

Supplemental Table S.1. Observed and expected deaths, standardized mortality ratios, and 95% confidence intervals for selected causes*

Cause of death	Inception subcohort (n=7,273) [†]				Inception subcohort, follow up beginning in 1973 (n=6,701) [†]			
	O	E	SMR	95% CI	O	E	SMR	95% CI
All causes	3882	4489.4	0.86	0.84–0.89	3441	3921.8	0.88	0.85–0.91
All malignant neoplasms	1166	1216.8	0.96	0.90–1.01	1076	1123.5	0.96	0.90–1.02
Oral cavity and pharynx	26	24.6	1.06	0.69–1.55	20	21.3	0.94	0.57–1.45
Esophagus	42	34.5	1.22	0.88–1.65	39	32.7	1.19	0.85–1.63
Stomach	23	30.0	0.77	0.49–1.15	21	25.5	0.82	0.51–1.26
Intestine except rectum	72	96.5	0.75	0.58–0.94	69	89.8	0.77	0.60–0.97
Rectum	24	20.5	1.17	0.75–1.74	23	18.1	1.27	0.80–1.91
Liver, biliary passages & gall bladder	78	32.8	2.37	1.88–2.96	72	30.2	2.38	1.86–3.00
Liver only ‡	70	22.3	3.14	2.45–3.97	65	21.1	3.08	2.38–3.93
Pancreas	55	58.0	0.95	0.71–1.23	53	53.4	0.99	0.74–1.30
Larynx	8	14.9	0.54	0.23–1.06	6	13.5	0.45	0.16–0.97
Trachea, bronchus, lung	425	476.8	0.89	0.81–0.98	397	446.4	0.89	0.80–0.98
Pleura	3	0.8	3.89	0.80–11.36	2	0.7	2.77	0.34–10.01
Breast	2	1.4	1.41	0.17–5.10	2	1.3	1.57	0.19–5.65
Prostate	72	83.7	0.86	0.67–1.08	71	80.9	0.88	0.69–1.11
Kidney	37	31.6	1.17	0.82–1.61	33	29.2	1.13	0.78–1.59
Bladder & other urinary organs	36	31.2	1.15	0.81–1.60	34	29.4	1.16	0.80–1.62
Bone	3	3.3	0.90	0.18–2.62	2	2.4	0.82	0.10–2.96
Melanoma	18	19.4	0.93	0.55–1.47	17	17.4	0.98	0.57–1.57
Skin	3	6.3	0.48	0.10–1.39	2	5.8	0.35	0.04–1.25
Mesothelioma	9	3.9	2.28	1.04–4.33	9	3.9	2.28	1.04–4.33
Connective tissue	12	5.9	2.05	1.06–3.58	10	5.3	1.88	0.90–3.46
Brain and Central Nervous System	38	29.5	1.29	0.91–1.77	31	25.2	1.23	0.83–1.74
Eye	2	0.7	2.98	0.36–10.75	2	0.5	3.84	0.46–13.86
Thyroid	2	2.2	0.89	0.11–3.23	1	2.0	0.50	0.01–2.79
Other & unspecified malignancy	59	86.6	0.68	0.52–0.88	56	80.8	0.69	0.52–0.90
Hodgkin's disease	3	5.6	0.53	0.11–1.56	1	3.2	0.31	0.01–1.73
Non Hodgkin lymphoma	40	43.9	0.91	0.65–1.24	35	40.4	0.87	0.60–1.21
Multiple myeloma	20	19.5	1.03	0.63–1.59	20	18.5	1.08	0.66–1.67

