

Table 2.12. Case-control studies of exposure to benzene and multiple myeloma

Reference, study location and period	Characteristics of cases	Characteristics of controls	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of exposed cases	Odds ratio (95% CI)*	Adjustment for potential confounders	Comments
Linet <i>et al.</i> (1987) USA	Cases were ascertained from seven Baltimore area hospitals January 1, 1975, to December 31, 1982. 121 met the case definition, 100 were interviewed (83%). Next of kin interviews were conducted for 81 cases.	Controls were individually matched to cases on hospital, age sex, and yr of diagnosis. One of 11 hospital discharge diagnosis categories of diseases was randomly chosen, excluding all cancers, diseases of blood-forming organs, mental disorders, obstetrical conditions, and congenital anomalies. 146 controls approached to obtain 100 matched pairs. Next of kin interviews were conducted for 47 of these controls.	A standardized questionnaire was administered by telephone to the study subject, or, if that individual had died or from the closest possible next of kin. Areas assessed in the interview included occupations, occupational and environmental exposures.	MM 203	Occupational exposure to benzene		1.2 (0.4–3.6)	Respondent status	Matched pair analysis (65 pairs), 8 cases/7 controls discordant.

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Cuzick & De Stavola (1988) United Kingdom	Cases were identified at major referral centres in six different parts of England and Wales between May 1978 and December 1984. 409 cases were interviewed, 399 matched case-hospital control pairs and 260 matched case-GP controls were available for analysis.	Two controls were sought for each case matched for age (± 3 yr) and sex. One control was selected from the general surgical and medical wards of the same hospital as the case, excluding patients with other cancers and other long standing medical conditions. A second control was selected at random from the same general practitioner as the case except in London.	Interviewer administered questionnaire including previous Occupations and chemical exposures.	MM 203	Proportion exposed to solvents/benzene Cases 1-10 yr > 10 yr Hospital controls 1-10 yr > 10 yr	(Percent) 4.0% 6.0% 2.5% 4.3%			Numbers of cases and controls in exposure categories not given. p NS for linear trend in exposure

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La Vecchia <i>et al.</i> (1989) Italy	110 cases (56 men, 54 women) aged 15–74 with histologically confirmed diagnosis of multiple myeloma.	396 subjects (269 men, 127 women, admitted for acute conditions to the same network of hospitals where cases had been identified.	Interviewer elicited history of occupations and occupational exposures. Information was collected on exposure to 13 selected occupational agents or groups of agents.	MM 203	Proportion exposed to solvents/benzene Cases 1–10 yr > 10 yr Controls 1–10 yr > 10 yr	(Percent) 2.7% 5.5% 2.5% 3.0%			Numbers of cases and controls in exposure categories not given. P < 0.05 for linear trend in exposure
Heineman <i>et al.</i> (1992) Denmark	1222 men cases of MM from the Danish Cancer Registry diagnosed 1970–1984.	4888 potential controls from the Danish population registry matched (4 per case) on sex and yr of birth, and alive at the time of diagnosis of the case.	Data from the Danish Supplementary Pension Fund records on most recent occupation. Hygienists assessed exposure from job title and industry. 124 (10%) cases and 719 (15%) controls with no occupational information excluded.	MM 203	Possible exposure to benzene 1 mo- < 5 yr ≥ 5 yr p for trend Probable exposure to benzene 1 mo- < 5 yr ≥ 5 yr p for trend	137 58 68 52 22 25	1.3 (1.0–1.6) 1.5 (1.1–2.1) 1.1 (0.8–1.5) 0.16 0.8 (0.6–1.1) 1.2 (0.7–2.1) 0.7 (0.4–1.1) 0.07		Referent not stated

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Costantini <i>et al.</i> (2008) Italy (11 areas)	All cases of hematolymphopoietic malignancies, incident in men and women aged 20–74 yr in the period 1991–1993 were identified. A total of 2 737 cases of hematolymphopoietic malignancies were interviewed, 263 cases of MM.	1779 subjects randomly selected through the demographic files of the municipalities in each of the areas under study, stratified by sex and 5-yr age groups. 1 100 controls used in analysis of MM.	Job or industry-specific questionnaires and subsequent expert ratings used to assign a level of exposure to a definitive list of agents. Industrial hygiene experts from each geographic area examined questionnaires and assessed a level of probability and intensity of exposure to substances at the individual level for each case and control.	MM 203	Benzene			Sex, age, education, area	The unexposed referent group never used any chemicals.
					Unexposed	163	1.0		
					Very low/low	8	0.6 (0.3–1.5)		
					Medium/high	14	1.9 (0.9–3.9)		
					Yr worked with benzene:				
Unexposed	163	1.0							
≤ 15	26	0.8 (0.3–2.2)							
> 15	3	4.1 (0.8–20.0)							
p for trend		0.10							

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Cocco <i>et al.</i> (2010) (Epilymph study – 6 European countries)	All consecutive adult patients first diagnosed with lymphoma 1998–2004 resident in the referral area of the participating centres. 2 348 cases provided informed consent, overall participation 88%	Controls from Germany and Italy were selected by random sampling from the general population, and matched to cases by sex, 5-yr age group, and residence area. The other 4 centres used matched hospital controls, with eligibility criteria limited to diagnoses other than cancer, infectious diseases and immunodeficient diseases. 2462 controls provided informed consent, participation rate 52% for population controls and 81% for hospital.	Trained interviewers conducted in-person interviews with cases and controls, using the same structured questionnaire translated to the local language. Questions included information on a list of all fulltime jobs held for 1 yr or longer. Industrial hygienists in each participating centre coded the occupations and industries.	MM 203	Benzene Unexposed All exposed Low Medium High p for trend	160 16 4 2 10	1.0 0.9 (0.5–1.6) 0.7 0.4 1.4 0.14	Age, sex, education and centre.	Only subjects whose exposure was assessed with high degree of confidence were included in the analysis.

Mo, month or months; MM, multiple myeloma; yr, year or years