Cancer incidence and HWSE path analysis
GM-UAW Cohort Study

July 2, 2020

Table 1: Summary of population characteristics. Follow-up for cancer incidence extends from 1985 through 2015.

	n	p	
Study population size (N)	39 770	100%	
Race			
White	25 612	64%	
Black	6 890	17%	
Unknown	7 268	18%	
Sex			
Male	35 099	88%	
Female	4 671	12%	
Plant[♮]			
Plant 1	11 481	29%	
Plant 2	15 922	40%	
Plant 3	12 367	31%	
Ever exposed to MWFs			
Straight	21 589	54%	
Soluble	34 406	87%	
Synthetic	12 587	32%	
Diagnosed with cancer by end of follow-up	7 945	20%	
	Median	25th %tile	75th %tile
Years of follow-up	39.34	34.19	46.81
Years at work[*]	15.71	7.66	27.02
Year of hire	1964	1951	1973
Age at hire (years)	24	20	31
Year of birth	1936	1920	1948
Year of first cancer diagnosis	1999	1991	2007
Age at first cancer diagnosis (years)	67	59	74
Cumulative exposure[♯] to MWFs (mg/m^3·y)			
Straight	0.7	0.22	2.61
Soluble	4.94	1.93	13.33
Synthetic	0.45	0.15	1.58

[♮] Some individuals worked at several sites; plant indicates the site of longest work record time.

[*] Among those with known date of worker exit.

