



RED MEAT AND PROCESSED MEAT

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TO HUMANS

Table 2.9.4 Case-control studies: Processed 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
Riboli et al. (1991) Spain, hospital-based 1985–1986 Case-Control	<p>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.</p> <p>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.</p> <p>Exposure assessment method: Questionnaire; cured meat, liver. Dietary questionnaire (diet history method), 60 food groups. FFQ, portion size included. Subject's home by a trained interviewer.</p>	Urinary bladder	<p>Quartiles of processed meat consumption</p> <p>Q1</p> <p>Q2</p> <p>Q3</p> <p>Q4</p> <p>Trend-test p-value: 0.22</p>	<p>NR</p> <p>NR</p> <p>NR</p> <p>NR</p>	<p>1</p> <p>0.97</p> <p>1.2</p> <p>1.2 (0.82–1.75)</p>	Total calories and for tobacco smoking
Ward et al. (1994) United States (Nebraska) 1983–1986 Case-Control	<p>Cases: 385; White men and women age 21 years and over residing in 66 counties of eastern Nebraska diagnosed with histologically confirmed non-Hodgkin's lymphoma between 1983 and 1986, identified through the Nebraska Lymphoma Study Group and area hospitals.</p> <p>Controls: 1432; Residents of the 66 counties. Random digit dialing for cases younger than 65 years, through Medicare for those aged 65 or older, and through Nebraska state mortality files additionally matching of year of death for those cases who were deceased. 3:1 frequency matching by gender, vital status, and age (five-year age groups).</p>	<p>NHL: non-Hodgkin's lymphoma</p> <p>NHL: non-Hodgkin's lymphoma</p>	<p>For men, specific categories of frequency of processed meat intake</p> <p>< 2 times a week</p> <p>2–3 times a week</p> <p>4–6 times a week</p> <p>> 6 times a week</p> <p>For women, specific categories of frequency of processed meat intake</p> <p>< 2 times a week</p>	<p>36</p> <p>44</p> <p>53</p> <p>38</p> <p>40</p>	<p>1</p> <p>0.6 (0.3–1)</p> <p>0.8 (0.4–1.3)</p> <p>0.6 (0.4–1.1)</p> <p>1</p>	<p>Age</p> <p>Age</p>

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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
	Exposure assessment method: Questionnaire; Food frequency interview on 30 food items, exposure to pesticides, hair dye; family history of cancer. Gender-specific portion sizes derived from NHANES-II.		2 times a week	25	0.9 (0.5–1.6)	
			3–4 times a week	40	1.1 (0.7–1.9)	
			> 4 times a week	39	1.2 (0.7–2.1)	
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 preserved meat consumption frequency (times/week)			Age, sex, study centre, body mass index, smoking and total calories
			Q1	NR	1	
			Q2	NR	0.82 (0.65–1.03)	
			Q3	NR	0.91 (0.72–1.14)	
			Q4	NR	0.94 (0.73–1.22)	
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. Processed meat not defined.	Endometrium	Quartiles of processed meat intake (g/day)			Pregnancy history, OC use, history of diabetes, BMI, total calories
			Q1: < 6.9	NR	1	
			Q2: 6.9– < 16.4	NR	0.7	
			Q3: 16.4– < 33.4	NR	1.1	
			Q4: ≥ 33.4	NR	1.3	
			Trend-test p-value: 0.38			

