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RED MEAT AND PROCESSED MEAT

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Table S2.32 Case-control studies: Red meat and other cancers (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
Shu et al. (1989) China, population-based 1984–1986 Case-Control	**Cases:** 172; Women aged 18–70 years with ovarian cancer newly diagnosed in the Shanghai urban area between 1 September 1984 and 30 June 1986. **Controls:** 172; Controls were selected from the Shanghai general population, matched by age (5-years categories) **Exposure assessment method:** Questionnaire; red meat (pork, pork chops, spareribs, pigs' feet, salted pork, pork liver, organ meats, beef, lamb). Interviews by trained interviewers. Information on consumption of 63 common foods was obtained. FFQ and portion size were not specified.	Ovary	Red meat, Quartiles Q1	NR	1	Age and education
			Q2	NR	0.8	
			Q3	NR	1	
			Q4	NR	1.4	
			Trend-test p-value: 0.19			
Riboli et al. (1991) Spain, hospital-based 1985–1986 Case-Control	**Cases:** 497; Men aged under 80 years, diagnosed with histologically confirmed bladder cancer 1983–1986, hospitalized in one of the collaborating hospitals for diagnosis or treatment 1985–1986 and residents in the province where the hospital was located. **Controls:** 792; Two series of controls, matched to the cases by sex, age (within 5-year age groups): one drawn from the municipal registers or census files and the other from the same hospital registers as the cases. **Exposure assessment method:** Questionnaire; red meat (beef, pork, lamb), cured meat, liver. Dietary questionnaire (diet history method), 60 food groups.	Urinary bladder	Quartiles of red meat consumption (g/day)			Total calories and for tobacco smoking
			Q1 (< 43)	NR	1	
			Q2 (43–67)	NR	0.86	
			Q3 (> 67–96)	NR	0.9	
			Q4 (> 96)	NR	0.67 (0.46–0.96)	
			Trend-test p-value: 0.056			

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	FFQ, portion size included. In subject's home by a trained interviewer.					
Wolk et al. (1996) Australia, Denmark, Sweden, US, population-based 1989–1991 Case-Control	**Cases:** 1185; Patients with histopathologically confirmed RCC (adenocarcinoma; ICD-9 189.0) newly diagnosed between 1989 and 1991 were identified by a rapid ascertainment system through population- based cancer registries. **Controls:** 1526; Controls were selected from the same study areas as cases and frequency-matched by sex and 5-year age groups. **Exposure assessment method:** Questionnaire; red meat, preserved meat. Self- administered questionnaire, face to face interviews. FFQ, 147 foods, validity not specified. Portion size included.	Kidney: renal cell carcinoma (ICD-9 189.0)	Quartiles of red meat intake (times/week)			Age, sex, stud centre, body mass index, smoking and total calories
			Q1	NR	1	
			Q2	NR	0.98 (0.77–1.25)	
			Q3	NR	0.96 (0.76–1.23)	
			Q4	NR	0.94 (0.73–1.2)	
		Kidney: renal cell carcinoma (ICD-9 189.0)	Usual way of meat preparation			Same as above
			Baked/Roasted	244	1	
			Boiled/stewed	106	1 (0.73–1.39)	
			Broiled/grilled	180	0.77 (0.59–1)	
			Fried/sautéed	626	1.44 (1.15–1.79)	
		Kidney: renal cell carcinoma (ICD-9 189.0)	Degree of meat "doneness"			Same as above
			Rare + medium rare	204	1	
			Medium	115	1.06 (0.77–1.46)	
			Medium well	128	1.22 (0.89–1.67)	
			Well done/charred/burnt	710	1.24 (0.99–1.59)	
			Trend-test p-value: 0.05			

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Goodman et al. (1997) USA, Hawaii, population-based 1985–1993 Case-Control	**Cases:** 332; Residents of Oahu aged 18–84y, with incident, histologically confirmed primary endometrial cancer. Hawaii Tumor Registry. **Controls:** 511; Random selection from Oahu residents, individually matched 2:1 or 3:1 to cases on ethnicity and age (+/–2.5y). Intact uterus. **Exposure assessment method:** Questionnaire; 250-item diet history interview. Red meat not defined.	Endometrium	Quartiles of red meat intake (g/day)			Pregnancy history, OC use, history of diabetes, BMI, total calories
			Q1: < 28.2	NR	1	
			Q2: 28.2– < 55.4	NR	1.1	
			Q3: 55.4– < 98.6	NR	1.6	
			Q4: ≥ 98.6	NR	2 (1.1–3.7)	
			Trend-test p-value: 0.03			
		Endometrium	Quartiles of beef intake (g/day)			Same as above
			Q1: < 14.8	NR	1	
			Q2: 14.8– < 30.0	NR	0.9	
			Q3: 30.0– < 54.3	NR	1.5	
			Q4: ≥ 54.3	NR	1.8	
			Trend-test p-value: 0.04			
		Endometrium	Quartiles of pork intake (g/day)			Same as above
			Q1: < 3.9	NR	1	
			Q2: 3.9– < 10.2	NR	0.6	
			Q3: 10.2– < 21.2	NR	1	
			Q4: ≥ 21.2	NR	1.4	
			Trend-test p-value: 0.53			
De Stefani et al. (1998) Uruguay 1988–1995 Case-Control	**Cases:** 160; All incident cases of non-Hodgkin lymphoma (20–84 years) admitted for diagnosis or treatment in the Instituto Nacional de Oncologia of Montevideo, Uruguay. **Controls:** 163; Selected among other patients	NHL: Non-Hodgkin's lymphoma (ICD-O)	For men, tertiles of red meat intake (servings/week)			Age, residence, urban/rural status, type of tobacco, beer intake and 'mate'/years
			T1 (≤ 7.7)	22	1	
			T2 (7.8–12.6)	28	1.09 (0.46–2.61)	
			T3 (≥ 12.7)	35	2.53 (1.01–6.34)	
			Trend-test p-value: 0.04			
		NHL: Non-	For women, tertiles of red meat intake			Same as above

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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
	admitted to the same centre as the cases but with non-neoplastic disorders or with benign tumours, frequency matched on 10-y age group, sex, residence and urban/rural. **Exposure assessment method:** Questionnaire; Short FFQ used by interviewers. Detailed tobacco, alcohol and maté questions. Red meat defined as beef and lamb.	Hodgkin's lymphoma (ICD-O)	T1 (≤ 6.0 servings/week)	23	1	
			T2 (6.1–9.2 servings/week)	24	1.22 (0.5–3.01)	
			T3 (≥ 9.3 servings/week)	28	2.45 (0.88–6.82)	
			Trend-test p-value: 0.08			
Jain et al. (2000) Canada, Ontario, population-based 1994–1998 Case-Control	**Cases:** 552; Patients aged 30 to 79, identified through the Ontario Cancer Registry. ICD-9, code 182. **Controls:** 563; Random selection from property assessment lists of Ontario Ministry of Finance, matched by age group and geographic area. Listed phone number, intact uterus. **Exposure assessment method:** Questionnaire; Red meat (all beef, pork, veal, lamb, game, meat stews, meat soups). Home interviews by trained female interviewers. 1-year pre-diagnosis period for cases and 1 year prior the interview date for controls. 142 food groups, portion size used.	Endometrium	Quartiles of red meat intake (g/day)			Total energy, age, body weight, ever smoked, history of diabetes, used oral contraceptives, used hormone replacement therapy, university education, live births, age at menarche.
			Q1: < 15	107	1	
			Q2: 15– < 31	147	1.25 (0.87–1.8)	
			Q3: 31– < 53	129	1.01 (0.69–1.46)	
			Q4: ≥ 53	169	1.21 (0.83–1.77)	
			Trend-test p-value: 0.55			