[♯] Summary statistics calculated for ever-exposed individuals at end of follow-up only. Exposures were lagged 21 years.
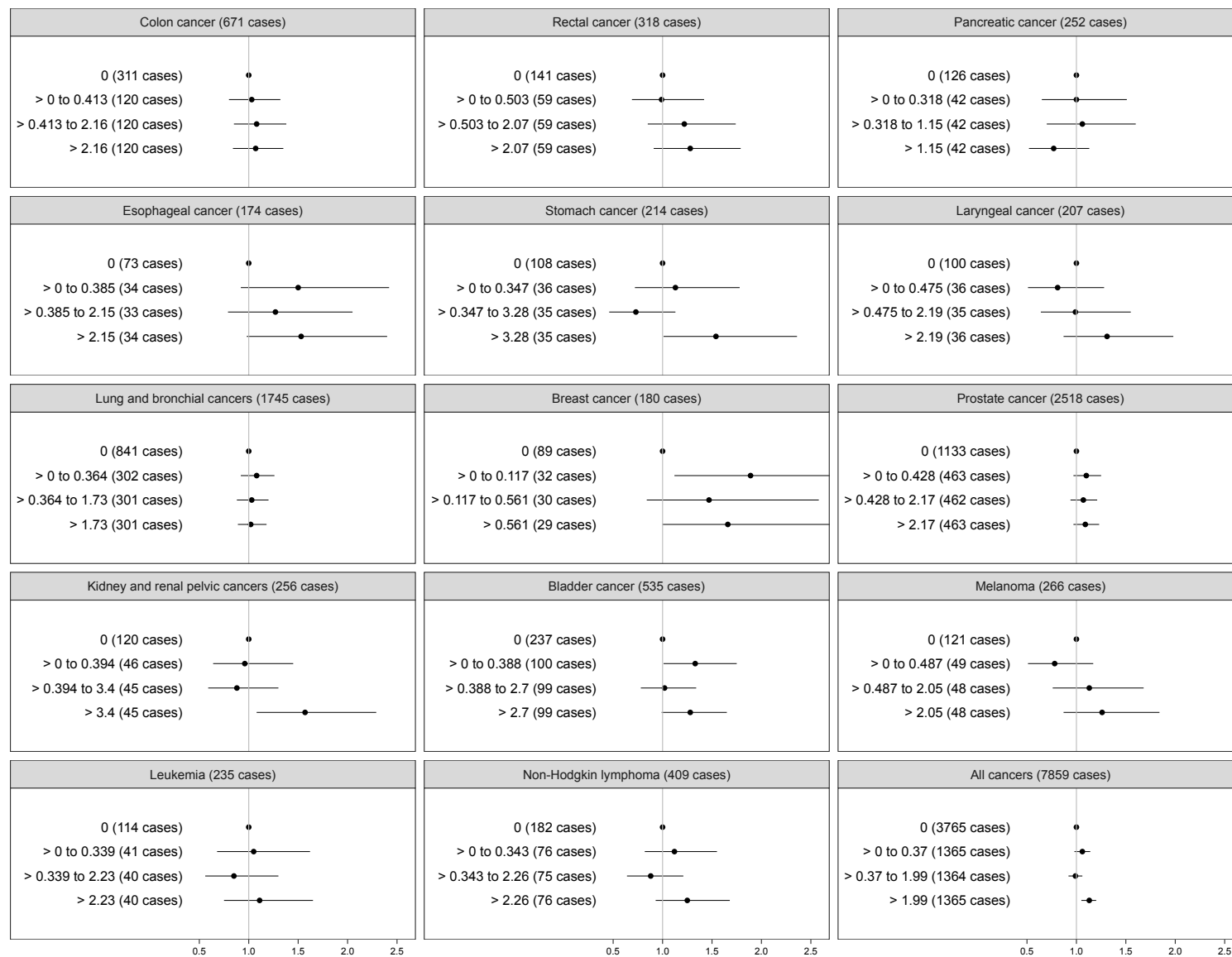
Figure 1: Adjusted hazard ratios associated with exposure to straight metal working fluids in the **UAW-GM Cohort**.
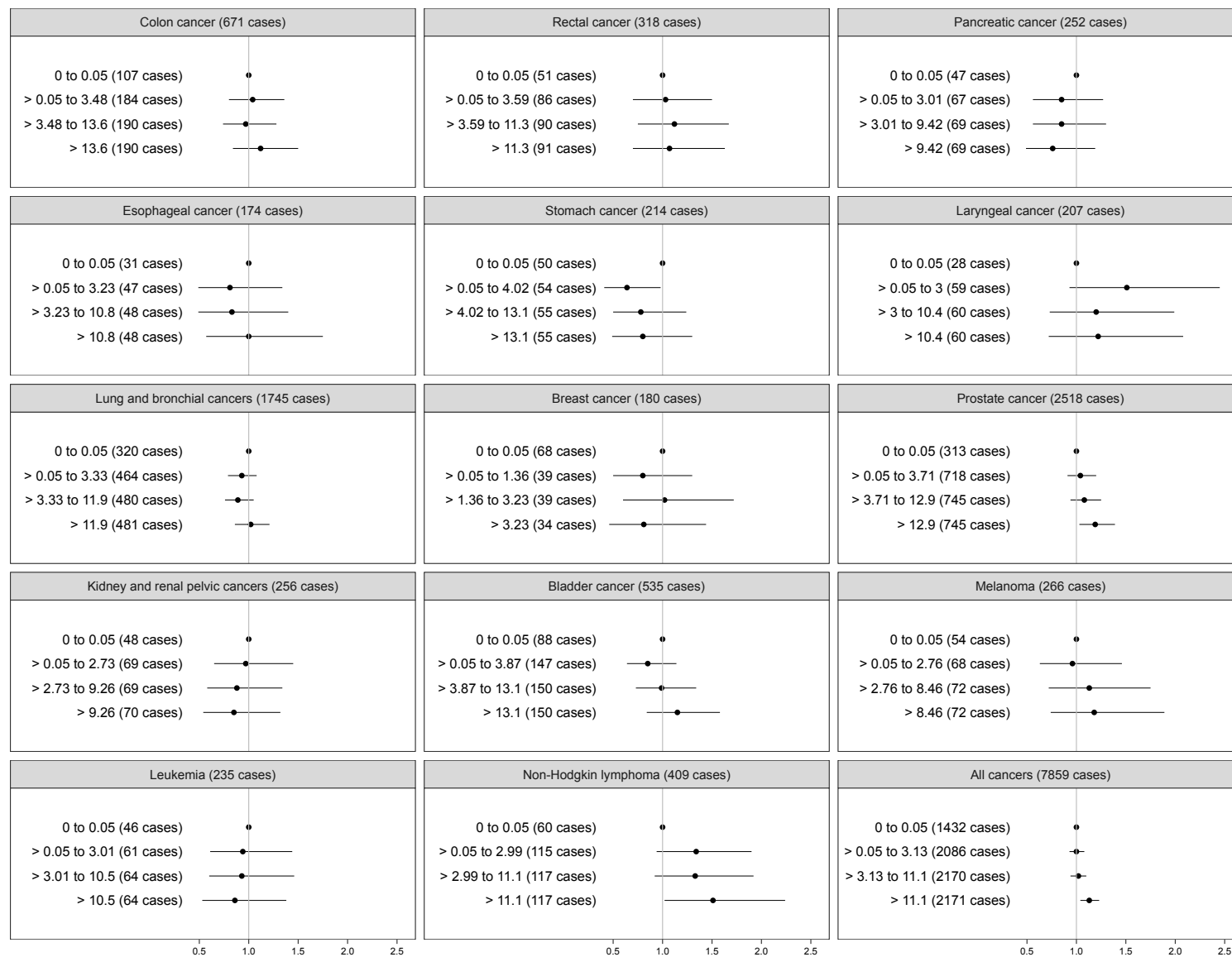
Figure 2: Adjusted hazard ratios associated with exposure to soluble metal working fluids in the **UAW-GM Cohort**.
