

**Table 2.2. Cohort studies of vinyl chloride monomer and polyvinyl chloride production workers and lung cancer**

Reference, location, name of study	Cohort description	Exposure assessment	Organ site (ICD code)	Exposure categories	No. of cases/deaths	Relative risk (95% CI)*	Adjustment for potential confounders	Comments
Mundt <i>et al.</i> (2000) USA	10 109 male workers employed at least ≥ 1 year in jobs that entailed exposure to VCM in 1942–72; mortality follow-up, 1942–95; vital status, 96.8%; cause of death, 99%	JEM	Trachea, bronchus and lung (ICD-9 162)	Job exposed to VC	303	<b>SMR</b> (state rates) 0.82 (0.73–0.92) <b>SMR</b> (national rates) 0.96 (0.86–2.07)		Reference rates: state rates and USA population
Ward <i>et al.</i> (2000, 2001) Italy, Norway, Sweden, UK	12 700 male workers employed in 19 VCM/PVC plants ≥ 1 year in 1950–85; mortality follow-up, 1955–97; incidence follow-up, 1955–96	Calendar period JEM for 13/19 factories grouped in 22 broad categories; factory-specific JEM with validated exposure estimates (ppm)	Trachea, bronchus and lung (ICD-9 162)	Employed in VC industry (full cohort)	272	<b>SMR</b> 0.95 (0.84–1.07)		Reference rates: national; Incidence rates: national
					154	<b>SIR</b> 0.80 (0.68–0.94)	Age, calendar period	
				VCM production	14	<b>SMR</b> 1.47 (0.80–2.47)		
				PVC production	56	0.88 (0.67–1.15)		
				VCM and PVC production	184	0.91 (0.79–1.05)		
				PVC processing	18	1.43 (0.85–2.26)		

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Ward <i>et al.</i> (2000, 2001) (contd)				<i>Latency (years)</i>		<b>Relative risk</b>		
				< 16	57	1.00		
				16–21	55	0.96 (0.65–1.41)		
				22–26	66	1.21 (0.82–1.78)		
				27–34	54	0.73 (0.48–1.11)		
				≥ 35	40	0.76 (0.47–1.25)		
						Test for linear trend,		
						$p = 0.119$		
				<i>Duration (years)</i>				
				1–2	57	1.00		
				3–6	55	1.12 (0.76–1.64)		
				7–11	66	1.31 (0.91–1.88)		
				12–18	54	0.89 (0.60–1.30)		
				≥ 19 years	40	0.77 (0.52–1.15)		
						Test for linear trend,		
						$p = 0.094$		
				<i>Cumulative exposure (ppm-years)</i>				
				0–34	52	1.00		
				35–99	52	1.11 (0.75–1.62)		
				100–535	55	0.90 (0.62–1.32)		
				536–2811	46	0.85 (0.57–1.27)		
				≥ 2812	43	0.84 (0.56–1.26)		
						Test for linear trend,		
						$p = 0.190$		

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Ward <i>et al.</i> (2000, 2001), (contd)				<i>Autoclave worker</i>				
				Never	220	1.00		
				Ever	44	0.84 (0.61–1.16)		
				Unknown	8	0.38 (0.19–0.77)		
				<b>Cumulative exposure (ppm–years)</b>				
				<i>Ever employed as packers and baggers</i>				
				0–34	9	1.12 (0.51–2.13)		
				35–99	9	0.99 (0.45–1.88)		
				100–535	14	1.08 (0.59–1.82)		
				536–2811	9	0.85 (0.39–1.60)		
				≥ 2812	10	1.02 (0.49–1.88)		
				<i>Never employed as packers and baggers</i>				
				0–34	43	0.98 (0.71–1.33)		
				35–99	43	1.09 (0.79–1.46)		
				100–535	41	0.83 (0.60–1.13)		
				536–2811	37	0.86 (0.60–1.18)		
				≥ 2812	33	0.87 (0.60–1.23)		
				<i>Only employed as packers and baggers</i>				
				0–34	5	0.88 (0.28–2.04)		
				35–99	6	1.28 (0.47–2.78)		
				100–535	11	1.63 (0.81–2.92)		
				536–2811	4	1.37 (0.37–3.52)		
				≥ 2812	4	3.12 (0.85–8.00)		
					Test for trend $\chi^2$ , $p = 0.009$			