Table 2.9.4 Case-control studies: Processed 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
De Stefani et al. (1998) Uruguay 1988–1995 Case-Control	<p>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.</p> <p>Controls: 163; Selected among other patients 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.</p> <p>Exposure assessment method: Questionnaire; Short FFQ used by interviewers. Detailed tobacco, alcohol and maté questions. Processed meat is defined as salami, saucisson, ham and mortadella.</p>	NHL: Non-Hodgkin's lymphoma (ICD-O)	For men, tertiles of processed meat intake (servings/week)			Age, residence, Urban/rural status, type of tobacco, beer intake and 'mate'/years
			T1 (≤ 0.2)	28	1	
			T2 (0.3–1.0)	22	0.44 (0.19–1.02)	
			T3 (≥ 1.1)	35	1.03 (0.43–2.42)	
			Trend-test p-value: 0.92			
			For women, tertiles of processed meat intake (servings/week)			
		T1 (≤ 0.2)	19	1		
		T2 (0.3–1.0)	36	3.19 (1.32–7.74)		
		T3 (≥ 1.1)	20	1.9 (0.66–5.45)		
		Trend-test p-value: 0.09				
NHL: NHL Non-Hodgkin's lymphoma (ICD-O)	For men: tertiles of salted meat intake (servings/week)			Same as above		
	I: never	53	1			
	II: 0.1–1.0	16	1.39 (0.54–3.61)			
	III: ≥ 1.1	16	4.96 (1.39–17.7)			
	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
Yuan et al. (1998) US, population-based 1986–1994 Case-Control	<p>Cases: 1204; Non-Asians aged 25–74 years with histologically confirmed RCC from the population-based Surveillance, Epidemiology, and End Results (SEER) cancer registry of Los Angeles County</p> <p>Controls: 1204; Controls matched on sex, date of birth (within 5 years), ethnicity and neighbourhood of residence at the time of cancer diagnosis.</p> <p>Exposure assessment method: Expert judgement; processed meat (bacon, salami, luncheon meats, hot dogs) FFQ, 90 food items, validity not specified. Standard portion size was included. In-person interviews up to 2 years before the diagnosis. Controls were interviewed 14 months after their index cases, 77% were interviewed within 2 years after the cases, All interviews by the same team.</p>	Kidney: renal cell carcinoma	<p>Quintiles of processed meat intake frequency (times/month)</p> <p>Q1 (≤ 4 times/month)</p> <p>Q2 (4.1–8.3)</p> <p>Q3 (8.4–14.6)</p> <p>Q4 (14.7–25.7)</p> <p>Q5 (≥ 25.8)</p> <p>Trend-test p-value: 0.57</p>	<p>NR</p> <p>NR</p> <p>NR</p> <p>NR</p> <p>NR</p>	<p>1</p> <p>0.97 (0.72–1.29)</p> <p>0.97 (0.72–1.29)</p> <p>0.86 (0.64–1.15)</p> <p>1.15 (0.86–1.54)</p>	Education and other non-dietary risk factors including usual body mass index, history of hypertension, number of cigarettes per day, current smoking status, total grams of analgesics consumed over lifetime and regular use of amphetamines
McCann et al. (2000) USA, New York, population-based 1986–1991 Case-Control	<p>Cases: 232; Women aged 40–85 y, with histologically confirmed endometrial adenomatous carcinoma and no history of other cancer.</p> <p>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.</p> <p>Exposure assessment method: Questionnaire; Processed meat not defined. Trained interviewers. 172-item FFQ, validity not specified. Portion size included.</p>	Endometrium	<p>Quartiles of processed meat intake (monthly frequency)</p> <p>Q1: ≤ 2.5</p> <p>Q2: 2.6–6.0</p> <p>Q3: 6.1–10.5</p> <p>Q4: > 10.5</p> <p>Trend-test p-value: 0.64</p>	<p>59</p> <p>73</p> <p>44</p> <p>56</p>	<p>1</p> <p>1.3 (0.8–2)</p> <p>1 (0.6–1.6)</p> <p>1 (0.6–1.7)</p>	Age, education, BMI, diabetes, hypertension, pack-years cigarette smoking, age at menarche, parity, oral contraceptive use, menopause status, and postmenopausal estrogen use, other food groups

Table 2.9.4 Case-control studies: Processed 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
Pan et al. (2004) Canada, population-based 1994–1997 Case-Control	<p>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).</p> <p>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.</p> <p>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. Processed meat included hot dogs, smoked meat, or corned beef; bacon and sausage.</p>	Ovary: ovarian cancer ICD-O-2 C56	Processed 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	0.77 (0.55–1.07)	
			Q3	NR	0.89 (0.64–1.24)	
			Q4	NR	0.98 (0.72–1.33)	
			Trend-test p-value: 0.82			

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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	Ham and sausage never	40	1	Adjusted for age, sex, year of first visit and cumulative consumption of cigarettes
			1–3 times/month	44	1.08 (0.69–1.71)	
			1–2 times/week	28	0.72 (0.43–1.2)	
			≥ 3–4 times/week	12	0.97 (0.49–1.94)	
			Trend-test p-value: 0.37			
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 smoked meat intake			Smoking
			1 tertile	51	1	
			2 tertile	44	2.73 (1.27–5.87)	
			3 tertile	0	-	