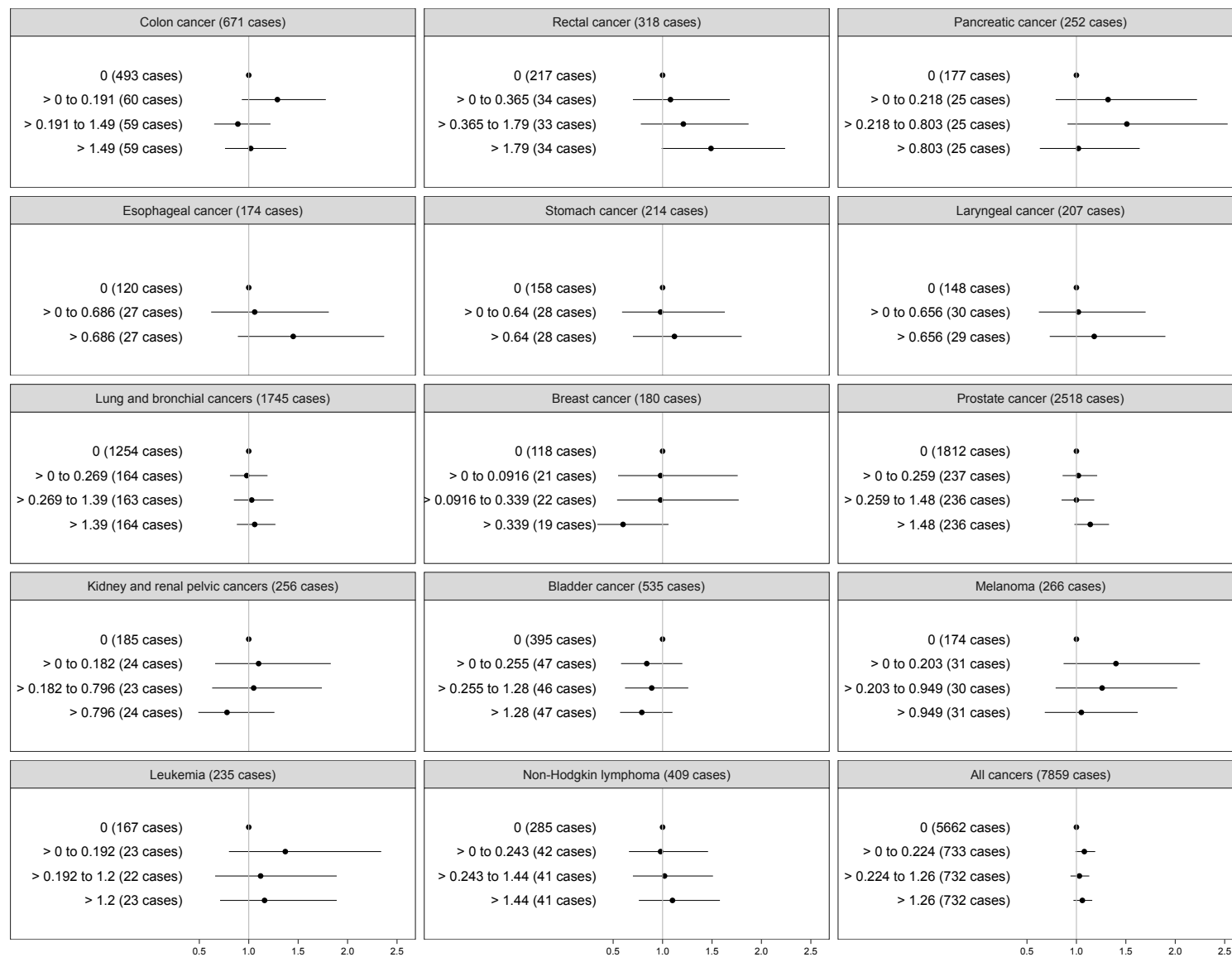
Figure 3: Adjusted hazard ratios associated with exposure to synthetic metal working fluids in the **UAW-GM Cohort**.
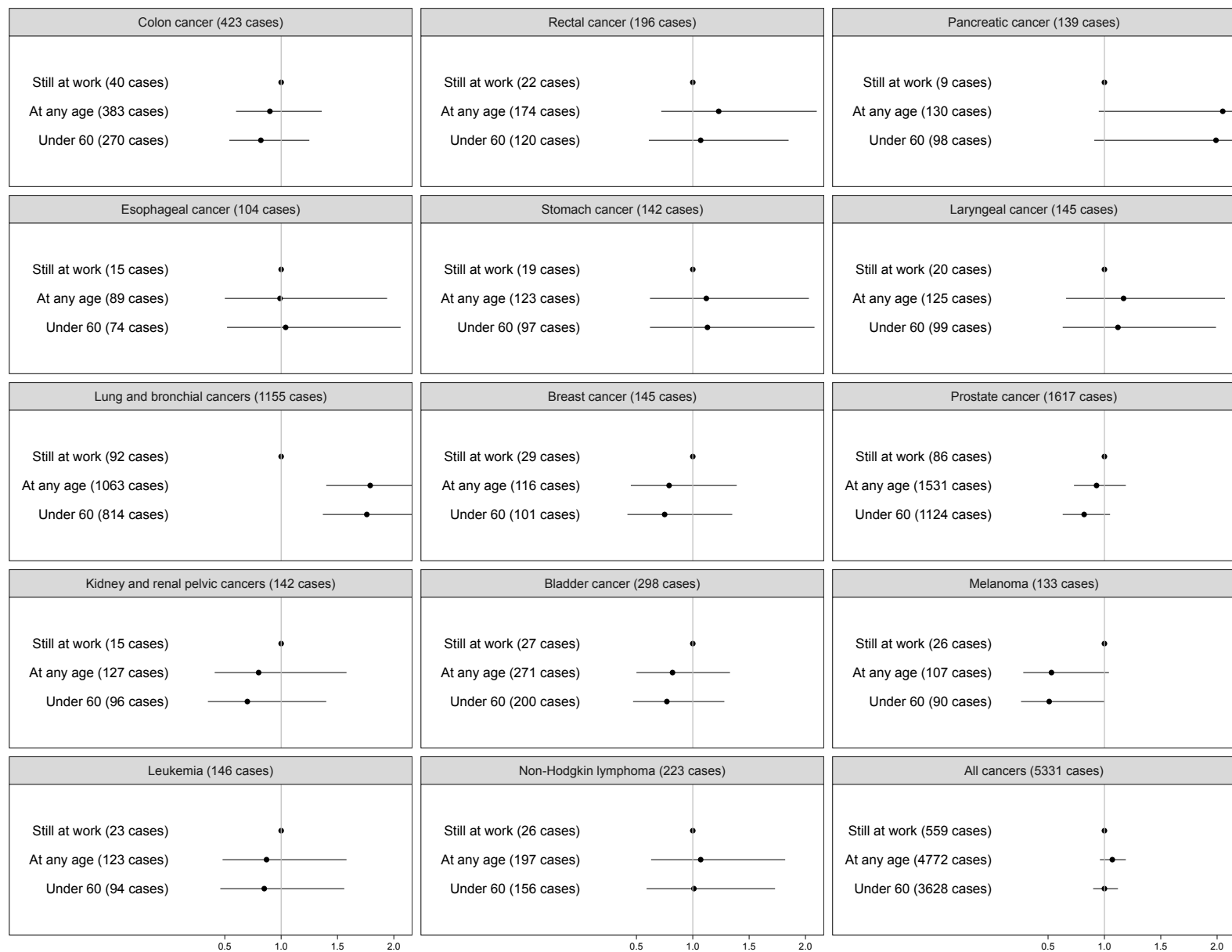
Figure 4: Adjusted hazard ratios for cancer incidence associated with leaving work in the **UAW-GM Cohort** (HWSE Condition 2).