Cause of death	Inception subcohort (n=7,273) [†]				Inception subcohort, follow up beginning in 1973 (n=6,701) [†]			
	O	E	SMR	95% CI	O	E	SMR	95% CI
Leukemia & Aleukemia	46	44.2	1.04	0.76–1.39	41	39.3	1.04	0.75–1.42
Benign and unspecified neoplasms	9	14.6	0.62	0.28–1.17	4	6.8	0.59	0.16–1.50
Diseases of blood and blood forming organs	13	17.2	0.76	0.40–1.30	12	15.9	0.75	0.39–1.32
Diabetes	94	106.6	0.88	0.71–1.08	88	99.1	0.89	0.71–1.09
Nervous system and sense organs	98	91.4	1.07	0.87–1.31	94	86.3	1.09	0.88–1.33
Diseases of the heart	1276	1501.9	0.85	0.80–0.90	1096	1296.7	0.85	0.80–0.90
Cerebrovascular disease	185	210.1	0.88	0.76–1.02	164	181.2	0.91	0.77–1.05
Diseases of the respiratory system	297	408.5	0.73	0.65–0.81	282	379.8	0.74	0.66–0.83
Chronic Obstructive Pulmonary Disease	180	236.1	0.76	0.66–0.88	171	226.8	0.75	0.65–0.88
Asbestosis	1	1.6	0.61	0.02–3.42	1	1.6	0.62	0.02–3.43
Diseases of the digestive system	129	172.1	0.75	0.63–0.89	117	143.5	0.82	0.67–0.98
Cirrhosis & other chronic liver disease	65	78.8	0.82	0.64–1.05	59	64.2	0.92	0.70–1.19
Diseases of genitourinary	61	77.6	0.79	0.60–1.01	59	69.4	0.85	0.65–1.10
Diseases of skin and subcutaneous tissue	4	4.0	1.00	0.27–2.56	4	3.5	1.15	0.31–2.94
Symptoms and ill-defined conditions	32	41.3	0.77	0.53–1.09	30	33.3	0.90	0.61–1.29
External causes	243	336.1	0.72	0.63–0.82	167	216.2	0.77	0.66–0.90

* NIOSH state-specific referent rates used unless otherwise noted.

[†]299,747 person-years for inception subcohort of 7,273 workers, 205,108 person-years for subcohort of 6,701 workers.

[‡] NCHS/CanQues state referent rates used.

Abbreviations: O, observed; E, expected; SMR, standardized mortality ratio; CI, confidence interval.

Supplemental Table S.2. Cox proportional hazards ratios for selected causes of death by cumulative exposure* to vinyl chloride in inception subcohort, n=7,273.†

Cumulative exposure, ppm-years	Melanoma, n=18			Brain cancer, n=38			Lung cancer, n=425			NHL, n=40		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<63	3	ref		7	ref		69	ref		11	ref	
63- <287	5	1.6	0.4–6.7	10	1.4	0.5–3.6	98	1.4	1.0–1.9	4	0.4	0.1–1.1
287- <865	4	1.2	0.3–5.1	10	1.3	0.5–3.4	92	1.2	0.9–1.6	7	0.6	0.2–1.4
865- <2,271	3	0.9	0.3–4.2	4	0.5	0.2–1.8	96	1.2	0.9–1.7	9	0.7	0.3–1.7
≥2,271	3	0.9	0.3–4.5	7	1.1	0.4–3.1	70	1.0	0.7–1.4	9	0.8	0.3–1.8

Cumulative exposure, ppm-years	Connective and soft tissue cancers, n=12			Cirrhosis of the liver, n=65			NMRD, n=297			COPD, n=180		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<63	1	ref		8	ref		41	ref		26	ref	
63- <287	1	1.0	0.1–15.4	13	1.6	0.7–3.8	57	1.4	0.9–2.0	39	1.5	0.9–2.4
287- <865	2	1.8	0.2–19.4	15	1.7	0.7–4.0	69	1.4	1.0–2.1	46	1.5	0.9–2.4
865- <2,271	4	3.5	0.4–31.7	17	1.9	0.8–4.5	75	1.5	1.0–2.0	40	1.3	0.8–2.1
≥2,271	4	4.1	0.5–37.1	12	1.6	0.7–4.0	55	1.1	0.7–1.7	29	0.9	0.5–1.6

* Quintiles of cumulative exposure based on distribution among the full cohort, n=9,951.

† All models unadjusted.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; NHL, non-Hodgkins lymphoma; NMRD, nonmalignant respiratory disease; COPD, chronic obstructive pulmonary disease; ppm, parts per million.

Supplemental Table S.3. Cox proportional hazards ratios for selected causes of death by cumulative exposure* to vinyl chloride in inception subcohort with follow-up starting in 1973, n=6,701.†

Cumulative exposure, ppm-years	Melanoma, n=17			Brain cancer, n=31			Lung cancer, n=397			NHL, n=35		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<63	3	ref		6	ref		68	ref		10	ref	
63- <287	5	1.6	0.4–6.7	9	1.4	0.5–4.0	94	1.3	1.0–1.8	4	0.4	0.1–1.2
287- <865	4	1.2	0.3–5.2	9	1.4	0.5–3.9	82	1.1	0.8–1.5	7	0.6	0.2–1.6
865- <2,271	2	0.6	0.1–3.4	3	0.5	0.1–1.9	89	1.2	0.8–1.6	6	0.5	0.2–1.4
≥2,271	3	0.9	0.2–4.6	4	0.8	0.2–2.7	64	0.9	0.7–1.3	8	0.7	0.3–1.9