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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; The processed meat definition includes bacon, sausage, ham, hotdog, liver and luncheon meats	NHL: Non-Hodgkin's lymphoma (ICD O-2)	Quartiles of processed meat consumption			Gender, age, physical activity, alcohol consumption, total caloric intake, study site
			Q1 (categories not specified)	NR	1	
			Q2	NR	1.36 (0.89–2.06)	
			Q3	NR	1.32 (0.86–2.03)	
			Q4	NR	1.18 (0.74–1.89)	
			Trend-test p-value: 0.94			
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 range, admitted to the same network of hospitals for various acute conditions. Exclusion criteria: malignant diseases, conditions related to alcohol and tobacco	NHL: Non-Hodgkin's lymphoma (ICD-O-2)	Quartiles of pork and processed meat consumption (servings/week)			Gender, age, centre, education, place of birth, hepatitis C virus test, total energy intake
			Q1: 0–1.5	NR	1	
			Q2: > 1.5–2.0	NR	0.76 (0.45–1.28)	
			Q3: > 2.0–3.5	NR	1.04 (0.63–1.72)	
			Q4: > 3.5	NR	1.1 (0.67–1.81)	

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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
	consumption, hepatitis, any chronic diseases that might have substantially changed lifestyle, hematological, autoimmune and allergic diseases. Exposure assessment method: Questionnaire; A validated 63-item food frequency questionnaire covering the 2 years before cancer diagnosis or hospital submission for the controls. Processed meat is reported together with pork consumption.					
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. Pork and processed meat food group includes pork, beef, veal, pork, prosciutto, ham, salami, and sausages.	Liver: hepatocellular carcinoma	Quartiles of pork/processed meat intake (servings/week) Q1 (< 1.25 servings/week) Q2 (1.25– < 2.00 servings/week) Q3 (2.00–3.00 servings/week) Q4 (> 3.00 servings/week)	NR NR NR NR	1 0.6 (0.28–1.27) 0.96 (0.46–2.02) 0.83 (0.4–1.7)	Gender, age, centre, education, place of birth, drinking habits, maximal lifetime alcohol intake, total energy intake, Hepatitis B and C viruses
			Trend-test p-value: 0.47			
						Trend-test p-value: 0.86

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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
Bravi et al. (2007) Italy, hospital-based 1992–2004 Case-Control	<p>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.</p> <p>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</p> <p>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.</p>	Kidney: renal cell carcinoma (ICD-9 189.0)	Quintiles of processed meat intake (servings/week, upper limit)			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.
			Q1 (0.9)	NR	1	
			Q2 (1.9)	NR	0.82 (0.59–1.14)	
			Q3 (2.9)	NR	0.97 (0.7–1.35)	
			Q4 (3.9)	NR	0.76 (0.54–1.07)	
			Q5 (-)	NR	0.64 (0.45–0.9)	
			Trend-test p-value: 0.006			
García-Closas R et al. (2007) Spain, hospital-based 1998–2001 Case-Control	<p>Cases: 912; Cases were patients newly diagnosed with histologically confirmed bladder cancer in 18 participating hospitals.</p> <p>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</p> <p>Exposure assessment method:</p>	Urinary bladder	Quintiles of processed red meat intake (median g/day/kcal)			Adjusted for age, gender, region, smoking status, duration of smoking and quintiles of fruit and vegetable intake.
			Q1 (2)	158	1	
			Q2 (7)	212	1.4 (1–1.9)	
			Q3 (11)	172	1.2 (0.9–1.7)	
			Q4 (15)	177	1.2 (0.8–1.6)	
Q5 (24)	193	1.2 (0.9–1.7)				

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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
	Questionnaire; 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.					
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 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 processed meat Low (< 1 time/month) Medium (< 1 time/week) High (≥ 1 time/week)	52 109 904	1 0.85 (0.55–1.33) 1.03 (0.71–1.51)	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.