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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
McCann et al. (2000) USA, New York, population-based 1986–1991 Case-Control	**Cases:** 232; Women aged 40–85 y, with histologically confirmed endometrial adenomatous carcinoma and no history of other cancer. **Controls:** 639; Women randomly selected from driver's license lists (< 65 y) and from Health Care Finance Administration lists (≥ 65 y), frequency-matched to cases on age and county of residence; intact uterus. **Exposure assessment method:** Questionnaire; Red meat not defined. Trained interviewers.172-item FFQ, validity not specified. Portion size included.	Endometrium	Quartiles of red meat intake (monthly frequency)			Age, education, BMI, diabetes, hypertension, pack-years cigarette smoking, age at menarche, parity, oral contraceptive use, menopause status, and postmenopausal estrogen use
			Q1: ≤ 8	78	1	
			Q2: 9–13	69	1 (0.6–1.5)	
			Q3: 14–17	45	0.7 (0.4–1.2)	
			Q4: > 17	40	0.8 (0.5–1.4)	
			Trend-test p-value: 0.96			
Tavani et al. (2000) Italy, hospital-based 1983–1996 Case-Control	**Cases:** 431; Men and women age < 75 y with incident (interviewed at most 1 y after diagnosis), histologically confirmed cancer of the urinary bladder, admitted to one of the 4 largest teaching and general hospitals in Milan. **Controls:** 7,990; Men and women age < 75 y, admitted to the same hospitals as the cancer cases for a wide spectrum of acute non-neoplastic conditions. **Exposure assessment method:** Questionnaire; Red meat (beef, veal and pork) FFQ, 40 food items. Portion size included. Diet 2 years preceding the diagnosis.	Urinary bladder	Tertiles of red meat consumption (portions/week; median)			Age, year of recruitment, sex, education, smoking habits and alcohol, fat, fruit and vegetable intakes.
			T1 (0–3; median = 3)	137	1	
			T2 (> 3–6; 5)	167	1.4 (1.1–1.8)	
			T3 (≥ 7; 7)	127	1.6 (1.2–2.1)	
			Increment of 1 portion/day	NR	1.3 (1–1.6)	
			Trend-test p-value: ≤ 0.01			

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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
Tavani et al. (2000) Italy, hospital-based 1983–1996 Case-Control	**Cases:** 750; Women < 75 y with incident (interviewed ≤ 1 y after diagnosis), histologically confirmed endometrial cancer. **Controls:** 4770; Women < 75 y, admitted to the same hospitals as the cases for a wide spectrum of acute non-neoplastic conditions. **Exposure assessment method:** Questionnaire; Red meat (beef, veal and pork) FFQ, 40 food items. Portion size included. Diet 2 years preceding the diagnosis.	Endometrium:	Tertiles of red meat intake (portions/week) Low: ≤ 3 Intermediate: > 3 to ≤ 6 High: > 6 Increment of 1 portion/ay Trend-test p-value: ≤ 0.01	249 245 256 NR	1 1.2 (1–1.5) 1.5 (1.2–1.8) 1.5 (1.2–1.9)	Age, year of recruitment, sex, education, smoking habits and alcohol, fat, fruit and vegetable intakes.
Tavani et al. (2000) Italy, hospital-based 1983–1996 Case-Control	**Cases:** 971; Women younger than 75 years with incident (i.e. interviewed at most 1 year after diagnosis), histologically confirmed ovarian cancer **Controls:** 4770; Women younger than 75 years, admitted to the same network of hospitals as the cancer cases for a wide spectrum of acute non-neoplastic conditions. **Exposure assessment method:** Questionnaire; red meat (beef, veal and pork) FFQ, 40 food items, validity not specified Portion size included. Diet 2 years preceding the diagnosis.	Ovary	Red meat consumption, portions/week ≤ 3 > 3–6 > 6	308 327 336	1 1.1 (0.9–1.3) 1.3 (1.1–1.6)	Same as above
		Ovary	Red meat consumption Increment of 1 portion/day Trend-test p-value: ≤ 0.01	NR	1.3 (1.1–1.5)	Same as above

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Tavani et al. (2000) Italy, hospital-based 1983–1996 Case-Control	**Cases:** 200; Age < 75 years, incident (i.e. interviewed at most 1 year after diagnosis), histologically confirmed non-Hodgkin's lymphomas, admitted to one of the 4 largest teaching and general hospitals in Milan (National Cancer Institute, university clinics, Ospedale Maggiore of Milan) **Controls:** 7990; Age < 75 years, admitted to the same hospitals as the cases, for a wide spectrum of acute non-neoplastic conditions. Exclusions were made for any condition related to tobacco smoking, alcohol consumption or any disorder which might have induced long-term modifications of the diet. **Exposure assessment method:** Questionnaire; 40-item FFQ through interview up to 1 year post diagnosis referring to diet 2 years pre-diagnosis. Red meat: beef, veal and pork, excluding canned and preserved meat. Portion size100–150 g.	NHL: Non-Hodgkin's lymphoma	Red meat consumption, tertiles (portions/week)			Age, year of recruitment, sex, education, smoking habits and alcohol, fat, fruit and vegetable intakes.
			T1 (≤ 3)	69	1	
			T2 (4–6)	63	1 (0.7–1.4)	
			T3 (≥ 7)	68	1.2 (0.8–1.7)	
			Trend-test p-value: 0.94			
		NHL: Non-Hodgkin's lymphoma	1 portion/day of red meat consumption (100–150 g)			Same as above
			Increment of 1 portion/day	200	1.2 (0.9–1.7)	
Tavani et al. (2000) Italy, hospital-based 1983–1996 Case-Control	**Cases:** 428; Men and women age < 75 y with incident, histologically confirmed hepatocellular cancer, admitted to one of the 4 largest teaching and general hospitals in Milan. **Controls:** 7990; Men and women age < 75 y, admitted to the same hospitals as the cases, for a wide spectrum of acute non-neoplastic conditions. Excluded: conditions related to tobacco smoking,	Liver: Hepatocellular carcinoma	Red meat consumption, tertiles (portions/week)			Age, year of recruitment, sex, education, smoking habits and alcohol, fat, fruit and vegetable intakes.
			T1 (≤ 3 times/week)	166	1	
			T2 (4–6 times/week)	157	1 (0.8–1.2)	
			T3 (≥ 7 times/week)	105	0.8 (0.6–1.1)	
		Liver: Hepatocellular carcinoma	1 serving/day of red meat consumption (100–150 g)			Same as above
			Increment of 1 serving/day	428	0.9 (0.7–1.1)	

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	alcohol consumption or any disorder which might have induced long-term modifications of the diet. **Exposure assessment method:** Questionnaire; 40-item FFQ through interview up to 1 year post diagnosis referring to diet 2 years pre-diagnosis. Red meat: beef, veal and pork, excluding canned and preserved meat. Portion size100–150 g.					
Tavani et al. (2000) Italy, hospital-based 1983–1996 Case-Control	**Cases:** 60; Men and women age < 75 y with incident, histologically confirmed gallbladder cancer, admitted to one of the 4 largest teaching and general hospitals in Milan.	Bile duct: Gallbladder cancer	Red meat consumption, tertiles (portions/week)			Age, year of recruitment, sex, education, smoking habits and alcohol, fat, fruit and vegetable intakes.
			T1 (≤ 3 times/week)	25	1	
			T2 (> 3–6 times/week)	24	1.1 (0.6–1.9)	
			T3 (≥ 7 times/week)	11	0.7 (0.3–1.4)	
	Controls: 7990; Men and women age < 75 y, admitted to the same hospitals as the cases, for a wide spectrum of acute non-neoplastic conditions. Excluded: conditions related to tobacco smoking, alcohol consumption or any disorder which might have induced long-term modifications of the diet. **Exposure assessment method:** Questionnaire; 40-item FFQ through interview up to 1 year post diagnosis referring to diet 2 years pre-diagnosis. Red meat: beef, veal and pork, excluding canned and preserved meat. Portion size100–150 g.	Bile duct: Gallbladder cancer	1 serving/day of red meat consumption (100–150 g)			Same as above
			Increment of 1 serving/day	60	0.6 (0.3–1.2)	

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Zhang et al. (2002) China, hospital-based 1999–2000 Case-Control	**Cases:** 254; Women under 75 years of age, who were residents (at least 10 years residence in Zhejiang province) and who had been histopathologically diagnosed with epithelial ovarian cancer in the past 3 years **Controls:** 652; Women recruited from the same hospitals where the cases were identified: 340 hospital visitors, 261 outpatients; and 51 community controls **Exposure assessment method:** Questionnaire; Fresh meat mainly red. Face to face interview. FFQ, 120 food items, validated. 5 years before diagnosis (cases) or interview (control). Portion size used.	Ovary	Quartiles of fresh meat intake, kg/year Q1: ≤ 7.45 Q2: 7.5–13.20 Q3: 13.25–22.70 Q4: ≥ 22.75 Trend-test p-value: > 0.05	NR NR NR NR	1 1.78 (1–3.2) 1.98 (1.1–3.6) 1.98 (1–3.8)	Age at interview, education, living area, BMI, smoking, alcohol drinking, tea drinking, family income, marital and menopause status, parity, tubal ligation, oral contraceptive use, physical activity, family history of ovarian cancer, total energy intake, and all food groups except vegetable subgroups
McCann et al. (2003) USA, Western New York, population-based 1986–1991 Case-Control	**Cases:** 124; White women age 40–85 y, residents of Erie or Niagara counties, with incident, primary, histologically confirmed ovarian carcinoma identified from pathology records of the major hospitals in the two counties. **Controls:** 696; White women age 40–85 y, residents of Erie or Niagara counties, randomly selected from driver's license lists (age < 65 y) and from Health Care Finance Administration lists (age ≥ 65 y), frequency matched to cases on age and county of residence. Exposure assessment method: Questionnaire; red meat (not defined). In-person interview by trained	Ovary	Quintiles of red meat consumption (g/month) Q1: < 766 Q2: 766–1171 Q3: 1171–1574 Q4: 1575–2224 Q5: > 2224	25 14 29 28 28	1 0.6 (0.3–1.23) 1.19 (0.65–2.18) 1.3 (0.69–2.43) 1.22 (0.61–2.44)	Age, education, total months menstruating, difficulty becoming pregnant, oral contraceptive use, menopausal status and total energy