Table 2: Adjusted HR estimates for cancer incidence and employment status.

	n	HR	(95% CI)	p	
Colon cancer (423 events)					
Still employed	40	1.00	–		
Not employed	383	0.90	(0.60, 1.36)	0.61	
Left work (under 50)	159	0.76	(0.50, 1.18)	0.22	
Left work (50 or older)	224	1.07	(0.69, 1.65)	0.76	
Left work (under 55)	207	0.80	(0.52, 1.22)	0.30	
Left work (55 or older)	176	1.09	(0.70, 1.70)	0.70	
Left work (under 60)	270	0.82	(0.54, 1.25)	0.35	
Left work (60 or older)	113	1.14	(0.72, 1.79)	0.58	
Rectal cancer (196 events)					
Still employed	22	1.00	–		
Not employed	174	1.23	(0.72, 2.10)	0.45	
Left work (under 50)	66	0.92	(0.52, 1.63)	0.76	
Left work (50 or older)	108	1.82	(1.01, 3.27)	0.05	
Left work (under 55)	96	1.07	(0.61, 1.87)	0.81	
Left work (55 or older)	78	1.65	(0.90, 3.00)	0.10	
Left work (under 60)	120	1.07	(0.61, 1.85)	0.82	
Left work (60 or older)	54	1.97	(1.05, 3.70)	0.03	*
Pancreatic cancer (139 events)					
Still employed	9	1.00	–		
Not employed	130	2.05	(0.95, 4.42)	0.07	
Left work (under 50)	55	1.74	(0.79, 3.87)	0.17	
Left work (50 or older)	75	2.50	(1.12, 5.61)	0.03	*
Left work (under 55)	73	1.82	(0.83, 4.00)	0.14	
Left work (55 or older)	57	2.58	(1.13, 5.87)	0.02	*
Left work (under 60)	98	1.99	(0.91, 4.34)	0.08	
Left work (60 or older)	32	2.23	(0.95, 5.25)	0.07	
Esophageal cancer (104 events)					
Still employed	15	1.00	–		
Not employed	89	0.99	(0.50, 1.94)	0.97	
Left work (under 50)	47	0.98	(0.49, 1.99)	0.96	
Left work (50 or older)	42	0.99	(0.48, 2.07)	0.99	

Left work (under 55)	63	1.08	(0.54, 2.15)	0.83	
Left work (55 or older)	26	0.80	(0.37, 1.74)	0.58	
Left work (under 60)	74	1.04	(0.52, 2.06)	0.92	
Left work (60 or older)	15	0.81	(0.34, 1.93)	0.64	

Stomach cancer (142 events)

Still employed	19	1.00	–		
Not employed	123	1.12	(0.62, 2.03)	0.72	
Left work (under 50)	57	0.99	(0.53, 1.86)	0.99	
Left work (50 or older)	66	1.33	(0.69, 2.55)	0.39	
Left work (under 55)	77	1.09	(0.59, 2.02)	0.78	
Left work (55 or older)	46	1.17	(0.60, 2.30)	0.64	
Left work (under 60)	97	1.13	(0.62, 2.08)	0.69	
Left work (60 or older)	26	1.07	(0.52, 2.20)	0.86	

Laryngeal cancer (145 events)

Still employed	20	1.00	–		
Not employed	125	1.17	(0.66, 2.07)	0.59	
Left work (under 50)	54	0.89	(0.49, 1.65)	0.72	
Left work (50 or older)	71	1.69	(0.91, 3.16)	0.10	
Left work (under 55)	75	1.00	(0.56, 1.81)	0.99	
Left work (55 or older)	50	1.72	(0.89, 3.31)	0.11	
Left work (under 60)	99	1.12	(0.63, 1.99)	0.71	
Left work (60 or older)	26	1.43	(0.70, 2.92)	0.32	

Lung and bronchial cancers (1155 events)

Still employed	92	1.00	–		
Not employed	1063	1.79	(1.40, 2.29)	< 0.005	*
Left work (under 50)	480	1.57	(1.22, 2.03)	< 0.005	*
Left work (50 or older)	583	2.16	(1.66, 2.81)	< 0.005	*
Left work (under 55)	635	1.68	(1.30, 2.16)	< 0.005	*
Left work (55 or older)	428	2.08	(1.59, 2.72)	< 0.005	*
Left work (under 60)	814	1.76	(1.37, 2.25)	< 0.005	*
Left work (60 or older)	249	1.91	(1.44, 2.54)	< 0.005	*

Breast cancer (145 events)

Still employed	29	1.00	–		
Not employed	116	0.79	(0.45, 1.39)	0.41	

Left work (under 50)	71	0.72	(0.39, 1.31)	0.28
Left work (50 or older)	45	0.90	(0.48, 1.70)	0.75
Left work (under 55)	86	0.73	(0.41, 1.32)	0.30
Left work (55 or older)	30	0.95	(0.48, 1.86)	0.88
Left work (under 60)	101	0.75	(0.42, 1.35)	0.34
Left work (60 or older)	15	0.99	(0.46, 2.13)	0.97

Prostate cancer (1617 events)

Still employed	86	1.00	–	
Not employed	1531	0.93	(0.73, 1.19)	0.57
Left work (under 50)	679	0.82	(0.63, 1.06)	0.13
Left work (50 or older)	852	1.02	(0.79, 1.32)	0.86
Left work (under 55)	884	0.82	(0.63, 1.06)	0.13
Left work (55 or older)	647	1.08	(0.84, 1.40)	0.54
Left work (under 60)	1124	0.82	(0.63, 1.05)	0.12
Left work (60 or older)	407	1.21	(0.93, 1.58)	0.16

Kidney and renal pelvic cancers (142 events)

Still employed	15	1.00	–	
Not employed	127	0.80	(0.41, 1.58)	0.53
Left work (under 50)	58	0.62	(0.30, 1.26)	0.19
Left work (50 or older)	69	1.13	(0.54, 2.34)	0.74
Left work (under 55)	81	0.72	(0.36, 1.46)	0.36
Left work (55 or older)	46	0.98	(0.47, 2.06)	0.96
Left work (under 60)	96	0.70	(0.35, 1.40)	0.31
Left work (60 or older)	31	1.17	(0.54, 2.55)	0.69

Bladder cancer (298 events)