Cumulative exposure, ppm-years	Connective and soft tissue cancers, n=10			Cirrhosis of the liver, n=59			NMRD, n=282			COPD, n=171		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<63	1	ref		8	ref		41	ref		26	ref	
63- <287	1	0.9	0.1–15.2	10	1.2	0.5–3.0	55	1.3	0.9–1.9	38	1.4	0.9–2.3
287- <865	1	0.9	0.1–14.3	14	1.6	0.7–3.9	65	1.4	0.9–2.0	43	1.4	0.9–2.3
865- <2,271	3	2.7	0.3–26.3	15	1.8	0.8–4.3	69	1.4	0.9–2.0	37	1.2	0.7–1.9
≥2,271	4	4.3	0.5–39.0	12	1.8	0.7–4.6	52	1.0	0.7–1.6	27	0.9	0.5–1.5

* Quintiles of cumulative exposure based on distributions among the full cohort, n=9,951.

† All models unadjusted.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; NHL, non-Hodgkins lymphoma; NMRD, nonmalignant respiratory disease; COPD, chronic obstructive pulmonary disease; ppm, parts per million.

Supplemental Table S.4. Cox proportional hazards ratios for selected causes of death by duration of employment* in the full cohort, n=9,951.†

Duration of employment, years	Melanoma, n=29			Brain cancer, n=52			Lung cancer, n=591			NHL, n=64		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<5	7	ref	--	10	ref	--	120	ref	--	10	ref	--
5- <12	4	0.6	0.2–2.1	7	0.7	0.3–1.9	85	0.8	0.6–1.0	6	0.6	0.2–1.7
12- <18	7	0.9	0.3–2.5	12	1.0	0.5–2.4	113	0.8	0.6–1.1	15	1.4	0.6–3.0
18- <28	7	0.7	0.2–1.9	13	1.1	0.5–2.4	135	0.8	0.6–1.0	16	1.2	0.5–2.7
≥28	4	0.4	0.1–1.3	10	1.1	0.4–2.6	138	0.8	0.6–1.0	17	1.3	0.6–2.8

Duration of employment, years	Connective and soft tissue cancers, n=20			Cirrhosis of the liver, n=97			NMRD, n=430			COPD, n=248		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<5	4	ref	--	23	ref	--	89	ref	--	57	ref	--
5- <12	2	0.5	0.1–2.9	19	0.9	0.5–1.6	69	0.9	0.7–1.2	42	0.8	0.6–1.3
12- <18	2	0.4	0.1–2.3	18	0.7	0.4–1.3	68	0.7	0.5–0.9	43	0.7	0.4–1.0
18- <28	7	1.3	0.4–4.4	22	0.8	0.4–1.4	105	0.7	0.6–1.0	57	0.6	0.4–0.9
≥28	5	1.0	0.3–3.8	15	0.6	0.3–1.2	99	0.6	0.5–0.8	49	0.4	0.3–0.7

* Quintiles of duration of employment based on distributions among the full cohort, n=9,951.

† All models unadjusted.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; NHL, non-Hodgkins lymphoma; NMRD, nonmalignant respiratory disease; COPD, chronic obstructive pulmonary disease; ppm, parts per million.

Supplemental Table S.5. Cox proportional hazards ratios for selected causes of death by duration of employment* in inception subcohort, n=7,273.†

Duration of employment, years	Melanoma, n=18			Brain cancer, n=38			Lung cancer, n=425			NHL, n=40		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<5	6	ref		10	ref		117	ref		10	ref	
5- <12	4	0.9	0.2–3.0	5	0.6	0.2–1.7	68	0.7	0.5–1.0	2	0.2	0.1–1.1
12- <18	4	0.7	0.2–2.6	8	0.9	0.4–2.2	85	0.8	0.6–1.0	10	1.1	0.5–2.6
18- <28	3	0.5	0.1–2.2	9	1.2	0.5–3.0	77	0.8	0.6–1.0	7	0.8	0.3–2.2
≥28	1	0.2	0.02–1.5	6	1.0	0.4–2.9	78	0.8	0.6–1.1	11	1.3	0.5–3.0