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	interviewers. Diet in the 12 months period 2 y before the interview FFQ, was validated Portion size included					
Pan et al. (2004) Canada, population-based 1994–1997 Case-Control	**Cases:** 442; Women aged 20–76 y with incident, primary ovarian cancer histologically confirmed between 1994 and 1997 in the seven participating provinces (Alberta, British Columbia, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Saskatchewan). **Controls:** 2135; Random sample from provincial population databases, random digit dialing in Newfoundland and Alberta, frequency matched by age and sex distribution, so that there would be at least one control for every case and 5-year age group within each province. **Exposure assessment method:** Questionnaire; Data from the Canadian National Enhanced Cancer Surveillance System (NECSS), which detailed information on diet including red meat and processed meat, and other risk factors. Self-administered questionnaire and telephone follow-up. Diet information from 2 years before interview and general changes with 20 years ago. FFQ, 69 food items, validated. Portion size included. Red meat included beef, pork, or lamb as a main dish; beef, pork, or lamb as a mixed dish (stew or casserole, pasta dish), and hamburger.	Ovary: ICD-O-2 C56	Red meat, Quartiles (serving/week) Q1	NR	1	10-year age group, province of residence, education, alcohol consumption, cigarette pack-years, BMI, total caloric intake, recreational physical activity, number of live births, menstruation years, and menopause status.
			Q2	NR	0.8 (0.59–1.09)	
			Q3	NR	0.75 (0.54–1.03)	
			Q4	NR	0.78 (0.57–1.06)	
			Trend-test p-value: 0.104			

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Wakai et al. (2004) Japan, hospital-based 1994–2000 Case-Control	**Cases:** 124; Diagnosed bladder cancer patients in the Aichi Cancer Center Hospital **Controls:** 620; randomly selected five controls for each case from among the 29 815 cancer-free individuals, matching for age (5-year strata), sex and year of first visit. **Exposure assessment method:** Questionnaire; Red meat (beef, pork, ham and sausage). Self-administered questionnaire by trained interviewer. FFQ, validity was specified, portion size included.	Urinary bladder	Beef Almost never	19	1	Adjusted for age, sex, year of first visit and cumulative consumption of cigarettes
			1–3 times/month	46	0.83 (0.47–1.47)	
			1–2 times/week	50	0.78 (0.44–1.36)	
			≥ 3–4 times/week	9	0.83 (0.36–1.93)	
			Trend-test p-value: 0.5			
		Urinary bladder	Pork Almost never	14	1	Same as above
			1–3 times/month	53	1.27 (0.68–2.38)	
			1–2 times/week	46	0.94 (0.5–1.78)	
			≥ 3–4 times/week	11	0.9 (0.39–2.07)	
			Trend-test p-value: 0.37			
Chang et al. (2005) Sweden 2000–2002 Case-Control	**Cases:** 597; Newly diagnosed and morphologically verified non-Hodgkin lymphoma including chronic lymphocytic leukaemia **Controls:** 467; Population controls through computerized population register sampled every 6 months, frequency matched on sex and 10 y age interval. **Exposure assessment method:** Questionnaire; Telephone interview on medical and family history, habits, NHL risk factors etc. Semiquantitative 137-item FFQ covering reported intake in previous 2 years. Food preparation habits e.g. degree of frying or grilling included. Red meat included	NHL: Non-Hodgkin's lymphoma (ICD 10)	Quartiles of red meat consumption including processed meat like sausage and sandwich meat (servings/day, median)			Age (5 year categories), sex
			Q1 (0.0–0.8; 0.6)	153	1	
			Q2 (> 0.8–1.1; 1.0)	114	0.8 (0.5–1.1)	
			Q3 (> 1.1–1.6; 1.3)	147	1 (0.7–1.4)	
			Q4 (> 1.6; 2.0)	183	1.2 (0.8–1.7)	
			Trend-test p-value: 0.13			
		NHL: Non-Hodgkin's lymphoma (ICD 10)	Quartiles of fried red meat (beef, pork, and sausage) consumption (servings/day, median)			Age (5 year categories), sex
			Q1 (0.0–0.07; 0.0)	121	1	
			Q2 (> 0.07–0.1; 0.1)	118	1.1 (0.7–1.5)	
			Q3 (> 0.1–0.3; 0.2)	142	1.3 (0.9–1.8)	

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	mincemeat/hamburger, pork, beef/veal, sausage, sandwich meat, fried sausage/beef/ pork chop, and grilled sausage/beef/pork chop.		Q4 (> 0.3; 0.4)	216	1.5 (1–2.1)	
			Trend-test p-value: 0.02			
		NHL: Non-Hodgkin's lymphoma (ICD 10)	Quartiles of grilled red meat (beef, pork, sausage) consumption (servings/day, median)			Age (5 year categories), sex
			Q1 (0.0–0.01; 0.00)	180	1	
			Q2 (> 0.01–0.02; 0.01)	153	1.1 (0.8–1.6)	
			Q3 (> 0.02–0.04; 0.03)	127	0.7 (0.5–1)	
			Q4 (> 0.04; 0.05)	137	0.8 (0.6–1.2)	
			Trend-test p-value: 0.21			
		NHL (DLBCL): Diffuse large B-cell lymphoma (IDC-10)	Fried red meat (beef, pork, sausage) consumption by quartile (servings/day)			Age (5 year categories), sex
			Q1: 0–0.07	NR	1	
			Q2: > 0.07–0.1	NR	0.8 (0.4–1.5)	
			Q3: > 0.1–0.3	NR	1.3 (0.7–2.3)	
			Q4: > 0.3	NR	1.6 (1–2.8)	
			Trend-test p-value: 0.02			

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Radosavljević et al. (2005) Serbia, hospital-based 1997–1999 Case-Control	**Cases:** 130; Men and women with newly diagnosed bladder cancer from two major hospitals. **Controls:** 130; Patients from the same hospitals, without diseases that may lead to permanent change in diet, individually matched to cases by sex, age (± 2 years) and place of residence (rural or urban). **Exposure assessment method:** Questionnaire; One doctor interviewed all study subjects. Lifetime dietary history, 101-item FFQ. Red meat or processed meat as groups not defined. Pork, liver and canned meat included in multivariate logistic regression model.	Urinary bladder	Tertiles of pork intake			Smoking
			1 tertile	9	1	
			2 tertile	51	8.71 (3.87–19.58)	
			3 tertile	48	3.51 (1.62–7.6)	
		Urinary bladder	Categories of liver intake			Smoking
			No	NR	1	
			Yes	NR	6.6 (1.89–23.03)	
Cross et al. (2006) United States 1998–2000 Case-Control	**Cases:** 458; Histologically confirmed new cases of non-Hodgkin lymphoma according to SEER definition without HIV aged 20–74 years **Controls:** 383; Population-based controls through random-digit dialing for those 65 years and younger, and through Center for Medicare and Medicaid Services files for those 65–74 years, matched on age (5 years), centre, race and gender **Exposure assessment method:** Questionnaire; Red meat was not well defined and may include some processed meats, the definition seems to include at least meats for which cooking methods and doneness levels were estimated, but also more since it is distinguished from	NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Quartiles of red meat consumption			Gender, Age, Physical activity, Alcohol consumption, Total caloric intake, Study site
			Q1 (categories not specified)	NR	1	
			Q2	NR	1 (0.65–1.52)	
			Q3	NR	1.24 (0.8–1.91)	
			Q4	NR	1.1 (0.67–1.81)	
			Trend-test p-value: 0.87			