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Pirastu <i>et al.</i> (2003) Italy	1658 male workers employed in 1956–99; mortality follow-up, 1973–99; vital status, 100%; cause of death, 99%	JEMs, job-and time-specific VCM estimates (ppm); ever/never autoclave worker	Lung cancer (ICD-9 162.1–162.9)	Full cohort	40	<b>SMR</b> 0.83 (0.64–1.07) <sup>a</sup>	Not adjusted Latency	Part of study by Ward <i>et al.</i> (2001). Reference rates: regional Internal comparison versus never baggers
				Only versus never baggers	7	1.73 (0.93–3.21)		
					7	<b>SMR</b> 2.31 (1.15–4.61) <sup>a</sup>		
Thériault & Allard (1981) Canada	451 male workers exposed to VCM for ≥ 5 years in a polymerization plant, employed in 1948–72; mortality follow-up, 1948–77	Questionnaire to the worker or next of kin on detailed occupational history	Trachea, bronchus and lung (ICD-9 162)	Exposed to VCM	2	<b>SMR</b> 0.34 (0.04–1.25)		Reference rates: Canadian population in 1971; comparison population: 870 workers not exposed to VCM for ≥ 5 Months
Smulevich <i>et al.</i> (1988) Soviet Union	3232 VCM/PVC production workers (2195 men, 1037 women) employed for ≥ 1 month in VCM-exposed jobs; mortality follow-up, 1939–77	Exposure data in 1953–66 from JEM	Trachea, bronchus and lung (ICD-9 162)	Estimated area exposure: low, medium and high	17	<b>SMR</b> 1.39 (0.81–2.23)		City (Gorki) mean death rates in 1959, 1969 and 1975

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Wong <i>et al.</i> (2002) Taiwan, China	3293 male workers in 6 PVC polymerization plants exposed to VCM <sup>3</sup> 1 year in 1950–92; mortality follow-up, 1985–97; vital status 99%	JEM	Trachea, bronchus and lung (ICD-9 162)		4	<b>SMR</b> 0.59 (0.16–1.52)		Reference rates: national; cohort enumerated from records of the Labour Insurance Bureau
Mastrangelo <i>et al.</i> (2003) Italy	38 histologically confirmed lung cancers  224 with no history of cancer	Facility specific JEM	Trachea, bronchus and lung (ICD-9 162)	<i>Cumulative exposure to VCM (ppm-years)</i>			Smoking habits in relation to years of work as a bagger	Italian cohort of 1658 vinyl chloride workers; nested case-control analysis.
				≤ 392	16/71	1.00		
				393–1650	13/74	0.78 (0.32–1.87)		
				≥1651	9/79	0.51 (0.18–1.31)		
						$\chi^2$ trend $p > 0.01$		
				<i>Circumstances of exposure to PVC dust</i>				
				None	8/87	1.00		
				PVC compounding	8/49	1.78 (0.54–5.78)		
				Baggers (unknown length)	5/55	0.99 (0.24–3.63)		
				Baggers (known length)	17/33	5.60 (2.03–16.3)		
				<b>PVC compounding</b>				
				None	30/175	1.00		
				≤ 8.0 years	4/23	1.10 (0.24–3.28)		
				> 8.0 years	4/26	0.90 (0.21–2.86)		

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Mastrangelo <i>et al.</i> (2003) Italy (contd.)				<b>Baggers</b>				
				<i>Duration of job</i>				
				None	21/191	1.00		
				< 3.6 years	6/19	2.87 (0.84–8.56)		
				≥ 3.6 years	11/14	7.51 (2.55–19.3)		
				<i>Calendar year of onset</i>				
				None	21/191	1.00		
				Before	10/19	4.79 (1.73–12.5)		
				Since onwards	7/14	4.55 (1.38–13.6)		
				<i>Age at onset</i>				
				No	21/191	1.00		
				≤ 33 years	6/20	2.73 (0.80–8.07)		
				> 33 years	11/13	7.70 (2.72–21.1)		
				<i>Length of time elapsed from onset of job to end of follow-up or death</i>				
				None	21/191	1.00		
				20 years	12/29	3.76 (1.51–8.99)		
				≤ 20 years	5/4	11.4 (2.21–60.7)		

JEM, job exposure matrix; VCM, vinyl chloride monomer; PVC, polyvinyl chloride