Table 2.9 Case–control studies on cancer of the urinary bladder and welding/welding fumes (web only)

Reference, location, enrolment/follow-up period	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled	Comments
Howe et al. (1980) Canada (British Columbia, Nova Scotia, Newfoundland) 1974–76	Cases: 632; newly diagnosed bladder cancer cases Controls: 632; neighbourhood controls individually matched on age (± 5 years) and sex Exposure assessment method: Questionnaire; full job history, followed by detailed questions on industries/occupations of a priori interest re. bladder cancer (not including welding).	Urinary bladder	Men: Welding	17	2.8 (1.1–8.8)	Age, smoking	Strengths: relatively large study size Limitations: number of welders relatively small, and no specific welding information available
Silverman et al. (1983) USA, Detroit 1977–78	Cases: 303; histologically confirmed cases of newly diagnosed carcinoma (or papilloma not specified as benign) of the lower urinary tract (bladder [95%], renal pelvis, ureter, urethra), aged 21–84 years Controls: 296; General population controls from same area frequency matched on age Exposure assessment method: Questionnaire; full job history, followed by exposure details for each job.	Urinary bladder	Motor vehicle manuf. industry: Welder, flame cutter, solderer	12	0.6 (0.3–1.2)	None	Strengths: histologically confirmed cases from 60 of the 61 Detroit hospitals; face to face interviews. Limitations: only white males and only OR for welding within the motor vehicle industry is reported
		Urinary bladder	Regardless of industry: Welder, flame cutter, solderer	18	0.6 (0.3–1)	None	

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Schifflers et al. (1987) Belgium 1984–1985	Cases: 74; histologically confirmed cases selected through urologists. 56 males, 18 females, from two industrial area (Charleroi and Liege) Controls: 203; population controls selected from electoral roll matched on year of birth and sex. 154 males, 49 females Exposure assessment method: Questionnaire	Urinary bladder	Welders	1	0.4 (0.04–3.61)	Tobacco use	In Reulen et al. (2008) meta-analysis Limitations: very small
Claude et al. (1988) northern Germany 1977–1984	Cases: 531; histologically confirmed bladder cancer cases from 3 hospitals, reclassified by pathologist, Controls: 531; recruited from same hospital urological ward and from homes for the elderly located in the same town. Exposure assessment method: Questionnaire; lifetime occupational history and list of substances	Urinary bladder	Men only: Welder	12	1.2 (0.52–2.77)	Age, smoking	
Risch et al. (1988) Canada (Edmonton, Calgary, Toronto, Kingston) 1979–1982	Cases: 826; Hospital admitted cases, all bladder cancer originating from urothelium, aged between 35 and 79 years Controls: 792; population controls, individually matched by sex, age, area of residence Exposure assessment method: Questionnaire	Urinary bladder	Men only: Welding (ever)	117	1.05 (0.71–1.57)	Age, residence, smoking	In Reulen et al. (2008) meta-analysis
		Urinary bladder	Per 10 year			Age, residence, smoking	
			Men only: Duration of welding	117	0.93 (0.78–1.1)		

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Reference, location, enrolment/follow-up period	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled	Comments
Silverman et al. (1989a) USA 1977–1978	Cases: 2100; histologically confirm urinary bladder cancer cases, aged 21–84 years from 10 geographic areas Controls: 3874; general population, frequency matched on age (± 5 yr) and geographic region Exposure assessment method: Questionnaire	Urinary bladder	White men: Welder and solderer	88	1 (0.7–1.3)	Smoking	Strengths: large size Limitations: results by type or duration of welding not reported
Silverman et al. (1989b) USA 1977–1978	Cases: 126; non-white men, as part of National Bladder Cancer Study Controls: 383; general population, frequency matched on age (± 5 yr) and geographic region Exposure assessment method: Questionnaire	Urinary bladder	Non-white men: Welder, flamecutter, solderer	4	0.9 (0.2–3)	Smoking	In Reulen et al. (2008) meta-analysis Strengths: only report on nonwhite men Limitations: small size
Silverman et al. (1990) USA 1977–1978	Cases: 652; histologically confirmed incident cases of urinary bladder carcinoma, aged 21–84 years Controls: 1266; general population, frequency matched on age (± 5 yr) and geographic region Exposure assessment method: Questionnaire	Urinary bladder	White women: Welder and flame-cutter	6	1.7 (0.5–6)	Smoking	In Reulen et al. (2008) meta-analysis Strengths: report on women Limitations: small number of welders
Burns & Swanson (1991) USA, Detroit 1973?-19??	Cases: 2160; incident cases, aged 40–84 years, Controls: 3979; colon and rectum cancer cases Exposure assessment method: Questionnaire	Urinary bladder	Men and women: Welders	24	0.7 (0.4–1.2)	Smoking, race, sex	In Reulen et al. (2008) meta-analysis Strengths: size Limitations: results by type and duration of welding not reported

