Table 2.3. Nested case-control studies of arsenic exposure and cancer

Reference, study location and period	Organ site (ICD code)	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)*	Adjustment for potential confounders	Comments
Lee-Feldstein (1989) Montana, 1925-1947	Respira-tory cancer (160-164)	302 employees who died of respiratory cancer during the follow up of a Montana cohort of 8045 white male employees employed at least 12 months by December 31, 1956 followed during the period January 1, 1938-September 30, 1977	1 case was matched with 6 controls chosen from among the employees: 1. Who were born in the five year time period as the case 2. Survived the five year time period of death for the corresponding case and if deceased not due to respiratory cancer 3. Belonged to the same cohort as the case with the cohort defined by broad period of initial employment	Employment records with information on work area, year started and year ended from the start of employment through September 30, 1977. Airborne arsenic measured in light, medium and heavy areas with time weighted average airborne arsenic concentration	Light Medium Heavy	1.00 2.80 (1.81-4.33) 2.53 (1.46-4.37)		

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Järup and Pershagen (1991) Stockholm, Sweden, 1928-1967 to 1981	Lung cancer (ICD-8 162 and 163)	Nested case-control study in cohort of 3,916 Swedish copper smelter workers employed 1928-1967. 103 subjects dying from lung cancer were identified and an additional 4 cases occurring during the observation period obtained from Swedish Cancer Register.	Two deceased controls per case matched on year of birth, chosen from deaths other than lung cancer occurring during the observation period.	Detailed information on exposure to arsenic from different departments for different time periods and employment records used to estimate individual exposures.	Cumulative arsenic exposure (mg/m^3 years)				Age Smoking status	Interaction between smoking and arsenic exposure intermediate between additive and multiplicative
					<0.25	1.0	1.0	1.0		
					0.25-<1	1.3	1.1	0.7 (0.2-2.2)		
					1-<5	0.9	1.3	1.0 (0.3-2.9)		
					5-<15	1.3	1.6	1.3 (0.4-4.6)		
					15-<50	1.7	1.7	1.5 (0.5-4.2)		
					50-<100	2.7	2.1	2.0 (0.4-9.4)		
					>=100	4.2	5.4	8.7 (1.6-90.4)		

Table 2.3. Nested case-control studies of arsenic exposure and cancer

Reference, study location and period	Organ site (ICD code)	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)*	Adjustment for potential confounders	Comments
Mc Laughlin *et al.* (1992), China, 1972-89	Lung	319 men with lung cancer with 3 excluded. Cases from a cohort in 29 mines and factories in China.	1358 controls, six were excluded due to lack of work history	Detailed quantitative exposure matrix was developed using information from the work histories, historical hygiene records and a special monitoring program	Cumulative arsenic (µg/m^3/y) *Potteries* None Low (0.1-5.52) Medium (5.53-28.5) High (≥28.6) *Tungsten mines* None Low (0.1-5.52) Medium (5.53-28.5) High (≥28.6) *Iron-Copper mines* None Low (0.1-5.52) Medium (5.53-28.5) High (≥28.6) *Tin mines* None Low (0.1-5.52) Medium (5.53-28.5) AHigh (≥28.6)	 1.0 -- -- -- 1.0 1.3 0.5 -- 1.0 0.6 -- -- 1.0 1.4 1.5 2.8	Age Cigarette smoking	Original cohort consisted of 68285 workers who worked from the period 1st January 1972 to 31st December 1974. The workers were followed up for lung cancer mortality till 31st December 1989

