Table 2.7.3 Case-control studies: Red meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
Goodman et al. (1992) Hawaii 1983–85	**Cases:** 226 men, 100 women, age 30–84; Population-based. Cases identified through rapid report system of Cancer Registry, histologically verified. **Controls:** 597 men, 268 women, age 30–84; Community controls matched by age, sex 2:1, based on random digit dialing or random household survey of 2% of residents **Exposure assessment method:** Questionnaire; Home interviews 130 food items in FFQ plus 3-day measured food records Estimation of intake of nitrite and nitrosamines	Lung cancer	Quartiles			Age, ethnicity, smoking, pack-years, β-carotene intake
			Processed meat: sausage Men: Q2 vs Q1	NR	1.6 (0.9–2.9)	
			Q3 vs Q1	NR	1.6 (0.9–2.9)	
			Q4 vs Q1	NR	3.4 (2–6)	
			Women: Q2 vs Q1	NR	1.3 (0.6–2.7)	
			Q3 vs Q1	NR	1.2 (0.5–2.7)	
			Q4 vs Q1	NR	1.3 (0.5–3.2)	
Swanson et al. (1992) China 1987–90	**Cases:** 428; Cases identified among current and retired employees, reported to the Cancer Registry of the Labor Protection Institute of the Yunnan Tin Corporation **Controls:** 1,011; Controls selected among the same company and the Gejiu City residents, matched by age (2:1) **Exposure assessment method:** Questionnaire; 31 food items questionnaire	Lung	Pork (quartiles) T2 vs T1	NR	0.67	Age group, respondent type, study site, education and income
			T3 vs T1	NR	0.72	
			T4 vs T1	NR	0.46	
Sankaranarayanan et al. (1994) India 1990	**Cases:** 281; Hospital-based. Incident cancers identified via Cancer Registry **Controls:** 1,207; Controls were relatives of patients or by-standers in hospital **Exposure assessment method:** Questionnaire	Lung	Beef, occasional vs never	72	12.43 (5–30.86)	Age, education, religion and smoking
			1–2/week	112	3.13 (1.25–7.81)	
			> 2/week	20	12.49 (3.13–49.8)	

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Table 2.7.3 Case-control studies: Red meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
Sinha et al. (1998) USA 1993–1994	**Cases:** 593; Population-based study. Incident cancers identified via Cancer Registry. Women only **Controls:** 628; Controls sampled from drivers' license files or Health Care Financing Administration, frequency matched by age (apparently also by smoking) **Exposure assessment method:** Questionnaire; 100-item Health Habits and History Questionnaire of which 15 were red meat items	Lung	Red meat, 90th vs 10th percentile in controls	NR	1.8 (1.2–2.7)	Age, fat intake, calories, smoking (pack years), BMI, fruit and vegetable intake, education
			Read meat OR for increment by 10 g/day	NR	1.06	
			Well done red meat, 90th vs 10th percentile in controls	NR	1.5 (1.1–2.1)	
			Well done read meet OR for increment by 10 g	NR	1.08	
			Fried red meat, 90th vs 10th percentile in controls	NR	1.5 (1.1–2)	
			Fried red meat OR for increment by 10 g	NR	1.09	
Brennan et al. (2000) Europe NR	**Cases:** 506; Multicenter hospital-based study in 6 countries. Incident, histologically confirmed cases. All non-smokers, 79% women, 53% adenocarcinomas. **Controls:** 1045; Non-smoking hospitalized controls (diseases not specified). In Germany and Sweden: population controls. **Exposure assessment method:** Questionnaire	Lung	Meat, tertile 2 vs T1	91	1.1 (0.8–1.6)	Age, sex, centre
			T3 vs T1	53	1.1 (0.8–1.6)	
		Lung: small cell carcinoma	Meat, tertile 2 vs T1	NR	1.2 (0.3–4.5)	
			T3 vs T1	NR	1.6 (1.1–2.2)	
			Trend-test p-value: 0.6			
Alavanja et al. (2001) USA 1993–1996	**Cases:** 360; Population-based. Cases ascertained via SEER programme. Incident lung carcinomas, histologically confirmed. **Controls:** 574; Controls: random sample of state drivers license and rosters of Medicare recipients **Exposure assessment method:** Questionnaire; 70-item Food Frequency Questionnaire	Lung	Red meat (times/week)			Age, education, smoking history, fruits intake, calories, previous lung disease, alcohol, BMI
			< 3.5	NR	1	
			3.5–5.5	NR	1.7 (0.9–3.3)	
			5.6–7.6	NR	2 (1.4–4)	
			7.7–9.8	NR	2.5 (1.2–5.2)	
			> 9.8	NR	3.3 (1.7–7.6)	
			Trend-test p-value: 0.005			