Table 2.9 Case–control studies on cancer of the urinary bladder and welding/welding fumes (web only)

Reference, location, enrolment/follow-up period	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled	Comments
Siemiatycki (1991) Canada, Montreal 1979–1985	Cases: 484; male residents of the Montreal metropolitan area with histologically confirmed incident bladder cancer, age 35–70 Controls: 2412; 1879 study subjects with other cancers and 533 population controls Exposure assessment method: Expert judgement	Urinary bladder	Welders and flame cutters (any)	16	1.5 (0.9–2.6)	Age, family income, cigarette index, coffee index, type of respondent	Strengths: expert assessment based on detailed job descriptions. Limitations: the control group may include cancers associated with the exposure
			Welders and flame cutters (substantial)	7	1.3 (0.6–2.8)		
			Arc welding fumes (any)	63	1.2 (0.9–1.5)		
			Arc welding fumes (substantial)	16	0.9 (0.5–1.4)		
			Gas welding fumes (any)	63	1.2 (0.9–1.5)		
			Gas welding fumes (substantial)	25	1.1 (0.8–1.7)		
Kunze et al. (1992) Germany (South Lower Saxony) 1977–1985	Cases: 531; histologically confirmed benign or malignant epithelial tumours of the urinary bladder, ureters, renal pelves and urethra, cases were drawn from four urologic wards in three cities, Controls: 531; hospital controls with non-neoplastic diseases of the lower urinary tract from the same hospital matched by age (± 5 years). (and sex, but OR is for men only) Exposure assessment method: Questionnaire	Urinary bladder: majority urinary bladder (64% papillary transitional cell carcinoma; 19% nonpapillary transitional cell carcinoma)	Men only: Welder	13	1.2 (0.5–2.8)	Smoking	In Reulen et al. (2008) meta-analysis

Table 2.9 Case–control studies on cancer of the urinary bladder and welding/welding fumes (web only)

Reference, location, enrolment/follow-up period	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled	Comments
Zaridze et al. (1992) the Russian Federation, Moscow 1987–1989	Cases: 116; histologically confirmed bladder cancer cases, aged 30–85 years Controls: 116; matched on the region, polyclinic, place of residence and sex Exposure assessment method: Questionnaire	Urinary bladder	Men and women: Gas and arc welding operators	9	1.5 (0.48–4.67)	None	Limitations: small size
Cordier et al. (1993) France 1984–1987	Cases: 658; histologically confirmed bladder cancer cases, under 80 years of age, Controls: 658; hospital controls (not cancer, respiratory disease or symptoms suggestive of bladder cancer), matched by age (± 5 years), ethnic origin, place of residence. Exposure assessment method: Expert judgement	Urinary bladder	Men only: Welding fumes (any type)	86	1.4 (0.98–2.01)	Smoking, matching variables	In Reulen et al. (2008) meta-analysis (OR for occupation not for welding fumes exposure?). In Kogevinas et al. (2003) pooled analysis, but only for occupation, not welding fumes Strengths: large size, results by type of welding fume presented Limitations: occupations in which the welding fume exposure occurred was not reported (only a small proportion were 'welders')
			Oxyacetylenic welding fumes	40	1.61 (0.95–2.72)		
			Stainless steel welding fumes	4	1.1 (0.24–5.05)		
			Electric arc welding fumes	37	1.34 (0.79–2.27)		
			Other welding fumes	12	1.25 (0.51–3.07)		
			Welder	8	7 (0.87–56.62)		
Teschke et al. (1997) BC, Canada 1990–1991	Cases: 105; all incident histologically confirmed primary malignant tumours of the urinary bladder aged ≥ 19 years registered in cancer agency Controls: 159; population-based controls were randomly selected from five year age and sex strata and frequency matched to the age and sex distribution of the cases, selected from the provincial voters, aged ≥ 19 Exposure assessment method: Questionnaire	Urinary bladder	Men only: Ever welders	4	0.9 (0.2–5.6)	Age, smoking, sex	In Reulen et al. (2008) meta-analysis Limitations: small size