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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. Processed meat (hot dogs, smoked meat, or corned beef; bacon and sausage). Luncheon meals (salami, bologna) and liver. 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 processed meat consumption (servings/week)			10 year age group, province, education, BMI, sex, alcohol use, pack-year smoking, total of vegetable and fruit intake, total energy intake
			I (≤ 0.94)	NR	1	
			II (0.95–2.41)	NR	1.2 (1–1.6)	
			III (2.42–5.41)	NR	1.5 (1.1–1.9)	
			IV (≥ 5.42)	NR	1.6 (1.2–2.1)	
			Trend-test p-value: 0.0002			
Hu et al. (2008) Canada 1994–1997 Case-Control	Cases: 1666; Men and women aged 20–76 years with histologically confirmed incident cases of non-Hodgkin's lymphoma as defined by ICD-O–2, from the provincial cancer registries. Controls: 5039; Men and women without cancer, selected from a random sample within a province, with an age/sex distribution similar to that of all cancer cases in the National Enhanced Cancer Surveillance System. In most provinces the stratified random samples of population were obtained through the provincial health insurance plans. Two provinces used random digit dialing. Exposure assessment method:	NHL: Non-Hodgkin's lymphoma (ICD-O-2)	Quartiles of processed meat consumption (servings/week)			Same as above
			Q1 (≤ 0.94)	NR	1	
			Q2 (0.95–2.41)	NR	1.1 (1–1.4)	
			Q3 (2.42–5.41)	NR	1.2 (1–1.5)	
			Q4 (≥ 5.42)	NR	1.2 (0.9–1.4)	
			Trend-test p-value: 0.15			

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	Questionnaire. Processed meat (hot dogs, smoked meat, or corned beef; bacon and sausage). Luncheon meals (salami, bologna) and liver. Questionnaire was mailed, reminder postcard, telephone follow-up. Validated FFQ, 69 food items. 2 year before diagnosis for cases and controls.					
Hu et al. (2008) Canada, population-based 1994–1997 Case-Control	<p>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).</p> <p>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</p> <p>Exposure assessment method: Questionnaire. Processed meat (hot dogs, smoked meat, or corned beef; bacon and sausage). Luncheon meals (salami, bologna) and liver. Questionnaire was mailed, reminder postcard, telephone follow-up. FFQ, 69 food items, validity not specified. 2 year before diagnosis for cases and controls.</p>	Kidney	<p>Quartiles of processed meat consumption (servings/week)</p> <p>Q1 (0–0.94)</p> <p>Q2 (0.95–2.41)</p> <p>Q3 (2.42–5.41)</p> <p>Q4 (5.42+)</p> <p>Trend-test p-value: 0.02</p>	<p>NR</p> <p>NR</p> <p>NR</p> <p>NR</p>	<p>1</p> <p>1.3 (1.1–1.6)</p> <p>1.3 (1–1.5)</p> <p>1.3 (1.1–1.6)</p>	Same as above

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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: 5039; Serve as controls for many other cancer cases as well. Exposure assessment method: Questionnaire. Processed meat (hot dogs, smoked meat, or corned beef; bacon and sausage). Luncheon meals (salami, bologna) and liver. 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 processed meat consumption (servings per week)			Same as above
			Q1 (≤ 1.41 servings/week)	NR	1	
			Q2 (1.42–3.41 servings/week)	NR	1.2 (0.8–1.7)	
			Q3 (3.42–6.94 servings/week)	NR	1.2 (0.8–1.8)	
			Q4 (≥ 6.95 servings/week)	NR	1.5 (1.1–2.2)	
			Trend-test p-value: 0.01			
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. Processed meat not defined.	Endometrium	Quintiles of processed meat intake (servings/week, upper limit)			Age, centre, year of interview, education, total energy intake, BMI, history of diabetes, age at menarche, parity, OC use, HRT, menopausal status
			Q1: 1.00	NR	1	
			Q2: 2.00	NR	1.31 (0.92–1.88)	
			Q3: 2.50	NR	1.08 (0.67–1.74)	
			Q4: 4.00	NR	1.17 (0.81–1.68)	
			Q5: -	NR	0.73 (0.46–1.14)	
			Increment of 1 serving/day	NR	0.69 (0.42–1.15)	
			Trend-test p-value: 0.24			