Still employed	27	1.00	–	
Not employed	271	0.82	(0.50, 1.33)	0.42
Left work (under 50)	117	0.70	(0.42, 1.16)	0.17
Left work (50 or older)	154	0.96	(0.58, 1.61)	0.89
Left work (under 55)	153	0.73	(0.44, 1.21)	0.22
Left work (55 or older)	118	0.97	(0.58, 1.64)	0.92
Left work (under 60)	200	0.77	(0.47, 1.28)	0.31
Left work (60 or older)	71	0.93	(0.54, 1.60)	0.80

Melanoma (133 events)

Still employed	26	1.00	–		
Not employed	107	0.53	(0.28, 1.04)	0.06	
Left work (under 50)	58	0.49	(0.25, 0.97)	0.04	*
Left work (50 or older)	49	0.70	(0.33, 1.49)	0.35	
Left work (under 55)	74	0.50	(0.25, 0.99)	0.05	
Left work (55 or older)	33	0.69	(0.31, 1.51)	0.35	
Left work (under 60)	90	0.51	(0.26, 1.00)	0.05	
Left work (60 or older)	17	0.68	(0.29, 1.61)	0.38	
Leukemia (146 events)					
Still employed	23	1.00	–		
Not employed	123	0.87	(0.48, 1.58)	0.65	
Left work (under 50)	65	0.88	(0.48, 1.62)	0.68	
Left work (50 or older)	58	0.86	(0.45, 1.67)	0.66	
Left work (under 55)	83	0.92	(0.51, 1.69)	0.80	
Left work (55 or older)	40	0.74	(0.37, 1.47)	0.39	
Left work (under 60)	94	0.85	(0.46, 1.56)	0.60	
Left work (60 or older)	29	0.97	(0.47, 2.01)	0.95	
Non-Hodgkin's lymphoma (223 events)					
Still employed	26	1.00	–		
Not employed	197	1.07	(0.63, 1.82)	0.79	
Left work (under 50)	109	1.06	(0.62, 1.82)	0.83	
Left work (50 or older)	88	1.10	(0.62, 1.96)	0.74	
Left work (under 55)	125	0.98	(0.57, 1.69)	0.94	
Left work (55 or older)	72	1.37	(0.76, 2.48)	0.30	
Left work (under 60)	156	1.01	(0.59, 1.73)	0.97	
Left work (60 or older)	41	1.36	(0.73, 2.55)	0.34	

Table 3: Adjusted HR estimates for **leaving work**.

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	10718	1.0	–		
	> 0 to 0.364	4350	1.1	(1.1, 1.2)	< 0.005	*
	> 0.364 to 1.79	4587	1.0	(1.0, 1.1)	0.05	
	> 1.79	4757	1.0	(1.0, 1.1)	0.05	
Cumulative soluble	0	2506	1.0	–		
	> 0 to 3.13	6730	1.1	(1.1, 1.2)	< 0.005	*
	> 3.13 to 11.5	7330	1.0	(1.0, 1.1)	0.09	
	> 11.5	7846	1.0	(0.9, 1.0)	0.21	
Cumulative synthetic	0	16896	1.0	–		
	> 0 to 0.26	2418	0.9	(0.9, 1.0)	< 0.005	*
	> 0.26 to 1.47	2520	0.9	(0.9, 1.0)	0.01	*
	> 1.47	2578	1.0	(1.0, 1.1)	0.22	
Race	White	19975	1.0	–		
	Black	4437	0.7	(0.7, 0.7)	< 0.005	*
Plant	1	7982	1.0	–		
	2	9976	0.7	(0.7, 0.7)	< 0.005	*
	3	6454	0.5	(0.5, 0.6)	< 0.005	*
P-spline of calendar year (df = 16.99)		27380		–	< 0.005	*
P-spline of year of hire (df = 16.82)		27380		–	< 0.005	*

Table 4: Adjusted HR estimates for incidence of **colon cancer** ($n = 671$).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	311	1.00	–		
	> 0 to 0.413	120	1.03	(0.80, 1.32)	0.82	
	> 0.413 to 2.16	120	1.08	(0.85, 1.38)	0.53	
	> 2.16	120	1.07	(0.84, 1.35)	0.59	
Cumulative soluble	0 to 0.05	107	1.00	–		
	> 0.05 to 3.48	184	1.04	(0.80, 1.36)	0.75	
	> 3.48 to 13.6	190	0.97	(0.74, 1.28)	0.83	
	> 13.6	190	1.12	(0.84, 1.50)	0.43	
Cumulative synthetic	0	493	1.00	–		
	> 0 to 0.191	60	1.29	(0.93, 1.78)	0.13	
	> 0.191 to 1.49	59	0.89	(0.65, 1.22)	0.46	
	> 1.49	59	1.02	(0.76, 1.38)	0.88	
Race	White	508	1.00	–		
	Black	163	1.79	(1.45, 2.22)	< 0.005	*
Plant	1	226	1.00	–		
	2	244	0.97	(0.74, 1.27)	0.82	
	3	201	1.11	(0.86, 1.43)	0.43	
Sex	Male	593	1.00	–		
	Female	78	0.90	(0.69, 1.16)	0.40	
P-spline of calendar year (df = 12.54)		671		–	0.05	
P-spline of year of hire (df = 13.03)		671		–	0.46	

Table 5: Adjusted HR estimates for incidence of **rectal cancer** (n = 318).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	141	1.00	–		
	> 0 to 0.503	59	0.99	(0.69, 1.42)	0.96	
	> 0.503 to 2.07	59	1.22	(0.85, 1.74)	0.28	
	> 2.07	59	1.28	(0.91, 1.79)	0.15	
Cumulative soluble	0 to 0.05	51	1.00	–		
	> 0.05 to 3.59	86	1.03	(0.70, 1.50)	0.90	
	> 3.59 to 11.3	90	1.12	(0.75, 1.67)	0.59	
	> 11.3	91	1.07	(0.70, 1.63)	0.75	
Cumulative synthetic	0	217	1.00	–		
	> 0 to 0.365	34	1.08	(0.70, 1.68)	0.73	
	> 0.365 to 1.79	33	1.21	(0.78, 1.87)	0.40	
	> 1.79	34	1.49	(0.99, 2.24)	0.05	
Race	White	267	1.00	–		
	Black	51	0.89	(0.63, 1.24)	0.49	
Plant	1	98	1.00	–		
	2	128	0.78	(0.54, 1.12)	0.17	
	3	92	0.79	(0.56, 1.12)	0.18	
Sex	Male	293	1.00	–		
	Female	25	0.60	(0.39, 0.92)	0.02	*
P-spline of calendar year (df = 7.17)		318		–	0.12	
P-spline of year of hire (df = 6)		318		–	0.03	*

