustment for<br>confounding                         | Comments   |
|---|---|--|---------------|--------------------------------|---|--|
| <a href="#">Boehm et al. (2015)</a><br>Canada<br>2005–2012    | 1933<br>Population                                | BMI                                      |               |                                |   | Age, ancestry, first-degree family history of prostate cancer, annual physician visits, number of PSA tests within 5 yr before index date                  |
|   |   | < 25                                     | 649           | 1.00                           | No associations were observed with waist-to-hip ratio |  |
|   |   | 25–29.9                                  | 922           | 0.87 (0.74–1.01)               |   |  |
|   |   | ≥ 30                                     | 351           | 0.72 (0.60–0.87)               |   |  |
|   |   | WC (cm)                                  |               |                                |   |  |
|   |   | < 102                                    | 1073          | 1.00                           |   |  |
|   |   | ≥ 102                                    | 711           | 1.03 (0.89–1.19)               |   |  |
| <a href="#">Gerdtsen et al. (2015)</a><br>Sweden<br>1974–1996 | 1355<br>Population                                | Weight at age 16–22 yr per 5 kg increase |               | Incidence:<br>1.05 (1.01–1.09) |   | No associations were observed with BMI or weight at age 44–50 yr and prostate cancer risk. BMI and weight at age 44–50 yr also associated with metastasis. |
|   |   | BMI at age 44–50 yr per 5 kg increase    |               | Mortality:<br>1.08 (1.03–1.13) |   |  |
|   |   | Weight at age 44–50 yr per 5 kg increase |               | Mortality:<br>1.11 (1.03–1.19) |   |  |
| <a href="#">Zhang et al. (2015)</a><br>China<br>2013–2014     | 101<br>Hospital                                   | BMI                                      |               |                                | WC, BP, triglyceride levels, free blood glucose       |  |
|   |   | < 24                                     | 35            | 1.00                           |   |  |
|   |   | ≥ 24                                     | 66            | 2.51 (0.18–9.52)               |   |  |

BMI, body mass index (in kg/m<sup>2</sup>); BP, blood pressure; CI, confidence interval; CVD, cardiovascular disease; HDL, high-density lipoprotein; LBM, lean body mass; NR, not reported; PSA, prostate-specific antigen; SD, standard deviation; WC, waist circumference; yr, years or years

**Table 2.2.14c Meta-analyses of measures of body fatness and cancer of the prostate**

| Reference  | Total number of studies<br>Total number of cases                                      | Organ site or cancer subtype | Exposure categories   | Relative risk (95% CI)                                     | Adjustment for confounding                        | Comments  |
|--|---|------------------------------|---|--|---|---|
| <a href="#">Bergström et al. (2001)</a>                    | 6 observational studies (4 cohort and 2 case-control)<br>4592                         | Prostate                     | BMI per 1 kg/m <sup>2</sup> increase                          | 1.01 (1.00–1.02)   | Different adjustment by study, some non-adjusted  |   |
| <a href="#">MacInnis &amp; English (2006)</a>              | 43 observational studies (22 cohort and 21 case-control) (9 studies for WC)<br>68 753 | Prostate                     | BMI per 5 kg/m <sup>2</sup> increase                          | 1.05 (1.01–1.08)   | Different adjustment by study                     | No associations were found with WC  |
| <a href="#">Renehan et al. (2008)</a>                      | 27 prospective studies<br>70 421  | Prostate                     | BMI per 5 kg/m <sup>2</sup> increase                          | 1.03 (1.00–1.07)   |   | Between-study heterogeneity of I <sup>2</sup> = 73%<br>No differences in the results were observed by region (Asia-Pacific, Australia, Europe, North America) |
| <a href="#">Robinson et al. (2008)</a>                     | 9 cohort studies and 7 case-control studies<br>NR                                     | Prostate                     | BMI before age 29 yr, per 5 kg/m <sup>2</sup> increase        | Cohort: 1.08 (0.97–1.19)<br>Case-control: 1.07 (0.98–1.17) | Age for all; other factors depending on the study |   |
| <a href="#">Guh et al. (2009)</a>                          | 7 cohort studies<br>NR  | Prostate                     | BMI<br>Normal<br>Overweight<br>Obesity                        | 1.00<br>1.14 (1.00–1.31)<br>1.05 (0.85–1.30)               | NR  |   |
| <a href="#">Esposito et al. (2013)</a>                     | 13 observational studies (cohort and case-control)<br>4634                            | Prostate                     | BMI<br>High vs low  | 1.05 (0.97–1.15)   | NR  | [Cut-off values differ by study]  |
| <a href="#">WCRF/AICR (2014) Continuous Update Project</a> | 24 prospective studies for BMI, 4 for WC<br>11 149                                    | Prostate, advanced           | BMI per 5 kg/m <sup>2</sup> increase<br>WC per 10 cm increase | 1.08 (1.04–1.12)<br>1.12 (1.04–1.21)                       | NR  | Advanced prostate cancer includes advanced, high-grade, and fatal prostate cancers  |