Table 2.9.4 Case-control studies: Processed 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	
Grieb et al. (2009) US, hospital-based 2000–2004 Case-Control	<p>Cases: 335; 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.</p> <p>Controls: 337; 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.</p> <p>Exposure assessment method: Questionnaire. Processed meat (bacon, sausages) In-person interview by trained personnel. FFQ, 70 food items, validated. 1-year period before the interview. Portion size included.</p>	Kidney: renal cell carcinoma	Bacon and sausages consumption frequency			Age at interview, sex, race, income, body mass index and pack-years of smoking.	
			< 1 time/week	155	1		
			1 time/week	73	1.47 (0.96–2.24)		
			2 times/week	48	1.4 (0.85–2.29)		
			3–4 times/week	35	1.48 (0.83–2.64)		
			≥ 5 times/week	22	1.28 (0.63–2.62)		
				Trend-test p-value: 0.37			
		Kidney: renal cell carcinoma	Bacon and sausages consumption frequency among men				Same as above
			< 1 time/week	73	1		
			1 time/week	39	1.42 (0.77–2.64)		
			2 times/week	33	1.54 (0.8–2.95)		
			3–4 times/week	18	1.12 (0.49–2.57)		
≥ 5 times/week	18		1.02 (0.44–2.39)				
		Trend-test p-value: 0.37					

Table 2.9.4 Case-control studies: Processed 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
		Kidney: renal cell carcinoma	Bacon and sausages consumption frequency among women			Same as above
			Bacon and sausage in women, < 1 time/week	82	1	
			1 time/week	34	1.51 (0.84–2.74)	
			2 times/week	15	1.23 (0.56–2.7)	
			≥ 3 times/week	21	1.87 (0.88–3.96)	
			Trend-test p-value: 0.03			
Pogoda et al. (2009) Multicentre: Sydney, Australia; Winnipeg, Canada; Paris, France; Tel-Hashomer, Israel; Milan, Italy; Valencia, Spain; Los Angeles, San Francisco, Seattle, USA. Pooled analysis 1976–1992 Case-Control	Cases: 1203; Paediatric brain tumours, age 0–19 Controls: 2223; From population registry or random-digit-dialing (US centres), individually matched or frequency matched (US centres) by region or geographic area of residence, age, and sex. Exposure assessment method: Questionnaire; For each food, mothers were asked about their consumption during the past year and during the index pregnancy using detailed dietary recall methods and abstract food models to gauge portion size. FFQ was focused on foods high in nitrate and/or nitrite and on foods containing nitrosation inhibitors like vitamins C and E.	Brain (Childhood cancer): Brain ICD-O codes 191.0–192.1	Quartiles of maternal cured meat intake during pregnancy			Study centre, age, sex, other food groups
			Q1	375	1	
			Q2	236	1.1 (0.9–1.2)	
			Q3	261	1.2 (1–1.5)	
			Q4	284	1.5 (1.1–2.1)	
			Trend-test p-value: 0.03			
		Brain (Childhood cancer): Brain, astroglial. ICD-O 9380–9382, 9384, 9400–9421, and 9424–9442.	Quartiles of maternal cured meat intake during pregnancy			Same as above
			Q1	170	1	
			Q2	128	1.1 (1–1.3)	
			Q3	132	1.3 (1–1.9)	

Table 2.9.4 Case-control studies: Processed 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
			Q4	161	1.8 (1.2–2.6)	
			Trend-test p-value: 0.01			
		Brain (Childhood cancer): Brain. PNET. ICD-O 9470–9473 and 9501	Quartiles of maternal cured meat intake during pregnancy			Same as above
			Q1	87	1	
			Q2	43	1.1 (0.8–1.4)	
			Q3	59	1.1 (0.9–1.4)	
			Q4	52	1.2 (0.9–1.6)	
			Trend-test p-value: 0.15			

Table 2.9.4 Case-control studies: Processed 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. Processed meat was not defined. Standardized face-to-face interview, self-administered questionnaire. FFQ validated, portion size included.	Ovary	Processed meat intake, servings/week			Age, age-squared, oral contraceptive use, level of education, parity, and energy intake
			< 1	671	1	
			1–1.9	662	1.19 (0.86–1.64)	
			2–3.9	409	1.32 (1–1.74)	
			≥ 4	307	1.18 (1.15–1.21)	
			Trend-test p-value: 0.03			
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	NHL: Non-Hodgkin's lymphoma (ICD-9 200&202)	Tertiles of processed meat			Age, sex, education, energy intake, white meat intake, red meat intake
			T1 (< 6.2 g/1000 kcal)	85	1	
			T2 (6.2–13.1 g/1000 kcal)	132	1.4 (1–2.1)	
			T3 (≥ 13.1 g/1000 kcal)	118	1.3 (0.9–1.9)	
			Trend-test p-value: 0.2			