Table 6: Adjusted HR estimates for incidence of **pancreatic cancer** ($n = 252$).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	126	1.00	–		
	> 0 to 0.318	42	1.00	(0.65, 1.51)	0.98	
	> 0.318 to 1.15	42	1.06	(0.70, 1.60)	0.80	
	> 1.15	42	0.77	(0.52, 1.13)	0.18	
Cumulative soluble	0 to 0.05	47	1.00	–		
	> 0.05 to 3.01	67	0.85	(0.56, 1.27)	0.42	
	> 3.01 to 9.42	69	0.85	(0.56, 1.30)	0.45	
	> 9.42	69	0.76	(0.49, 1.19)	0.24	
Cumulative synthetic	0	177	1.00	–		
	> 0 to 0.218	25	1.32	(0.79, 2.22)	0.29	
	> 0.218 to 0.803	25	1.51	(0.91, 2.53)	0.11	
	> 0.803	25	1.02	(0.63, 1.64)	0.94	
Race	White	187	1.00	–		
	Black	65	1.46	(1.05, 2.04)	0.02	∗
Plant	1	85	1.00	–		
	2	99	0.74	(0.49, 1.13)	0.16	
	3	68	0.75	(0.51, 1.12)	0.16	
Sex	Male	221	1.00	–		
	Female	31	0.89	(0.59, 1.35)	0.60	
P-spline of calendar year ($df = 9.07$)		252		–	0.36	
P-spline of year of hire ($df = 10.15$)		252		–	0.99	

Table 7: Adjusted HR estimates for incidence of **esophageal cancer** ($n = 174$).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	73	1.00	–		
	> 0 to 0.385	34	1.50	(0.92, 2.42)	0.10	
	> 0.385 to 2.15	33	1.27	(0.79, 2.05)	0.32	
	> 2.15	34	1.53	(0.98, 2.40)	0.06	
Cumulative soluble	0 to 0.05	31	1.00	–		
	> 0.05 to 3.23	47	0.81	(0.49, 1.34)	0.41	
	> 3.23 to 10.8	48	0.83	(0.49, 1.40)	0.48	
	> 10.8	48	1.00	(0.57, 1.75)	1.00	
Cumulative synthetic	0	120	1.00	–		
	> 0 to 0.686	27	1.06	(0.62, 1.81)	0.82	
	> 0.686	27	1.45	(0.89, 2.37)	0.14	
Race	White	134	1.00	–		
	Black	40	1.39	(0.93, 2.08)	0.11	
Plant	1	54	1.00	–		
	2	55	0.70	(0.42, 1.16)	0.16	
	3	65	0.96	(0.62, 1.49)	0.86	
Sex	Male	169	1.00	–		
	Female	5	0.19	(0.08, 0.48)	< 0.005	*
P-spline of calendar year ($df = 6.02$)		174		–	0.88	
P-spline of year of hire ($df = 6.12$)		174		–	0.01	*

Table 8: Adjusted HR estimates for incidence of **stomach cancer** (n = 214).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	108	1.00	–		
	> 0 to 0.347	36	1.13	(0.72, 1.78)	0.60	
	> 0.347 to 3.28	35	0.73	(0.46, 1.13)	0.16	
	> 3.28	35	1.54	(1.01, 2.36)	0.05	
Cumulative soluble	0 to 0.05	50	1.00	–		
	> 0.05 to 4.02	54	0.64	(0.41, 0.98)	0.04	*
	> 4.02 to 13.1	55	0.78	(0.50, 1.24)	0.30	
	> 13.1	55	0.80	(0.49, 1.30)	0.37	
Cumulative synthetic	0	158	1.00	–		
	> 0 to 0.64	28	0.98	(0.59, 1.63)	0.95	
	> 0.64	28	1.12	(0.70, 1.80)	0.63	
Race	White	159	1.00	–		
	Black	55	1.70	(1.18, 2.45)	< 0.005	*
Plant	1	73	1.00	–		
	2	91	1.18	(0.76, 1.84)	0.47	
	3	50	0.78	(0.49, 1.23)	0.28	
Sex	Male	198	1.00	–		
	Female	16	0.49	(0.28, 0.83)	0.01	*
P-spline of calendar year (df = 8.19)		214		–	0.84	
P-spline of year of hire (df = 11.35)		214		–	0.80	

Table 9: Adjusted HR estimates for incidence of **laryngeal cancer** (n = 207).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	100	1.00	–		
	> 0 to 0.475	36	0.81	(0.51, 1.28)	0.37	
	> 0.475 to 2.19	35	0.99	(0.64, 1.55)	0.98	
	> 2.19	36	1.31	(0.87, 1.98)	0.20	
Cumulative soluble	0 to 0.05	28	1.00	–		
	> 0.05 to 3	59	1.51	(0.93, 2.45)	0.10	
	> 3 to 10.4	60	1.20	(0.73, 1.99)	0.47	
	> 10.4	60	1.22	(0.72, 2.08)	0.45	
Cumulative synthetic	0	148	1.00	–		
	> 0 to 0.656	30	1.02	(0.62, 1.70)	0.93	
	> 0.656	29	1.18	(0.73, 1.90)	0.50	
Race	White	148	1.00	–		
	Black	59	1.74	(1.22, 2.48)	< 0.005	*
Plant	1	80	1.00	–		
	2	81	0.95	(0.61, 1.46)	0.81	
	3	46	0.57	(0.37, 0.89)	0.01	*
Sex	Male	203	1.00	–		
	Female	4	0.15	(0.06, 0.42)	< 0.005	*
P-spline of calendar year (df = 1)		207		–	0.45	
P-spline of year of hire (df = 5.18)		207		–	0.61	