Table 2.3. Nested case-control studies of arsenic exposure and cancer

Reference, study location and period	Organ site (ICD code)	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)*	Adjustment for potential confounders	Comments
Chen and Chen (2002), Southern China, 1994	Lung Cancer (162)	130 cases were identified from the cohort subjects (7855 tin miners); those who died of lung cancer were ascertained by biopsy and were reconfirmed through medical records in local and regional hospitals. Radiologist panel reviewed chest X-Rays to determine cases.	627 controls with complete work history from 7855 cohort subjects. Controls who died at an age younger than the age at diagnosis of corresponding cases were excluded from the analysis	Personal and medical examination from industrial hygiene records. Questionnaire was also administered to obtain demographic information, medical history, tobacco smoking (pack-years)	Total arsenic exposure (µg/m^3 -year) No exposure <100 100-499.9 500-999.9 ≥1000 Cumulative exposure (µg/m^3 -year) *Low* No exposure <100 100-499.9 500-999.9 ≥1000 *Medium* No exposure <100 100-499.9 500-999.9 ≥1000 *High* No exposure <100 100-499.9 500-999.9 ≥1000	 1.0 (-) 2.0 (1.1-3.7) 2.0 (1.0-3.7) 1.9 (1.0-3.7) 3.5 (1.8-7.0) 1.0 (-) 2.1(1.0-4.4) 2.0 (1.0-4.1) - - 1.0(-) 1.7(0.7-4.1) 1.9(0.9-4.0) 1.5(0.6-3.5) - 1.0(-) 2.2(0.9-5.0) 3.4(0.9-12.6) 2.3(1.0-4.9) 3.5(1.8-7.0)	Age Smoking	Nested case control study from a cohort study of 7855 subjects employed at least 1 year between 1972 and 1974 in four tin mines in China. Women were excluded from the cases to avoid the influence of sex. Questionnaire administered to both the subjects and the members of their family

Table 2.3. Nested case-control studies of arsenic exposure and cancer

Reference, study location and period	Organ site (ICD code)	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories		Relative risk (95% CI)*	Adjustment for potential confounders	Comments
Grimsrud *et al.* (2005) Norway, 1952-1995	Lung cancer	Nested case-control in a cohort of workers employed at a metal refinery in Norway between 1910-1944. 213 cases of lung cancer diagnosed between 1951 and August 1995 from workers in a refinery treating a sulfidic nickel copper concentrate (94% of those originally identified) with minimum one year of exposure.	525 controls (94% of those originally identified) free of lung cancer at the time of diagnosis of the case matched according to sex and year of birth of cases.	Time and department specific exposure matrix constructed from data on arsenic summarized by a chemist from refinery	Arsenic [(mg/m^3) × years]			Smoking Other occupational exposures (nickel, asbestos, sulfuric acid mist, cobalt, carcinogenic exposure in work outside the refinery)	
					Unexposed	1.0	1.0		
					Low (0-0.0009)	1.8 (1.1-3.1)	1.3 (0.7-2.3)		
					Medium(0.01-0.17)	1.7 (1.0-3.0)	1.2 (0.7-2.3)		
					High(0.18-5.9)	1.8 (1.0-3.3)	1.2 (0.6-2.4)		

Table 2.3. Nested case-control studies of arsenic exposure and cancer

Reference, study location and period	Organ site (ICD code)	Characteristics of cases	Characteristics of controls	Exposure assessment	Exposure categories	Relative risk (95% CI)*	Adjustment for potential confounders	Comments
Chen *et al.*, (2007) China 1994	Lung Cancer	518 cases from cohort of males in mining and pottery industries, identified based on underlying cause of death in the death certificates, diagnostic information reconfirmed by medical records in local or regional hospital	1884 male controls were selected by density sampling 4:1 matched to cases until 1989 and 3:1 matched to cases during the extended follow up by decade of birth, mine and factory	Complete individual working history was reconstructed using employment records in personal files of the involved mining companies and factories. Cumulative exposure was determined by using JEM (Job title/calendar exposure matrix) and individual work history	Per mg/m^3 increase in arsenic exposure per year	1.86 (1.14-3.04)	Smoking	Nested case control study in a cohort of 65285 workers in 29 mines from January 1972-December 1974 until December 31, 1989. 47108 workers were followed till 1994

SMR_0 = Standardized Mortality Ratio of lowest exposure category
SMR_1 = Standardized Mortality Ratio of next six exposure groups
SMR_1/ SMR_0 = SMR ratios from underlying cohort
OR_1 = Odds Ratio stratified for age
OR_2 = Odds Ratio stratified for age and smoking status (nonsmokers, 1-10 and >10g of tobacco per day)
Crude OR = Odds Ratio adjusted for smoking only
Adjusted OR* = Odds Ratio adjusted for smoking and other occupational exposures (nickel, asbestos, sulfuric acid mist, cobalt, carcinogenic exposure in work outside the refinery)