Table 2.9.4 Case-control studies: Processed 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	
	Estimations of HCAs using the CHARRED database (Computerized Heterocyclic Amines Resource for Research in Epidemiology of Disease) Processed meat: bacon, sausage, baked ham, hotdogs, ham/bologna, and other luncheon meat.	NHL: Diffuse large B-cell lymphoma (DLBCL)	Tertiles of processed meat			Same as above	
			T1	21	1		
			T2	29	1.1 (0.6–2)		
			T3	37	1.5 (0.8–2.8)		
					Trend-test p-value: 0.1		
		NHL follicular lymphoma	Tertiles of processed meat			Same as above	
			T1	34	1		
			T2	42	1.1 (0.7–1.9)		
			T3	30	0.9 (0.5–1.6)		
			Trend-test p-value: 0.6				
		NHL: B-cell chronic lymphocytic leukaemia/ small lymphocytic lymphoma (SLL/CLL)	Tertiles of processed meat			Same as above	
			T1	6	1		
			T2	8	0.8 (0.3–2.7)		
T3	11		1.1 (0.4–3.2)				
Trend-test p-value: 0.8							

Table 2.9.4 Case-control studies: Processed 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: T-cell lymphoma	Tertiles of processed meat			Same as above
			T1	4	1	
			T2	8	2 (0.5–7)	
			T3	7	1.7 (0.5–6.5)	
			Trend-test p-value: 0.5			
De Stefani et al. (2012) 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. These hospitals admit only patients of low socioeconomic status. Controls: 2352; 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; Processed meat (hot dogs, sausages, ham, salami, saucisson, mortadella, bacon, salted meat). FFQ, 64 food items, was not validated but tested for reproducibility. Interview by trained interviewers. Portion size included.	Kidney: renal cell carcinoma	Tertiles of processed meat intake among men, (g/day)			Age, residence, body mass index, smoking status, smoking cessation, number of cigarettes smoked per day among current smokers, alcohol drinking, maté consumption, total energy, total vegetables and fruits, total white meat, and red meat intakes.
			T1 (1–11.4)	NR	1	
			T2 (11.5–28.2)	NR	0.99 (0.53–1.85)	
			T3 (> 28.3)	NR	1.21 (0.65–2.25)	
			Trend-test p-value: 0.51			
		Kidney: renal cell carcinoma	Tertiles of processed meat intake among women (g/day)			Same as above
			T1 (1–11.4)	NR	1	
			T2 (11.5–28.2)	NR	2.04 (0.85–4.91)	
			T3 (> 28.3)	NR	2.15 (0.9–5.13)	
			Trend-test p-value: 0.07			

Table 2.9.4 Case-control studies: Processed 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
		Kidney: renal cell carcinoma	Bacon consumption in men	NR	0.54 (0.33–0.89)	Age, residence, body mass index, smoking status, smoking cessation, number of cigarettes smoked per day among current smokers, alcohol drinking, mate consumption, total energy, total vegetables and fruits, total white meat, red meat intakes, bacon, sausage, mortadella, salami, saucisson, hot dog, ham, and salted meat
			Bacon consumption in women	NR	0.51 (0.24–1.1)	
			Sausage consumption in men	NR	0.85 (0.65–1.11)	
			Sausage consumption in women	NR	1.44 (0.96–2.15)	
			Mortadella consumption in men	NR	1.08 (0.88–1.33)	
			Mortadella consumption in women	NR	0.65 (0.43–0.98)	
			Salami consumption in men	NR	1.02 (0.82–1.28)	
			Salami consumption in women	NR	1.13 (0.78–1.62)	
			Saucisson consumption in men	NR	0.48 (0.27–0.86)	
			Saucisson consumption in women	NR	1.55 (0.9–2.68)	
			Hot dog consumption in men	NR	0.9 (0.7–1.14)	
			Hot dog consumption in women	NR	1.22 (0.9–1.64)	
		Ham consumption in men	NR	1.35 (1.1–1.65)		