Table 10: Adjusted HR estimates for incidence of **lung and bronchial cancers** (n = 1745).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	841	1.00	–		
	> 0 to 0.364	302	1.08	(0.92, 1.26)	0.36	
	> 0.364 to 1.73	301	1.03	(0.88, 1.20)	0.70	
	> 1.73	301	1.02	(0.89, 1.18)	0.74	
Cumulative soluble	0 to 0.05	320	1.00	–		
	> 0.05 to 3.33	464	0.93	(0.79, 1.08)	0.34	
	> 3.33 to 11.9	480	0.89	(0.76, 1.05)	0.18	
	> 11.9	481	1.02	(0.86, 1.21)	0.84	
Cumulative synthetic	0	1254	1.00	–		
	> 0 to 0.269	164	0.98	(0.81, 1.19)	0.85	
	> 0.269 to 1.39	163	1.03	(0.85, 1.25)	0.76	
	> 1.39	164	1.06	(0.88, 1.27)	0.56	
Race	White	1395	1.00	–		
	Black	350	1.18	(1.03, 1.35)	0.02	*
Plant	1	549	1.00	–		
	2	712	0.93	(0.80, 1.09)	0.38	
	3	484	0.87	(0.75, 1.01)	0.07	
Sex	Male	1557	1.00	–		
	Female	188	0.81	(0.69, 0.95)	0.01	*
P-spline of calendar year (df = 7.67)		1745		–	0.04	*
P-spline of year of hire (df = 5.74)		1745		–	< 0.005	*

Table 11: Adjusted HR estimates for incidence of **breast cancer** (n = 180).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	89	1.00	–		
	> 0 to 0.117	32	1.89	(1.12, 3.21)	0.02	*
	> 0.117 to 0.561	30	1.47	(0.84, 2.58)	0.18	
	> 0.561	29	1.66	(1.00, 2.78)	0.05	
Cumulative soluble	0 to 0.05	68	1.00	–		
	> 0.05 to 1.36	39	0.80	(0.50, 1.30)	0.37	
	> 1.36 to 3.23	39	1.02	(0.60, 1.72)	0.95	
	> 3.23	34	0.81	(0.46, 1.44)	0.48	
Cumulative synthetic	0	118	1.00	–		
	> 0 to 0.0916	21	0.98	(0.55, 1.76)	0.95	
	> 0.0916 to 0.339	22	0.98	(0.54, 1.77)	0.94	
	> 0.339	19	0.60	(0.34, 1.06)	0.08	
Race	White	113	1.00	–		
	Black	67	1.33	(0.92, 1.93)	0.13	
Plant	1	31	1.00	–		
	2	149	1.32	(0.81, 2.16)	0.26	
P-spline of calendar year (df = 3.84)		180		–	0.12	
P-spline of year of hire (df = 2.69)		180		–	0.95	

Table 12: Adjusted HR estimates for incidence of **prostate cancer** ($n = 2518$).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	1133	1.00	–		
	> 0 to 0.428	463	1.10	(0.97, 1.25)	0.14	
	> 0.428 to 2.17	462	1.07	(0.94, 1.21)	0.30	
	> 2.17	463	1.09	(0.97, 1.23)	0.14	
Cumulative soluble	0 to 0.05	313	1.00	–		
	> 0.05 to 3.71	718	1.04	(0.91, 1.20)	0.54	
	> 3.71 to 12.9	745	1.08	(0.94, 1.25)	0.28	
	> 12.9	745	1.19	(1.03, 1.39)	0.02	*
Cumulative synthetic	0	1812	1.00	–		
	> 0 to 0.259	237	1.02	(0.86, 1.21)	0.79	
	> 0.259 to 1.48	236	1.00	(0.85, 1.18)	0.98	
	> 1.48	236	1.14	(0.98, 1.33)	0.09	
Race	White	1799	1.00	–		
	Black	722	2.20	(1.99, 2.44)	< 0.005	*
Plant	1	918	1.00	–		
	2	802	0.94	(0.82, 1.08)	0.40	
	3	801	1.02	(0.90, 1.15)	0.79	
P-spline of calendar year ($df = 16.65$)		2518		–	0.05	
P-spline of year of hire ($df = 14.14$)		2518		–	< 0.005	*

Table 13: Adjusted HR estimates for incidence of **kidney and renal pelvic cancers** ($n = 256$).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	120	1.00	–		
	> 0 to 0.394	46	0.96	(0.64, 1.45)	0.85	
	> 0.394 to 3.4	45	0.88	(0.59, 1.30)	0.51	
	> 3.4	45	1.57	(1.08, 2.29)	0.02	*
Cumulative soluble	0 to 0.05	48	1.00	–		
	> 0.05 to 2.73	69	0.97	(0.65, 1.45)	0.88	
	> 2.73 to 9.26	69	0.88	(0.58, 1.34)	0.55	
	> 9.26	70	0.85	(0.54, 1.32)	0.47	
Cumulative synthetic	0	185	1.00	–		
	> 0 to 0.182	24	1.10	(0.66, 1.83)	0.72	
	> 0.182 to 0.796	23	1.05	(0.63, 1.74)	0.86	
	> 0.796	24	0.78	(0.49, 1.26)	0.31	
Race	White	215	1.00	–		
	Black	41	0.93	(0.64, 1.35)	0.70	
Plant	1	67	1.00	–		
	2	98	1.04	(0.68, 1.57)	0.87	
	3	91	1.00	(0.68, 1.46)	0.99	
Sex	Male	235	1.00	–		
	Female	21	0.58	(0.36, 0.94)	0.03	*
P-spline of calendar year ($df = 9.72$)		256		–	0.03	*
P-spline of year of hire ($df = 7.44$)		256		–	0.26	