Duration of employment, years	Connective and soft tissue cancers, n=12			Cirrhosis of the liver, n=65			NMRD, n=297			COPD, n=180		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<5	4	ref		22	ref		79	ref		53	ref	
5- <12	1	0.3	0.03–2.7	15	0.8	0.4–1.6	56	0.9	0.7–1.3	36	0.9	0.6–1.3
12- <18	2	0.5	0.1–2.9	10	0.5	0.2–1.1	47	0.7	0.5–1.0	31	0.7	0.4–1.0
18- <28	2	0.6	0.1–3.3	12	0.7	0.3–1.4	59	0.8	0.6–1.1	34	0.7	0.4–1.0
≥28	3	1.1	0.2–5.0	6	0.4	0.2–1.0	56	0.7	0.5–0.9	26	0.4	0.3–0.7

* Quintiles of duration of employment based on distributions among the full cohort, n=9,951.

† All models unadjusted.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; NHL, non-Hodgkins lymphoma; NMRD, nonmalignant respiratory disease; COPD, chronic obstructive pulmonary disease; ppm, parts per million.

Supplemental Table S.6. Cox proportional hazards ratios for selected causes of death by duration of employment* in inception subcohort with follow-up starting in 1973, n=6,701.†

Duration of employment, years	Melanoma, n=17			Brain cancer, n=31			Lung cancer, n=397			NHL, n=35		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<5	6	ref		7	ref		110	ref		9	ref	
5- <12	3	0.6	0.2–2.6	5	0.8	0.3–2.7	63	0.7	0.5–1.0	2	0.3	0.1–1.3
12- <18	4	0.7	0.2–2.6	7	1.1	0.4–3.1	76	0.7	0.6–1.0	7	0.8	0.3–2.3
18- <28	3	0.5	0.1–2.2	6	1.2	0.4–3.5	70	0.7	0.5–1.0	6	0.7	0.3–2.1
≥28	1	0.2	0.02–1.3	6	1.2	0.4–3.7	78	0.8	0.6–1.0	11	1.2	0.5–3.0

Duration of employment, years	Connective and soft tissue cancers, n=10			Cirrhosis of the liver, n=59			NMRD, n=282			COPD, n=171		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
<5	3	ref		20	ref		74	ref		51	ref	
5- <12	1	0.4	0.04–3.9	13	0.8	0.4–1.5	51	0.9	0.6–1.3	33	0.8	0.5–1.3
12- <18	2	0.7	0.1–4.2	8	0.4	0.2–1.0	44	0.7	0.5–1.0	28	0.6	0.4–1.0
18- <28	1	0.4	0.04–4.0	12	0.8	0.4–1.7	57	0.8	0.6–1.1	33	0.7	0.4–1.0
≥28	3	1.2	0.2–6.2	6	0.4	0.2–1.1	56	0.7	0.5–0.9	26	0.4	0.3–0.7

* Quintiles of duration of employment based on distributions among the full cohort, n=9,951.

† All models unadjusted.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; NHL, non-Hodgkins lymphoma; NMRD, nonmalignant respiratory disease; COPD, chronic obstructive pulmonary disease; ppm, parts per million.

Supplemental Table S.7. Observed and expected deaths, standardized mortality ratios, and 95% confidence intervals using state referent rates* for liver cancer†