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Table 2.7.3 Case-control studies: Red meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
Hu et al. (2002) Canada 1994–1997	**Cases:** 161; Population-based. Cases identified from Cancer registry. Never smokers and women only. **Controls:** 483; populations samples from Provincial Health Insurance Plans, Ministry of Finance or random digit dialing **Exposure assessment method:** Questionnaire; postal questionnaires with telephone follow-up – 70-item food frequency questionnaire	Lung	Red meat (servings/week) < 2 2–3 3.1–5 > 5	 35 29 43 45	 1 0.8 (0.4–1.5) 1.4 (0.7–2.6) 1.4 (0.7–2.8)	Age, province, education, social class and total energy intake
Zatloukal et al. (2003) Czech Republic 1998–2002	**Cases:** 145; Hospital-based. Women only with incident histologically confirmed cancers **Controls:** 1624; Controls were spouses, relatives, or friends of other patients hospitalized **Exposure assessment method:** Questionnaire	Lung: adenocarcinoma Lung: other than adenocarcinomas	Red meat, weekly vs never/monthly daily weekly daily	61 66 101 99	0.89 (0.5–1.58) 1.21 (0.68–2.15) 1.54 (0.89–2.67) 1.81 (1.04–3.8)	Age, residence, education and pack-years of smoking
Kubík et al. (2004) Czech republic 1998–2002	**Cases:** 130; Hospital-based. Women only, non smokers **Controls:** 1022; Controls were spouses, friends or relatives of other hospital patients **Exposure assessment method:** Questionnaire; 9 food item	Lung	Red meat, at least once per week	121	2.2 (1.07–4.51)	Age, education, residence
Aune et al. (2009) Uruguay 1996–2004	**Cases:** 931; Multisite hospital-based case-control study. Incident cases **Controls:** 2,032; Hospital controls: non-neoplastic diseases not related to smoking, drinking or	Lung	Tertile Red meat tertile 1 (0–150 g/d) T2 (150 < 250 g/d) vs T1 T3 (250–600 g/d) vs T1	 356 383 192	 1 1.13 (0.91–1.42) 2.17 (1.52–3.1)	Age, sex, residence, education, smoking, alcohol, income, BMI, food items, energy intake

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Table 2.7.3 Case-control studies: Red meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
	diet (mainly minor surgery) **Exposure assessment method:** Questionnaire; 64 food items		Trend-test p-value: 0.0001			
De Stefani et al. (2009) Uruguay 1996–2004	**Cases:** 846; Hospital-based, same as Aune et al. (2009). Men only **Controls:** 846; Hospital controls: non-neoplastic diseases not related to tobacco smoking, alcohol drinking or diet **Exposure assessment method:** Questionnaire; 64 food items 1 year before diagnosis. This FFQ allowed the calculation of total energy intake and represented the usual diet of the Uruguayan population. Although the FFQ was not validated, it was tested for reproducibility. red meat = beef, ham	Lung	Red meat ≤ 5.0 servings per week	160	1	Age, residence, education, family history of lung cancer among first-degree relatives, body mass index, smoking status, smoking cessation, number of cigarettes smoked per day among current smokers, age of start smoking, total energy intake, total vegetables and fruits, reduced glutathione, and nonmeat fatty foods intakes
			5.1–7 servings per week vs ≤ 5	180	1.02 (0.73–1.42)	
			7.1–9.0	214	1.46 (1.04–2.05)	
			9.1	292	2.33 (1.63–3.32)	
			Trend-test p-value: 0.0001			
		Lung	PhIP intake estimate, ≤ 17.5 nanograms/g	159	1	Same as above
			17.6–27.2 vs ≤ 17.5 nanograms/g	196	1.12 (0.8–1.56)	
			27.3–34.6	213	1.48 (1.05–2.07)	
			≥ 34.7	278	2.16 (1.48–3.15)	
			Trend-test p-value: 0.0001			
Lam et al. (2009)	Cases:	Lung	Tertiles			Age, gender, area of