Table S2.32 Case-control studies: Red meat and other cancers (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
	this variable: hamburger, steak, pork chops, bacon and sausage.	NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Quartiles of barbecued red meat consumption			Same as above
			Q1 (categories not specified)	NR	1	
			Q2	NR	0.92 (0.61–1.32)	
			Q3	NR	0.79 (0.53–1.2)	
			Q4	NR	0.67 (0.44–1.03)	
			Trend-test p-value: 0.07			
		NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Quartiles of pan-fried red meat consumption			Same as above
			Q1 (categories not specified)	NR	1	
			Q2	NR	0.77 (0.5–1.18)	
			Q3	NR	1.08 (0.71–1.65)	
			Q4	NR	1.18 (0.75–1.84)	
			Trend-test p-value: 0.11			
		NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Broiled red meat consumption (yes versus no)			Same as above
			Not consumed	NR	1	
			Consumed	NR	1.32 (0.99–1.77)	
			Trend-test p-value: 0.09			
		NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Rare red meat consumption (yes versus no)			Same as above
			Not consumed	NR	1	
			Consumed	NR	0.87 (0.64–1.2)	
			Trend-test p-value: 0.33			

Table S2.32 Case-control studies: Red meat and other cancers (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
		NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Quartiles of rare/medium red meat consumption			Same as above
			Q1 (categories not specified)	NR	1	
			Q2	NR	0.68 (0.44–1.06)	
			Q3	NR	1.13 (0.77–1.68)	
			Q4	NR	0.69 (0.45–1.06)	
			Trend-test p-value: 0.14			
		NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Quartiles of medium red meat consumption			Same as above
			Q1 (categories not specified)	NR	1	
			Q2	NR	0.59 (0.3–1.15)	
			Q3	NR	1.14 (0.79–1.66)	
			Q4	NR	0.92 (0.62–1.35)	
			Trend-test p-value: 0.57			
		NHL: Non-Hodgkin's lymphoma (ICD O-2 based on SEER codes)	Quartiles of well done red meat consumption			Same as above
			Q1 (categories not specified)	NR	1	
			Q2	NR	0.75 (0.48–1.16)	
			Q3	NR	1.13 (0.74–1.73)	
			Q4	NR	1.17 (0.73–1.86)	
			Trend-test p-value: 0.08			

Table S2.32 Case-control studies: Red meat and other cancers (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
Talamini et al. (2006a) Italy 1999–2002 Case-Control	**Cases:** 190; incident, histologically confirmed non-Hodgkin's lymphoma (HIV-negative) aged 18 to 84 years old admitted to major reference hospitals of the areas under surveillance (Pordenone, North-Eastern Italy and Naples, Southern Italy) **Controls:** 484; Hospital-based controls of the same age admitted to the same network of hospitals. **Exposure assessment method:** Questionnaire; Validated 63-item FFQ covering the 2 preceding years. Red meat food group includes beef, veal, pork, liver, pasta/rice with meat sauce and lasagna/cannelloni. Processed meat is also reported but only together with pork.	NHL: Non-Hodgkin's lymphoma (ICD-O-2)	Quartiles of red meat consumption (servings/week)			Gender, age, centre, education, place of birth, hepatitis C virus test, total energy intake
			Q1 (≤ 1.6)	NR	1	
			Q2 (1.61–2.4)	NR	0.98 (0.59–1.63)	
			Q3 (2.41–3.25)	NR	0.84 (0.5–1.4)	
			Q4 (> 3.25)	NR	0.93 (0.56–1.55)	
			Trend-test p-value: 0.65			

Table S2.32 Case-control studies: Red meat and other cancers (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
Talamini et al. (2006b) Italy 1999–2002 Case-Control	**Cases:** 185; Incident hepatocellular cancer cases (age 43–84 y) who had not received cancer treatment before and admitted to selected hospitals in province of Pordenone, North-eastern Italy, and Naples, South of Italy. **Controls:** 412; Patients from the same hospitals (age 40–82 y), excluding those whose hospital admission was related to alcohol and tobacco use, hepatitis viruses or hospitalization for chronic diseases that might have led to substantial lifestyle modifications. Controls were matched on age, gender and study centre. **Exposure assessment method:** Questionnaire; Validated 63-item FFQ covering the 2 preceding years. Red meat food group includes beef, veal, pork, liver, pasta/rice with meat sauce and lasagna/cannelloni.	Liver: hepatocellular carcinoma	Quartiles of red meat intake (servings/week)			Gender, age, centre, education, place of birth, drinking habits, maximal lifetime alcohol intake, total energy intake, Hepatitis B and C viruses
			Q1 (< 1.5 servings/week)	NR	1	
			Q2 (1.5– < 2.25 servings/week)	NR	1.54 (0.7–3.39)	
			Q3 (2.25–3.00 servings/week)	NR	0.87 (0.37–2.04)	
			Q4 (> 3.00 servings/week)	NR	2.07 (0.88–4.82)	
			Trend-test p-value: 0.23			

Table S2.32 Case-control studies: Red meat and other cancers (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
Xu et al. (2006) China, population-based 1997–2003 Case-Control	**Cases:** 1204; Residents of urban Shanghai, aged 30–69 years, newly diagnosed with endometrial cancer **Controls:** 1212; Women randomly selected from the Shanghai Resident Registry, with intact uterus, frequency matched to cases by age **Exposure assessment method:** Questionnaire; Red meat (pork, beef, mutton), organ meat. In-person interview by trained interviewer. FFQ, 76 food items, validated. Portion size included.	Endometrium	Quartiles of red meat intake (g/day) Q1: < 22.4 Q2: 22.4– < 38.6 Q3: 38.6– < 61.9 Q4: ≥ 61.9 Trend-test p-value: 0.02	238 290 325 351	1 1.2 (0.9–1.5) 1.3 (1–1.7) 1.3 (1–1.8)	Age, menopausal status, diagnosis of diabetes, alcohol consumption, BMI, physical activity, and total energy intake, meat intake other than red meat

Table S2.32 Case-control studies: Red meat and other cancers (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
Bravi et al. (2007) Italy, hospital-based 1992–2004 Case-Control	**Cases:** 767; Men and women under age 79 years with incident, histologically confirmed RCC, admitted to major teaching and general hospitals in greater Milan area and the provinces of Udine and Pordenone in northern Italy, the province of Latina in central Italy and the urban area of Naples in southern Italy. Cancers of the renal pelvis and ureter were not included. **Controls:** 1534; Men and women under age 79 years (median age 62 years, range 22–79 years) admitted to the same hospitals as cases for a wide spectrum of acute nonneoplastic conditions, unrelated to known or potential risk factors for RCC **Exposure assessment method:** Questionnaire; red meat, processed meat. Interview by trained interviewers. FFQ, 78 food items, validity not specified. 2 years before diagnosis for cases or hospital admission for control. Portion size was included.	Kidney: renal cell carcinoma (ICD-9 189.0)	Quintiles of red meat intake (servings/week, upper limit) Q1(2.4) Q2 (3.4) Q3 (4.4) Q4 (5.9) Q5 (-) Trend-test p-value: 0.17	NR NR NR NR NR	1 1.16 (0.87–1.54) 0.93 (0.7–1.24) 0.97 (0.73–1.3) 0.84 (0.62–1.14)	Center, sex, and age, and adjusted for period of interview, education, tobacco smoking, alcohol drinking, body mass index, family history of kidney cancer, and total energy intake.