Year of birth	Full cohort (n=9,951)				Inception subcohort (n=7,273)				Inception subcohort, follow-up beginning in 1973 (n=6,701)			
	O	E	SMR	95% CI	O	E	SMR	95% CI	O	E	SMR	95% CI
≤ 1917	28	6.5	4.33	2.87–6.25	9	3.6	2.48	1.13–4.71	8	2.6	3.06	1.32–6.02
1918-1925	32	7.7	4.18	2.86–5.90	18	4.9	3.70	2.19–5.85	16	4.7	3.40	1.94–5.52
1926-1932	27	7.1	3.78	2.49–5.50	21	5.1	4.11	2.54–6.28	20	5.1	3.93	2.40–6.07
1933-1941	25	7.0	3.59	2.32–5.29	17	5.3	3.20	1.86–5.12	16	5.3	3.01	1.72–4.89
≥ 1942	5	3.5	1.41	0.46–3.29	5	3.4	1.49	0.48–3.47	5	3.4	1.49	0.48–3.47
Year of hire												
≤ 1946	33	6.3	5.23	3.60–7.35	13	3.1	4.25	2.26–7.27	11	2.4	4.51	2.25–8.07
1947 – 1952	29	7.7	3.75	2.51–5.39	20	5.7	3.50	2.14–5.41	18	5.3	3.40	2.01–5.38
1953 – 1960	33	6.7	4.95	3.40–6.95	18	3.8	4.73	2.80–7.47	17	3.7	4.58	2.67–7.34
1961 – 1966	13	6.4	2.02	1.08–3.46	11	5.3	2.08	1.04–3.72	11	5.3	2.09	1.04–3.74
≥1967	9	4.7	1.93	0.88–3.67	8	4.4	1.82	0.78–3.59	8	4.4	1.82	0.79–3.59
Age at hire (yrs)												
≤ 22	27	5.7	4.77	3.14–6.93	16	3.6	4.39	2.51–7.14	16	3.6	4.41	2.52–7.16
22 - < 24	28	5.0	5.65	3.75–8.16	18	3.6	5.06	3.00–8.01	15	3.5	4.24	2.37–6.99
24 - < 28	21	8.1	2.61	1.61–3.99	11	5.7	1.94	0.97–3.47	10	5.6	1.79	0.86–3.29
28 - < 33	20	6.0	3.32	2.03–5.12	15	4.3	3.48	1.95–5.74	14	4.1	3.39	1.85–5.69
≥ 33	21	7.1	2.97	1.84–4.54	10	5.1	1.97	0.94–3.62	10	4.2	2.38	1.14–4.38
Duration of employment (yrs)												
< 5	5	5.6	0.89	0.29–2.07	5	5.3	0.95	0.31–2.21	4	5.0	0.81	0.22–2.07
5 - < 12	14	5.1	2.76	1.51–4.64	9	4.3	2.12	0.96–4.02	9	4.0	2.25	1.03–4.28
12 - < 18	21	6.4	3.26	2.02–4.98	16	4.8	3.30	1.89–5.37	14	4.6	3.04	1.66–5.11
18 - < 28	41	7.4	5.56	3.99–7.55	19	4.0	4.71	2.83–7.36	17	3.7	4.57	2.66–7.32
≥ 28	36	7.3	4.96	3.47–6.86	21	3.9	5.45	3.37–8.33	21	3.8	5.48	3.39–8.38

Year of birth	Full cohort (n=9,951)				Inception subcohort (n=7,273)				Inception subcohort, follow-up beginning in 1973 (n=6,701)			
	O	E	SMR	95% CI	O	E	SMR	95% CI	O	E	SMR	95% CI
Time since hire (yrs)												
< 33	28	7.6	3.67	2.44–5.31	22	5.7	3.83	2.40–5.80	17	4.6	3.72	2.17–5.96
33 - < 43	36	10.7	3.36	2.35–4.65	16	7.9	2.02	1.15–3.28	16	7.9	2.02	1.15–3.28
43 - < 48	16	5.7	2.80	1.60–4.54	12	4.0	3.00	1.55–5.24	12	4.0	3.00	1.55–5.24
48 - < 54	23	4.6	4.97	3.15–7.46	13	2.9	4.56	2.43–7.80	13	2.9	4.56	2.43–7.80
≥ 54	14	3.1	4.52	2.47–7.59	7	1.7	4.01	1.61–8.25	7	1.7	4.01	1.61–8.25
Region‡												
Midwest	15	5.3	2.83	1.58–4.67	14	3.7	3.81	2.08–6.40	14	3.6	3.94	2.15–6.62
Northeast	30	4.6	6.53	4.41–9.33	8	2.6	3.02	1.30–5.96	8	2.6	3.10	1.33–6.10
South	72	21.9	3.29	2.57–4.14	48	16.0	3.01	2.22–3.99	43	15.0	2.88	2.08–3.87
Plant product												
PVC	112	27.5	4.07	3.35–4.89	69	20.3	3.41	2.65–4.31	64	19.1	3.35	2.58–4.28
VCM only	5	4.2	1.18	0.38–2.76	1	2.0	0.50	0.01–2.78	1	2.0	0.50	0.01–2.80

*State referent rates: 401,524 person-years for a full cohort of 9,951 workers.

† Liver cancers were ICD-9 155.0, 155.2, ICD-10 C22.0, C22.2-C22.4, C22.7, C22.9.

‡Defined using US census regions. South includes the state of California.