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Table 2.7.3 Case-control studies: Red meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
Italy 2002–2005	1,903; Population-based case-control study. Incident histologically confirmed cases. Controls: 2,073; Controls randomly selected from the Regional Health Service database. Matched by age, residence, gender Exposure assessment method: Questionnaire; selfadministered 58-item food frequency questionnaire, plus 24-hour recalls to estimate portion sizes. Mutagens estimated from CHARRED database		Red meat (beef steak, hamburger, pork chops, and veal chop/cutlet)	539	1	residence, education, BMI, alcohol, smoking intensity in pack-year per day, duration of cigarettes smoking, and years since last cigarettes
			Red meat Tertiles (T) 2 vs T1	614	1.3 (1.1–1.6)	
			T3 vs T1	719	1.8 (1.5–2.2)	
			Trend-test p-value: 0.001			
		Lung	(Tertile)			Same as above
			PhIP intake	587	1	
			PhIP intake T2 vs T1	618	1.1 (0.9–1.4)	
			T3 vs T1	698	1.5 (1.2–1.8)	
Lim et al. (2011) Singapore 2005–2008	**Cases:** 258; Hospital-based. Non-smoking Chinese women only **Controls:** 712; Hospital controls with wide range of mainly mild conditions **Exposure assessment method:** Questionnaire; meats: 18 items in the FFQ	Lung	Total meats (serving/week)			Age, history of cancer, country of origin, dwelling type, yr of education, usual body mass index, and fruit and vegetable intake
			T1 (< 9.70)	103	1	
			T2 (9.70–19.60)	93	0.88 (0.61–1.26)	
			T3 (> 19.60)	61	0.59 (0.39–0.89)	
			Trend-test p-value: 0.012			
		Lung	Pork (serving/week)			Age, history of cancer, country of origin, dwelling type, yr of education, usual body mass index, and fruit and vegetable intake
			T1 (< 1.01)	106	1	
			T2 > 1.00–2.5	68	1.09 (0.75–1.6)	
			T3 (> 2.5)	84	1.15 (0.8–1.64)	
			Trend-test p-value: 0.44			

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Table 2.7.3 Case-control studies: Red meat and cancer of the lung (web only)

Reference, location enrolment/follow-up period, study design	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/deaths	Risk estimate (95% CI)	Covariates controlled
Deneo-Pellegrini et al. (2015) Uruguay 1995–2004	**Cases:** 300 SCC; see De Stefani et al. (2012) and Aune et al. (2009). Restricted to squamous cell carcinomas in men **Controls:** 600; see De Stefani et al. (2012) and Aune et al. (2009). **Exposure assessment method:** Questionnaire	Lung SCC	Red meat, Tertile 1 (< 130.3 g/d) T2 (130.3–174.6 g/d) vs T1 T3 (> 174.6 g/d) vs T1 Trend-test p-value: 0.01	77 107 116	1 1.33 (0.87–2.03) 1.82 (1.13–2.91)	Age, residence, education, family history, body mass index, smoking status, smoking cessation, number of cigarettes smoked per day among current smokers, total energy, and total vegetable and fruit intakes

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