Table S2.32 Case-control studies: Red meat and other cancers (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
García-Closas R et al. (2007) Spain, hospital-based 1998–2001 Case-Control	**Cases:** 912; Cases were patients newly diagnosed with histologically confirmed bladder cancer in 18 participating hospitals. **Controls:** 873; Controls without a previous history of cancer were selected among patients from the same hospitals with diagnoses believed to be unrelated to the exposures of interest, matched to the cases on age (within a 5-year window), gender, race and study hospital **Exposure assessment method:** Questionnaire; Red meat (beef, veal, lamb, pork) Doneness level (photographs) FFQ, 127 food items, validated, portion size specified 49% of the FFQ were administered with the help of the relative, 34% were self-administered and 17% were administered by the interviewer. 39% of FFQ were completed while in the hospital and 61% were completed at home few days after discharge. Interview, Diet 5 years before diagnosis for cases and before interview for controls.	Urinary bladder	Quintiles of red meat intake (median, g/day/kcal) Q1 (14) Q2 (26) Q3 (37) Q4 (50) Q5 (70) Trend-test p-value: 0.09	184 211 188 180 149	1 1.1 (0.8–1.5) 1.1 (0.8–1.5) 1 (0.7–1.3) 0.8 (0.6–1.1)	Adjusted for age, gender, region, smoking status, duration of smoking and quintiles of fruit and vegetable intake

Table S2.32 Case-control studies: Red meat and other cancers (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
Hsu et al. (2007) the Russian Federation, Czech Republic, Poland, Romania, hospital-based 1999–2003 Case-Control	**Cases:** 1065; Men and women with newly diagnosed and histologically confirmed renal cell carcinoma, between the ages of 20 and 79. Cases had to be residents of the study areas for at least 1 year at the time of recruitment. **Controls:** 1509; Men and women admitted to the same hospital as cases for conditions unrelated to smoking or genitourinary disorders (except for benign prostatic hyperplasia) who were frequency matched on age to cases. Controls had to be residents of the study areas for at least 1 year at the time of recruitment. **Exposure assessment method:** Questionnaire; processed meat (ham, salami, sausages) Red meat (beef, pork, lamb) FFQ, 23 food items, validated. In-person interview by trained interviewers within 3 months of diagnosis. Portion size included.	Kidney: renal cell cancer O-2 C.64	Intake of red meat			Age, country, gender, tobacco pack-years of smoking, education (categorical), body mass index, hypertension medication use, categories of total weekly alcohol consumption (none, low, medium, and high tertiles), and tertiles of total vegetable consumption.
			Low (< 1 time/month)	12	1	
			Medium (< 1 time/week)	90	1.44 (0.7–2.98)	
			High (≥ 1 time/week)	963	2.01 (1.02–3.99)	
			Trend-test p-value: < 0.01			

Table S2.32 Case-control studies: Red meat and other cancers (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. (2008) Canada, population-based 1994–1997 Case-Control	**Cases:** 19 732; Participating provincial cancer registries ascertained a total of 35 040 (15 872 females and 19 168 males) histologically confirmed incident cancer cases aged 20 to 76 yr between 1994 and 1997. **Controls:** 5,039; Individuals without cancer were selected from a random sample within a province, with an age/sex distribution similar to that of all cancer cases in the NECSS. **Exposure assessment method:** Questionnaire; Red meat (beef, pork, lamb as a main dish; beef, pork, or lamb as a mixed dish (stew or casserole, pasta dish), and hamburger. Questionnaire was mailed, reminder postcard, telephone follow-up. FFQ, 69 food items, validity not specified. 2 year before diagnosis for cases and controls.	Urinary bladder	Quartiles of red meat consumption (servings/week) I (0–2) II (2.1–3.94) III (3.95–5.0) IV (≥ 5.1) Trend-test p-value: 0.04	NR NR NR NR	1 1.2 (1–1.6) 1.2 (0.9–1.5) 1.3 (1–1.7)	10 year age group, province, education, BMI, sex, alcohol use, pack-year smoking, total of vegetable and fruit intake, total energy intake

Table S2.32 Case-control studies: Red meat and other cancers (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. (2008) Canada, population-based 1994–1997 Case-Control	**Cases:** 1345; individual data from a population-based sample that covered 19 types of cancer and population controls in the Canadian provinces of British Columbia (BC), Alberta (AB), Saskatchewan (SASK), Manitoba (MB), Ontario (ON), Prince Edward Island (PEI), Nova Scotia (NS), and Newfoundland (NFD). **Controls:** 5039; Individuals without cancer were selected from a random sample within a province, with an age/sex distribution similar to that of all cancer cases **Exposure assessment method:** Questionnaire; red meat: beef, pork, lamb as a main dish; beef, pork, or lamb as a mixed dish (stew or casserole, pasta dish), and hamburger. Questionnaire was mailed, reminder postcard, telephone follow-up. FFQ, 69 food items, validity not specified. 2 year before diagnosis for cases and controls.	Kidney	Quartiles of red meat consumption (servings/week) Q1 (0–2) Q2 (2.1–3.94) Q3 (3.95–5) Q4 (> 5.1) Trend-test p-value: 0.21	NR NR NR NR	1 1 (0.9–1.3) 1.1 (0.9–1.3) 1.1 (0.9–1.4)	Same as above
Hu et al. (2008) Canada 1994–1997 Case-Control	**Cases:** 1666; Men and women aged 20–76 years with histologically confirmed incident non-Hodgkin's lymphoma as defined by ICD-O–2, from the provincial cancer registries. **Controls:** 5039; Men and women without cancer, random selection within a province, with an age/sex distribution similar to that of all cancer cases in the National Enhanced Cancer Surveillance System. Mostly	NHL: Non-Hodgkin's lymphoma (ICD-O-2)	Quartiles of red meat consumption (servings/week) Q1 (≤ 2) Q2 (2.1–3.94) Q3 (3.95–5) Q4 (≥ 5.1) Trend-test p-value: 0.6	NR NR NR NR	1 1.1 (0.9–1.3) 1.1 (0.9–1.3) 1.1 (0.9–1.3)	Same as above

Table S2.32 Case-control studies: Red meat and other cancers (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
	provincial health insurance plans, two provinces used random digit dialing. Exposure assessment method: Questionnaire; 69-item FFQ was mailed, reminder postcard, telephone follow-up. Diet recall 2 years before diagnosis. Red meat: beef, pork, lamb as a main dish; beef, pork, or lamb as a mixed dish (stew or casserole, pasta dish), and hamburger.					
Hu et al. (2008) Canada 1994–1997 Case-Control	**Cases:** 686; Histologically confirmed incident cases of testis cancer aged 20–74 years from the provincial cancer registries. **Controls:** 2547; Serve as controls for many other cancer cases as well. **Exposure assessment method:** Questionnaire; Questionnaire, red meat (beef, pork, lamb as a main dish; beef, pork, or lamb as a mixed dish (stew or casserole, pasta dish), and hamburger. Questionnaire was mailed, reminder postcard, telephone follow-up. FFQ, 69 food items, validity not specified. 2 year before diagnosis for cases and controls.	Testis: (ICD-O-2)	Quartiles of red meat consumption (servings per week)			Same as above
			Q1 (≤ 2 servings/week)	NR	1	
			Q2 (2.1–3.94 servings/week)	NR	1.3 (0.9–1.9)	
			Q3 (3.95–6 servings/week)	NR	1.2 (0.8–1.7)	
			Q4 (≥ 6.1 servings/week)	NR	1.1 (0.8–1.6)	
			Trend-test p-value: 0.87			

Table S2.32 Case-control studies: Red meat and other cancers (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
Aune et al. (2009) Uruguay, hospital-based 1996–2004 Case-Control	**Cases:** 114; All the cases were < 90 years old at diagnosis (age range 26–89 years, mean 63.6 years) and were drawn from the four major public hospitals of Montevideo. **Controls:** 2032; Patients < 90 years old (age range 23–89 years, mean 62.3 years) from the same hospitals, with non-neoplastic diseases not related to smoking, drinking and without recent changes in their diet. **Exposure assessment method:** Questionnaire; Red meat: beef, lamb. FFQ, 64 food items, was not validated but tested for reproducibility. Interview by trained interviewers. Portion size included.	Kidney	Tertiles of red meat consumption (median, g/d)			Age, sex, residence, education, income, interviewer, smoking status, cigarettes per day, duration of smoking, age at starting, years since quitting, alcohol, dairy foods, grains, fatty foods (butter, eggs, custard, cake), fruits and vegetables, fish, poultry, mate drinking, BMI and energy intake, processed meat
			T1 (85.5)	53	1	
			T2 (160.3)	43	1.12 (0.68–1.84)	
			T3 (300.2)	18	2.72 (1.22–6.07)	
			Trend-test p-value: 0.06			
		Kidney	Sex-specific tertiles of beef consumption (g/day)			Same as above
			T1 (Men: 85.5, Women: 64.1)	56	1	
			T2 (M: 150, W: 117.5)	43	1.14 (0.71–1.84)	
			T3 (M: 300, W: 171)	15	2.53 (1.14–5.59)	
			Trend-test p-value: 0.073			
		Kidney	Sex-specific tertiles of lamb consumption (g/day)			Same as above
			T1 (Men: 0, Women: 0)	68	1	
			T2 (M: 7.4, W: 4.9)	43	1.47 (0.96–2.25)	
			T3 (M: 150, W: 96.2)	3	0.77 (0.22–2.67)	
			Trend-test p-value: 0.29			