Abbreviations: O, observed; E, expected; SMR, standardized mortality ratio; CI, confidence interval; yrs, years; PVC, polyvinyl chloride; VCM, vinyl chloride monomer.

Supplemental Table S.8. Cox proportional hazards ratios for angiosarcoma of the liver (ASL) and hepatocellular carcinoma (HCC) by lagged cumulative exposure (low cut-points)*

Cumulative exposure, ppm-years	ASL, n=63			HCC, n=32		
	n	HR	95% CI	n	HR	95% CI
10-year lag						
<63		Ref		3	Ref	
63- <287				3	1.1	0.2–5.3
287- <865	5†	Ref		1	0.3	0.03–3.1
865- <2,271	10	6.5	2.2–19.2	4	1.2	0.3–5.3
≥2,271	48	34.2	13.5–86.3	21	5.6	1.7–18.8
20-year lag						
<63	6	Ref		3	Ref	
63- <287	2	1.2	0.2–6.4	3	1.3	0.3–6.4
287- <865	5	3.0	0.8–10.9	1	0.4	0.04–3.8
865- <2,271	9	5.8	1.8–18.9	4	1.5	0.3–6.6
≥2,271	41	33.8	11.9–96.1	21	7.1	2.1–24.4
30-year lag						
<63	25	Ref		3	Ref	
63- <287	0	--	--	3	2.4	0.5–12.6
287- <865	6	1.7	0.6–4.6	1	0.8	0.1–7.6
865- <2,271	8	2.6	1.0–6.6	7	5.2	1.2–21.8
≥2,271	24	11.1	5.1–24.0	18	14.2	3.7–54.5
40-year lag						
<63	41	Ref		9	Ref	
63- <287	4	2.2	0.7–6.9	3	2.1	0.5–8.5
287- <865	2	1.2	0.3–5.3	4	2.5	0.7–9.3
865- <2,271	8	5.7	2.2–15.1	4	2.6	0.7–9.9
≥2,271	8	9.2	3.3–25.9	12	9.4	3.1–28.2

*Low cut-points based on quintiles of unlagged cumulative exposure for the entire cohort.

†Due to zero cases in the referent group and few cases in the first two quintiles of the 10-year lag model, the first three quintiles have been collapsed to form a single referent category.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; Ref, referent

Supplemental Table S.9. Cox proportional hazards ratios for angiosarcoma of the liver (ASL) and hepatocellular carcinoma (HCC), by lagged cumulative exposure (high cut-points)*

Cumulative exposure, ppm-years	ASL, n=63			HCC, n=32		
	n	HR	95% CI	n	HR	95% CI
10-year lag						
<1,021	7	Ref		8	Ref	
1,021- <3,301	12	5.4	2.1–13.7	4	1.2	0.4–3.9
3,301- <5,686	11	18.8	7.2–48.6	7	7.4	2.7–20.5
5,686- <10,551	21	47.4	19.9–112.7	6	7.5	2.6–21.7
≥10,551	12	69.2	26.8–179.1	7	19.7	7.1–54.7
20-year lag						
<1,021	15	Ref		8	Ref	
1,021- <3,301	12	4.3	1.9–9.7	4	1.3	0.4–4.3
3,301- <5,686	11	16.3	7.1–37.6	8	9.5	3.5–25.4
5,686- <10,551	16	35.4	16.1–78.1	5	7.2	2.3–22.3
≥10,551	9	66.9	26.4–169.5	7	24.5	8.7–69.2
30-year lag						
<1,021	33	Ref		8	Ref	
1,021- <3,301	9	2.8	1.2–6.2	8	3.8	1.4–10.4
3,301- <5,686	10	13.2	5.9–29.5	5	8.9	2.8–28.5
5,686- <10,551	6	14.0	5.2–37.1	6	14.6	4.7–45.1
≥10,551	5	55.8	18.4–168.9	5	34.6	10.3–115.8
40-year lag						
<1,021	47	Ref		17	Ref	
1,021- <3,301	8	4.9	2.0–12.1	3	1.1	0.3–4.0
3,301- <5,686	3	8.7	2.4–32.3	3	4.3	1.2–15.6
5,686- <10,551	4	24.6	7.2–84.0	7	15.5	5.8–41.7
≥10,551	1	54.4	5.9–499.4	2	22.4	4.6–108.9

*High cut-points based on quintiles of unlagged cumulative exposure for liver cancers in the entire cohort.