Table 2.9.4 Case-control studies: Processed 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; Processed meat (fried bacon/ham, salami, pastrami, hot dogs/polish sausage) FFQ, 40 food items, validity not specified. Standard portion size included. In-person structured interviews Diet 2 years before the diagnosis.	Urinary bladder	Ham consumption in women	NR	1.28 (0.97–1.7)	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.
			Salted meat consumption in men	NR	1.22 (0.99–1.51)	
			Salted meat consumption in women	NR	1.66 (1.24–2.23)	
		Total processed meat, < once a week	281	1	Same as above	
		1–2 times a week	275	0.96 (0.76–1.23)		
		3 times a week	365	1.11 (0.87–1.41)		
		4–6 times a week	381	1.23 (0.96–1.58)		
		1+ times a day	345	0.97 (0.74–1.27)		
		Trend-test p-value: 0.846				
		Urinary bladder	Fried bacon/ham < once a month	412		
1–2 times a month	172	1.04 (0.8–1.35)				
3–4 times a month	490	1.12 (0.91–1.36)				
Weekly	276	1 (0.79–1.27)				
2+ Times a week	297	1.33 (0.73–1.21)				
Trend-test p-value: 0.453						

Table 2.9.4 Case-control studies: Processed 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: Bladder including non-invasive, in situ	Salami/Pastrami/Corned Beef intake			Same as above
			< twice a year	369	1	
			2–11 times a year	495	1.07 (0.87–1.3)	
			Monthly	202	1.12 (0.86–1.45)	
			Twice monthly	349	1.34 (1.07–1.69)	
			Weekly	232	1.33 (1.02–1.74)	
			Trend-test p-value: 0.008			
		Urinary bladder	Bologna/other lunch meats never	343	1	Same as above
			< once a month	363	0.83 (0.66–1.03)	
			Monthly	458	0.87 (0.7–1.08)	
			Weekly	198	0.96 (0.73–1.28)	
			Twice weekly	285	0.81 (0.63–1.04)	
			Trend-test p-value: 0.406			

Table 2.9.4 Case-control studies: Processed 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	Hot dog/polish Sausage < 4 times a year	319	1	Same as above
			4–11 times a year	450	1.01 (0.81–1.25)	
			Monthly	263	1 (0.78–1.27)	
			Twice monthly	446	1.18 (0.94–1.48)	
			Weekly	169	0.88 (0.66–1.18)	
			Trend-test p-value: 0.926			
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 the Houston metropolitan area, with 18 clinics and more than 325 physicians and over 400 000 patients Exposure assessment method: Questionnaire; Processed meat (hot dogs or franks, sausage or chorizo) 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 processed meat intake (ounces/day)			Adjusting for age, sex, ethnicity, smoking status, pack year of smoking, energy intake, total vegetable intake, total fruit intake and BMI
			Q1 (< 0.11)	199	1	
			Q2 (0.11–0.28)	190	0.88 (0.66–1.18)	
			Q3 (0.29–0.61)	227	0.98 (0.73–1.31)	
			Q4 (≥ 0.62)	268	1.03 (0.76–1.39)	
			Trend-test p-value: 0.696			
		Urinary bladder	Levels of bacon intake (g/day)			Same as above
			< 0.79	329	1	
			≥ 0.79	555	1.51 (1.23–1.85)	
			Trend-test p-value: < 0.001			

Table 2.9.4 Case-control studies: Processed 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	Levels of hotdogs intake (g/day)			Same as above
			< 0.29	393	1	
			≥ 0.29	491	1.02 (0.83–1.24)	
			Trend-test p-value: 0.88			
		Urinary bladder	Levels of lunch meats intake (g/day)			Same as above
			< 0.94	387	1	
			≥ 0.94	497	1.01 (0.82–1.23)	
			Trend-test p-value: 0.948			
		Urinary bladder	Levels of sausage intake (g/day)			Same as above
			< 1.32	415	1	
			≥ 1.32	469	1.01 (0.83–1.24)	
			Trend-test p-value: 0.907			