Table 14: Adjusted HR estimates for incidence of **bladder cancer** (n = 535).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	237	1.00	–		
	> 0 to 0.388	100	1.33	(1.01, 1.75)	0.04	*
	> 0.388 to 2.7	99	1.02	(0.78, 1.34)	0.86	
	> 2.7	99	1.28	(0.99, 1.65)	0.06	
Cumulative soluble	0 to 0.05	88	1.00	–		
	> 0.05 to 3.87	147	0.85	(0.64, 1.14)	0.28	
	> 3.87 to 13.1	150	0.99	(0.73, 1.34)	0.96	
	> 13.1	150	1.15	(0.84, 1.58)	0.38	
Cumulative synthetic	0	395	1.00	–		
	> 0 to 0.255	47	0.84	(0.58, 1.20)	0.33	
	> 0.255 to 1.28	46	0.89	(0.62, 1.26)	0.51	
	> 1.28	47	0.79	(0.57, 1.10)	0.17	
Race	White	481	1.00	–		
	Black	54	0.55	(0.41, 0.75)	< 0.005	*
Plant	1	144	1.00	–		
	2	187	0.95	(0.71, 1.27)	0.73	
	3	204	1.14	(0.88, 1.48)	0.31	
Sex	Male	512	1.00	–		
	Female	23	0.30	(0.20, 0.46)	< 0.005	*
P-spline of calendar year (df = 8.9)		535		–	0.55	
P-spline of year of hire (df = 7.96)		535		–	< 0.005	*

Table 15: Adjusted HR estimates for incidence of **melanoma** ($n = 266$).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	121	1.00	–		
	> 0 to 0.487	49	0.78	(0.51, 1.17)	0.23	
	> 0.487 to 2.05	48	1.13	(0.76, 1.68)	0.55	
	> 2.05	48	1.26	(0.87, 1.84)	0.22	
Cumulative soluble	0 to 0.05	54	1.00	–		
	> 0.05 to 2.76	68	0.96	(0.63, 1.46)	0.85	
	> 2.76 to 8.46	72	1.13	(0.72, 1.75)	0.60	
	> 8.46	72	1.18	(0.74, 1.89)	0.49	
Cumulative synthetic	0	174	1.00	–		
	> 0 to 0.203	31	1.40	(0.87, 2.25)	0.16	
	> 0.203 to 0.949	30	1.26	(0.79, 2.02)	0.34	
	> 0.949	31	1.05	(0.68, 1.62)	0.83	
Race	White	262	1.00	–		
	Black	4	0.08	(0.03, 0.21)	< 0.005	*
Plant	1	44	1.00	–		
	2	115	1.16	(0.75, 1.81)	0.50	
	3	107	1.06	(0.71, 1.58)	0.78	
Sex	Male	247	1.00	–		
	Female	19	0.60	(0.37, 0.98)	0.04	*
P-spline of calendar year ($df = 2.7$)		266		–	< 0.005	*
P-spline of year of hire ($df = 6.89$)		266		–	0.90	

Table 16: Adjusted HR estimates for incidence of **leukemia** (n = 235).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	114	1.00	–		
	> 0 to 0.339	41	1.05	(0.68, 1.62)	0.82	
	> 0.339 to 2.23	40	0.85	(0.56, 1.30)	0.45	
	> 2.23	40	1.11	(0.75, 1.65)	0.60	
Cumulative soluble	0 to 0.05	46	1.00	–		
	> 0.05 to 3.01	61	0.94	(0.61, 1.44)	0.77	
	> 3.01 to 10.5	64	0.93	(0.60, 1.46)	0.75	
	> 10.5	64	0.86	(0.53, 1.38)	0.53	
Cumulative synthetic	0	167	1.00	–		
	> 0 to 0.192	23	1.37	(0.80, 2.34)	0.25	
	> 0.192 to 1.2	22	1.12	(0.66, 1.89)	0.68	
	> 1.2	23	1.16	(0.71, 1.89)	0.56	
Race	White	190	1.00	–		
	Black	45	1.21	(0.83, 1.75)	0.32	
Plant	1	71	1.00	–		
	2	89	0.90	(0.58, 1.40)	0.64	
	3	75	1.00	(0.66, 1.50)	0.99	
Sex	Male	215	1.00	–		
	Female	20	0.61	(0.37, 0.99)	0.04	*
P-spline of calendar year (df = 2.44)		235		–	0.66	
P-spline of year of hire (df = 7.12)		235		–	0.45	

Table 17: Adjusted HR estimates for incidence of **non-hodgkin's lymphoma** (n = 409).

Covariate	level	n	HR	(95% CI)	p	
Cumulative straight	0	182	1.00	–		
	> 0 to 0.343	76	1.12	(0.82, 1.55)	0.47	
	> 0.343 to 2.26	75	0.88	(0.64, 1.21)	0.43	
	> 2.26	76	1.25	(0.93, 1.68)	0.14	
Cumulative soluble	0 to 0.05	60	1.00	–		
	> 0.05 to 2.99	115	1.34	(0.94, 1.90)	0.10	
	> 2.99 to 11.1	117	1.33	(0.92, 1.92)	0.13	
	> 11.1	117	1.51	(1.02, 2.24)	0.04	*
Cumulative synthetic	0	285	1.00	–		
	> 0 to 0.243	42	0.98	(0.66, 1.46)	0.93	
	> 0.243 to 1.44	41	1.02	(0.70, 1.51)	0.90	
	> 1.44	41	1.10	(0.76, 1.58)	0.62	
Race	White	358	1.00	–		
	Black	51	0.68	(0.49, 0.95)	0.02	*
Plant	1	107	1.00	–		
	2	163	1.09	(0.77, 1.54)	0.62	
	3	139	0.99	(0.72, 1.36)	0.96	
Sex	Male	362	1.00	–		
	Female	47	0.91	(0.65, 1.26)	0.56	
P-spline of calendar year (df = 13.16)		409		–	0.07	
P-spline of year of hire (df = 12.37)		409		–	0.41	