†Due to zero cases in the referent group and few cases in the first two quintiles of the 10-year lag model, the first three quintiles have been collapsed to form a single referent category.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; Ref, referent

Supplemental Table S.10. Cox proportional hazard ratios for angiosarcoma of the liver (ASL), hepatocellular carcinoma, (HCC), and unspecified liver cancer by duration of employment in the full cohort, n=9,951.*

Duration of employment, years	ASL, n=63			HCC, n=32			Unspecified liver cancer, n=36		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Low cut-points†									
<5	2	ref					4	ref	
5- <12	4	2.1	0.4–11.3	4‡	ref		6	1.7	0.5–6.0
12- <18	12	5.1	1.2–23.0	4	1.7	0.4–6.6	8	1.7	0.5–5.8
18- <28	24	9.9	2.3–41.8	10	2.9	0.9–9.2	12	1.9	0.6–5.9
≥28	21	11.9	2.8–51.6	14	3.6	1.2–11.1	6	0.9	0.2–3.0
High cut-points§									
<14	9	ref		4	ref		13	ref	
14- <21	15	3.5	1.5–8.0	6	2.9	0.8–10.2	9	1.3	0.6–3.1
21- <26	16	6.6	2.9–15.0	5	3.1	0.8–11.7	6	1.2	0.5–3.2
26- <31	6	2.5	0.9–7.2	9	4.4	1.4–14.5	7	1.1	0.4–2.8
≥31	17	9.2	4.0–21.4	8	4.2	1.2–14.0	1	0.2	0.02–1.3

*All models unadjusted.

†Low cut-points based on quintiles of duration of employment for the entire cohort.

‡ Due to zero cases in the referent group, the first two quintiles have been collapsed to form a single referent category.

§ High cut-points are based on quintiles of duration of employment for all liver cancers in the entire cohort.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent.

Supplemental Table S.11. Cox proportional hazard ratios for angiosarcoma of the liver (ASL), hepatocellular carcinoma, (HCC), and unspecified liver cancer, by cumulative exposure in inception subcohort, n=7,273.*

Cumulative exposure, ppm-years	ASL, n=43			HCC, n=18			Unspecified liver cancer, n=19		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Low cut-points†									
<63				1	ref		1	ref	
63- <287				2	1.9	0.2–21.4	2	1.9	0.2–21.3
287- <865	4‡	ref		1	0.9	0.1–13.5	4	3.4	0.4–30.8
865- <2,271	8	5.8	1.8–19.3	4	3.2	0.4–29.1	5	4.2	0.5–36.0
≥2,271	31	28.1	9.9–79.7	10	8.1	1.0–63.5	7	6.2	0.8–50.9
High cut-points§									
<1,021	6	ref		5	ref		8	ref	
1,021- <3,301	10	4.6	1.7–12.7	3	1.4	0.3–5.8	6	1.8	0.6–5.2
3,301- <5,686	9	19.0	6.8–53.4	2	3.7	0.7–19.2	2	2.5	0.5–12.0
5,686- <10,551	12	35.1	13.2–93.6	3	8.1	1.9–33.8	2	3.6	0.8–17.2
≥10,551	6	40.8	13.1–127.0	5	28.8	8.3–100.2	1	3.9	0.5–31.6

*All models unadjusted.

†Low cut-points based on quintiles of cumulative exposure for the entire cohort.

‡Due to zero cases in the referent group and few cases in the second and third quintiles, the first three quintiles have been collapsed to form a single referent category.

§High cut-points based on quintiles of cumulative exposure for all liver cancers in the entire cohort.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; ppm, parts per million.

Supplemental Table S.12. Cox proportional hazard ratios for angiosarcoma of the liver (ASL), hepatocellular carcinoma, (HCC), and unspecified liver cancer, by cumulative exposure in inception subcohort with follow-up starting in 1973, n=6,701.*

Cumulative exposure, ppm-years	ASL, n=38			HCC, n=18			Unspecified liver cancer, n=19		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Low cut-points†									
<63				1	ref		1	ref	
63- <287				2	1.9	0.2–21.2	2	1.9	0.2–21.1
287- <865	4‡	ref		1	0.9	0.1–13.8	4	3.5	0.4–31.4
865- <2,271	7	5.5	1.6–18.8	4	3.3	0.4–29.6	5	4.3	0.5–36.6
≥2,271	27	28.6	9.9–82.2	10	8.3	1.1–65.3	7	6.4	0.8–52.4
High cut-points§									
<1,021	6	ref		5	ref		8	ref	
1,021- <3,301	9	4.6	1.6–13.0	3	1.4	0.3–5.9	6	1.9	0.6– 5.4
3,301- <5,686	7	16.3	5.4–48.8	2	3.7	0.7–19.4	2	2.5	0.5–12.0
5,686- <10,551	11	38.9	14.2–106.2	3	8.2	2.0–34.7	2	3.7	0.8–17.4
≥10,551	5	46.7	14.0–155.9	5	30.4	8.7–106.3	1	4.1	0.5–33.2

*All models unadjusted.