Table 2.9 Case–control studies on cancer of the urinary bladder and welding/welding fumes (web only)

Reference, location, enrolment/follow-up period	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled	Comments
Kogevinas et al. (2003) Europe (pooled analysis of 11 studies from 6 European countries) 1976–1996	Cases: 3346; all incident cases, age 30–79, excluded prevalent cases Controls: 6840; Pooled analysis: 3 studies population controls, 7 studies hospital controls, 1 study both. Exposure assessment method: Questionnaire	Urinary bladder	Men only: Welders	88	1.22 (0.91–1.63)	Age, smoking, study centre	Strengths: very large size; includes 11 studies of which all but one had not yet reported on welding; not subject to publication bias Limitations: results by type of and duration of welding not presented
Colt et al. (2004) USA, New Hampshire 1994–1998	Cases: 424; primary bladder cancer cases age 25–74 Controls: 645; population-based controls selected from tow sources, a previous non-melanoma skin cancer study and additional controls, frequency matched on age and sex Exposure assessment method: Questionnaire	Urinary bladder	Welders/solderers (men)	6	1.3 (0.4–4.5)	Age, smoking	In Reulen et al. (2008) meta-analysis Strengths: reports results by sex Limitations: small number of welders
			Welders/solderers (women)	1	0.3 (0.04–3.1)		
			Welders/solderers (both sexes)	7	[0.92 (0.32–2.65)]		
Gaertner et al. (2004) Canada 1994–1997	Cases: 887; incident cases of histologically confirmed bladder cancer aged 20–74 Controls: 2847; random selection of population controls, frequency matched on age and sex Exposure assessment method: Questionnaire	Urinary bladder	Men only: Welder	25	1.34 (0.76–2.38)	Age, province, race, smoking, diet	In Reulen et al. (2008) meta-analysis Strengths: large size, results reported by duration of welding Limitations: no results by type of welding
		Urinary bladder	Duration (years)			Age, province, race, smoking, diet	
			Men only: Welder (> 1–5)	6	1.45 (0.5–4.19)		
			Welder (> 5–15)	2	0.61 (0.12–2.98)		
			Welder (> 15)	16	1.66 (0.78–3.48)		

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Reference, location, enrolment/follow-up period	Population size, description, exposure assessment method	Organ site	Exposure category or level	Exposed cases/ deaths	Risk estimate (95% CI)	Covariates controlled	Comments
Samanic et al. (2008) Spain (Barcelona, Valles, Asturias, Alicante, Tenerife) 1998–2000	Cases: 1219; incident cases from 18 hospitals with urothelial cell carcinoma or carcinoma in situ of the bladder, aged 21–80 Controls: 1271; hospital controls, diseases/conditions unrelated to exposures under study Exposure assessment method: Questionnaire	Urinary bladder	Welders	42	1.05 (0.67–1.64)	Age, hospital region, smoking	In Reulen et al. (2008) meta-analysis Strengths: large size, results by duration of welding, reports results for all occupations and industries (no reporting bias) Limitations: results by welding type not reported
		Urinary bladder	Duration (years)			Age, hospital region, smoking	
			Welders (> 0- < 10)	16	0.77 (0.4–1.52)		
			Welders (≥ 10)	26	1.32 (0.74–2.36)		
Colt et al. (2011) USA, (Maine, New Hampshire, Vermont) 2001–2004	Cases: 1158; all residents in Maine, Vermont and New Hampshire newly diagnosed with histologically confirmed carcinoma of the urinary bladder, aged 30–79 Controls: 1402; population controls randomly selected from the Department of Medical Vehicle (DMV) records, matched by state, sex and age Exposure assessment method: Questionnaire; obtained by personal interviews	Urinary bladder	Men only: Welders and cutters	21	1 (0.5–2)	Age, race, state, smoking, ever employment in other high-risk occupations	Strengths: large size Limitations: results by welding type and duration not available

CI, confidence interval

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