Table 2.9.4 Case-control studies: Processed 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
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 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 Exposure assessment method: Questionnaire; Processed meat included red processed (ham, bacon, sausage, hot dog, and cold cuts) DHQ, 124 food items, was validated. Portion size included, by a trained interviewer using a detailed computer-assisted personal interview.	Urinary bladder	Quartiles of processed red meat intake (median g/1000kcal)			Adjusted for gender, age, region, race, Hispanic status, smoking status, usual BMI, and total energy.
			Q1 (1.9)	200	1	
			Q2 (4.3)	263	1.24 (0.96–1.6)	
			Q3 (7.4)	289	1.39 (1.07–1.81)	
			Q4 (13.5)	316	1.41 (1.08–1.84)	
			Trend-test p-value: 0.024			
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; Processed meat (bacon, sausage, mortadella, salami, saucisson, hot dog, ham, salted meat). FFQ with 64 food items, was not validated but tested for reproducibility. Portion size included. Face-to-	Urinary bladder	Tertiles of processed meat consumption			Age, residence, education, BMI, smoking, alcohol drinking, mate consumption, total energy, total vegetable and fruit intake
			TI	69	1	
			TII	94	1.3 (0.89–1.89)	
			TIII	62	1.55 (1.07–2.24)	

Table 2.9.4 Case-control studies: Processed 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
	face interview.	Urinary bladder	Tertiles of bacon, mortadella, and sausage intake			Same as above
			TI	140	1	
			TII	37	1.37 (0.96–1.95)	
			TIII	48	0.91 (0.62–1.35)	
			Trend-test p-value: 0.64			
		Urinary bladder	Tertiles of salami intake			Same as above
			TI	136	1	
			TII	45	1.05 (0.7–1.57)	
			TIII	44	0.99 (0.69–1.44)	
			Trend-test p-value: 0.97			
		Urinary bladder	Tertiles of hot dog intake			Same as above
			T I	148	1	
			TII	26	1.76 (1.19–2.61)	
			TIII	51	2.16 (1.45–3.23)	
			Trend-test p-value: < 0.0001			

Table 2.9.4 Case-control studies: Processed 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	Tertiles of ham intake			Same as above
			TI	174	1	
			TII	10	1.43 (0.86–2.39)	
			TIII	41	1.83 (1.26–2.65)	
			Trend-test p-value: 0.002			
Charbonneau et al. (2013) United States 2002–2008 Case-Control	Cases: 603; Age ≥ 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 infection; English-speaking; Pathologically confirmed incident non-Hodgkin's lymphoma (excluding those with HIV infection). Histologic subtype results reported according to the WHO Classification of Tumours. Pathology and Genetics of Haematopoietic and Lymphoid Tissues (WHO 2001). Controls: 1007; Clinic-based controls from Mayo Clinic Rochester patients with prescheduled general medical examinations, at least 18 years old. Exposure assessment method: Questionnaire; Processed meat includes hot dogs, ham, bologna and lunch meats, i.e. red meat includes processed meat.	NHL: Non-Hodgkin's lymphoma (WHO definition)	Quartiles of processed meat (Hot dogs, ham, bologna, and lunch meats) consumption (servings/months)			Total energy, age, sex, residence
			Q1 (≤ 0.9)	169	1	
			Q2 (1.0–2.1)	101	1.05 (0.77–1.43)	
			Q3 (2.2–6.0)	173	1.21 (0.92–1.59)	
			Q4 (> 6.0)	159	1.37 (1.02–1.83)	
			Trend-test p-value: 0.03			

Table 2.9.4 Case-control studies: Processed 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	
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 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. Processed meat: bacon, sausage, blood pudding, mortadella, salami, saucisson, hot dog, ham. Frequency in servings per year.	NHL: Non-Hodgkin's lymphoma (WHO 2001)	Tertiles of processed meat consumption (servings/year)			Age, sex, residence, urban/rural status, education, body mass index, smoking intensity (in pack yr), alcohol drinking, maté consumption, total vegetable and fruit intake, total energy	
			T1	NR	1		
			T2	NR	1.59 (1.23–2.06)		
			T3	NR	0.95 (0.72–1.25)		
			Trend-test p-value: 0.86				
			Tertiles of salted meat intake, servings/year				Same as above
			T1	NR	1		
TII	NR	1.58 (1.11–2.24)					
TIII	NR	2.29 (1.62–3.22)					
Trend-test p-value: < 0.0001							

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