†Low cut-points based on quintiles of cumulative exposure for the entire cohort.

‡Due to zero cases in the referent group and few cases in the second and third quintiles, the first three quintiles have been collapsed to form a single referent category.

§High cut-points based on quintiles of cumulative exposure for all liver cancers in the entire cohort.

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent; ppm, parts per million.

Supplemental Table S.13. Cox proportional hazard ratios for angiosarcoma of the liver (ASL), hepatocellular carcinoma (HCC), and unspecified liver cancer, by duration of employment in inception subcohort, n=7,273.*

Duration of employment, years	ASL, n=43			HCC, n=18			Unspecified liver cancer, n=19		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Low cut-points†									
<5	2	ref					4	ref	
5- <12	4	2.3	0.4–12.5				4	1.3	0.3–5.1
12- <18	11	6.0	1.3–26.9	4‡	ref		4	1.1	0.3–4.5
18- <28	15	10.3	2.4–45.2	4	2.7	0.7–10.9	3	0.8	0.2–3.6
≥28	11	11.8	2.6–54.7	10	6.3	1.9–20.7	4	1.0	0.2–4.0
High cut-points§									
<14	9	ref		1	ref		9	ref	
14- <21	13	3.9	1.6–9.0	3	7.3	0.8–70.4	5	1.4	0.5–4.1
21- <26	9	6.1	2.4–15.5	1	4.2	0.3–67.7	1	0.5	0.1–4.0
26- <31	5	3.2	1.0–9.8	8	22.6	2.8–182.1	4	1.3	0.4–4.3
≥31	7	7.5	2.7–21.3	5	19.2	2.2–167.0	0	--	--

*All models unadjusted.

†Low cut-points based on quintiles of duration of employment for the entire cohort.

‡ Due to zero cases in the referent group and few cases in the second and third quintiles, the first three quintiles have been collapsed to form a single referent category.

§ High cut-points based on quintiles of duration of employment for all liver cancers in the entire cohort

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent.

Supplemental Table S.14. Cox proportional hazard ratios for angiosarcoma of the liver (ASL), hepatocellular carcinoma (HCC), and unspecified liver cancer, by duration of employment in inception subcohort with follow up starting in 1973, n=6,701.*

Duration of employment, years	ASL, n=38			HCC, n=18			Unspecified liver cancer, n=19		
	n	HR	95% CI	n	HR	95% CI	n	HR	95% CI
Low cut-points†									
<5	1	ref					4	ref	
5- <12	4	4.7	0.5–42.0				4	1.3	0.3–5.1
12- <18	9	9.4	1.2–74.1	4‡	ref		4	1.1	0.3–4.4
18- <28	13	18.0	2.3–137.7	4	2.7	0.7–11.1	3	0.8	0.2–3.7
≥28	11	18.7	2.4–146.6	10	6.1	1.9–20.1	4	1.0	0.2–3.9
High cut-points§									
<14	8	ref		1	ref		9	ref	
14- <21	10	3.4	1.3–8.6	3	7.4	0.8–70.8	5	1.4	0.5–4.1
21- <26	8	6.0	2.2–16.1	1	4.3	0.3–68.7	1	0.5	0.1–4.0
26- <31	5	3.0	1.0–9.2	8	22.0	2.7–177.4	4	1.3	0.4–4.2
≥31	7	6.6	2.3–18.8	5	18.5	2.1–161.0	0	--	--

*All models unadjusted.

†Low cut-points based on quintiles of duration of employment for the entire cohort.

‡ Due to zero cases in the referent group and few cases in the second and third quintiles, the first three quintiles have been collapsed to form a single referent category.

§ High cut-points based on quintiles of duration of employment for all liver cancers in the entire cohort

Abbreviations: n, number; HR, hazard ratio; CI, confidence interval; ref, referent.