Table S2.32 Case-control studies: Red meat and other cancers (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
Bravi et al. (2009) Italy, hospital-based 1992–2006 Case-Control	**Cases:** 454; Women aged 18–79 y with incident, histologically confirmed endometrial cancer, admitted to major teaching and general hospitals of study area. **Controls:** 908; Women aged 19–80 y admitted to the same hospitals for a wide variety of acute non-neoplastic conditions, excluding gynaecological or hormone-related conditions or medical conditions relate to long-term dietary changes. Matched 1:2 by 5-year age group and study centre. **Exposure assessment method:** Questionnaire; 78-item FFQ, 2-year recall. Red meat defined in Di Maso et al. (2013).	Endometrium	Quintiles of red meat intake (servings/week, upper limit) Q1: 2.00 Q2: 3.25 Q3: 4.25 Q4: 5.25 Q5: - Increment of 1 serving/day Trend-test p-value: 0.002	NR NR NR NR NR NR	1 1.17 (0.78–1.76) 1.23 (0.82–1.85) 1.75 (1.14–2.7) 1.82 (1.19–2.78) 2.07 (1.29–3.33)	Age, centre, year of interview, education, total energy intake, BMI, history of diabetes, age at menarche, parity, OC use, HRT, menopausal status
Grieb et al. (2009) US, population-based 2000–2004 Case-Control	**Cases:** 329; Men and women resident in Florida or Georgia, older than 20 years, with incident, histologically confirmed renal cell carcinoma identified from hospital records in three participating hospitals in North Florida and Georgia and through the Florida Cancer Data System registry. **Controls:** 331; Men and women resident in Florida or Georgia with no history of renal disease, identified by random-digit dialing, frequency-matched to cases by age (± 5 years), sex, and race. **Exposure assessment method:** Questionnaire; red meat (beef, steaks, pot roasts, and ground meat) In-person interview by trained personnel.	Kidney: renal cell carcinoma	Red meat consumption frequency < 1 time/week 1 time/week 2 times/week 3–4 times/week ≥ 5 times/week Trend-test p-value: < 0.001	72 81 65 84 27	1 1.51 (0.97–2.35) 1.46 (0.91–2.37) 2.22 (1.37–3.58) 4.43 (2.02–9.75)	Age at interview, sex, race, income, body mass index and pack-years of smoking.

Table S2.32 Case-control studies: Red meat and other cancers (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
	FFQ, 70 food items, validated. 1-year period before the interview. Portion size included.	Kidney: renal cell carcinoma	Red meat consumption frequency among men			Same as above
			< 1 time/week	36	1	
			1 time/week	42	1.49 (0.77–2.89)	
			2 times/week	39	1.12 (0.58–2.17)	
			3 or more times/week	61	2.08 (1.08–4)	
			Trend-test p-value: 0.22			
		Kidney: renal cell carcinoma	Red meat consumption frequency among women			Same as above
			< 1 time/week	36	1	
			1 time/week	39	1.48 (0.81–2.73)	
			2 times/week	26	2.03 (0.98–4.19)	
			3 or more times/week	50	3.04 (1.6–5.79)	
			Trend-test p-value: < 0.001			
Kallianpur et al. (2010) China, population-based Jan1997–Dec 2003 Case-Control	**Cases:** 1,204; Women, permanent residents in urban Shanghai, 30–69 yr of age, no hysterectomy before diagnosis (cases) or study enrollment (controls). **Controls:** 1,212; Randomly selected among the general population using the Shanghai Resident Registry. **Exposure assessment method:** Questionnaire; In-person interview by trained interviewers. Validated FFQ, 76 food items, covering > 85% of commonly consumed foods including 19 animal foods. Serving size included, over the past 5 years ignoring any recent changes.	Endometrium	Quartiles of heme iron intake (mg/day)			Age; education; BMI; age at menarche; age at menopause; number of pregnancies; family history of colorectal, breast, and/or endometrial cancer; regular exercise; total energy intake; vitamin A, C, and E intake; folic acid and isoflavone intake; vitamin supplement use; OC; HRT; saturated fat and monounsaturated fat intake
			Q1: < 1.92	224	1	
			Q2: 1.92–2.86	263	1.23 (0.91–1.66)	
			Q3: 2.87–4.14	340	1.8 (1.26–2.58)	
			Q4: > 4.14	338	1.86 (1.22–2.85)	
			Trend-test p-value: < 0.01			

Table S2.32 Case-control studies: Red meat and other cancers (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
Kolahdooz et al. (2010) Australia, population-based SWH 1990–1993; AOCS 2002–2005 Case-Control	**Cases:** 2049; Women aged 18–79 y newly diagnosed with epithelial ovarian cancer in the Australian states of New South Wales, Victoria, and Queensland between 1990 and 1993 AND Australian residents aged 18–79 y newly diagnosed with invasive or borderline epithelial ovarian, fallopian tube, or primary peritoneal cancer between 2002 and 2005. **Controls:** 2191; Selected at random from the Australian electoral roll and matched to cases by state of residence and 5-y age group. Women with a history of ovarian cancer, and women who reported a previous bilateral oophorectomy were excluded. **Exposure assessment method:** Questionnaire; red meat (beef, lamb, pork). Liver meat was studied alone. Standardized face-to-face interview, self-administered questionnaire. FFQ validated, portion size included.	Ovary	Red meat intake, servings/week			Age, age-squared, oral contraceptive use, level of education, parity, and energy intake
			< 3	576	1	
			3–4.9	556	1 (0.87–1.16)	
			5–6.9	466	1.02 (0.85–1.22)	
			≥ 7	451	1.07 (0.8–1.42)	
			Trend-test p-value: 0.5			
		Ovary	Liver intake, servings/month			Same as above
			Never	1328	1	
			< 1	483	1 (0.97–1.04)	
			≥ 1	217	1.48 (1.2–1.81)	
			Trend-test p-value: 0.002			

Table S2.32 Case-control studies: Red meat and other cancers (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
Aschebrook-Kilfoy et al. (2012) United States 1999–2002 Case-Control	**Cases:** 336; Residents of the 66 counties in eastern Nebraska, aged 20–75 years, newly diagnosed with histologically confirmed NHL, without HIV infection or a prior malignancy, and alive and mentally competent to participate. **Controls:** 460; Selected by random digit dialing from the same 66 county area and frequency matched to the cases by gender and 5-year age-groups. **Exposure assessment method:** Questionnaire; 117 item FFQ, validated using dietary records (r for nutrients: 0.5–0.6) and included a meat cooking practice module Estimations of HCAs using the CHARRED database (Computerized Heterocyclic Amines Resource for Research in Epidemiology of Disease) Red meat: beef (including roast beef/sandwiches), pork and liver.	NHL: Non-Hodgkin's lymphoma	Tertiles of red meat intake			Age, sex, education, energy intake, white meat intake, processed meat intake
			T1 (< 41.2 g/1000 kcal)	85	1	
			T2 (41.2–61.8 g/1000 kcal)	110	1.2 (0.9–1.8)	
			T3 (≥ 61.8 g/1000 kcal)	140	1.5 (1.1–2.2)	
			Trend-test p-value: 0.01			
		NHL: Diffuse large B-cell lymphoma (DLBCL)	Tertiles of red meat intake			Same as above
			T1	17	1	
			T2	32	1.8 (1–3.5)	
			T3	38	2.1 (1.1–3.9)	
			Trend-test p-value: 0.02			
		NHL follicular lymphoma	Tertiles of red meat intake			Same as above
			T1	25	1	
			T2	36	1.4 (0.8–2.6)	
			T3	45	1.9 (1.1–3.3)	
			Trend-test p-value: 0.03			
Lin et al. (2012) Texas, hospital-based 1999 Case-Control	**Cases:** 884; Cases were newly diagnosed and histologically confirmed urinary BC patients who had not received prior chemotherapy or radiotherapy before enrollment **Controls:** 878; control subjects were recruited from Kelsey-Seybold Clinic, the largest private multispecialty group practice in	Urinary bladder	Quartiles of red meat intake (ounce/day)			Adjusting for age, sex, ethnicity, smoking status, pack year of smoking, energy intake, total vegetable intake, total fruit intake and BMI
			Q1 (< 0.55)	156	1	
			Q2 (0.55–1.10)	178	1.17 (0.87–1.58)	
			Q3 (1.11–2.05)	231	1.47 (1.09–1.99)	
			Q4 (≥ 2.06)	319	1.95 (1.41–2.68)	
			Trend-test p-value: < 0.001			