**Table 2.2.14c (continued)**

| Reference                          | Total number of studies<br>Total number of cases  | Organ site or cancer subtype                              | Exposure categories            | Relative risk (95% CI)   | Adjustment for confounding  | Comments |
|------------------------------------|---|---|--------------------------------|--|---|----------|
| <a href="#">Keum et al. (2015)</a> | 4 prospective studies<br>6882   | Prostate  | Weight gain per 5 kg increase  | 0.98 (0.94–1.02)   | Age and baseline BMI or weight in all, and different additional covariates depending on the study |          |
|                                    |   | Prostate, localized                                       | Weight gain per 5 kg increase  | 0.96 (0.92–1.00)   |   |          |
|                                    |   | Prostate, advanced  | Weight gain per 5 kg increase  | 1.04 (0.99–1.09)   |   |          |
|                                    |   |   | WC per 10 cm increase          | 1.03 (0.99–1.07)   |   |          |
| <a href="#">Chen et al. (2016)</a> | 9 observational studies (5 cohort, 1 nested case–control, and 3 case–control)<br>22 338 | All<br>Low- and intermediate-grade<br>High-grade<br>Fatal | Adult weight per 5 kg increase | 1.01 (0.94–1.08)<br>0.97 (0.87–1.07)<br>1.13 (1.00–1.28)<br>1.58 (1.01–2.47) | Age (in all studies except one) and different covariates depending on the study                   |          |

BMI, body mass index (in kg/m<sup>2</sup>); CI, confidence interval; NR, not reported; WC, waist circumference; WCRF/AICR, World Cancer Research Fund/American Institute for Cancer Research; yr, years or years

**Table 2.2.14d Mendelian randomization studies of measures of body fatness and cancer of the prostate**

| Reference Study   | Characteristics of study population   | Sample size                               | Exposure (unit)   | Odds ratio (95% CI) and <i>P</i> value (with each unit increase in exposure) of the association between the exposure and outcome(s)  | Adjustment for confounding                          |
|---|---|---|---|--|---|
| <a href="#">Lewis et al. (2010)</a><br>Prostate Testing for Cancer and Treatment Study (ProtecT)  | Men aged 50–69 yr from 300 general practices across 9 regions in the United Kingdom | 4540 (1550 cases and 2990 controls)       | BMI<br>per 1 kg/m <sup>2</sup> increase<br><br>per 1 kg/m <sup>2</sup> increase                               | All:<br>0.77 (0.52–1.15)<br><i>P</i> = 0.20<br>High-grade vs low-grade:<br>1.35 (0.90–2.03)<br><i>P</i> = 0.15   | Age, centre   |
| <a href="#">Davies et al. (2015)</a><br>Prostate Cancer Association Group to Investigate Cancer-Associated Alterations in the Genome (PRACTICAL) Consortium | 19 independent studies of individuals of European descent                           | 41 062 (20 848 cases and 20 214 controls) | Increase of 1 SD in genetically predicted BMI   | 0.98 (0.96–1.00)<br><i>P</i> = 0.07  | 8 principal components of population stratification |
| <a href="#">Gao et al. (2016)</a><br>Genetic Associations and Mechanisms in Oncology (GAME-ON) Consortium   | 6 studies of individuals of European ancestry                                       | 26 884 (14 160 cases and 12 724 controls) | Increase of 1 SD in genetically predicted BMI (~0.073 kg/m <sup>2</sup> )<br>Childhood BMI:<br><br>Adult BMI: | All:<br>1.01 (0.83–1.22)<br><i>P</i> = 0.91<br>Aggressive:<br>1.10 (0.83–1.45)<br><i>P</i> = 0.49<br>All:<br>1.00 (0.96–1.04)<br><i>P</i> = 0.97<br>Aggressive:<br>1.02 (0.96–1.08)<br><i>P</i> = 0.44 | N/A   |

BMI, body mass index (in kg/m<sup>2</sup>); CI, confidence interval; N/A, not applicable; SD, standard deviation; vs, versus; yr, years or years

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