Table S2.32 Case-control studies: Red meat and other cancers (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
	the Houston metropolitan area, with 18 clinics and more than 325 physicians and over 400 000 patients **Exposure assessment method:** Questionnaire; Doses are in ounce/day. Red meat (beef, veal, lamb, pork and game). Meat cooking methods (pan-fried, grilled/barbequed, oven-broiled, microwaved and other cooking methods) Doneness level (photographs) FFQ, 135 food items, was validated. 1 year before the diagnosis (cases), and 1 year before the interview (controls). In-person interview, portion size included.	Urinary bladder	Quartiles of hamburger intake (g/day)			Same as above
			Q1 (< 4.05)	146	1	
			Q2 (4.05–8.79)	234	1.03 (0.77–1.39)	
			Q3 (8.80–17.56)	90	1.17 (0.86–1.59)	
			Q4 (≥ 17.57)	414	1.1 (0.79–1.53)	
			Trend-test p-value: 0.442			
		Urinary bladder	Quartiles of beef steaks, roasts intake (g/day)			Same as above
			Q1 (< 1.47)	186	1	
			Q2 (1.47–4.41)	76	1.11 (0.77–1.59)	
			Q3 (4.42–19.13)	324	1.28 (0.99–1.66)	
			Q4 (≥ 19.14)	298	1.56 (1.12–2.18)	
			Trend-test p-value: 0.006			
		Urinary bladder	Quartiles of pork chops, roasts intake (g/day)			Same as above
			Q1 (< 0.92)	204	1	
			Q2 (0.92–4.41)	131	0.71 (0.52–0.96)	
			Q3 (4.42–8.83)	182	1.05 (0.78–1.41)	
			Q4 (≥ 8.84)	367	1.25 (0.96–1.63)	
			Trend-test p-value: 0.014			
		Urinary bladder	Quartiles of BBQ meat intake (g/day)			Same as above
			Q1 (< 0.72)	211	1	
			Q2 (0.72–4.33)	108	0.88 (0.64–1.21)	
			Q3 (4.34–17.33)	285	1.11 (0.85–1.45)	
			Q4 (≥ 17.34)	280	1.27 (0.95–1.7)	
			Trend-test p-value: 0.056			

Table S2.32 Case-control studies: Red meat and other cancers (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
		Urinary bladder	Number of unfavourable genotypes			Same as above
			0–4	160	1	
			5	210	1.6 (1.2–2.13)	
			≥ 6	350	2.37 (1.82–3.1)	
			Trend-test p-value: < 0.001			
Wu et al. (2012) New England (USA), hospital-based 1 Sept 2001–31 Oct 2004 Case-Control	**Cases:** 1068; Newly diagnosed, histologically confirmed cases of urinary bladder carcinoma (including carcinoma in situ) aged 30–79 years were enrolled in Maine, Vermont, and New Hampshire	Urinary bladder	Quartiles of red meat intake (median, g/1000kcal)			Adjusted for gender, age, region, race, Hispanic status, smoking status, usual BMI, and total energy.
			Q1 (17.2)	241	1	
			Q2 (27.6)	254	0.97 (0.76–1.24)	
			Q3 (37.4)	269	1.04 (0.81–1.33)	
	Controls: 1266; Controls aged 30–64 and 65–79 years were identified from Department of Motor Vehicles (DMV) records and by the Centers for Medicare and Medicaid Services (CMS), respectively		Q4 (53.0)	304	1.14 (0.89–1.46)	
			Trend-test p-value: 0.258			
		Urinary bladder	Quartiles of baked/microwave-cooked/broiled meat intake median, g/1000kcal)			Same as above
	Exposure assessment method: Questionnaire; Categories with median (g per 1000 kcal). Red (beef, veal, pork, and lamb) DHQ, 124 food items, was validated. Portion size included, by a trained interviewer using a detailed computer-assisted personal interview.		Q1 (0.4)	261	1	
			Q2 (2.2)	270	1.07 (0.84–1.36)	
			Q3 (5.0)	286	1.13 (0.89–1.44)	
			Q4 (12.6)	251	1 (0.78–1.29)	
			Trend-test p-value: 0.814			
		Urinary bladder	Quartiles of barbecued meat intake (median, g/1000kcal)			Same as above
			Q1 (0)	260	1	
			Q2 (1.5)	298	1.15 (0.91–1.47)	
			Q3 (4.1)	265	1.04 (0.81–1.32)	
			Q4 (10.2)	245	1 (0.78–1.29)	
			Trend-test p-value: 0.649			

Table S2.32 Case-control studies: Red meat and other cancers (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
		Urinary bladder	Quartiles of pan-fried meat intake (median, g/1000kcal)			Same as above
			Q1 (0.2)	228	1	
			Q2 (1.6)	290	1.23 (0.96–1.57)	
			Q3 (3.9)	239	0.92 (0.71–1.18)	
			Q4 (9.5)	311	1.1 (0.86–1.4)	
			Trend-test p-value: 0.942			
		Urinary bladder	Quartiles of heme iron intake (median, μg/day)			Same as above
			Q1 (111.6)	243	1	
			Q2 (220.5)	257	1.01 (0.78–1.28)	
			Q3 (338.1)	262	0.99 (0.77–1.28)	
			Q4 (565.5)	306	1.08 (0.82–1.42)	
			Trend-test p-value: 0.558			
Balasubramaniam et al. (2013) India 1997–1999 Case-Control	**Cases:** 390; Male microscopically confirmed cases from one hospital **Controls:** 1383; Male controls from comprehensive cancer centre, those who were diagnosed as free of cancer **Exposure assessment method:** Questionnaire; FFQ through interview food frequency per week one year before interview red meat: mutton, liver, pork, brain, etc.	NHL: Non-Hodgkin's lymphoma	Red meat consumption (yes versus no)			Age, education, cigarette smoking, bidi smoking, tobacco lime chewing, milk, coffee, chicken consumption, eggs, fish consumption, chilli consumption, vegetable consumption, pesticides worker, cotton dust worker
			No	55	1	
			Yes	314	7.3 (2.2–24.6)	

Table S2.32 Case-control studies: Red meat and other cancers (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
Charbonneau et al. (2013) United States 2002–2008 Case-Control	**Cases:** 603; Age of ≥ 18 y; resident of Minnesota, Iowa, or Wisconsin at the time of diagnosis; within 9 months of initial diagnosis at presentation to the Mayo Clinic Rochester; no history of lymphoma, leukaemia, or HIV; English-speaking; Pathologically confirmed incident non-Hodgkin's lymphoma (excluding HIV-positives). Histologic subtype reported according to WHO 2001 Classification. Controls: 1007; Clinic-based from Mayo Clinic Rochester: patients with prescheduled general medical examinations, at least 18 y old, no history of lymphoma, leukaemia, or HIV infection, residents of Minnesota, Iowa, or Wisconsin at the time of appointment; English-speaking. Exposure assessment method: Questionnaire; Red meat includes hamburger, other beef, hot dogs, ham, bologna, lunch meats. The only subtype of red meat reported is hamburger meat, not other beef.	NHL: Non-Hodgkin's lymphoma (WHO definition)	Quartiles of red meat (Hamburger, other beef, hot dogs, ham, bologna, and lunch meats) consumption (servings/months) Q1 (≤ 19.5) Q2 (19.6–32.4) Q3 (32.4–50.1) Q4 (> 50.1) Trend-test p-value: 0.77	 252 252 253 250	 1 0.98 (0.72–1.32) 0.96 (0.7–1.33) 1.07 (0.75–1.53)	Total energy, Age, Sex, Residence
De Stefani et al. (2013) Uruguay 1996–2004 Case-Control	**Cases:** 369; All incident, microscopically confirmed NHL cases diagnosed in the National Cancer Institute were eligible. Defined according to WHO 2001 classification. All cases were from the low socioeconomic strata of the Uruguayan population. **Controls:** 3606; Random selection from the same institute among patients with	NHL: Non-Hodgkin's lymphoma (WHO, 2001)	Tertiles of red meat consumption (servings/year) T1 T2 T3 Trend-test p-value: 0.14	 NR NR NR	 1 1.13 (0.88–1.46) 1.25 (0.92–1.69)	Age, sex, residence, urban/rural status, education, body mass index, smoking intensity, alcohol drinking, maté consumption, total vegetable and fruit intake, total energy

Table S2.32 Case-control studies: Red meat and other cancers (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
	nonneoplastic conditions not related to tobacco smoking and alcohol drinking, age matched to cases. Exposure assessment method: Questionnaire; FFQ at personal interview, focused on red meat, salted meat, barbecued meat, processed meat, whole milk, total vegetables, total fruits, beer, red wine, hard liquor, and maté consumption. No mention of validation or number of items. Red meat defined as beef or lamb.					
Di Maso et al. (2013) Italy, Switzerland, hospital-based 1991–2009 Case-Control	**Cases:** 454; Incident endometrial cancer cases, identified in the major teaching and general hospitals of the study areas. **Controls:** 908; Women admitted to the same hospitals as cases for a wide spectrum of acute, nonneoplastic conditions unrelated to tobacco and alcohol consumption, to known risk factors for endometrial cancer or to conditions associated with long-term diet modification. **Exposure assessment method:** Questionnaire; Red meat: beef, veal, pork, horsemeat, meat sauce (e.g. lasagna, pasta/rice with bologna sauce). 2-year diet recall. Validated FFQ. Serving size included.	Endometrium	Tertiles of red meat intake (g/day) Low: < 60 Intermediate: 60–89 High: ≥ 90 Increase of 50 g/day Trend-test p-value: < 0.01	148 143 163 NR	1 1.05 (0.79–1.41) 1.71 (1.26–2.33) 1.3 (1.1–1.55)	Study centre, age, education, BMI, tobacco smoking, alcohol drinking, vegetable consumption, fruit consumption

Table S2.32 Case-control studies: Red meat and other cancers (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
Di Maso et al. (2013) Italy, Switzerland, hospital-based 1991–2009 Case-Control	**Cases:** 1031; Incident cancer cases in northern (greater Milan area; provinces of Pordenone, Padua, Udine, Forlì; urban area of Genoa), central (provinces of Rome and Latina) and southern (urban area of Naples and Catania) Italy, and in the Swiss Canton of Vaud, identified in the major teaching and general hospitals of the study areas.	Ovary	Red meat (g/day) < 60	364	1	Adjusted for study centre, age, education, BMI, tobacco smoking, alcohol drinking, vegetable consumption and fruit consumption, menopausal status, parity, OC/HRT use
			60–89	346	1.34 (1.11–1.61)	
			≥ 90	321	1.49 (1.23–1.8)	
			Trend-test p-value: 0.01			
	Controls: 2411; Women admitted to the same network of hospitals as cases for a wide spectrum of acute, non-neoplastic conditions unrelated to tobacco and alcohol consumption, to known risk factors for ovarian cancer or to conditions associated with long-term diet modification	Ovary	For every 50 g/day increase in red meat			Same as above
			Roasting/grilling	NR	1.33 (1.12–1.57)	
			Boiling/stewing	NR	1.48 (1.19–1.84)	
	Exposure assessment method: Questionnaire; red meat according to different cooking methods (i.e. boiling/stewing, roasting/ grilling, or frying/pan frying), beef, veal, pork, horsemeat, meat sauce (e.g. lasagna, pasta/rice with bologna sauce).Trained personnel administered a structured questionnaire. Diet in the 2 years before diagnosis. FFQ, validated, Serving size included.		Frying/pan frying	NR	1.96 (1.34–2.87)	

Table S2.32 Case-control studies: Red meat and other cancers (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
Catsburg et al. (2014) USA, population-based 1987–1996 Case-Control	**Cases:** 1,671; Incident cases of bladder cancer, specifically transitional cell carcinoma, were identified through the Los Angeles County Cancer Surveillance Program, the population-based Surveillance, Epidemiology and End Results (SEER) cancer registry of Los Angeles County **Controls:** 1,586; For each enrolled case, a control individual was recruited from the neighbourhood where the index case resided at the time of diagnosis. Controls were matched by age (within 5 years), gender and race/ethnicity non-Hispanic white, Hispanic, African American) **Exposure assessment method:** Questionnaire; Red meat (corned beef i.e. processed meat, liver) FFQ, 40 food items, validity not specified. Standard portion size included. In-person structured interviews Diet 2 years before the diagnosis.	Urinary bladder: Bladder cancer including non-invasive, in situ	Liver – level of intake			BMI, race/ethnicity, education, history of diabetes, total vegetable intake per day, vitamin A intake, vitamin C intake, carotenoid intake, total servings of food per day, smoking duration and smoking intensity, smoking status
			Never	523	1	
			< once a year	152	1.08 (0.82–1.41)	
			1–3 times a year	240	0.97 (0.77–1.22)	
			4–11 times a year	423	1.1 (0.9–1.34)	
			Monthly	309	1.26 (1–1.6)	
			Trend-test p-value: 0.039			
		Urinary bladder: Bladder cancer including non-invasive, in situ	Quintiles of heme iron (from processed meat and liver) intake (mg/day)			Same as above
			Q1 (≤ 1.0)	253	1	
			Q2 (1.0–2.1)	350	1.24 (0.98–1.57)	
			Q3 (2.2–3.4)	334	1.14 (0.9–1.46)	
			Q4 (3.4–5.1)	312	1.04 (0.8–1.34)	
			Q5 (≥ 5.2)	398	1.32 (1–1.73)	
			Trend-test p-value: 0.191			

Table S2.32 Case-control studies: Red meat and other cancers (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
Ronco et al. (2014) Uruguay, hospital-based 1996–2004 Case-Control	**Cases:** 225; Men only. All newly diagnosed and microscopically validated cases of transitional-cell carcinoma of the urinary bladder from 4 major public hospitals in Montevideo. **Controls:** 1,510; Men from the same time period and the same hospitals, with non-neoplastic conditions not related to smoking and alcohol drinking. **Exposure assessment method:** Questionnaire; Red meat (beef, lamb). FFQ with 64 food items, was not validated but tested for reproducibility. Portion size included. Face-to-face interview.	Urinary bladder	Red meat intake, tertiles			Age, residence, education, BMI, smoking, alcohol drinking, mate consumption, total energy, total vegetable and fruit intake
			TI	71	1	
			TII	64	0.78 (0.53–1.15)	
			TIII	90	1.18 (0.83–1.69)	
			Trend-test p-value: 0.33			
		Urinary bladder	Liver intake, tertiles			Same as above
			TI	NR	1	
			TII	NR	1.29 (0.82–2.03)	
			TIII	NR	0.95 (0.61–1.5)	
			Trend-test p-value: 0.61			

Table S2.32 Case-control studies: Red meat and other cancers (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
Liu et al. (2015) China, Zheijiang and Liaoning provinces, hospital-based 2008–2013 Case-Control	**Cases:** 442; Inpatients aged ≥ 15 y with first-time hematologically confirmed diagnosis of leukaemia in the major public and teaching hospitals of Zhejiang or Liaoning provinces (1st and 2nd Affiliated Hospitals of Zhejiang University in Hangzhou, 1st Affiliated Hospital of China Medical University in Shenyang), residing in the province for ≥ 1 year. Cases with other malignancies were excluded. **Controls:** 442; Outpatients at the same hospitals as their cases, free of malignancies at the time of recruitment. **Exposure assessment method:** Questionnaire; FFQ from a dietary questionnaire for cancer research in Shanghai, China, with additional questions adapted from the diet questionnaire for the Hawaii and Los Angeles Cohort Study, and the Australian Health Survey 1995. The FFQ was validated and its reliability was assessed in previous studies. Face to face interview was conducted. Frequency was classified into 9 categories: never or hardly ever, once/mo, 2–3 times/mo, once/wk, 2–3 times/wk, 4–6 times/wk, once/day, 2 times/d, and ≥ 3 times/d. Red meat (pork chops/spareribs, pig feet, fresh pork (fat or lean), pork liver, organ meats, beef, and mutton)	Leukaemia: All Leukemias (AML, ALL, CML, CLL)	Quartiles of red meat intake (g/day)			Residence, education, BMI, cigarette smoking, alcohol consumption, tea consumption, energy intake, vegetables, fruits, poultry, fish, milk
			Q1: < 47.3	128	1	
			Q2: 47.3–82.6	81	0.7 (0.43–1.14)	
			Q3: 82.7–137.2	130	1.05 (0.64–1.72)	
			Q4: > 137.2	103	0.85 (0.47–1.52)	
			OR per 50 g/day	442	1.06 (0.91–1.22)	
			Trend-test p-value: 0.47			
		Leukaemia: Acute myeloid leukaemia (AML)	Quartiles of red meat intake (g/day)			Same as above
			Q1: < 47.3	67	1	
			Q2: 47.3–82.6	48	1.03 (0.49–2.18)	
			Q3: 82.7–137.2	72	1.67 (0.71–3.93)	
			Q4: > 137.2	56	0.75 (0.29–1.9)	
			OR per 50 g/day	243	0.99 (0.77–1.28)	
			Trend-test p-value: 0.95			

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